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Brothers, sisters, and support to older parents: Separate spheres across and within support types?

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Brothers, Sisters, and Support to Older Parents: Separate Spheres Across and Within Support Types?*

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Abstract

Parents in many countries exhibit a strong preference for sons over daughters; a preference that is often observed regarding transfers *to* children. Here, we ask whether son preference also drives differences in behavior regarding transfers *from* sons and daughters. We use data from the China Health and Retirement Longitudinal Study (CHARLS) to examine the patterns of giving to parents and find strong evidence of such differentiation. Coresidential support comes almost exclusively from sons as do large transfers, while daughters are more likely to make small transfers. Moreover, crowding-out of financial transfers by siblings occurs primarily within gender: sons give less when they have more brothers, and daughters give less when they have more sisters, a pattern that exists for both cash and in-kind transfers. These results provide strong evidence of separate spheres or "mental accounts" for upward family transfers and suggest that sons and daughters are still viewed quite differently.

JEL: D13, J13, J14, J16

Keywords: brothers, sisters, old age support, separate spheres, mental accounting

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1 Introduction

Family transfers play a critical role in many societies. Such transfers are especially important in economies with less well-developed financial and insurance markets. A prime example of this is the reliance of parents on old-age support from their children in many developing countries. Absent strong pension systems or other instruments that facilitate retirement savings, parents can "save" by investing in their children, with the expectation that children will assist their parents as the parents age. These patterns of giving, with transfers flowing predominantly from adult children to older parents, have been well-documents in countries such as China (Guo and Zhang, 2020; Oliveira, 2016), and are opposite from the direction of transfers flows observed in nations such as the United States (Gale and Scholtz, 1994; McGarry, 2016).

Alongside this reliance on family for support, there may also exist cultural norms that dictate which child (or children) is expected to shoulder the primary responsibility for parents. In China, as in many countries, sons are assumed to play this role. Given these norms, parents may have an incentive to invest more in their sons than daughters and may focus on the expectation of transfers from sons rather than daughters in planning for their old age.[1] If so, then while transfers from daughters to their parents can seemingly provide support in much the same way as transfers from sons, parents may view these transfers differently insofar as they are not expected or part of the traditional cultural landscape.

The notion that transfers from sons and daughters may differentially affect parental utility is similar in spirit to early work by Richard Thaler (Thaler, 1990, 2008) that posits that individuals may have separate mental "accounts" for income from different sources or for spending in different categories. In some cases, this sort of mental accounting can lead to decisions that may appear puzzling on the surface, but are observed regularly in empirical studies. Income from a windfall gain, for example, is typically spent on different items than is income from regular labor earnings. Even "expected" income that is received irregularly, such as a bonus for job performance, has been shown to be associated with a different marginal propensity to consume than income in the form of regular payments. Similarly, Duflo and Udry (2004) show that in Côte d'Ivoir, husbands and wives

[1] Numerous studies have postulated that the dependence of parents on sons for financial support provides a strong economic rationale for the preference of sons over daughters and for the greater investment in the human capital of sons (Das Gupta et al., 2003; Ebenstein and Leung, 2010; Jayachandran, 2015; National Research Council, 2012). Similarly, preferential investment in sons and a reliance on their support, could arise from the likelihood that a son will earn greater income over his life than a daughter, and / or have greater control over his own family's resources, making him more able to provide such support.

farm different crops and that income from these different sources is allocated to the purchase of different goods. Work in anthropology too draws on this idea and posits a sharp distinction between income from sources viewed as good or "appreciated" such as agriculture, and income from bad or "bitter" sources that comes from activities associated with disapproval such as the sale of ancestral land (Shipton, 1989; Werthmann, 2003).

In this study, we build on these ideas to introduce the notion of the existence of separate "spheres" of transfers from adult children to their older parents. Parents may, in effect, have separate accounts for transfers from sons and daughters, with transfers from one gender being valued differently than those from the other, even if the financial value of the gifts is the same. As such, the source of transfer matters to parents and the substitutability of transfers across children will differ across and within genders. Similarly, there may exist separate accounting by types of transfers, with greater or lesser substitutability across genders for some transfer types than for others.[2]

We examine two types of parental support: shared residence and financial transfers, the latter including both gifts of cash and gifts in-kind. We model coresidence and financial transfers as distinct items because of the very different nature of the gifts. Coresidence is an experience good wherein the transfer affects parental (and child) utility both from the financial value of shared housing as well as from the experience of living together. Furthermore, there is a public aspect of shared residence that is less prominent for financial transfers. Individuals outside the household will know that the parent is the recipient of a housing transfer and will know which child is providing that assistance. With social norms in China being such that sons are expected to provide for parents, a parent may fear that they will lose face if they are observed to be living with a daughter, or the son himself may face criticism if he is leaving this role to a sister. In contrast, financial transfers are less readily observed by others, making it possible to conceal a transfer from a daughter and / or publicize a transfer from a son. Thus, financial transfers from daughters may be discounted less heavily than would housing transfers. Furthermore, it is unlikely that a parent would receive coresidential support from more than one child at a time whereas financial transfers can come for several children at once.

In addition to these potential differences in value due to cultural norms and to the type of support, financial transfers from sons and daughters may be valued differently if transfers from sons are expected, while transfers from daughters are unanticipated, representing a windfall gain. This

[2] The idea of gender-specific spheres is not new, but in the past has been applied to the division of household production and / or market work, and thus across types of tasks (Lundberg and Pollak, 1993; Nugent, 2013), rather than within a given task, or in our case, transfer type and income source.

idea relates to the literature examining the marginal propensity to consume from transitory income shocks (Agarwal and Qian, 2014; Bodkin, 1959; Fagereng et al., 2021; Jappelli and Pistaferri, 2010; Lee, 1975). Moreover, as Thaler (1990) discusses, the marginal propensity to consume may differ with the magnitude of the windfall gain. This too could lead to transfers from sons and daughters being categorized differently in parental accounting if transfers from sons are typically larger for example, and thus differentially affect their utility.

Several types or "currencies" of family transfers have been examined in the literature. While prior empirical studies have consistently found evidence that a larger number of children is associated with greater total support (Cunningham et al. 2013; Oliveira 2016; Zimmer and Kwong 2003) and a decline in the amount of care from any one child (Antman, 2012; Brown, 2006; Checkovich and Stern, 2002; Grigoryeva, 2017), the evidence for financial transfers from any one child is less conclusive. Antman (2012) finds that in Mexico, greater monetary transfers from siblings increases one's own transfers – an indicator of "crowding in", while Rosenzweig and Zhang (2014) find that children in larger families in China provide smaller financial transfers on average. Our study introduces the notion of separates spheres or "mental accounts" in upward family transfers, and builds on past studies by paying particular attention to the differences in patterns of giving by the gender of the child, their siblings, and the potential for crowding-out of transfers across siblings.[3]

The empirical analyses use data from the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative survey of the Chinese population ages 45 or older. The survey collects information on the demographic and socioeconomic characteristics of older respondents and their adult children, and importantly for our study, information regarding coresidence with, and financial transfers from children. CHARLS is ideal for our focus on sibling interactions in that most of the children in the sample were born prior to the 1979 one-child policy and as such, they have several siblings. This family structure allows us to look at patterns of giving in relation to the gender composition of siblings.

In our analysis, we first examine differences in patterns of giving by the gender of the child. Then, to assess the extent to which transfers from sons and daughters exists in separate spheres, we assess the potential for crowding-out of transfers by siblings, looking at differences in the substitution of transfers within and across genders. Finally, we compare the patterns of crowd-out across two very different types of transfers: coresidence, wherein we would expect assistance

[3]Our paper is complementary to Guo and Zhang (2020), who study changes in parental expectations of support from a son or daughter when the child has a twin brother or sister. The objective of that paper is to test the instilling of filial piety in young children in rural China.

from at most one child at a time, and financial transfers, wherein additional transfers would be expected to have a positive marginal utility. Within the category of financial transfers, we also look separately at in-kind versus cash gifts, since the public / private nature and expectations may differ for these two types.

Formally examining these patterns and assessing the nature of crowding-out of transfers among siblings, poses several challenges with regard to estimation. First, there is difficulty in determining causality. Unobserved factors such as parental preferences may simultaneously drive both family size or composition and support from children. For instance, parents who place great value on family relationships may both have more children and instill in their children a greater sense of familial obligations. Standard instrumental variables are difficult if not impossible to find, so we choose to employ the heteroscedastic-based instrumental variable strategy proposed by Lewbel (2012). Rather than rely on traditional exclusion restrictions, identification is based on assumptions regarding the covariance of heteroscedastic error terms with a set of regressors. These assumptions are easily tested using standard tests of heteroscedasticity, F-statistics, and tests of overidentifying restrictions. Second, family size and birth order may be jointly determined. In China, parents who have a daughter as a first born child are more likely to have a second child in the hope of having a son (Ebenstein, 2010). Moreover, consistent with the traditional quality-quantity trade-off, family size may affect the educational attainment of children, the eventual incomes of children, and thus their ability to provide for parents. To deal with these issues, we employ a two-step approach similar in spirit to that proposed by Bagger et al. (2021) which we detail below.

Consistent with our expectations, and given the role of cultural norms, we find that parents are significantly more likely to coreside with a son than with a daughter. Moreover, an increase in the number of children is associated with a decrease in the probability that any particular child coresides with their parent(s), but we find a much smaller response when the increase in siblings is an increase in sisters rather than brothers.

With respect to financial transfers, perhaps surprisingly, we find that daughters are *more* likely to provide financial transfers to parents than are sons, but conditional on providing financial transfers, sons provide significantly larger transfers, on average, than do daughters – perhaps due to their greater income and greater control of resources within their own families. Such behavior would be consistent with daughters desiring to give to parents but with sons retaining the primary responsibility of support.

Regarding the notion of separate spheres of giving for sons and daughters, we find patterns of giving that indicate that crowding-out of financial transfers occurs primarily within gender:

An increase in the number of brothers leads to a substantial decrease in the amount of financial transfers that a son provides to his parents, while an increase in the number of sisters leads to a much smaller decline. The reverse is true for daughters, with larger crowding-out from an increase in the number of sisters than in the number of brothers. This result holds consistently across a variety of robustness checks and suggests that transfers from daughters operate as substitutes for each other in one sphere, while transfers from sons do so in a different sphere.

This paper proceeds as follows: Section 2 presents a framework to conceptualize the idea of separate spheres across and within which children of different genders operate. Section 3 presents the data and provides some descriptive statistics. Section 4 elaborates on the identification issues related to the testable predictions of the model and outlines our empirical strategy. We then present the main results in Section 5 along with several robustness checks. Section 6 provides some additional discussion and ideas for future work along these lines and a final section 7 concludes.

2 Conceptual Framework

As discussed above, social norms can play a key role in driving family transfers, and in many countries, the gender of a child determines much of what is expected with respect to these transfers. In China in particular, filial piety is deeply ingrained within the Confucian custom and children, especially sons, are expected to provide for their elderly parents. Empirical studies have repeatedly shown that this expectation is commonly realized, with sons providing greater residential and financial support to parents than daughters, and in doing so, perhaps reinforcing the persistent son preference in that parents anticipate relying on them for help (Ebenstein and Leung, 2010; Emery et al., 2019; Jayachandran, 2015).

Left unexplored, has been the relative strength of these gender biases across types of transfers, in our case, across the spheres of coresidence and financial assistance. These two currencies differ in numerous ways, including the experiential nature of the transfer, the visibility of the gift, and the extent to which gifts from multiple sources are valued. Both types of gifts may carry some degree of symbolism and may be made even when there is not a financial need, playing instead an important role in strengthening family bonds (Ho, 2019; Hwang, 1987; Rosenzweig and Zhang, 2014; Xie and Zhu, 2009). Given these issues, we anticipate that the gender of the child making the gift may carry some import.[4] Here we add this important dimension to our analysis, assessing

[4]While we acknowledge that expanding educational and career opportunities for women will likely

the extent to which transfers from sons and daughters occupy separate gender-specific / transfer-specific spheres.

We explore these conjectures theoretically in the subsections below and then turn to an empirical analysis in the subsequent sections. We find strong support for our separate spheres / gendered public goods model, that remains intact across numerous robustness checks. We also present some alternative theories of behavior based on a standard public goods and gendered competition frameworks. None of these alternatives theories is consistent with our data.

2.1 Gendered Public Goods Model

We begin with the often used assumption that familial support is based on an altruistic motive. Such a framework has received substantial support in the literature examining behavior in China and elsewhere (Brown, 2006; Cai et al., 2006; McGarry and Schoeni, 1995; Oliveira, 2016). We consider a multi-donor framework with one parent, the "recipient", and n altruistic children, the "donors". Because we are examining differences in giving associated with the gender of the child, we specify our model to focus on families in which there is at least one son and one daughter. Denoting sons with subscript S and daughters with subscript D, we have number of sons $n_S \geq 1$, number of daughters $n_D \geq 1$, and number of children $n = n_S + n_D \geq 2$.

Let I_i denote income that child i has at his or her disposal. Without loss of generality, we assume that all sons have the same income I_S and that all daughters have the same income I_D.[5] Consistent with evidence of the existing gender-wage gap in China (Iwasaki and Ma, 2020), we further assume that $I_S > I_D$. Moreover, consistent with the quantity-quality trade-off, we posit that the incomes of children decline with family size such that $\frac{\partial I_i}{\partial n_g} \leq 0$ with $g = S, D$ (Becker, 1960; Bagger et al., 2021; Black et al., 2005).[6]

Each child cares about his / her own consumption, $c_i \in R_+$, and about parental well-being. A child may affect parental utility by providing support to their parent through coresidence, $h_i \in \{0, 1\}$, or financial transfers, $t_i \in R_+$. Coresidence entails a psychological or privacy cost $\gamma_i > 0$ to

begin to erode these norms, they are still extant to a large extent (Ho, 2019; Xie and Zhu, 2009). We do not focus on this issue, although we do explore the impact of changes due to modernization to a limited extent later on, by comparing the behavior for rural and urban families and by comparing our results across waves. We find no significant distinction across regions and only suggestive evidence that modernization may matter across waves.

[5]We make this simplifying assumption to capture the key intuitions of the model; we extend the model to the case where children have different income levels within gender later on.

[6]We establish that this correlation exists in our data. See footnote 19 for details.

the child, which may differ across children.[7] For example, sons may face a lower privacy cost than daughters if they were brought up to expect to provide such support to parents. Financial transfers entail a budgetary cost by decreasing the amount available for the child's own consumption.

The parent cares about both coresidential support and financial transfers from children. With regard to coresidence, the utility the parent receives depends on which child is providing the support. Parental utility from housing is given by: $H = max\{\delta_1 h_1, ..., \delta_n h_n\}$, where $\delta_i \in R$ is the child-specific parameter that captures how the parent weights coresidence with different children. A parent may assign a higher δ_i to sons than daughters given patrilocal norms, but may also value more highly coresidence with a child whom the parent favors for reasons in addition to gender, such as staying in or near the parent's current home. In contrast to the utility from shared residence that comes from a single child, the parent cares about *total* financial transfers but potentially differentially for the total from all sons $\left(T_S = \sum_{S=1}^{n_S} t_S\right)$, and total from all daughters $\left(T_D = \sum_{D=1}^{n_D} t_D\right)$. We assume that given the fungibility of financial transfers, parents make no distinction as to which son or which daughter provided support, but rather care only about the total received from each gender. As in other transfer models (Schoeni, 2003), H, T_S and T_D may therefore be considered as family public goods towards which each child may contribute.

A child i solves:

$$\max_{c_i > 0, h_i \in \{0,1\}, t_i \geq 0} u(c_i) + \underbrace{v(T_S) + v(T_D) + H}_{Parent's\,Utility} - \underbrace{\gamma_i h_i}_{Privacy\,Cost}$$

subject to the budget constraint:

$$c_i + t_i = I_i.$$

We assume that u and v are strictly concave and twice continuously differentiable functions: $u' > 0$ and $u'' < 0$; $v' > 0$ and $v'' < 0$. Furthermore, the parent's utility is separable in the three public goods H, T_S and T_D.[8] The child's problem may be solved as part of a two-stage optimization problem: First, the child determines the coresidential support to the parent and second, the child determines financial transfers to the parent.

[7] This privacy cost can also be thought to include any cost from shared food, utilities, etc. Distinct financial transfers to co-resident parents are reported in the survey and we include those separately.

[8] We provide evidence consistent with such separability in the empirical Sections 3 and 5.

First Stage Optimization: Coresidence

Each child chooses coresidence:

$$\max_{h_i \in \{0,1\}} H - \gamma_i h_i,$$

where $H = max\{\delta_1 h_1, ..., \delta_n h_n\}$.

It is straightforward to see that the parent will not share a home with any child if there is no child for whom $\delta_i > 0$. Moreover, child i will potentially provide coresidential support only if child i derives some surplus from the arrangement: $\delta_i - \gamma_i \geq 0$.

Furthermore, a necessary condition for coresidential support is that there exists a child i such that:

$$\delta_i - \gamma_i \geq \delta_j \ , \forall j \neq i. \tag{1}$$

Additionally, if (1) is satisfied, then the child with the greatest residential surplus ($\delta_i - \gamma_i$), will provide the coresidential support. To see this, consider a family with three children in which

$$\delta_1 - \gamma_1 > \delta_2 \text{ and } \delta_2 - \gamma_2 > \delta_3.$$

Intuitively, Child 1 will coreside with the parent because child 1 receives a larger net benefit from providing coresidential support than if Child 2 or 3 were to do so. Similarly, Child 2 and 3 themselves receive larger benefits, δ_1, with Child 1 coresiding and incur no privacy cost, γ_i $i = 2, 3$. If Child 1 did not exist, then Child 2 would provide the coresidential support. This structure leads to two testable predictions.

PREDICTION 1 (Coresidence propensity): Sons are more likely to provide coresidence support to parents than daughters.

Given patrilocal norms, δ_i is likely to be greater for sons than for daughters – a parent simply prefers to reside with a son. And relatedly, privacy costs γ_i are likely to be lower for sons than daughters as expectations of support from sons are likely ingrained in children from an early age.

PREDICTION 2 (Brothers crowd-out coresidence): An increase in the number of siblings decreases the probability that a son or daughter provides coresidence support to the parent. And the effect of an additional brother is greater than that of an additional sister.

An additional brother will reduce the probability that any sibling i provides coresidence by increasing the probability that another child in the family has a higher residential surplus, $\delta_j - \gamma_j$.

These observations do not preclude daughters from providing coresidential support to parents, but given the preference for sons over daughters, the crowding-out effect of an additional brother will be larger than for a sister, and larger within rather than across genders.

Second Stage Optimization: Financial Transfers

Each child chooses financial transfers:

$$\max_{\{t_i\}} u\left(\underbrace{I_i - t_i}_{c_i}\right) + v\left(\sum_{S=1}^{n_S} t_S\right) + v\left(\sum_{D=1}^{n_D} t_D\right),$$

where the expression for consumption is derived from the budget constraint $c_i = I_i - t_i$.

Given the separate gender-specific spheres existing for financial transfers, the second stage problem reduces to that of a gender-specific public good problem with homogeneous children within gender.[9] Under a symmetric Nash equilibrium among children of gender $g = S, D$, the optimal level of transfers to the parent is the solution to the following conditions:

$$\begin{aligned} -u'(I_g - t_g) + v'(n_g t_g) &= 0 \quad if \quad t_g > 0, \\ -u'(I_g - t_g) + v'(n_g t_g) &< 0 \quad if \quad t_g = 0, \end{aligned} \tag{2}$$

where t_g denotes the optimal financial transfers from each child of gender $g = S, D$.

Consider next how an increase in the number of siblings will affect financial transfers on the intensive margin (i.e., when the first order conditions are satisfied with equality and $t_i > 0$). Taking the derivative of equation (2) with respect to t_S, n_S and n_D and rearranging, we obtain the following partial effects for children of gender $g = S, D$:

$$\frac{\partial t_g}{\partial n_g} = \frac{u'' \cdot \frac{\partial I_g}{\partial n_g} - v'' \cdot t_g}{u'' + v'' \cdot n_g} < 0. \tag{3}$$

$$\frac{\partial t_g}{\partial n_{-g}} = \frac{u'' \cdot \frac{\partial I_g}{\partial n_{-g}}}{u'' + v'' \cdot n_g} \leq 0. \tag{4}$$

From the partial effects, an increase in the number of brothers unambiguously leads to a decrease in the financial transfers provided by a son to the parent and *may* lead to a decrease in the

[9]We discuss extensions with heterogeneity within a gender below.

financial transfers provided by a daughter. The reverse is true for an increase in the number of sisters; an increase in the number of sisters unambiguously leads to a decrease in the financial transfers provided by a daughter and *may* lead to a decrease in the financial transfers provided by a son.

The partial effect (3) can be decomposed into two separate effects. The first stems from the quantity-quality trade-off in that given resource constraints, parents will likely have invested less in any particular child if they have more children, leading to a lower income for the child, and lower transfers. The second effect, one of free-riding, stems from the fact that transfers from sons and transfers from daughters are substitutable within gender and can therefore crowd-out transfers by a same-gender sibling. Thus, (3) is unambiguously negative.

The sign of the partial effect (4) depends on how the quantity-quality trade-off operates across genders. If the number of siblings of the opposite gender does not impact parental investments in a particular child, then financial transfers from a son (for example) would not depend on the number of sisters, and visa versa. We investigate this mechanism empirically in Section 5.

Comparing expressions (3) and (4), we can see that if $\left|\frac{\partial I_g}{\partial n_g}\right| \geq \left|\frac{\partial I_g}{\partial n_{-g}}\right|$, then $\left|\frac{\partial t_g}{\partial n_g}\right| > \left|\frac{\partial t_g}{\partial n_{-g}}\right|$; if the income of a child of gender g is reduced by the same or by a greater amount when the child has an additional sibling of the same gender than when they have an additional sibling of the opposite gender, then the financial support from that child will be crowded out to a greater extent when the child has an additional same-gender sibling than an opposite-gender sibling. Conversely, if $\left|\frac{\partial I_g}{\partial n_g}\right| < \left|\frac{\partial I_g}{\partial n_{-g}}\right|$, then $\left|\frac{\partial t_g}{\partial n_g}\right| \gtreqless \left|\frac{\partial t_g}{\partial n_{-g}}\right|$. In particular, for $\left|\frac{\partial I_g}{\partial n_g}\right|$ close enough to $\left|\frac{\partial I_g}{\partial n_{-g}}\right|$, we may still have $\left|\frac{\partial t_g}{\partial n_g}\right| > \left|\frac{\partial t_g}{\partial n_{-g}}\right|$. Otherwise, $\left|\frac{\partial t_g}{\partial n_g}\right| \leq \left|\frac{\partial t_g}{\partial n_{-g}}\right|$. These results lead to our third prediction.

PREDICTION 3 (Transfers crowd-out at intensive margin): If the income of a child is reduced by the same or by a greater margin when the child has an additional sibling of the same gender than of the opposite gender, then a larger number of same-gender siblings leads to a larger decrease in the financial transfers provided by a child, than would a larger number of opposite gender siblings.

Finally, for transfers at the extensive margin (i.e., the probability of making a transfer), we note that an increase in the number of brothers or sisters will have an indeterminate effect on the probability that a child provides financial support; the responsiveness will depend on the relative magnitudie of the marginal utility of consumption and the marginal utility of transfers (see Appendix A.1 for derivations).

2.2 Model Extensions and Alternative Models

Our model can be extended to the case in which sons and daughters care differentially about parental well-being, possibly due to patriarchal values (e.g., a son may feel more of an obligation to his own family than a daughter). The model can also be extended to the case where the incomes of children differ within gender, possibly due to different abilities. As shown in Appendix A.2 the predictions presented above carry over with these extensions.

We also explore the implications of two additional competing models in the appendices. The first is a standard public good model wherein parents treat transfers from sons and daughters as a single total amount (Appendix A.3). The second is a gendered competition model wherein sons and daughters compete for parental resources, modeled in our exposition as a bequest or attention from the parent (Appendix A.4). This competition model has the opposite prediction from the separate spheres model presented here, in that in a competition model, transfers from any one child can *increase* with the addition of a sibling as children compete for parental favor. We fail to find empirical support for either of these two competing models.

3 Descriptive Statistics

In order to assess the validity of the predictions outlined above we turn to an empirical analysis of transfers from children to parents. To do so, we draw on the China Health and Retirement Longitudinal Study (CHARLS), a large scale panel study of the Chinese population ages 45 or older. The study surveys approximately 10,000 households and 17,500 individuals across 28 provinces in China (CHARLS Research Team, 2013). It is follows the framework of the Health and Retirement Study (HRS) launched in the United States in 1992 and similar "sister surveys" such as the English Longitudinal Study of Aging (ELSA) and the Survey of Health, Aging and Retirement in Europe (SHARE).

CHARLS contains detailed information on demographic and socioeconomic characteristics of the survey respondents, including information regarding each of their children. Importantly for our study, these data also include information on financial transfers (both monetary and in-kind gifts) between parents and their children, as well as information regarding their living arrangements. We focus our main analytic sample to observations from the 2015 wave, which is the latest wave to have been subject to the rigorous cleaning and imputation procedures that the CHARLS team undertook to create child level data sets. Nevertheless, we also perform sensitivity analyses on adjacent waves, 2013 (subject to the same data cleaning and imputation as for 2015) and 2018 (subject to the authors' own cleaning).[10]

3.1 Sample

While most of the data in CHARLS are reported at the respondent (parent) level, our analyses are primarily based on living adult children. To create our child-level sample, we take the information relevant to each child as reported by the parent and merge it with family-level data.[11] The selection criteria for our child-level sample are illustrated in Appendix Figure A1.

We begin with an initial sample of 32,630 children. Because our focus is on support from children to their parents, we limit our sample to children in families in which the parent (or the average age of both parents in two-parent families) is 60 or older and the child is 25 years old or older, and thus unlikely to still be in school. These restrictions reduce the sample to 18,848 children. To examine the role of a child's gender in determining the distribution of support among siblings, we further require that there be at least two children in the family, and at least one son and one daughter. These restrictions reduce our sample to 15,599 children. Finally, we delete 485 observations for children with missing values on financial transfers and one outlier with reported transfers of 100 million yuan (over $14 million). Our final analytic samples consist of 15,114 children from 4,078 families, of which 7,535 observations are for sons and 7,579 are for daughters.

While our analyses focus on this restricted sample of children, we conduct sensitivity analyses removing the age and gender composition restriction. We also report the results of analyses for separate sub-samples of urban and rural respondents, for families with and without coresident children, and separately for each adjacent survey wave.

Table 1 reports selected summary statistics separately by the gender of the child, divided approxiately equally between sons and daughters. In terms of siblings, sons have approximately 1.43 brothers and 1.86 sisters, while daughters, on average, have 1.87 brothers and 1.45 sisters. The average age of children is 44 and nine to ten percent are reported to be in poor or very poor health. Sons in our sample have more schooling than daughters; 57 percent of sons but just 41 percent of daughters have a middle school education or more. Rural residence still dominates in this co-

[10]The first wave of the survey was fielded in 2011, but due to changes in the questions on financial transfers, we do not use data from this wave. The wording of questions regarding financial transfers in the 2011 wave appears to have led to substantial under-reporting of transfers relative to later waves.

[11]In the case of a married couple, one spouse is designated as the family respondent and provides information on children.

hort with 50 percent of sons and 62 percent of daughters living in a rural area, consistent with the greater schooling of sons and their more likely migration to an urban area. Nearly all children in our sample are married: 90 percent of sons and 96 percent of daughters. Average household income in the past year for a son or a daughter are very similar, at around a bit more than 33,000 yuan (≈ 5,000 USD).[12]

Table 1 Socio-economic Characteristics of Children

	Sons		Daughters	
	Mean/Prop.	SD	Mean/Prop.	SD
Age	43.64	(8.14)	43.86	(8.00)
Prop. first born	0.24	(0.43)	0.30	(0.45)
Prop. second born	0.26	(0.44)	0.27	(0.45)
Prop. third born	0.22	(0.41)	0.21	(0.41)
Prop. fourth born	0.15	(0.36)	0.12	(0.33)
Prop. fifth born and above	0.13	(0.33)	0.10	(0.31)
No. of brothers	1.43	(1.21)	1.87	(1.03)
No. of sisters	1.86	(1.02)	1.45	(1.24)
Prop. primary school or less	0.43	(0.49)	0.59	(0.49)
Prop. middle school	0.35	(0.48)	0.26	(0.44)
Prop. high school or more	0.22	(0.42)	0.15	(0.36)
Prop. married	0.90	(0.30)	0.96	(0.21)
No. of children	1.65	(0.99)	1.75	(0.84)
Prop. live in urban area	0.50	(0.50)	0.38	(0.49)
Prop. in poor health	0.09	(0.28)	0.10	(0.30)
Household income (yuan)	33,915.11	(43,413.84)	33,048.17	(41,916.88)
No. of children	7,535		7,579	

Note: Means or proportions and standard deviations (in parentheses) from the child sample.

The situation of the parents is also likely to impact transfers. Table 2 reports selected summary statistics at the household level for the parents (respondents). The average age of parents is 70. Schooling levels are low for this cohort: 31 percent report being illiterate, while just 22 percent have middle school education or more.[13] Consistent with the greater longevity of women, 10

[12]Each child's household income is reported in categories by the parent chosen to be the family respondent. We use the midpoint of the category to proxy a child's income and treat it as a continuous value. Income is missing for 29 percent of children. So, we use cross-wave imputations, drawing on data from the 2011 to 2018 waves. This imputation method reduces the percent of missing values to 1 percent for sons and 2 percent for daughters. The difference by gender is not significantly different from zero at the 10 percent level. We use a dummy variable to control for missing income in our regression analyses. All monetary variables have been deflated to 2018 values in this study.

[13]For married couples, age is the average age of the two spouses, schooling is that reported for the

percent of the parents are unmarried males while 26 percent are unmarried females. Because this cohort was in their child-bearing years prior to the establishment of the one-child policy, they have nearly four (3.8) children on average. Approximately two-thirds of households are located in a rural area, 45 percent have reported being in poor or very poor health, and average wealth is a bit less than 400,000 yuan (≈ 60,000 USD).

Table 2 Socio-economic Characteristics of Parents

	Mean/Prop.	SD
Age	70.12	(7.35)
Prop. illiterate	0.31	(0.46)
Prop. primary school	0.47	(0.50)
Prop. middle school or more	0.22	(0.41)
Prop. married	0.64	(0.48)
Prop. single male	0.10	(0.29)
Prop. single female	0.26	(0.44)
No. of children	3.80	(1.46)
Prop. live in urban area	0.36	(0.48)
Prop. in poor health	0.45	(0.50)
Net household wealth (yuan)	398,799.10	(5,930,568.00)
No. of parents	4,078	

Note: Means or proportions and standard deviations (in parentheses) from the parent sample.

3.2 Old Age Support by Child Gender

Our study focuses on support for parents in the forms of coresidence and financial transfers. However, while the direction of financial gifts is obvious, shared living arrangements could potentially indicate mutual support or support from the parent to child. Past literature has found evidence of positive associations between the likelihood of coresidence with parents and children's filial piety and parental needs, as well as the provision of grandchild care (Zhang et al., 2014). As a proxy for the primary direction of the coresidence transfer, we use the homeownership status of the child. If a child lives with the parent and is reported to own a home, we presume that the parent is the primary beneficiary of the shared living arrangement.[14] As shown in Table 3, 22 percent

husband, and health is a measure of whether either spouse reports being in poor or very poor health. Wealth and urban residence are measured at the household level.

[14]Home ownership status of each child comes from the question: "Does [child's name] own a house?" Approximately 63 percent of sons who are living with a parent own a house as do 60 percent of daughters. Sensitivity analyses ignoring home ownership status, as well as sensitivity analyses

of sons provided residential support to parents compared to 3 percent of daughters, a statistically significant difference at the one percent level.

Table 3 Support from Sons and Daughters

	Sons	Daughters	Difference
Prop. coresident homeowner	0.22	0.03	0.19***
	(0.00)	(0.00)	(0.01)
Prop. gave financial support	0.70	0.78	-0.08***
	(0.01)	(0.01)	(0.01)
Amount of financial support (>0)	2,755.82	1,743.08	1,012.73***
	(127.84)	(68.47)	(140.59)
No. of children	7,535	7,579	

Note: Means or proportions and standard errors (in parentheses) from the child sample. Two-tailed t-tests of differences are reported. $^{*}p < .10;^{**}p < .05;^{***}p < .01$.

We define financial support to parents as any monetary or in-kind transfers that children made over the previous year. Monetary transfers can include cash or payment of bills, while in-kind transfers include the value of gifts of food and clothing and other items. As shown in Table 3, significantly more daughters than sons made a financial transfer: 70 percent of sons versus 78 percent of daughters. However, conditional on making a transfer, sons provided an average of 2,756 yuan (≈ 413 USD) while daughters provided an average of just 1,743 yuan (≈ 261 USD). These differences by gender on both the extensive and intensive margins are again statistically significantly different from zero at the one percent level.

These patterns of giving are consistent with Prediction 1 of Section 2, with clear preferences for parent-son coresident arrangements over parent-daughter. This result is confirmed in regression analyses presented in Section 5. With regard to financial transfers, the greater likelihood of a gift from a daughter, despite the lower amount, could indicate a desire on the part of daughters to give to the parent, even though sons are the ones expected to provide financial support.[15] Daughters also likely have fewer financial resources at their disposal if their husband controls their family incomes.

that add the condition that the parent themselves does not own a house (11 percent of sons and 1.4 percent of daughters owned a house and lived with parents who did not fully or partially own a house) yield qualitatively similar results. We control for parental wealth (inclusive of housing wealth) and the number of grandchildren in the main analyses presented below. We further perform sensitivity analyses controlling for intervivos transfers of time and money from parents to children to capture potential mutual exchanges that could drive co-residence. Our results are robust to these inclusions.

[15]While the greater probability of giving for daughters may seem surprising, Xie and Zhu (2009) also find that daughters are more likely to make financial transfers to parents than are sons, while sons are far more likely to coreside. Shan and Park (2023) posit that in China, daughters are more altruistic towards parents than sons, but potentially have limited family resources. Interestingly, if we combine coresidence and financial transfers, 76 percent of sons and 78 percent of daughters provide make some

These patterns are present regardless of the birth order of the child as depicted in Appendix Figure A2.

Table 4 examines the differences in giving by residency status. Perhaps surprisingly, there are no statistically significant differences in financial support by whether the parent coresides with the child. In particular, all four gender-specific comparisons of coresident and non-coresident giving (gave financial support and amount of financial support given, by living arrangement) were not statistically significantly different from zero at the 10 percent level. These results are broadly consistent with the separability of residential and financial support assumed in Section 2.1. We revisit this discussion in Section 5.

Table 4 Financial Support from Sons and Daughters by Coresidency

	Sons		Daughters	
	Coresident	Non-Resident	Coresident	Non-Resident
Gave financial support	0.69	0.70	0.75	0.78
	(0.01)	(0.01)	(0.03)	(0.00)
Amount of financial support (>0)	2,747.45	2,758.14	1,919.97	1,737.97
	(162.93)	(157.06)	(193.82)	(70.23)
No. of children	1,636	5,899	220	7,359

Note: Means and standard errors (in parentheses) from the child sample.

4 Empirical Strategy

In light of our separate spheres framework, our formal empirical analysis focuses on the relationship between transfers from sons and daughters and the gender composition of their siblings. Here we discuss the identification challenges arising in this exercise and present a two-step estimation strategy that also employs a heteroscedastic based instrumental variable strategy.

4.1 Identification

The conceptual framework in Section 2 implies that support from a child will be a function of a child's own gender as well as the number of brothers and sisters the child has. A straightforward

form of transfer and the difference is statistically significantly different from zero at the one percent level. Thus, even accounting for son-preference in terms of coresidence, daughters seem more likely to gift to parents, although sons potentially help in more substantial ways.

ordinary least squares (OLS) regression model at the child level, including other socioeconomic regressors is thus written as:

$$S_{ij} = \beta_0 + \beta_1 Male_{ij} + \beta_2 Brothers_{ij} + \beta_3 Sisters_{ij} + \beta_4 \left(Male_{ij} \times Brothers_{ij}\right)$$

$$+ \beta_5 \left(Male_{ij} \times Sisters_{ij}\right) + \theta_B' BirthOrder_{ij} + \theta_E' Economic_{ij} + \theta_C' X_{ij}^C + \theta_P' X_j^P + \varepsilon_{ij}, \qquad (5)$$

where S_{ij} represents old age support from child i in family j, alternatively, coresidential support yes/no), financial support (yes/no) and the natural logarithm of the amount of financial support conditional on positive values.

$Male_{ij}$ is a dummy variable that takes a value of 1 if child i is male and a value of 0 otherwise. $Brothers_{ij}$ is the number of brothers that child i has, and $Sisters_{ij}$ denotes the number of sisters. We include interaction terms between $Brothers_{ij}$ and $Male_{ij}$ and between $Sisters_{ij}$ and $Male_{ij}$ to allow for differential effects of brothers and sisters by the gender of the child. The coefficients of interests are the βs. β_1 captures differences in the level of parental support by child gender. β_2 and β_3 capture the responsiveness of support from daughters with respect to an additional brother or sister while $(\beta_2 + \beta_4)$ and $(\beta_3 + \beta_5)$ capture the responsiveness support from sons to an additional brother or sister, respectively.

While our focus is on these βs, equation (5) also includes a set of additional control variables likely to be correlated with parental support. $BirthOrder_{ij}$ is a vector of indicators for whether the child i is the second, third, fourth, or fifth or higher child in family j, with the reference category being the first born. We include the interaction of $BirthOrder_{ij}$ with $Male_{ij}$ to allow for the possible differential effect of birth order by gender.[16]

$Economic_{ij}$ represents a vector of variables approximating the child's economic status and ability to make transfers. It includes indicators for whether child i has a middle school education, or a high school education or more (with the reference category being primary school or less), and the inverse hyperbolic sine transformation of household income of the child $sinh^{-1}(HH\ income)$.[17] It further includes interaction terms between the education indicators and $Male_{ij}$, and an interaction term between $sinh^{-1}(HH\ income)$ and $Male_{ij}$ to allow for the fact that sons likely earn more than

[16]The results and inferences are robust to scaling this measure to lie between 0 and 1 ($\frac{BirthOrder-1}{FamilySize-1}$) thereby capturing the relative birth order (Eirnaes and Pörtner, 2004), and to using indicators for just the oldest and youngest child.

[17]We use the inverse hyperbolic sine as an approximation of the natural logarithm because it is defined for zero and negative values.

daughters, and if married, may have a greater say in determining how household income is used than would a married daughter. We also control for an indicator for missing child income as well as its interaction with child gender.

The child's other control variables, X_{ij}^{C}, include demographic characteristics: a second order polynomial in age, male (yes/no), married (yes/no), married interacted with male, number of children (i.e., the grandchildren of the respondent), number of children interacted with male, an indicator of poor health (yes/no), and whether the child lives in an urban area (yes/no). The control variables for the characteristics of the child's parents (X_{j}^{P}), include a second order polynomial in age, single male (yes/no), single female (yes/no), indicator variables for primary school or middle school or more (with the reference category being illiteracy), an inverse hyperbolic sine transformation of household net wealth, an indicator for missing net wealth (yes/no), an indicator of poor health (yes/no), urban residence (yes/no), and dummy variables for each province. ε_{ij} is an error term that is clustered at the family level to allow for within-family correlations.

This simple formulation (5) raises two specific challenges to identification with which we must contend. First, unobserved family-level characteristics may affect parental support from children as well as affect the number of brothers and sisters (i.e., family size). For example, parents with preferences for a larger family may also instill in their children more altruistic norms and loyalty to family. If so, then one would expect a positive correlation between the number of siblings and the error term ε, and OLS estimates of $\beta_2 - \beta_5$ would be biased upward. To address this omitted variables issue, we use a heteroscedastic based instrumental variable estimator as proposed by Lewbel (2012) and described below.[18]

The second concern with a simple OLS approach is that the number of brothers and sisters is likely to be correlated with birth order in that a child with a higher birth order is more likely to

[18] We also attempted a traditional instrumental variables approach with instrumental variables being (i) the gender of the first born child, (ii) first-born twin boys and twin girls, and (iii) the number of brothers and sisters of the parents. Prior work has shown a correlation between these variables and family size (Beaujouan and Solaz, 2019; Bratti et al., 2020; Lee, 2007; Rosenzweig and Wolpin, 1980). However, we found these instrumental variables unappealing for the following reasons: (i) Gender of the first born child is often posited to affect old age support directly (Horioka et al., 2018; Jayachandran and Pande, 2017), thus violating the exclusion restriction. (ii) The number of first-born twins in the data is very small; just 0.26 percent and 0.33 percent of children were in families with first-born twin boys or twin girls, respectively. Moreover, recent work has shown that twin births may not be exogenous (Bhalotra and Clarke, 2019a,b). (iii) As with (i), unobserved family preferences in the parental generation's birth family, could simultaneously drive norms of old age support and fertility in a family, again violating the exclusion restriction. Finally, the Kleibergen-Paap Wald rk F tests further indicate that these constitute weak instruments (Kleibergen-Paap $F < 1$) in the current context. The Lewbel (2012) strategy does not require the use of external instruments and is thus our preferred approach.

come from a larger family (e.g., there are no fourth born children in families with one, two, or three children). Similarly, given the traditional quality-quantity trade-off, the number of brothers and sisters are likely correlated with schooling level and with the child's income.[19] Here, we adopt a two-step estimation strategy similar in spirit to that proposed by Bagger et al. (2021) and applied in recent studies such as Bratti et al. (2020). The first step employs a set of family fixed effect models to estimate the effect of a child's birth order and economic variables on the provision of support to parents. The second step calculates a value for predicted support net of the estimated effects of birth order and of the economic variables based on the estimates from the first step, along with an heteroscedastic instrumental variable strategy à la Lewbel (2012), to identify the effects of the number of brothers and sisters as well as their interaction terms on old age support.

4.2 First Step: Family Fixed Effects Models

The first step estimates a family fixed effects (FE) version of our primary specification, equation (5), such that:

$$S_{ij} = \alpha_0 + \alpha_1 Male_{ij} + \alpha_B' BirthOrder_{ij} + \alpha_E' Economic_{ij} + \alpha_C' X_{ij}^C + \mu_j + \eta_{ij}, \tag{6}$$

where μ_j is an unobserved family fixed effect that captures characteristics that are specific to a particular family and do not vary across children. These include parental variables, X_j^P, as well as unobserved family characteristics such as beliefs regarding familial obligations and attitudes towards altruism. Note further that the number of brothers and sisters as well as their interactions with $Male_{ij}$ are absorbed by the family fixed effects specification. We cluster the standard errors at the family level because errors within a family may be correlated.

Variation across siblings allows us to identify the effects of birth order, education, and income. As discussed above, the second step of our estimation strategy uses the predicted values of S_{ij}, net of birth order and economic effects as the dependent variable, such that $\hat{S}_{ij} = S_{ij} - \hat{\alpha}_B' BirthOrder_{ij} - \hat{\alpha}_E' Economic_{ij}$.

[19] We put the quantity-quality trade-off assumption to a test in Appendix Table A1. We find negative associations between a child's education and household income and the number of siblings, a result consistent with less investment in children in larger families.

4.3 Second Step: Heteroscedastic Based Instrumental Variable Models

Our second step is to estimate the effects of the number of brothers and the number of sisters on support to parents net of birth order and economic effects ($\hat{S}_{ij}$). To do so, we employ a two-stage least squares (2SLS) estimation strategy following Lewbel (2012). This method constructs valid instrumental variables by exploiting the heteroscedasticity of the error terms from regressions predicting the value of the endogenous predictors. It has become popular recently for cases in which external instrumental variables are weak or unavailable (Breschi and Lenzi, 2016; Brown and Murthy, 2020; Caliendo et al., 2017; Ho, 2022; Millimet and Roy, 2016).

Consider the following regressions for the of set endogenous predictors y_{ij}:

$$y_{ij} = \Theta' Z_{ij} + \zeta_{ij}, \tag{7}$$

where $y_{ij} = \left\{Brothers_{ij}, Sisters_{ij}, Male_{ij} \times Brothers_{ij}, Male_{ij} \times Sisters_{ij}\right\}$ and $Z_{ij} = \left\{X_j^P, X_{ij}^C\right\}$.

In the presence of heteroscedastic error terms, ζ, two-stage least squares models using $(Z - \bar{Z})\,\hat{\zeta}$ as instruments for y yield consistent estimates of $\beta_2 - \beta_5$, where $\bar{Z}$ is the sample mean of Z. Consistent estimates of $\beta_2 - \beta_5$ may then be obtained as follows:

a. *Construct instrumental variables:* Estimate $\hat{\Theta}$ by OLS regression of (7) and obtain the residuals $\hat{\zeta}$. Construct the instrumental variables $(Z - \bar{Z})\,\hat{\zeta}$.

b. *Estimate the first stage of the 2SLS:* Regress y_{ij} on Z_{ij} and $(Z - \bar{Z})\,\hat{\zeta}$:

$$y_{ij} = \Theta' Z_{ij} + \Omega' (Z - \bar{Z})\,\hat{\zeta} + \zeta_{ij}, \tag{8}$$

and obtain the predicted values, $\hat{y}_{ij}$.

c. *Estimate the second stage of the 2SLS:* Regress $\hat{S}_{ij}$ (predicted from the first step family fixed effects regressions (6)) on $\hat{y}_{ij}$ (predicted from the first stage of the 2SLS (8)):

$$\hat{S}_{ij} = \beta_0 + \beta_1 Male_{ij} + \beta_2 \widehat{Brothers}_{ij} + \beta_3 \widehat{Sisters}_{ij} + \beta_4 \left(\widehat{Male_{ij} \times Brothers_{ij}}\right)$$

$$+ \beta_5 \left(\widehat{Male_{ij} \times Sisters_{ij}}\right) + \theta_C' X_{ij}^C + \theta_P' X_j^P + \varepsilon_{ij}, \tag{9}$$

These heteroscedastic-based instrumental variables work in a similar fashion to traditional external instrumental variables and are equivalent to having probabilistic instruments (Rigobon, 2003). For instance, consider two sub-samples, one with a larger variation in family size and another with a smaller variation. The sub-sample with the larger variance is more likely to include families in the tails of the distribution of family size than is the sub-sample with a smaller variation. In a standard instrumental variables approach, valid external instruments will be correlated with family size. In our heteroscedastic instrumental variable approach, we do not assume that our instrumental variables shift family size, but rather that in the sub-sample with the larger variance, shocks to family size are more likely to occur. The constructed instrumental variables are thus equivalent to probabilistic instruments.

Formally, identification requires that $cov\left(Z,\zeta^2\right) \neq 0$. This assumption implies that ζ is heteroscedastic with respect to Z. The constructed instrumental variables will be stronger when this covariance is higher, and weaker when the covariance is lower. This assumption is testable using standard tests of heteroscedasticitity and is reflected in the F-statistic for $(Z-\bar{Z})\hat{\zeta}$ in the first-stage regressions. The assumption is easily satisfied in our data: Breusch-Pagan tests of heteroscedasticity always reject the presence of constant variances at the 1 percent statistical level in equation (7). The test statistics are reported for the main results in next section.[20]

A second identifying assumption is that $cov(Z,\varepsilon\zeta) = 0$. This assumption requires that the covariates Z, that are used to construct the instrumental variables, are uncorrelated with the product of the heteroscedastic errors. Lewbel (2012) shows that the two identification assumptions are satisfied in models in which the correlation of errors is due to an unobserved common characteristic. In the context of this study, parents with a preference for a larger family may also raise children who are more generous or committed to family themselves. In this case, one may expect a correlation between ε and ζ due to a common unobserved family taste component. If the correlation of errors is only due to this unobserved family taste component, then the two assumptions would be satisfied in our context. While the second assumption cannot be directly tested, we report the p-values from Hansen tests of the hypothesis that the overidentifying restrictions in the 2SLS estimation are valid in the next section. Failure to reject the hypothesis provides additional evidence in support of the estimator (Baum and Lewbel, 2019; Courtemanche et al., 2021).

[20]The Breusch-Pagan test is applicable in the case of pooled OLS (Wooldridge, 2010). However, as we have a de facto panel data with potential correlation in the standard errors among children of the same family, the standard test may not be directly applicable in our context. We therefore also perform a modified version of the test. In particular, we perform separate tests by birth order such that we have only one child from each family in each test (We combine those of birth order five and above and conduct the tests jointly due to the small sample size). Once again, the null hypothesis of constant variances is always rejected. Even when we apply the stringent Bonferroni correction for multiple hypothesis testing and multiply the p-values by five (for the five birth orders), we still reject the presence of constant variances. These results give us confidence that we have strong heteroscedasticity in equation (7) and thus potentially strong constructed instruments.

Finally, because the dependent variables in equation (9) are predicted from the first step, and because the residuals across siblings of the same family may be correlated, we follow Bagger et al. (2021), and block-bootstrap the standard errors at the family level using 500 repetitions.

5 Results

Focusing on the key predictions of our separate spheres framework, this section presents the results on the responsiveness of support from sons and daughters to the gender composition of their siblings using the two-step estimation outlined above. In line with the descriptive statistics, we find that sons are more likely to provide coresidence than daughters. In contrast, daughters are more likely to provide financial support, but as before, conditional on the provision of financial transfers, sons provide greater amounts. Moreover, we find significant evidence of the crowd-out of financial transfers by siblings, with this crowding-out far stronger within gender; each daughter gives less when she has more sisters while each son gives less when he has more brothers. These patterns are robust for both cash and in-kind transfers, for children in families with non-coresident children only, and across the sub-samples of rural and urban families.

5.1 First Step: Responsiveness to Birth Order and Education

Following our outline above, our first step employs a family fixed effects model (6) to estimate the relationship between birth order, education, and income, and support from children to their parents, with support measured alternatively as shared residence or financial transfers. In the latter case, we examine both the decision to make a transfer (0/1) and the natural logarithm of the conditional amount given.

As shown in Table 5, we find that birth order is positively related to coresidence for sons and significantly so for second born and fifth born and above ($p < .10$). Conversely, younger daughters seem less likely to coreside with parents than older daughters, although the associations are not statistically significant. Additionally, younger sons are more likely to give financial transfers compared to oldest sons, while younger daughters are less likely to give financial transfers than oldest daughters. However, there is no apparent pattern by birth order in the amount of financial support. The results and inferences are robust when we control for relative birth order (see footnote 16) or for indicators for being the oldest or youngest in lieu of birth order indicators.

Table 5 Responsiveness of Support to Birth Order, Education, and Income

	Co-resident Homeowner (1)	*Gave Financial Support* (2)	*Ln(Amount of Financial support)* (3)
Sons			
Birth order 2	0.025*	0.038***	-0.023
	(0.014)	(0.014)	(0.044)
Birth order 3	0.015	0.020	-0.036
	(0.016)	(0.018)	(0.055)
Birth order 4	0.028	0.031	0.010*
	(0.019)	(0.022)	(0.069)
Birth order 5 and above	0.048**	0.019	0.034
	(0.024)	(0.029)	(0.090)
Middle school	-0.043***	0.030**	0.015
	(0.012)	(0.012)	(0.040)
High school or more	-0.113***	0.059***	0.184***
	(0.014)	(0.015)	(0.049)
Sinh^{-1}(HH income)	0.006***	0.011***	0.023***
	(0.001)	(0.002)	(0.006)
Daughters			
Birth order 2	-0.001	-0.017	-0.034
	(0.009)	(0.012)	(0.035)
Birth order 3	-0.013	-0.037**	-0.029
	(0.011)	(0.016)	(0.047)
Birth order 4	-0.006	-0.042*	-0.015
	(0.016)	(0.022)	(0.088)
Birth order 5 and above	0.012	-0.018	0.109
	(0.020)	(0.028)	(0.073)
Middle school	0.010	0.020*	0.153***
	(0.009)	(0.012)	(0.037)
High school or more	0.034***	0.040**	0.354***
	(0.012)	(0.016)	(0.051)
Sinh^{-1}(HH income)	0.001	0.012***	0.022***
	(0.001)	(0.002)	(0.005)
Child gender			
Male	0.156***	-0.203***	0.281**
	(0.026)	(0.037)	(0.121)
R-squared	0.137	0.053	0.069
Mean/prop. of dependent var.	0.123	0.738	6.801
No. of children	15,114	15,114	11,151

Note: Marginal effects and standard errors (in parentheses) are reported. The first step employs family fixed effects models and cluster standard errors at the family level. Child control variables include second order polynomials in age, indicators for male, married (and its interaction with male), poor health, urban region, and number of children (and its interaction with male). Note that parent variables, family size, and sibship gender composition are absorbed by the family fixed effects. $^{*}p < .10$;$^{**}p < .05$;$^{***}p < .01$.

These results may seem surprising given that some prior research has found a preference towards eldest sons in Asian countries such as Japan and India (Horioka et al., 2018; Jayachandran and Pande, 2017). However, while evidence of gender bias in China abounds (Das Gupta et al., 2003; Ho, 2019; Jayachandran, 2015), evidence towards eldest son bias is lacking and often anecdotal. Wang et al. (2020) point out that the existence of an eldest son preference in China has not been verified in rigorous empirical work. Using data from the China Family Panel Studies, they find no evidence for preference towards eldest sons relative to younger sons in terms of educational investments. Our findings are also consistent with the findings of Compton and Pollak (2015) in the United States, Konrad et al. (2002) in Germany, and Lei et al. (2015) in China, all of which find that younger children (and youngest sons in the case of China) are more likely to coreside with parents than older children.[21]

The results also indicate that while the probability of coresidence decreases with education for sons, it increases with education for daughters, with the effects of a high school education or more being significantly different from zero for both genders, but opposite in sign. Education could affect the probability of coresidence in two ways: First, more schooling typically implies greater income, making it more likely that a child would have resources necessary to support a coresidential arrangement. Second, education could be associated with a greater probability of migrating away from home (Adda et al., 2022). Our results indicate that for sons, who are likely to be the primary earners in their families, the migration effect dominates, while for daughters, the likely secondary earners, the resources play the greater role.

With respect to financial transfers, we find that for both sons and daughters, greater education is associated with greater giving – both in the probability and the amount – with the positive effects of high school being significantly different from zero. The result is consistent with most other work showing that children with more resources provide greater financial transfers to parents (McGarry and Schoeni, 1995; Rao et al., 2020; Raut and Tran, 2005).

[21] One suggested explanation for such finding is that older children have a first-mover advantage and choose to locate further away from parents making it difficult to provide care or share housing, and thus shifting any future burden to younger siblings – particularly to the youngest child (Konrad et al., 2002). Parents may prefer not to leave their home village to live with a child who migrated away as coresidence would require. Indeed, Martin and Tsuya (1991) show that parents are more likely to live with sons who are living in a small town or rural area (indicative of not having migrated) than those in urban areas.

5.2 Second Step: Responsiveness to Sibling Gender Composition

Our second step uses the coefficient estimates from the first step (shown in Table 5) to calculate a measure of predicted support, net of birth order, education, and household income effects. Using this measure as the dependent variable, we estimate the relationship between support from sons and daughters and the number of brothers and sisters they have. As outlined earlier, this methodology follows the heteroscedastic based instrumental variable procedure from (9).[22] The results for the coefficients of interest are reported in Table 6 with additional coefficients estimates contained in Appendix Table A3.

We find that sons are 18.3 percentage points more likely to provide coresidential support than daughters, and 16.9 percentage points less likely to give financial transfers ($p < .01$). However, when making financial transfers, sons give amounts that are 22.7 percent larger than those from daughters ($p < .05$). These findings agree with the descriptive statistics presented in Section 3.2.

An increase in the number of brothers leads to a 4.9 percentage points decrease ($p < .01$) in the probability that a son coresides with his parent, but the effect of an additional brother for daughters is just 0.7 percentage points ($p < .01$), indicating that coresidence with a daughter is a poor substitute for living with a son. Moreover, an increase in the number of sisters has just a small effect on coresidency for both sons and daughters, leading to a 0.2 to 0.4 percent point decrease in the probability that a particular child coresides with parents, a decrease that is only marginally significantly different from zero for daughters. These findings are consistent with Prediction 2 and suggest that coresidential support from sons and daughters fall into different spheres.

Looking at whether any financial support is given to parents, we find that an additional brother increases the probability that a son makes a transfer by 1.7 percentage point ($p < .05$) but leads to a smaller 1.3 percentage point increase for daughters ($p < .10$). Conversely, an increase in the number of sisters is associated with a 2 percentage point decrease in the probability that a son give a transfers ($p < .05$) but has no statistically significant effect for daughters.

When turning to the amount of transfers, we find strong evidence of gender-specific crowd-out. An additional brother is associated with a 10.6 percent decrease in the amount ($p < .01$), while an additional sister leads to just a statistically insignificant 2.3 percent decrease. For daughters, the reverse is true, with an additional sister leading to a 9.4 percent decrease in the amount ($p < .01$) while an additional brother is associated with a statistically insignificant 2.8 percent decline. These

[22] OLS estimates of (5) are reported in Appendix Table A2 and are very close to the estimates from two-step estimation, suggesting that the endogeneity issues may not be sizeable. Probit estimates (not shown) of discrete outcomes also yielded quantitatively similar marginal effects to OLS estimates.

Table 6 Responsiveness of Support to Sibling Gender Composition

	Co-resident Homeowner (1)	*Gave Financial Support* (2)	*Ln(Amount of Financial support)* (3)
Sons' responsiveness to			
No. of brothers	-0.049***	0.017**	-0.106***
	(0.005)	(0.007)	(0.023)
No. of sisters	-0.002	-0.020***	-0.023
	(0.005)	(0.007)	(0.023)
Daughters' responsiveness to			
No. of brothers	-0.007***	0.013*	-0.028
	(0.002)	(0.007)	(0.020)
No. of sisters	-0.004*	-0.003	-0.094***
	(0.002)	(0.006)	(0.018)
Child gender			
Male	0.183***	-0.169***	0.227**
	(0.021)	(0.033)	(0.112)
R-squared	0.097	0.063	0.148
Hansen overid J stat [p-val]	237.08 [0.00]	198.90 [0.16]	166.21 [0.76]
1st Stage Tests			
Breusch-Pagan χ^2 stat [p-val]			
Brothers	796.10 [0.00]	796.10 [0.00]	785.92 [0.00]
Sisters	361.45 [0.00]	361.45 [0.00]	203.53 [0.00]
Male x Brothers	7,045.58 [0.00]	7,045.58 [0.00]	5,945.54 [0.00]
Male x Sisters	7,653.12 [0.00]	7,653.12 [0.00]	6,403.56 [0.00]
Kleibergen-Paap F stat	78.33	78.33	73.74
Mean/prop. of dependent var.	0.123	0.738	6.801
No. of children	15,114	15,114	11,151

Note: Marginal effects and standard errors (in parentheses) are reported. The second step uses the predicted measures of support from the first step, net of birth order, education and household income effects, and a heteroscedastic based instrumental variable strategy. Child control variables include second order polynomials in age, indicators for male, married (and its interaction with male), poor health, urban region, and number of children (and its interaction with male). Parent control variables include second order polynomials in age, indicators for single male, single female, primary school, middle school or more, poor health, and urban region, $sinh^{-1}$(household net wealth), an indicator for missing wealth, and dummies for province of residence. Standard errors are block-bootstrapped at the family level using 500 repetitions. Hansen tests of the hypothesis that the over-identifying restrictions are valid; F tests of whether the instruments are jointly significant from the first stage of the second step; and Breusch-Pagan tests of the hypothesis of constant variances in equation (7). $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

results are again consistent with the prediction of our model, Prediction 3. In particular, financial transfers are crowded-out to a much greater extent (approximate 3 to 4 times greater) when there is an increase in number of same-gendered siblings relative to opposite-gendered siblings, again pointing to the existence of separate spheres of support.

5.3 Additional Inferences

Our primary analysis is focused on support from children to parents in the form of shared residence and financial transfers. Here, we explore support from children in greater detail first by disaggregating financial transfers into those transfers made as cash gifts and those transfers that are made in-kind, second, by examining the behavior of children in families with and without a coresident child, and third, by assessing whether there are differences in behavior between rural and urban families.

Cash and In-Kind Transfers. We previously defined financial support to include both the transfer of cash (including payment of bills) and gifts in-kind (including items such as food and clothing). Both types of gifts are important. Among the 74 percent of children making a financial transfer of some sort, 44 percent made gifts of both types, 28 percent made only cash transfers, and 28 percent made only gifts in-kind. However, the average value of cash transfers, at 2,091 yuan, is more than twice as large as the average value of in-kind gifts, at 993 yuan.

When cash and in-kind gifts are examined separately by gender, as with total financial transfers, daughters are more likely to provide both cash transfers and in-kind support than sons, with the difference larger for the latter type of gift. Fifty-five percent of daughters and 51 percent of sons provide cash transfers while 61 and 47 percent of daughters and sons provide in-kind gifts, respectively. However, in terms of the conditional amounts, sons again provide more of each: Sons transfer an average of 2,690 yuan in cash compared to 1,534 yuan for daughters, and 1,157 yuan in in-kind gifts compared to 867 yuan for daughters. As Table 7, shows, these patterns hold in the multi-variate analysis, except for the amount of in-kind transfers, which is not statistically significantly different between sons and daughters.

Table 7 also reports the responsiveness of cash and in-kind transfers to the gender composition of a child's siblings. The results and inferences for both types of giving are qualitatively similar to those reported for the pooled outcome of any financial support in Table 6. We find that Prediction 3 holds for both cash and in-kind support: siblings of the same gender crowd-out transfers by more

Table 7 Responsiveness of Cash and In-Kind Support to Sibling Gender Composition

	Cash Support		*In-Kind Support*	
	Gave Any	*Ln(Amount)*	*Gave Any*	*Ln(Amount)*
	(1)	(2)	(3)	(4)
Sons' responsiveness to				
No. of brothers	0.033***	-0.164***	0.005	-0.114***
	(0.008)	(0.023)	(0.008)	(0.023)
No. of sisters	-0.006	-0.043*	-0.032***	-0.006
	(0.008)	(0.023)	(0.007)	(0.026)
Daughters' responsiveness to				
No. of brothers	0.019**	-0.037**	0.000	-0.033
	(0.008)	(0.018)	(0.008)	(0.020)
No. of sisters	0.022***	-0.128***	-0.019**	-0.099***
	(0.007)	(0.018)	(0.008)	(0.019)
Child gender				
Male	-0.069**	0.456***	-0.236***	-0.105
	(0.033)	(0.112)	(0.035)	(0.116)
R-squared	0.084	0.217	0.075	0.144
Hansen J stat [p-val]	188.81 [0.31]	164.98 [0.78]	198.57 [0.16]	164.84 [0.78]
Mean/prop. of dependent var.	0.530	6.818	0.543	6.011
No. of children.	15,114	8,007	14,846	8,057

Note: Marginal effects and standard errors (in parentheses) are reported. The second step uses the predicted measures of support from the first step, net of birth order, education and household income effects, and a heteroscedastic based instrumental variable strategy. Child control variables include second order polynomials in age, indicators for male, married (and its interaction with male), poor health, urban region, and number of children (and its interaction with male). Parent control variables include second order polynomials in age, indicators for single male, single female, primary school, middle school or more, poor health, and urban region, $sinh^{-1}$(household net wealth), an indicator for missing wealth, and dummies for province of residence. Standard errors are block-bootstrapped at the family level using 500 repetitions. Hansen tests of the hypothesis that the over-identifying restrictions are valid. $^{*}p < .10$;$^{**}p < .05$;$^{***}p < .01$.

than siblings of a different gender, irrespective of the type of financial transfer.

We note that the magnitudes of the crowding-out effects are somewhat larger for cash support than for in-kind gifts as might be expected if cash transfers from different children are more readily substitutable than in-kind transfers which may include symbolic gifts made for special occasions. Our estimates indicate that an additional brother decreases the amount of son's cash transfer by 16.4 percent and the amount of in-kind transfer by 11.4 percent ($p < .01$). Looking at the marginal effect of an additional sister, the magnitudes are 4.3 percent ($p < .10$) and an insignificant 0.6 percent, respectively. Meanwhile, an additional brother decreases the amount of cash support from a daughter by 3.7 percent ($p < .05$) and the amount of in-kind support by an insignificant 3.3

percent, while an additional sister decreases cash support by 12.8 percent and in-kind support by a smaller 9.9 percent ($p < .01$).

Families with and without Coresident Children. Because coresidence and financial transfers are potentially substitutable, families in which a parent coresides with one child may behave differently from families without such arrangement. To explore this possibility, we repeat our analysis separately for the subsample of children in families that have at least one coresident child and the subsample of children in families that have no coresident child in Table 8.

The marginal effects for the variables of interest for each subsample are qualitatively similar to those reported in Table 6. Unsurprisingly, the results for coresidence support are even stronger while the results for the amount of financial transfers are slightly weaker when only families with a coresident child contribute to the estimation. Nevertheless, for both subsamples the effects of same and opposite gender children lead to the same conclusions as for the full sample. Focusing again on the amount of the transfer, the estimates indicate that crowding-out occurs primarily among siblings of the same gender, with brothers having a large and significantly negative effect for sons but not for daughters, and sisters having large and significantly negative effects for daughters but less so for sons.

The consistency of our results when focusing solely on families in which there are no coresident children suggests that the crowding-out of financial transfers is unlikely due to substitution between coresidency and financial support within gender. This conclusion is consistent with our earlier discussion based on Table 4, pointing to a potential separability between coresidence and financial transfers. Sensitivity analyses controlling for coresidency in the first stage family fixed effect regressions and using measures of old age support net of the effects of coresidency, birth order, and economic variables in the second step regressions, yielded similar results.[23]

Rural and Urban Families. Finally, rural families may be more likely to adhere to traditional values and norms of behavior than urban families (Wu, 2022; Xie and Zhu, 2009). We therefore re-examine our main results, running the regressions separately for children whose parents live in a rural or urban area, and assessing whether the separation of transfers into separate spheres is more stark for rural families. Table 9 reports the results.

In general, we find that transfers of both coresidence and financial gifts are somewhat more prevalent in rural than in urban areas although the transfer amounts are larger in urban areas. We

[23]Results are omitted here for the sake of conciseness but are available upon request.

Table 8 Responsiveness of Financial Transfers in Families with and without Coresident Children

	With Coresident Children			*Without Coresident Children*	
	Co-resident Homeowner (1)	*Gave Financial Support* (2)	*Ln(Amount of Financial support)* (3)	*Gave Financial Support* (4)	*Ln(Amount of Financial support)* (5)
Sons' responsiveness to					
No. of brothers	-0.129***	0.017*	-0.080**	0.018**	-0.127***
	(0.009)	(0.010)	(0.033)	(0.007)	(0.028)
No. of sisters	-0.008	-0.026***	0.013	-0.015*	-0.043
	(0.008)	(0.010)	(0.033)	(0.008)	(0.029)
Daughters' responsiveness to					
No. of brothers	-0.027***	0.004	-0.044	0.018**	-0.001
	(0.005)	(0.009)	(0.028)	(0.009)	(0.026)
No. of sisters	-0.016***	-0.010	-0.060**	0.004	-0.116***
	(0.006)	(0.011)	(0.027)	(0.007)	(0.023)
Child gender					
Male	0.476***	-0.142***	0.174	-0.175***	0.265*
	(0.050)	(0.057)	(0.182)	(0.043)	(0.137)
R-squared	0.260	0.082	0.144	0.065	0.158
Hansen J stat [p-val]	247.28 [0.00]	205.29 [0.06]	160.54 [0.79]	171.22 [0.67]	227.34 [0.01]
Mean/prop. of dependent var.	0.317	0.738	6.662	0.738	6.889
No. of children	5,862	5,862	4,325	9,252	6,826

Note: Marginal effects and standard errors (in parentheses) are reported. The second step uses the predicted measures of support from the first step, net of birth order, education and household income effects, and a heteroscedastic based instrumental variable strategy. Child control variables include second order polynomials in age, indicators for male, married (and its interaction with male), poor health, urban region, and number of children (and its interaction with male). Parent control variables include second order polynomials in age, indicators for single male, single female, primary school, middle school or more, poor health, and urban region, $sinh^{-1}$(household net wealth), an indicator for missing wealth, and dummies for province of residence. Standard errors are block-bootstrapped at the family level using 500 repetitions. Hansen tests of the hypothesis that the over-identifying restrictions are valid. $^{*}p < .10$;$^{**}p < .05$;$^{***}p < .01$.

Table 9 Responsiveness of Support for Rural and Urban Households

	Co-resident Homeowner (1)	*Gave Financial Support* (2)	*Ln(Amount of Financial support)* (3)
A. Rural			
Sons' responsiveness to			
No. of brothers	-0.050***	0.018**	-0.084***
	(0.006)	(0.009)	(0.028)
No. of sisters	-0.006	-0.022***	-0.012
	(0.007)	(0.008)	(0.027)
Daughters' responsiveness to			
No. of brothers	-0.005**	0.011	-0.003
	(0.002)	(0.008)	(0.024)
No. of sisters	-0.004	-0.005	-0.077***
	(0.003)	(0.007)	(0.021)
Child gender			
Male	0.242***	-0.138***	0.442***
	(0.026)	(0.041)	(0.129)
R-squared	0.107	0.059	0.169
Hansen overid J stat [p-val]	209.27 [0.01]	187.23 [0.10]	150.82 [0.76]
Mean/prop. of dependent var.	0.129	0.750	6.696
No. of children	10,034	10,034	7,522
B. Urban			
Sons' responsiveness to			
No. of brothers	-0.044***	0.006	-0.142***
	(0.007)	(0.013)	(0.039)
No. of sisters	0.006	-0.017	-0.038
	(0.009)	(0.012)	(0.045)
Daughters' responsiveness to			
No. of brothers	-0.010***	0.010	-0.076**
	(0.004)	(0.012)	(0.039)
No. of sisters	-0.003	-0.006	-0.132***
	(0.004)	(0.013)	(0.040)
Child gender			
Male	0.036	-0.244***	-0.259
	(0.030)	(0.052)	(0.203)
R-squared	0.087	0.099	0.123
Hansen overid J stat [p-val]	191.47 [0.15]	189.87 [0.17]	176.88 [0.38]
Mean/prop. of dependent var.	0.111	0.714	7.019
No. of children	5,080	5,080	3,629

Note: Marginal effects and standard errors (in parentheses) from two-step estimation. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

also find that the direct effect of sons (as opposed to daughters) on coresidence is larger in rural areas than in urban areas, as is the relationship between being a son and the amount of a financial transfer. These results are consistent with a greater reliance on sons in rural areas than urban areas. Conversely, the magnitude of the negative relationship between being a son and the probability of making a financial transfer to a parent is smaller in rural than in urban areas, possibly due to social norms of gift giving being stronger in rural than in urban areas.

The results for the effect of same and opposite gendered siblings are as before in both samples. The marginal effects for number of brothers and number of sisters in the results for coresidential support are very similar across sub-samples, with brothers largely crowding-out support for sons, but doing so far less so for daughters ($p < .05$). With respect to financial support, the addition of a same-gendered sibling has a much larger (negative) effect on the amount than the addition of an opposite gendered sibling, indicating that the same gender-specific patterns exist within families regardless of location.

5.4 Robustness Checks

As a check on the robustness of our conclusions, we re-estimate the main model for various alternative specifications and samples: controlling for intervivos transfers that a child receives from parents (if any), removing sample restrictions on age and gender composition of families, and finally, estimating the model separately for adjacent survey waves.

Inter Vivos Transfers from Parents. Financial support flows predominantly from children to parents in China. Only 19 percent of sons and 16 percent of daughters *receive* financial transfers from parents, compared to 70 percent of sons and 78 percent of daughters who *give* transfers to parents. When examining transfers from parents by the gender of the child, the strong son preference embedded in the Chinese culture continues to be observed. Conditional on receiving a transfer from parents, sons receive on average 4,535 yuan while daughters receive far less than half as much, just 1,970 yuan. Looking at comparable numbers for the provision of assistance in the form of care for a grandchild, 24 percent of sons and just 5 percent of daughters receive help from parents. These differences are all statistically significant at the 1 percent level.

To assess whether these downstream transfers affect our behaviors of interest – the responsiveness of children's upstream transfers to the gender composition of siblings, we repeat the two-step estimation procedure used in our primary analysis but include controls for the receipt of transfers from parents. We include indicators regarding grandchild care (yes/no), financial assistance (yes/no), and a variable measuring the amount of any financial assistance.[24] The downstream transfer measures are included as control variables in the first step family fixed effect estimation to allow for the possibility that inter vivos transfers from parents to children may be endogenously determined with sibling gender composition. The dependent variables used in the second step are thus old age support (coresidence or financial transfers) net of the estimated effects of birth order, education, household income, and now, inter vivos transfers from parents.

As shown in the top panel of Appendix Table A4, the estimates from the first step of our estimation procedure show that the receipt of grandchild care is positively related to coresidence and amount of financial support from children ($p < .01$). The probability that a parent makes a financial transfer is negatively related to coresidence but positively related to the likelihood of receiving financial transfers from a child ($p < .05$). However, the greater the amount of transfer from the parent, the more likely the child is coresident and the less likely the child is to give ($p < .05$).

Our results and inferences regarding the responsiveness of sons and daughters to the number of brothers and sisters are similar to those reported in the second panel of Table 6. Both sons and daughters are less likely to provide coresident support to parents in response to an increase in the number of brothers ($p < .01$). In addition, both sons and daughters significantly decrease the amount of financial support to parents in response to an increase in the number of siblings of the same gender ($p < .01$) and do so to a far lesser extent in response to an increase in the number of siblings of the opposite gender (very small magnitudes and not statistically significant). Thus, the notion of separate sphere of giving, including the dominance of sons with regard to coresidence and the strength of within-gender crowding-out, remains when controlling for parental intervivos transfers.

Removing sample restrictions The main analyses were based on the sample of children documented in Appendix Figure A1. That is, on a sample limited to those children in families where the average age of parents is 60 years old or older, all children in the family are 25 years old or older, and there is at least one son and at least one daughter in the family. Appendix Table A5 removes the age restrictions and the sibling structure restriction. The results and inferences are qualitatively

[24]Among those who received grandchild care help, a large proportion, 27 percent, had missing hours. We thus exclude the amount of time transferred but include the number of grandchildren (i.e., the number of children of each adult child of the respondent) and its interaction with child gender as proxies and part of the control variables.

similar to those reported in Table 6.

Adjacent waves Our analyses thus far have relied on observations from the 2015 wave, as it was the latest wave that had undergone the rigorous cleaning of the CHARLS team to create the child-level data sets. As an additional check of the robustness of our conclusions, we compare these results to analyses that estimate the same specifications separately for adjacent waves 2013, which was subject to the same rigorous cleaning as 2015, and 2018, which has not been processed by the CHARLS team as have data from the earlier waves.

As shown in the top panel of Appendix Table A6, we find similar results with crowding-out of coresidence only due to brothers and not sisters regardless of the child's gender, and a strong asymmetry in the crowd-out of the amount of financial transfers by gender from the 2013 wave. As shown in column (3), the responsiveness of the amount of financial transfers to the number of siblings of the same gender is far larger than that for opposite gendered-siblings. We also tested the robustness of our results to using the 2018 wave of data in the bottom panel of Appendix Table A6. While there are no statistically significant patterns for coresidence, the asymmetry in the crowd-out of the amount of financial transfers by gender is still present, albeit weaker for daughters.[25]

6 Discussion

In line with the predictions of our contextual framework (Predictions 1 and 2), the results of our regression analyses examining coresidency are consistent with China's patrilocal culture: Sons are the main providers of coresidential support and the crowding-out of such support is far greater among brothers than sisters. Similarly, the estimates examining the relationship between additional siblings and financial support are consistent with Prediction 3: sons provide larger amounts of financial support than daughters, and crowding-out of financial transfers at the intensive margin is substantially larger within gender than between genders. These conclusions are robust across various samples and hold for both cash and in-kind gifts.

[25]Given the multi-wave analyses, all monetary values have been deflated to 2018 in this study. Nevertheless, a comparison of results across wave needs to be interpreted with caution due to the different data cleaning processes. Tentatively, if we were to attempt an interpretation, the lack of crowd-out in coresidence as well as the weaker asymmetry in crowd-out of the amount of financial transfers from daughters in 2018, compared to 2013 and 2015, could be due to modernization leading to a gradual erosion of certain norms. There is suggestive evidence that this erosion could potentially be driven by the more visible transfers such as in-kind rather than cash transfers (Appendix Table A7). Future research examining a longer panel could potentially shed light on changing family dynamics over time.

While our results are consistent with the framework we propose regarding separate spheres of transfers across genders, we have not formally tested the theory against alternative models. In the following subsection, we examine the implications for two alternative frameworks, a standard public good framework and a model of competition, both of which have been used in prior literature, and show that neither model is consistent with our findings. Because the past use of these models has focused on financial transfers, we limit our attention here to testing the predictions in this currency. We then follow this discussion by raising two new avenues for exploration with regard to the existence of separate spheres by gender, considering these fertile ground for future work. These ideas build on the idea of separate spheres of giving by providing additional motivation for the origin of such spheres.

6.1 Alternative Models

While there are obviously numerous alternative models that can be posited as alternatives to our preferred framework, we focus here on two models that are prominent in the literature and potentially relevant to our context: the standard public good model and the Tullock contest model.

Standard public good model. The common framework for the depiction of transfers within the family is a standard public good model, which we illustrate formally in Appendix A.3. Here, financial transfers from sons and daughters are additive rather than separable, and enter equally into the parental utility function. In this case, sons would likely still provide greater transfers than daughters because they have higher incomes, but parents would not distinguish between transfers from either gender. In addition, as we illustrate in the appendix, an increase in the number of brothers will crowd-out financial transfers (whether made by either a son or a daughter), by a greater margin than would an increase in the number of sisters. The empirical results in Table 6 do not support this conclusion – an additional brother crowds-out financial transfers from other sons to a far greater extent than it crowds-out transfers from daughters, and the reverse is true for an additional sister. These patterns are inconsistent with the standard public good model.

Competition among sons and among daughters. A second alternative to our framework is a Tullock contest model (Chang, 2009; Chang and Weisman, 2005). In such a model, it is assumed that children make financial transfers to their parents to compete with their siblings for a “reward" from the parents. In varying contexts, Bernheim et al. (1985) for the United States, Almås et al.

(2020) for China, and Ho (2022) for Singapore, studies have found a positive relationship between bequeathable wealth or expected/intended bequests and the amount of attention, assistance, or financial transfers received from children in multi-children families, and with weaker or no effect for single-child families. These past findings suggest that when children must compete with siblings, greater transfers are given to parents in anticipation of a potential reward.[26]

Given these results, and the tradition of sons inheriting bequests in China (Yang, 2013), we consider an alternative model, wherein sons compete for parental bequests by providing transfers to parents. We envision that daughters instead compete with their sisters for attention or praise from their parents, but not bequests. This framework is consistent with our idea that parents view support from sons and daughters differently, perhaps viewing sons as carrying on the family legacy and name and thus being stewards of the estate.

This model is laid out formally in Appendix A.4. While it generates similar predictions for sons and daughters as our spheres framework, with stronger within than across gender effects on giving to parents, the signs of the effects predicted by a Tullock contest model are in the opposite direction from those posed by our model. Intuitively, if children are "competing" for an eventual inheritance in the case of sons, or for attention in the case of daughters, we should see a "crowding-in" of sorts, particularly with respect to the first same-gendered sibling: moving from no brothers to one brother would result in an *increase* in transfers by sons, while moving from no sisters to one sister would result in an *increase* in transfers by daughters.

We put this hypothesis to the test by performing separate analyses on families with one or two sons and on families with one or two daughters in Appendix Table A8 to assess directly the impact of the first same-gendered sibling. As seen in column (3) of the table, we continue to find negative associations between the financial transfers of sons and the number of brothers and between financial transfers of daughters and the number of sisters, a result which is not consistent with the Tullock contest model of financial support.

6.2 Avenues for Exploration

As our empirical work shows, different patterns exist for transfers from sons and those from daughters, with transfers to parents apparently occupying separate spheres. We focused on the role of traditional cultural norms, the visibility of transfers, and the preferences of parents as potential

[26] Note that as discussed in Section 4 and in footnote 14, all regression analyses control for parental wealth including housing wealth. From Appendix Table A3, we also find a positive association between parental wealth and coresidency and the amount of transfers ($p < .05$).

explanations for the distinction by gender. Here, we consider two related ideas that we suggest as avenues for future research. First, the role of gender-specific information flows within the family, and second, the interaction of the gender of the child and parent with there potentially being a same gender affinity between fathers and sons and between mother and daughters.

Information transmission Intuitively, one might expect that there could be differences by gender in how parents communicate with their children and in what information they share with those children. For example, parents may share more information about their own financial circumstance with sons rather than daughters, or may discuss with daughters the transfer (or other behaviors) of sisters, but discuss with sons, the behavior of their brothers. It is also possible that siblings share information directly with each other about their own giving or about a parent's need. Brothers might share more with brothers, and sisters more with sisters. We believe that the idea of how information is shared could be a potential avenue for further investigation.[27]

Gender of the parent recipient A second possible avenue is whether the gender of the parent affects patterns of giving. There is a great deal of evidence in the literature that households do not pool income completely, and that husbands and wives may prefer to spend their resources on different goods (Lundberg et al., 1996; Thomas, 1990; Armand et al., 2020; Duflo, 2003). It may therefore matter whether a transfer from a child is made directly to a mother or father in terms of how that transfer is used. One can imagine that if daughters share the tastes of their mothers or simply feel a closer bond with their mothers than with their fathers (and the reverse for sons) then daughters may give primarily to mothers and sons to fathers. In this case, crowding-out would primarily exist within gender – with sisters crowding-out gifts to their mothers, and sons crowding-out gifts to their fathers. Unfortunately, in our data we know only the total amount received by the parental household and cannot distinguish to which parent the transfers are made. However, we view this too as a fruitful ground for future work.[28]

[27]Heterogeneity analyses by whether the child contacts the parent at least once a month or not still showed somewhat larger a crowd-out within than between genders, irrespective of the frequency of contact. However, these patterns do not necessarily rule out the information channel since we do not observe what parents discuss with their children, and therefore cannot know the extent to which the content of such conversations might vary with the gender of the child. Furthermore, it takes very little interaction for a parent to relay information about a transfer from a child's sibling or about their own needs so the amount of contact may not be a good predictor of the sharing of information on transfers.

[28]We explored giving to unmarried (widowed) mothers and unmarried (widowed) fathers separately, and found generally similar patterns with respect to crowding-out of financial transfers. However, those estimates are difficult to interpret. While the gender differences in how transfers are directed are likely diminished when a parent is widowed, some of the established differences by gender may continue

7 Conclusion

In this study, we provide what we believe is a relatively novel framework for considering parental transfers, a framework in which there are separate "spheres" of support from children to parents. Here, we define spheres by the type of support and the gender of the donor child, as might be most applicable to countries with a strong patrilineal culture. We focus our attention on transfer behavior in China. Our measure of support encompasses support of two types: (i) coresidence and (ii) financial transfers. The two types differ in important respects: Coresidence is an experience good, can be provided by only one child, and is more visible to those outside the household than are financial transfers. In contrast, financial transfers are far less experiential than coresidence, can be provided simultaneously by multiple children, and are less visible to others. These different characteristics, coupled with persistent patrilineal norms, imply that patterns for shared residence may vary more so with the gender of a child than would patterns of financial transfers. Our framework thus predicts that coresidence will be provided predominantly by sons, and that crowding-out of a child's coresidential support would be primarily driven by brothers. For financial transfers, because more than one child can provide support, we do not expect crowding-out by sons to be complete, but we similarly predict that crowing-out would be predominantly within gender, with an additional sibling of the same gender decreasing transfers by a larger amount than a sibling of the opposite gender.

The potential for these separate spheres suggests that we may need to rethink the models of transfer behavior that are traditionally employed in many contexts. The substitutability of financial support from children may vary with the gender of the child and with the gender(s) of any siblings. Consider the context of the standard altruistic model (Barro, 1974; Becker, 1974) wherein children care about the well-being (utility) of the parent. If the parent values support from one type of child more so than another (e.g., a son's gift means more to the parent than that from a daughter), then the standard predictions of redistributive neutrality will likely fail. Furthermore, in the case where siblings are equally altruistic towards the parent, the parental preference structure may imply that support among siblings may be allocated more efficiently than a standard public good model would indicate. For instance, if a dollar (yuan) from a son is more valuable to a parent than a dollar from a daughter, then the daughter could more efficiently add to parental utility by transferring to her brother who would then use his sibling's gift to provide for the parent. The same level of

either because the unmarried parent values transfers from sons and daughters differently or because families are just continuing to follow earlier patterns.

utility of the parent could be "bought" for less with the indirect transfer. Alternatively, in a model of exchange (Cox, 1987) parents may be willing to "pay a higher price" for coresidence from particular children. We leave such interesting extensions for future research.

References

Adda, J., C. Dustmann, and J. S. Görlach (2022). The dynamics of return migration, human capital accumulation, and wage assimilation. *Review of Economic Studies 89*(6), 2841–2871.

Agarwal, S. and W. Qian (2014). Consumption and debt response to unanticipated income shocks: Evidence from a natural experiment in Singapore. *American Economic Review 104*(12), 4205–4230.

Almås, I., E. Freddi, and Ø. Thøgersen (2020). Saving and bequest in China: An analysis of intergenerational exchange. *Economica 87*(345), 249–281.

Antman, F. M. (2012). Elderly care and intrafamily resource allocation when children migrate. *The Journal of Human Resources 47*(2), 331–363.

Armand, A., O. Attanasio, P. Carneiro, and V. Lechene (2020). The effect of gender-targeted conditional cash transfers on household expenditures: Evidence from a randomized experiment. *Economic Journal 130*(631), 1875–1897.

Bagger, J., J. A. Birchenall, H. Mansour, and S. Urzua (2021). Education, birth order, and family size. *Economic Journal 131*(633), 33–69.

Barro, R. (1974). Are government bonds net wealth ? *Journal of Political Economy 82*(6), 1095–1117.

Baum, C. F. and A. Lewbel (2019). Advice on using heteroscedasticity based identification. *Stata Journal 19*(4), 1–9.

Beaujouan, E. and A. Solaz (2019). Is the family size of parents and children still related? Revisiting the cross-generational relationship over the last century. *Demography 56*, 595–619.

Becker, G. S. (1960). An economic analysis of fertility. In G. B. Roberts (Ed.), *Demographic and economic change in developed countries*, pp. 209–240. Columbia University Press.

Becker, G. S. (1974). A theory of social interactions. *Journal of Political Economy 82*(6), 1063–1093.

Bernheim, D. B., A. Shliefer, and L. H. Summers (1985). The strategic bequest motive. *The Journal of Political Economy 93*(6), 1045–1076.

Bhalotra, S. and D. Clarke (2019a). The twin instrument: Fertility and human capital investment. *Journal of the European Economic Association 00*(0), 1–50.

Bhalotra, S. and D. Clarke (2019b). Twin birth and maternal condition. *Review of Economics and Statistics 101*(5), 853–864.

Black, S. E., P. D. Devereux, and K. G. Salvanes (2005). The more the merrier? The effect of family size and birth order on children's education. *The Quarterly Journal of Economics 120*(May), 669–700.

Bodkin, B. Y. R. (1959). Windfall income and consumption. *American Economic Review 49*(4), 602–614.

Bratti, M., S. Fiore, and M. Mendola (2020). The impact of family size and sibling structure on the great Mexico–USA migration. *Journal of Population Economics 33*(2), 483–529.

Breschi, S. and C. Lenzi (2016). Co-invention networks and inventive productivity in US cities. *Journal of Urban Economics 92*, 66–75.

Brown, M. (2006). Informal care and the division of end-of-life transfers. *Journal of Human Resources XLI*(1), 191–218.

Brown, T. T. and V. Murthy (2020). Do public health activities pay for themselves? The effect of county-level public health expenditures on county-level public assistance medical care benefits in California. *Health Economics 29*(10), 1220–1230.

Cai, F., J. Giles, and X. Meng (2006). How well do children insure parents against low retirement income? An analysis using survey data from urban China. *Journal of Public Economics 90*(12), 2229–2255.

Caliendo, M., W. S. Lee, and R. Mahlstedt (2017). The gender wage gap and the role of reservation wages: New evidence for unemployed workers. *Journal of Economic Behavior and Organization 136*, 161–173.

Chang, Y. M. (2009). Strategic altruistic transfers and rent seeking within the family. *Journal of Population Economics 22*, 1081–1098.

Chang, Y. M. and D. L. Weisman (2005). Sibling rivalry and strategic parental transfers. *Southern Economic Journal 71*(4), 821–836.

CHARLS Research Team (2013). Challenges of population aging in China. Technical report, Peking University.

Checkovich, T. J. and S. Stern (2002). Shared caregiving responsibilities of adult siblings with elderly parents. *Journal of Human Resources 37*(3), 441–478.

Compton, J. and R. A. Pollak (2015). Proximity and co-residence of adult children and their parents in the United States: Descriptions and correlates. *Annals of Economics and Statistics 117/118*(Gender), 91–114.

Courtemanche, C., J. C. Pinkston, and J. Stewart (2021). Time spent exercising and obesity: An application of Lewbel's instrumental variables method. *Economics and Human Biology 41*, 100940.

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

Cunningham, S. A., K. M. Yount, M. Engelman, and E. Agree (2013). Returns on lifetime investments in children in Egypt. *Demography 50*(2), 699–724.

Das Gupta, M., J. Zhenghua, L. Bohua, X. Zhenming, W. Chung, and B. Hwa-Ok (2003). Why is son preference so persistent in East and South Asia? A cross-country study of China, India and the Republic of Korea. *Journal of Development Studies 40*(2), 153–187.

Duflo, E. (2003). Grandmothers and granddaughters: old-age pensions and intrahousehold allocation in South Africa. *The World Bank Economic Review 17*(I), 1–25.

Duflo, E. and C. Udry (2004). Intrahousehold resource allocation in Cote d'Ivoire: social norms, separate accounts and consumption choices. *NBER Working Paper*.

Ebenstein, A. (2010). The 'missing girls' of China and the unintended consequences of the one child policy. *Journal of Human Resources 45*(1), 87–115.

Ebenstein, A. and S. Leung (2010). Son preference and access to social insurance: Evidence from China's rural pension program. *Population and Development Review 36*(1), 47–70.

Eirnaes, M. and C. C. Pörtner (2004). Birth order and the intrahousehold allocation of time and education. *Review of Economics and Statistics 86*(4), 1008–1019.

Emery, T., P. A. Dykstra, and M. Djundeva (2019). Intergenerational co-residence during later life in Europe and China. *Chinese Journal of Sociology 5*(2), 241–259.

Fagereng, A., M. B. Holm, and G. J. Natvik (2021). MPC heterogeneity and household nalance sheets. *American Economic Journal: Macroeconomics 13*(4), 1–54.

Gale, W. and J. Scholtz (1994). The accumulation of wealth. *Journal of Economic Perspectives 8*(4), 145–160.

Grigoryeva, A. (2017). Own gender, sibling's gender, parent's gender: The division of elderly parent care among adult children. *American Sociological Review 82*(1), 116–146.

Guo, R. and J. Zhang (2020). The effects of children's gender composition on filial piety and old-age support. *Economic Journal 130*(632), 2497–2525.

Ho, C. (2019). Child's gender, parental monetary investments and care of elderly parents in China. *Review of Economics of the Household 17*(3), 741–774.

Ho, C. (2022). Strategic parent meets detached child? Parental intended bequest division and support From children. *Demography 59*(4), 1353–1376.

Horioka, C. Y., E. Gahramanov, A. Hayat, and X. Tang (2018). Why do children take care of their elderly parents? Are the Japanese any different? *International Economic Review 59*(1), Forthcoming.

Hwang, K. (1987). Face and favor: The Chinese power game. *American Journal of Sociology 92*(4), 944–974.

Iwasaki, I. and X. Ma (2020). Gender wage gap in China: a large meta-analysis. *Journal for Labour Market Research 54*(1).

Jappelli, T. and L. Pistaferri (2010). Does consumption inequality track income inequality in Italy? *Review of Economic Dynamics 13*(1), 133–153.

Jayachandran, S. (2015). The roots of gender inequality in developing countries. *Annual Review of Economics 7*, 63–88.

Jayachandran, S. and R. Pande (2017). Why are Indian children so short? The role of birth order and son preference. *American Economic Review 107*(9), 2600–2629.

Konrad, K. A., H. Kumnemund, K. E. Lommerud, and R. J. R. (2002). Geography of the family. *The American Economic Review 92*(4), 981–998.

Lee, J. (2007). Sibling size and investment in children's education: An Asian instrument. *Journal of Population Economics 21*(4), 855–875.

Lee, T. H. (1975). More on windfall income and consumption. *Journal of Political Economy 83*(2), 407–417.

Lei, X., J. Strauss, M. Tian, and Y. Zhao (2015). Living arrangements of the elderly in China: Evidence from the CHARLS national baseline. *China Economic Journal 8*(3), 191–214.

Lewbel, A. (2012). Using heteroscedasticity to identify and estimate mismeasured and endogenous regressor models. *Journal of Business and Economic Statistics 30*(1), 67–80.

Lundberg, S. and R. A. Pollak (1993). Separate spheres bargaining and the marriage market. *The Journal of Political Economy 101*(6), 988–1010.

Lundberg, S. J., R. A. Pollak, and T. J. Wales (1996). Do husbands and wives pool their resources? *The Journal of Human Resources 32*(3), 463–480.

Martin, L. G. and N. O. Tsuya (1991). Interactions of middle-aged Japanese with their parents. *Population Studies 45*(2), 299–311.

McGarry, K. (2016). Dynamic aspects of family transfers. *Journal of Public Economics 137*, 1–13.

McGarry, K. and R. Schoeni (1995). Transfer behavior in the Health and Retirement Study: Measurement and the redistribution of resources within the family. *The Journal of Human Resources 30*, S184–S226.

Millimet, D. L. and J. Roy (2016). Empirical tests of the pollution haven hypothesis when environmental regulation is endogenous. *Journal of Applied Econometrics 31*, 652–677.

National Research Council (2012). *Aging in Asia: Findings from new and emerging data initiatives*. Washington, DC: National Academies Press.

Nugent, C. N. (2013). Wanting mixed-sex children: Separate spheres, rational choice, and symbolic capital motivations. *Journal of Marriage and Family 75*(4), 886–902.

Oliveira, J. (2016). The value of children: Inter-generational support, fertility, and human capital. *Journal of Development Economics 120*, 1–16.

Rao, Z., M. Groneck, and R. Alessie (2020). Should I stay or should I go? Intergenerational transfers and residential choice. Evidence from China. *Working Paper*.

Raut, L. K. and L. H. Tran (2005). Parental human capital investment and old-age transfers from children: Is it a loan contract or reciprocity for Indonesian families? *Journal of Development Economics 77*(2), 389–414.

Rigobon, R. (2003). Identification through heteroskedasticity. *The Review of Economics and Statistics LXXXV*(4), 777–792.

Rosenzweig, M. R. and K. I. Wolpin (1980). Testing the quantity-quality fertility model: The use of twins as a natural experiment. *Econometrica 48*(1), 227–240.

Rosenzweig, M. R. and J. Zhang (2014). Co-residence, life-cycle savings and inter-generational support in urban China. *NBER Working Paper*.

Schoeni, R. F. (2003). Support networks within the family as a public good problem. *PSC Research Report*.

Shan, X. and A. Park (2023). Access to pensions, old-age support, and child investment in China. *Journal of Human Resources*, Forthcoming.

Shipton, P. M. (1989). *Bitter money: cultural economy and some African meanings of forbidden commodities*. American Anthropological Association.

Thaler, R. H. (1990). Anomalies: savings, fungibility, and mental accounts. *The Journal of Economic Perspectives 4*(1), 193–205.

Thaler, R. H. (2008). Mental accounting and consumer choice. *Marketing Science 27*(1), 15–25.

Thomas, D. (1990). Intra-household resource allocation. *Journal of Human Resources XXV*(4), 635–664.

Wang, W., X. Liu, Y. Dong, Y. Bai, S. Wang, and L. Zhang (2020). Son preference, eldest son preference, and educational attainment: Evidence from Chinese families. *Journal of Family Issues 41*(5), 636–666.

Werthmann, K. (2003). Cowries, gold and 'bitter money': gold-mining and notions of ill-gotten wealth in Burkina Faso. *Paideuma: Mitteilung zur Kulturkunde 49*, 105–124.

Wooldridge, J. (2010). *Econometric analysis of cross section and panel data*. MIT Press.

Wu, F. (2022). Intergenerational support and life satisfaction of older parents in China: A rural–urban divide. *Social Indicators Research 160*(2-3), 1071–1098.

Xie, Y. and H. Zhu (2009). Do sons or daughters give more money to parents in Urban China. *Journal of Marriage and Family 71*(1), 1–20.

Yang, X. (2013). Gender and intergenerational support in later life : A research of urban China and Japan based on case studies. *Journal of Political Science and Sociology 3*(18), 115–136.

Zhang, Z., D. Gu, and Y. Luo (2014). Coresidence with elderly parents in contemporary China: The role of filial piety, reciprocity, socioeconomic resources, and parental needs. *Journal of Cross-Cultural Gerontology 29*(3), 259–276.

Zimmer, Z. and J. Kwong (2003). Family size and support of older adults in urban and rural China: Current effects and future implications. *Demography 40*(1), 23–44.

A Appendix

A.1 Extensive Margin of Financial Transfers

We examine how an increase in the number of siblings may affect financial transfers at the extensive margin (i.e., the probability of making financial transfers). From the first order condition (2), a child of gender $g = S,D$ would provide financial support to the parent if marginal utility from providing transfers is greater than marginal utility from consumption when transfers are zero: $v'(n_g t_g) > u'(I_g - t_g)$ at $t_g = 0$. In other words, the marginal rate of substitution between transfers and consumption, evaluated at zero transfers, needs to be positive for a child to provide any financial support to the parent.

Denote the marginal rate of substitution between transfers and consumption for a child of gender $g = S,D$ as $MRS_g = \frac{v'(n_g t_g)}{u'(I_g - t_g)}$. Differentiating this expression with respect to n_g and n_{-g}, respectively, we have:

$$\frac{\partial MRS_g}{\partial n_g} = \frac{1}{(u')^2} \cdot \left\{ u' \cdot v'' \cdot \left[t_g + n_g \frac{\partial t_g}{\partial n_g} \right] - v' \cdot u'' \cdot \left(\frac{\partial I_g}{\partial n_g} - \frac{\partial t_g}{\partial n_g} \right) \right\}.$$

$$\frac{\partial MRS_g}{\partial n_{-g}} = \frac{1}{(u')^2} \cdot \left\{ u' \cdot v'' \cdot \left[n_g \frac{\partial t_g}{\partial n_{-g}} \right] - v' \cdot u'' \cdot \left(\frac{\partial I_g}{\partial n_{-g}} - \frac{\partial t_g}{\partial n_{-g}} \right) \right\}.$$

Evaluating these expressions at $t_g = 0$ and using the partial effects (3) and (4), we have:

$$\frac{\partial MRS_g}{\partial n_g}|_{t_g=0} = \frac{1}{(u')^2} \cdot \left[\frac{u'' \cdot v'' \cdot n_g}{u'' + v'' \cdot n_g} \cdot \frac{\partial I_g}{\partial n_g} \cdot (u' - v') \right] \gtreqless 0.$$

$$\frac{\partial MRS_g}{\partial n_{-g}}|_{t_g=0} = \frac{1}{(u')^2} \cdot \left\{ \frac{u'' \cdot v'' \cdot n_g}{u'' + v'' \cdot n_g} \cdot \frac{\partial I_g}{\partial n_{-g}} \cdot (u' - v') \right\} \gtreqless 0.$$

Given concavity of u and v and the fact that $\frac{\partial I_g}{\partial n_g} \leq 0$ for $g = S,D$, the partial effects depend on the sign of $u' - v'$. In particular, if the marginal utility from consumption is greater than the marginal utility from transfers ($u' - v' > 0$), then the probability that the child will make a transfer to the parent (weakly) increases in the number of siblings of gender $g = S,D$, $\frac{\partial MRS_S}{\partial n_g}|_{t_S=0} \geq 0$. Conversely, if the marginal utility from consumption is lower than the marginal utility from transfers, $u' - v' < 0$, then the probability that the child will make a transfer to the parent (weakly) decreases in the number of siblings of gender $g = S,D$, $\frac{\partial MRS_S}{\partial n_g}|_{t_S=0} \leq 0$.

The model thus predicts that an increase in the number of brothers or sisters may increase, not change, or decrease the probability that a child provides financial support to parents so that the net effect is indeterminate.

A.2 Extended Gendered Public Good Model

We extend the model to allow sons and daughters to care differently about parental well-being and for heterogeneous income of children within a gender. As before, we consider a multi-donor framework with one recipient parent and n altruistic children. Because we are examining differences associated with the gender of the child, we again specify our model to focus on families in which there is at least one son and one daughter. Denoting sons with subscript S and daughters with subscript D, we thus have number of sons $n_S \geq 1$, number of daughters $n_D \geq 1$, and number of children $n = n_S + n_D \geq 2$.

Let I_i denote income of child i. Consistent with empirical evidence on the gender-wage gap in China (Iwasaki and Ma, 2020), we assume that sons have higher income than daughters. Thus, as before, sons earn more than daughters, $I_S > I_D$, but income may differ within gender in this extended model. Moreover, we posit that $\frac{\partial I_i}{\partial n_g} \leq 0$ with $g = S, D$, to capture the fact that parents may have had fewer resources to invest in a child if there were a larger number of children to provide for (Becker, 1960; Bagger et al., 2021; Black et al., 2005). Thus, the child's income may depend on sibship size. We investigate this assumption empirically in Section 5.

Each child cares about his / her own consumption, $c_i \in R_+$, and parental utility. A child may affect parental utility by providing support to the parent. In particular, a child may provide coresident housing support, $h_i \in \{0, 1\}$, or financial transfers, $t_i \in R_+$, to the parent. Coresidence with the parent entails a psychological or privacy cost $\gamma_i > 0$ to the child and may differ across children. For instance, sons may face a lower γ_i than daughters because sons but not daughters are conditioned to provide coresidence support to parents due to societal norms. Conversely, financial transfers entail a budgetary cost by decreasing the amount available for the child's own consumption.

The parent cares about coresidential support and financial transfers from children. In particular, the parent derives utility from coresidential support from the child who can provide the greatest value: $H = max\{\delta_1 h_1, ..., \delta_n h_n\}$, where $\delta_i \in R$ is a parameter that captures the fact that the parent values coresidential support from children differently. For instance, parents may assign a higher δ_i to sons than daughters given patrilocal norms or given that coresidence is an experience good, parents may value coresidence differently according to the personality of each child. Additionally, the parent cares about total financial transfers from all sons $\left(T_S = \sum_{S=1}^{n_S} t_S\right)$, and total financial transfers from all daughters $\left(T_D = \sum_{D=1}^{n_D} t_D\right)$. As discussed before, this assumption stems from our inquiry into whether the family treats financial transfers from sons and daughters differently, possibly due to the presence of separate mental accounts. Thus, H, T_S and T_D may be considered as family public goods towards which each child may contribute.

A child i solves:

$$\max_{c_i>0, h_i\in\{0,1\}, t_i\geq 0} u(c_i) + \theta_i \left[\underbrace{v(T_S) + v(T_D) + H}_{Parent's\ Utility} \right] - \underbrace{\gamma_i h_i}_{Privacy\ Cost}$$

subject to the budget constraint:

$$c_i + t_i = I_i.$$

θ_i is an altruism parameter: it captures the weight that a child puts on a parents' utility. We assume that all sons have the same θ_S and all daughters have the same θ_D, and that sons weakly care more about parents than daughters, potentially due the former's ingrained obligation to take care of parents in old age: $\theta_S \geq \theta_D$. We further maintain the assumption that u and v are strictly concave and twice continuously differentiable functions: $u' > 0$ and $u'' < 0$; $v' > 0$ and $v'' < 0$. Furthermore, the parent's utility is separable in the three public goods H, T_S and T_D. We provide evidence consistent with such separability in the empirical Sections 3 and 5. The child's problem may be solved as part of a two-stage optimization problem: First, the child determines coresidence support to the parent and second, the child determines financial transfers to the parent.

First Stage Optimization: Coresidence

Each child chooses coresidence:

$$\max_{h_i\in\{0,1\}} \theta_i H - \gamma_i h_i,$$

where $H = max\{\delta_1 h_1, ..., \delta_n h_n\}$.

It is straightforward to see that no child will provide coresidence support to the parent if the parent does not value or dislikes coresidence with any child: $\theta_i \delta_i \leq 0\ \forall i$. The parent must value coresidence from children for the parent to stand a chance at receiving such support. Moreover, child i may provide coresidence support only if child i derives a surplus from the arrangement: $\theta_i \delta_i - \gamma_i \geq 0$. No child will provide coresidence support to the parent if $\theta_i \delta_i - \gamma_i < 0\ \forall i$.

Furthermore, for the parent to benefit from coresidence support, there must exists a child i:

$$\theta_i \delta_i - \gamma_i \geq \theta_i \delta_j \text{ ,} \forall j \neq i. \tag{A1}$$

To see this, consider the case where $\theta_i \delta_i - \gamma_i < \theta_i \delta_j$ for all i, j. Then, child i may free-ride on sibling j by not coresiding, and thus save on the cost γ_i while enjoying the benefits $\theta_i \delta_j$. However, sibling j will also reason in a similar way and seek to free-ride on other siblings so that no one would provide coresidence support. Thus, condition (A1) must hold for the parent to benefit from coresidence support from children.

Additionally, provided that (A1) is satisfied, there is a hierarchy such that the child with the highest residential surplus, $\theta_i \delta_i - \gamma_i$, will be the one to provide coresidence support to the parent. To see this, consider a family with three children:

$$\theta_1 \delta_1 - \gamma_1 > \theta_1 \delta_2 \text{ and } \theta_2 \delta_2 - \gamma_2 > \theta_2 \delta_3.$$

It is straightforward to see from the above inequalities that $\delta_1 > \delta_2 > \delta_3$. Moreover, Child 1 will coreside with the parent since Child 1 gets greater net benefits from providing coresidence support than allowing Child 2 or 3 to do so: $\theta_1 \delta_1 - \gamma_1 > \theta_1 \delta_2 > \theta_1 \delta_3$. Similarly, Child 2 and 3 get greater benefits: $\theta_2 \delta_1$ and $\theta_3 \delta_1$, respectively, by letting child 1 coreside with the parent and do not need to incur the cost, γ_i $i = 2, 3$, themselves. Conversely, if Child 1 did not exist, then Child 2 would provide the coresidence support rather than child 3. Thus, the child with the highest residential surplus is the most likely to coreside with the parent.

Several observations stem from this hierarchical structure. First, given patrilocal norms, δ_i is likely to be higher for a son than for a daughter. Similarly, sons are also more likely to be conditioned to provide coresidential support to parents and as such γ_i is likely to be lower for a son than for a daughter. Thus, a son is more likely to satisfy condition (A1) and is therefore more likely to provide coresidential support to a parent than is a daughter. Therefore, Prediction 1 also holds in the extended model.

Second, an increase in the number of brothers is expected to lead to a greater probability that at least one other brother will have a greater residential surplus: $\theta_j \delta_j - \gamma_j$ that the child himself. Thus, an increase in the number of brothers will decreases the probability that a son or daughter provides coresidential support to the parent. Therefore, Prediction 2 also holds in this model.

Second Stage Optimization: Financial Transfers

Each child chooses financial transfers:

$$\underset{\{t_i\}}{max}\, u\left(I_i - t_i\right) + \theta_i \left[v\left(\sum_{S=1}^{n_S} t_S\right) + v\left(\sum_{D=1}^{n_D} t_D\right)\right],$$

where the expression for consumption is derived from the budget constraint $c_i = I_i - t_i$.

Given the separate spheres in financial transfers, the second stage problem reduces to that of a gender specific public good problem with heterogeneous children within a gender. Under a Nash equilibrium among children of gender $g = S, D$, the optimal level of transfer to the parent is the solution to the following conditions:

$$\begin{array}{rcl} -u'\left(I_i - t_i\right) + \theta_i v'\left(\sum_{j=1}^{n_g} t_j\right) & = & 0 \quad if \quad t_i > 0, \\ -u'\left(I_i - t_i\right) + \theta_i v'\left(\sum_{j=1}^{n_g} t_j\right) & < & 0 \quad if \quad t_i = 0, \end{array} \tag{A2}$$

where t_i denotes the optimal financial transfers that each child i provides to the parent.

We now examine how an increase in the number of siblings may affect financial transfers at the *intensive* margin (i.e., when the first order conditions are satisfied with equality and $t_i > 0$). Denote $T_g = \sum_{j=1}^{n_g} t_j$, total transfers from gender $g = S, D$. Totally differentiating the equation in (A2) with respect to t_i, n_g and n_{-g}:

$$\left[u''\left(I_i - t_i\right) + \theta_i v''\left(T_g\right)\right] \cdot \partial t_i + \left[-u''\left(I_i - t_i\right) \cdot \frac{\partial I_i}{\partial n_g} + \theta_i v''\left(T_g\right) \cdot \frac{\partial T_g}{\partial n_g}\right] \partial n_g - u''\left(I_i - t_i\right) \cdot \frac{\partial I_i}{\partial n_{-g}} \partial n_{-g} = 0.$$

Rearranging and simplifying, we obtain the following partial effects for transfers from child i of gender g:

$$\frac{\partial t_i}{\partial n_g} = \frac{u'' \cdot \frac{\partial I_i}{\partial n_g} - \theta_i v'' \cdot \frac{\partial T_g}{\partial n_g}}{u'' + \theta_i v''} < 0. \tag{A3}$$

$$\frac{\partial t_i}{\partial n_{-g}} = \frac{u'' \cdot \frac{\partial I_i}{\partial n_{-g}}}{u'' + \theta_i v''} \leq 0. \tag{A4}$$

The weak inequality in (A4) stems from concavity of u and v and the assumption that $\frac{\partial I_i}{\partial n_{-g}} \leq 0$.

To prove the inequality in (A3), we next show that $\frac{\partial T_g}{\partial n_g} > 0$. From (A2), we can write transfers as:

$$t_i = I_i - u'^{-1}\left[\theta_i v'(T_g)\right].$$

Recall that children of the same gender have the same $\theta_i = \theta_g$. Denote total income of children of gender g as $I_g = \sum_{j=1}^{n_g} I_j$. We then sum transfers across children of gender g:

$$T_g = I_g - n_g u'^{-1}\left[\theta_g v'(T_g)\right]$$

Rewrite the above expression:

$$-u'\left(\frac{I_g - T_g}{n_g}\right) + \theta_g v'(T_g) = 0.$$

Totally differentiate the above expression with respect to T_g and n_g to get:

$$\left[u''\left(\frac{I_g - T_g}{n_g}\right)\cdot\frac{1}{n_g} + \theta_g v''(T_g)\right]\cdot \partial T_g - \left[u''\left(\frac{I_g - T_g}{n_g}\right)\cdot\frac{\left(n_g\frac{\partial I_g}{\partial n_g} - (I_g - T_g)\right)}{{n_g}^2}\right]\partial n_g = 0.$$

Rearranging the above expression, we get

$$\frac{\partial T_g}{\partial n_g} = \frac{1}{{n_g}^2}\cdot\frac{u''\cdot\left(n_g\frac{\partial I_g}{\partial n_g} - (I_g - T_g)\right)}{u''\cdot\frac{1}{n_g} + \theta_g v''} > 0.$$

The inequality stems from concavity of u and v, and the assumption that $\frac{\partial I_g}{\partial n_g} > \frac{I_g - T_g}{n_g}$. The latter assumption posits that an additional child of gender g would increase the total income of children by more than the average consumption of children, such that parents can now receive higher transfers from children. This assumption may apply to forward looking parents who optimize fertility to receive maximum transfers from children. Thus, total transfers from a given gender increase in the number of children of that gender. It follows that the inequality in (A3) holds.

From the partial effects (A3) and (A4), an increase in the number of brothers [sisters] leads to a decrease in the financial transfers provided by a son [daughter] to the parent and *may* lead to a decrease in the financial transfers provided by a daughter [son] to the parent. The former effect stems from the fact that sons and daughters provide financial support to parents in separate spheres such that an increase in the number of brothers [sisters] crowd-outs financial support from any particular son [daughter]. The latter effect stems from the fact that parents may have invested less in a son [daughter] if they have more daughters [sons] due to limited resources, thereby leading to a fall in the son's [daughter's] income. Nevertheless, if the number of sisters [brothers] does not decrease parental investments in a son [daughter], then financial transfers from the son [daughter] would not depend on the number of sisters [brothers]. We investigate this potential investment channel empirically in Section 5.

Additionally, comparing expressions (A3) and (A4), we can see that if $\left|\frac{\partial I_g}{\partial n_g}\right| \geq \left|\frac{\partial I_g}{\partial n_{-g}}\right|$, then $\left|\frac{\partial t_g}{\partial n_g}\right| > \left|\frac{\partial t_g}{\partial n_{-g}}\right|$. Thus if the income of a child of gender g is crowded-out by the same or by a greater extent when the child has more siblings the same gender compared with siblings of a different gender, then the financial support that the child provides to the parent will be crowded-out by a greater extent when the child has more siblings of the same gender compared to siblings of a different gender. Conversely, if $\left|\frac{\partial I_g}{\partial n_g}\right| < \left|\frac{\partial I_g}{\partial n_{-g}}\right|$, then $\left|\frac{\partial t_g}{\partial n_g}\right| \gtrless \left|\frac{\partial t_g}{\partial n_{-g}}\right|$. In particular, for $\left|\frac{\partial I_g}{\partial n_g}\right|$ close enough to $\left|\frac{\partial I_g}{\partial n_{-g}}\right|$, we may still have $\left|\frac{\partial t_g}{\partial n_g}\right| > \left|\frac{\partial t_g}{\partial n_{-g}}\right|$. Otherwise, $\left|\frac{\partial t_g}{\partial n_g}\right| \leq \left|\frac{\partial t_g}{\partial n_{-g}}\right|$. Thus, prediction 3 still holds in the extended model.

Thus, if our model is extended to allow heterogeneous income of children as well as differential altruism towards the parent for sons and daughters, the key predictions (1 to 3) continue to hold: Sons are more likely to provide coresidence support than daughters; an increase in the number of brothers decreases the probability that a son or daughter provides coresidence support; and an increase in the number of siblings of the same gender leads to a decrease in the financial transfers provided by a child by a larger margin while an increase in the number of siblings of a different gender may decrease financial transfers provided by a child by a smaller margin.

A.3 Standard Public Good Model

Consider the model in Section 2.1 but assume that financial support from sons and daughters are not separable. A parent's utility function is thus $C_P + v(T_S + T_D) + H$ and child i solves:

$$\max_{c_i>0, h_i \in \{0,1\}, t_i \geq 0} u(c_i) + \underbrace{C_P + v(T_S + T_D) + H}_{Parent's\,Utility} - \underbrace{\gamma_i h_i}_{Privacy\,Cost}$$

subject to the budget constraint:

$$c_i + t_i = I_i.$$

The child problem may once again be solved as part of a two-stage optimization problem. The first stage of the problem is as before so we turn our attention to the second stage of the problem. Each child chooses financial transfers:

$$\underset{\{t_i\}}{max}\, u\left(I_i - t_i\right) + v\left(\sum_{S=1}^{n_S} t_S + \sum_{D=1}^{n_D} t_D\right).$$

with the budget constraint $c_i = I_i - t_i$. Note the difference from the second stage of the gendered spheres model wherein t_S and t_D enter separately.

Under a symmetric Nash equilibrium within gender and focussing on interior solutions, the first order conditions for a son and a daughter are respectively given by:

$$-u'\left(I_S - t_S\right) + v'\left(n_S t_S + n_D t_D\right) = 0,$$

$$-u'\left(I_D - t_D\right) + v'\left(n_S t_S + n_D t_D\right) = 0.$$

Thus, it is straightforward to show that because $I_S > I_D$, sons will make larger transfers than daughters: $t_S > t_D$.

Totally differentiating the above two conditions with respect to t_S, t_D, n_S and n_D yields

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} \partial t_S \\ \partial t_D \end{bmatrix} = \begin{bmatrix} -e \\ -f \end{bmatrix} \partial n_S + \begin{bmatrix} -g \\ -h \end{bmatrix} \partial n_D,$$

where

$$\begin{array}{lclclcl} a &=& u''\left(I_S - t_S\right) + v''\left(n_S t_S + n_D t_D\right) n_S &;& e &=& v''\left(n_S t_S + n_D t_D\right) t_S \\ b &=& v''\left(n_S t_S + n_D t_D\right) n_D &;& f &=& v''\left(n_S t_S + n_D t_D\right) t_S \\ c &=& v''\left(n_S t_S + n_D t_D\right) n_S &;& g &=& v''\left(n_S t_S + n_D t_D\right) t_D \\ d &=& u''\left(I_D - t_D\right) + v''\left(n_S t_S + n_D t_D\right) n_D &;& h &=& v''\left(n_S t_S + n_D t_D\right) t_D \end{array}.$$

The Jacobian determinant is

$$|J| = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = u''_S \cdot u''_D + n_S \cdot u''_D \cdot v'' + n_D \cdot u''_S \cdot v'' > 0.$$

Using Cramer's rule, the partial effects for sons are given by

$$\frac{\partial t_S}{\partial n_S} = -\frac{1}{|J|}\left[t_S \cdot u_D'' \cdot v''\right] < 0,$$

$$\frac{\partial t_S}{\partial n_D} = -\frac{1}{|J|}\left[t_D \cdot u_D'' \cdot v''\right] < 0.$$

From these two partial effects, it can be shown that with $t_S > t_D$, $\left|\frac{\partial t_S}{\partial n_S}\right| > \left|\frac{\partial t_S}{\partial n_D}\right|$. Thus, an increase in the number of brothers crowds-out financial transfers from sons by more than an increase in the number of sisters.

And similarly for daughters:

$$\frac{\partial t_D}{\partial n_S} = -\frac{1}{|J|}\left[t_S \cdot u_S'' \cdot v''\right] < 0,$$

$$\frac{\partial t_D}{\partial n_D} = -\frac{1}{|J|}\left[t_D \cdot u_S'' \cdot v''\right] < 0.$$

Thus, with $t_S > t_D$, once again, $\left|\frac{\partial t_D}{\partial n_S}\right| > \left|\frac{\partial t_D}{\partial n_D}\right|$ and an increase in the number of brothers crowds-out financial transfers from daughters by more than an increase in the number of sisters.

Thus, the key difference between the predictions of the gendered public good model and the standard public good model, is that in the former, crowding-out of financial transfers occurs primarily within gender while in the latter, crowding-out of financial transfers occurs predominantly with respect to brothers rather than sisters. The weight of the empirical evidence does not lend support to the latter.

A.4 Gendered Competition Model

Finally we consider a gendered competition model . Suppose that financial transfers from children are symbolic, demonstrating close familial ties, rather than providing needed financial support to the parent (Hwang, 1987; Rosenzweig and Zhang, 2014; Xie and Zhu, 2009). As discussed in the text, these transfers can therefore be used to "purchas" attention, bequests, or other items from parents, leading to competition among children (Bernheim et al., 1985; Ho, 2022; Almås et al., 2020).

Consider a framework where sons compete for financial favors, that is, bequests, while daughters compete for attention. The genders may be inverted without loss of generality or there may be competiton for other rewards. For simplicity, we focus here on support from children in the form of financial transfers, although the same concept can be applied to coresidence.

Sons compete for bequests

Suppose that sons provide financial support to older parents because they anticipate bequests. A son solves

$$\underset{c_i,t_i}{Max}\, u(c_i)$$

subject to

$$c_i + t_i = I_i + \frac{t_i}{\sum_{S=1}^{n_S} t_S} B,$$

where B denotes the total bequests that the parent gives to sons. The bequest share is allocated according to a Tullock contest function.

Under a symmetric Nash equilibrium among sons,

$$\frac{(n_S - 1)\, t_S B}{(n_S t_S)^2} = 1.$$

Simplifying,

$$t_S = \frac{n_S - 1}{n_S^2} B.$$

Thus, financial support increases in bequests. The partial effect with respect to the number of sons is

$$\frac{\partial t_S}{\partial n_S} = -\frac{(n_S - 2)}{n_S^3} B.$$

Note that t_S is non-monotonic in n_S. In particular, if $n_S = 1$, then $t_S = 0$; if $n_S = 2$, then t_S increases; and if $n_s > 2$, then t_S decreases. Thus, if we compare families with one son to families with 2 sons, we should observe that t_S increases in n_S.

Daughters compete for attention

Suppose that daughters provide financial support to older parents only because they want attention from the parent. A daughter solves

$$\underset{c_i,t_i}{Max}\, u(c_i) + \frac{t_i}{\sum_{s=1}^{n_S} t_s} A$$

subject to

$$c_i + t_i = I_i,$$

where A denotes the total attention that the parent gives to daughters. The attention share is allocated according to a Tullock contest function.

Under a symmetric Nash equilibrium among daughters,

$$\frac{(n_D - 1)\, t_D A}{(n_D t_D)^2} = u'(I_D - t_D).$$

Simplifying,

$$t_D = \frac{n_D - 1}{u' \cdot n_D^2} A.$$

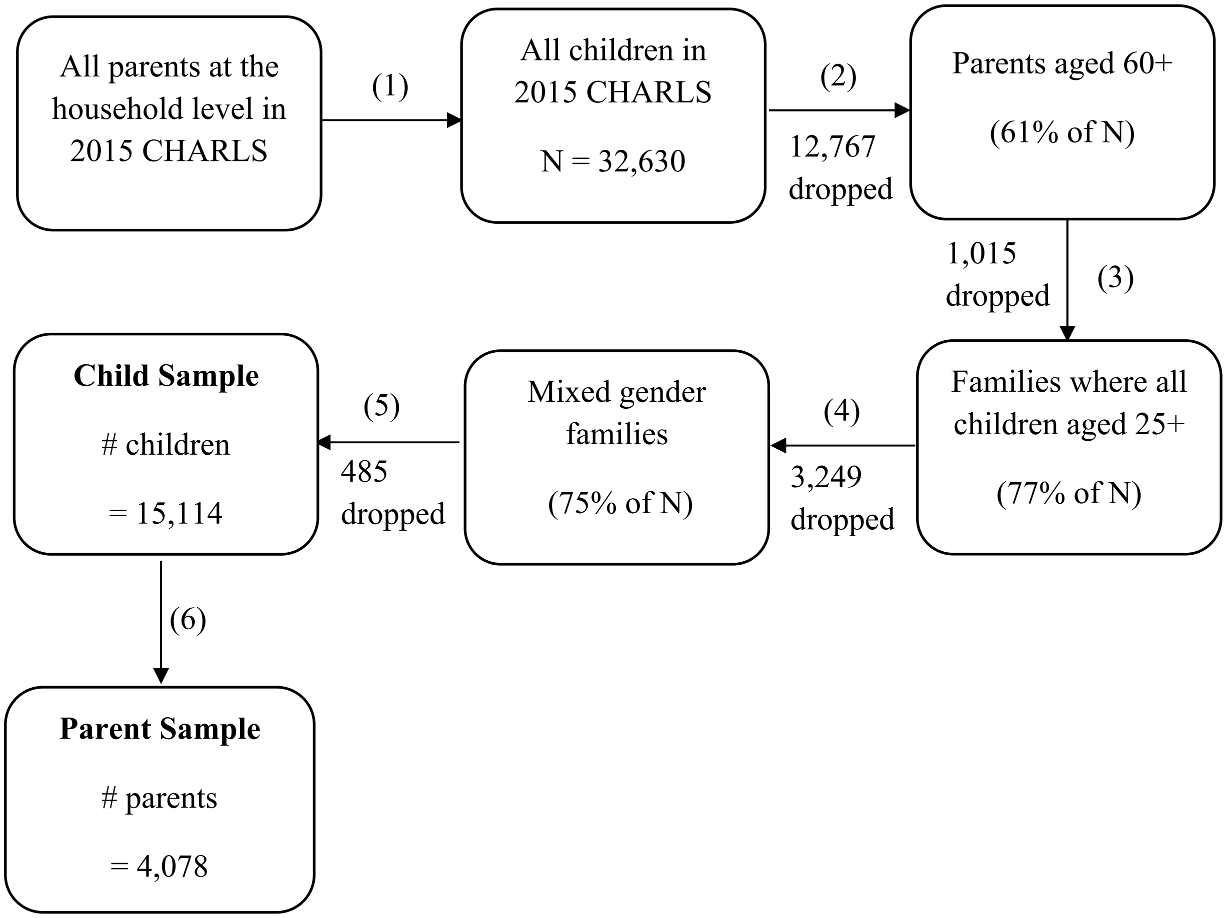
Thus, financial support from daughters increase in attention for daughters. Totally differentiate the Nash condition, use the expression for t_D, and simplify to get

$$\frac{\partial t_D}{\partial n_D} = -\frac{(n_D - 2)}{n_D^3 \left[-u'' \cdot t_D + u'\right]} A.$$

Note that t_D is non-monotonic in n_D. In particular, if $n_D = 1$, then $t_D = 0$; if $n_D = 2$, then t_D increases; and if $n_D > 2$, then t_D decreases. Thus, if we compare families with one daughter to families with 2 daughters, we should observe that t_D increases in n_D.

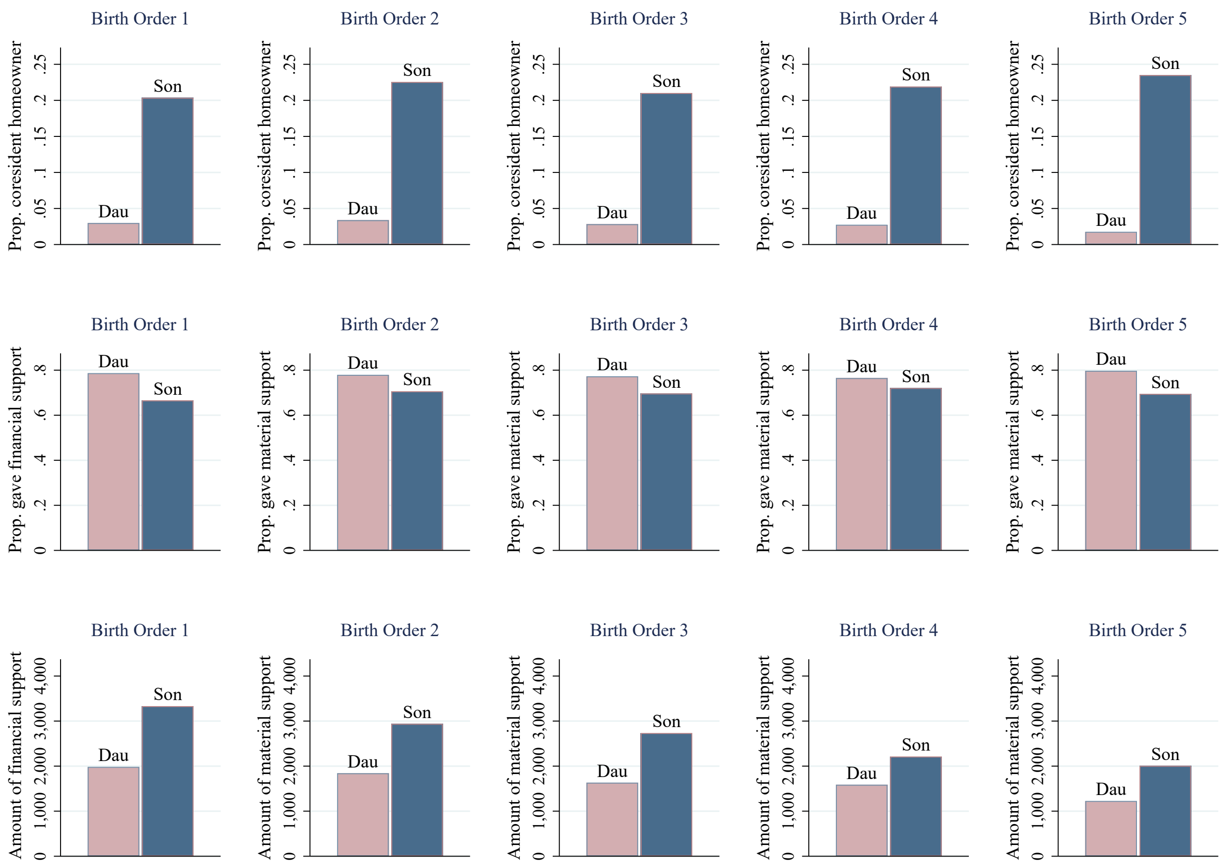
Thus, the key difference in the predictions between the gendered public goods model and the competition model is that in the former, we expected crowding-out of financial transfers, while in the latter, we expect some crowding-in of financial transfers. As shown in the text, the empirical evidence does not support a competition model.

Figure A1 Sample Selection



Note: The sample selection and construction are as follows: (1) reshape the CHARLS sample of parents into a sample containing all living children; limit the sample to children in families where (2) the parent is aged 60 and above, (3) all children are aged 25 and above, and (4) there are mixed gender children (at least one son and one daughter); (5) after Step 4, drop missing values and outliers on the selected sample to get the child sample; (6) reshape the child sample to the respondent level to get the parent sample.

Figure A2 Support from Sons and Daughters by Birth Order



Note: Means or proportions for sons and daughters from the child sample. The top, middle, and last rows depict, respectively, the proportion of children who are coresident homeowners, the proportion of children who gave financial support, and the amount of financial support at the intensive margin.

Table A1 Responsiveness of Predictors of Child Income to Sibling Gender Composition

	≤ Primary (1)	*Middle* (2)	*≥ High School* (3)	*HH Income* (4)
Sons' responsiveness to				
No. of brothers	0.024**	-0.010*	-0.014***	-1,080.48
	(0.006)	(0.006)	(0.005)	(597.70)
No. of sisters	0.012*	-0.012**	-0.000	-17.47
	(0.006)	(0.006)	(0.005)	(567.55)
Daughters' responsiveness to				
No. of brothers	0.031***	-0.019***	-0.011**	-556.37
	(0.006)	(0.006)	(0.005)	(566.20)
No. of sisters	0.027***	-0.015***	-0.014***	-488.10
	(0.005)	(0.005)	(0.005)	(594.22)
Child gender				
Male	0.112***	-0.030	-0.092***	17.26
	(0.030)	(0.030)	(0.026)	(2,290.41)
R-squared	0.249	0.047	0.222	0.131
Hansen J stat [p-val]	184.41 [0.40]	216.28 [0.03]	266.56 [0.00]	187.65 [0.33]
Mean/prop. of dependent var.	0.497	0.305	0.193	34,350.22
No. of children	15,114	15,114	15,114	15,114

Note: Marginal effects and standard errors (in parentheses) are reported. We employ two step estimation where the first step is a family FE regression of education or income on $Male$, $BirthOrder$, and X_{ij}^C, and the second step follows equation (9). The second step use the predicted measures of support from the first step, net of birth order effects, and a heteroscedastic based instrumental variable strategy. Child control variables include second order polynomials in age, indicators for male, married (and its interaction with male), poor health, and urban area, number of children (and its interaction with male). Parent control variables include second order polynomials in age, indicators for single male, single female, primary school, middle school or more, poor health, and urban region, $sinh^{-1}$(net household wealth), an indicator for missing net wealth, and dummies for province of residence. Standard errors are block-bootstrapped at the family level using 500 repetitions. Hansen tests of the hypothesis that the overidentifying restrictions are valid. $^{*}p < .10$;$^{**}p < .05$;$^{***}p < .01$.

Table A2 Responsiveness of Support from OLS and Two-Step Estimation

	Co-resident Homeowner (1)	*Gave Financial Support* (2)	*Ln(Amount of Financial support)* (3)
A. OLS			
Sons' responsiveness to			
No. of brothers	-0.048***	0.017**	-0.106***
	(0.005)	(0.006)	(0.023)
No. of sisters	-0.003	-0.021***	-0.022
	(0.006)	(0.007)	(0.023)
Daughters' responsiveness to			
No. of brothers	-0.009***	0.008	-0.019
	(0.002)	(0.007)	(0.021)
No. of sisters	-0.005**	-0.006	-0.081***
	(0.002)	(0.007)	(0.019)
Child gender			
Male	0.185***	-0.189***	0.240*
	(0.025)	(0.040)	(0.136)
R-squared	0.121	0.066	0.189
Mean/prop. of dependent var.	0.123	0.738	6.801
No. of children	15,114	15,114	11,151
B. Two-Step Estimation			
Sons' responsiveness to			
No. of brothers	-0.049***	0.017**	-0.106***
	(0.005)	(0.007)	(0.023)
No. of sisters	-0.002	-0.020***	-0.023
	(0.005)	(0.007)	(0.023)
Daughters' responsiveness to			
No. of brothers	-0.007***	0.013*	-0.028
	(0.002)	(0.007)	(0.020)
No. of sisters	-0.004*	-0.003	-0.094***
	(0.002)	(0.006)	(0.018)
Child gender			
Male	0.183***	-0.169***	0.227**
	(0.021)	(0.033)	(0.112)
R-squared	0.097	0.063	0.148
Mean/prop. of dependent var.	0.123	0.738	6.801
No. of children	15,114	15,114	11,151

Note: Panel A reports results from OLS regresssions of (5), with standard errors (in parentheses) clustered at the family level. Panel B replicates the results in Table 6 from two-step estimation of (9). $^{*}p < .10;^{**} p < .05;^{***} p < .01$.

Table A3 Selected Coefficients from Two-Step Estimation of (9)

	Co-resident Homeowner (1)	*Gave Financial Support* (2)	*Ln(Amount of Financial support)* (3)
Child characteristics			
Age	0.004	0.008*	-0.023
	(0.003)	(0.005)	(0.015)
Age squared	-0.000	-0.000*	0.000
	(0.000)	(0.000)	(0.000)
Married*Male	0.001	0.083***	-0.026
	(0.019)	(0.028)	(0.100)
Married	-0.006	0.070***	-0.098**
	(0.009)	(0.021)	(0.065)
No. of children*Male	0.028***	-0.003	0.043
	(0.007)	(0.009)	(0.028)
No. of children	-0.007**	0.007	-0.058***
	(0.003)	(0.007)	(0.022)
Lives in urban area	-0.049***	0.031**	0.391***
	(0.006)	(0.009)	(0.022)
Poor health	0.020**	-0.084***	-0.308***
	(0.009)	(0.014)	(0.051)
Parent characteristics			
Age	-0.001	0.018*	-0.073*
	(0.006)	(0.011)	(0.032)
Age squared	0.000	-0.000*	0.000*
	(0.000)	(0.000)	(0.000)
Primary school	-0.006	-0.008	0.183***
	(0.007)	(0.014)	(0.043)
Middle school or more	-0.005	-0.028*	0.305***
	(0.009)	(0.017)	(0.053)
Single male	0.029***	-0.018	-0.168***
	(0.010)	(0.019)	(0.062)
Single female	0.043***	0.041***	-0.016
	(0.008)	(0.013)	(0.044)
Lives in urban area	0.005	-0.066***	0.031
	(0.006)	(0.012)	(0.037)
Poor health	-0.007**	0.013	-0.086**
	(0.006)	(0.010)	(0.035)
Sinh^{-1}(Net household wealth)	0.001**	0.001	0.010***
	(0.000)	(0.001)	(0.003)
R-squared	0.097	0.063	0.148
Mean/prop. of dependent var.	0.123	0.738	6.801
No. of children	15,114	15,114	11,151

Note: Marginal effects and standard errors (in parentheses) are reported from two-step estimation corresponding to Table 6. Additional controls include indicators for missing value for net household wealth and province. $^{*}p < .10$;$^{**}p < .05$;$^{***}p < .01$.

Table A4 Responsiveness of Support Controlling for Inter Vivos from Parents

	Co-resident Homeowner (1)	*Gave Financial Support* (2)	*Ln(Amount of Financial support)* (3)
A. First Step			
Sons			
Any grandchild care	0.122***	0.035**	0.319***
	(0.014)	(0.014)	(0.046)
Any transfers from parents	-0.122**	0.290***	0.103
	(0.055)	(0.056)	(0.235)
Sinh^{-1}(Amount from parents)	0.015**	-0.041***	-0.035
	(0.007)	(0.008)	(0.033)
Daughters			
Any grandchild care	0.086***	-0.012	0.273***
	(0.024)	(0.025)	(0.086)
Any transfers from parents	-0.045	0.231***	-0.207
	(0.051)	(0.067)	(0.228)
Sinh^{-1}(Amount from parents)	0.010	-0.032***	0.026
	(0.007)	(0.010)	(0.034)
R-squared	0.149	0.056	0.079
B. Second Step			
Sons' responsiveness to			
No. of brothers	-0.042***	0.017**	-0.093***
	(0.005)	(0.007)	(0.023)
No. of sisters	-0.001	-0.022***	-0.018
	(0.005)	(0.009)	(0.023)
Daughters' responsiveness to			
No. of brothers	-0.006**	0.011*	-0.025
	(0.002)	(0.006)	(0.022)
No. of sisters	-0.002	-0.004	-0.084***
	(0.003)	(0.006)	(0.018)
Child gender			
Male	0.192***	-0.157***	0.267**
	(0.022)	(0.035)	(0.123)
R-squared	0.091	0.064	0.146
Hansen overid J stat [p-val]	233.70 [0.00]	198.90 [0.16]	180.52 [0.48]
Mean/prop. of dependent var.	0.123	0.741	6.786
No. of children	13,946	13,946	10,336

Note: Marginal effects and standard errors (in parentheses) from two-step estimation. The first step employs family FE models - controlling for birth order, economic, and child variables - and cluster standard errors at the family level. The second step uses the predicted measures of support - net of the effects of birth order, education, income, grandchild care, and transfers from parents - and 2SLS; controls include both parent and child variables; and standard errors are block-bootstrapped at the family level using 500 repetitions. $^{*}p < .10$;$^{**}p < .05$;$^{***}p < .01$.

Table A5 Responsiveness of Support without Age or Gender Composition Restrictions

	Co-resident Homeowner (1)	*Gave Financial Support* (2)	*Ln(Amount of Financial support)* (3)
A. Including Younger Families			
Sons' responsiveness to			
No. of brothers	-0.045^{***}	0.009	-0.123^{***}
	(0.004)	(0.006)	(0.020)
No. of sisters	-0.008^{***}	-0.034^{***}	-0.010
	(0.002)	(0.006)	(0.020)
Daughters' responsiveness to			
No. of brothers	-0.004	-0.001	-0.037^{*}
	(0.005)	(0.006)	(0.020)
No. of sisters	-0.004^{**}	-0.012^{**}	-0.082^{***}
	(0.002)	(0.006)	(0.016)
Child gender			
Male	0.178^{***}	-0.078^{***}	0.306^{***}
	(0.011)	(0.015)	(0.051)
R-squared	0.081	0.096	0.180
Hansen overid J stat [p-val]	319.28 [0.00]	222.45 [0.09]	208.28 [0.26]
Mean/prop. of dependent var.	0.130	0.729	6.857
No. of children	23,521	23,521	15,901
B. Including Single Gender Families			
Sons' responsiveness to			
No. of brothers	-0.048^{***}	0.011	-0.102^{***}
	(0.004)	(0.007)	(0.022)
No. of sisters	-0.006	-0.011^{*}	-0.012
	(0.004)	(0.006)	(0.019)
Daughters' responsiveness to			
No. of brothers	-0.022^{***}	0.015^{**}	-0.046^{**}
	(0.003)	(0.006)	(0.019)
No. of sisters	-0.007^{***}	-0.001	-0.072^{***}
	(0.002)	(0.006)	(0.017)
Child gender			
Male	0.211^{***}	-0.103^{***}	0.207^{***}
	(0.012)	(0.019)	(0.058)
R-squared	0.095	0.064	0.186
Hansen overid J stat [p-val]	298.88 [0.00]	224.47 [0.08]	201.75 [0.37]
Mean/prop. of dependent var.	0.101	0.676	6.949
No. of children	18,260	18,260	13,305

Note: Marginal effects and standard errors (in parentheses) are reported. $^{*}p < .10;^{**} p < .05;^{***} p < .01$.

Table A6 Responsiveness of Support for Adjacent Waves

	Co-resident Homeowner (1)	*Gave Financial Support* (2)	*Ln(Amount of Financial support)* (3)
A. 2013 Wave			
Sons' responsiveness to			
No. of brothers	-0.021***	0.023***	-0.134***
	(0.005)	(0.008)	(0.023)
No. of sisters	-0.005	-0.017**	-0.067***
	(0.005)	(0.008)	(0.024)
Daughters' responsiveness to			
No. of brothers	0.002	0.011	-0.010
	(0.002)	(0.007)	(0.024)
No. of sisters	-0.001	0.004	-0.118***
	(0.002)	(0.008)	(0.020)
Child gender			
Male	0.133***	-0.181***	0.468***
	(0.024)	(0.046)	(0.131)
R-squared	0.080	0.088	0.172
Hansen overid J stat [p-val]	200.90 [0.14]	197.02 [0.18]	205.64 [0.09]
Mean/prop. of dependent var.	0.075	0.740	6.538
No. of children	11,741	11,741	8,687
B. 2018 Wave			
Sons' responsiveness to			
No. of brothers	0.008	0.004	-0.181***
	(0.006)	(0.008)	(0.022)
No. of sisters	0.001	-0.008	-0.069***
	(0.007)	(0.007)	(0.024)
Daughters' responsiveness to			
No. of brothers	0.001	-0.009	-0.051**
	(0.004)	(0.007)	(0.023)
No. of sisters	0.002	-0.008	-0.061***
	(0.003)	(0.006)	(0.018)
Child gender			
Male	0.066***	-0.164***	0.286**
	(0.022)	(0.032)	(0.115)
R-squared	0.100	0.063	0.140
Hansen overid J stat [p-val]	206.60 [0.08]	183.42 [0.42]	181.16 [0.46]
Mean/prop. of dependent var.	0.135	0.786	6.871
No. of children	13,932	13,932	10,955

Note: Marginal effects and standard errors (in parentheses) from two-step estimation. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$.

Table A7 Responsiveness of Financial Transfers for Adjacent Waves

	Cash Support		*In-Kind Support*	
	Gave Any	*Ln(Amount)*	*Gave Any*	*Ln(Amount)*
	(1)	(2)	(3)	(4)
A. 2013 Wave				
Sons' responsiveness to				
No. of brothers	0.027***	-0.177***	0.010	-0.097***
	(0.009)	(0.024)	(0.009)	(0.028)
No. of sisters	-0.010	-0.093***	-0.015*	-0.030
	(0.009)	(0.027)	(0.009)	(0.034)
Daughters' responsiveness to				
No. of brothers	0.020**	-0.028	0.001	0.008
	(0.009)	(0.024)	(0.010)	(0.028)
No. of sisters	0.007	-0.143***	-0.007	-0.080***
	(0.008)	(0.020)	(0.008)	(0.022)
Child gender				
Male	-0.026	0.528***	-0.266***	0.209
	(0.048)	(0.138)	(0.046)	(0.156)
R-squared	0.102	0.229	0.071	0.170
Hansen J stat [p-val]	200.03 [0.15]	188.55 [0.33]	174.83 [0.59]	191.72 [0.26]
Mean/prop. of dependent var.	0.530	6.514	0.507	5.865
No. of child-wave obs.	11,741	6,224	11,652	5,904
B. 2018 Wave				
Sons' responsiveness to				
No. of brothers	0.011	-0.213***	-0.009	-0.160***
	(0.009)	(0.024)	(0.008)	(0.027)
No. of sisters	0.009	-0.081***	-0.020**	-0.103***
	(0.008)	(0.025)	(0.008)	(0.026)
Daughters' responsiveness to				
No. of brothers	0.007	-0.076***	-0.024***	-0.095***
	(0.008)	(0.023)	(0.008)	(0.019)
No. of sisters	0.019**	-0.106***	-0.019***	-0.099***
	(0.008)	(0.017)	(0.007)	(0.019)
Child gender				
Male	-0.043	0.338***	-0.220***	-0.009
	(0.037)	(0.113)	(0.034)	(0.114)
R-squared	0.084	0.082	0.161	0.037
Hansen J stat [p-val]	186.90 [0.35]	176.50 [0.56]	208.05 [0.07]	196.42 [0.19]
Mean/prop. of dependent var.	0.546	6.886	0.622	6.078
No. of child-wave obs.	13,932	7,609	13,696	8,519

Note: Marginal effects and standard errors (in parentheses) from two-step estimation. $^{*}p < .10$;$^{**}\ p < .05$;$^{***}\ p < .01$.

Table A8 Responsiveness of Support for Children in Families with 1 or 2 Sons or Daughters

	Co-resident Homeowner (1)	*Gave Financial Support* (2)	*Ln(Amount of Financial support)* (3)
A. Families with 1-2 sons			
Sons' responsiveness to			
No. of brothers	-0.066***	0.037**	-0.290***
	(0.014)	(0.016)	(0.058)
No. of sisters	-0.016**	-0.013	-0.054*
	(0.007)	(0.008)	(0.029)
Daughters' responsiveness to			
No. of brothers	-0.001	0.026*	-0.069
	(0.004)	(0.015)	(0.045)
No. of sisters	0.000	-0.000	-0.096***
	(0.003)	(0.008)	(0.021)
Child gender			
Male	0.185***	-0.159***	0.424***
	(0.026)	(0.044)	(0.147)
R-squared	0.126	0.064	0.150
Hansen overid J stat [p-val]	213.63 [0.04]	201.54 [0.13]	197.56 [0.18]
Mean/prop. of dependent var.	0.121	0.741	6.690
No. of children	10,326	10,326	7,656
B. Families with 1-2 daughters			
Sons' responsiveness to			
No. of brothers	-0.047***	0.015*	-0.104***
	(0.006)	(0.008)	(0.027)
No. of sisters	-0.007	-0.002	-0.010
	(0.013)	(0.016)	(0.053)
Daughters' responsiveness to			
No. of brothers	-0.010***	0.018***	-0.047***
	(0.003)	(0.007)	(0.024)
No. of sisters	-0.012*	0.010	-0.131***
	(0.006)	(0.014)	(0.045)
Child gender			
Male	0.177***	-0.143***	0.091***
	(0.026)	(0.042)	(0.147)
R-squared	0.088	0.058	0.145
Hansen overid J stat [p-val]	220.72 [0.02]	194.44 [0.22]	176.87 [0.55]
Mean/prop. of dependent var.	0.134	0.742	6.910
No. of children	10,147	10,147	7,527

Note: Marginal effects and standard errors (in parentheses) are reported. $^{*}p < .10$;$^{**}p < .05$;$^{***}p < .01$.