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Child's gender, parental monetary investments and care of elderly parents in China

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Son Biased Investments and Old Age Support*

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Abstract

Son biased investments are common in many Asian countries where sons are customarily responsible for providing old age support to parents. Using data from the China Health and Retirement Longitudinal Study, I find that parents invested twice more in sons than in daughters in terms of college education spending and marriage gifts value. Conversely, parents received relatively higher marginal returns to investment from daughters than from sons in terms of living proximity, monetary and in-kind support, and help with activities of daily living. Family fixed effects models as well as an instrumental variable strategy are employed to control for the potential endogeneity of parental investments in children. The results indicate that parental investments help stimulate support from children, especially daughters.

JEL: D13, I26, J13, J14, J16

Keywords: son bias, parental investment, old age support

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Introduction

Son biased parental investments are prevalent in many societies. There is evidence of higher school enrolment rates for boys and higher spending on sons' private education in many countries such as China, India, Pakistan and South Korea (Alderman and Gertler 1997; Bauer *et al.* 1992; Chen *et al.* 2014; Choi and Hwang 2015). Similarly, son targeting fertility behavior is widespread in Asia, where the families with earlier born girls tend to have more children as parents attempt to have a son (Basu and De Jong 2010; Ebenstein 2010; Lee 2007). Sons also tend to benefit from greater health investments in the form of longer breastfeeding duration and higher medical expenditures (Barcellos *et al.* 2014; Lhila and Simon 2008; Rosenzweig and Schultz 1982).

It has been hypothesized in the literature that higher investments in sons may be attributed to the fact that, in patriarchal and patrilocal societies, sons are responsible for providing old age support to parents whereas daughters leave the family upon marriage (Das Gupta *et al.* 2003; Jayachandran 2015). There is indeed evidence that children may be an important source of support in Asian countries, with transfers flowing predominantly from children to parents and where a large proportion of elderly also live with their adult children (Cai, Giles and Meng 2006; National Research Council 2012).[1] Sons, in particular, are viewed as an important source of support in China. Li and Lavely (2003) documented that 85% of rural Chinese women believed that it was important to have a son and that 75% [3%] expected to receive financial support from sons [daughters]. Ebenstein and Leung (2010) found that parents who have at least one son were less likely to enroll in a pension program whereas Huang *et al.* (2016) found that parents who expect support from sons were more likely to match-make their sons to daughters-in-laws who would be more suited to household production.

Despite sons being perceived as an important source of support, there has been increasing accounts of daughters providing support or comfort to parents in Asia (Salaff 1976; Teerawichitchainan 2016; Yi *et al.* 2016). This suggests that even though son biased parental investments are still prevalent, a feature attributed to highly persistent patriarchal values (Das Gupta *et al.* 2003; Jayachandran 2015), daughters may also provide a non-trivial source of help to parents. Given the reliance of parents on children for old age support in developing countries, it is important to understand whether son biased investments were optimal from an old age support receipt perspective and whether daughters were as "useless" in that respect as customarily believed.

[1] This is in contrast to the US where Social Security is well established and where intergenerational transfers flow predominantly from parents to children (McGarry and Schoeni 1995). The evidence on gender preference in the US also tends to be mixed (Baker and Milligan 2013; Dahl and Moretti 2008).

This study attempts to answer following questions: Do monetary investments in children pay off in terms of support to parents? Are there gender differences in realized marginal parental old age support returns to investment? I focus on parental spending on college education and marriage which represent two major components of investment in children.[2] This study also takes into account various forms of support such as best living proximity to children, monetary and in-kind support and help with activities of daily living (ADL). I focus on old age support returns from a pure production efficiency perspective and do not attempt to distinguish between the different motives behind intergenerational transfers. In particular, this paper studies whether parental investments stimulate support from children and whether there are gender differences in returns.

I use data from the 2013 China Health and Retirement Longitudinal Study (CHARLS), a nationally representative data set of Chinese residents aged 45 and above. Gender-household group analysis estimates the marginal returns to total investment by gender group, which takes gender-based quantity and quality investments into account. Child level analysis estimates the marginal returns to investment per child by gender, which only takes quality investments into account. I employ family fixed effects models as well as an instrumental variable approach to address the potential endogeneity of investment. In particular, family fixed effects models difference out fixed family level unobserved factors that may correlate with both investment and support. The instrumental variable approach exploits the fact that the allocation of parental investment among children of different genders may have varied over time such that *interaction terms* between the first born child's gender and birth year are used as exogenous instruments for investment.

Theoretical Model

Children have long been viewed as a source of support to parents, especially in societies with less developed financial and insurance markets (Caldwell 1976). Children may provide support due to numerous reasons such as filial duty stemming from social norms following the Confucian philosophy, altruism where children care about the well-being of parents, and exchange motives where children reciprocate parental transfers (Altonji *et al.* 1992; Andreoni 1990; Cox and Rank 1992). Parents may also manipulate children towards providing support through investments in their human capital (Becker *et al.* 2016). There is indeed evidence of positive correlations between

[2] While the literature tends to use education attainment or marital status as proxies for parental investments, they are imperfect measures of the actual amount spent by parents. Wei and Zhang (2011) reported that 85% of Chinese households save primarily for children's education and marriage expenses. Brandt, Siow and Wang (2015) found that parents increased marital transfers to compensate sons with lower education investments.

education attainment and financial transfers from children, suggesting that children could be repaying parents for their education investment (Lee and Xiao 1998; Lillard and Willis 1997; Raut and Tran 2005). There is also evidence that parents who have a greater number of children tend to receive higher material and instrumental support (Cunningham *et al.* 2013; Oliveira 2016).

I sketch below a simple model of old age support from a pure production efficiency perspective to highlight the mechanisms by which parental investments in children may stimulate support. The model incorporates elements of filial duty, altruism and reciprocity. The model predicts that children who care more about parents provide higher support and children who receive higher parental investments generate higher market returns, which enable them to provide higher support. I also show that pure old age support production efficiency requires that parents equalize the marginal returns to investments between sons and daughters. This implies that if marginal returns were not equalized between children of different genders, then by reallocating parental investments across genders, one may achieve higher old age support.

Framework

Consider a two stage model where parents make investment decisions in the first stage and children make old age support decisions in the second stage. Parents care about their consumption C_p and about total support received from children $\bar{O} = \sum_{i=1}^{n} O_i$, where O_i is support received from child i and n is the total number of children. Parents' utility is given by $u\left(C_p, \bar{O}\right)$, where u is separable, increasing, and concave in its arguments: $u_x > 0$ and $u_{xx} < 0$, $x = C_p, \bar{O}$. Parents are endowed with exogenous income M_p in the first stage and decide how much to allocate to consumption C_p and to investment I_i in each child i.

In the second stage, each child cares about his or her consumption C_i and support provided to parents O_i. Child i's utility is given by $v_i\left(C_i, O_i\right)$, where v_i is separable, increasing, and concave in its arguments: $v_{ix} > 0$ and $v_{ixx} < 0, x = C_i, O_i$. Children care about their old age support provision to parents which may stem from the historically grounded Confucian norm of filial duty and altruism (Das Gupta *et al.*, 2003; Jayachandran, 2015; Zimmer and Kwong, 2003).[3]

Each child has market returns, $M_i\left(I_i\right)$, which is an increasing and concave function of parental investment from the first stage: $M_i' > 0$ and $M_i'' < 0$. For instance, higher investment in children's education and marriage may lead to higher labor market earnings as well as better prospects to

[3]Whereas transfers from children do not seem to stem from strategic bequest motives nor from payment for grandchild care services (Oliveira, 2016), there is evidence supporting the altruism motive (Cai *et al.*, 2006) in China. The theoretical hypotheses presented here would still hold in an extended model of altruism where children care about total support received by the parents $\bar{O}$ (see Appendix).

marry a spouse with high earnings capacity. This may result in higher overall child family income which may influence children's ability to provide support.

I assume that children of the same gender have the same preferences and market returns but that preferences and market returns may differ by gender. It follows that parents invest the same amount in each child of the same gender but investment may differ by gender. The model is solved using backward induction.

Children's Problem

Taking parental investment as given, each child i maximizes utility:

$$\underset{C_i,O_i}{Max} \quad v_i\left(C_i,O_i\right),$$

subject to the budget constraint

$$C_i+O_i=M_i\left(I_i\right).$$

The following results hold *ceteris paribus*: (i) Optimal support from child i, O_i^*, is increasing in I_i, and (ii) Total optimal support from children of gender g, $\sum_{i=1}^{n_g} O_i^*$, is increasing in I_i and n_g, where n_g is the total number of children of gender g (see Appendix for derivation). The intuition behind those results is straightforward. An increase in parental investment per child increases market returns of the child, which in turn, relaxes the budget constraint. The child may thus increase both consumption and support O_i^*. If parents invest more in children of a certain gender, then it follows that total support from all children of that gender $\sum_{i=1}^{n_g} O_i^*$ increase. Similarly, all else equal, total support from children of the same gender $\sum_{i=1}^{n_g} O_i^*$ increase in the number of children of that gender. This gives rise to the following hypothesis:

Hypothesis 1 (Marginal Returns): There exists a positive relationship between old age support and parental investments in children.

Parents' Problem

Let S denote sons and D denote daughters. Parents choose consumption and investment in sons and daughters taking into account the fact that such investments will affect old age support:

$$\underset{C_p,I_S,I_D}{Max} \quad u\left(C_p,\sum_{i=1}^{n_S} O_S\left(I_S\right)+\sum_{i=1}^{n_D} O_D\left(I_D\right)\right),$$

subject to the budget constraint

$$C_p + \sum_{i=1}^{n_S} I_S + \sum_{i=1}^{n_D} I_D = M_p.$$

Parents therefore equate the marginal returns to investment between sons and daughters:

$$O'_S(I_S) = O'_D(I_D). \tag{1}$$

Note that the equality in marginal returns from sons and daughters also hold at the gender-household group level (see Appendix for derivation). This gives rise to the following hypothesis:

Hypothesis 2 (Gender Differences in Marginal Returns): Failure to reject [satisfy] old age support optimality condition Eq. 1 indicates that parents may [not] be optimally allocating resources between sons and daughters from a *pure old age support production efficiency* perspective.

Note that failure to reject or rejection of Eq. 1 in the empirical analyses would not invalidate the various potential other reasons for gender differences in parental investments, such as son preference, but rather sheds light on whether investments across children of different genders were optimal from a pure old age support production efficiency criteria. See the Appendix for a model where altruistic parents also directly value their investment in children.

Data and Descriptive Statistics

I use data from the 2013 China Health and Retirement Longitudinal Study (CHARLS). The study surveyed one person per household who was 45 years or older and the spouse, totaling 17,708 individuals living in 10,257 households in 28 of China's provinces (CHARLS Research Team 2013). Besides containing detailed information on demographic characteristics of parents and coresident and non-coresident children, CHARLS also contains information on intergenerational transfers. The survey includes past transfers made from parents to children in terms of college education expenditure and marriage gifts. The survey also includes details on living arrangements, monetary and in-kind transfers from non-coresident children, and help with ADL.

Sample and Analysis Levels

I drop families where the family respondent (parent) was aged less than 50 or whose youngest child was aged less than 25, so as to ensure that parents' fertility decisions and investment provisions for most children were likely completed.[4] This yields a sample of 6,618 families.

[4]The family respondent was the main respondent or spouse, and was responsible for answering questions related to family transfers.

Gender differences analyses are performed both at the gender-household group level and at the child level. Gender-household group analysis is based on the sample of all families and each family has two observations, one for each gender group. This analysis level captures both quantity and quality of children by gender groups. For example, in line with the theoretical model, total investment by gender group is $\sum_{i=1}^{n_g} I_i$. Thus, families may have higher total investment in gender g because they have a greater number of children of that gender or because they make greater per child investment or a combination of both. Those without children of a certain gender invest zero in that gender group.

Child level analysis is based on the sample of families with children of both genders and each family has several observations, one for each child. This analysis level is from children's point of view and captures only child quality by gender. It follows that a child would receive higher investments if parents increase investment per child I_i.

Note that while the theoretical hypotheses apply at both the gender-household and child levels, the empirical results from the two analysis levels may not necessarily be the same. First, while the child level analysis only captures the effects of an increase in per child investment, the gender-household group analysis captures the effect of increases in total investment, which may arise due to an increase in per child investment or in the number of children in a certain gender group. Second, the sample of families with both sons and daughters may be different from the sample of all families. For instance, such families may have a stronger son preference if they chose to have children until a son is born, which may translate into higher investments in sons.[5]

Measures of Investment and Support

Education investment captures spending on college education in 10,000 yuan and is based on the question: "*How much did you and your spouse spend to support this [child name]'s college education?*". The amount is converted to 2013 prices assuming that the expenses were incurred when the child was aged 20. Education expenditure is 0 for those with no parental expenditure on college education.[6]

Marriage investment captures the sum of betrothal gifts and house gifts to children in 10,000 yuan and is based on the questions: "*Did you give betrothal gifts when [child name] got married? At that time, how much was the total value of the betrothal gifts*?" and "*Did you buy a house*

[5]While the child sample is evenly made up of 50% male and female children, 54% [46%] of children had a sister [brother] as the eldest sibling.

[6]2% of families had missing college expenditure for at least one child, which was imputed as zero. Dropping those families from the sample did not change any of the results.

for him/her when [child name] got married? At that time, how much was the total value of the house?". Marriage gifts value for each child was converted to 2013 prices assuming that the expenses were incurred when the child got married. Marriage expenditure is 0 for those with no parental expenditure on marriage.

Total investment captures the sum of education and marriage investments. The investment amounts are summed across sons and daughters in gender-household group analysis and are per child in child level analysis.

Best living proximity denotes a dummy variable that takes a value of 1 if the parent had a child coresident or living in the same village or neighborhood *and* the parent deemed such arrangement to be the best for an elderly person; and a value of 0 otherwise. The best living arrangement is based on the questions: *"Suppose an elderly person has (a spouse / no spouse) and adult children, and has good relationship with them, what do you think is the best living arrangement for the elderly person?*" Parents may face a trade-off between coresidence and living in the same village or neighborhood since coresidence involves sharing public goods while living apart helps maintain greater privacy. In addition, since living proximity may be helpful to either parents or to adult children, taking into account parents' preferred living arrangement in old age may provide a more accurate measure of support that is appreciated by the parent.[7]

Monetary and in-kind support captures the amount of support from non-coresident children in 10,000 yuan and is based on the question: "*In the past year, how much economic supports did you or your spouse receive from your non-coresident children [child name]?*". Monetary support included help with living expenses while in-kind support included gifts of food or clothing. Monetary and in-kind support is 0 for those who received no such support in the previous year.

ADL help denotes a dummy variable that takes a value of 1 if the parent received help with ADL from a child or the child's spouse and a value of 0 otherwise. Such activities are based on the questions: "*Who most often helps you with [dressing/bathing/eating/ getting (in/out of) bed/using the toilet?*" and *"Who most often helps you with [do household chores/preparing hot meals/shopping/making telephone calls/taking medications]"*.

Any support is defined as an index that takes a value of 1 if the parent had a child with the best living proximity, or received monetary and in-kind support of more than 1,000 yuan, or received

[7]In particular, grandchild care may be an important source of support that parents provide to their adult children (Compton and Pollak, 2014; Ho, 2015a,b). Parents were 26% [20%] more likely to provide grandchild care to sons [each son] than to daughters [each daughter]. Controlling for grandchild care help in the empirical analyses below yielded similar results and conclusions.

ADL help; and a value of 0 otherwise. The old age support variables are constructed at the gender-household group level and at the child level in the relevant analyses.

Measures of Other Variables

Characteristics of parents include gender (male/female); age and age squared; education dummies (yes/no) for primary, secondary, high school and college; whether married (yes/no); presence of a first born son (yes/no); presence of first born twin children (yes/no); Han ethnicity (yes/no); ADL limitation (yes/no); urban area of residence (yes/no); and province dummies.

Characteristics of children include gender (male/female); age and age squared; education dummies (yes/no) for primary, secondary, high school and college; whether married (yes/no); number of grandchildren; and birth order.

Summary Statistics

Summary statistics for the sample of 6,618 families are presented in Table 1 from parents' point of view. The average age of parents and children were 64.76 and 37.2, respectively. The average number of children was 2.94 among which 56% were male. The higher proportion of sons is consistent with China's well-known skewed gender ratio (Qian 2008; Wei and Zhang 2011).

24% of families had at least one college educated child and 15% of children were college educated. The mean of total college education spending on all children was 16,700 yuan.[8] 87% of children were married and 70% of parents gave a marriage gift. The mean of total marriage gifts value to all children was 18,700 yuan at 2013 prices.[9] In total, 74% of parents invested in children either in terms of college education spending or marriage gifts. The mean of total investment in children was 35,400 yuan.

65% of parents had at least one child within the best living proximity. There was a strong positive correlation between the best living proximity and having one child living in the same household, village or neighborhood ($\rho = 0.83$, $p < .05$). 74% of parents received monetary and in-kind support, with an average value of 3,600 yuan.[10] 39% of respondents reported having difficulty performing at least one ADL and 34% of such respondents received help from children including children's spouse.

[8]The conditional mean among families with positive expenditure was 87,400 yuan.

[9]The conditional mean among families with positive expenditure was 27,700 yuan.

[10]In contrast, much fewer (23%) parents provided support to children over the past year. Since the main interest is to estimate gender-based returns to investment, I focus on support received by parents.

Table 1 Summary Statistics

	Mean/Proportion	Standard Deviation
Parent's characteristics		
Age of parent	64.76	9.10
Prop. of parents male	0.49	0.50
Prop. of parents married	0.74	0.44
No. of children	2.94	1.49
Prop. of parents with primary school	0.40	0.49
Prop. of parents with secondary school	0.17	0.38
Prop. of parents with high school	0.11	0.31
Prop. of parents with college degree	0.02	0.14
Prop. of parents with a first born son	0.53	0.50
Prop. of parents with first born twins	0.01	0.12
Prop. of parents Han	0.93	0.26
Prop. of parents with ADL limitation	0.39	0.49
Prop. of parents living in urban area	0.40	0.49
Children's characteristics		
Age of children	37.20	7.63
Prop. of children male	0.56	0.31
Prop. of children married	0.87	0.26
No. of grandchildren per child	1.37	0.69
Prop. of children with primary school	0.35	0.39
Prop. of children with secondary school	0.33	0.36
Prop. of children with high school	0.16	0.29
Lifetime investment in children		
Prop. of children with college degree	0.15	0.31
Amount spent on college education	1.67	6.20
Prop. gave marriage gift	0.70	0.46
Value of marriage gifts	1.87	4.02
Prop. of invested in children	0.74	0.44
Amount spent on education and marriage	3.54	7.65
Annual old age support from children		
Prop. with best living proximity	0.65	0.48
Prop. receiving monetary and in-kind support	0.74	0.44
Amount of monetary and in-kind support	0.36	1.12
Prop. receiving ADL help	0.34	0.47
Prop. receiving any support	0.87	0.33
No. of families	6,618	

Note: The parent refers to the family respondent in CHARLS. All monetary values are in 10,000 yuan ≈ 1,600 USD and were converted to 2013 prices using the GDP deflator from Index Mundi for years prior to 1986 and the CPI from World Bank for years 1986 onwards.

From t-tests of differences in means, parents with the best living proximity were 4% less likely to receive monetary and in-kind support compared to other parents ($p < 0.05$). Conversely, among parents with an ADL limit, those with the best living proximity were 8% more likely to receive ADL help compared to other parents ($p < 0.05$). This suggests that there may be some substitution or complementarity between the means of support from children.

Table 2 Investment in Children and Old Age Support by Children's Gender

	Sons Mean (sd)	Daughters Mean (sd)	Difference in Means
Gender-Household Group Level			
Lifetime investment in children			
Prop. with college education	0.16 (0.36)	0.12 (0.32)	0.04**
Amount spent on college education	0.99 (4.43)	0.68 (3.19)	0.32**
Prop. gave marriage gift	0.58 (0.49)	0.38 (0.49)	0.20**
Value of marriage gifts	1.42 (3.59)	0.45 (1.48)	0.97**
Prop. invested in children	0.61 (0.49)	0.41 (0.49)	0.20**
Amount spent on education and marriage	2.42 (5.87)	1.12 (3.72)	1.29**
Annual old age support from children			
Prop. with best living proximity	0.54 (0.50)	0.25 (0.43)	0.30**
Prop. receiving monetary and in-kind support	0.49 (0.50)	0.58 (0.49)	-0.09**
Amount of monetary and in-kind support	0.19 (0.75)	0.17 (0.79)	0.02
Prop. receiving ADL help	0.28 (0.45)	0.10 (0.30)	0.18**
Prop. receiving any support	0.73 (0.45)	0.51 (0.50)	0.22**
No. of families	6,618	6,618	
No. of children	10,311	8,752	
Child Level			
Lifetime investment per child			
Prop. with college education	0.09 (0.29)	0.07 (0.26)	0.02**
Amount received for college education	0.49 (3.12)	0.35 (2.41)	0.14**
Prop. received marriage gift	0.54 (0.50)	0.40 (0.49)	0.14**
Value of marriage gifts received	0.78 (2.07)	0.28 (0.91)	0.50**
Prop. received investment	0.57 (0.49)	0.43 (0.49)	0.14**
Amount received for education and marriage	1.27 (3.82)	0.63 (2.69)	0.64**
Annual old age support to parent			
Prop. with best living proximity	0.54 (0.50)	0.21 (0.41)	0.33**
Prop. giving monetary and in-kind support	0.52 (0.50)	0.75 (0.43)	-0.23**
Amount of monetary and in-kind support	0.12 (0.62)	0.12 (0.68)	0.00
Prop. giving ADL help	0.21 (0.41)	0.07 (0.26)	0.14**
Prop. giving any support	0.74 (0.44)	0.49 (0.50)	0.26**
No. of families	4,356	4,356	
No. of children	7,478	7,420	

Note: Means, proportions, standard deviations (in parentheses) and two-tailed t-test of differences are reported. Investment and support are in 10,000 yuan. †p < .10; *p < .05; **p < .01.

Gender Differences in Investment and Support Levels

Table 2 documents the means of parental investment and old age support by gender of children. The means are documented by gender-household group (total by gender) from the sample of all families and by child gender (per child) from the sample of children in families with at least one son and one daughter. t-tests of differences in means by gender are reported in the last column.

On average, parents invested 3,200 yuan [9,700 yuan] more in sons than in daughters in terms of college education spending [marriage gifts value] by gender-household group. Similarly, parents invested 1,400 yuan [5,000 yuan] more per son than per daughter in terms of college education spending [marriage gifts value]. In terms of total investment in education and marriage, parents invested twice more in sons than in daughters.

On average sons were 30% to 33% more likely to provide support in terms of best living proximity. Parents with an ADL limitation were also 14% to 18% more likely to receive ADL help from sons and daughters-in-law than from daughers and sons-in-law. On the other hand, parents were 9% to 23% more likely to receive monetary and in-kind support from non-coresident daughters than from non-coresident sons.

The descriptive statistics suggest that parents invested relatively more in sons than in daughters in terms of college education and marriage gifts. Parents received higher old age support from sons in terms of best living proximity and ADL help whereas parents were also more likely to receive monetary and in-kind support from daughters.

Empirical Strategy

Several empirical models are used to estimate marginal parental old age support returns to investment. Baseline models consist of ordinary least squares (OLS) and of maximum likelihood estimation (MLE) that account for the latent nature of support, that is, probit [tobit] for discrete [censored] variables. Family fixed effects (FE) and two-stage least squares (2SLS) models take into account the potential endogeneity of investments. Both strategies attempt to account for unobserved characteristics that may correlate with both investments and support, which may bias the baseline estimates.

Baseline Models

The following model is estimated by *gender-household group* using OLS and MLE:

$$O_g = \beta_{g0} + \beta_{g1} I_g + \beta_{g2} I_g^2 + \beta_{g3} X + u_g, \tag{2}$$

O_g represents old age support from children of gender $g = S, D$; I_g denotes parental investments in children; X is a vector of covariates that include characteristics of parents: gender, age, education, marital status, first born son, first born twin children, Han ethnicity, ADL limitation, urban area of residence and province dummies; and characteristics averaged across all children: age, education, and number of grandchildren; and u_g is an error term.[11]

Since family size may be endogenous, I control for variables that may proxy for the number of children such as the presence of a first born son and the presence of first born twins (Dahl and Moretti 2008; Lee 2007; Li *et al.* 2008; Oliveira 2016; Rosenzweig and Zhang 2009).[12] Whereas one may worry about the exogeneity of gender of the first born child, the literature has reported that the male ratios for first births in China were similar across families who were subject to and not subject to the 1979 one child policy rule (Chen *et al.*, 2013; Ebenstein, 2010).[13] Explicitly controlling for family size in sensitivity analysis also yielded quantitatively similar results.

The estimates for sons and daughters are combined as seemingly unrelated estimations in order to compute gender differences in marginal returns. The marginal returns to investment from OLS and Tobit models are computed as $\left(\hat{\beta}_{g1} + 2\hat{\beta}_{g2}\bar{I}_g\right)$, where $\bar{I}_g$ is the average investment in gender g. In probit models, the marginal returns to investment are computed as $\phi\left(\hat{\beta}_{g0} + \hat{\beta}_{g1}\bar{I}_g + \hat{\beta}_{g2}\bar{I}_g{}^2 + \hat{\beta}_{g3}\bar{X}\right)$ $\left(\hat{\beta}_{g1} + 2\hat{\beta}_{g2}\bar{I}_g\right)$, where ϕ is the normal probability density function and $\bar{X}$ are the average values of X in the sample. Standard errors are computed using the delta method (Wooldridge 2010).

The following model is estimated at the *child level* using OLS and MLE:

$$O_{ij} = b_0 + b_1 I_{ij} + b_2 I_{ij}^2 + b_3\left(I_{ij} \times boy_{ij}\right) + b_4\left(I_{ij}^2 \times boy_{ij}\right) + b_5 X_{ij} + u_{ij}, \qquad (3)$$

O_{ij} represents old age support from child i in family j; I_{ij} is investment that child i received

[11] A flexible second order polynomial is specified for investment: The estimated $\hat{\beta}_{g1}$ was positive and $\hat{\beta}_{g2}$ was negative suggesting diminishing marginal returns. Controlling for household wealth or excluding controls for parents' marital status and ADL limitation, children's education, and number of grandchildren also yielded quantitatively similar results.

[12] Families with a first born son [twins] had on average 0.32 fewer [0.73 more] children ($p < 0.05$). The old age support equation may be interpreted as a reduced form version where the equation for family size has been substituted in and where family size is a function of the presence of a first born son, first born twins, and family characteristics X.

[13] There were no statistically significant differences in parental marital status and education among families with and without a first born son or first born twins. Sensitivity analyses on the subsamples of families with children born prior to 1979 (which was also prior to the diffusion of ultrasound technology in the mid-1980s) and families where the parent holds an agricultural hukou (and thus faced less strict fertility rules; Wang 2005) yielded similar results to those from the main sample.

from parents; boy_{ij} is a dummy variable taking a value of 1 if child i is male and a value of 0 otherwise; X_{ij} is a vector of covariates that include characteristics of parents as defined above and characteristics specific to child i as listed above, and is also inclusive of child gender and birth order; u_{ij} is an error term.[14]

The marginal returns to investment from OLS and tobit models are computed as $\left(\hat{b}_1 + 2\hat{b}_2\bar{I}\right)$ for daughters and $\left(\hat{b}_1 + 2\hat{b}_2\bar{I} + \hat{b}_3 + 2\hat{b}_4\bar{I}\right)$ for sons, where $\bar{I}$ is the average per child investment. The marginal returns from probit models are computed as $\phi\left(\hat{\mathbf{b}}'\bar{\mathbf{X}}\right)\left(\hat{b}_1 + 2\hat{b}_2\bar{I}\right)$ for daughters and $\phi\left(\mathbf{b}'\bar{\mathbf{X}}\right)\left(\hat{b}_1 + 2\hat{b}_2\bar{I} \ + \hat{b}_3 + 2\hat{b}_4\bar{I}\right)$ for sons, where $\bar{\mathbf{X}}$ represent the average values of all covariates.

Potential Endogeneity of Investment

The theoretical model suggests that investments in children depend on parents' *perceived* old age support returns from children. Generous parents may believe that their children would also be generous such that there may be a postive correlation between investment and the error terms in the old age support equations, which in turn, would lead to overestimation of the marginal returns in the baseline models. Conversely, parents who are prone to spoil their children may not only spend more on them but may also raise them as self-entitled individuals so that the children may be less inclined to provide support. This would imply a negative correlation between investment and the error terms in the old age support equations, which would lead to underestimation of the marginal returns in the baseline models. I employ family fixed effects models as well as two-stage least squares models to address such endogeneity issues.

Family Fixed Effects Models

In an attempt to control for the potential endogeneity of investment, I estimate FE models. In particular, the error terms in Eq. 2 and Eq. 3 can be decomposed into a family fixed effect and a random component. The identifying assumption is that investment may be correlated with the family fixed effects but not with the random error terms. The FE models are estimated using first differences between son and daughter groups in the gender-household level analysis and using within-group family differences in the child level analysis. Any fixed family level charateristic such as unobserved family taste is, therefore, differenced out.

Two-Stage Least Squares

[14] I control for birth order as it may be correlated with parental investments or old age support (Black *et al.* 2005; Wakabayashi and Horioka 2009). The coefficient of birth order was statistically insignificant at the 5% level in all regressions.

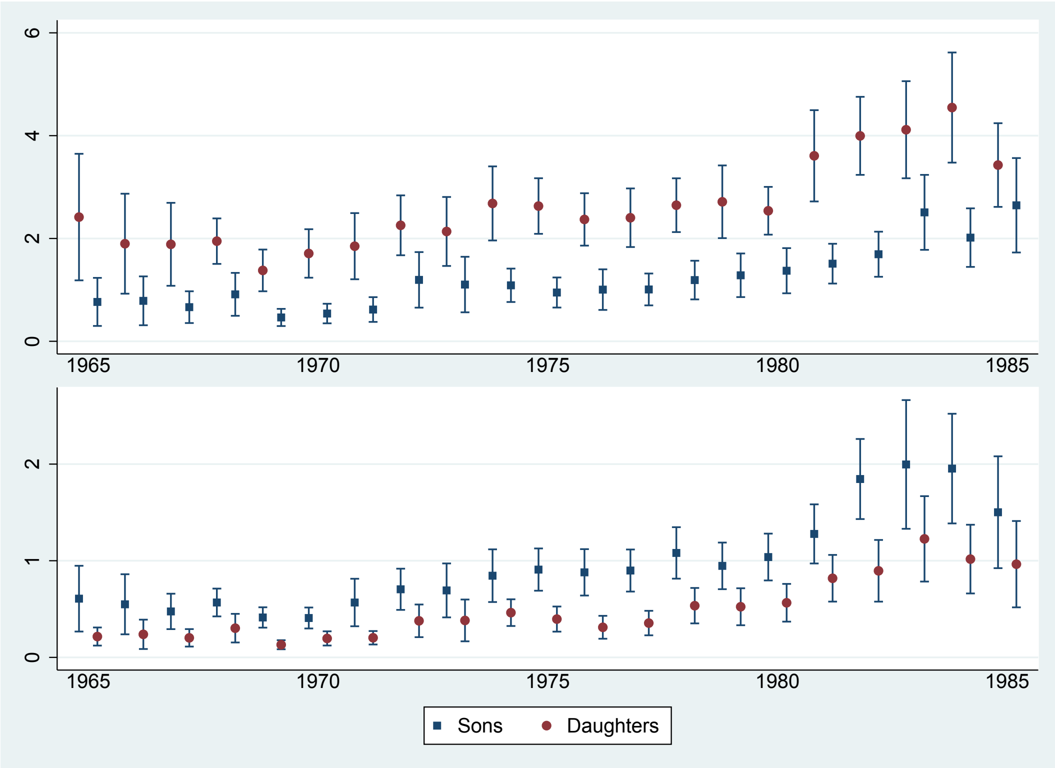
I also employ 2SLS models in an attempt to control for the potential endogeneity of investment. Valid instruments for investment should consist of exogenous variables that correlate with investments in children but that do not correlate with the error terms in the old age support equations. I exploit the fact that old age support is contemporaneous while investments in children were made at different timings to argue that *interaction terms* between birth year dummies and gender of the first born child are suitable instruments for investment.

For the sake of clarity, the intuition behind the suitability of the instruments is interpreted in conjuction with the theoretical model. From the second stage children's problem, old age support depends on children's reciprocity (say, the preference weight on old age support relative to consumption) and market returns within the year prior to the respondents' interview in 2013. Conversely, from the first stage parents' problem, investments in children depend on parents' income as well as parents' perceived reciprocity and market returns by child gender *at the different timings at which the investment decisions were made*, that is, when the children went to college or got married. Such perceived reciprocity or market returns may have varied over time, which may have influenced parental allocation of investment resources to sons and daughters by birth cohort.

A series of economic reforms were indeed implemented in China in the 1980s aiming at shifting China from a planned economy to a more market based economy. Market returns to education increased dramatically over time and especially for women (Maurer-Fazio 1999; Zhang *et al.* 2005). With females experiencing relatively higher market returns in China, parents may change their perception that female children generate lower returns than males and therefore, be more inclined to invest in daughters. Conversely, with such improvement in female economic status, parents may instead be more willing to invest in sons so as to increase their chances of finding a suitable marriage match. Figure 1 illustrates the substantial variations in means of *total investments* in sons and daughters by birth cohort of the first child.

I use interaction terms between birth year dummies and gender of the first born child as instruments to control for the potential endogeneity of investment. As argued above, gender of the first born child is likely exogenous based on the fact that sex ratios for first births were similar prior to and after the introduction of the one child policy (Chen *et al.* 2013; Ebenstein 2010). The interaction terms are meant to capture the allocation of parental investments by gender at the different timings at which investment decisions were made. Thus, the main identifying assumption is that the interaction terms affect old age support only through investments in children. Note that, as described above, parents' and children's ages as well as the presence of a first bon son are separately controlled for in the vector of covariates X and are therefore, allowed to affect both old age support and investment. Conversely, the interaction terms between birth year dummies and gender of the first born child only enter the investment equations so that the 2SLS model is identified from the additional exogenous variation captured by the interaction terms. I report results from tests of the hypothesis that the over-identifying restrictions are valid in the next section.

Figure 1 Parental Investments across Birth Cohort



Note: Vertical axes denote *total investments* in 10,000 yuan and horizontal axes denote year of birth of the first child. The squares and circles denote respectively, mean investment in sons and in daughters. 95% confidence intervals are illustrated.

The following first stage equations are estimated by *gender-household group* using OLS:

$$Inv_g = \alpha_{g0} + \alpha_{g1}\left(first\ birth \times boy\ first\right) + \alpha_{g2}X + \psi_g, \tag{4}$$

where Inv_g represent the investment related terms in Eq. 2; X is a vector of covariates as defined in the baseline model; *first birth* are birth year dummies of the first born child; *boy first* indicate the presence of a first born son; and ψ_g is an error term. In the second stage, old age support Eq. 2 are estimated using the predicted values for the investment related terms from Eq. 4.

The following first stage equations are estimated at the *child level* using OLS:

$$Inv_{ij} = a_0 + a_1 \left(first\ birth_j \times boy\ first_j\right) + a_2 X_{ij} + \psi_{ij}, \tag{5}$$

where Inv_{ij} represent the investment related terms in Eq. 3; X_{ij} is a vector of covariates as defined in the baseline model; $first\ birth_j$ and $boy\ first_j$ are as defined above; and ψ_{ij} is an error term. In the second stage, old age support Eq. 3 is estimated using the predicted values for the investment related terms from Eq. 5.

Hypothesis Testing

Denote the estimated marginal returns from sons and daughters as $\hat{r}_S$ and $\hat{r}_D$ respectively. In line with Eq. 1, I test the hypothesis that the estimates for sons and daughters were equal, $H_0 : \hat{r}_S - \hat{r}_D = 0$. The Wald statistics is given by:

$$\frac{\left(\hat{r}_S - \hat{r}_D\right)^2}{Var\left(\hat{r}_S\right) + Var\left(\hat{r}_D\right) + 2Cov\left(\hat{r}_S, \hat{r}_D\right)} \sim \chi^2_{(1)}.$$

I also test the hypotheses that the estimates for sons were greater or smaller than for daughters: $H_1 : \hat{r}_S - \hat{r}_D > 0$ or $H_2 : \hat{r}_S - \hat{r}_D < 0$ respectively, using one-tailed z tests.

Results

This section estimates marginal parental returns from sons and daughters from the main empirical analysis that considers *any support* as the dependent variable. Further analyses include backing out the distribution of marginal returns, performing separate analyses for *best living proximity* and *monetary and in-kind support* outcomes, for *education investment* and *marriage investment*, and for rural and urban households. Sensitivity analyses also control for contemporary intervivos from parents, for the changing bargaining power of females, and for investments at the extensive margin. Lastly, results that take into account the *average levels* of support in terms of reciprocity and market returns are presented.

Marginal Parental Returns from Sons and Daughters

Table 3 reports the marginal parental returns to *total investment* in sons and in daughters, as well as the differences in marginal returns between sons and daughters. The marginal effects of receiving *any support* per 10,000 yuan invested are reported from OLS, MLE, FE and 2SLS models. In 2SLS models, F-tests of the hypothesis that the coefficients of the instrumental variables were zero in the first stage investment regressions were rejected at the 5% significance level ($F \in [1.59, 5.86]$). The Sargan and Basmann tests of the hypothesis that the over-identifying restrictions are valid could also not be rejected at the 5% significance level in both the gender-household group ($p \in [0.09, 0.58]$) and child level ($p \in [0.68, 0.69]$) analyses.

Table 3 Marginal Parental Returns to Investment in Sons and Daughters

	Gender-Household Group			Child Level Analysis		
	Sons	Daughters	Diff.	Sons	Daughters	Diff.
OLS Marginal effect	0.016**	0.026**	**-0.010****	-0.004*	0.018**	**-0.022****
(SE)/[Wald]	(0.002)	(0.002)	[13.56]	(0.002)	(0.004)	[34.49]
R-squared	0.17	0.19		0.09	0.09	
MLE Marginal effect	0.017**	0.035**	**-0.018****	-0.006*	0.018**	**-0.024****
(SE)/[Wald]	(0.002)	(0.004)	[16.88]	(0.003)	(0.004)	[30.25]
Log-likelihood	-3,320	-3,915		-9,211	-9,211	
FE Marginal effect	0.024**	0.039**	**-0.015****	-0.007**	0.014**	**-0.021****
(SE)/[Wald]	(0.003)	(0.003)	[15.86]	(0.003)	(0.004)	[35.90]
R-squared	0.25	0.25		0.11	0.11	
2SLS Marginal effect	0.027**	0.080**	**-0.054****	0.004	0.054**	**-0.050****
(SE)/[Wald]	(0.007)	(0.009)	[25.84]	(0.015)	(0.015)	[18.53]
R-squared	0.15	0.18		0.10	0.10	
No. of families	6,618	6,618		4,356	4,356	
No. of children	10,311	8,752		7,478	7,420	

Note: Marginal effects from ordinary least squares (*OLS*), maximum likelihood estimation (*MLE*), family fixed effects (*FE*) and two-stage least squares (*2SLS*). Robust standard errors (in parentheses) and Wald statistics [in parentheses] for testing differences between sons and daughters (H_0). Regressions control for characteristics of parents: gender, age and age squared, education, marital status, first born son, first born twins, Han ethnicity, ADL limitation, urban area of residence and province dummies; and characteristics of children: age and age squared, education, and number of grandchildren, as well as child gender and birth order in child level analysis. †p < .10; *p < .05; **p < .01.

From the gender-household group analysis, a 10,000 yuan increase in lifetime parental *total investment* in sons was associated with an increase in the annual probability of receiving *any sup-*

port from sons. The increase in probability ranged from a low of 1.6% in the OLS model to a high of 2.7% in the 2SLS model ($p < 0.05$). Moreover, a 10,000 yuan increase in lifetime parental *total investment* in daughters was associated with an increase in the annual probability of receiving *any support* from daughters. The increase in probability ranged from a low of 2.6% in the OLS model to a high of 8% in the 2SLS model ($p < 0.05$). Similarly, from the child level analysis, daughters increased the probability of providing support from a low of 1.4% in the FE model to a high of 5.4% in the 2SLS model ($p < 0.05$). Conversely, marginal returns from sons in seems negative although not statistically significant at the 5% level in the 2SLS model, suggesting that sons may be less inclined to provide support once they have a sibling to free-ride on.[15]

Gender differences in the marginal increase in probability of receiving *any support* from sons and daughters were negative and statistically significant ($p < 0.05$) across all models. In particular, the increase in the probability of receiving support from sons was lower than the increase in the probability of receiving support from daughters. At the gender-household group level, the differences between the increases in the probability of receiving support (from sons minus from daughters), ranged from a low magnitude of -1.0% in the OLS model to a high magnitude of -5.4% in the 2SLS model. At the child level, the differences between the increases in the probability receiving support (from a son minus from a daughter), ranged from a low magnitude of -2.1% in the FE model to a high magnitude of -5% in the 2SLS model.

The Wald statistics from tests of differences in marginal returns, reported in squared parentheses in the fourth and seventh columns of Table 3, indicate that the hypothesis that marginal returns from sons and daughters were the same (H_0) is always rejected ($p < 0.05$). The hypothesis that marginal returns from sons were higher than from daughters (H_1) is also always rejected ($p < 0.05$) whereas the hypothesis that marginal returns from sons were lower than from daughters (H_2) can never be rejected at the 5% statistical significance level.

Further Results and Sensitivity Analyses

Distribution of marginal returns, support and investment types. The distribution of marginal returns are illustrated in Appendix Figure A1. Result focused on *best living proximity*, and *mone-*

[15] As can be seen from Appendix Tables A1, A2 and A3, the negative marginal returns from sons in the child level analyses seem to be driven by *best living proximity* and *education investment* by rural households. It is possible that once a sibling provides support, the other sons are less likely to help, with the highly educated ones moving away for work. This would be consistent with Rosenzweig and Zhang (2014), who found that coresidence is lower for higher income children. t-tests of differences in means reveal that college educated sons [daughters] were 7% less [17% more] likely ($p < 0.05$) to provide support than their non-college educated counterparts. I leave such interesting considerations on inter-sibling allocations of support by gender for future research.

tary and in-kind support, and results focused on *education investment* and *marriage investment* are presented in Appendix Tables A1 and A2. The evidence once again suggests that marginal returns from daughters were relatively higher than from sons.

Rural and urban households. Gender-based parental investments and reliance on children for old age support may differ across rural and urban families. In particular, rural families may rely more on children because they have lower access to pensions (Cai *et al.* 2006; Oliveira 2016). I estimate the marginal returns to *total investment* in terms of receiving *any support* separately for families where the parent lives in a rural area and in an urban area. Parents invested much more in sons than in daughters in rural areas: Parents invested on average 22,100 yuan [7,600 yuan] in sons [daughters] and 13,000 yuan [5,400 yuan] per son [daughter]. Son biased investments were less pronounced in urban areas although still existent: Parents invested on average 27,300 yuan [16,600 yuan] in sons [daughters] and 20,100 yuan [13,700 yuan] per son [daughter]. From Appendix Table A3, marginal parental returns from daughters seem to have been higher than from sons for both rural and urban households.

Contemporary exchanges. One concern is that parental investments may be proxying for parental contemporary transfers to children such that the positive relationship between parental investments and old age support may be reflecting contemporary exchanges. McGarry (2016) found that the distribution of transfers among siblings tend to become more unequal over time in the US, suggesting that parents who invest more in some children at a certain point in time also invest more in those children throughout the lifecycle. From the CHARLS sample, parents provided on average 1,800 yuan [400 yuan] more to sons [each son] than to daughters [each daughter] in terms of monetary and in-kind transfers ($p < 0.05$) in the previous year, suggesting that parental contemporary transfers still favor sons. Reassuringly, controlling for contemporary transfers from parents yielded similar results to those of Table 3.

Bargaining power of women. Even though the literature has found relatively stable gender ratios for first births in China, there is evidence of skewed gender ratios at higher birth parities, especially for the later censuses (Chen *et al.* 2013; Ebenstein 2010). Higher sex ratios may increase the bargaining power of women (Angrist 2002), who may then be in a better position to provide support to their own parents. In sensitivity analysis, I used data from China Census 2000 to control for the local sex ratios associated with the 5 year birth cohort of the first born child. The results were quantitatively very similar to those of Table 3.

Zero investment and outliers. Additionally controlling for children's marital and college status or dropping children who received zero parental investments in their education and marriage yielded quantitatively similar results. Dropping families with more than 100,000 yuan investment also yielded similar results to those of Table 3.

Reciprocity and Market Returns

I now present marginal parental old age support return results that also account for the *average levels* of reciprocity and market returns from sons and daughters. Suppose that support from a child of gender g is given by the product of reciprocity probability and market returns:

$$O_g = R_g\left(I_g\right) M_g\left(I_g\right). \tag{6}$$

Reciprocity to investment, $R_g\left(I_g\right)$, reflects children's propensity to provide support as a function of parental investment. For instance, higher parental investment may make children feel compelled to be more filial. Market returns to investment, $M_g\left(I_g\right)$, are interpreted as before. The Appendix presents a mapping of Eq. 6 to children's first stage problem in the theoretical model, where the preference weight on parents' support is now also modelled as a function of investment.

The old age support production optimality condition Eq. 1 can now be rewritten as:

$$R_S'\left(I_S\right) M_S\left(I_S\right) + R_S\left(I_S\right) M_S'\left(I_S\right) = R_D'\left(I_D\right) M_D\left(I_D\right) + R_D\left(I_D\right) M_D'\left(I_D\right). \tag{7}$$

As can be seen from Eq. 7, marginal parental old age support returns are now made up of a combination of *marginal reciprocity* to investment and *market returns level* as well as a combination of *reciprocity level* and *marginal market returns* to investment.

Reciprocity is captured by *any support* while market returns are defined as annual child income in 1,000 yuan. Although all families reported income for at least one child, approximately 26% of all children had their income missing. I report results below after dropping children with missing income from the sample. Results based on imputing the income of those children (by projecting income on children's characteristics) are reported in Appendix Tables A4 and A5 and were similar to those reported here.

The second to fourth columns of Tables 4 and 5 report the marginal reciprocity returns analogous to the estimates in Table 3. The fifth to seventh columns of Tables 4 and 5 report the marginal market returns to *total investment*. Similar models as above are employed to estimate marginal market returns. In 2SLS market returns models, the Sargan and Basmann tests of the hypothesis that the over-identifying restrictions are valid could not be rejected at the 5% significance level

Table 4 Reciprocity and Market Reutrns to Investment by Gender-Household Group

	Reciprocity (R)			Market Return (M)			Old Age Support Return (O)		
	Sons	Daughters	Diff.	Sons	Daughters	Diff.	Sons	Daughters	Diff.
OLS Marginal effect	0.016**	0.026**	**-0.010****	3.398**	4.824**	**-1.427****	3.104**	3.327**	**-0.223**
(SE)/[Wald]	(0.001)	(0.002)	[13.56]	(0.276)	(0.382)	[9.37]	(0.217)	(0.237)	[0.51]
R-squared	0.17	0.19		0.17	0.16				
MLE Marginal effect	0.017**	0.035**	**-0.018****	3.398**	4.824**	**-1.427****	3.150**	3.626**	**-0.475**
(SE)/[Wald]	(0.002)	(0.004)	[16.88]	(0.276)	(0.382)	[9.37]	(0.224)	(0.263)	[1.97]
Log-L/R-squared	-3,320	-3,915		0.17	0.16				
FE Marginal effect	0.024**	0.039**	**-0.015****	3.228**	5.001**	**-1.773****	0.976**	1.320**	**-0.344***
(SE)/[Wald]	(0.003)	(0.003)	[15.86]	(0.312)	(0.436)	[12.08]	(0.115)	(0.115)	[6.54]
R-squared	0.25	0.25		0.20	0.20				
2SLS Marginal effect	0.027**	0.080**	**-0.053****	-0.780	3.479**	**-4.259****	0.484	4.435**	**-3.951****
SE/Wald	(0.007)	(0.009)	[25.84]	(0.917)	(0.838)	[11.36]	(0.739)	(0.585)	[18.42]
R-squared	0.15	0.18		0.11	0.12				
Sample average	0.73	0.51		39.33	33.21				
No. of families	6,618	6,618		6,618	6,618				
No. of children	7,816	6,222		7,816	6,222				

Note: Robust standard errors (in parentheses) and Wald statistics [in parentheses] for testing differences between sons and daughters (H_0). Regressions control for characteristics of parents and children. $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$.

Table 5 Reciprocity and Market Reutrns to Investment per Child

	Reciprocity (R)			Market Return (M)			Old Age Support Return (O)		
	Sons	Daughters	Diff.	Sons	Daughters	Diff.	Sons	Daughters	Diff.
OLS Marginal effect	-0.007^{**}	0.014^{**}	**-0.021^{**}**	1.161^{**}	1.872^{**}	**-0.712**	0.645^{**}	1.450^{**}	**-0.805^{*}**
(SE)/[Wald]	(0.002)	(0.004)	[27.85]	(0.272)	(0.412)	[2.47]	(0.231)	(0.278)	[5.96]
R-squared	0.09	0.09		0.15	0.15				
MLE Marginal effect	-0.010^{**}	0.014^{**}	**-0.023^{**}**	1.161^{**}	1.872^{**}	**-0.712**	0.561^{*}	1.436^{**}	**-0.875^{**}**
(SE)/[Wald]	(0.003)	(0.004)	[25.82]	(0.272)	(0.412)	[2.47]	(0.237)	(0.287)	[6.75]
Log-L/R-squared	-6,588	-6,588		0.15	0.15				
FE Marginal effect	-0.008^{**}	0.013^{**}	**-0.022^{**}**	0.400^{*}	0.940^{**}	**-0.540^{*}**	0.035	0.942^{**}	**-0.907^{**}**
(SE)/[Wald]	(0.003)	(0.004)	[31.58]	(0.199)	(0.281)	[4.43]	(0.179)	(0.205)	[11.16]
R-squared	0.10	0.10		0.05	0.05				
2SLS Marginal effect	$-0.029^{\dagger}$	0.043^{**}	**-0.072^{**}**	3.792^{**}	3.970^{**}	**-0.178**	1.746	3.517^{**}	**$-1.771^{\dagger}$**
SE/Wald	(0.016)	(0.015)	[39.09]	(1.255)	(1.031)	[0.04]	(1.196)	(0.760)	[3.02]
R-squared	0.09	0.09		0.15	0.15				
Sample average	0.76	0.51		32.11	34.76				
No. of families	4,356	4,356		4,356	4,356				
No. of children	5,647	5,178		5,647	5,178				

Note: Robust standard errors (in parentheses) and Wald statistics [in parentheses] for testing differences between sons and daughters (H_0). Regressions control for characteristics of parents and children. $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$.

neither at the gender-household level ($p \in [0.38, 0.46]$) nor at the child level ($p \in [0.25, 0.26]$). The statistically significant ($p < 0.05$) marginal market returns to investment in sons [daughters] ranged from 3,228 yuan to 3,398 yuan [3,479 yuan to 5,001 yuan] at the gender-household level and from 400 yuan to 3,792 yuan [940 yuan to 3,970 yuan] at the child level per 10,000 yuan invested.

Marginal parental old age support returns are computed according to Eq. 7 at the average reciprocity and market return levels, and reported in the last three columns of Tables 4 and 5. The statistically significant ($p < 0.05$) marginal returns to investment in sons [daughters] ranged from 976 yuan to 3,150 yuan [1,320 yuan to 4,435 yuan] at the gender-household level and from 561 yuan in the MLE model to 645 yuan [942 yuan to 3,517 yuan] at the child level.

The statistically significant ($p < 0.05$) gender differences in marginal parental returns from sons and daughters ranged from a low magnitude of -344 yuan in the FE model to a high magnitude of -3,951 yuan in the 2SLS model at the gender-household level and from a low magnitude of -805 yuan in the OLS model to a high magnitude of -907 yuan in the FE model at the child level. The results once again suggest that the marginal parental returns to investment in daughters were relatively higher than the marginal parental returns to investment in sons.

Conclusion

This study examined whether parental investments in children paid off in terms of old age support, and estimated the realized annual marginal parental old age support returns to lifetime invesment by gender of children using data from the 2013 CHARLS. Whereas parents invested twice more in sons than in daughters, marginal returns to investment in daughters were relatively higher than marginal returns to investment in sons. Gender differences in the marginal increase in the probability of receiving *any support* (from sons minus daughters) ranged from -1% to -5.4% at the gender-household group level and from -2.1% to -5% at the child level per 10,000 yuan invesment. Taking into account the *average levels* of reciprocity and market returns of children suggests that gender differences in the annual value of marginal parental old age support returns ranged from -344 yuan to -3,951 yuan at the gender-household group level and from -805 yuan to -907 yuan at the child level per 10,000 yuan invesment.

Given that real interest rate in China was 3.7% in 2013 (World Bank), the gender differences in marginal returns are non-trivial, especially in terms of the annual value of marginal parental returns. The findings indicate that parental investments in college education spending and marriage gifts value help stimulate support from children in terms of best living proximity, monetary and in-kind support, and ADL help. Given the higher marginal returns to investment from daughters than from sons, encouraging parental investments in female children may help increase family provided old age support.

I note that this study may be subject to several limitations. First, there may be additional parental investments that are not observed in the data. For example, parents may also invest more in sons' health (Barcellos *et al.* 2014; Lhila and Simon 2008; Rosenzweig and Schultz 1982) such that gender differences in investments may be underestimated, thereby resulting in the estimates of gender differences in marginal parental returns between sons and daughters to be underestimated. In particular, diminishing marginal returns to investment (see footnote 11) implies that marginal returns from sons would be even lower if sons experienced even greater parental investments.

Second, since investments are made in the past, self-reported measures of investment in children may suffer from recollection errors especially among older respondents. Sensitivity analyses on subsamples of younger families (inclusive of parents aged below 50) and older families (exclusive of parents aged below 60) yielded similar results, suggesting that the results are robust across age groups. Nevertheless, one cannot exclude the possibility that recollection errors are gender-based. For example, parents may overinflate [underestimate] self-reported investments in daughters [sons] as they may not wish to appear too biased. In this case, diminishing marginal returns to investment implies that the marginal returns from daughters [sons] would be even higher [lower] if daughters [sons] received even lower [higher] actual investments than the self-reported figures. The converse holds if parents overinflate [underestimate] self-reported investments in sons [daughters]. For example, parents may keep track of sons' investments in view of arguing for a return but treat daughters' investment as a lost cause.

Third, there may be additional forms of support that are valued by parents. For instance, parents may feel comforted by the idea of having ancestral rituals performed by children after death (Das Gupta *et al.* 2003; Jayachandran 2015). To the extent that such forms of support are performed primarily by sons, gender differences in marginal parental returns may be overestimated. Conversely, if parents' well-being improve more under daughters' rather than sons' care (Zeng *et al.*, 2015), then gender differences in marginal parental returns may be underestimated. Nevertheless, this study may still shed light on old age support returns in terms of living proximity, monetary and in-kind support and ADL help.

While China has been rapidly expanding its New Rural Pension Program since 2009, the incentives to participate in the program have been found to be low (Lei *et al.* 2011). Parents with sons are also less likely to enroll in a pension program (Ebenstein and Leung 2010; Zhang 2011), indicating the possible reliance on sons for old age support. I, however, find that parents may have received higher marginal returns from daughters than from sons. The study suggests that policies geared towards reducing gender differences in parental investments in children may be desirable. For example, education subsidies for females or baby girl bonuses may help encourage higher investments in daughters. Exploiting the higher returns from female workers may not only help with informal support provisions but may also result in higher tax contributions to the expanding social security system. It may also be interesting to study whether brothers may have been increasingly relying on their sisters to provide support such that the allocation of old age support among siblings may have also varied over time and according to the gender composition of siblings. I leave such interesting considerations for future research.

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Online Appendix

Model Derivations

Partial Effects from Children's Problem

The optimal level of support to parents, O_i^*, is obtained by equating the marginal utility of consumption to the marginal utility of old age support:

$$v_{iC}\left(M_i\left(I_i\right) - O_i^*, O_i^*\right) = v_{iO}\left(M_i\left(I_i\right) - O_i^*, O_i^*\right). \tag{A1}$$

Under the assumption that children's utility is separable in its arguments, one can rewrite optimality condition Eq. A1 as follows:

$$v_{iC}\left(M_i\left(I_i\right) - O_i^*\right) = v_{iO}\left(O_i^*\right).$$

Differentiating with respect to I_i, it follows that:

$$\frac{\partial O_i^*}{\partial I_i} = \frac{v_{iCC}}{v_{iCC} + v_{iOO}} M_i' > 0,$$

where the inequality stems from the fact that $v_{ixx} < 0$ for $x = C_i, O_i$ and that $M_i' > 0$. Thus, (i) old age support from child i increases in investment in child i.

One can also rewrite optimality condition Eq. A1 as a function of total support from children of gender g, $\bar{O}_g = \sum_{i=1}^{n_g} O_i^*$:

$$v_{iC}\left(M_i\left(I_i\right) - \frac{\bar{O}_g}{n_g}\right) = v_{iO}\left(\frac{\bar{O}_g}{n_g}\right).$$

Differentiating with respect to I_i, and with respect to n_g, we have:

$$\frac{\partial \bar{O}_g}{\partial I_i} = n_g \frac{v_{iCC}}{v_{iCC} + v_{iOO}} M_i' > 0 \quad \textit{and} \quad \frac{\partial \bar{O}_g}{\partial n_g} = \frac{\bar{O}_g}{n_g} > 0.$$

Thus, all else equal, (ii) total old age support from children of gender g increase in investment per child of gender g and in the number of children of gender g.

Gender-Household Group Optimality Condition

Parents choose total investment per gender:

$$\underset{C_p,\bar{I}_S,\bar{I}_D}{Max} \quad u\left(C_p, \bar{O}_S\left(\bar{I}_S\right)+\bar{O}_D\left(\bar{I}_D\right)\right) \quad s.t. \quad C_p+\bar{I}_S+\bar{I}_D=M_p,$$

where $\bar{O}_g=\sum_{i=1}^{n_g} O_i$ and $\bar{I}_g=\sum_{i=1}^{n_g} I_i$. It follows that parents equate marginal returns to total investment in sons and daughters:

$$\bar{O}_S'\left(\bar{I}_S\right)=\bar{O}_D'\left(\bar{I}_D\right).$$

Extended Model of Altruism

I now show that the key predictions of the model would still hold in an extended model of altruism where children care about total old age support received by the parents. Child i's utility is thus given by $v_i\left(C_i,\bar{O}\right)$, where v_i is separable, increasing, and concave in its arguments: $v_{ix}>0$ and $v_{ixx}<0$, $x=C_i,\bar{O}$. Under the assumption the private and public goods are normal for all children, there exists a unique Nash equilibrium where children of the same gender as child i provide O_i^* of care and children of a different gender from child i provide O_j^* of care.

Partial Effects from Children's Problem

The optimality condition Eq. A1 now depends on total old age support received by the parent:

$$v_{iC}\left(M_i\left(I_i\right)-O_i^*\right)=v_{iO}\left(n_iO_i^*+n_jO_j^*\right).$$

A similar condition may be derived for children of gender j

$$v_{jC}\left(M_j\left(I_j\right)-O_j^*\right)=v_{jO}\left(n_iO_i^*+n_jO_j^*\right).$$

Totally differentiating the two conditions above, we get in matrix form

$$\begin{bmatrix} \left(v_{iCC}+v_{iOO}n_i\right) & v_{iOO}n_j \\ v_{jOO}n_i & \left(v_{jCC}+v_{jOO}n_j\right) \end{bmatrix} \begin{bmatrix} dO_i^* \\ dO_j^* \end{bmatrix} = \begin{bmatrix} v_{iCC}M_i' \\ 0 \end{bmatrix} dI_i$$

where $v_{kk}<0$ denotes the second derivative with respect to $k=c,o$. Applying Cramer's rule,

$$\frac{\partial O_i^*}{\partial I_i}>0.$$

Thus, (i) old age support from child i increases in investment in child i.

One can also rewrite the optimality condition as a function of total support from children of gender g, $\bar{O}_g = \sum_{i=1}^{n_g} O_i^*$:

$$v_{iC}\left(M_i\left(I_i\right) - \frac{\bar{O}_g}{n_g}\right) = v_{iO}\left(\bar{O}_g + \bar{O}_{-g}\right).$$

A similar condition may be obtained for children of gender j

$$v_{jC}\left(M_j\left(I_j\right) - \frac{\bar{O}_{-g}}{n_{-g}}\right) = v_{jO}\left(\bar{O}_g + \bar{O}_{-g}\right).$$

Totally differentiating the two conditions above, we get in matrix form

$$\begin{bmatrix} \left(\frac{v_{iCC}}{n_g} + v_{iOO}\right) & v_{iOO} \\ v_{jOO} & \left(\frac{v_{jCC}}{n_{-g}} + v_{jOO}n_j\right) \end{bmatrix} \begin{bmatrix} d\bar{O}_g \\ d\bar{O}_{-g} \end{bmatrix} = \begin{bmatrix} v_{iCC}M_i' \\ 0 \end{bmatrix} dI_i + \begin{bmatrix} v_{iCC}\frac{\bar{O}_g}{n_g^2} \\ 0 \end{bmatrix} dn_g.$$

Applying Cramer's rule,

$$\frac{\partial \bar{O}_g}{\partial I_i} > 0 \quad and \quad \frac{\partial \bar{O}_g}{\partial n_g} > 0,$$

Thus, all else equal, (ii) total old age support from children of gender g increase in investment per child of gender g and in the number of children of gender g.

Note that the derivation of the old age support production efficiency optimality condition from the parent's problem is as before: Parents will optimally equate marginal returns between sons and daughters. The qualitative predictions of the model, therefore, still holds in an extended model of altruism where children care about total support received by parents.

Parents Value Investment in Children

I now show that production efficiency optimality Eq. 1 would still hold in a model where parents directly care about their investment in children. Consider the following parental preferences:

$$u\left(C_p, \sum_{i=1}^{n_S} O_S\left(I_S\right) + \sum_{i=1}^{n_D} O_D\left(I_D\right), \sum_{i=1}^{n_S} I_S + \sum_{i=1}^{n_D} I_D\right).$$

It is straightforward to see from the parents' first stage problem, that they would still equate the marginal returns to investment between sons and daughters: $O_S'\left(I_S\right) = O_D'\left(I_D\right)$.

Now, conder a model where parents value investment in sons and daughters differently. In particular, let parental preferences be

$$u\left(C_p, \sum_{i=1}^{n_S} O_S\left(I_S\right) + \sum_{i=1}^{n_D} O_D\left(I_D\right), \sum_{i=1}^{n_S} I_S, \sum_{i=1}^{n_D} I_D\right).$$

In this case, the optimality condition becomes

$$u_2 O_S'\left(I_S\right) + u_3 = u_2 O_D'\left(I_D\right) + u_4,$$

where u_k with $k = 2,3,4$ denote the derivative of the utility function with respect to the k^{th} argument. The modified condition captures a combination of old age support production efficiency and of parental gender preferences. The implication of *Hypothesis 2* still holds since failure to equate $O_S'\left(I_S\right) = O_D'\left(I_D\right)$ still implies that parents may not be optimally allocating resources between sons and daughters *from a pure old age support production efficiency perspective*. In this extended model, failure to equate $O_S'\left(I_S\right) = O_D'\left(I_D\right)$ has the added implication that such failure is due to gender preferences.

Reciprocity and Market Returns Mapping

Suppose that child i's utility is given by:

$$ln\left(C_i\right) + \alpha_i ln\left(O_i\right),$$

where α_i is the weight that chid i puts on support to parents and is a function of investment. α_i is assumed to be the same for children of the same gender but different across genders. The first order condition Eq. A1 from the second stage child maximization problem becomes:

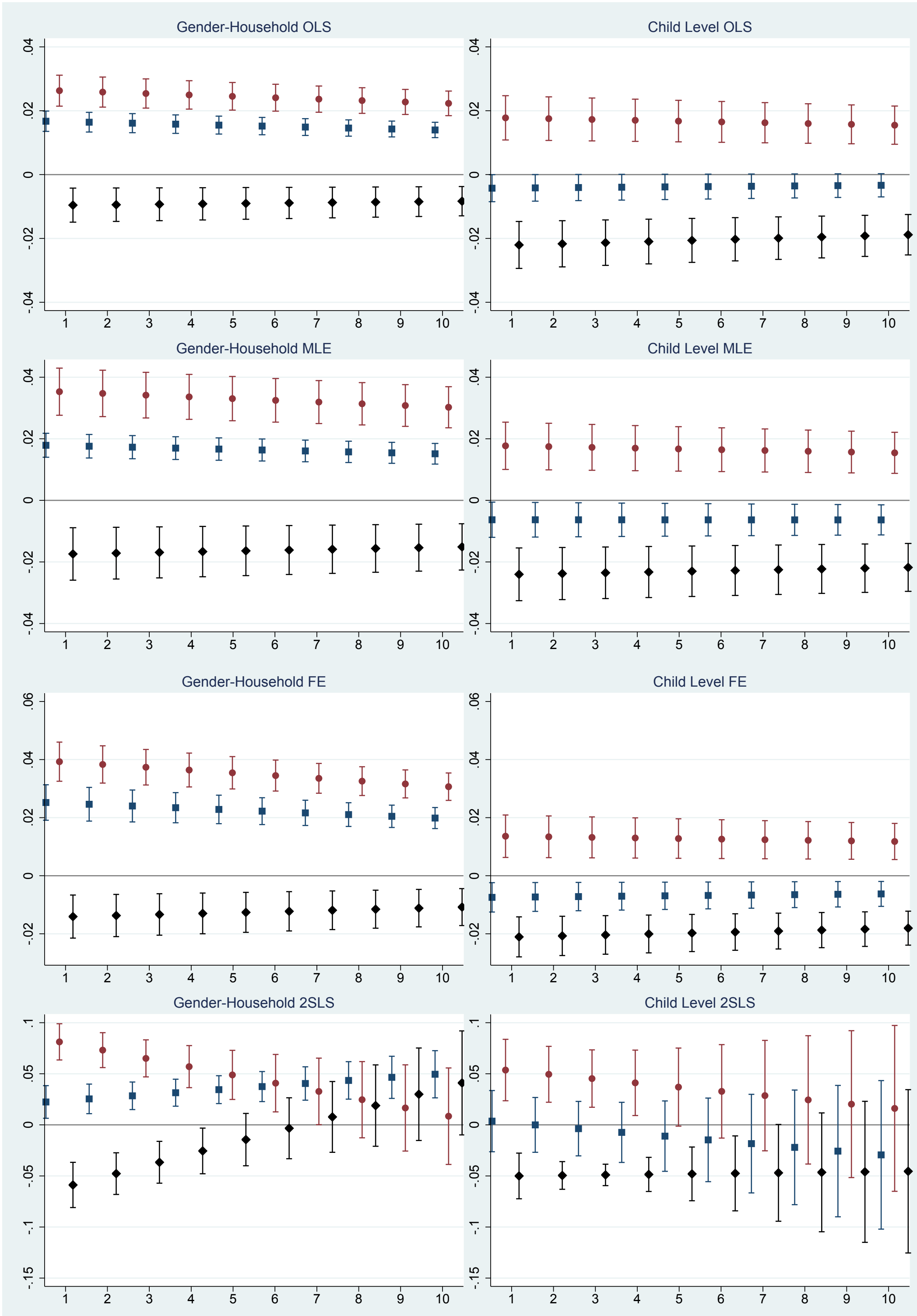
$$\frac{1}{M_i - O_i} = \frac{\alpha_i}{O_i}.$$

We thus have old age support from child i:

$$O_i = \frac{\alpha_i}{1+\alpha_i} M_i.$$

Let $R_i = \frac{\alpha_i}{1+\alpha_i}$ be the reciprocity function. It follows that we obtain Eq. 6 for children of gender g.

Figure A1 Distribution of Marginal Parental Old Age Support Returns



Note: Vertical axes denote marginal returns in terms of *any support* and horizontal axes denote *total investment* in 10,000 yuan. The squares, circles, and diamonds denote respectively, returns from sons, returns from daughters, and differences in returns. 95% confidence intervals are illustrated.

Table A1 Marginal Returns for Best Living Proximity and Monetary and In-Kind Support

	Gender-Household Group			Child Level Analysis		
	Sons	Daughters	Diff.	Sons	Daughters	Diff.
Best Living Proximity						
OLS Marginal effect	0.008**	0.006**	**0.002**	-0.008**	0.007**	**-0.016****
(SE)/[Wald]	(0.002)	(0.002)	[0.34]	(0.002)	(0.002)	[33.67]
R-squared	0.12	0.09		0.16	0.16	
MLE Marginal effect	0.011**	0.008**	**0.004**	-0.007**	0.015*	**-0.023****
(SE)/[Wald]	(0.002)	(0.002)	[0.61]	(0.002)	(0.007)	[9.59]
Log-likelihood	-4,135	-3,396		-8,639	-8,639	
FE Marginal effect	0.017**	0.017**	**-0.000**	-0.003	0.013**	**-0.016****
(SE)/[Wald]	(0.002)	(0.003)	[0.00]	(0.002)	(0.004)	[22.72]
R-squared	0.14	0.14		0.20	0.20	
2SLS Marginal effect	0.018*	0.043**	**-0.025***	0.009	0.025†	**-0.016**
(SE)/[Wald]	(0.008)	(0.008)	[4.78]	(0.016)	(0.015)	[2.04]
R-squared	0.12	0.09		0.16	0.16	
No. of families	6,618	6,618		4,356	4,356	
No. of children	10,311	8,752		7,478	7,420	
Monetary and In-Kind Support						
OLS Marginal effect	0.015**	0.039**	**-0.025***	0.012	0.033†	**-0.021**
(SE)/[Wald]	(0.004)	(0.009)	[5.76]	(0.010)	(0.018)	[1.42]
R-squared	0.03	0.04		0.03	0.03	
MLE Marginal effect	0.047**	0.086**	**-0.039**	0.022†	0.042†	**-0.020**
(SE)/[Wald]	(0.008)	(0.025)	[2.17]	(0.014)	(0.021)	[1.05]
Log-likelihood	-6,675	-7,069		-14,963	-14,963	
FE Marginal effect	0.013**	0.033**	**-0.019**	0.011**	0.026**	**-0.015****
(SE)/[Wald]	(0.004)	(0.012)	[2.34]	(0.004)	(0.005)	[8.73]
R-squared	0.04	0.04		0.01	0.01	
2SLS Marginal effect	-0.009	0.028**	**-0.037****	0.018	0.015	**-0.004**
(SE)/[Wald]	(0.011)	(0.007)	[7.50]	(0.018)	(0.014)	[0.09]
R-squared	0.02	0.03		0.02	0.02	
No. of families	6,618	6,618		4,356	4,356	
No. of children	10,311	8,752		7,478	7,420	

Note: Robust standard errors (in parentheses) and Wald statistics [in parentheses] for testing differences between sons and daughters (H_0). †p < .10; *p < .05; **p < .01.

Table A2 Marginal Parental Returns to Education and Marriage Investments

	Gender-Household Group			Child Level Analysis		
	Sons	Daughters	Diff.	Sons	Daughters	Diff.
Education Investment						
OLS Marginal effect	0.016**	0.023**	**-0.007***	-0.012**	0.014**	**-0.025****
(SE)/[Wald]	(0.002)	(0.003)	[3.85]	(0.003)	(0.004)	[29.17]
R-squared	0.16	0.18		0.09	0.09	
MLE Marginal effect	0.018**	0.031**	**-0.013***	-0.020**	0.012**	**-0.032****
(SE)/[Wald]	(0.003)	(0.004)	[6.15]	(0.005)	(0.005)	[31.75]
Log-likelihood	-3,353	-3,950		-9,211	-9,211	
FE Marginal effect	0.022**	0.032**	**-0.010**†	-0.011**	0.012**	**-0.023****
(SE)/[Wald]	(0.004)	(0.004)	[3.39]	(0.004)	(0.004)	[29.18]
R-squared	0.23	0.23		0.11	0.11	
2SLS Marginal effect	0.029**	0.102**	**-0.072****	0.020	0.052*	**-0.032**
(SE)/[Wald]	(0.010)	(0.011)	[28.71]	(0.019)	(0.021)	[2.45]
R-squared	0.15	0.18		0.10	0.10	
No. of families	6,618	6,618		4,356	4,356	
No. of children	10,311	8,752		7,478	7,420	
Marriage Investment						
OLS Marginal effect	0.026**	0.064**	**-0.038****	0.004	0.048**	**-0.044****
(SE)/[Wald]	(0.002)	(0.008)	[19.25]	(0.004)	(0.009)	[18.79]
R-squared	0.17	0.18		0.09	0.09	
MLE Marginal effect	0.030**	0.079**	**-0.048****	0.004	0.048**	**-0.043****
(SE)/[Wald]	(0.004)	(0.010)	[20.16]	(0.005)	(0.010)	[15.58]
Log-likelihood	-3,325	-3,931		-9,217	-9,217	
FE Marginal effect	0.036**	0.094**	**-0.058****	-0.005	0.038**	**-0.043****
(SE)/[Wald]	(0.003)	(0.011)	[27.33]	(0.005)	(0.011)	[16.09]
R-squared	0.24	0.24		0.11	0.11	
2SLS Marginal effect	0.035*	0.375**	**-0.340****	-0.064	0.046	**-0.110****
(SE)/[Wald]	(0.014)	(0.034)	[82.92]	(0.051)	(0.046)	[15.47]
R-squared	0.15	0.18		0.10	0.10	
No. of families	6,618	6,618		4,356	4,356	
No. of children	10,311	8,752		7,478	7,420	

Note: Robust standard errors (in parentheses) and Wald statistics [in parentheses] for testing differences between sons and daughters (H_0). $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$.

Table A3 Marginal Parental Returns to Investment for Rural and Urban Families

	Gender-Household Group			Child Level Analysis		
	Sons	Daughters	Diff.	Sons	Daughters	Diff.
Rural Households						
OLS Marginal effect	0.012**	0.031**	**-0.019****	-0.004	0.017*	**-0.021****
(SE)/[Wald]	(0.002)	(0.004)	[17.93]	(0.003)	(0.005)	[14.45]
R-squared	0.11	0.16		0.11	0.11	
MLE Marginal effect	0.014**	0.041**	**-0.028****	-0.008†	0.016**	**-0.024****
(SE)/[Wald]	(0.002)	(0.007)	[16.71]	(0.004)	(0.006)	[15.93]
Log-likelihood	-1,927	-2,412		-6,150	-6,150	
FE Marginal effect	0.018**	0.039**	**-0.020****	-0.009**	0.013*	**-0.022****
(SE)/[Wald]	(0.003)	(0.005)	[13.14]	(0.003)	(0.006)	[18.76]
R-squared	0.18	0.18		0.14	0.14	
2SLS Marginal effect	0.023*	0.098**	**-0.074****	-0.015	0.027	**-0.041****
(SE)/[Wald]	(0.010)	(0.017)	[15.71]	(0.018)	(0.017)	[8.80]
R-squared	0.10	0.15		0.11	0.11	
No. of families	3,960	3,960		2,866	2,866	
No. of children	6,711	5,517		5,090	4,919	
Urban Households						
OLS Marginal effect	0.024**	0.036**	**-0.012***	-0.001	0.027**	**-0.028****
(SE)/[Wald]	(0.003)	(0.004)	[5.64]	(0.004)	(0.006)	[17.67]
R-squared	0.25	0.26		0.08	0.08	
MLE Marginal effect	0.028**	0.048**	**-0.021****	-0.001	0.029**	**-0.031****
(SE)/[Wald]	(0.004)	(0.006)	[9.18]	(0.005)	(0.007)	[15.77]
Log-likelihood	-1,346	-1,454		-2,996	-2,996	
FE Marginal effect	0.028**	0.051**	**-0.023****	-0.005	0.015*	**-0.020****
(SE)/[Wald]	(0.003)	(0.006)	[11.55]	(0.005)	(0.007)	[8.70]
R-squared	0.35	0.35		0.06	0.06	
2SLS Marginal effect	0.024**	0.075**	**-0.051****	0.001	0.043	**-0.042****
(SE)/[Wald]	(0.008)	(0.009)	[17.46]	(0.028)	(0.028)	[8.50]
R-squared	0.22	0.25		0.08	0.08	
No. of families	2,658	2,658		1,490	1,490	
No. of children	3,600	3,235		2,388	2,501	

Note: Robust standard errors (in parentheses) and Wald statistics [in parentheses] for testing differences between sons and daughters (H_0). †p < .10; *p < .05; **p < .01.

Table A4 Reciprocity and Market Reutrns to Investment by Gender-Household Group (Imputed Income)

	Reciprocity (R)			Market Return (M)			Old Age Support Return (O)		
	Sons	Daughters	Diff.	Sons	Daughters	Diff.	Sons	Daughters	Diff.
OLS Marginal effect	0.016^{**}	0.026^{**}	**-0.010^{**}**	3.339^{**}	4.738^{**}	**-1.399^{**}**	3.267^{**}	3.633^{**}	**-0.366**
(SE)/[Wald]	(0.002)	(0.002)	[13.56]	(0.265)	(0.365)	[9.55]	(0.215)	(0.256)	[1.25]
R-squared	0.17	0.19		0.25	0.23				
MLE Marginal effect	0.017^{**}	0.035^{**}	**-0.018^{**}**	3.339^{**}	4.738^{**}	**-1.399^{**}**	3.328^{**}	4.051^{**}	**$-0.724^{\dagger}$**
(SE)/[Wald]	(0.002)	(0.004)	[16.88]	(0.265)	(0.365)	[9.55]	(0.229)	(0.300)	[3.74]
Log-L/R-squared	-3,320	-3,915		0.25	0.23				
FE Marginal effect	0.024^{**}	0.039^{**}	**-0.015^{**}**	3.536^{**}	5.570^{**}	**-2.035^{**}**	1.283^{**}	1.842^{**}	**-0.559^{**}**
(SE)/[Wald]	(0.003)	(0.003)	[15.86]	(0.311)	(0.432)	[15.87]	(0.152)	(0.160)	[9.40]
R-squared	0.25	0.25		0.26	0.26				
2SLS Marginal effect	0.027^{**}	0.080^{**}	**-0.054^{**}**	$-1.680^{\dagger}$	3.815^{**}	**-5.495^{**}**	0.167	5.676^{**}	**-5.509^{**}**
SE/Wald	(0.007)	(0.009)	[25.84]	(0.905)	(0.860)	[18.51]	(0.775)	(0.706)	[28.47]
R-squared	0.15	0.18		0.19	0.19				
Sample average	0.73	0.51		51.91	46.54				
No. of families	6,618	6,618		6,618	6,618				
No. of children	10,311	8,752		10,311	8,752				

Note: Robust standard errors (in parentheses) and Wald statistics [in parentheses] for testing differences between sons and daughters (H_0). Regressions control for characteristics of parents and children. $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$.

Table A5 Reciprocity and Market Reutrns to Investment per Child (Imputed Income)

	Reciprocity (R)			Market Return (M)			Old Age Support Return (O)		
	Sons	Daughters	Diff.	Sons	Daughters	Diff.	Sons	Daughters	Diff.
OLS Marginal effect	-0.004^{*}	0.018^{**}	**-0.022^{**}**	1.008^{**}	1.591^{**}	**-0.583**	0.602^{**}	1.382^{**}	**-0.780^{**}**
(SE)/[Wald]	(0.002)	(0.004)	[34.49]	(0.225)	(0.355)	[2.21]	(0.190)	(0.238)	[7.68]
R-squared	0.09	0.09		0.18	0.18				
MLE Marginal effect	-0.006^{*}	0.018^{**}	**-0.024^{**}**	1.008^{**}	1.591^{**}	**-0.583**	0.542^{**}	1.380^{**}	**-0.838^{**}**
(SE)/[Wald]	(0.003)	(0.004)	[30.25]	(0.225)	(0.355)	[2.21]	(0.199)	(0.249)	[8.26]
Log-L/R-squared	-9,211	-9,211		0.18	0.18				
FE Marginal effect	-0.007^{**}	0.014^{**}	**-0.021^{**}**	0.360^{*}	0.716^{**}	**$-0.356^{\dagger}$**	0.028	0.813^{**}	**-0.785^{**}**
(SE)/[Wald]	(0.003)	(0.004)	[35.90]	(0.151)	(0.218)	[3.02]	(0.139)	(0.166)	[13.15]
R-squared	0.11	0.11		0.07	0.07				
2SLS Marginal effect	0.004	0.054^{**}	**-0.050^{**}**	2.643^{**}	2.554^{**}	**0.089**	2.142	3.082^{**}	**-0.940**
SE/Wald	(0.015)	(0.015)	[18.53]	(0.784)	(0.732)	[0.02]	(0.799)	(0.628)	[1.61]
R-squared	0.10	0.10		0.17	0.17				
Sample average	0.74	0.49		32.06	34.17				
No. of families	4,356	4,356		4,356	4,356				
No. of children	7,478	7,420		7,478	7,420				

Note: Robust standard errors (in parentheses) and Wald statistics [in parentheses] for testing differences between sons and daughters (H_0). Regressions control for characteristics of parents and children. $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$.