In Exchange for Nothing: Marriage Payments and Old-Age Support in China*

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Abstract

Marriage payments in China can be seven times as large as annual household income, and parental contribution to children's marriage payments is considered non-human capital investment in children. In this paper, I study offering marriage payments to children in the context of intra-household allocation and analyze whether parents use these payments to assure their old-age financial security. Using data from the China Health and Retirement Longitudinal Study (CHARLS), I find that maternal resources are positively associated with offering marriage payments to children, especially to daughters, as a compensation for their disadvantages in terms of human capital. Paternal resources are not a factor in determining whether or not to support children's marriage payments, probably because irrespective of their income, fathers expect children to fully repay the parental investment in them. Compared to their non-recipient siblings, children who received marriage payments do not provide parents with more financial support, which is a strong rejection of the exchange motive for offering marriage payments to children. However, parents do benefit from human capital investment in their children, implying that to receive old-age support from children, parents should invest human capital in children in their early years instead of non-human capital in their adulthood.

Keywords: marriage payments; household allocation; human capital; old-age support

1 Introduction

Marriage payments can be as large as seven times annual household income in China (Yan, 2005), which makes parental support for it almost necessary for young people.

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Giving marriage payments to children involves two types of resource allocation: intergenerational allocation and intra-household allocation, and the latter is particularly interesting in China, because bride-prices and dowries coexist and parents are allowed to financially support each of their children for their marriage payments. Using data from the China Health and Retirement Longitudinal Study (CHARLS), I study two empirical questions in this paper:

1. What determines parents to offer marriage payments to their children? Would parents prefer daughters over sons or vice versa?

2. What is the motive of parents to provide their children with marriage payments? Would parents transfer marriage payment in exchange for old-age support in the future?

This study is original from the following perspectives. First, I consider parental support for children's marriage payments a non-human capital investment in children, and I analyze this behavior in the context of intra-household allocation. Though the effect of parental resources on the human capital accumulation of children have been well-studied, little attention has been paid to the effect on non-human capital investment in children. Second, I construct parental working history variables to indicate parental resources in my empirical study, which is new in context of household allocation. Working experience can effectively measure the resourcefulness of individuals over a long period, especially in societies where monetary income data is unavailable or unreliable. Third, I associate offering children's marriage payments with old-age support of parents. Given the large value of bride-prices and dowries, it is interesting to learn the degree to which parents give these marriage payments in exchange for financial support in the future. Despite case studies, this question is empirically under-studied.

The main findings of this study are summarized in this paragraph. First, as mothers become more resourceful, children are more likely to receive marriage payments from parents. However, the likelihood of offering marriage payments to children is not subject

to paternal resources, probably because fathers usually expect children to fully repay parental investment, and thus the earnings of fathers is not a factor in determining whether or not to support children's marriage payments. Second, daughters benefit more from increases in parental resources than sons by having a greater chance of receiving dowries, because parents tend to compensate disadvantaged children in terms of human capital. As the gender gap in education and employment is closed, the daughter bias of parents will diminish as well. Third, compared to their non-recipient siblings, children who received marriage payments in the past do not currently make more transfers to parents, which is a strong rejection of the exchange motive of giving marriage payments to children. Last, though children are not reciprocal in terms of receipt of marriage payments, they do reward their parents for their human capital investment. Healthier, better-educated, and higher-income children make more transfers to parents. In other words, to obtain old-age support from children, the best strategy for parents is to invest human capital in children in their early years instead of transferring assets to them in their adulthood.

This paper is organized as follows. A brief review on marriage payments and household allocation is presented in Section 2. In Section 3, I theorize on parental support for marriage payments of children. Section 4 presents data sources and summary statistics. Section 5 presents the empirical study of factors in determining giving marriage payments to children. Section 6 investigates the association between marriage payments and old-age support. The last section closes the paper with concluding remarks.

2 Literature Review on Marriage Payments and Household Allocation

2.1 Economics of Marriage Payments

Transactions between families at the time of marriage exist across cultures, which can be made either from the groom's side or from the bride's side. [1] The occurrences of bride-prices and dowries are linked to different social characteristics: bride-prices are more common in societies with polygamy, less stratification, and high female labor participation in agriculture; whereas dowries are mainly found in societies where socioeconomic differentiation is substantial among men and women are excluded from agricultural work (Murdock, 1967; Goody, 1973). According to Anderson (2007), the bride-price is paid to compensate the bride's family for their loss of her labor and reproductive capability, and the dowry is used to the brides maintain family social status by attracting a high-status husband. In practices, the value of bride-prices does not vary much within each society, but the value of dowries tends to be negotiated on an individual basis and is positively related to the wealth of both families and the earning ability of the new couple.

Several economic models are made to throw light on the origin of marriage payments. In Becker (1993), the marriage payment is a means of clearing an efficient marriage market. A bride-price is supposed to be paid in the case where the wife's (the bride's) share of family income is below her shadow value in the marriage market, and vice versa for the dowry. However, the Becker's model cannot explain the coexistence of bride-prices and dowries in one society. To explain this puzzle, Zhang and Chan (1999) hypothesize that dowries are used as a complementary means for the enforcement of efficient marriage contracts. By holding a dowry, the wife has a larger control over household resources, thus maintaining her market-determined level of utility. Botticini and Siow (2003) analyze the occurrence of dowries in the context of free-riding problem in patrilocal societies, where

[1] In this paper, bride-prices refer to transfers from the groom's side to the bride's side, either to the parents of the bride or to the bride directly. Transfers from the bride's parents are termed dowry, which can be held by the bride or go to the groom and his family.

sons look after their aged parents and inherit household wealth. The free-riding problem among siblings may arise if daughters received bequests after marriage without effort made in looking after their parents' wealth. By giving a dowry, which serves as a pre-mortem inheritance, parents exclude daughters from any future bequests and motivate sons to work hard with family assets by leaving them the full benefits of their efforts.

2.2 Marriage Payments in China

China is one of the rare societies where bride-prices and dowries coexist as marriage payments.[2] The bride-price plays an important role in validating the marriage between two families, while a dowry is not mandatory. Paying marriage payments is more prevalent in rural area than in cities (Anderson, 2007). In most cases, a proportion of the bride-price will be re-transferred to the groom's side as the dowry, but the bride's side may also add new assets to the dowry or offer no dowry at all (Zhai, 2003; Fei, 2006; Diao, 2007; Gui & Yu, 2010). After getting married, the bride has direct control over her dowry, especially when it has been converted into a lump sum (Yan, 2005). The value of marriage payments varies over time and has shown an upward trend in recent decades. In the Mao era, marriage payments were prohibited by the 1950 Marriage Law. [3] However, practices of this tradition were never fully banned. In the 1950s, marriage payments were transferred in only small amounts. The value of marriage payments increased gradually from 1962 to the 1980s, in which household goods such as grain, furniture, clothes, and electrical appliances were most commonly used as bride-prices or dowries (Li, 2017). From the late 1980s onwards, cash took the place of household goods as marriage payments, and the value of bride-prices steadily increased, especially after the late 1990s (Wang, 2014). In rural Henan province, bride-prices increased by ten times within one decade

[2]The tradition of giving marriage payments is true not only in the Han population, but also in 54 out of 55 Chinese minority populations except Chinese Russians (Zhai, 2003).

[3]In the 1950 Marriage Law, Article 3. "Marriage upon arbitrary decision by any third party, mercenary marriage and any other acts of interference in the freedom of marriage shall be prohibited. The exaction of money or gifts in connection with marriage shall be prohibited." This article is still effective in the 2018 Marriage Law.

of 2000. Apart from the bride-price, the groom's side is usually expected to offer an independent residence for the newlywed couple, which makes marriage more costly for young men, particularly those with brothers (Wang, 2014).

Chinese parents actively engage in the payment negotiation and contribution to marriage payments for their children, which can be explained by both altruism and exchange motive. On the one hand, parents can support children based on altruism since these transfers directly enhance the children's welfare. A large dowry can effectively increase the wife's post-marital well-being in the conjugal household (Yan, 2005; Zhang & Chan, 1999; Brown, 2009). For sons, parental support for their bride-prices is critical in making them compete with other men in the marriage market. In rural north China, the bride-price on average was 17 times as large as the annual income of young male laborers and seven times as large as the average annual household income in the late 1990s (Yan, 2005). Thus, without financial support from parents, bride-prices can be unaffordable for young men. On the other hand, parents who finance their children's marriages may expect repayments in the future. Since the national pension scheme for rural residents was unavailable until 2009, the overwhelming majority of rural parents could only depend on their children in their old age. Hence, parents are incentivized to maintain a favorable relationship with their children by making extra efforts to satisfy their children's needs, including paying lavish marriage payments for them (Yan, 2005; Xiong and Mu, 2009).

2.3 Literature on Resources Allocation

To analyze parental support for children's marriage payments, I review literature on intra-household allocation. Previous studies show that the common preference model of family behaviors is rejected and that there exist gender differences in resource allocation within the household. In Thomas (1990), increasing maternal resources is associated with better child health, but this association is much weaker for paternal income in Brazil. The gender of children also matters for the allocation of parental resources: maternal education and income are positively related to the height of daughters, while paternal

resources are biased toward sons (Thomas, 1994). In Duflo (2000), increasing pension income of the maternal grandmother is only associated with better health outcome of the granddaughter in South Africa.

To understand the motives of offering marriage payments to children, I review the literature on the motives of inter-vivos transfers: altruism and exchange motives. In Becker (1993), altruism of parents takes place if their utility function depends positively on the well-being of children. Rich altruistic parents transfer more assets than poor parents do to their children, especially those disadvantaged ones (e.g. worse-endowed children or lower-income children). In Cox (1987), transfers are made in exchange if the recipient's utility does not increase by receiving transfers from and providing services to the donor; whereas transfers are made based on altruism if the recipient is better off by taking this transfer-service contract. Using the U.S. household data, Cox (1987) finds inter-vivos transfers are more consistent with exchange-related motives. Lucas and Stark (1985), in addition to pure altruism and pure self-interest motives, pose tempered altruism or enlightened self-interest as the third hypothesis for motives to explain remittances. They consider remittance an inter-temporal and mutually beneficial contract between migrants and home. Using remittance data in Botswana, they find empirical evidence of cooperative contracts. In the literature on marriage payments, both Zhang and Chan (1999) and Botticini and Siow (2003) model dowry-giving behavior based on the pure altruism of parents. However, it is also possible that parents expect recipient children to financially reward them in their old age.

Lastly, I present a short review on inter-generational dependence in China. Secondi (1997) finds that most private transfers in rural China were made from children to older generations, and the amount of the transfers was higher if the recipient family was richer or had grandchildren, which supports the hypothesis of contractual arrangement in Lucas and Stark (1985). Xie and Zhu (2009) study inter-generational transfers and co-residence in three cities, and co-residence is considered the moderator of financial support. Controlling for the children's socioeconomic status, married daughters, especially

those living with parents, transfer more to parents than married sons. Zhang (2004) finds that parent-adult child co-residence rate decreases until children reach middle age and increases afterward: middle-age parents use their resources to meet the needs of adult children; when parents are old-aged, their needs for care are met through living together with children. These literature on inter-generational transfers and co-residence decision focus on behaviors within a short period (usually in the survey year using cross-sectional data), without paying attention to the effects of transfers made in the past. In this paper, I investigate the inter-temporal effects of parental support for children's marriage payments on inter-generational transfers. I focus on economic support, because (i) direct support such as personal care is much diminished for non-co-residing children, (ii) co-residence does not necessarily mean to provide parents with direct support, and (iii) both co-residing and non-co-residing children are eligible to make transfers to parents

3 A Model of Offering Marriage Payments to Children

In this section, I construct a simple model showing how parents determine the value of marriage payments offered to children and how this transfer behaviors are affected by parental expectation of repayments from children. Consider a household consisting of parents and one child, where the mother and the father are assumed to have homogeneous preferences and they are altruistic toward their child. Eq.(1) presents the parental utility function, where Z_p and Z_c are consumption of an aggregate commodity by parents and by the child respectively over their life cycle. U_p is a well-behaved utility function with $U_i' > 0$ and $U_{ii}'' < 0$, $i = 1, 2$, where $U_1' = \frac{\partial U_p}{\partial Z_p}$, $U_2' = \frac{\partial U_p}{\partial \alpha Z_c}$, $U_{11}'' = \frac{\partial^2 U_p}{\partial Z_p^2}$, and $U_{22}'' = \frac{\partial^2 U_p}{\partial (\alpha Z_c)^2}$. Besides, I assume that the marginal utility of parental consumption does not depend on the consumption of the child and vice versa, i.e. $U_{12}'' = U_{21}'' = 0$, where $U_{12}'' = \frac{\partial^2 U_p}{\partial (\alpha Z_c) \partial Z_p}$ and $U_{21}'' = \frac{\partial^2 U_p}{\partial Z_p \partial (\alpha Z_c)}$. α is an altruistic multiplier measuring the importance of the child for his parents, which is strictly positive.

$$U_p = U_p(Z_p, \alpha Z_c) \tag{1}$$

The budget equation of parents is shown in Eq.(2), where I_p is the parental income over their life circle. As discussed in Becker (1993), parents can invest human capital y, such as nutrition and schooling, and non-human capital D, including money, in-kind, and other assets transfers, in their child. Marriage payments are one of the most important components of D due to their large value.[4] I use the terms "non-human capital investment" and "asset transfers" interchangeably in this paper. T is the transfer from the child to his or her parents when they are old-aged.

$$Z_p + y + D = I_p + T \tag{2}$$

I present the budget equation of the child in Eq.(3), where e and r represent the rate of return on human capital and that on non-human capital respectively, and they are assumed to be strictly positive. The total income of the child consists of his gain from human capital (y) and that from non-human capital (D). The value of e varies by society and by individual, which reflects wage premium on education in the labor market and the endowment of the child: healthier and smarter children are expected to have a higher e. Conversely, the rate of return on non-human capital r is less subject to individual characteristics and can be assumed the same for everyone (Becker, 1993). The child is supposed to transfer a certain amount of money or in kind to parents (T), as shown in Eq.(4), which is proportional to the total investments made by his or her parents. The more the child is reciprocal, the higher proportion (β) of his or her total income will be transferred to the parents. Given that Z_c must be positive, I restrict $\beta < max\{1+e, 1+r\}$. When $\beta \leq 0$, the child is selfish; when $0 < \beta < 1$, the child is partly reciprocal; when $1 < \beta < 1+r$, the child is fully reciprocal; and when $\beta > 1+r$,

[4] "The most common strategy of parental investment in old-age security is to provide the largest possible size of bridewealth because younger generation regards the value of bridewealth as the most important marker of parental supports." See Yan (2005).

I call the child hyper-reciprocal.

$$Z_c + T = (1+e)y + (1+r)D \tag{3}$$

$$T = \beta(y + D) \tag{4}$$

After plugging Eq.(4) into Eqs.(2) and (3), I express the utility function of parents in an unconstrained form shown in Eq.(5). In the context of offering marriage payments, since the child has reached adulthood at the age of marriage, parents take human capital of the child as given and they only choose the optimal level of non-human capital investment to maximize their utility. Eq.(6) is the corresponding first order condition, which implies that at the equilibrium level of D^*, by providing the child with one additional unit of asset transfers, the marginal disutility of reducing parental consumption must be equal to the marginal gain from increasing the child's consumption.

$$\max_{\{D\}} U_p(I_p + (\beta - 1)(y + D), \alpha[(1 + e - \beta)y + (1 + r - \beta)D]) \tag{5}$$

$$FOC: \qquad F(D^*) = \frac{\partial U_p}{\partial D} = (\beta - 1)U_1' + \alpha(1 + r - \beta)U_2' = 0 \tag{6}$$

To analyze the optimal level of D based on the unconstrained problem in Eq.(5), I make two assumptions as below. The first assumption is posed since there would be no interior solution of D^* when β were equal to 1 or $1 + r$. I make the second assumption to ensure that given the optimal choice of non-human capital investment in the child, the child has positive consumption (i.e. $Z_c|_{D^*} > 0$); otherwise, the child would not survive. I allow the solution D^* to be negative. Empirically, a non-positive D^* suggests that no non-human capital would be invested in the child by parents.

ASSUMPTION 1: (i) $\beta \neq 1$, and (ii) $\beta \neq 1 + r$.

ASSUMPTION 2: The parental utility function and its first order condition with respect to D must satisfy:

- when $\beta < (1+r)$, $F(-\frac{1+e-\beta}{1+r-\beta}y) > 0$;
- when $\beta > (1+r)$, $F(-\frac{1+e-\beta}{1+r-\beta}y) < 0$.

where $F(-\frac{1+e-\beta}{1+r-\beta}y) = (\beta-1)U_1'|_{D^*=-\frac{1+e-\beta}{1+r-\beta}y} + \alpha(1+r-\beta)U_2'|_{D^*=-\frac{1+e-\beta}{1+r-\beta}y}$.

PROPOSITION 1: Let $\beta < 1$, i.e. the child is either selfish or partly reciprocal. Given $\alpha > 0$, $r > 0$, and $e > 0$, the equilibrium choice of D^* satisfies:

$$\frac{dD^*}{dI_p} > 0, \ \frac{dD^*}{dy} < 0, \ \frac{dD^*}{de} < 0.$$

For $\frac{dD^*}{d\beta}$, the sufficient condition for $\frac{dD^*}{d\beta} > 0$ is $D^* \geq -y$.
For $\frac{dD^*}{d\alpha}$, the necessary and sufficient condition for $\frac{dD^*}{d\alpha} > 0$ is $U_2' + \alpha Z_c U_{22}'' > 0$.
For $\frac{dD^*}{dr}$, the sufficient condition for $\frac{dD^*}{dr} > 0$ is $D^* \leq 0$.

In Proposition 1, I analyze the scenario where parents do not expect the child to repay the total investments (i.e. $\beta < 1$). Detailed partial derivatives are presented in the Appendix. Given the low reciprocity of the child, high-income, altruistic parents will transfer more non-human assets to their child. The expected reciprocity is also positively associated with the optimal level of asset transfers. Given $\frac{dD^*}{dy} < 0$ and $\frac{dD^*}{de} < 0$, this model implies that increases in human capital investment and the rate of return on it will reduce non-human capital investment in the child. In other words, as indicated in Becker (1993), allocation of non-human capital is always compensating so that disadvantaged children in terms of human capital receive more asset transfers from parents, such as a larger marriage payment. Besides, conditional on no asset transfer taking place ($D^* \leq 0$), parents are more likely to make asset transfers to the child, as the rate of return on it increases. For the altruistic weight α, being more altruistic does not necessarily mean a higher level of non-human capital investment in the child, unless the marginal utility of parents from the child's consumption is diminishing slowly so that $U_2' + \alpha Z_c U_{22}'' > 0$.

PROPOSITION 2: Let $1 < \beta < 1+r$, i.e. the child is fully reciprocal. Given $\alpha > 0$,

$r > 0$, $e > 0$, the equilibrium choice of D^* satisfies:

$$\frac{dD^*}{dI_p} < 0, \ \frac{dD^*}{de} < 0.$$

For $\frac{dD^*}{d\alpha}$, the necessary and sufficient condition for $\frac{dD^*}{d\alpha} > 0$ is $U_2' + \alpha Z_c U_{22}'' > 0$.
For $\frac{dD^*}{dr}$, the sufficient condition for $\frac{dD^*}{dr} > 0$ is $D^* \leq 0$.
For $\frac{dD^*}{dy}$, when (i) $1 < \beta < min\{1+e, 1+r\} \leq 1+r$, or (ii) $1 < \beta = 1+e < 1+r$, there is $\frac{dD^*}{dy} < 0$; Otherwise, when $1+e < \beta < 1+r$, the sign of $\frac{dD^*}{dy} < 0$ is undetermined.
Given $1 < \beta < 1+r$, the sign of $\frac{dD^*}{d\beta}$ is undetermined.

In the case where the child is fully reciprocal, i.e. $1 < \beta < 1+r$, I present comparative statics on the optimal level of asset transfers in Proposition 2. First, contrary to the low-reciprocity case, resourceful parents will only provide the fully reciprocal child with a low level of asset transfers, because parents know that the child will repay all principal with interest and the more they gave to the child, the more the child will repay. Similar to Proposition 1, human capital accumulation and its return are substitutable to non-human capital investment, unless $1 + e < \beta < 1 + r$. Also, a higher rate of return on assets (r) makes parents more likely to transfer assets to the child. Last, the impact of the altruistic weight and the reciprocity of the child on the optimal level of asset transfers D^* is ambiguous, depending on the shape of the parental utility function and the value of other parameters.

PROPOSITION 3: Given given $r < e$ and $\beta < 1 + e$, let $1 + r < \beta$, i.e. the child is hyper-reciprocal. Given $\alpha > 0$, $r > 0$, $e > 0$, the equilibrium choice of D^* satisfies:

$$\frac{dD^*}{dI_p} < 0, \ \frac{dD^*}{de} > 0.$$

For $\frac{dD^*}{d\beta}$, the sufficient condition for $\frac{dD^*}{d\beta} < 0$ is $D^* \geq -y$.
For $\frac{dD^*}{d\alpha}$, the necessary and sufficient condition for $\frac{dD^*}{d\alpha} > 0$ is $U_2' + \alpha Z_c U_{22}'' < 0$.
For $\frac{dD^*}{dr}$, the sufficient condition for $\frac{dD^*}{dr} > 0$ is $D^* \geq 0$.

The sign of $\frac{dD^*}{dy}$ is undetermined.

The third scenario is regarding the hyper-reciprocal child, i.e. $1 + r < \beta$, where parents will receive more transfers from the child than what they have invested in him or her. First, parental income and the reciprocity of the child are no longer positively related to the optimal asset transfers to the child, since any additional asset transfer to a hyper-reciprocal child is considered a financial burden for him or her and lower the consumption by the child. Second, increasing the rate of return on either human capital or non-human capital encourages parents to transfer more assets to the child, because a higher return leads to a higher consumption by the child, which counteracts the disutility caused by his or her hyper-reciprocity. In the hyper-reciprocal case, the marginal effects of the altruistic weight and human capital investment in the child are undetermined, subject to the shape of the utility function and the values of other parameters.

I conduct further analysis regarding the scenario where the child is either selfish or partly reciprocal ($\beta < 1$), which predicts $\frac{dD^*}{dI_p} > 0$. Since empirical evidence of the positive association between the donor's income and the amount of transfers is found (Lucas and Stark, 1985), it should be common for the donor to expect low reciprocity of the recipient. I use θ to denote $\frac{dD^*}{dI_p}$, the marginal effect of the parental income on the level of non-human capital investment in the child. Proposition 4 predicts how θ will change with other parameters given $\beta < 1 \Leftrightarrow \frac{dD^*}{dI_p} = \theta > 0$. For prudent parents, as their income increases, more assets will be transferred to the well-endowed child in terms of human capital and the return on it. For non-prudent parents, they practice the opposite strategy that the disadvantaged child will be compensated for his or her low human capital and low return on it, by receiving a larger amount of assets. The marginal effect of income on capital transfers θ is also subject to α, r, and β, but the direction of their impacts on θ can only be determined with more information on the shape of the utility function and the value of other parameters.

PROPOSITION 4: Let $\beta < 1$ so that $\theta = \frac{dD^*}{dI_p} > 0$.

- When the marginal utility of parents decreases at a *decreasing* rate (i.e. prudent parents with $U'''_{iii} > 0$, $i = 1, 2.$), the marginal effect of parental income on the optimal level of non-human capital investment in the child θ will change with:

$$\frac{\partial \theta}{\partial y} > 0, \ \frac{\partial \theta}{\partial e} > 0.$$

  For $\frac{\partial \theta}{\partial \alpha}$, the necessary and sufficient condition for $\frac{\partial \theta}{\partial \alpha} > 0$ is $2U''_{22} + \alpha Z_c^* U'''_{222} > 0$.

  For $\frac{\partial \theta}{\partial r}$, the sufficient condition for $\frac{\partial \theta}{\partial r} > 0$ is $D^* < 0$.

  The sign of $\frac{d\theta}{d\beta}$ is undetermined.

- Otherwise, when the marginal utility of parents decreases at an *increasing* rate (i.e. non-prudent parents with $U'''_{iii} < 0$, $i = 1, 2.$), the marginal effect of parental income on the optimal level of non-human capital investment in the child θ will change with:

$$\frac{\partial \theta}{\partial \alpha} < 0, \ \frac{\partial \theta}{\partial y} < 0, \ \frac{\partial \theta}{\partial e} < 0.$$

  For $\frac{\partial \theta}{\partial r}$, the sufficient condition for $\frac{\partial \theta}{\partial r} > 0$ is $D^* > 0$.

  For $\frac{\partial \theta}{\partial \beta}$, the sufficient condition for $\frac{\partial \theta}{\partial \beta} > 0$ is $\beta \leq 1 - r$ and $y + D^* \geq 0$.

This model has several implications. First, parents adjust non-human capital investment in their child (D^*) to the expected reciprocity of the child. If the reciprocity level is low, increasing expected repayment from the child leads to higher asset transfers to him or her. Second, increasing the altruistic weight of the child in the parental utility function does not necessarily lead to a larger amount of asset transfers to the child, which depends on the shape of the utility function and the rate of return on capitals. Thus, when interpreting empirical findings, before associating asset transfers to the child with the parental altruism, assumptions on relevant variables should be posed. Third, this model shows that the existence of the positive association between the donor's income and the level

of asset transfers, which can be predicted by both altruism and exchange motives (Cox, 1987; Becker, 1993), is conditional on a low expected reciprocity of the recipient. The reciprocity parameter (β) is not introduced explicitly in previous works, partly because classic models on the exchange motive focus on the money-service exchange, instead of the inter-temporal money-money exchange (Cox, 1987).[5]

4 Data and Summary Statistics

In this section, I briefly introduce the data sources of my empirical research and present summary statistics. Detailed information of my sample is presented in the Appendix. This paper investigates household allocation using household survey data from CHARLS, a national representative survey whose baseline was launched in 2011, in which households with one person who is 45 or older than 45 years old are selected (Zhao, Hu, Smith, Strauss, & Yang, 2012).[6] Given my study interests in parental support for children's marriage payments, only couple households with at least one married child are eligible in my sample.

4.1 Parental Resources Variables

In this paper, I use parental working experience variables as indicators of parental resources. Previous studies of intra-household allocation and parental preference of children use non-labor income and educational achievement as proxies of bargaining power and individual resources in the household (Thomas, 1990; Thomas, 1994; Duflo, 2000). [7] There are three reasons why I do not adopt income or education variables. First, China used to be a fully planned economy for decades since 1949, in which the deficient wage

[5]To compare model set ups, in my model, the aggregate commodity can include services, and $\beta(y+D)$ can be considered the total monetary cost of services provided by the child. However, I do not distinguish between the marginal utilities produced by different forms of goods in Eq.(5).

[6]The spouse of the main respondent can be younger than 45 years old in CHARLS

[7]Studies concerning household allocation and children's health do not use labor income as the indicator of parental resources, because children's health and parental labor market performance may be simultaneously determined by unobservable factors. For example, healthier parents are more likely to have healthy children and a higher salary.

system and the rationing system made monetary income unable to represent individual resources. Before the introduction of the floating wage system in 1985, wage level on average was low and equalized in urban industries, especially for junior workers (Korzec & Whyte, 1981; World Bank, 1992b), and there was no wage system in the agricultural sector. Meanwhile, consumption of food and most household goods was severely subject to quota for urban households until the 1990s (Huenemann, 1966; World Bank, 1992a), which also undermined the importance of monetary income. Second, I do not use parental education as the proxy of bargaining power in the household, because variation in parental education is low in my sample, especially for mothers: only 43 percent of mothers with married children completed primary school. Thomas (1994) uses parental education because it predicts potential income. However, as explained above, even monetary earning per se could not represent available resources for a long period in China. Third, parental support for marriage payments is relevant to household wealth, but due to the high inflation rate since the 1980s, inferring household wealth from current income is difficult.

I construct working experience variables of each parent based on CHARLS 2014 Life History Survey, in which respondents recalled their working history.[8] Each respondent could conduct multiple works at the same time, including part-time jobs and seasonal jobs. For each married child, his or her parental resources are calculated as the sums of maternal and paternal working years by work category by the year of the child's marriage. I categorize four types of works as follows:

(a) Non-agricultural work in the **public sector**: e.g. government, public institutions, state-owned enterprises (SOEs), the military.

(b) **Self-employed** non-agricultural work

(c) Non-agricultural work in the **private sector**: e.g. private firms, non-governmental organizations (NGOs).

[8]For parents whose children got married in 2015, I count parental working years by the end of 2014.

(d) **Agricultural work**

In the planned economy, self-employed jobs and opportunities in the private sector were extremely rare (if not nonexistent), and most positions in urban areas were in the public sector. Working in the public sector was associated with low wages and good social welfare, such as a pension scheme and low cost of medical services. After in 1978, self-employment and working in the private sector became increasingly common. Those positions may provide a high salary, but usually, their social insurance packages are not as good as those for people working in the public sector (Gu & Zhang, 2006). The last category is agricultural work, in which most respondents had working experience. Compared to other occupations, agricultural workers benefit much less and later from the social insurance system: the medical insurance scheme for rural residents was launched in 2002 (Liang, Guo, Jin, Peng, & Zhang, 2012); the nationwide public pension scheme was unavailable for peasants until 2009.[9] To sum up, I presume that parents with longer working experience in the public sector are most likely to be resourceful, while due to low social welfare, agricultural worker may have fewer resources for their children than parents in other sectors.

4.2 Marriage Payments

I construct marriage payments variables using CHARLS 2015. Each couple were asked if they offered any betrothal gifts or bought a house for each of their married children when he or she got married, along with the values of betrothal gifts and houses in the current year. In this study, marriage payments consist of betrothal gifts and houses.[10]

I present the frequency of marriages and offering marriage payments in Figure 1. Most married children of CHARLS respondents got married after 2000. For both sons

[9]Before the implementation of the new medical insurance (New Cooperative Medical Scheme) and the new pension scheme (New Rural Pension Scheme), there were old medical insurance and pension scheme for rural residents. However, those schemes collapsed due to the low participation rate and lack of subsidy from the government. See Shen and Williamson (2010) and Liang et al. (2012).

[10]Questions regarding marriage payments are only available in CHARLS 2015. In the case where the respondents' child got married more than once, information on the child's first marriage was collected.

and daughters, a certain proportion of them did not receive marriage payments from parents, but this proportion is much higher for daughters.

In Figures 2a and 2b, I present the ratio of sons and daughters receiving marriage payments from parents since 1980. I distinguish between the whole sample and the rural sample of married children in Figure 2a, where I find neither clear time trend of the prevalence of marriage payments for both sons and daughters, nor evidence of a difference in that between rural and urban areas. In the early 1980s, there was a drop in the marriage payments receiving ratio for all marriages, probably because of the release of the modified Marriage Law in 1980, and marriage payments were suppressed in the following years. Practices of this tradition resumed in the mid-1980s, and the ratio became stable afterward. In Figure 2b, I show the proportion of children receiving betrothal gifts, houses, or any item of them from parents over time. Betrothal gifts play a major role in marriage payments, especially dowries, since buying housing assets for daughters as their dowries is extremely rare: only 0.85 percent of married daughters received houses as their marriage payments, while this proportion is 16 percent for married sons.

4.3 Characteristics of Parents and Children

I extract parental demographics and background variables from CHARLS: demographic variables, consisting of age and education, are sourced from CHARLS 2015,[11] ; background variables, from CHARLS 2014. There are five binary background variables of each parent, viz. rural background,[12] self-reported health before 15 years old, famine experience before 12 years old, the literacy of the parent's parents, and the Party membership of the parent's parents. I code poor health in childhood as one if the respondent was somewhat less healthy or much less healthy compared to his or her cohort before 15 years old. The famine variable is constructed based on the subjective question "Was

[11]For missing values in parental variables in CHARLS 2015, I consult the information in CHARLS 2011, 2013, for the same respondent.

[12]Rural background is equal to one if his or her first residence was registered in rural areas (i.e. rural Hukou) or his or her identity was not registered in the government bureau. The latter case is rare and mostly occurs in rural areas.

there ever a time when your family did not have enough food to eat". Literacy parent and Party-member parent are equal to one if at least one parent of the respondent is literate or has party membership respectively. As seen in Table 1, 72 percent of fathers and 43 percent of mothers completed primary school. Most parents in my sample are from rural areas, experienced famine, and are not from literate or party-member families.

I collected data of the characteristics of married children from CHARLS 2015, including age, rural background, birth order, education, ethnic minority, age at marriage, the number of siblings, current health status, annual income with the spouse,[13] having any child under 16 years old, and co-residence status with parents. Summary statistics of married-children characteristics are presented in Table 2 by gender and by receipt of marriage payments from parents. On average, CHARLS children get married at the age of 24 for sons and 23 for daughters. More than three quarters of them are from rural areas. The average number of their siblings is two. Most children completed middle school, though sons are better educated than daughters. Eight percent of married children in my sample belong to ethnic minority populations, which is consistent with the minority ratio in the national population census. In 2015, these sampled children were in their mid-30s, and more than 70 percent of them had young children under 16 years old. The average annual income of these children and their spouses is around 40,000 CNY. Besides, compared to their non-recipient counterparts, recipient children are slightly younger, more likely to be the first child in the family, and have fewer siblings. Only sons and sons from rural areas are more likely to receive marriage payments from parents, but it is not the case for only or rural daughters. Recipient daughters currently have higher income and are in better health than non-recipient daughters, and it is also true for recipient sons in terms of health. Nearly 40 percent of sons and nine percent of daughters are living with their parents, and this living arrangement is not associated with receipt of marriage payments. To sum up, recipient children, especially daughters, are better off compared to their non-recipient counterparts, in terms of educational achievement, current health,

[13]In CHARLS questionnaire, income information is given by 12 income category. I construct the income level variable using the average of the upper bound and the lower bound of each income category.

and current income.

4.4 Inter-generational Transfers

I construct six variables of the amount of inter-generational transfers within the last year, viz. the total transfers from married children, the regular transfers from married children, the total transfers to married children, the regular transfers to married children, the net total transfers from married children, and the net regular transfers from married children.[14] Transfers consist of monetary and in-kind transfers. Among the total transfers, a proportion of them which have been given regularly for years such as monthly allowances, are defined as regular transfers. As shown in in Table 2, sons transferred 2,300 CNY per year to parents while daughters transferred 1,800 CNY, but the average net transfers from children to parents do not vary much by gender of children. For children who received marriage payments, their parents are richer, and they received more transfers from parents in 2015 than their non-recipient counterparts.

4.5 Socio-demographics and Natural Disaster

Apart from household survey data, I consider socio-demographics and natural disaster in this study.

The socio-demographic variables, which are compiled based on populations in the 18 to 30 age group, consist of the sex ratio, the female literacy rate, and the male literacy rate. In regions with a high sex ratio, men are expected to offer a high bride-price to compete against other single men in the marriage market. The literacy rate is a proxy of human capital investment in the local society. Data sources of these three variables are the one-percent sample of the National Population Census conducted in 1982, 1990, and 2000.[15] The census sample of 1982 is used to infer socio-demographic variables from

[14]Children who made the top 0.5 percentile and the bottom 0.5 percentile of net transfers to parents are considered as outliers, and these 94 observations are excluded from empirical analyses on inter-generational transfers.

[15]The original data was produced by the National Bureau of Statistics of China. Data available from *IPUMS International* website: `https://international.ipums.org/international`

1978 to 1985; the census sample in 1990, from 1986 to 1995; and the census sample in 2000, from 1996 to 2015. The literacy rate is measured in populations at or older than 12 years old in the census year.[16] I aggregate the raw data to variables of interest at the prefecture level, and merge these variables to CHARLS data set based on the community location of CHARLS sampling sites.

I use the lag-areas covered by natural disasters to capture agricultural shocks. Given that more than three quarters of married children in my sample are from rural areas, the household revenue and the capability of their parents to offer marriage payments are subject to agricultural yields. A one-year lag is considered because the value of marriage payments is usually negotiated one year before the marriage (Brown, 2009). The natural disaster variable at provincial level is taken from the website of the National Bureau of Statistics of China, which is under the category of agriculture and is supposed to be relevant to agricultural outputs.[17]

After matching the four variables to the sample of married children, I present summary statistics of them in Table 3. The mean of the sex ratio in populations age 18 to 30 is 1.059, suggesting that there are more men than women in the marriage market. Also, men on average are more likely to be literate.

[16]For example, to construct the literacy rate of males aged 18 to 30 in 2015, I do not use populations who were aged three to 15 in 2000. Rather, I calculate the literacy rate of males based on populations who are aged 12 to 15 in 2000 (i.e. people who were born from 1985 to 1988). The Compulsory Education Law was released in 1986 in China, which makes nine-year education compulsory and significantly lowers the cost of education in public schools. Hence, the literacy rate of younger generations born after 1988 is supposed to be higher than that of people born before 1988, and the literacy rate can only be underestimated. The measurement errors should be small since the average literacy rate of people born from 1985 to 1988 is already high: 98.89 percent for women and 99.27 percent for men.

[17]Data available from: `http://data.stats.gov.cn`
For Chongqing, which used to be a city in Sichuan province and was approved as a provincial-level municipality by the central government in 1997, its areas covered by disasters is constructed as a proportion of those in Sichuan province in each year before 1997; for Sichuan province, the areas covered by disasters is modified as the remaining part of the original value. The proportion is determined as the ratio of cumulative areas covered by natural disasters in Chongqing to the sum of those in Sichuan and Chongqing from 1997 to 2015.

5 Empirical Study of Marriage Payments in the Context of Household Allocation

5.1 Likelihood of Receiving Marriage Payments

To begin with, I study the correlation between parental resources and the likelihood of offering marriage payments to sons and daughters respectively. The baseline specification is shown in Eq.(7), where h indexes household and i indexes child. Working experience variables are denoted as PW for the father and MW for the mother. XC, XH, XP, and XM represent characteristics of the married child, the household, the father, and the mother respectively. The binary outcome variable D is equal to one if the parents provided the married child with betrothal gifts, housing assets, or any combination of them as his or her marriage payments (i.e. $D^* > 0$ in the theoretical model). I perform regressions of each outcome variable by son and daughter except the regression of receiving houses for daughters, because the proportion of recipient daughters is less than one percent. To control for province-invariant and time-invariant unobservables, I introduce *province* fixed effects and *marriage year* fixed effects.[18]

$$\begin{aligned} P(D_{hi}=1|\mathbf{X_1}) = P(D^*_{hi}>0|\mathbf{X_1}) = G(&PW_{hi}\beta_{pw} + MW_{hi}\beta_{mw} + XC_{hi}\beta_C + XH_h\beta_H \\ &+XP_h\beta_p + XM_h\beta_m + i.myr + i.prov + u_{hi}) \end{aligned} \tag{7}$$

Using Logit model, I present the baseline estimates in Table 4. I start from the interpretation of parental working experience variables. For maternal variables, mothers with higher socioeconomic status, i.e. those with longer working experience in the public or private sector, are more likely to finance the marriage payments of their children, especially dowries for their daughters. Also, in columns (1) and (4), mothers who have

[18]The location of the province is based on current residence of respondents. According to CHARLS 2011, more than 93 percent of CHARLS respondents are currently living in the same province as the province of their birth place.

worked for longer in the agricultural sector are also more likely to finance children's marriage payments, but the coefficients are only significant at ten percent significance level. The self-employment experience of mothers does not affect the likelihood of offering marriage payments to children. As for paternal variables, in general, increasing paternal working experience does not make children more likely to receive marriage payments from parents, and the self-employment experience of fathers is even negatively associated with providing sons with housing assets as their bride-prices. The discrepancy between the effects of maternal resources and paternal resources indicates a clear rejection of the unitary model of the household.

I summarize other baseline findings in this paragraph. First, in terms of the number and the order of siblings, the order of children is irrelevant to receipt of marriage payments from parents, but the number of siblings matters, since it changes the budget constraints of the household. Only sons are more likely to receive housing assets from parents as a component of their bride-prices. Only daughters, however, are less likely to receive betrothal gifts from parents, probably because by asking for a high bride-price and transferring it as the dowry, their parents do not spend their own money on their daughter's dowry. Daughters with more brothers are less likely to receive dowries from parents, while the probability of sons to receive bride-prices is not affected by the number of daughters in the household. Second, sons who are younger or from rural areas are more likely to receive bride-prices from parents, probably because the practice of giving bride-prices is more common in rural areas, and men living in rural areas get married earlier than those living in cities. These young men may also have less money for a deposit at the age of marriage, which makes parental support more necessary. Third, for education variables, paternal education has a strong positive effect on determining bride-prices. A higher education level for children is not associated with a better chance of receiving marriage payments from parents. Compared to those who did not complete middle school, sons whose highest level of education is middle school are more likely to receive bride-prices, but sons who completed high school or college have the same chance

of being financed as those who did not complete middle school. Last, the ethnicity of the child has no impact on the likelihood of receiving marriage payments from the parents.

I present robustness checks of baseline results using Eq.(8) with additional controls and Eq.(9) with Conditional Logit model. Additional controls $\mathbf{z}$ consist of parental background variables, socio-demographic variables, and the natural disaster variable. Parental background variables are introduced since the early environment and health in childrhood are highly related to individual resources in the later life (Case, Fertig, & Paxson, 2005; Case & Paxson, 2008a; Case & Paxson, 2008b; Haas, Glymour, & Berkman, 2011; Huang and Zhou, 2013). Parents who are from rural areas, who were in poor health or suffered from famine in childhood are less likely to come from a resourceful family, and they may have fewer resources in their middle age to allocate due to poorer health, lower education or fewer social connections.

$$\begin{aligned} P(D_{hi}=1|\mathbf{X_2}) = P(D^*_{hi}>0|\mathbf{X_2}) = G(PW_{hi}\beta_{pw} + MW_{hi}\beta_{mw} + XC_{hi}\beta_C + XH_h\beta_H \\ + XP_h\beta_p + XM_h\beta_m + \mathbf{z}\beta_{\mathbf{z}} + i.myr + i.prov + u_{hi}) \end{aligned} \tag{8}$$

$$\begin{aligned} P(D_{hi}=1|\mathbf{X_2}) = P(D^*_{hi}>0|\mathbf{X_2}) = G(PW_{hi}\beta_{pw} + MW_{hi}\beta_{mw} + XC_{hi}\beta_C + XH_h\beta_H \\ + XP_h\beta_p + XM_h\beta_m + \mathbf{z}\beta_{\mathbf{z}} + i.myr \times prov + u_{hi}) \end{aligned} \tag{9}$$

My baseline findings are quite robust to both checks. In Table 5, using Logit model with additional controls, I find that the previous findings on the impacts of parental resources on the likelihood of offering marriage payments to children still hold. For additional variables, sons who have literate or party-member grandparents are more likely to be financed upon their marriage by their parents. Neither the sex ratio nor natural disasters have any impact on giving marriage payments to children. The literacy rate among young adults plays an important role in dowry giving. A high literacy rate among young women increases the likelihood of giving dowries to daughters, while the same

among young men reduces it. The interpretation of this finding could be that in regions with a high female literacy rate, women in general have greater bargaining power in the household due to higher levels of human capital and better prospects in the job market, and thus daughters are more capable of asking parents for assets such as dowries. Conversely, a high male literacy rate implies a relatively low bargaining power of women so that daughters are less able to take household assets away from their parents. In Table 6, I conduct Conditional Logit regressions with *province*×*marriage year* fixed effects based on Eq.(9).[19] All previous findings in Table 4 and Table 5 still hold.

5.2 Intra-household Analysis

In Section 5.1, I study parental resource allocation using the married-sons sample and the married-daughters sample separately, without investigating whether parents treat sons and daughters differently within the household in terms of giving them marriage payments. To examine gender-related bias within the household, I use the specification in Eq.(10) and Eq.(11), where I add interaction terms of the son indicator and other regressors $\mathbf{X_2}$ used in Eq.(9) and only households having at least one married son and at least one married daughter are eligible for empirical analysis.

$$\begin{aligned} D_{hi} = PW_{hi}\beta_{pw} + MW_{hi}\beta_{mw} + XC_{hi}\beta_C + XH_h\beta_H + XP_h\beta_p + XM_h\beta_m + \mathbf{z}\beta_{\mathbf{z}} \\ + d_{son} + \mathbf{X_2}d_{son}\beta_{\mathbf{X_2}} + \lambda_h + u_{hi} \end{aligned} \tag{10}$$

In Eq.(10), I use linear probability model (LPM) with household fixed effects to study the likelihood of offering marriage payments to sons and daughters within the household. Estimates are shown in Table 7. The binary variable is equal to one if the married child received any marriage payment or any betrothal gifts in columns (1) and (2) respectively.[20] Maternal working experience variables are positively associated with

[19] All variables used in Table 5 are used in Table 6 except the lag-areas covered by natural disasters, which is dropped due to multi-collinearity.

[20] The regression of receiving housing assets is omitted because housing assets are extremely rare in

the likelihood of offering marriage payments to children, and these variables are jointly significant in column (1). In other words, as the mother becomes senior in her job and more resourceful, she will benefit her children by supporting their marriage payments. Paternal working experience variables are jointly insignificant in both columns. For the differentiated effects by gender, the daughter bias is revealed: as the father in the public sector and the self-employed mother become more experienced in their work, they are more likely to finance their daughters than their sons. Given the joint significance of the interaction terms between maternal working years and the son indicator in both columns, I conclude that this daughter bias is particularly strong for mothers.

$$\begin{aligned} D^*_{hi} = PW_{hi}\beta_{pw} + MW_{hi}\beta_{mw} + XC_{hi}\beta_C + XH_h\beta_H + XP_h\beta_p + XM_h\beta_m + \mathbf{z}\beta_{\mathbf{z}} \\ + d_{son} + \mathbf{X_2}d_{son}\beta_{\mathbf{X_2}} + \lambda_h + (u_{hi}|D^*_{hi} > 0) \end{aligned} \tag{11}$$

In Eq.(11), the dependent variable is the value of marriage payments D^* instead of a binary outcome, which is censored at zero. I apply Trimmed Least Square (Trimmed LS) estimator with household fixed effects (Honoré, 1992). I present regressions of the value of total marriage payments and that of betrothal gifts in Table 8.[21] Again, maternal working experience variables are jointly significant in column (1), showing that children will receive a larger bride-price or dowry as their mother becomes more resourceful. However, the value of children's marriage payments is not subject to paternal earnings. Also, the daughter bias is confirmed. In column (1), the interaction term between maternal working years in the public sector and the son indicator is negatively significant, suggesting that daughters benefit more from mothers with high socioeconomic status than sons. Noticeably, in column (2), the interaction term between the local sex ratio and the son indicator is positively significant, implying that men tend to pay a higher bride-price if there are more young men than young women in the marriage market. On average, an

dowries.

[21] The regression of housing assets is omitted because housing assets are extremely rare in dowries.

increase in the sex ratio by one standard deviation drives up the value of bride-prices by CNY 8,252 (USD 1,194), but it has no impact on the value of dowries.

5.3 Summary and Explanation of the Main Findings

There are two findings in the previous subsections. First, resourceful mothers are inclined to provide children with more marriage payments, while resourceful fathers are not ($\theta_M > \theta_P$). Second, as mothers become more resourceful, they tend to give larger marriage payments to daughters, instead of sons ($\theta_D > \theta_S$). In this subsection, I make hypotheses to explain these two findings using my theoretical model and test my hypotheses.

I use Proposition 1 to explain the first finding: the value of children's marriage payments increases with maternal earnings but not paternal ones ($\theta_P \leq \theta_M$), because probably due to the patriarchy in Chinese culture, fathers expect more repayments than mothers do from children ($\beta_P > 1 > \beta_M$). If the father expects children to fully repay his investment in them (i.e. β is close to one), then whatever amount he invests, it will not change his budget constraint and the amount of marriage payments transferred to children will not be subject to his resources. *If this hypothesis is true, paternal resources should also contribute to childrens marriage payments as fathers expect less repayment from children.*

The finding regarding the daughter bias is explain based on the difference in human capital between sons and daughters. Seeing that daughters were less educated and less healthy than sons in Table 2, parents probably invest less human capital in daughters in their early years ($y_D < y_S$). Also, daughters are disadvantaged compared to sons in terms of the return on human capital, due to maternal leave and other labor market discrimination ($e_D < e_S$). Based on the existence of the gender gap in human capital, using Proposition 4, I make two mutually exclusive hypotheses to explain the daughter bias:

- **Preference Motive:** For prudent parents ($U'''_{iii} > 0$, $i = 1, 2$) who have $\beta < 1$, there are $\frac{\partial \theta}{\partial \alpha} > 0$, $\frac{\partial \theta}{\partial e} > 0$, and $\frac{\partial \theta}{\partial y} > 0$. The daughter bias arises if daughters are

strongly preferred by prudent parents ($\alpha_D \gg \alpha_S$) so that the positive effect of altruistic weight on the marginal effect of income (θ) exceeds the negative effect of daughters' disadvantages in term of human capital (given $e_D < e_S$ and $y_D < y_S$). As a result, parents provide daughters with larger dowries as their resources increase. *If this explanation is true, I expect a stronger daughter bias as the gender discrepancy of human capital diminishes* (i.e. the effect of high altruistic weight could outweigh the effect of daughter's disadvantages in terms of human capital to a greater degree).

- **Compensation Motive:** For non-prudent parents ($U'''_{iii} < 0$, $i = 1, 2$) who have $\beta < 1$, there are $\frac{\partial \theta}{\partial e} < 0$ and $\frac{\partial \theta}{\partial y} < 0$. Supposing mothers are neutral to sons and daughters ($\alpha_S = \alpha_D$), the daughter bias results from the compensation for low human capital investment in daughters and their low return on it compared to sons. *If this explanation is true, I expect to see a weaker daughter bias as the gender discrepancy of human capital diminishes.* Since in this case, mothers would no longer need to compensate daughters as much as they used to.

I test my hypotheses of the two findings using the urban sample.[22] Compared to the national sample, urban fathers financially rely less on children for their old-age support (See Figure 3), because of the weakened traditional filial piety by modernization and the high coverage of social insurance for urban residents (Cheung & Kwan, 2009), implying a lower level of reciprocity of children. Also, Figure 4 shows that the gender gap in human capital investment is narrower in urban sample than the national one. I present regressions using the urban sample in Table 9, where columns (1) and (2) are based on Eq.(10); columns (3) and (4), based on Eq.(11). First, in urban households, paternal working experience variables are positively associated with providing children with marriage payments, which is consistent with the prediction in Hypothesis 1: conditional on a low expectation of repayment, fathers do invest children with more capital asset as they become more resourceful. Second, given no joint significance of interaction term across

[22] In the urban sample, parents are currently living in urban areas

columns, I conclude that the daughter bias is much weaker in the urban sample than the national one. Thus, the narrower gender gap in human capital leads to a lower level of daughter bias, and the increasing value of dowries is attributable to compensation for low human capital and low return on it for daughters. Due to gender equality in education and career prospects, urban parents no longer need to compensate their daughters in terms of human capital with asset transfers as much as they used to.

I summarize findings of the marriage payments study in this paragraph. Compared to fathers, children with resourceful mothers are more likely to receive marriage payments from parents. Since fathers usually expect children to fully repay parental investment, paternal resources are not a factor in determining whether or not to support children's marriage payments. Also, as parents become more resourceful, they tend to transfer more assets to daughters instead of sons. A large dowry is used to compensate the daughter for her low human capital and low return on it in the labor market. This daughter bias is expected to diminish as the gender gap in education is closed and the female discrimination in the labor market is reduced.

6 Marriage Payments and Old-Age Support

6.1 Empirical Specification

Seeing the large value of marriage payments, I associate giving marriage payments to children with investment in old-age security of parents. Thus, I examine the motive for offering marriage payments to children and investigate whether parents benefit from it in terms of current inter-generational transfers in this section. If parents provide children with their marriage payments based on altruism without asking for repayment, there should be no positive correlation between marriage payments receipt and the amount of current transfers from children to parents ($\beta \leq 0$ in the theoretical model). However, if the exchange motive is involved, financing the child's marriage payments is a strategy to strengthen family ties and parents expect repayments from recipient children in the

future ($\beta > 0$ in the theoretical model). In other words, these recipient children should make more transfers than their non-recipient siblings to their parents .

I present my specification in Eq.(12) and Eq.(13), where fixed effects are introduced in both equations to focus on within-household variation.[23] In Eq.(12), the dependent variable T represents the total or regular inter-generational transfers, which can be either from the child to the parents or vice versa. Since T is censored at zero, I use Trimmed Least Square estimator to identify parameters in Eq.(12). In Eq.(13), the dependent variable NT is the net total transfers or the net regular transfers to parents. Given no censored observation in NT, I use within estimator. G can be either a binary variable D, which is equal to one if parents in household h offered any marriage payment to the child i, or a continuous variable D^*, which is the value of total marriage payments received by the child. I perform regressions on D and D^* separately based on the same specification. XC represents characteristics of the married-child; XH, the number of alive sons and the number of alive daughters in the household. In patrilocal and patriarchal societies like China, since sons usually are supposed to keep a closer relationship with their parents after getting married and to take more responsibility than daughters of taking care of their parents, I presume the impacts of characteristics of the child and the household to differentiate by sons and daughters. Thus, I introduce interaction terms between the son indicator and other regressors in Eq.(12) and Eq.(13).

$$\begin{aligned} T_{hi} = G_{hi}\gamma_g + XC_{hi}\gamma_c + d_{son} + G_{hi}d_{son} + XC_{hi}d_{son}\gamma_{cson} + XH_h d_{son}\gamma_{hson} \\ + u_h + (v_{hi}|T_{hi} > 0) \\ where \quad G = D, D^* \end{aligned} \tag{12}$$

[23] Only households having at least one alive, married son and at least one alive, married daughter are eligible for estimations.

$$NT_{hi} = G_{hi}\gamma_g + XC_{hi}\gamma_c + d_{son} + G_{hi}d_{son} + XC_{hi}d_{son}\gamma_{cson} + XH_h d_{son}\gamma_{hson} + u_h + v_{hi} \quad (13)$$

$$where \quad G = D, D^*$$

6.2 Empirical Results

In Table 10, I present regressions of inter-generational transfers on the binary marriage payments receipt variable. From column (1) to column (4), I show regressions of transfers from children to parents and those from parents to children based on Eq.(12). In columns (5) and (6), I present regressions of net transfers to parents based on Eq.(13). As shown in columns (1) and (2), the coefficients of marriage payments receipt are negatively significant irrespective of gender of the children, suggesting that those who took advantage of parents in the past, compared to those who did not, currently provide parents with fewer transfers. This is a strong rejection of the exchange motive for offering marriage payments to children. For other variables, high-income children transfer more to their parents, and this effect is equal for both sons and daughters. Educated and elderly sons provide parents with less economic support than their counterpart daughters. However, in terms of the total transfers to parents, sons contribute CNY 7,912 more than daughters per year. Noticeably, married sons will transfer less to parents if they have more brothers, while a higher level of transfers will be made if they have more sisters. This finding implies that sons share the financial responsibility of taking care of their aging parents with each other, but not with their sisters. Last, there is no evidence that rural background, order of child, co-residence status, health status, or having young children affects the level of transfers from children to their parents.

In Table 10, columns (3) and (4) present regressions of transfers from parents to married children. Children who received marriage payment from parents, especially daughters, currently receive more transfers from parents compared to their non-recipient sib-

lings. Sons, on average, received more transfers than daughters from parents over the last year. Good health of children, especially daughters, is associated with receiving lower levels of regular transfers from parents. Given the strong correlation between health and wealth, this finding indicates that parents do compensate disadvantaged adult children by increasing regular transfers to them.

I present regressions of net transfers to parents in Table 10, columns (5) and (6). Again, irrespective of gender of the child, marriage payments receipt is negatively correlated with the amount of net transfers to parents, implying that recipient children are selfish, and no repayment is associated with asset transfers to children in their early adulthood. However, income, education, and health are crucial predictors of net transfers to parents, suggesting that children do repay human capital investment made by their parents. From columns (1) to (6), married sons are found to maintain closer economic ties than married daughters with their parents by engaging in higher levels of bilateral transfers. However, after controlling for the human capital of children, there is no evidence that sons provide their parents with more financial support than daughters in terms of net transfers.

Findings in Table 10 are strongly upheld by Table 11, where I present regressions on the value of marriage payments. The coefficient of marriage payments is insignificant in columns (1) and (2) and is negatively significant in column (5), suggesting that in terms of the provision of old-age support, parents benefit nothing from giving marriage payments to children. Recipient children simply take parental support for granted, and they are financially more dependent on their parents than their non-recipient siblings. Also, income, education, and health positively predict the level of net transfers to parents, which confirms that compared to non-human capital, human capital investment in children results in more repayments to parents in the long term.

To sum up, Tables 10 and 11 show that married children financed by parents in the past do not currently transfer more money or in-kind payments than their non-recipient siblings to their parents. Despite the high value of bride-prices and dowries, I find no

evidence of repayment by recipient sons and daughters. This finding challenges the point of view that offering marriage payments for children is a strategy to secure the provision of parental old-age support, and the exchange motive can hardly explain parental support for children's marriage payments. Although married sons maintain closer ties with parents, after controlling for income and education, they do not provide parents with more net transfers than married daughters. Noteworthily, richer, better-educated, and healthier children engage in higher levels of transfers to parents compared to disadvantaged ones, suggesting that parents do receive returns on human capital investment in their children. In other words, to obtain old-age support from children, the best strategy for parents is to invest human capital in them in their early years instead of transferring capital assets to them in their adulthood.

7 Concluding Remarks

In this paper, I consider parental support for marriage payments of children as an investment of non-human capital, and I theorize on their investment behaviors taking parental altruism, return on investments, and reciprocity of children into account. Using CHARLS data, I find that children, especially daughters, are more likely to receive marriage payments from parents as their mother becomes more resourceful. Increases or decreases in paternal resources do not affect the chance for children to receive support for their marriage payment, because fathers expect their children to fully repay their investment in them, and thus paternal investment behavior is not subject to earnings. As parental resources increase, they tend to contribute more to dowries than bride-prices, because dowries play a role in compensation for disadvantages of daughters in terms of low human capital and its low return in the labor market. I also study whether parents invest their children with marriage payments in exchange for old-age support. However, no evidence of the exchange motive is found, and recipient children do not provide parents with more support than their non-recipient siblings. Health, income, and education of

children are strong predictors of the provision of old-age support to parents, suggesting that though non-human capital investment in children such as bride-prices and dowries results in no return, parents do benefit from human capital investment in their children.

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Figures

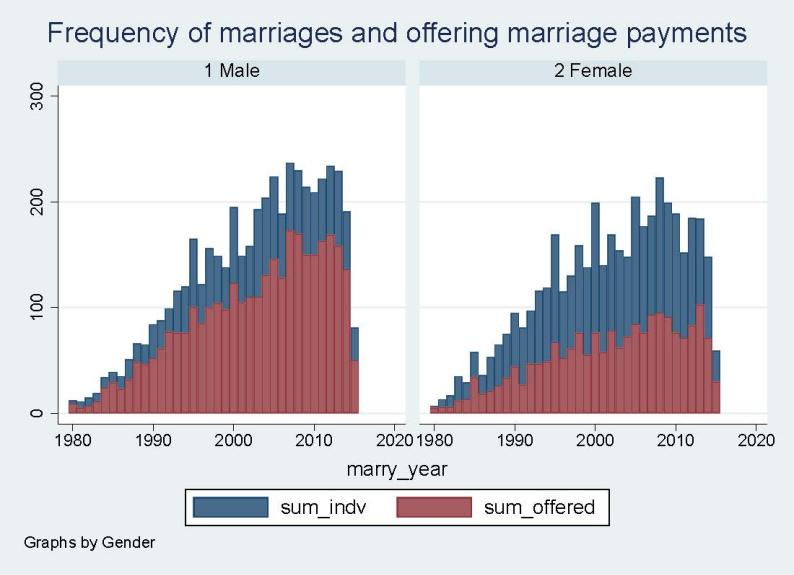

Figure 1: Frequency of Marriages and Offering Marriage Payments

Notes: Data from CHARLS 2015. Marriage observations in or after 1980 are used, because the number of marriages per year is fewer than 15 before 1980. There 4743 married sons (including 3652 sons from rural areas) and 4325 married daughters (including 3300 daughters from rural areas) in the sample.

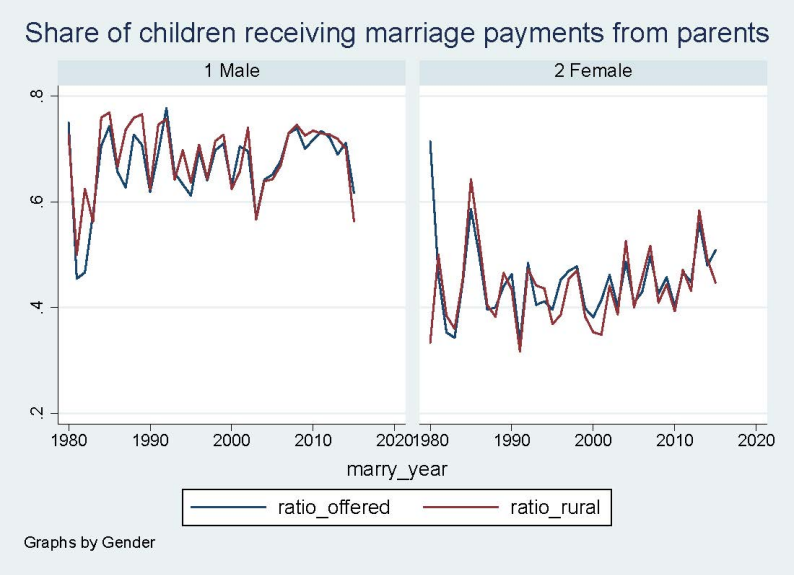

Figure 2(a): Share of Children Receiving Marriage Payments

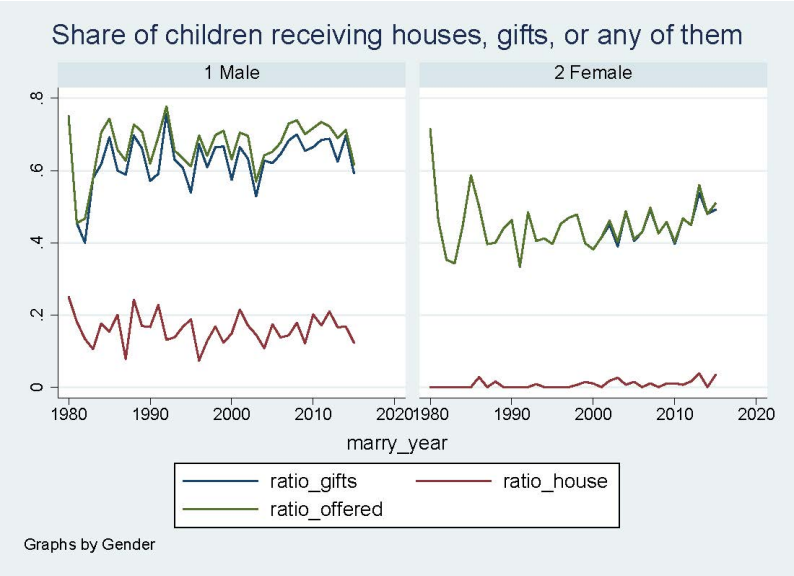

Figure 2(b): Share of Children Receiving Gifts, Houses, or Any of Them

Notes: Data from CHARLS 2015. Marriage observations in or after 1980 are used.

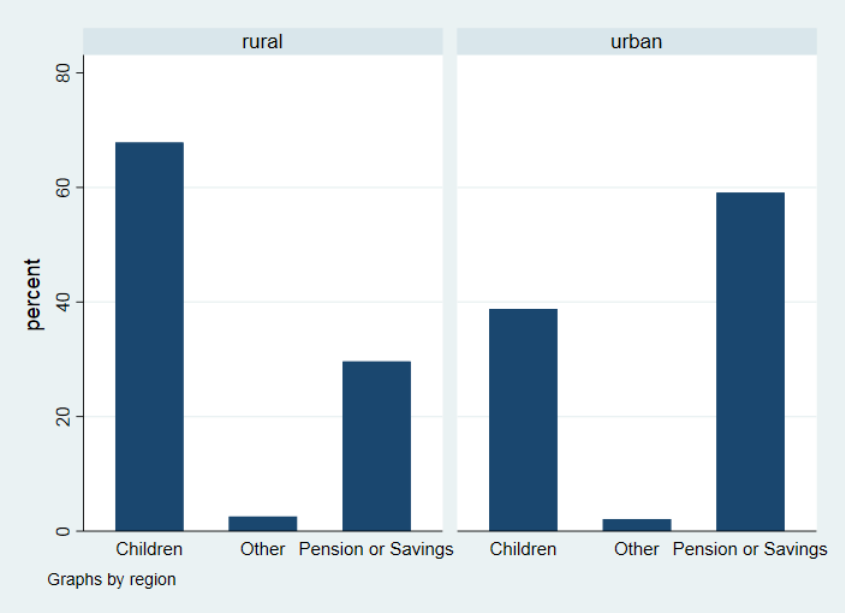

Figure 3: Share of Fathers by Expected Sources of Old-Age Support and by Region

Notes: Self-reported source of old-age support based on 4385 fathers of married children in CHARLS 2015.

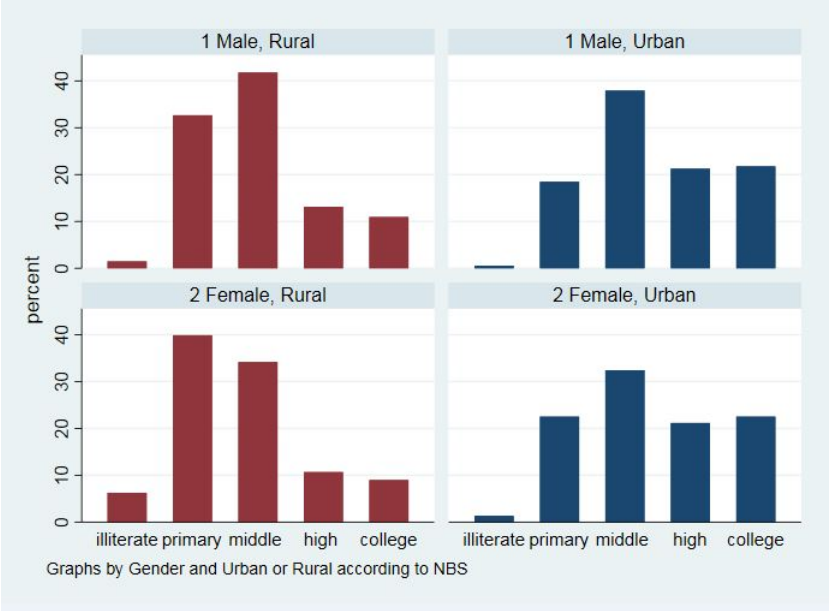

Figure 4: Share of Children by Education, by Gender, and by Region

Notes: Highest level of education of 9325 married children in CHARLS 2015, consisting of 3254 rural sons, 1608 urban sons, 2918 rural daughters, and 1545 urban daughters. Urban children indicate children whose parents are currently living in cities.

Tables

Table1: Summary Statistics of Parental Variables

	Father			Mother		
VARIABLES	N	mean	sd.	N	mean	sd.
Panel A: Parental variables in the year of the child's marriage						
Age at the marriage of children	9,123	51.27	6.259	9,123	49.04	5.998
Working experiences by sector by the year of children's marriage						
Public sector	8,681	3.627	8.699	8,490	0.792	4.231
Self-employed	8,681	2.093	6.645	8,490	0.956	4.217
Private sector	8,681	6.523	11.13	8,490	2.223	6.675
Agriculture	8,681	24.45	15.79	8,490	28.11	13.09
Panel B: Demographic variables of parents						
Age in 2015	4,385	62.44	8.365	4,385	60.29	7.983
primary school	4,385	0.721	0.449	4,385	0.429	0.495
Panel C: Background variables of parents						
Rural background	4,056	0.928	0.259	4,079	0.935	0.247
Poor health in childhood	4,071	0.187	0.39	4,098	0.176	0.381
Famine experience before 12	4,071	0.652	0.476	4,098	0.607	0.488
Literate parent	3,999	0.409	0.492	4,017	0.404	0.491
Party member parent	4,071	0.13	0.337	4,098	0.148	0.355

Notes: Only respondents who are in a couple and have at least one married child are in the sample.

Table 2: Summary of Children Variables by Marriage Payments Variable

	Sons			Daughters		
	offered	not offered	difference	offered	not offered	difference
Panel A: Demographic variables of married children						
Age in 2015	36.334	37.726	-1.392***	35.963	36.536	-0.572**
	(0.133)	(0.191)	(0.234)	(0.181)	(0.157)	(0.239)
Rural background	0.786	0.75	0.036***	0.758	0.781	-0.023*
	(0.007)	(0.011)	(0.013)	(0.010)	(0.008)	(0.013)
First child	0.396	0.362	0.034**	0.441	0.398	0.043***
	(0.008)	(0.012)	(0.015)	(0.011)	(0.010)	(0.015)
Only child	0.069	0.044	0.025***	0.045	0.036	0.009
	(0.004)	(0.005)	(0.007)	(0.005)	(0.004)	(0.006)
Middle school	0.716	0.694	0.021	0.64	0.595	0.045***
	(0.008)	(0.012)	(0.014)	(0.011)	(0.010)	(0.015)
Ethnic minority	0.072	0.086	-0.015*	0.077	0.08	-0.003
	(0.004)	(0.007)	(0.008)	(0.006)	(0.005)	(0.008)
Age at marriage	24.03	24.812	-0.783***	22.924	22.946	-0.022
	(0.064)	(0.110)	(0.120)	(0.079)	(0.074)	(0.109)
Number of brothers	1.957	2.084	-0.127***	1.185	1.314	-0.129***
	(0.017)	(0.025)	(0.030)	(0.021)	(0.019)	(0.029)
Number of sisters	1.143	1.227	-0.084**	2.045	2.163	-0.119***
	(0.018)	(0.029)	(0.033)	(0.023)	(0.024)	(0.034)
Panel B: Variables of married children in 2015						
Good health	0.675	0.626	0.048***	0.641	0.572	0.068***
	(0.008)	(0.012)	(0.015)	(0.011)	(0.010)	(0.015)
Annual income	41.636	41.077	0.559	45.173	39.188	5.985***
(w/ spouse)	(0.790)	(1.257)	(1.449)	(1.064)	(0.952)	(1.424)
having child under 16	0.749	0.735	0.014	0.705	0.709	-0.004
	(0.008)	(0.012)	(0.014)	(0.011)	(0.009)	(0.014)
Panel C: Inter-dependence with parents in 2015						
Total to parents	2.298	2.308	-0.010	1.96	1.733	0.227**
	(0.087)	(0.108)	(0.148)	(0.075)	(0.068)	(0.102)
Total to child	1.589	1.024	0.565***	1.044	0.577	0.467***
	(0.101)	(0.122)	(0.170)	(0.106)	(0.072)	(0.125)
Total net to parents	0.709	1.284	-0.575***	0.916	1.156	-0.240
	(0.121)	(0.164)	(0.210)	(0.123)	(0.088)	(0.147)
Regular to parents	0.569	0.628	-0.059	0.443	0.396	0.047
	(0.041)	(0.059)	(0.072)	(0.034)	(0.031)	(0.046)
Regular to child	0.274	0.16	0.114*	0.207	0.138	0.068
	(0.041)	(0.037)	(0.066)	(0.045)	(0.036)	(0.057)
Regular net to parents	0.295	0.468	-0.173*	0.236	0.258	-0.022
	(0.053)	(0.070)	(0.092)	(0.054)	(0.046)	(0.071)
Co-residence	0.397	0.373	0.024	0.087	0.086	0.000
	(0.009)	(0.013)	(0.015)	(0.006)	(0.006)	(0.009)
Parents financial assets	27.027	17.336	9.690***	33.571	18.819	14.752***
	(1.535)	(1.653)	(2.522)	(2.126)	(1.554)	(2.578)

Table 3: Summary Statistics of Sociodemographic and Natural Disaster Variables

Variables	N	Mean	sd.	Min	Max
sex ratio	9,097	1.059	0.067	0.565	1.504
female literacy rate	9,097	0.956	0.09	0.185	1
male literacy rate	9,097	0.984	0.036	0.389	1
lag-areas covered by natural disasters (1,000,000 hectares)	9,084	1.916	1.069	0	7.394

Notes: Sociodemographic variables are constructed based on populations in the 18 to 30 age group.

Table 4: Logit Regressions of Offering Marriage Payments to Children

	(1)	(2)	(3)	(4)	(5)
	Any payment		Any betrothal gift		Any house
VARIABLES	Son	Daughter	Son	Daughter	Son
Paternal working experience by the child's marriage					
Public sector	-0.001	0.007	-0.001	0.008	-0.003
	(0.007)	(0.007)	(0.006)	(0.007)	(0.008)
Self-employed	-0.003	0.009	-0.002	0.010	-0.024**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.012)
Private sector	-0.004	0.001	-0.002	0.001	-0.009
	(0.005)	(0.006)	(0.005)	(0.006)	(0.007)
Agriculture	-0.008	-0.002	-0.006	-0.002	-0.007
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
Maternal working experience by the child's marriage					
Public sector	0.024*	0.050***	0.015	0.045***	0.012
	(0.014)	(0.012)	(0.012)	(0.012)	(0.014)
Self-employed	0.006	0.017	0.007	0.017	-0.007
	(0.010)	(0.011)	(0.010)	(0.011)	(0.015)
Private sector	0.015*	0.028***	0.011	0.028***	0.003
	(0.009)	(0.008)	(0.008)	(0.008)	(0.009)
Agriculture	0.009*	0.008	0.008	0.009*	0.006
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
first child	0.032	-0.003	0.077	-0.007	-0.030
	(0.084)	(0.081)	(0.081)	(0.081)	(0.115)
single child	0.349*	-0.340	0.121	-0.420**	0.915***
	(0.199)	(0.208)	(0.183)	(0.210)	(0.211)
n_sons	-0.023	-0.119**	-0.015	-0.117**	0.122*
	(0.053)	(0.057)	(0.053)	(0.057)	(0.068)
n_daughters	0.058	-0.032	0.046	-0.033	0.068
	(0.048)	(0.051)	(0.048)	(0.050)	(0.065)
Minority	0.037	0.102	-0.014	0.110	0.027
	(0.174)	(0.189)	(0.167)	(0.189)	(0.211)
Child-marry_age	-0.032**	0.009	-0.039***	0.008	0.014
	(0.014)	(0.016)	(0.014)	(0.016)	(0.023)
Child-edu_mid	0.130	0.092	0.162*	0.089	-0.153
	(0.096)	(0.096)	(0.093)	(0.096)	(0.129)
Child-edu_high	-0.106	0.137	-0.049	0.137	-0.009
	(0.116)	(0.124)	(0.113)	(0.124)	(0.158)
father-primary edu.	0.207**	0.155	0.176*	0.151	-0.056
	(0.100)	(0.106)	(0.097)	(0.105)	(0.141)
mother-primary edu.	0.122	0.060	0.097	0.061	0.163
	(0.100)	(0.101)	(0.096)	(0.101)	(0.126)
Father age	0.012	-0.022*	0.012	-0.021	-0.010
	(0.014)	(0.013)	(0.013)	(0.013)	(0.017)
Mother age	-0.036**	-0.012	-0.034**	-0.013	-0.024
	(0.014)	(0.014)	(0.014)	(0.014)	(0.019)
Child-rural background	0.305***	0.141	0.291**	0.146	-0.155
	(0.117)	(0.115)	(0.114)	(0.115)	(0.149)
Observations	4,160	3,745	4,158	3,743	4,071
Province FE	Y	Y	Y	Y	Y
Marriage year FE	Y	Y	Y	Y	Y

Notes: standard errors clustered on household.

Table 5: Logit Regressions of Offering Marriage Payments to Children with Additional Controls

	(1)	(2)	(3)	(4)	(5)
	Any payment		Any betrothal gift		Any house
VARIABLES	Son	Daughter	Son	Daughter	Son
Father-Public sector	-0.000	0.005	-0.001	0.006	-0.001
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Father-Self-employed	-0.002	0.007	-0.001	0.007	-0.024**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.012)
Father-Private sector	-0.003	-0.000	-0.002	0.000	-0.010
	(0.005)	(0.006)	(0.005)	(0.006)	(0.007)
Father-Agriculture	-0.008	-0.004	-0.007	-0.004	-0.008
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
Mother-Public sector	0.026*	0.048***	0.016	0.042***	0.011
	(0.015)	(0.012)	(0.012)	(0.012)	(0.015)
Mother-Self-employed	0.004	0.013	0.006	0.013	-0.009
	(0.011)	(0.011)	(0.011)	(0.011)	(0.015)
Mother-Private sector	0.014	0.030***	0.010	0.030***	0.005
	(0.009)	(0.009)	(0.008)	(0.009)	(0.010)
Mother-Agriculture	0.011**	0.007	0.010*	0.008	0.007
	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)
first child	0.014	-0.009	0.067	-0.013	-0.022
	(0.087)	(0.083)	(0.084)	(0.083)	(0.120)
single child	0.393*	-0.300	0.157	-0.384*	0.903***
	(0.208)	(0.213)	(0.191)	(0.215)	(0.217)
n_sons	-0.035	-0.128**	-0.033	-0.127**	0.123*
	(0.056)	(0.059)	(0.055)	(0.059)	(0.070)
n_daughters	0.078	-0.031	0.053	-0.033	0.097
	(0.051)	(0.053)	(0.050)	(0.053)	(0.068)
minority	0.028	0.028	-0.026	0.034	0.058
	(0.182)	(0.198)	(0.172)	(0.197)	(0.224)
Child-marry_age	-0.030**	0.008	-0.037***	0.006	0.029
	(0.014)	(0.016)	(0.014)	(0.016)	(0.024)
Child-edu_mid	0.131	0.060	0.189**	0.057	-0.224*
	(0.099)	(0.099)	(0.097)	(0.099)	(0.135)
Child-edu_high	-0.144	0.070	-0.065	0.070	-0.097
	(0.121)	(0.127)	(0.117)	(0.127)	(0.167)
father-primary edu.	0.159	0.150	0.138	0.144	-0.075
	(0.105)	(0.110)	(0.102)	(0.110)	(0.146)
mother-primary edu.	0.098	0.070	0.083	0.069	0.130
	(0.103)	(0.105)	(0.099)	(0.105)	(0.131)
Father age	0.004	-0.020	0.009	-0.019	-0.014
	(0.014)	(0.013)	(0.014)	(0.013)	(0.018)
Mother age	-0.026*	-0.008	-0.026*	-0.009	-0.026
	(0.015)	(0.014)	(0.014)	(0.014)	(0.020)
Child-rural background	0.303**	0.118	0.294**	0.125	-0.176
	(0.124)	(0.119)	(0.120)	(0.119)	(0.155)

To be cont.

Cont. Table 5: Logit regressions of offering marriage payments to children					
Lag-disaster areas	-0.021	0.013	-0.033	0.009	0.022
	(0.053)	(0.049)	(0.051)	(0.049)	(0.063)
Sex ratio	-0.082	-0.133	0.207	-0.190	-1.527
	(0.829)	(0.876)	(0.802)	(0.877)	(1.251)
female literacy rate	1.103	3.221**	1.508	3.167**	-2.712
	(1.376)	(1.483)	(1.337)	(1.478)	(2.114)
male literacy rate	-1.652	-6.888**	-2.214	-6.829**	6.310
	(2.767)	(3.054)	(2.744)	(3.046)	(6.154)
Father-poor hlth before 15	-0.059	-0.031	-0.083	-0.049	-0.211
	(0.111)	(0.117)	(0.107)	(0.117)	(0.154)
Father-party parent	0.087	0.072	0.145	0.073	-0.297*
	(0.140)	(0.136)	(0.134)	(0.136)	(0.161)
Father- famine before 12	-0.160	0.117	-0.095	0.118	0.040
	(0.097)	(0.096)	(0.093)	(0.096)	(0.127)
Father-literate parent	0.168*	0.095	0.113	0.099	0.313***
	(0.091)	(0.093)	(0.088)	(0.093)	(0.118)
Father-rural background	-0.228	-0.091	-0.305	-0.115	0.116
	(0.238)	(0.230)	(0.222)	(0.230)	(0.291)
Mother-poor hlth before 15	-0.103	0.014	-0.008	0.002	-0.000
	(0.115)	(0.118)	(0.112)	(0.117)	(0.153)
Mother -party parent	0.428***	-0.045	0.298**	-0.027	0.082
	(0.142)	(0.128)	(0.134)	(0.128)	(0.158)
Mother - famine before 12	0.022	-0.133	-0.006	-0.137	-0.161
	(0.095)	(0.092)	(0.091)	(0.092)	(0.120)
Mother -literate parent	0.092	0.132	0.024	0.137	0.277**
	(0.093)	(0.092)	(0.090)	(0.092)	(0.119)
Mother -rural background	-0.031	0.248	0.126	0.231	0.022
	(0.250)	(0.237)	(0.231)	(0.239)	(0.267)
Observations	3,962	3,576	3,960	3,574	3,884
Province FE	Y	Y	Y	Y	Y
marriage year FE	Y	Y	Y	Y	Y

Notes: standard errors clustered on household.

Table 6: Conditional Logit Regressions of Offering Marriage Payments to Children with Additional Controls

	(1)	(2)	(3)	(4)	(5)
	Any payment		Any betrothal gift		Any house
VARIABLES	Son	Daughter	Son	Daughter	Son
Father-Public sector	-0.002	0.006	-0.002	0.008	-0.000
	(0.006)	(0.007)	(0.006)	(0.007)	(0.009)
Father-Self-employed	-0.001	0.009	0.001	0.009	-0.025**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.011)
Father-Private sector	-0.002	-0.001	-0.001	-0.001	-0.006
	(0.005)	(0.006)	(0.005)	(0.005)	(0.007)
Father-Agriculture	-0.008	-0.004	-0.006	-0.004	-0.011*
	(0.005)	(0.005)	(0.004)	(0.005)	(0.006)
Mother-Public sector	0.016	0.051***	0.004	0.044***	0.012
	(0.011)	(0.013)	(0.011)	(0.014)	(0.015)
Mother-Self-employed	0.002	0.011	0.005	0.011	-0.007
	(0.010)	(0.011)	(0.010)	(0.010)	(0.016)
Mother-Private sector	0.006	0.030***	0.005	0.030***	-0.001
	(0.008)	(0.009)	(0.007)	(0.010)	(0.013)
Mother-Agriculture	0.008*	0.009*	0.007	0.010**	0.007
	(0.005)	(0.006)	(0.005)	(0.005)	(0.007)
first child	-0.002	0.046	0.028	0.042	-0.058
	(0.112)	(0.101)	(0.096)	(0.105)	(0.157)
single child	0.453**	-0.352	0.268	-0.405*	0.896***
	(0.227)	(0.228)	(0.231)	(0.237)	(0.209)
n_sons	-0.056	-0.108*	-0.058	-0.102*	0.133*
	(0.059)	(0.062)	(0.050)	(0.053)	(0.080)
n_daughters	0.074	-0.016	0.047	-0.017	0.107*
	(0.054)	(0.044)	(0.047)	(0.046)	(0.063)
Minority	0.019	-0.021	-0.030	-0.020	0.101
	(0.180)	(0.172)	(0.171)	(0.164)	(0.237)
Child-marry age	-0.031*	0.001	-0.038***	0.000	0.024
	(0.017)	(0.017)	(0.015)	(0.019)	(0.025)
Child-edu_mid	0.108	0.187*	0.157	0.183*	-0.176
	(0.103)	(0.099)	(0.097)	(0.108)	(0.140)
Child-edu_high	-0.158	0.179	-0.085	0.181	-0.094
	(0.124)	(0.140)	(0.109)	(0.146)	(0.178)
father-primary edu.	0.107	0.146	0.101	0.138	-0.100
	(0.094)	(0.110)	(0.111)	(0.097)	(0.133)
mother-primary edu.	0.082	-0.004	0.075	-0.001	0.072
	(0.092)	(0.097)	(0.097)	(0.087)	(0.130)
Father age	-0.000	-0.026*	0.003	-0.025*	-0.011
	(0.014)	(0.015)	(0.013)	(0.014)	(0.018)
Mother age	-0.018	-0.009	-0.019	-0.011	-0.031
	(0.014)	(0.014)	(0.014)	(0.015)	(0.020)
Child-rural background	0.241*	0.107	0.251**	0.116	-0.175
	(0.125)	(0.137)	(0.113)	(0.132)	(0.139)

To be cont.

Cont. Table 6: Conditional Logit regressions					
Sex ratio	-0.320	-0.235	-0.316	-0.274	-1.604
	(0.964)	(1.098)	(1.180)	(0.996)	(1.544)
female literacy rate	3.109	4.940***	2.979	4.826**	-1.544
	(2.318)	(1.890)	(2.165)	(1.954)	(3.446)
male literacy rate	-5.240	-9.844***	-5.382	-9.714***	6.555
	(4.026)	(3.201)	(3.803)	(3.328)	(13.609)
Father-poor hlth before 15	-0.020	-0.065	-0.026	-0.079	-0.216
	(0.104)	(0.114)	(0.102)	(0.118)	(0.149)
Father-party parent	0.086	0.033	0.142	0.031	-0.194
	(0.126)	(0.128)	(0.138)	(0.112)	(0.167)
Father- famine before 12	-0.231**	0.040	-0.160*	0.041	-0.010
	(0.098)	(0.098)	(0.096)	(0.090)	(0.128)
Father-literate parent	0.135	0.109	0.097	0.118	0.330***
	(0.087)	(0.091)	(0.077)	(0.090)	(0.112)
Father-rural background	-0.205	-0.018	-0.318	-0.029	0.153
	(0.244)	(0.202)	(0.215)	(0.215)	(0.323)
Mother-poor hlth before 15	-0.054	0.024	0.038	0.010	0.125
	(0.113)	(0.109)	(0.103)	(0.106)	(0.150)
Mother -party parent	0.516***	-0.048	0.360***	-0.030	0.063
	(0.129)	(0.110)	(0.133)	(0.125)	(0.164)
Mother - famine before 12	0.042	-0.137	0.013	-0.139	-0.212
	(0.092)	(0.093)	(0.088)	(0.095)	(0.133)
Mother -literate parent	0.128	0.165*	0.047	0.180**	0.324***
	(0.093)	(0.094)	(0.094)	(0.087)	(0.121)
Mother -rural background	-0.211	0.085	-0.080	0.054	-0.056
	(0.254)	(0.223)	(0.248)	(0.234)	(0.272)
Observations	3,252	3,106	3,362	3,104	2,307
Number of prov×myr	440	504	460	504	275
Prov.×marriage year FE	Y	Y	Y	Y	Y

Notes: standard errors are constructed by bootstrapping with 200 repetitions.

Table 7: Lineal Probability Model (LPM) with Household Fixed Effects

VARIABLES	(1) Any payment	(2) Any betrothal gift
Father-Public sector	-0.004	-0.003
	(0.005)	(0.005)
Father-Self-employed	-0.005	-0.002
	(0.007)	(0.006)
Father-Private sector	0.001	0.000
	(0.005)	(0.005)
Father-Agriculture	-0.002	-0.002
	(0.004)	(0.004)
Mother-Public sector	0.027*	0.008
	(0.016)	(0.017)
Mother-Self-employed	-0.001	-0.006
	(0.009)	(0.009)
Mother-Private sector	0.020**	0.015*
	(0.009)	(0.009)
Mother-Agriculture	0.005	0.004
	(0.004)	(0.004)
Son (=1)	0.137	-0.182
	(0.529)	(0.522)
Father-Public sector×son	-0.004*	-0.005**
	(0.002)	(0.002)
Father-Self-employed×son	-0.002	-0.001
	(0.002)	(0.002)
Father-Private sector×son	-0.002	-0.001
	(0.002)	(0.002)
Father-Agriculture×son	-0.001	-0.001
	(0.001)	(0.001)
Mother-Public sector×son	-0.004	-0.002
	(0.004)	(0.004)
Mother-Self-employed×son	-0.011***	-0.009**
	(0.004)	(0.004)
Mother-Private sector×son	-0.003	-0.004
	(0.003)	(0.003)
Mother-Agriculture×son	-0.002	-0.002
	(0.002)	(0.002)
F test of paternal working experience (p)	0.835	0.972
F test of maternal working experience	0.065	0.373
F test of paternal working experience×son	0.418	0.189
F test of maternal working experience×son	0.050	0.097
Observations	5,656	5,654
Number of households	2,405	2,405
Household FE	Y	Y

Notes: standard errors constructed by bootstrapping with 200 repetitions. Only households having at least one married son and one married daughter are used in regressions. All variables used in Table 5 as well as their interaction terms with the son dummy are introduced in regressions.

Table 8: Trimmed Least Square (Trimmed LS) Regressions of the Value of Marriage Payments with Household Fixed Effects (1,000 CNY)

	(1)	(2)
VARIABLES	Any payment	Any betrothal gift
Father-Public sector	-7.593	0.387
	(10.589)	(2.459)
Father-Self-employed	18.614	0.117
	(12.472)	(1.819)
Father-Private sector	11.871	-0.525
	(9.789)	(1.369)
Father-Agriculture	0.230	-2.831
	(5.153)	(2.640)
Mother-Public sector	39.519	-2.011
	(58.954)	(3.733)
Mother-Self-employed	1.429	1.103
	(12.795)	(2.690)
Mother-Private sector	15.034	3.336
	(18.239)	(2.766)
Mother-Agriculture	17.772***	3.102*
	-7.593	0.387
Sex ratio	340.496	11.277
	(396.324)	(74.242)
female literacy rate	-130.471	-43.852
	(507.844)	(64.543)
male literacy rate	-204.340	-152.463
	(1,629.498)	(134.288)
Son (=1)	-309.369	-49.113
	(1,156.688)	(196.116)
Father-Public sector×son	8.153	1.315
	(9.235)	(0.854)
Father-Self-employed×son	-1.076	-0.446
	(5.201)	(0.616)
Father-Private sector×son	0.510	1.993
	(2.780)	(1.553)
Father-Agriculture×son	-2.590	1.348*
	(2.716)	(0.813)
Mother-Public sector×son	-16.465***	-0.125
	(6.381)	(0.994)
Mother-Self-employed×son	6.157	0.297
	(11.814)	(1.335)
Mother-Private sector×son	-2.575	-0.525
	(5.681)	(0.755)
Mother-Agriculture×son	-3.405	-0.574
	(3.199)	(0.466)
To be cont.		

Cont. Table 8: Trimmed Least Square Regressions		
Sex ratio×son	127.800	123.164*
	(391.161)	(69.214)
female literacy rate×son	397.660	108.538
	(524.721)	(113.508)
male literacy rate×son	14.427	-153.898
	(1,518.888)	(236.421)
F test of paternal working experience (p)	0.261	0.794
F test of maternal working experience	0.043	0.337
F test of paternal working experience ×son	0.580	0.132
F test of maternal working experience ×son	0.142	0.629
Observations	5552	5543
Number of households	2381	2377
Chi-square	865.2	1549.31
Household FE	Y	Y

Notes: I use Trimmed Least Squares estimator, i.e., the estimation is based on the quadratic error loss function. Standard errors are constructed by bootstrapping. Only households having at least one married son and one married daughter are included in regressions. Apart from variables shown above, all other variables used in Table 6 as well as their interaction terms with the son dummy are also introduced. In column (1), the dependent variable is the value of all marriage payments received by the married child consisting of the value of betrothal gifts and that of housing assets. In column (2), the dependent variable is the value of betrothal gifts only.

Table 9: Regressions of Marriage Payments Using the Urban Sample

	(1)	(2)	(3)	(4)
	LPM		Trimmed LS	
VARIABLES	Any payment =1	Any gift =1	Payments value	Gifts value
Father-Public sector	0.005	0.004	15.104	2.950
	(0.008)	(0.008)	(11.189)	(2.143)
Father-Self-employed	-0.007	-0.010	12.564	-0.418
	(0.009)	(0.010)	(14.288)	(3.041)
Father-Private sector	0.012*	0.006	24.848***	1.260
	(0.007)	(0.007)	(9.258)	(1.342)
Father-Agriculture	0.013**	0.012*	10.307	0.812
	(0.006)	(0.007)	(7.848)	(1.321)
Mother-Public sector	0.019	0.009	12.603	-2.511
	(0.015)	(0.018)	(25.151)	(4.343)
Mother-Self-employed	0.009	0.006	20.557	4.512
	(0.015)	(0.015)	(19.602)	(3.298)
Mother-Private sector	0.028**	0.026**	26.924	3.815
	(0.012)	(0.012)	(22.699)	(2.396)
Mother-Agriculture	0.003	0.002	16.254	1.889
	(0.007)	(0.007)	(9.886)	(1.269)
Son (=1)	-1.222	-2.398	-3,014.204	95.795
	(2.074)	(2.026)	(4,179.621)	(628.801)
Father-Public sector×son	-0.008**	-0.009**	-2.147	0.668
	(0.004)	(0.003)	(5.847)	(0.725)
Father-Self-employed×son	-0.007	-0.004	0.261	0.127
	(0.004)	(0.004)	(6.961)	(1.023)
Father-Private sector×son	-0.004	-0.004	-5.851	0.140
	(0.003)	(0.003)	(4.164)	(0.492)
Father-Agriculture×son	-0.003	-0.003	-3.983	0.421
	(0.002)	(0.002)	(3.710)	(0.395)
Mother-Public sector×son	0.002	0.005	-13.647	1.414
	(0.005)	(0.005)	(9.027)	(1.212)
Mother-Self-employed×son	-0.008	-0.005	3.947	-1.109
	(0.006)	(0.006)	(12.330)	(0.939)
Mother-Private sector×son	-0.001	-0.002	5.859	0.839
	(0.003)	(0.003)	(6.423)	(0.771)
Mother-Agriculture×son	-0.000	-0.001	-1.587	-0.182
	(0.003)	(0.003)	(4.477)	(0.500)
F test of paternal working experience	0.125	0.236	0.110	0.700
F test of maternal working experience	0.159	0.287	0.456	0.084
F test of paternal working experience ×son	0.192	0.128	0.548	0.797
F test of maternal working experience ×son	0.700	0.537	0.252	0.154
Observations	1,747	1,746	1,703	1,696
Chi-square	-	-	984.91	896.13
Number of households	739	739	732	729
Household FE	Y	Y	Y	Y

Notes: The urban sample consists of married children whose parents are currently living in urban areas. Standard errors are constructed by bootstrapping. Only households having at least one married son and one married daughter are used in estimation. All variables used in Table 6 as well as their interaction terms with the son dummy are also introduced.

Table 10: Regressions of Inter-generational Transfers on Receiving Marriage Payments

	(1)	(2)	(3)	(4)	(5)	(6)
	To parents		To children		Net transfers to parents	
VARIABLES	Total	Regular	Total	Regular	Total	Regular
Receiving payments	-1.503***	-4.340**	7.059*	2.165	-0.729**	-0.461***
(binary)	(0.521)	(1.973)	(4.035)	(6.059)	(0.300)	(0.177)
Child-income	0.030***	0.019	-0.026	-0.035	0.014***	0.004*
	(0.010)	(0.014)	(0.034)	(0.067)	(0.004)	(0.002)
Child-middle edu.	0.804	0.086	-3.028	1.260	0.694***	0.081
	(0.505)	(0.894)	(3.729)	(7.223)	(0.229)	(0.106)
Child-age	0.079*	0.094	0.450	0.285	-0.006	0.003
	(0.047)	(0.117)	(0.337)	(0.451)	(0.027)	(0.013)
Child-rural background	-0.902	-0.666	-6.179	8.455	-0.162	-0.164
	(0.798)	(1.130)	(5.911)	(11.819)	(0.388)	(0.230)
First child	-0.218	-0.199	-1.791	-3.961	0.214	0.112
	(0.363)	(0.726)	(2.574)	(3.591)	(0.224)	(0.105)
Co-residence	1.175	1.041	4.709	-2.100	0.090	0.241
	(1.282)	(1.841)	(9.680)	(10.030)	(0.666)	(0.493)
Child-good health	0.743	0.294	-1.840	-15.408**	0.489*	0.339**
	(0.523)	(0.965)	(3.995)	(7.379)	(0.276)	(0.163)
Child-having kid	-0.561	-0.310	-2.926	-6.332*	-0.070	0.008
	(0.437)	(0.890)	(2.915)	(3.626)	(0.218)	(0.102)
Son (=1)	7.912**	11.241*	24.469*	20.474	-0.549	0.526
	(3.312)	(6.654)	(14.666)	(38.505)	(1.472)	(0.787)
Son× payments(binary)	1.099	3.417	-7.218*	0.270	0.517	0.325
	(0.749)	(2.537)	(4.160)	(5.687)	(0.384)	(0.201)
Son× income	0.023	0.005	0.092	-0.008	-0.002	0.001
	(0.023)	(0.023)	(0.079)	(0.069)	(0.005)	(0.003)
Son× mid edu.	-1.674**	-1.293	1.079	-2.505	-1.050***	-0.206
	(0.687)	(1.394)	(4.656)	(8.469)	(0.350)	(0.196)
Son× age	-0.171**	-0.194	-0.481	-0.837	0.007	-0.008
	(0.077)	(0.135)	(0.398)	(0.701)	(0.028)	(0.015)
Son× rural background	-0.270	-0.465	6.193	-0.147	0.197	0.009
	(0.772)	(1.665)	(4.270)	(9.619)	(0.455)	(0.228)
Son× First child	0.858	-0.138	7.143	9.172*	-0.487	-0.092
	(0.699)	(1.106)	(4.485)	(5.286)	(0.316)	(0.150)
Son× Co-residence	-0.197	-0.792	-5.483	7.269	0.243	-0.260
	(1.462)	(1.899)	(9.571)	(11.397)	(0.697)	(0.510)
Son× good hlth	-1.284	-1.135	-5.442	13.731*	-0.114	-0.167
	(0.924)	(1.253)	(5.568)	(7.840)	(0.354)	(0.170)
Son× having kid	0.602	-0.597	6.082	5.936	0.175	-0.003
	(0.612)	(1.112)	(4.359)	(6.374)	(0.379)	(0.150)
Son× n_alive brothers	-0.817**	-0.373	-1.484	-2.488	-0.121	0.005
	(0.351)	(0.952)	(1.948)	(2.927)	(0.156)	(0.078)
Son× n_alive sisters	1.147***	0.468	1.173	6.271*	0.354*	0.010
	(0.428)	(0.655)	(2.181)	(3.437)	(0.182)	(0.069)
Observations	5,288	5,285	5,288	5,287	5,288	5,284
Chi-squared	60.74	40.23	69.88	32.67	-	-
Number of households	2,435	2,435	2,435	2,435	2,435	2,435
Household FE	Y	Y	Y	Y	Y	Y

Notes: I use Trimmed Least Squares estimator in columns (1), (2), (3), and (4). Standard errors are constructed by bootstrapping. In columns (5) and (6), OLS estimator with household fixed effects is applied, and standard errors are clustered on household. Households having at least one married, alive son and one married, alive daughter are used in regressions.

Table 11: Regressions of Inter-generational Transfers
on the Value of Marriage Payments

	(1)	(2)	(3)	(4)	(5)	(6)
	To parents		To children		Net transfers to parents	
VARIABLES	Total	Regular	Total	Regular	Total	Regular
Marriage payments	-0.047	-0.160	0.089	0.089	-0.032**	-0.021
(CNY 1,000)	(0.044)	(0.168)	(0.058)	(0.168)	(0.016)	(0.016)
Child-income	0.029**	0.017	-0.031	-0.060*	0.014***	0.004
	(0.014)	(0.011)	(0.034)	(0.032)	(0.004)	(0.002)
Child-middle edu.	0.863*	0.540	-3.578	0.287	0.780***	0.111
	(0.495)	(0.987)	(5.147)	(4.537)	(0.233)	(0.109)
Child-age	0.070	0.040	0.420	-0.246	0.002	0.004
	(0.067)	(0.115)	(0.349)	(0.367)	(0.027)	(0.012)
Child-rural background	-0.964	-0.705	-6.997	6.999	-0.215	-0.232
	(0.868)	(1.239)	(5.736)	(5.612)	(0.382)	(0.232)
First child	-0.145	0.183	-2.002	-1.971	0.152	0.099
	(0.424)	(0.566)	(2.579)	(2.127)	(0.223)	(0.097)
Co-residence	0.893	0.030	11.158*	8.628*	-0.014	0.131
	(1.148)	(2.223)	(6.771)	(4.531)	(0.576)	(0.379)
Child-good health	0.760	0.554	0.376	-3.763	0.455*	0.330**
	(0.490)	(1.024)	(3.177)	(4.388)	(0.270)	(0.156)
Child-having kid	-0.425	-0.060	-3.831	-5.975**	0.030	0.042
	(0.465)	(0.810)	(3.401)	(2.881)	(0.219)	(0.104)
Son (=1)	8.036**	9.532	24.712	5.613	1.236	0.876
	(3.539)	(7.406)	(18.095)	(22.716)	(1.528)	(0.821)
Son× payments(value)	0.040	0.161	-0.076	-0.038	0.013	0.014
	(0.045)	(0.169)	(0.064)	(0.171)	(0.015)	(0.015)
Son× income	0.023	0.005	0.091	0.039	-0.001	0.002
	(0.026)	(0.020)	(0.088)	(0.038)	(0.005)	(0.003)
Son× mid edu.	-1.665**	-1.795	1.501	-3.795	-1.035***	-0.181
	(0.760)	(1.681)	(5.635)	(7.931)	(0.359)	(0.205)
Son× age	-0.164**	-0.130	-0.556	-0.197	-0.019	-0.012
	(0.079)	(0.147)	(0.427)	(0.400)	(0.029)	(0.015)
Son× rural background	-0.196	-0.049	4.124	1.548	0.004	0.004
	(0.820)	(1.949)	(3.896)	(6.060)	(0.451)	(0.222)
Son× First child	0.743	-0.389	7.854*	7.652***	-0.504	-0.123
	(0.639)	(1.064)	(4.770)	(2.873)	(0.319)	(0.149)
Son× Co-residence	-0.100	-0.191	-9.795	-3.226	0.177	-0.213
	(1.166)	(2.396)	(7.455)	(6.525)	(0.614)	(0.403)
Son× good hlth	-1.186	-1.138	-7.639	-3.227	-0.123	-0.206
	(0.887)	(1.544)	(6.095)	(4.623)	(0.361)	(0.177)
Son× having kid	0.554	-0.391	5.778	6.101*	0.091	0.003
	(0.732)	(1.234)	(4.890)	(3.290)	(0.388)	(0.164)
Son× n_alive brothers	-0.848**	-0.456	-0.764	-0.933	-0.195	-0.013
	(0.423)	(1.114)	(1.877)	(1.928)	(0.158)	(0.080)
Son× n_alive sisters	1.131**	0.343	0.476	4.130	0.370**	0.015
	(0.552)	(0.886)	(2.737)	(2.665)	(0.184)	(0.069)
Observations	5,216	5,213	5,216	5,215	5,216	5,212
Chi-Square	93.6	26.02	57.85	70.96	-	-
Number of households	2,414	2,414	2,414	2,414	2,414	2,414
Household FE	Y	Y	Y	Y	Y	Y

Notes: I use Trimmed Least Squares estimator in columns (1), (2), (3), and (4). Standard errors are constructed by bootstrapping. In columns (5) and (6), OLS estimator with household fixed effects is applied, and standard errors are clustered on household. Households having at least one married, alive son and one married, alive daughter are used in regressions.

Appendix

Assumptions

For Assumption 1, $F(D^*)$ shown in Eq.(6) is strictly positive when β is equal to 1 or $1+r$, which lead to no inferior solution of D^*:
(i) when $\beta = 1$, $\frac{\partial U_p}{\partial D} = \alpha r U_2' > 0$, and
(ii) when $\beta = 1+r$, $\frac{\partial U_p}{\partial D} = r U_1' > 0$.
For Assumption 2, to ensure $Z_c^* = (1+e-\beta)y + (1+r-\beta)D^* > 0$, it must be

- given $\beta < (1+r)$, $D^* > (-\frac{1+e-\beta}{1+r-\beta}y)$
- given $\beta > (1+r)$, $D^* < (-\frac{1+e-\beta}{1+r-\beta}y)$.

Given $\frac{\partial F(D^*)}{\partial D^*} < 0$ (see more details below), the above conditions can be expressed as Assumption 2 to ensure there is a solution D^* which satisfies the first order condition and leads to a positive Z_c^*, where

$$F(-\frac{1+e-\beta}{1+r-\beta}y) = (\beta-1)U_1'|_{D^*=-\frac{1+e-\beta}{1+r-\beta}y} + \alpha(1+r-\beta)U_2'|_{D^*=-\frac{1+e-\beta}{1+r-\beta}y}$$

Partial derivatives of FOC

Here are partial derivatives of the first order condition with respect to D, α, y, I_p, e, r, and β.

$$\frac{\partial F(D^*)}{\partial D} = (\beta-1)^2 \cdot U_{11}'' + \alpha^2(1+r-\beta)^2 \cdot U_{22}'' < 0 \tag{A.1}$$

$$\frac{\partial F(D^*)}{\partial \alpha} = (1+r-\beta) \cdot [U_2' + \alpha Z_c^* \cdot U_{22}''] \tag{A.2}$$

$$\frac{\partial F(D^*)}{\partial y} = (\beta-1)^2 \cdot U_{11}'' + \alpha^2(1+r-\beta)(1+e-\beta) \cdot U_{22}'' \tag{A.3}$$

$$\frac{\partial F(D^*)}{\partial I_p} = (\beta-1) \cdot U_{11}'' \tag{A.4}$$

$$\frac{\partial F(D^*)}{\partial e} = \alpha^2(1+r-\beta)y \cdot U_{22}'' \tag{A.5}$$

$$\frac{\partial F(D^*)}{\partial r} = \alpha \cdot U_2' + \alpha^2(1+r-\beta)D^* \cdot U_{22}'' \tag{A.6}$$

$$\begin{aligned}\frac{\partial F(D^*)}{\partial \beta} &= U_1' + (\beta-1)(D^*+y) \cdot U_{11}'' - \alpha \cdot U_2' - \alpha^2(1+r-\beta)(D^*+y) \cdot U_{22}'' \\ &= (U_1' - \alpha U_2') - (D^*+y)[(1-\beta)U_{11}'' + \alpha^2(1+r-\beta)U_{22}'']\end{aligned} \tag{A.7}$$

In Eq.(A.7), there is $(U_1' - \alpha U_2') > 0$ if and only if $\beta < 1$, and $(U_1' - \alpha U_2') < 0$ if and only if $\beta > 1$. Here is a short proof. As shown in FOC, $(\beta-1)U_1' + \alpha(1+r-\beta)U_2' = 0$,

and thus in the equilibrium, $U_1' - \alpha U_2'$ can be expressed as below:

$$\begin{aligned} U_1' - \alpha U_2' &= U_1' - \alpha U_2' - 0 \\ &= U_1' - \alpha U_2' - \frac{1}{\beta - 1}[(\beta - 1)U_1' + \alpha(1 + r - \beta)U_2'] \\ &= \frac{\alpha r}{1 - \beta} U_2' \end{aligned}$$

In Eq.(A.7), the sufficient condition for $D^* + y > 0$ is $r > e$ and $\beta < (1 + r)$, because under this condition, there is $(D^* + y) > \frac{1}{1+r-\beta} Z_c^* > 0$.

Partial derivatives of $\frac{dD^*}{dI_p}$

Given $\frac{dy}{dx} = -\frac{F_x}{F_y}$, the marginal effects of the parental income I_p on the optimal level of non-human capital investment in the child D^* is shown in Eq.(A.8), where π denotes $(1 - \beta)U_{11}''$ and ξ denotes $\alpha^2(1 + r - \beta)^2 U_{22}''$:

$$\frac{dD^*}{dI_p} = -\frac{\frac{\partial F(D^*)}{\partial I_p}}{\frac{\partial F(D^*)}{\partial D}} = \frac{(1 - \beta)U_{11}''}{(\beta - 1)^2 U_{11}'' + \alpha^2(1 + r - \beta)^2 U_{22}''} = \frac{\pi}{(1 - \beta)\pi + \xi} \tag{A.8}$$

The partial derivative of $\frac{dD^*}{dI_p}$ with respect to x is expressed in Eq.(A.9), where $x \in \{\alpha, e, y, r\}$, $\pi_x' = \frac{\partial \pi}{\partial x}$, and $\xi_x' = \frac{\partial \xi}{\partial x}$.

$$\frac{\partial \frac{dD^*}{dI_p}}{\partial x} = \frac{((1 - \beta)\pi + \xi)\pi_x' - \pi((1 - \beta)\pi_x' + \xi_x')}{[(1 - \beta)\pi + \xi]^2} = \frac{\xi \pi_x' - \xi_x' \pi}{[(1 - \beta)\pi + \xi]^2} \tag{A.9}$$

$$\begin{aligned} \frac{\partial \frac{dD^*}{dI_p}}{\partial \alpha} = \frac{\xi \pi_\alpha' - \xi_\alpha' \pi}{[(1 - \beta)\pi + \xi]^2} &= \frac{(-\pi) \cdot (1 + r - \beta)^2 (2\alpha U_{22}'' + \alpha^2 Z_c^* U_{222}''')}{[(1 - \beta)\pi + \xi]^2} \\ &= \frac{(\beta - 1)U_{11}'' \cdot \alpha(1 + r - \beta)^2 (2U_{22}'' + \alpha Z_c^* U_{222}''')}{[(1 - \beta)\pi + \xi]^2} \end{aligned} \tag{A.10}$$

$$\begin{aligned} \frac{\partial \frac{dD^*}{dI_p}}{\partial y} &= \frac{-(1 - \beta)^2 U_{111}''' \xi - \alpha^3 (1 + r - \beta)^2 (1 + e - \beta)\pi}{[(1 - \beta)\pi + \xi]^2} \\ &= -\frac{\alpha^2 (1 + r - \beta)^2}{[(1 - \beta)\pi + \xi]^2} \cdot [(1 - \beta)^2 U_{22}'' U_{111}''' + \alpha(1 - \beta)(1 + e - \beta) U_{11}'' U_{222}'''] \end{aligned} \tag{A.11}$$

$$\frac{\partial \frac{dD^*}{dI_p}}{\partial e} = \frac{0 - \pi \alpha^2 (1 + r - \beta)^2 \cdot U_{222}''' \alpha y}{[(1 - \beta)\pi + \xi]^2} = \frac{\alpha^3 (\beta - 1)(1 + r - \beta)^2 y U_{11}'' U_{222}'''}{[(1 - \beta)\pi + \xi]^2} \tag{A.12}$$

$$\begin{aligned}\frac{\partial \frac{dD^*}{dI_p}}{\partial r} &= \frac{0 - \pi\alpha^2[2(1+r-\beta)U''_{22} + (1+r-\beta)^2 U'''_{222}\alpha D^*]}{[(1-\beta)\pi + \xi]^2} \\ &= \frac{\alpha^2(\beta-1)(1+r-\beta)U''_{11}[2U''_{22} + \alpha(1+r-\beta)D^* U'''_{222}]}{[(1-\beta)\pi + \xi]^2}\end{aligned} \tag{A.13}$$

$$\begin{aligned}\frac{\partial \frac{dD^*}{dI_p}}{\partial \beta} &= \frac{[(1-\beta)\pi + \xi]\pi'_\beta - \pi[-\pi + (1-\beta)\pi'_\beta + \xi'_\beta]}{[(1-\beta)\pi + \xi]^2} = \frac{\xi\pi'_\beta - \xi'_\beta\pi + \pi^2}{[(1-\beta)\pi + \xi]^2} \\ &= \frac{\alpha^2(1+r-\beta)[(1+r-\beta)(1-\beta)(y+D^*)\kappa + (1-r-\beta)U''_{11}U''_{22}] + \pi^2}{[(1-\beta)\pi + \xi]^2}\end{aligned} \tag{A.14}$$

where $\kappa = (U'''_{111}U''_{22} + \alpha U''_{11}U'''_{222})$.