

Substitution Effects in Parental Investments

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Abstract

As an influential theory on intergenerational transfers, Becker's (1991) unitary model argues that parents should first choose investments in their children to maximize total household wealth, and then use intra-household transfers to compensate for differences in children's income so that consumption among their children maximizes parental utility. Traditional tests of the unitary model usually require either direct measures or certain proxies of individual-specific income.

Patrilocality is a common practice in rural societies of developing countries. The nature of co-residence and joint production makes the income contribution of individual household members hard to identify, hence the traditional tests of the unitary model are usually impractical to implement. This paper provides a new test of Becker's unitary model for traditional rural households. We recognize that adult income is a consequence of childhood investments made by parents. Our test is therefore based on studying how parental transfers adjust to compensate for differences in parental investments.

We build a generic unitary model to deliver a regression of parental transfers on schooling expenditure for each child in the household, controlling for household and sibling fixed effects in a multiplicative form. We apply our test using a unique household survey dataset from rural China collected by the authors, where expenditures on education are the largest component of monetary parental investment, and bride-prices plus land divisions are typically the largest transfers from parents to sons. The latter provides us with a measure closer to the lifetime inter-vivos transfer in Becker's model.

Our preferred estimate implies that when a son receives one yuan less in schooling investment than his brother, he will obtain 0.7 yuan more in observable marital and post-marital transfers as partial compensation. Controlling for unobserved household heterogeneity, a fuller accounting of lifetime transfers, and controlling for consumption differences across sons are quantitatively important. The point estimate provides the strongest quantitative support for the unitary model to date.

JEL code: D13, J12, J13

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1 Introduction

Parents have to decide how much to invest and the types of investment to make in each of their children. As summarized in his 1991 book, Becker argues that parents should first choose investments in their children to maximize total household wealth, and then use intra-household transfers to distribute consumption among their children to maximize parental utility. Family members' consumption levels are independent of their income contributions to the family wealth.

The above model is known as the unitary or wealth maximization model of the family. There are three classes of tests of the model based on the above two predictions. One class is the income pooling test. If family member i gains a dollar of exogenous own income while member j loses a dollar of exogenous own income, there should be no change in i 's or j 's consumption because total family wealth remains the same. The results from this test generally reject the unitary model (E.g. Thomas (1990); Altonji et al (1992); Lundberg et al (1997); Duflo (2003); Bobonis (2009)).

The second class is the income difference transfer test (E.g. Menchik (1980, 1988); Cox (1987); Cox and Rank (1992); Altonji et al (1997); Raut and Tran (2005)). If family member i gains a dollar of exogenous own income and member j loses a dollar of exogenous own income, i will receive one dollar less in intra-household transfers and j will receive one dollar more in transfers; hence every family member's consumption remains the same. Empirical results of this literature are mixed. Based on US bequests data, Menchik (1980, 1988) argues that there are no compensating transfers within most families. Using pension and household survey in the US, Cox (1987), Cox and Rank (1992) find that transfers are reinforcing rather than compensatory. Using the PSID data, Altonji, et. al. estimate a marginal compensation effect of 0.13, which is a very small. Using data from Indonesia, Raut and Tran (2005) estimate the same specification as Altonji et al (1997), but with data on transfers from children to parents. They find a compensation effect of 0.95, which is much higher than estimates with US data.

A third class of test is based on the hypothesis that families invest to maximize household wealth. Efficiency in investments requires more resources to be directed towards family members with higher marginal return or lower marginal cost, which serves as a testable implication in this literature (E.g. Udry (1996); Qian (2008)). Udry's (1996) study of African rural households reveals that, within the same household, plots controlled by women have significantly higher marginal productivity of capital and labor input than the plots controlled by men, indicating that production inputs are not efficient among these households. Comparing across different regions of China, Qian (2008) found that daughters had higher survival rates when their adult wages are higher, consistent with the unitary model.

The choice of which test to use is primarily driven by data availability. In most of developing societies, especially in rural area, sons typically either live with their parents or stay in the same village after they marry. Parents and children often farm and conduct other businesses together. Thus, there are closer interactions between parents and adult sons than observed in modern urban environments. Allocation decisions within rural households are more likely to be made consistently with the unitary model. However, tests of the unitary model among these rural societies are limited

because of the nature of patrilocality: as household incomes are jointly earned, data on the income contribution of each adult household member is usually unavailable;¹ in addition, daily financial transfers among household members, normally identified by the difference between individual specific consumption and income, are also hard to measure. To get around the measurement problems, most studies testing for income pooling use policy or geographic variations to proxy for individual-specific income changes;² while the literature on income difference transfer test tends to ignore the co-resident sample completely.³

This paper provides a new test of the unitary model for traditional rural households called the investment difference transfer test. It is based on studying how parental transfers adjust to compensate for differences in parental investments. We apply our test using a unique household survey dataset from rural China, where patrilocality is a common practice: 38 percent of the sons live with their parents, and 64 percent live in the same village with their parents after marriage. To test the unitary model in this environment, we study the relationship between a significant investment, educational expenditure, and two inter-vivos transfers made by Chinese villagers to their sons: marital transfers (bride-price), and post-marital land divisions. As suggested by our interviews with parents, and also confirmed by our data, educational expenditures are the largest component of monetary parental investment. Bride-prices plus land divisions are typically the largest transfers from parents to sons. In this sense, they are closer to the lifetime inter-vivos transfer in Becker's model.⁴

Our regression specifications and the interpretation of our results are guided by a generic unitary model, which can nest all of the alternative tests discussed above. We use the model to deliver a regression of a measure of parental transfers on schooling expenditure for each child in the household, controlling for household and sibling fixed effects in a multiplicative form. The regression provides a casual estimate of how parents adjust a particular transfer to their children in response to differences in schooling expenditures on these children. We call this regression coefficient the *marginal compensation coefficient*. In the standard unitary model, this coefficient should identify the return to the children's schooling investment, r , which should be higher than 1.0. However, when a rural family invests in a child, a portion of the gross return to the investment may accrue to the family rather than to the child directly.⁵ If a child directly appropriates a fraction f of the gross returns from his investment, the marginal compensation coefficient estimates $f \cdot r$. When $f < 1$, the 1.0 benchmark is only suggestive.

The main empirical finding of our paper is that our point estimate of the marginal compensation

¹Duflo (2003) is an exception.

²For example, Qian (2008) uses inter-regional variation in tea production as a proxy for female wage. Bobonis (2009) uses a child care subsidy program to proxy for an increase in wife's income and rain shocks to proxy for the variations in jointly-held income by the couple.

³This sample selection is salient both in studies on developing counties (e.g. Raut and Tran (2005)) and studies on developed counties (e.g. Altonji et al (1997)).

⁴While we use the term bride-price for convenience, most if not all the transfer is given to the son to help him set up his new household. It is not a transfer payment to the bride's family.

⁵Most obviously, this will occur when the activity is jointly carried out by family members. Even if the activities are carried out separately, and children do not live with their parents, some portion of the gross return may be appropriated by the family.

coefficient for differences in schooling expenditures across sons is 0.7. The estimate implies that when a son receives one yuan less in schooling investment than his brother, he will obtain 0.7 yuan more in transfers that are *observed by us* as partial compensation. This point estimate is significantly larger than previous estimates of compensating transfers for differences in intra-household investments. In the farming households considered here, full appropriation of the returns to schooling expenditure ($f = 1$) is not appropriate. The 1.0 benchmark for $f \cdot r$ is not compelling. Thus the evidence here provides significant support for the unitary model for the communities in our study.

Four factors are important in obtaining our point estimate. First, it is quantitatively important to control for unobserved household heterogeneity. Due to data limitations, most researchers cannot control for household unobservables. In the context of the income difference transfer test, if children from richer families receive more in parental investments and have higher own incomes, failing to control for household unobservables will result in a substantial underestimate of the parental compensation response. Our results confirm the downward biases in the OLS regressions: the estimated marginal compensation coefficient increases by a third in absolute value when we control for unobserved household heterogeneity.

Second, fuller accounting for lifetime transfers matters. Becker's model is static. Most empirical work, including ours, tests the model using partial lifetime transfers and partial lifetime income observed over a window of only a few years.^{6,7} Using partial lifetime transfers to carry out our test leads to a systematic bias in our estimate of the marginal compensation coefficient. The extent of the bias can be tested with multiple transfers and we do so here. The household fixed effects regression of marital transfers on schooling expenditure delivers an estimated marginal compensation coefficient of 0.4. By adding post-marital land transfers to the bride price, we increase the value of the estimated compensation coefficient to 0.7.

Third, controlling for other observed sibling differences does not change the estimated homogeneous marginal compensation coefficient. Most studies based on sibling variation assume "equal concern", i.e., parents put equal weights on the consumption of their children in the utility function. Parents may 'like' children with higher income more. In this case, parents may not fully compensate those children with lower earnings. Some previous rejections of the unitary model may be due to "unequal concern" rather than non-unitary behavior. Our empirical results show that parents do not equalize consumption across children. We further relax the homogeneous marginal compensation coefficient assumption and find that children's attributes affect the magnitude of the marginal compensation coefficients as predicted by the theoretical model, but these effects are not

⁶To name a few, the President's Commission on Pension Policy (PCPP) survey used by Cox (1987) reports transfers received by children in 1979. The Panel Study of Income Dynamics (PSID) data used by Altonji et al (1997) include transfers of more than 100 dollars in 1988. The Health and Retirement Study (HRS) data used in McGarry and Schoeni (1995) reports transfers of 500 dollars or more made to each child over the past two years.

⁷Altonji et al (1997) show that under some circumstances using partial lifetime transfers is valid. For example, a child's unemployment spell may spill over two years. A parent may aid the child when the child's savings run low. Thus there may be little or no transfer in the first year in which the unemployment spell is located. In the second year, the transfer may be high relative to the income loss. Such measurement error may lead to rejection of the unitary model.

precisely estimated due to our small sample size.

Lastly, the optimal transfer to a child may be negative and infeasible because the child refuses to cooperate. In these cases, optimal parental investments are more complicated because the two-step optimization breaks down (Behrman, et. al. (1995)). When negative transfers are infeasible, tests using data with only positive transfers may suffer from selection bias.⁸ Our current framework does not deal with corner solutions in our measure of parental transfers where the two-step optimization fails.⁹ But this problem is not quantitatively significant in our context because nearly all of the sons receive strictly positive bride-prices.^{10,11}

We check the robustness of our results along several dimensions. Accounting for measurement error in schooling expenditure, discounting of the timing of school expenditures and bride prices, or accounting for the public goods' components in children's consumption do not increase the estimate of the compensation coefficient.

This paper is organized as follows. Section 2 presents a model of parental investment, derives testable implications, and discusses identification issues. Section 3 introduces the data and descriptive results. Section 4 reports the estimation results. Section 5 addresses some related issues. Section 6 concludes the paper.

2 A Unitary Model of Parental Investment

Consider a household h with two of their children, denoted by $i = 1, 2$ respectively. The parents have a wealth endowment of m_h . Child i has ability level a_{ih} . The parents decide how to allocate family resources to its members.

Let the parents' utility function be

$$U_h = u(c_h, c_{1h}, c_{2h}) \tag{1}$$

where $u(\cdot)$ is a twice differentiable, concave function; c_h represents the consumption of the parents; c_{ih} is child i 's consumption.¹² A family may have more than two children; the consumption of the

⁸Cox (1987); Altonji et al (1997); Raut and Tran correct for selection in their empirical work.

⁹Two-step optimization may also fail when the marginal utilities of consumption and labor supply are not separable in the household utility function (Pitt et. al. (1990)). In this case, welfare maximization does not necessarily require total household wealth maximization.

¹⁰It is an issue with dowries for daughters where one-third of the households provide no dowry to at least one daughter.

¹¹Our paper does not address gender difference. The gender difference patterns in our data are similar with other developing counties (e.g. villages examined by Quisumbing's (1994) in Philippines): girls receive comparable schooling investments with their brothers, but they generally receive significantly less dowry and nearly no bequests. We believe that this transfer disparity in gender requires deeper investigation of institutional details, which will not be captured by the simple generic Becker model. We leave this to future research.

¹²As later on we will use the marital transfer as a measure of inter-vivos transfers, we might think of incorporating the marital market clearing conditions into our framework. This can be easily done by assuming positive assortative matching among spouses. Imagine that parents care not only about the consumption level of their own children, but also about the consumption of whom they are married. For example, we can consider a family h thinking of finding potential spouses for their sons 1 and 2 by equipping them with consumption level c_{1h}^g and c_{2h}^g so that they can attract brides with expected consumption levels of \hat{c}_{1h}^b and \hat{c}_{2h}^b respectively. Here we use superscript g and b to

other children in the household is subsumed in parental consumption.

Parents can invest in their children's schooling. Let the parents spend s_{ih} on child i 's schooling. This expenditure generates $R(s_{ih}, a_{1h}, a_{2h}, m_h)$ revenue from i 's schooling for the family. $R(\cdot)$ may be labor earnings if the child works outside the home. In rural households, $R(\cdot)$ is the contribution of the child to family income. We expect $R(\cdot)$ to be increasing in its arguments. The total cost of s_{ih} to the family is $C(s_{ih}, a_{1h}, a_{2h}, m_h)$. The cost function $C(\cdot)$ contains both the monetary and time cost to the family associated with each yuan spent in schooling. Notice that our cost and benefit functions are generic: they depend not only the children's own attributes (s_{ih}, a_{ih}) and family attributes (m_h), but also their sibling's attributes as well.

The budget constraint of the family is

$$\begin{aligned} c_h + c_{1h} + c_{2h} &= m_h + \sum_{i=1}^2 (R(s_{ih}, a_{1h}, a_{2h}, m_h) - C(s_{ih}, a_{1h}, a_{2h}, m_h)) \\ &= m_h + \sum_{i=1}^2 \Pi(s_{ih}, a_{1h}, a_{2h}, m_h) \\ &\equiv w_h \end{aligned}$$

where $\Pi(\cdot)$ denotes the profit from schooling investment and w_h denotes the total family wealth available for consumption.

To maximize utility, schooling investments should be chosen to maximize total family wealth. The first order condition

$$\frac{\partial R(s_{ih}, a_{1h}, a_{2h}, m_h)}{\partial s_{ih}} = \frac{\partial C(s_{ih}, a_{1h}, a_{2h}, m_h)}{\partial s_{ih}} \quad (2)$$

determines the optimal schooling investment level $s_{ih}^*(a_{1h}, a_{2h}, m_h)$ of child i . The two schooling decisions will determine optimal family wealth $w_h^*(s_{1h}, s_{2h}, a_{1h}, a_{2h}, m_h)$.

We now solve for the optimal consumption allocations. Following Becker, we employ a homothetic utility function $u(\cdot)$. A convenient property of homotheticity is that the expenditure on each consumption good will be a fixed proportion of total wealth. In our context, the utility maximizing level of consumption will be

$$c_{1h}^* = k_{1h} w_h^* \quad (3)$$

$$c_{2h}^* = k_{2h} w_h^* \quad (4)$$

$$c_h^* = (1 - k_{1h} - k_{2h}) w_h^* \quad (5)$$

denote the groom and bride. The parental utility function is then $\tilde{u}(c_h, c_{1h}^g, \hat{c}_{1h}^b, c_{2h}^g, \hat{c}_{2h}^b)$.

This equation, however, can be simplified to equation (1) through positive assortative matching in the marriage market. To illustrate this point, assume that the matching function takes the form $c_{ih}^b = \phi_0 + \phi_1 c_{ih}^g + \nu_{ih}$, where $i = 1, 2$ and ν_{ih} is the deviation (with zero mean) from positive assortative matching in wealth due to love and other match-specific factors. From the parents' point of view, the expected daughter-in-law should possess $\hat{c}_{ih}^b = \phi_0 + \phi_1 c_{ih}^g$. Plugging into the utility function yields $\tilde{u}(c_h, c_{1h}^g, \hat{c}_{1h}^b, w_{2h}^g, \hat{w}_{2h}^b) = \tilde{u}(c_h, c_{1h}^g, \phi_0 + \phi_1 c_{1h}^g, c_{2h}^g, \phi_0 + \phi_1 c_{2h}^g) = u(c_h, c_{1h}^g, c_{2h}^g)$ which is the utility function (1) we use in the model.

where k_{ih} denotes the proportion of total family wealth allocated to child i .¹³ We do not interpret k_{ih} as parental preference parameters. Different values of k_{ih} serve as a convenient form to capture alternative concerns as to why different children may have different levels of consumption. Parents may give more consumption to their older sons not because they "like" them more than their other sons, but because the older sons are more likely to live with them after marriage and provide them elder support. Such dynamic concerns from the parents are embedded in our model through k_{ih} . Becker refers to the case where $k_{1h} = k_{2h}$ as equal concerns. In our context, equal concerns has no normative implication.

The parents can affect child i 's consumption through two channels: revenue from schooling investment for the whole family, R_{ih}^* , and parental transfers, t_{ih} . The total consumption of child i is

$$c_{ih}^* = k_{ih}w_{ih}^* = t_{ih}^* + f_{ih}R_{ih}^*$$

In rural households, $R(s_{ih}^*, a_{1h}, a_{2h}, m_h)$ may include family income that is jointly earned. Thus, not all of it may be appropriated by the child. $f_{ih} \in [0, 1]$ is the proportion of $R(s_{ih}^*, a_{1h}, a_{2h}, m_h)$ retained by the child for his own consumption.¹⁴ Substituting in the optimal consumption and schooling investment levels, the optimal inter-vivos transfer to child i is

$$t_{ih}^* = k_{ih}w_h^* - f_{ih}R_{ih}^* \quad (6)$$

So far, we have characterized the parental investment behavior under a framework that allows heterogeneity in both parents and children's attributes, and unequal parental valuations of their investments across children. We want to emphasize that the model presented here is a generic unitary model that nests all tests proposed in the literature. The choice of tests crucially depends on data availability. With the marginal returns (R) and investment data (s), as the female wage and educational investment in Qian (2008), one can test the model using the first order condition (2) and see if members with higher perspective returns receive more investments; with income (fR) and consumption data (c), as the child allowance shift from the father to the mother and gender specific expenditure in Lundberg et al (1997), one can use consumption decision equation (3) and (4) and see if family members' consumption remains the same with a dollar of income shift from one individual to the other within the family; with income (fR) and transfer data (t) as in Altonji et al (1997), one can test the model using equation (6) and see if, holding family wealth (w_h) constant, a dollar increase in income decrease transfers received by one dollar (so that the consumption is unchanged).

In our specific context, as in most developing countries, the individual income (fR) is not well

¹³ k_{ih} represents the weight parents put on child i 's consumption level in their utility function. To illustrate this point, consider two examples of the parental utility functions. If (1) $U_h = c_h^{1-\alpha_{1h}-\alpha_{2h}} c_{1h}^{\alpha_{1h}} c_{2h}^{\alpha_{2h}}$, then $k_{1h} = \alpha_{1h}, k_{2h} = \alpha_{2h}$; if (2) $U_h = [(1 - \alpha_{1h} - \alpha_{2h})c_h^\rho + \alpha_{1h}c_{1h}^\rho + \alpha_{2h}c_{2h}^\rho]^{\frac{1}{\rho}}$, then $k_{1h} = \frac{\alpha_{1h}^{\frac{1}{1-\rho}}}{\alpha_{1h}^{\frac{1}{1-\rho}} + \alpha_{2h}^{\frac{1}{1-\rho}} + (1-\alpha_{1h}-\alpha_{2h})^{\frac{1}{1-\rho}}}, k_{2h} = \frac{\alpha_{2h}^{\frac{1}{1-\rho}}}{\alpha_{1h}^{\frac{1}{1-\rho}} + \alpha_{2h}^{\frac{1}{1-\rho}} + (1-\alpha_{1h}-\alpha_{2h})^{\frac{1}{1-\rho}}}$.

¹⁴Parents and other family members obtain $(1 - f_{ih})R_{ih}^*$.

defined and hard to measure. Instead, we observe parental investments (s) and transfers (t). In this case, what we can learn from the data is the compensation/substitution relationship between s and t based on equation (6). We will develop a new test using this relationship to examine the fitness of the unitary model to the data.

2.1 Empirical specification

To turn (6) into a regression equation of transfers on schooling expenditure, consider a constant-marginal-return form of revenue $R(\cdot)$ on s_{ih}^* :

$$R(s_{ih}^*, a_{1h}, a_{2h}, m_h) = R(s_{ih}^*(a_{1h}, a_{2h}, m_h), a_{ih}) = r_{ih}s_{ih}^* + e_{ih}$$

where e_{ih} is an i.i.d random shock with $cov(s_{ih}^*, e_{ih}^*) = 0$ and r_{ih} is the marginal rate of return to schooling expenditure. For empirical tractability, we assume that other siblings' attributes a_{jh} ($j \neq i$) and parental wealth m_h only affect child i 's schooling return function R through his optimal schooling investment s_{ih}^* .

Substituting the above into (6), we have:

$$t_{ih}^* = k_{ih}w_h^* - f_{ih}r_{ih}s_{ih}^* - f_{ih}e_{ih} \quad (7)$$

We call $f_{ih}r_{ih}$ the *marginal compensation coefficient*. It measures the marginal effect of a child's schooling expenditure on his parental transfer.

The distinction between r_{ih} and $f_{ih}r_{ih}$ deserves attention. The former is the marginal return at the household level, while the latter is at the individual level. $(1 - f_{ih})r_{ih}$ captures the externalities that other family members benefit from the schooling investment in child i . In our context, parents are the only decision makers. When making schooling investment decisions, they only care about the efficiency at the household level. In other words, they will choose s_{ih}^* as determined by (2) even if $f_{ih}r_{ih} < \frac{\partial C(s_{ih}^*, a_{1h}, a_{2h}, m_h)}{\partial s_{ih}^*}$ for child i .

Given a random sample of households $h = 1, \dots, H$, consider the regression

$$t_{ih} = \kappa_{ih}F_h + \beta_{ih}s_{ih} + \varepsilon_{ih} \quad (8)$$

where $\{F_h\}_{h=1}^H$ are household fixed effects capturing household wealth, κ_{ih} are sibling fixed effects, and β_{ih} are the child-specific coefficients on schooling expenditure. The estimation and interpretation of κ_{ih} and β_{ih} warrants detailed discussions.

2.1.1 Sibling fixed effects κ_{ih}

First, unlike the usual specification in the literature, in equation (8), inter-vivos transfers are linear in schooling expenditure but multiplicative in household and sibling fixed effects.

Second, κ_{ih} is child dependent. Empirically, we allow κ_{ih} to depend a set of binary indicators: whether (1) the son is taller than his sibling, (2) has more years of agricultural experience at the

time of his marriage, (3) has more years of non-agricultural experience, (4) lived outside the home before marriage, (5) live with the parents after marriage, and (6) he is the first son.

We now discuss the normalization of κ_{ih} . To ease exposition, let son i in household h be characterized by two indicator variables $D_{ih} = (D_{ih}^a, D_{ih}^b) \in \{0, 1\} \times \{1, 0\}$. Let the sons with $(D_{ih}^a, D_{ih}^b) = (0, 0)$ be the base group for this group to be κ_0 . Not all households have a son where $\kappa_{ih} = \kappa_0$. For any type of son i ,

$$\begin{aligned}\kappa_{ih}F_h &= \frac{\kappa_{ih}}{\kappa_0} \cdot \kappa_0F_h \\ &= (1 + \delta_a D_{ih}^a + \delta_b D_{ih}^b) \cdot \omega_h\end{aligned}\tag{9}$$

ω_h estimates $k_0 w_h^*$, which is the consumption level enjoyed by a child with hypothetical characteristics κ_0 in household h . δ_a or δ_b is the increase in k_{ih} due to the presence of characteristic a or b for child i relative to the hypothetical child 0 within household h .

2.1.2 Marginal compensation for differences in schooling investment

β_{ih} in equation (8) estimates $f_{ih}r_{ih}$, the marginal compensation coefficient in equation (7). Because of the multiplicative form between f_{ih} and r_{ih} , we cannot identify them separately without imposing further assumptions.

Proposition 1 (Homogenous marginal compensation) *If (1) the marginal return to schooling investments is homogenous across children and families ($r_{ih} = r$), and (2) the appropriation coefficient is also homogenous across children and families ($f_{ih} = f$), then $\beta_{ih} = \beta$ in equation (8) identifies the marginal compensation coefficient $\text{plim } \hat{\beta} = -f \cdot r \geq -r$.*

First, the above proposition is true even if we cannot observe abilities of the children. When the gross return to educational investments is homogenous, abilities affect the level of investments only through the marginal cost of schooling. Variations in s_{ih} capture all variations in unobservable a_{ih} . Therefore $\text{cov}(s_{ih}, \varepsilon_{ih}) = 0$ holds in equation (8).

Second, the marginal benefit of schooling investments should be equalized with marginal cost at the optimum. The marginal cost of schooling will be larger than one with a positive interest rate and if there are non-pecuniary costs to schooling. Then if we observe positive schooling expenditure, the marginal benefit (r) must be greater than or equal to one as well. Proposition 1 says that β estimates $-f \cdot r \geq -r$. Our version of the income difference transfer test of Becker's unitary model tests whether $\beta < -1$, which is only valid if there is full appropriation, $f = 1$. Otherwise, there is no reason to expect $\beta < -1$.

Even if we are willing to accept that β estimates $-f \cdot r$, there are other empirical issues.

Proposition 2 (Regression without fixed effects) *Suppose that $f_{ih}r_{ih} = r \cdot f$. A regression without household fixed effects will deliver $\text{plim } \hat{\beta} > -f \cdot r$.*

If we work with a dataset without sibling variation in the same household, a household fixed effects regression is infeasible. In this case, we are estimating the equation

$$t_{ih} = \eta + \beta s_{ih} + v_{ih} \quad (10)$$

$$= \overline{k_{ih}w_h} - f \cdot r s_{ih} + k_{ih}w_h - \overline{k_{ih}w_h} + \varepsilon_{ih} \quad (11)$$

where $\overline{k_{ih}w_h} = \left(\sum_{h=1}^H (k_{1h} + k_{2h}) w_h \right) (2H)^{-1}$. Since $cov(s_{ih}, w_h) > 0$, $plim |\hat{\beta}| = -f \cdot r + \frac{Cov(s_{ih}, k_{ih}w_h)}{Var(s_{ih})} > -f \cdot r$. The result is intuitive. Richer families tend to invest more in both schooling and marital transfers, therefore a regression with imperfect controls for family wealth or fixed effects will bias the estimates of β upwards. However, controlling for household effects itself is not enough. The importance of sibling effects is emphasized in the following proposition.

Proposition 3 (Unobservable preference bias controls) *Suppose that $f_{ih}r_{ih} = f \cdot r$, and $cov(k_{ih}, a_{ih}) > 0$. Controlling for household fixed effects while ignoring the sibling fixed effects k_{ih} will bias the estimates of β upwards. i.e., $plim \hat{\beta} > -f \cdot r$.*

When k_{ih} is determined by children's ability, which we do not observe in our data, we are not able to control for k_{ih} at all. The transfers equation becomes

$$t_{ih} = \bar{k}w_h - f \cdot r s_{ih} + (k_{ih} - \bar{k})w_h$$

Even though $\bar{k}w_h$ is picked up with the household fixed effect, $(k_{ih} - \bar{k})w_h$ will be treated as part of the error term. Given that $cov(\widetilde{s}_{ih}, w_h) > 0$ and $cov(k_{ih}, s_{ih}) > 0$, $plim \hat{\beta} = -f \cdot r + \frac{Cov(\widetilde{s}_{ih}, (k_{ih} - \bar{k})w_h)}{Var(\widetilde{s}_{ih})} > -f \cdot r$, where \widetilde{s}_{ih} is the deviation of schooling investments from the household mean.

With the "equal concern" assumption, $k_{ih} = k$, hence $plim \hat{\beta} = -f \cdot r$. The bias discussed here is relevant when parental "unequal concern" towards children is quantitatively significant and that "unequal concern" is unobserved.

Proposition 4 (Heterogenous marginal compensation) *If $f_{ih} = f$ but $r_{ih} = \bar{r} + \psi^a \varepsilon_{ih}^a$, where $\varepsilon_{ih}^a = a_{ih} - E(a_{ih})$ and $\psi^a > 0$, then $plim \hat{\beta} < -\bar{r}$.*

When the return to schooling is positively correlated with children's unobserved abilities, we are estimating the equation

$$\begin{aligned} t_{ih} &= k_{ih}w_h - f \cdot \bar{r} s_{ih} + v_{ih} \\ &= k_{ih}w_h - f \cdot \bar{r} s_{ih} - f \cdot \psi^a \varepsilon_{ih}^a s_{ih} - e_{ih} \end{aligned}$$

If $Cov(s_{ih}, \psi^a \varepsilon_{ih}^a s_{ih}) > 0$, β in equation (8) will be biased downwards. In other words, the average marginal compensation coefficient $f \cdot \bar{r}$, will be over estimated.

To test if the coefficient on the schooling expenditure fr is child specific, we consider the following regression:

$$t_{ih} = (1 + \delta D_{ih})\omega_h + \beta s_{ih} + \gamma D_{ih}s_{ih} + \varepsilon_{ih} \quad (12)$$

where we interact schooling investments with children observables (D_{ih}). The sign of γ will tell us if children with certain attributes tend to receive higher or lower marginal compensation for differences in schooling investments ($f_{ih}r_{ih}$).

To sum up, the full specification that we estimate, without restricting $f_{ih}r_{ih} = fr$, is equation (12). The parameters $(\delta, \omega, \beta, \gamma)$ will be estimated through non-linear least squares. In the appendix, we discuss in detail the estimation algorithm and econometric issues including the incidental parameters problem.

2.2 Income difference multiple transfers test

All existing tests of the unitary model that are based on income-transfer differences suffer from a common measurement issue: researchers only observe a part of the total inter-vivos transfers that are made by parents over their children's lifetime.

Proposition 5 (Partially observable inter-vivos transfer) *Suppose we observe $t'_{ih} = \alpha t_{ih} + \mu_{ih}$, with $0 < \alpha < 1$, $\mu_{ih} \sim N(0, \sigma_\mu^2)$, $cov(t_{ih}, \mu_{ih}) = 0$. Let $f_{ih}r_{ih} = f \cdot r$. Then $plim \widehat{\beta} = -\alpha f \cdot r > -f \cdot r$.*

This proposition indicates a simple case: If the observed transfers are proportional to the real total value, the coefficient on schooling will be proportional to $f \cdot r$.

We use the above proposition to derive an income difference multiple transfer test. If we increase α by adding more transfers to the dependent variable, the magnitude of the coefficient on schooling should increase and converge towards the true value of marginal compensation coefficient. Formally, let the researcher observe two transfers: $t_{ih,1}$ and $t_{ih,2}$. We can sum these two transfers to get a more complete measure of lifetime parental transfer, denoted as $t_{ih,3}$. Note that

$$t_{ih,g} = \alpha_g k_{ih} w_h - \alpha_g f \cdot r s_{ih} + \alpha_g \varepsilon_{ih} + \mu_{ih,g} \quad (13)$$

where $g = 1, 2, 3$ and $\alpha_3 = \alpha_1 + \alpha_2$. When $Cov(s_{ih}, \varepsilon_{ih}) = 0$,

$$plim \widehat{\beta}_{t_i} < plim \widehat{\beta}_{t_3} = -(\alpha_1 + \alpha_2) f \cdot r < 0 \quad (14)$$

where $i = 1, 2$, $\widehat{\beta}_{t_g}$ denote the estimated β with transfer at time g as the dependent variable. We refer to the test with null hypothesis:

$$H_0: \frac{\beta_{t_3}}{\beta_{t_g}} > 1, g = 1, 2 \quad (15)$$

as the *income difference multiple transfers test* of the unitary model.

One nice feature about this test is that the result is independent of the other concerns affecting the consistency of our estimate of β . In (13), since $Cov(t_{ih,g}, \mu_{ih,g}) = Cov(s_{ih}, \mu_{ih,g}) = 0$ by construction, the potential bias associated with β_{t_g} in each transfer regression only comes from the possible correlation between s_{ih} and ε_{ih} , which is invariant across transfers. Denoting this bias term as ψ , then $plim \widehat{\beta}_{t_g} = -\alpha_g(f \cdot r - \psi)$. The bias term ψ may change the signs of the coefficients in different transfer regressions, but it will not affect their ratios. Specifically, when $\psi < f \cdot r$, β should always be negative and adding more transfers to the dependent variable should decrease the coefficient towards $-f \cdot r$ (increasing its magnitude). Readers are referred to appendix C for a concrete example of ψ and formal derivation of the above arguments.

Since testing hypothesis (15) involves comparing coefficients across different regressions (with different dependent variables), we employ the bootstrap method to obtain confidence bounds for our test statistics.

3 Data

The data used in this study come from the "Survey on Family and Marriage Dynamics in Hebei Province", which was carried out in rural Hebei in the summer of 2005 by the authors and their Chinese colleagues. Rural Hebei province is culturally, economically, and socially representative of North China. Altogether, 600 households from 30 villages, in 15 townships in 3 counties were surveyed.¹⁵ Figure 1 locates each of the counties in Hebei.

The survey was designed to address some of the issues discussed in the previous section. Each household was required to have at least one married child in order to be included in the sample. Our respondents are parents in the household between the ages of 50 to 69. We exclude parents older than 70 because of concerns about recall.

For each child, information on significant events over his/her life was collected from the parents, including (1) education, (2) pre-marital work experience, (3) engagement and marriage, (4) fertility and post-marriage intra-family arrangements and (5) pre-mortem household division if applicable. To minimize the burden of the interview, for households with more than three married children, three of them were selected.¹⁶ In total, our survey covers 600 households with 1688 children (853 sons and 830 daughters) in total, among which 1276 (628 Sons and 648 daughters) have been married. In the following parts of this section, we will discuss the key variables used in this study and the construction of our working sample.

¹⁵The three counties, Feng Run, Zhao Xian, and Chi Cheng, were selected after extensive analysis of county and township-level economic and demographic information from the 1980s and 1990s. Feng Run is the richest of the three in terms of per capita GDP, and Chi Cheng is the poorest. Within each county, five townships were selected from economic quantile. Two villages were then randomly selected in each township, one for the upper half of the income distribution, and one from the lower half. Finally, from each village, 20 households satisfying age requirements for the household head and his spouse were randomly selected.

¹⁶The selection criteria were: (1) Choose the children who married first and last; (2) If the two selected children are of the same sex, choose a third of the opposite sex; (3) If the two selected children are of the opposite sex, choose a third one about whom the parents were most worried when s/he was 15; (4) If none of these criterion are applicable, daughters are preferred.

3.1 Education Expenditure

In rural Hebei, parents shoulder almost all of the educational costs of their children. Self-financing by children is negligible. For each child in our dataset, we collected data on educational expenditure since middle school (grade 7), including tuition fees, books, boarding expenses, and other living expenses, all deflated to 1980 price levels. We do not have expenditure data for elementary school, because most parents could not accurately recall such information. Instead, we impute the spending on elementary school for each child. A recent study by Liu et al. (2006) shows that the total cost of elementary education is about half the cost of middle school education in rural China. In light of this, we regress observed middle school expenses on gender, cohort and village dummies, and halve the predicted value before using it as imputed elementary schooling expenditure.¹⁷

Figure 2 illustrates the dynamics of educational expenditures in our sample. Total educational expenditure on sons in 1980 yuan increased significantly along with household annual income following economic reform. They rose especially fast early on, but the increase slowed beginning in the late 1980s. Total household expenditure on a son's education amounts to about four-fifths of annual household income. Increases in educational expenditures arose mainly from an increase in years of schooling, rather than increases in annual costs (Refer to figure A2).¹⁸

3.2 Marital Transfers

The first significant inter-vivos transfer in our dataset is marital transfers. Currently, a large part of the marital transfers in rural Hebei is given by parents to their marrying children, and not to their in-laws. It is an inter-generational transfer rather than an inter-familial transfer. At the time of the marriage, both the groom's and the bride's families provide furniture, major home appliances, farm equipment, and sometimes cash payments to the newly-wed couple.¹⁹ The groom's family usually spends more because traditionally the groom is responsible for building a new house for the newly weds. In our dataset, for each marriage, we have a complete inventory of marital transfers along with their monetary value.

Parents must save for years in order to finance these expenditures. Escalating marital expenses in Chinese villages during the past two decades have been well documented in the literature (E.g. Siu (1993); Min and Eades (1995); Zhang (2000)). Our dataset confirms high and rising marital transfers, especially in bride-price, since the economic reform. Refer to Figure 2. Despite some

¹⁷The mean of this imputed variable is around 300 yuan.

¹⁸We also examine educational expenditures on daughters over the same period. In the 1980s, spending on girls' education was below that on boys, but by the mid-1990s investments in children's human capital are about the same between genders.

¹⁹Actually, the cash transfer paid by the groom's family, which accounts for about 20 percent of the bride price, is usually given directly to the bride's family. However, once the bride's parents receive this cash payment, they can either keep it or use it to purchase items for the dowry. The dowry financed by the cash component of the bride-price is often referred to as "indirect dowry" in the sociology literature (see Goody (1978)). According to our dataset, on average, nearly all of the cash in bride-price became indirect dowry. This suggests that the cash component in the bride price should be included in the marital transfers enjoyed by the grooms, even though they are initially given to the bride's parents as inter-familial transfers.

fluctuations in the early 1990s and 2000s, the bride-price is roughly two and a half times annual household income. With reported rural household savings running about thirty percent of reported household income,²⁰ it takes parents 7 to 8 years to accumulate the bride-price. By contrast, the dowry is normally equal to about half of annual household income.

In this paper, we focus on parental transfers toward sons. This sample restriction is based on several concerns. First, nearly all sons receive strictly positive marital transfers. When both sons receive positive transfers, transfer decisions reflect interior solutions to the parents' optimization problem. Thus, the two-step maximization is valid and all the implications of our model should apply. The same argument does not hold for daughters, where about 20 percent of the sampled daughters do not receive a dowry. For these cases, implications of the model's corner solution have to be derived, which is beyond the scope of this paper. Second, due to the nature of patrilocal society and village land rule, only sons are entitled to receive household land as part of household divisions. As a result, our income difference multiple transfer test is only feasible for the son sample. Lastly, given the magnitude of the bride-price and sons' eligibility to receive land transfers, our measure of total inter-vivos transfers is a better measure of lifetime transfer for sons than for daughters.

3.3 Land Division

Some families in our sample made household property divisions before the parents pass away. These agreements are typically verbal, with only 20 percent relying on formal written contracts. Noteworthy, daughters in rural China are not entitled to any forms of (pre-mortem) bequests. Only sons are potential recipients.

These pre-mortem bequests include housing, land, and other producer durable goods. 75 percent of our households have divided the house, 65 percent of the households have divided the land, and a few households (about 10 percent) have divided other items. The value of housing and items are reported. For land divisions, we know the amount of the land and the time of transfer. For purposes of valuing the inheritance associated with land, a few institutional details regarding property rights are required.

Land in rural China is not privately owned. Rather, ownership rights reside with the village (collective), and households are allocated usufruct rights. Since the introduction of economic reform in the late 1970s, these rights have largely been allocated to households on a per capita basis, with the length of tenure governed in principal by a series of land laws. For example, the first national land law extended tenure for 15 years. The land laws have not always been respected, and land has often been reallocated among households by villages before the expiration of the land law, however in Hebei province, use rights have been very secure.

As part of the household division of property, sons are effectively receiving usufruct rights to the land that has been allocated to the household by the village. At a minimum, these rights are secure until the next land law, but in practice, the claims run much longer. Conservatively, we

²⁰National Bureau of Statistics, China Statistical Yearbook (2007)

calculate the value of the land as the total real return to the land from cultivation over the first 10 years after the land is given to the son.²¹

Panel A of Table 5 reports the summary statistics for each of the pre-mortem bequests. Notice that the value of the housing given at the time of the marriage represents a large share of the total value of the bequest, but these transfers have been counted as part of the bride-price. Therefore, land is the only important transfer besides the marital transfers captured by our data.^{22,23}

3.4 Sons Sample

There are 178 households with more than one married son in our dataset. Further restrictions have to be imposed for purpose of our analysis. First of all, children with missing values for educational expenditure or marital transfers were dropped. There are also 16 households, or less than 10 percent, when the groom's family did not pay any bride-price. We exclude them in our analysis, as they do not represent the marriage arrangement we usually observe. We also exclude 18 matrilineal marriages,²⁴ since this marriage pattern deviated from the typical patrilineal custom in the region. We keep all households with more than 1 married son surviving the above criteria. Altogether, 127 households with 264 sons/grooms are used in the analysis of this paper.

Table 1 presents descriptive information on the characteristics of these households and their children. To show the relative importance of the between-sibling variation in our dataset, we calculate for individual-level variables the within-household standard deviations in column 4. The results are generally half of the overall standard deviations (column 3 of Table 1). Column 5 reports the number of households with within-household variations in children's characteristics.

Sons examined in this paper were born between the 1950s and the 1990s, with most married between 1980 and 2000. Mean age at marriage was 23. Before marriage, sons were more likely to participate in agricultural activities than non-agricultural activities.

We consider the education of the father as an important determinant of parental wealth. In addition, we use the total real value of housing and total value of agricultural investments as proxies for family wealth. These measures are constructed based on a complete inventory of the investments in housing and agricultural producer durables made by the parents since they were married.

²¹We assume that the share of land in value-added is fifty percent. Because of discounting, increasing the number of years does not significantly change the value of the inheritance.

²²In fact, other than marital transfers and household divisions, we ask in our survey about every transfer larger than 100 yuan that parents give to the children after their marriages. Only 43 sons (16 percent of total sample of sons) receive post-marital transfers, with an average of 1700 yuan. This value is only about one third of the mean bride-price these sons received. The evidence suggests that offering large post-marital transfers is not a common practice in rural Chinese villages.

²³We also estimate our model adding both post-marital transfers and the value of other property received as part of household division into the measure of inter-vivos transfers. The results are not significantly changed.

²⁴In matrilineal marriages, the newly-wed couples live with or in the same village as the bride's natal family.

4 Empirical Results

4.1 $f_{ih}r_{ih} = f \cdot r$

We first estimate the model assuming homogenous marginal compensation for sibling differences in educational expenditure, $f_{ih}r_{ih} = f \cdot r$. Columns (1) to (8) in Table 2 report the estimation results for equation (8) with various children's attributes as controls for k_{ih} . These attributes include: an indicator if they are the taller of the sons in the household, indicators for having more agricultural and non-agricultural experience in the household, an indicator if they lived with parents before or after marriage, and an indicator if they were the first son.²⁵ The "hypothetical" son for comparison in each household has zero values in all of these dummies. In column (8), we only select the significant factors in the full specification in order to focus our discussions.

The point estimate of β using OLS without any other covariates in column O1 is -0.23 with a standard error of 0.06. Since marital transfers and schooling expenditure are positively related with household income, the estimate of β is biased upward without controls for household income. Column O2 adds household fixed effects to the regression, which yields an estimate of β of -0.39 with a standard error of 0.15. Controlling for household fixed effects, the absolute value of β increases by over one third in the direction predicted by the theory.

As we add other household and sibling interaction effects, the point estimate for β generally remains in the vicinity of -0.35. Our preferred specification is in column (8). Here, compared with the "hypothetical son" in the household, taller sons enjoy 22 percentage more in total consumption. Sons who live with their parents after marriage obtain nearly 40 percent more consumption than those who do not. Last, older sons tend to receive one fifth less than their younger siblings, which at first sight is inconsistent with popular wisdom about first-son bias in rural China. Below, we show that this inconsistency is resolved with appropriate discounting.

The results also suggest that parents tend to provide more consumption to children with more premarital agricultural or non-agricultural experience, and to children who do not live outside the home before marriage (column (7)). Even though these coefficients are imprecisely estimated, their magnitudes suggest that they are not economically insignificant.²⁶

Estimates of k_0w_h are summarized in Table A2. Panels A and B show the summary statistics and distribution of k_0w_h estimated under alternative specifications in Table 2. Both the graph and the Kolmogorov-Smirnov statistics show that the distributions of k_0w_h are not significantly different from log-normal. In panel C, we examine the determinants of k_0w_h , by regressing it against household level characteristics. The estimates are consistent across columns. The coefficients on the number of sons and daughters in the household are negative, suggesting that the hypothetical son

²⁵In an unreported specification, we try to control for years effects using sons' (1) age at marriage and (2) age at the time of the survey. The former's coefficient is -0.02 and statistically insignificant. The latter carries a significant coefficient of -0.05, suggesting that one will receive 5 percent less in consumption if he is 1 year older than his brother. As we shall see later, this result is consistent with what we obtain from the first son dummy. However, it is not wise to put the "first son indicator" and "age" in the same regression since they are highly correlated. Given that our main conclusions are not affected in either way, we decide not to put these time controls in our final regressions.

²⁶If we plot the confidence intervals of these estimates, most of the intervals do not include zero.

enjoys less consumption if there are more sons or more girls in the family. The level of consumption is also higher for children from families that are richer, with better educated fathers, and that are located in richer counties.

Our behavioral model generates a linear regression model with multiplicative family and sibling fixed effects rather than log linear or linear fixed effects regression models. In appendix D, we present and discuss the estimation results with the traditionally used level-on-level and log-on-log regressions. We find that functional form matters: level-on-level specification is more appropriate under the (restricted) “equal concern” assumption while lacks behavioral justification in more general cases; log-on-log specification imposes a strong restriction in our multiple-transfers test which is rejected by our data.

4.1.1 Sensitivity to discount rates

The framework discussed in section 2 is a static model while actual intra-household transfers are made over time and in different periods for different children. To make these transfers comparable in present value, all transfers made in each household are discounted at rate d to the year in which the first son was married. In columns (1)-(6) of Table 4, we compare different specifications (the basic ones assuming “equal concerns” and the parsimonious ones with only the significant controls) under different discount rates in order to test the sensitivity of our results.

There are several patterns in Table 4. First, coefficients on schooling investments decline in magnitude as the discount rate increases. Therefore, taking the discount rate into account does not solve our problem of underestimating $f \cdot r$. Second, estimates of δ do not vary across alternative discount rates either in terms of their magnitudes or standard errors, except for a time related factor: the first son indicator. Coefficients on the first son dummy consistently increase with discount rates, and become positive eventually.

These trends are due to the nature of discounting. Educational expenditures occurred before marital transfers. If we discount everything to the time when the first son got married,²⁷ the differences in education expenditure across siblings by age will widen. Meanwhile, the difference in marital transfers by age will be compressed. So discounting increases the value of schooling expenditure of the first son and reduces the value of marital transfers to the second son. This logic explains why the estimates of the first son effect increases with the discount rate.

4.1.2 An income difference multiple transfers test

Parents may use transfers other than marital transfers to make up the difference in human capital investments among their children. Proposition 5 says that when we use a part of the life-time transfers to estimate equation (12), $f \cdot r$ will be biased downwards. To address this issue, we construct a more complete measure of life-time parental transfers by adding to marital transfers other significant parental transfers captured by our survey - the value of land division - and perform our income difference multiple test.

²⁷Choosing a different timing as baseline for discounting will generate the same trend.

We re-estimate equation (12) after adding the value of land to the dependent variable (t_{ih}). The sample size becomes smaller, because we concentrate on the subsample of households that have made land divisions. The results are reported in Table 5. Consistent with the proposition 5, taking into account the value of inherited land substantially increases the absolute value of the coefficients on schooling expenditures.²⁸ This result is robust across all discount factors. For example, with a ten percent discount rate, our preferred specification in column 6 now suggests $f \cdot r = 0.37$ rather than 0.16. That is, the estimated compensatory coefficient more than doubles when we are able to capture more of lifetime parental transfers.

To obtain confidence intervals for our multiple transfer test, we bootstrap our sample with 100 iterations and store the estimates of marginal compensation coefficients (β_{t_g}) with the value of bride price ($t_g = t_1$) and the value of bride price plus land division ($t_g = t_3$) as the dependent variable. Table 6 presents the summary statistics of the ratio β_{t_3}/β_{t_1} of these 100 iterations. Across different specifications and discounting rates, the mean value of the ratio is greater than 1. In addition, $\beta_{t_3}/\beta_{t_1} > 1$ occurs with more than 95 percent chance. The evidence suggests that we cannot reject "adding in more parental transfers increases the magnitude of marginal compensation coefficients" at conventional significance level.

Moreover, the magnitudes of the parental bias parameters become smaller but with similar standard errors as before. Overall, they become statistically insignificant. However, their signs are the same and the patterns under alternative discount rates remain as in Table 4.²⁹

Our theoretical model predicts that estimating equation (8) using a partial measure of parental transfer will underestimate $f \cdot r$. Our empirical results in Table 4 and 5 show that this concern is empirically significant. Two findings particularly stand out. First, controlling for unobserved household heterogeneity is important. Second, a fuller accounting of lifetime parental transfers significantly increases the estimate of the compensatory effect, consistent with the unitary model.

4.2 $f_{ih}r_{ih} \neq f \cdot r$

Relaxing the homogenous marginal compensation effect, we expect $f_{ih}r_{ih}$ to depend on sons activities and living arrangements with the parents. These patterns can be tested by examining the interaction terms between schooling expenditure and the children's attributes in equation (12).

We present in Table A1 the expected signs of the interaction terms. The main occupation of the parents in our sample is farming. Parents will benefit more from their sons' education when their sons participate in agricultural activities or live with them after marriage. Therefore, we expect the interaction term to be for these sons. (lower $f_{ih} \cdot r_{ih}$). Note that children with more agricultural experience have lower $f_{ih} \cdot r_{ih}$ not only because of the lower f_{ih} , but also because of their lower r_{ih} . i.e., returns to schooling are lower in agriculture than non-agriculture. Following the same logic,

²⁸Even though the difference is not statistically significant at times due to the larger standard errors.

²⁹The difference we observe may due to the fact that we are using a more restricted sample. To address this concern, we replicate marital transfer regressions in table 4 using the same subsample as table 5. The results are shown in table A3. The coefficients on schooling expenditures and parental bias factors in this table are very similar with those in table 4, suggesting that the increase in estimates of $f \cdot r$ in table 5 cannot be attributed to the sample selection.

we expect sons with more agricultural experience or live independently to have higher $f_{ih} \cdot r_{ih}$, therefore negative interaction terms. Traditionally, the first son usually takes more responsibility to take care of his parents and siblings. They are expected to have lower $f_{ih} \cdot r_{ih}$.

Table 3 reports the results. For each specification in columns (1) to (8), we interact the same attributes with schooling investments as used to control for the parental bias.³⁰ The first thing to notice is that our estimates of γ s in equation (12) are very imprecise. The large standard errors are mainly due to our relative small sample size. Second, because of the weak explanatory power of the interaction terms,³¹ adding them into the regressions does not significantly alter our estimates of β and δ s (comparing Table 3 with Table 2).

While imprecisely estimated, most coefficients for the interaction terms in Table 3 have the predicted signs (as Table A1). In column 7, sons living with parents before marriage or after marriage retain less income from schooling investments.³² The first sons are also found to directly benefit less from schooling than their siblings. By contrast, sons with more non-agriculture experience tend to receive 0.17 yuan more from each yuan spent on schooling, consistent with the view that their parents as farmers are less likely to benefit directly from them. On the other hand, sons with more agricultural experience retain more of their schooling returns which is anomalous.

The last three columns in Table 4 show that our main conclusions are robust to different discounting rates. Columns 7-9 in Table 5 show that including the value of land division parental transfers does not change the point estimates of δ 's substantially from that in Table 4.

In summary, we find evidence suggesting that $f_{ih}r_{ih} \neq f \cdot r$. However the large standard errors preclude us from being able to make precise quantitative statements on this heterogeneity in marginal compensation.

5 Other Issues

5.1 Measurement error in schooling investments

The low absolute value of the estimated marginal compensation coefficients may be due to attenuation bias. Given that our education expenditure variable mainly comes from recall data, measurement error might exist, which could bias OLS estimates towards zero. One way to correct for this bias is to adopt an instrumental variable approach. "Years of schooling" is an ideal candidate to serve as an instrument for education expenditure: (1) it is positively correlated with education expenditure and (2) its measurement error, if there is any, is not likely to be correlated with that of education expenditure.

In Panel A of table 7, we replicate all specifications in Table 4 with 2SLS estimation. The first stage regressions and reduced form regressions are presented in Panel B and Panel C, respectively.

³⁰We also try specifications where all of the attributes are interacted with the schooling investments regardless the way we control for k_{ih} . The conclusions are essentially the same.

³¹Notice that Table 2 and 3 have the same R^2 for all specifications.

³²However, this coefficient switches sign once other interaction terms are controlled simultaneously (compare column 2 and 7). This may be due to the collinearity between the agriculture and non-agriculture experience indicators.

As expected, "years of schooling" is a good predictor of education expenditure in the first stage. (One year of schooling costs about 800 yuan on average.) In the second stage, estimates of δ s and γ s do not change much. However, the precision of $f \cdot r$ is lost due to the increased standard errors. Compared with the OLS results, the IV estimates are slightly smaller, but the Hausman tests cannot reject that their difference is statistically insignificant. We conclude that the underestimation of $f \cdot r$ is not likely due to the attenuation bias.³³

5.2 Strategic behavior of the children

So far, our framework assumes children are passive and only parents make decisions in the family. Our model's implications are immune to the relaxation of this assumption as long as Becker's "Rotten Kid Theorem" applies. Becker (1974, 1991) argues that parental transfers force children to consider parents' interests. Active, selfish children will choose actions that maximize total family wealth, which is the only factor that determines their consumption level under the income pooling scheme. In this case, selfish children will choose exactly the same actions as their parents will ask of them in the two-step maximization problem.

There are, however, circumstances when the "Rotten Kid Theorem" fails. Bergstrom (1989) argues that the theorem will not hold if utility depends on more than transferable commodities. We discuss two examples with this feature. Both examples are Stackelberg games, where parents make their choices first while taking the response of children into account.

First, if children with higher education are more likely to study outside the village (mostly in the cities), they will have a higher chance of working in the non-agriculture sector and will not return. Taking this into account, parents with a preference for co-residence with their children may reduce children's schooling investments just to the level to keep their children to stay around. In this case, schooling investments may not be efficient.

Second, full compensation in transfers amounts to full insurance for children. If the returns to education depend on children's efforts, two problems emerge: free riding (among siblings) and moral hazard. Both of them cause the children to exert less effort than optimal. To avoid these problems, parents would break the linkage between education achievement and inter-vivos transfer and commit an equal amount of transfers to their children. In this case, wealth equalization would be violated, the efficiency, however, could still be achieved. Such strategic behaviors tend to drive the coefficient on education investment towards zero in our regression.

5.3 Public goods in transfers

The externality to the parents and other family members may not only exist in individual's schooling investment, but also in the transfers. For example, when a son lives with parents after

³³Table A7 reports the reduced form results of this exercise, suggesting that one year extra year of schooling only contributes about 120 yuan increase in life-time consumption (see preferred specification with discounting rate 0.05), which is much lower than the monetary cost suggested by the first stage results. It is not surprising that such a low estimate in marginal return to schooling is consistent with our low point estimates in marginal return to schooling expenditure.

marriage, his parents may enjoy the transfer made to this son at the time of marriage as well, such as a brand-new TV or a new house. However, it should be emphasized that the first order condition determining the optimal schooling is not distorted. As long as $MR(s_{ih}) = MC(s_{ih})$ holds, schooling investments are efficient, and family income is maximized at $w_h^*(s_{ih}^*)$. Suppose that parents own expenditure is c_h , and they also benefit a proportion of b_{ih} from the transfer to the children t_{ih} . The consumption of the parents and children are

$$\begin{aligned} c_h^* + b_{1h}t_{1h} + b_{2h}t_{2h} &= (1 - k_{1h} - k_{2h})w_h^* \\ c_{ih}^* &= f_{ih}R(s_{ih}^*) + t_{ih} = k_{ih}w_h^* \end{aligned}$$

where $i = 1, 2$. Notice that for given s_{ih}^* , the final consumption enjoyed by the parents, $c_h^* + b_{1h}t_{1h} + b_{2h}t_{2h}$, is the same regardless of the value of b_{ih} . In other word, when $b_{ih}t_{ih}$ increases, either because the parents live with the child (higher b_{ih}) or the child requires a larger transfer to obtain the desired consumption level (higher t_{ih}), parents will decrease their own expenditure c_h^* accordingly, so that their consumption is not changed.

6 Conclusion

This paper constructs an empirical unitary model of parental investments and allocation of their children's consumption which incorporates unobserved family heterogeneity, unequal parental valuations of their investments across children, and unobserved differences in children's abilities. In addition to a standard income transfer difference test, we also provide an income difference multiple transfers test based on the availability of multiple parental transfer measures. We also argue that the strong income transfer test in our context, a traditional agricultural society, is likely to be invalid.

Empirically, parents transfer more consumption to sons who are better endowed or who live together with them post marriage. Bias towards the first son is sensitive to the discount rate we use when comparing transfers given at different point in time.

Controlling for parental bias, parents compensate for the difference in schooling investments they made in their children. In particular, sons receiving 1 yuan less in schooling will be compensated by receiving an additional 0.4 yuan in his marital transfers. Our low point estimates cannot be explained by (1) measurement errors in schooling expenditure, (2) choice of discount rates, (3) heterogeneous returns to schooling, and (4) public goods components in children's consumption. Instead, we find that adding other parental transfers to the dependent variable can significantly increase the magnitude of the coefficient on schooling expenditure to 0.7, providing a strong evidence supporting the unitary model. This result indicates the importance of having a measure close to lifetime transfers when testing the unitary model.

References

- Altonji, Joseph G., Hayashi, Fumio and Kotlikoff, Laurence J. (1992). "Is the Extended Family Altruistically Linked? Direct Tests Using Micro Data", *The American Economic Review*, Vol. 82, No. 5, pp. 1177-1198
- Altonji, Joseph G., Hayashi, Fumio and Kotlikoff, Laurence J. (1997). "Parental Altruism and Inter Vivos Transfers: Theory and Evidence", *The Journal of Political Economy*, Vol. 105, No. 6, pp. 1121-1166.
- Becker, G. S. (1974). A theory of Social Interactions. *Journal of Political Economy*, 82 (6), 1063-1093.
- Becker, G. S. (1991). *A Treatise of the Family*, enlarged edn, Harvard University Press, Cambridge, Massachusetts.
- Bergstrom, Theodore C., (1989) "A Fresh Look at the Rotten Kid Theorem—and Other Household Mysteries," *The Journal of Political Economy*, 97, 1138-1159.
- Bobonis, Gustavo J., (2009) "Is the Allocation of Resources within the Household Efficient? New Evidence from a Randomized Experiment," *Journal of Political Economy*, 117, 453-503.
- Behrman, J.R., R.A. Pollak and P. Taubman (1995), "The wealth model: efficiency in education and equity in the family", in: J.R., Behrman, R.A. Pollak and P. Taubman, eds., *From parent to child: intrahousehold allocations and intergenerational relations in the United States*, University of Chicago Press, Chicago, IL.
- Cox, R. (1987). "Motives for private income transfers", *The Journal of Political Economy*, 95 (3): 508-546.
- Cox, R. and Rank, M. R. (1992). "Inter-vivos Transfers and Intergenerational Exchange", *Review of Economic Studies*, 74 (2): 305-314.
- Goody, Jack, (1973) "Brideprice and Dowry in Africa and Eurasia", in *Bridewealth and Dowry*, edited by Jack Goody and Stanley J. Tambiah. Cambridge Papers in Social Anthropology, no. 7. Cambridge: Cambridge University Press.
- Greene, William H. (2004). "Fixed Effects and the Incidental Parameters Problem in the Tobit Model", *Econometric Reviews*, 23, (2): 125-148.
- Lundberg, Shelly J., Robert A. Pollak, and Terence J. Wales, (1997) "Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit," *The Journal of Human Resources*, 32, 463-480.
- Liu, M., Xu, Z., Tao, R. and Su, X. (2006). "Study on the Dynamics of Famer's Education Fees Burden before and after the Rural Tax Reform", *Working Paper*.

- Menchik, P. (1980). "Primogeniture: equal sharing and the US distribution of wealth", *Quarterly Journal of Economics*, 95: 299-315.
- Menchik, P. (1988). "Unequal estate division: is it altruism, reverse bequests or simply noise?", in: D. Kessler and A. Masson, eds., *Modelling the accumulation and distribution of wealth* (Oxford University Press, Oxford).
- Min, H. and Eades, J. S. (1995). "Brides, Bachelors and Brokers: The Marriage Market in Rural Anhui in an Era of Economic Reform", *Modern Asian Studies*, 29 (4): 841-869.
- Neyman, J. and E. Scott (1948). "Consistent estimates based on partially consistent observations", *Econometrica*, 16, 1-32
- Pitt, Mark M., Mark R. Rosenzweig, and Md Nazmul Hassan, (1990) "Productivity, Health, and Inequality in the Intrahousehold Distribution of Food in Low-Income Countries," *The American Economic Review*, 80, 1139-1156.
- Qian, Nancy, (2008) "Missing Women and the Price of Tea in China: The Effect of Sex-Specific Earnings on Sex Imbalance," *Quarterly Journal of Economics*, 123, 1251-1285.
- Quisumbing, Agnes R., (1994) "Intergenerational transfers in Philippine rice villages : Gender differences in traditional inheritance customs," *Journal of Development Economics*, 43, 167-195.
- Raut, L. K. and Tran, L. H. (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: 389-414.
- Siu, H. F. (1993). "Reconstituting Dowry and Brideprice in South China", *Chinese Families in the Post-Mao Era*, University of California Press, pp. 139-164.
- Thomas, Duncan (1990), "Intra-Household Resource Allocation: An Inferential Approach," *The Journal of Human Resources*, 25, 635-664.
- Udry, Christopher, (1996) "Gender, Agricultural Production, and the Theory of the Household," *The Journal of Political Economy*, 104, 1010-1046.
- Zhang, W. (2000). "Dynamics of Marriage in Chinese Rural Society in Transition: A Study of a Northern Chinese Village", *Population Studies*, 54: 57-69.

A Estimation of the Multiplicative Model

Given a random sample of households $h = 1, \dots, H$, each with 2 children $i = 1, 2$, consider the regression

$$y_{ih} = (1 + D_{ih}\delta) \cdot \omega_h + X_{ih}b + \varepsilon_{ih} \quad (16)$$

where y_{ih} is the dependent variable; D_{ih} and X_{ih} are vectors of children's characteristics; ω_h is the household fixed effect. The parameters to be identified are $\theta = (\delta, \{\omega_h\}_{h=1}^H, b)$. In our context, comparing (16) and (12), we can see the following correspondence:

$$\begin{aligned} y_{ih} &= t_{ih} \\ D_{ih} &= (D_{ih}^a, D_{ih}^b) \\ \omega_h &= k_0 w_h \\ X_{ih} &= (s_{ih}, D_{ih}^a s_{ih}, D_{ih}^b s_{ih}) \\ b &= (\beta, \gamma_1, \gamma_2) \end{aligned}$$

A nonlinear least squares (NLS) estimator of θ , $\hat{\theta}$, solves

$$\min_{\theta} \sum_{h=1}^H \sum_{i=1}^2 [y_{ih} - (1 + D_{ih}\delta) \cdot W_h - X_{ih}b]^2$$

To release the computational burden of global search for all parameters ($H + 3$ dimensions), we take advantage of the partial linearity in (16): conditional on $1 + D_{ih}\delta$, equation (16) is a linear model and $\{\omega_h\}_{h=1}^H$ and b can be estimated through OLS. Denoting these estimators as $\{\omega_h^{ols}(\delta|X_{ih}, D_{ih})\}_{h=1}^H$ and $b^{ols}(\delta|X_{ih}, D_{ih})$, our problem is to find

$$\hat{\delta} = \arg \min_{\delta} \sum_{h=1}^H \sum_{i=1}^2 (y_{ih} - (1 + D_{ih}\delta) \cdot \omega_h^{ols}(\delta|X_{ih}, D_{ih}) - X_{ih}b^{ols}(\delta|X_{ih}, D_{ih}))^2$$

Given $\hat{\delta}$, the final estimator $\hat{\theta}$ is

$$\hat{\theta} = (\hat{\delta}, \{\omega_h^{ols}(\hat{\delta}|X_{ih}, D_{ih})\}_{h=1}^H, b^{ols}(\hat{\delta}|X_{ih}, D_{ih}))$$

B The Incidental Parameter Problem

The least square estimators outlined above are subjected to a so-called "incidental parameter" problem. As first noticed by Neyman and Scott (1948), standard estimators of nonlinear panel data model are usually inconsistent if the length of the panel is small relative to the number of observations. In this case, the finite sample bias in the fixed effects parameters ($\{\omega_h\}_{h=1}^H$ in our context) will contaminate estimations in other parameters (δ and b in (16)).

Given the partial nonlinearity feature of our model, an alternative approach that can help get

around the incidental parameter problem is quasi-differencing. To see this, divide $1 + D_{ih}\delta$ on both sides of (16),

$$\frac{y_{ih}}{1 + D_{ih}\delta} = W_h + \frac{X_{ih}}{1 + D_{ih}\delta}b + \frac{\varepsilon_{ih}}{1 + D_{ih}\delta}$$

and then take the sibling difference within the same household

$$\Delta \frac{y}{1 + D\delta_h} = \Delta \frac{X}{1 + D\delta_h} b + v_h \quad (17)$$

where $\Delta \frac{x}{1 + D\delta_h} = \frac{x_{1h}}{1 + D_{1h}\delta} - \frac{x_{2h}}{1 + D_{2h}\delta}$ and $v_h = \frac{\varepsilon_{1h}}{1 + D_{1h}\delta} - \frac{\varepsilon_{2h}}{1 + D_{2h}\delta}$. Notice that household fixed effects are eliminated in (17). The parameters to be determined are (δ, b) , which can be consistently estimated through NLS.³⁴

In order to compare the accuracy and efficiency between our least-square estimate and the above quasi-differencing estimate, we conduct Monte Carlo experiments. The number of households is 127, consistent with our dataset. In each simulation, each household is endowed with a k_0w_h assumed to be log normal distributed. Its distribution parameters are calibrated from the moments of the household fixed effects $\{\omega_h\}_{h=1}^H$ we estimate from the data.

Each household has two children, one of whom is the "first son". We randomly generate another two attributes of the children, "indicator of the taller son" (D_{ih}^{taller}) and "indicator of living with parents post marriage" (D_{ih}^{livep}), such that their variance-covariance matrices with the first son indicator (D_{ih}^{1stson}) replicate the patterns in the real data.

We regress schooling expenditure on k_0w_h and children's attributes using the actual dataset. Then collect the coefficients and the distribution parameters of error terms, which we use to generate the simulated schooling investments. Note that the error terms here act as the ability endowments of the children. The inter-vivos transfers are simulated using equation (8) with error terms randomly generated to match the sample moments of the marital transfers (t_{ih}). The resulting data set is $\{s_{ih}, t_{ih}, D_{ih}^{taller}, D_{ih}^{livep}, D_{ih}^{1stson}\}$. We estimate the model

$$t_{ih} = (1 + \delta_1 D_{ih}^{taller} + \delta_2 D_{ih}^{livep} + \delta_3 D_{ih}^{1stson}) \cdot \omega_h + \beta s_{ih} + \varepsilon_{ih}$$

with the "true" parameters as $(\beta, \delta_1, \delta_2, \delta_3) = (-0.3, 0.2, 0.4, -0.2)$. Note that we allow $cov(s_{ih}, \omega_h) > 0$ and $cov(s_{ih}, D_{ih}) > 0$, but keep $cov(s_{ih}, \varepsilon_{ih}) = 0$, which are basic identification assumptions maintained throughout our paper.

Table A4 reports the results of 500 simulations. Panel A contains our least square results and panel B contains the quasi-differencing results. The coefficients are the mean value of the 500 simulated estimates. In the brackets are their corresponding standard errors. We are testing the H_0 as "mean of the estimates has the same value as the true parameters".

With different specifications, the least square approach used in our paper delivers highly precise estimates. By contrast, the quasi-differencing results exhibit larger bias and larger standard errors, especially when all of the three attributes of the children are controlled simultaneously. We conclude

³⁴For consistency we need $cov(\Delta \frac{X}{1 + D\delta_h}, v_h) = 0$ in (17). This condition is ensured under our assumptions in the model.

that, even though our least square estimates may be theoretically inconsistent, their finite sample bias is negligible and they are more efficient than the consistent quasi-differencing estimates.³⁵ We therefore base our inferences on the least squared results in our paper.

C Robustness of income multiple different transfer test to the biases in the transfer regression

This section shows how our multiple transfer ratio test is immune to the potential bias in the transfer regression. For illustration purpose, consider the case where we regress marital transfer on a child's educational expenditure without household or sibling fixed effects, as discussed in proposition 2. The transfer equations can be written as

$$t_{ih,g} = \alpha_g \eta - \alpha_g f \cdot r s_{ih} + \alpha_g v_{ih} + \mu_{ih,g}, \quad g = 1, 2, 3, \quad \alpha_3 = \alpha_1 + \alpha_2$$

where $\eta = \overline{k_{ih} w_h} = \left(\sum_{h=1}^H (k_{1h} + k_{2h}) w_h \right) (2H)^{-1}$ and $v_{ih} = k_{ih} w_h - \overline{k_{ih} w_h}$. It is easy to show that

$$plim \widehat{\beta}_{t_g} = -\alpha_g \left(f \cdot r - \frac{Cov(s_{ih}, v_{ih})}{Var(s_{ih})} \right), \quad g = 1, 2, 3, \quad \alpha_3 = \alpha_1 + \alpha_2 \quad (18)$$

Hence

$$\frac{plim \widehat{\beta}_{t_3}}{plim \widehat{\beta}_{t_g}} = \frac{\alpha_1 + \alpha_2}{\alpha_g} > 1, \quad g = 1, 2$$

which is independent of the bias term.

D Regressions where sibling effects and household fixed effects enter linearly

Here we present the results and discuss the limitations of commonly-used regression with linear household and sibling fixed effects. We regress bride-price on schooling investments using both level-on-level form (Table A5) and log-on-log form (Table A6), with (panel As) and without household fixed effects (panel Bs).³⁶ Across columns, we put in different indicators to capture "unequal concerns" across siblings.

Controlling for household level heterogeneities is important. Without household fixed effects, the coefficients on schooling investments are significantly negative in level regressions and insignificant (sometimes even positive) in log form regressions. After adding in household dummies, the

³⁵This conclusion has the same spirit with Greene (2004), who find that, through Monte Carlo methods, the coefficients in the Tobit model with fixed effect are "unaffected" by the incidental parameter problem. He notices that the estimators' behavior in models with a continuous dependent variable (whether truncated or not) is quite different with the binary choice models.

³⁶Family level attributes, such as father's years of schooling, total number of sons and daughters, and wealth indicators are also added in regression without household fixed effects. To save spaces, these coefficients are not reported.

coefficients are substantially smaller (more negative) and significant throughout all specifications. Richer families tend to invest more in both education and inter-vivos transfers on their children, therefore simple OLS regression will result in upward bias in the coefficients on schooling investments if we cannot perfectly control for family wealth. From now on, we will focus our attentions on household fixed effect regressions.

According to our model, a level-on-level specification generates consistent estimates when $k_{1h} = k_{2h} = 0.5$ in (3) and (4), i.e., parents put equal weighs on the consumption of their children. For utility maximization, parents will equalize consumption of their two children and use inter-vivos transfers to fully compensate the difference in children's schooling investments. Our level-on-level results suggest that when one son receives 1 yuan less in his schooling investments than his brothers, he will be compensated by about 0.30 to 0.38 yuan in his marital transfers. The log form regressions support similar compensation story.

As for the parental bias indicators, level and log regressions occasionally produce different signs, but they are generally not statistically significant. However, some of the indicators have relatively large coefficients in magnitude. For example, sons living with their parents after marriage receive more than 1000 yuan than their brothers in marital transfers. However, the larger standard error of this estimate prevents us from drawing any inference at conventional confidence levels.

A level-on-level regression is problematic in the presence of "unequal concern" from the parents. For example, if parents love their first son 10 percent more than the others, they will give him 10 percent, rather than 0.1 yuan, more in marital transfers. In this sense, one might think of log-on-log form as a better approximation to the transfer decision model. However, the log-on-log specification imposes a very strong implication in case of multiple transfers. To see this, consider the life-time transfer determination equation

$$\ln t_{ih} = \ln \omega_h - e \ln s_{ih} + \varepsilon_{ih}$$

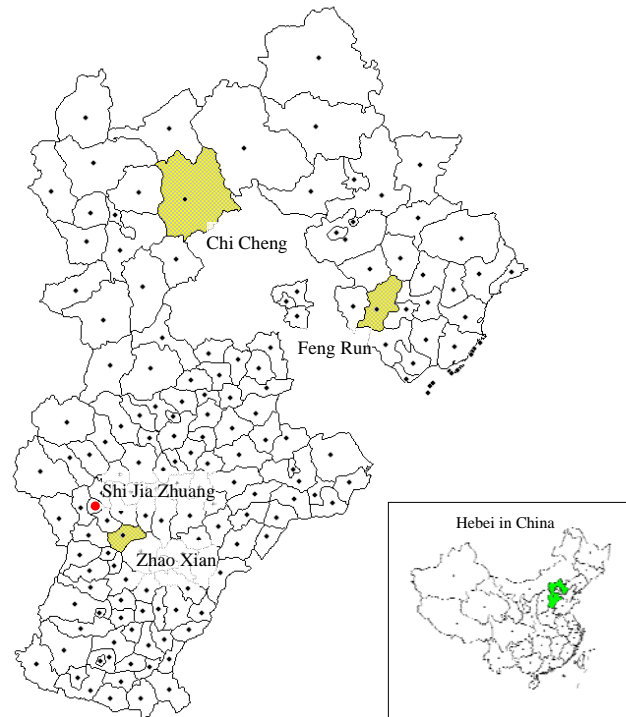
where e is the marginal compensation elasticity. Now suppose we only observe αt_{ih} instead of t_{ih} , the above equation becomes

$$\ln \alpha t_{ih} = \ln \alpha + \ln \omega_h - e \ln s_{ih} + \varepsilon_{ih}$$

The effect of α will be buried in the constant term with no impact on the estimation of e . That is to say, the log-on-log specification is robust to the problem of "partially observable life-time transfer". Adding more transfers into the dependent variable should not change the coefficient on the log of schooling expenditure.

Table A8 tests this implication by replicating results in the panel B of table A6 while adding land value into the dependent variable. Compared with table A6, estimates of e nearly double throughout the specifications in table A8, providing strong evidence rejecting the use of log-on-log specification for the transfer equation.

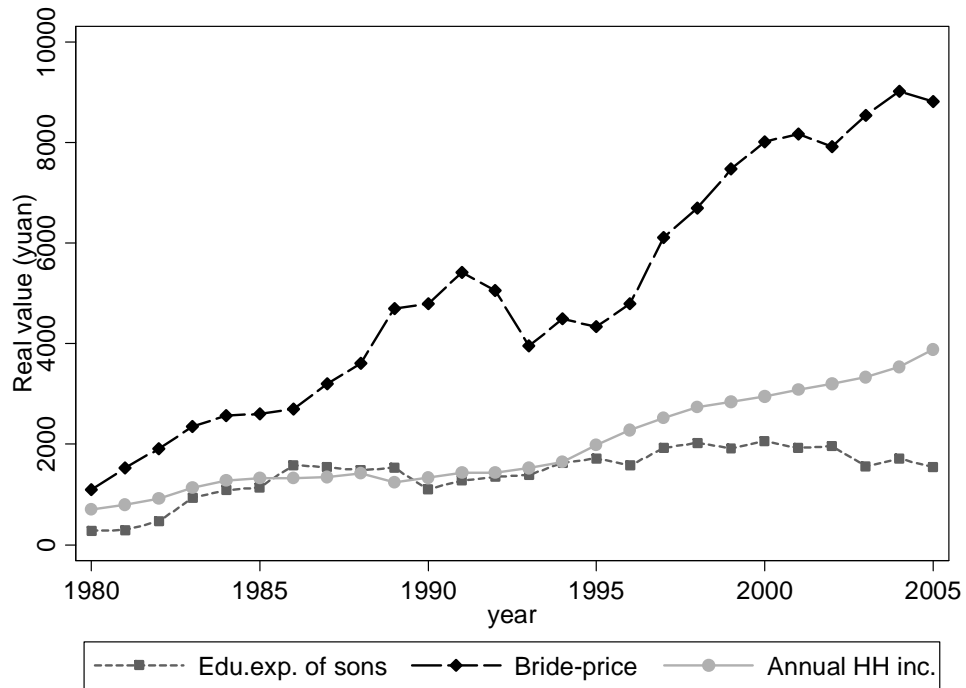
Figure 1 Survey Counties



Notes:

The survey was conducted in Hebei province, which has a cultural environment typical of North China. Three counties (Feng Run, Zhao Xian, and Chi Cheng) are selected after extensive analysis of county and township-level economic and demographic information from the 1980s and 1990s. Among them, Feng Run is the richest county in terms of GDP per capita, while Chi Cheng is the poorest. Within each county, five townships were selected from each economic quintile. Two villages were randomly selected in each township, one from the upper half of the township income distribution and one from the lower half. Finally, from each village, 20 households were randomly selected.

Figure 2. Marital Transfers and Educational Expenditure Received by Sons



Data Sources:

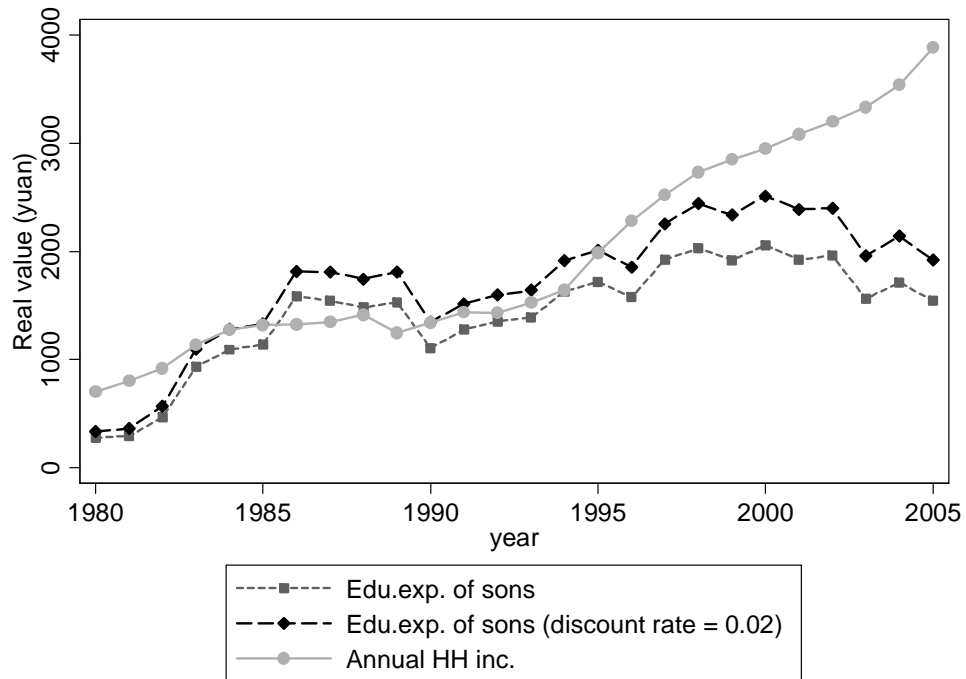
Annual household income: Hebei Bureau of Statistics (<http://www.hetj.gov.cn/>);

Marital transfers and educational expenditure: Survey on family and marriage dynamics in Hebei province.

Notes:

We firstly calculate the mean marital transfers (bride-price) and educational expenditure for children married in certain year, then smooth the graph by calculating the moving average of the four adjacent years. All monetary values have been deflated to 1980 price level.

Figure A1. Discounted v.s. Un-discounted Educational Expenditure



Data Sources:

Annual household income: Hebei Bureau of Statistics (<http://www.hetj.gov.cn/>);

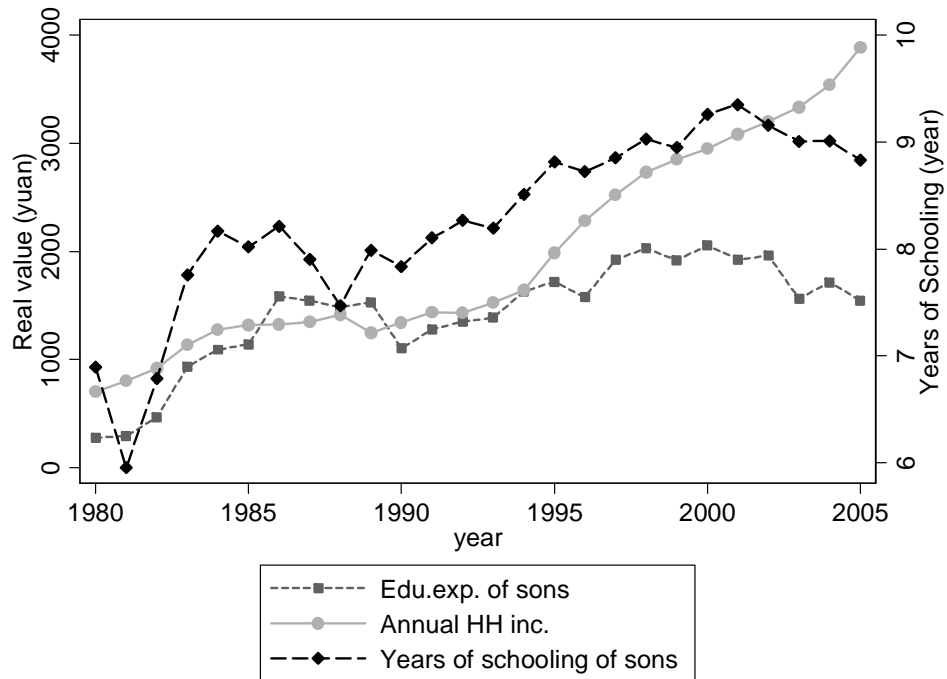
Educational expenditure: Survey on family and marriage dynamics in Hebei province.

Notes:

The un-discounted values are the mean educational expenditure received by sons married in certain years. The discounted values are the “present value” of the education expenditure in the actual marriage year, assuming a discount rate of 0.02.

The graph has been smoothed using the moving average of the four adjacent years. All monetary values have been deflated to 1980 price level.

Figure A2. Educational Expenditure v.s. Years of Schooling of Sons



Data Sources:

Annual household income: Hebei Bureau of Statistics (<http://www.hetj.gov.cn/>);

Educational expenditure and years of schooling: Survey on family and marriage dynamics in Hebei province.

Notes:

This graph plots the mean educational expenditure and the mean years of schooling of sons married in certain years.

The graph has been smoothed using the moving average of the four adjacent years. All monetary values have been deflated to 1980 price level.

Table 1. Variable Definitions and Summary Statistics

Variable Name	Unit	Definition or Notes	Obs	Mean	Std	Std w/i HH	# of HH w/ intra-HH variations
<i>Key Variables</i>							
yr_sch	year	Years of schooling.	264	8.42	(2.90)	(1.62)	127
edu_exp	yuan [†]	Total educational expenditure.	264	1556	(2785)	(1917)	127
mar_trans	yuan	Total monetary value of bride-price, including house, items and cash.	264	5085	(5151)	(2469)	127
land	yuan	Value of the land division. [‡]	172	2328	(2007)	(946)	83
<i>Sons' Attributes</i>							
age		Age.	264	33.87	(5.68)	(2.83)	127
age_mar		Age at marriage.	264	23.34	(2.53)	(1.64)	105
taller		Indicator of the taller son.*	264	0.39	(0.49)	(0.44)	99
more_ag_expr		Indicator of the son with more years of experience in agriculture.	264	0.29	(0.46)	(0.38)	72
more_nonag_expr		Indicator of the son with more years of experience in nonagriculture.	264	0.34	(0.47)	(0.42)	88
live_in_pre		Indicator of living with parents before marriage.	264	0.37	(0.48)	(0.28)	40
live_in_post		Indicator of living with parents after marriage.	264	0.38	(0.49)	(0.30)	46
1st_son		Indicator of the first born son.	264	0.48	(0.50)	(0.50)	126
<i>Variables used to construct the dummy variables in the sons' attributes</i>							
height	cm	Height.	264	170.34	(5.80)	(2.82)	99
ag_expr	year	Agricultural experience before marriage.	264	3.60	(4.60)	(2.26)	72
nonag_expr	year	Non-agricultural experience before marriage.	264	2.91	(3.04)	(1.60)	88
<i>Household Attributes</i>							
yr_sch_fa	year	Father's years of schooling.	127	5.32	(3.11)		
n_sons		Total number of sons in the household.	127	2.42	(0.76)		
n_daughters		Total number of daughters in the household.	127	0.76	(0.82)		
ttl_house	yuan	Total value of houses ever built by the parents.	127	11659	(12311)		
ttl_ag_equip	yuan	Total value of agricultural equipment ever possessed by the parents.	127	2224	(5085)		
fengrun		Indicator of residents in Fengrun county.	127	0.35	(0.48)		
zhaoxian		Indicator of residents in Zhaoxian county.	127	0.29	(0.45)		
chicheng		Indicator of residents in Chicheng county.	127	0.37	(0.48)		

Note:

[†] All monetary value is deflated to 1980 price level.

[‡] Construction of land value measurement. Hebei Statistics Yearbook provides the net income from cultivation per mu in each year. We assume that half this income is the net return to human capital. Given the area of the land received by each son, the value of the land is defined as the sum of the total return to human capital over the 10 years since the land was given by the parents.

* Compare among the selected sibling in the household. Same as "dum_ag_expr" and "dum_nonag_expr".

Table 2. Multiplicative Specification

	OLS		HH FE		Multiplicative FE					
	O1	O2	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.23 [0.06]***	-0.39 [0.15]***	-0.40 [0.15]***	-0.36 [0.15]**	-0.38 [0.16]**	-0.31 [0.17]*	-0.29 [0.13]**	-0.35 [0.14]**	-0.20 [0.11]*	-0.25 [0.12]**
δ_s										
taller			0.16 [0.1]						0.18 [0.1]*	0.22 [0.11]**
more_ag_expr				0.11 [0.15]					0.04 [0.13]	
more_nonag_exp					0.10 [0.12]				0.17 [0.12]	
live_in_pre						0.29 [0.3]			0.24 [0.22]	
live_in_post							0.40 [0.25]		0.45 [0.16]***	0.40 [0.17]**
1st_son								-0.20 [0.13]	-0.23 [0.12]**	-0.22 [0.12]*
R-squared	0.02	0.79	0.80	0.79	0.80	0.80	0.81	0.81	0.84	0.84
F-test (P) [†]									0.00	0.00

Note:

The regressions are based on sons sample with 264 observations in 127 households.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

T3. Multiplicative Specification with Interaction Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.37 [0.19]*	-0.36 [0.15]**	-0.33 [0.17]*	-0.32 [0.13]**	-0.29 [0.12]**	-0.44 [0.28]	-0.18 [0.22]	-0.29 [0.2]
δ_s								
taller	0.17 [0.07]**						0.22 [0.1]**	0.25 [0.08]***
more_ag_expr		0.10 [0.13]					0.17 [0.13]	
more_nonag_expr			0.16 [0.12]				0.21 [0.17]	
live_in_pre				0.26 [0.15]*			0.15 [0.22]	
live_in_post					0.39 [0.17]**		0.43 [0.21]**	0.40 [0.12]***
1st_son						-0.22 [0.1]**	-0.24 [0.12]**	-0.26 [0.08]***
Interaction with educational expenditure (edu_exp)								
taller	-0.07 [0.24]						-0.12 [0.16]	-0.16 [0.17]
more_ag_expr		0.06 [0.87]					-0.63 [0.86]	
more_nonag_expr			-0.34 [0.25]				-0.17 [0.24]	
live_in_pre				0.14 [0.48]			0.20 [0.34]	
live_in_post					0.10 [0.57]		0.15 [0.59]	0.12 [0.51]
1st_son						0.12 [0.28]	0.05 [0.19]	0.14 [0.21]
R-squared	0.80	0.79	0.80	0.80	0.81	0.81	0.84	0.84
F-test1†							0.00	0.00
F-test2‡							0.90	0.71

Note:

The regressions are based on sons sample with 264 observations in 127 households.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

T4. Multiplicative Specification with Discounting

	Basic			Preferred Specification			with Interactions		
	d=0 (1)	d=0.05 (2)	d=0.1 (3)	d=0 (4)	d=0.05 (5)	d=0.1 (6)	d=0 (7)	d=0.05 (8)	d=0.1 (9)
edu_exp	-0.40 [0.15]***	-0.26 [0.12]**	-0.14 [0.1]	-0.25 [0.12]**	-0.21 [0.1]**	-0.16 [0.1]	-0.29 [0.2]	-0.16 [0.18]	-0.06 [0.17]
δs									
taller				0.22 [0.11]**	0.21 [0.11]**	0.22 [0.11]*	0.25 [0.08]***	0.23 [0.07]***	0.25 [0.07]***
live_in_post				0.40 [0.17]**	0.39 [0.18]**	0.36 [0.18]**	0.40 [0.12]***	0.38 [0.08]***	0.34 [0.08]***
1st_son				-0.22 [0.12]*	0.11 [0.11]	0.47 [0.12]***	-0.26 [0.08]***	0.13 [0.07]*	0.64 [0.07]***
Interaction with educational expenditure (edu_exp)									
taller							-0.16 [0.17]	-0.02 [0.16]	0.00 [0.16]
live_in_post							0.12 [0.51]	0.07 [0.32]	0.07 [0.26]
1st_son							0.14 [0.21]	-0.04 [0.18]	-0.17 [0.15]
R-squared	0.80	0.82	0.80	0.84	0.83	0.84	0.84	0.83	0.84
F-test1†				0.00	0.00	0.00	0.00	0.01	0.00
F-test2‡							0.71	0.97	0.38

Note:

The regressions are based on sons sample with 264 observations in 127 households.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

T5. Adding Pre-mortem Bequests as Parts of the Transfers

Panel A. Summary Statistics of Pre-mortem Bequest

Items	# Household	# Household making pre-mortem	Mean Value
House	127	94	4259
Land	127	83	2328
Others	127	12	2542

Note:

1. Construction of land value measurement. Hebei Statistics Yearbook provides the net income from cultivation per mu in each year. We assume that half this income is the net return to human capital. Given the area of the land received by each son, the value of the land is defined as the sum of the total return to human capital over the 10 years since the land was given by the parents.

Panel B. Regression Results

	Basic			Preferred Specification			with Interactions		
	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1
edu_exp	-0.69 [0.2]***	-0.50 [0.19]***	-0.32 [0.17]*	-0.54 [0.19]***	-0.44 [0.2]**	-0.37 [0.2]*	-0.75 [0.18]***	-0.55 [0.17]***	-0.36 [0.17]**
δ_s									
taller				0.02 [0.08]	0.02 [0.09]	0.04 [0.1]	0.02 [0.08]	0.04 [0.07]	0.10 [0.08]
live_in_post				0.16 [0.14]	0.16 [0.16]	0.18 [0.18]	0.05 [0.11]	0.07 [0.09]	0.12 [0.09]
1st_son				-0.19 [0.1]*	0.01 [0.11]	0.25 [0.12]**	-0.23 [0.08]***	-0.05 [0.08]	0.23 [0.09]***
Interaction with educational expenditure (edu_exp)									
taller							-0.01 [0.3]	-0.11 [0.26]	-0.18 [0.26]
live_in_post							1.33 [0.96]	0.74 [0.68]	0.43 [0.59]
1st_son							0.28 [0.29]	0.17 [0.27]	0.02 [0.23]
R-squared	0.84	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.88
F-test1†				0.00	0.39	0.00	0.01	0.86	0.32
F-test2‡							0.22	0.36	0.47

Note:

The regressions are based on sons sample with land divisions (172 observations in 83 households).

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

Table 6. Bootstrap Results of β_3/β_1 (Summary Statistics)

			mean	std	min	max	$P(\beta_3/\beta_1 > 1)$
Basic	d=0	(1)	1.76	0.68	1.09	5.97	1.00
	d=0.05	(2)	1.47	0.60	1.05	6.00	1.00
	d=0.1	(3)	1.29	1.09	-3.77	9.77	0.94
Preferred Specification	d=0	(4)	2.27	1.76	-6.03	12.37	0.97
	d=0.05	(5)	1.22	7.10	-67.00	16.64	0.99
	d=0.1	(6)	1.42	0.81	-2.59	6.11	0.98

T7. Instrument Educational Expenditure by Years of Schooling

Panel A:

	Basic			Preferred Specification			with Interactions		
	d=0 (1)	d=0.05 (2)	d=0.1 (3)	d=0 (4)	d=0.05 (5)	d=0.1 (6)	d=0 (7)	d=0.05 (8)	d=0.1 (9)
edu_exp	-0.35 [0.26]	-0.24 [0.17]	-0.16 [0.13]	-0.20 [0.21]	-0.19 [0.17]	-0.14 [0.14]	-0.21 [0.25]	-0.12 [0.21]	-0.04 [0.18]
δ_s									
taller				0.22 [0.11]**	0.21 [0.11]*	0.22 [0.12]*	0.27 [0.09]***	0.26 [0.07]***	0.28 [0.07]***
live_in_post				0.40 [0.18]**	0.39 [0.18]**	0.36 [0.19]*	0.40 [0.13]***	0.39 [0.1]***	0.36 [0.09]***
1st_son				-0.22 [0.12]*	0.11 [0.12]	0.47 [0.12]***	-0.28 [0.09]***	0.09 [0.08]	0.64 [0.09]***
Interaction with educational expenditure (edu_exp)									
taller							-0.24 [0.22]	-0.11 [0.18]	-0.07 [0.16]
live_in_post							0.58 [0.42]	0.30 [0.33]	0.10 [0.25]
1st_son							0.19 [0.22]	0.00 [0.19]	-0.17 [0.19]
R-squared	0.78	0.81	0.82	0.83	0.83	0.83	0.84	0.83	0.84
F-test1†				0.00	0.00	0.00	0.00	0.02	0.00
F-test2‡							0.93	1.00	0.64

Panel B: 1st Stage

yr_sch	769.24 [178.6]***	883.35 [232.84]***	1044.11 [307.54]***	755.48 [165.72]**	839.61 [215.65]***	955.74 [284.44]***	755.48 [165.72]***	839.61 [215.65]***	955.74 [284.44]***
R-squared	0.73	0.72	0.71	0.76	0.74	0.73	0.76	0.74	0.73

Panel C: Reduced Form

	Basic			Preferred Specification			with Interactions		
	d=0 (1)	d=0.05 (2)	d=0.1 (3)	d=0 (4)	d=0.05 (5)	d=0.1 (6)	d=0 (7)	d=0.05 (8)	d=0.1 (9)
yr_sch	-208.52 [206.33]	-183.42 [151.01]	-153.10 [138.97]	-63.02 [137.37]	-126.16 [147.66]	-95.79 [131.88]	-149.26 [176.26]	-104.26 [144.88]	-75.70 [130.6]
R-squared	0.78	0.81	0.82	0.83	0.82	0.83	0.83	0.83	0.84

Note:

The regressions are based on sons sample with 264 observations in 127 households.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

Table A1. Prediction on the interaction terms

Child's Attributes (relative to his sibling when applicable)	Proportion of total educational return appropriated by the son	Sign of the interaction effects with schooling expenditure
Taller son	more	-
More agriculture experience before marriage	less	+
More non-agriculture experience before marriage	more	-
Live outside the home before marriage	more	-
Live with the parents after marriage	less	+
First son	less	+

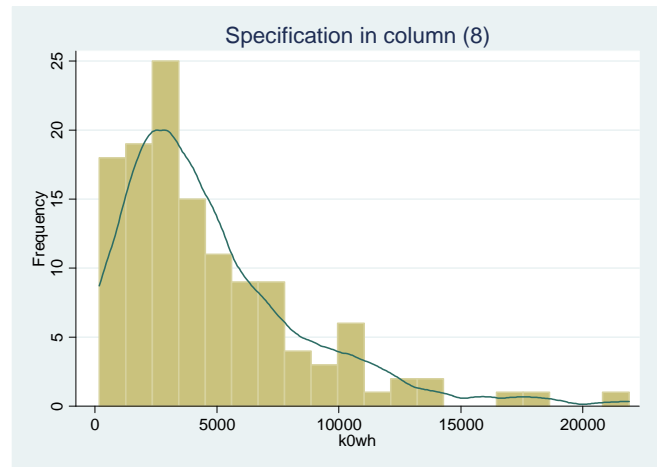
Table A2. Estimates of consumption level of the hypothetical son in each household (k0wh)

Panel A. Summary of k0wh from specifications in Table 2

Spec	Obs	Mean	Std. Dev.	Log-normality
				Test
(1)	127	5458	4360	0.21
(2)	127	5574	4480	0.08
(3)	127	5542	4402	0.16
(4)	127	4833	3956	0.24
(5)	127	4775	3818	0.26
(6)	127	6303	5017	0.19
(7)	127	3957	3294	0.19
(8)	127	4787	3877	0.14

Note: The “log-normality test” column reports the p-value of the Kolmogorov-Smirnov distribution test with the null “the log of k0wh follows normal distribution”.

Panel B. Distribution of k0wh.



Panel C. Regression of k0wh on household level characteristics

Dep. Var.: estimations of k0wh	Specification in Table 2 used to estimate k0wh							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
n_boy	-665.2 [329.4]**	-739.8 [340.0]**	-690.3 [339.5]**	-784.7 [295.7]***	-616.9 [307.3]**	-840.3 [383.9]**	-629.0 [256.3]**	-643.5 [312.0]**
n_girl	-707.9 [400.0]*	-790.4 [393.7]**	-710.8 [403.1]*	-724.2 [337.9]**	-591.5 [315.1]*	-779.0 [466.5]*	-454.8 [263.9]*	-517.0 [325.2]
literacy_fa	34.1 [92.4]	18.3 [94.1]	29.5 [93.2]	-8.9 [86.6]	8.6 [80.3]	24.7 [108.1]	-5.5 [69.8]	11.0 [81.0]
ttl_house	0.1 [0.1]***	0.1 [0.1]**	0.1 [0.1]**	0.1 [0.0]***	0.1 [0.0]**	0.2 [0.1]**	0.1 [0.0]**	0.1 [0.0]**
ttl_ag_equip	0.3 [0.1]***	0.3 [0.1]***	0.2 [0.1]***	0.3 [0.1]***	0.2 [0.1]***	0.3 [0.1]***	0.2 [0.1]***	0.3 [0.1]***
fengrun	427.0 [932.1]	512.8 [960.3]	479.1 [959.9]	418.5 [809.5]	543.3 [825.5]	669.4 [1,047.3]	482.1 [664.1]	576.3 [803.8]
chicheng	-1071.5 [875.9]	-1103.7 [903.6]	-1116.9 [903.4]	-589.7 [782.7]	-582.4 [773.1]	-1187.1 [1,010.1]	-369.0 [641.5]	-590.9 [762.7]
Obs	127	127	127	127	127	127	127	127
R-squared	0.38	0.38	0.36	0.38	0.33	0.37	0.36	0.36

TA3. Using Housholds with Land Division

	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1
edu_exp	-0.43 [0.22]**	-0.37 [0.19]*	-0.27 [0.16]	-0.27 [0.18]	-0.30 [0.19]	-0.29 [0.19]	-0.54 [0.25]**	-0.45 [0.2]**	-0.30 [0.19]
δs									
taller				0.09 [0.12]	0.06 [0.11]	0.07 [0.11]	0.09 [0.09]	0.06 [0.08]	0.11 [0.1]
live_in_post				0.25 [0.2]	0.21 [0.2]	0.19 [0.19]	0.16 [0.1]*	0.14 [0.09]	0.15 [0.1]
1st_son				-0.31 [0.14]**	-0.04 [0.13]	0.25 [0.13]*	-0.37 [0.09]***	-0.11 [0.09]	0.23 [0.1]**
Interaction with educational expenditure (edu_exp)									
taller							-0.03 [0.29]	-0.04 [0.27]	-0.12 [0.26]
live_in_post							0.93 [0.77]	0.46 [0.6]	0.32 [0.55]
1st_son							0.37 [0.3]	0.21 [0.26]	0.03 [0.23]
R-squared	0.82	0.87	0.88	0.86	0.86	0.87	0.87	0.87	0.87
F-test1†				0.00	0.35	0.01	0.00	0.52	0.38
F-test2‡							0.19	0.50	0.64

Note:

The regressions are based on sons sample with land divisions (172 observations in 83 households).

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

Table A4. Estimation Methods Comparison

Panel A. Least Square

	True Value		Estimation		
β	-0.30	-0.29	-0.30	-0.30	-0.30
		[0.099]	[0.096]	[0.104]	[0.106]
δ_s					
height	0.2	0.20			0.20
		[0.047]			[0.05]
live_in_post	0.4		0.40		0.40
			[0.063]		[0.076]
1st_son	-0.2			-0.20	-0.20
				[0.034]	[0.035]

Panel B. Quasi-differencing

	True Value		Estimation		
beta	-0.30	-0.28	-0.28	-0.31	-0.24
		[0.104]	[0.103]	[0.103]	[0.158]
height	0.2	0.27			0.39
		[0.056]			[0.666]
live_in_post	0.4		0.51		0.71
			[0.097]		[0.911]
1st_son	-0.2			-0.10	-0.03
				[0.046]**	[0.349]

Note:

Reported in the tables are the mean and standard deviation (in bracket) of the 500 simulations. The null hypothesis being tested is H_0 : estimate value = true value.

** means that the null can be rejected at 5 percent significance level.

Table A5. Transfers Regression (level-level specifications)

Panel A: Without Household Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.30 [0.08]***	-0.30 [0.08]***	-0.28 [0.08]***	-0.29 [0.08]***	-0.25 [0.08]***	-0.25 [0.08]***	-0.30 [0.08]***	-0.20 [0.08]**
taller		660.69 [416.12]						622.92 [410.47]
more_ag_expr			404.93 [553.03]					186.45 [564.47]
more_nonag_expr				378.79 [474.69]				638.08 [569.07]
live_in_pre					865.23 [696.08]			957.31 [811.19]
live_in_post						1498.27 [608.82]**		1412.04 [605.65]**
1st_son							51.92 [503.87]	69.23 [484.19]
R-squared	0.33	0.33	0.33	0.33	0.33	0.35	0.33	0.36

Panel B: With Household Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.38 [0.14]**	-0.38 [0.14]***	-0.37 [0.14]**	-0.37 [0.15]**	-0.35 [0.16]**	-0.32 [0.15]**	-0.38 [0.15]**	-0.30 [0.18]*
taller		491.72 [527.63]						487.29 [520.87]
more_ag_expr			63.09 [752.20]					-100.45 [820.57]
more_nonag_expr				98.52 [708.47]				238.68 [781.78]
live_in_pre					517.71 [972.00]			503.12 [1,029.51]
live_in_post						1146.18 [1,143.19]		1070.42 [1,158.68]
1st_son							-184.32 [846.33]	-228.35 [842.42]
R-squared	0.80	0.80	0.80	0.80	0.80	0.81	0.80	0.81

Note:

The regressions are based on sons sample with 264 observations in 127 households.

In panel A, family level attributes, such as father's years of schooling, total number of sons and daughters, and wealth indicators are controlled, but their coefficients are not reported to save space.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A6. Transfers Regression (log-log specifications)

Panel A: Without Household Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.05 [0.08]	-0.05 [0.08]	-0.03 [0.08]	-0.05 [0.08]	0.01 [0.08]	-0.02 [0.08]	-0.05 [0.08]	0.05 [0.08]
taller		0.07 [0.12]						0.06 [0.13]
more_ag_expr			0.16 [0.16]					0.09 [0.16]
more_nonag_expr				0.02 [0.13]				0.14 [0.13]
live_in_pre					0.40 [0.16]**			0.41 [0.16]**
live_in_post						0.44 [0.15]***		0.39 [0.15]***
1st_son							0.07 [0.14]	0.09 [0.14]
R-squared	0.34	0.34	0.34	0.34	0.36	0.36	0.34	0.38

Panel B: With Household Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.30 [0.15]*	-0.30 [0.16]*	-0.31 [0.16]*	-0.30 [0.15]**	-0.28 [0.16]*	-0.27 [0.15]*	-0.31 [0.16]*	-0.28 [0.16]*
taller		-0.02 [0.16]						-0.02 [0.16]
more_ag_expr			-0.08 [0.24]					-0.09 [0.25]
more_nonag_expr				-0.05 [0.18]				-0.03 [0.20]
live_in_pre					0.14 [0.29]			0.09 [0.32]
live_in_post						0.32 [0.27]		0.30 [0.29]
1st_son							0.17 [0.28]	0.16 [0.29]
R-squared	0.75	0.75	0.75	0.75	0.75	0.76	0.75	0.76

Note:

The regressions are based on sons sample with 264 observations in 127 households.

In panel A, family level attributes, such as father's years of schooling, total number of sons and daughters, and wealth indicators are controlled, but their coefficients are not reported to save space.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

Tabke A7. Reduced Form Regression - Expenditure replaced by Years of Schooling

	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1
yr_sch	-208.52 [206.33]	-183.42 [151.01]	-153.10 [138.97]	-63.02 [137.37]	-126.16 [147.66]	-95.79 [131.88]	-149.26 [176.26]	-104.26 [144.88]	-75.70 [130.6]
δ_s									
taller	0.16 [0.1]	0.10 [0.11]	0.07 [0.14]	0.22 [0.11]*	0.21 [0.11]**	0.22 [0.12]*	0.39 [0.12]***	0.41 [0.1]***	0.44 [0.1]***
live_in_post				0.40 [0.17]**	0.39 [0.18]**	0.36 [0.18]**	0.61 [0.17]***	0.56 [0.14]***	0.44 [0.11]***
1st_son				-0.22 [0.12]*	0.11 [0.11]	0.47 [0.13]***	-0.39 [0.11]***	0.04 [0.1]	0.65 [0.1]***
Interaction with educational expenditure (edu_exp)									
taller							-180.63 [126.67]	-149.36 [92]	-141.89 [75.08]*
live_in_post							-150.15 [160.45]	-66.82 [167.69]	13.56 [151.92]
1st_son							155.85 [115.46]	23.05 [88.46]	-111.22 [122.39]
R-squared	0.78	0.81	0.82	0.83	0.82	0.83	0.83	0.83	0.84
F-test1†	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
F-test2‡							1.00	1.00	1.00

Note:

The regressions are based on sons sample with 264 observations in 127 households.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

Table A8. Adding Value of Land as Parts of the Transfers (log-log specifications with household fixed effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.54	-0.55	-0.49	-0.53	-0.50	-0.49	-0.56	-0.44
	[0.15]***	[0.16]***	[0.17]***	[0.15]***	[0.16]***	[0.14]***	[0.16]***	[0.15]***
taller		-0.10						-0.10
		[0.17]						[0.16]
more_ag_expr			0.18					0.24
			[0.19]					[0.20]
more_nonag_expr				0.14				0.22
				[0.15]				[0.15]
live_in_pre					0.17			0.10
					[0.22]			[0.30]
live_in_post						0.47		0.44
						[0.26]*		[0.28]
1st_son							0.15	0.21
							[0.31]	[0.28]
R-squared	0.73	0.73	0.73	0.73	0.73	0.75	0.73	0.77

Note:

The regressions are based on sons sample with land divisions (172 observations in 83 households).

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 1. Variable Definitions and Summary Statistics

Variable Name	Unit	Definition or Notes	Obs	Mean	Std	Std w/i HH	# of HH w/ intra-HH variations
<i>Key Variables</i>							
yr_sch	year	Years of schooling.	264	8.42	(2.90)	(1.62)	127
edu_exp	yuan [†]	Total educational expenditure.	264	1556	(2785)	(1917)	127
mar_trans	yuan	Total monetary value of bride-price, including house, items and cash.	264	5085	(5151)	(2469)	127
land	yuan	Value of the land division. [‡]	172	2328	(2007)	(946)	83
<i>Sons' Attributes</i>							
age		Age.	264	33.87	(5.68)	(2.83)	127
age_mar		Age at marriage.	264	23.34	(2.53)	(1.64)	105
taller		Indicator of the taller son.*	264	0.39	(0.49)	(0.44)	99
more_ag_expr		Indicator of the son with more years of experience in agriculture.	264	0.29	(0.46)	(0.38)	72
more_nonag_expr		Indicator of the son with more years of experience in nonagriculture.	264	0.34	(0.47)	(0.42)	88
live_in_pre		Indicator of living with parents before marriage.	264	0.37	(0.48)	(0.28)	40
live_in_post		Indicator of living with parents after marriage.	264	0.38	(0.49)	(0.30)	46
1st_son		Indicator of the first born son.	264	0.48	(0.50)	(0.50)	126
<i>Variables used to construct the dummy variables in the sons' attributes</i>							
height	cm	Height.	264	170.34	(5.80)	(2.82)	99
ag_expr	year	Agricultural experience before marriage.	264	3.60	(4.60)	(2.26)	72
nonag_expr	year	Non-agricultural experience before marriage.	264	2.91	(3.04)	(1.60)	88
<i>Household Attributes</i>							
yr_sch_fa	year	Father's years of schooling.	127	5.32	(3.11)		
n_sons		Total number of sons in the household.	127	2.42	(0.76)		
n_daughters		Total number of daughters in the household.	127	0.76	(0.82)		
ttl_house	yuan	Total value of houses ever built by the parents.	127	11659	(12311)		
ttl_ag_equip	yuan	Total value of agricultural equipment ever possessed by the parents.	127	2224	(5085)		
fengrun		Indicator of residents in Fengrun county.	127	0.35	(0.48)		
zhaoxian		Indicator of residents in Zhaoxian county.	127	0.29	(0.45)		
chicheng		Indicator of residents in Chicheng county.	127	0.37	(0.48)		

Note:

[†] All monetary value is deflated to 1980 price level.

[‡] Construction of land value measurement. Hebei Statistics Yearbook provides the net income from cultivation per mu in each year. We assume that half this income is the net return to human capital. Given the area of the land received by each son, the value of the land is defined as the sum of the total return to human capital over the 10 years since the land was given by the parents.

* Compare among the selected sibling in the household. Same as "dum_ag_expr" and "dum_nonag_expr".

Table 2. Multiplicative Specification

	OLS		HH FE		Multiplicative FE					
	O1	O2	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.23 [0.06]***	-0.39 [0.15]***	-0.40 [0.15]***	-0.36 [0.15]**	-0.38 [0.16]**	-0.31 [0.17]*	-0.29 [0.13]**	-0.35 [0.14]**	-0.20 [0.11]*	-0.25 [0.12]**
δ_s										
taller			0.16 [0.1]						0.18 [0.1]*	0.22 [0.11]**
more_ag_expr				0.11 [0.15]					0.04 [0.13]	
more_nonag_exp					0.10 [0.12]				0.17 [0.12]	
live_in_pre						0.29 [0.3]			0.24 [0.22]	
live_in_post							0.40 [0.25]		0.45 [0.16]***	0.40 [0.17]**
1st_son								-0.20 [0.13]	-0.23 [0.12]**	-0.22 [0.12]*
R-squared	0.02	0.79	0.80	0.79	0.80	0.80	0.81	0.81	0.84	0.84
F-test (P) [†]									0.00	0.00

Note:

The regressions are based on sons sample with 264 observations in 127 households.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

T3. Multiplicative Specification with Interaction Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.37 [0.19]*	-0.36 [0.15]**	-0.33 [0.17]*	-0.32 [0.13]**	-0.29 [0.12]**	-0.44 [0.28]	-0.18 [0.22]	-0.29 [0.2]
δ_s								
taller	0.17 [0.07]**						0.22 [0.1]**	0.25 [0.08]***
more_ag_expr		0.10 [0.13]					0.17 [0.13]	
more_nonag_expr			0.16 [0.12]				0.21 [0.17]	
live_in_pre				0.26 [0.15]*			0.15 [0.22]	
live_in_post					0.39 [0.17]**		0.43 [0.21]**	0.40 [0.12]***
1st_son						-0.22 [0.1]**	-0.24 [0.12]**	-0.26 [0.08]***
Interaction with educational expenditure (edu_exp)								
taller	-0.07 [0.24]						-0.12 [0.16]	-0.16 [0.17]
more_ag_expr		0.06 [0.87]					-0.63 [0.86]	
more_nonag_expr			-0.34 [0.25]				-0.17 [0.24]	
live_in_pre				0.14 [0.48]			0.20 [0.34]	
live_in_post					0.10 [0.57]		0.15 [0.59]	0.12 [0.51]
1st_son						0.12 [0.28]	0.05 [0.19]	0.14 [0.21]
R-squared	0.80	0.79	0.80	0.80	0.81	0.81	0.84	0.84
F-test1†							0.00	0.00
F-test2‡							0.90	0.71

Note:

The regressions are based on sons sample with 264 observations in 127 households.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

T4. Multiplicative Specification with Discounting

	Basic			Preferred Specification			with Interactions		
	d=0 (1)	d=0.05 (2)	d=0.1 (3)	d=0 (4)	d=0.05 (5)	d=0.1 (6)	d=0 (7)	d=0.05 (8)	d=0.1 (9)
edu_exp	-0.40 [0.15]***	-0.26 [0.12]**	-0.14 [0.1]	-0.25 [0.12]**	-0.21 [0.1]**	-0.16 [0.1]	-0.29 [0.2]	-0.16 [0.18]	-0.06 [0.17]
δs									
taller				0.22 [0.11]**	0.21 [0.11]**	0.22 [0.11]*	0.25 [0.08]***	0.23 [0.07]***	0.25 [0.07]***
live_in_post				0.40 [0.17]**	0.39 [0.18]**	0.36 [0.18]**	0.40 [0.12]***	0.38 [0.08]***	0.34 [0.08]***
1st_son				-0.22 [0.12]*	0.11 [0.11]	0.47 [0.12]***	-0.26 [0.08]***	0.13 [0.07]*	0.64 [0.07]***
Interaction with educational expenditure (edu_exp)									
taller							-0.16 [0.17]	-0.02 [0.16]	0.00 [0.16]
live_in_post							0.12 [0.51]	0.07 [0.32]	0.07 [0.26]
1st_son							0.14 [0.21]	-0.04 [0.18]	-0.17 [0.15]
R-squared	0.80	0.82	0.80	0.84	0.83	0.84	0.84	0.83	0.84
F-test1†				0.00	0.00	0.00	0.00	0.01	0.00
F-test2‡							0.71	0.97	0.38

Note:

The regressions are based on sons sample with 264 observations in 127 households.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

T5. Adding Pre-mortem Bequests as Parts of the Transfers

Panel A. Summary Statistics of Pre-mortem Bequest

Items	# Household	# Household making pre-mortem	Mean Value
House	127	94	4259
Land	127	83	2328
Others	127	12	2542

Note:

1. Construction of land value measurement. Hebei Statistics Yearbook provides the net income from cultivation per mu in each year. We assume that half this income is the net return to human capital. Given the area of the land received by each son, the value of the land is defined as the sum of the total return to human capital over the 10 years since the land was given by the parents.

Panel B. Regression Results

	Basic			Preferred Specification			with Interactions		
	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1
edu_exp	-0.69 [0.2]***	-0.50 [0.19]***	-0.32 [0.17]*	-0.54 [0.19]***	-0.44 [0.2]**	-0.37 [0.2]*	-0.75 [0.18]***	-0.55 [0.17]***	-0.36 [0.17]**
δ_s									
taller				0.02 [0.08]	0.02 [0.09]	0.04 [0.1]	0.02 [0.08]	0.04 [0.07]	0.10 [0.08]
live_in_post				0.16 [0.14]	0.16 [0.16]	0.18 [0.18]	0.05 [0.11]	0.07 [0.09]	0.12 [0.09]
1st_son				-0.19 [0.1]*	0.01 [0.11]	0.25 [0.12]**	-0.23 [0.08]***	-0.05 [0.08]	0.23 [0.09]***
Interaction with educational expenditure (edu_exp)									
taller							-0.01 [0.3]	-0.11 [0.26]	-0.18 [0.26]
live_in_post							1.33 [0.96]	0.74 [0.68]	0.43 [0.59]
1st_son							0.28 [0.29]	0.17 [0.27]	0.02 [0.23]
R-squared	0.84	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.88
F-test1†				0.00	0.39	0.00	0.01	0.86	0.32
F-test2‡							0.22	0.36	0.47

Note:

The regressions are based on sons sample with land divisions (172 observations in 83 households).

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

Table 6. Bootstrap Results of β_3/β_1 (Summary Statistics)

			mean	std	min	max	$P(\beta_3/\beta_1 > 1)$
Basic	d=0	(1)	1.76	0.68	1.09	5.97	1.00
	d=0.05	(2)	1.47	0.60	1.05	6.00	1.00
	d=0.1	(3)	1.29	1.09	-3.77	9.77	0.94
Preferred Specification	d=0	(4)	2.27	1.76	-6.03	12.37	0.97
	d=0.05	(5)	1.22	7.10	-67.00	16.64	0.99
	d=0.1	(6)	1.42	0.81	-2.59	6.11	0.98

T7. Instrument Educational Expenditure by Years of Schooling

Panel A:

	Basic			Preferred Specification			with Interactions		
	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
edu_exp	-0.35	-0.24	-0.16	-0.20	-0.19	-0.14	-0.21	-0.12	-0.04
	[0.26]	[0.17]	[0.13]	[0.21]	[0.17]	[0.14]	[0.25]	[0.21]	[0.18]
δ_s									
taller				0.22	0.21	0.22	0.27	0.26	0.28
				[0.11]**	[0.11]*	[0.12]*	[0.09]***	[0.07]***	[0.07]***
live_in_post				0.40	0.39	0.36	0.40	0.39	0.36
				[0.18]**	[0.18]**	[0.19]*	[0.13]***	[0.1]***	[0.09]***
1st_son				-0.22	0.11	0.47	-0.28	0.09	0.64
				[0.12]*	[0.12]	[0.12]***	[0.09]***	[0.08]	[0.09]***
Interaction with educational expenditure (edu_exp)									
taller							-0.24	-0.11	-0.07
							[0.22]	[0.18]	[0.16]
live_in_post							0.58	0.30	0.10
							[0.42]	[0.33]	[0.25]
1st_son							0.19	0.00	-0.17
							[0.22]	[0.19]	[0.19]
R-squared	0.78	0.81	0.82	0.83	0.83	0.83	0.84	0.83	0.84
F-test1†				0.00	0.00	0.00	0.00	0.02	0.00
F-test2‡							0.93	1.00	0.64

Panel B: 1st Stage

yr_sch	769.24	883.35	1044.11	755.48	839.61	955.74	755.48	839.61	955.74
	[178.6]***	[232.84]***	[307.54]***	[165.72]**	[215.65]**	[284.44]***	[165.72]***	[215.65]**	[284.44]***
R-squared	0.73	0.72	0.71	0.76	0.74	0.73	0.76	0.74	0.73

Panel C: Reduced Form

	Basic			Preferred Specification			with Interactions		
	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
yr_sch	-208.52	-183.42	-153.10	-63.02	-126.16	-95.79	-149.26	-104.26	-75.70
	[206.33]	[151.01]	[138.97]	[137.37]	[147.66]	[131.88]	[176.26]	[144.88]	[130.6]
R-squared	0.78	0.81	0.82	0.83	0.82	0.83	0.83	0.83	0.84

Note:

The regressions are based on sons sample with 264 observations in 127 households.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

Table A1. Prediction on the interaction terms

Child's Attributes (relative to his sibling when applicable)	Proportion of total educational return appropriated by the son	Sign of the interaction effects with schooling expenditure
Taller son	more	-
More agriculture experience before marriage	less	+
More non-agriculture experience before marriage	more	-
Live outside the home before marriage	more	-
Live with the parents after marriage	less	+
First son	less	+

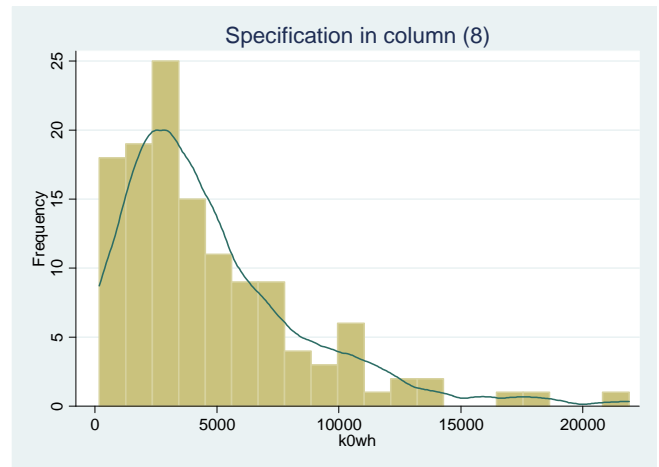
Table A2. Estimates of consumption level of the hypothetical son in each household (k0wh)

Panel A. Summary of k0wh from specifications in Table 2

Spec	Obs	Mean	Std. Dev.	Log-normality
				Test
(1)	127	5458	4360	0.21
(2)	127	5574	4480	0.08
(3)	127	5542	4402	0.16
(4)	127	4833	3956	0.24
(5)	127	4775	3818	0.26
(6)	127	6303	5017	0.19
(7)	127	3957	3294	0.19
(8)	127	4787	3877	0.14

Note: The “log-normality test” column reports the p-value of the Kolmogorov-Smirnov distribution test with the null “the log of k0wh follows normal distribution”.

Panel B. Distribution of k0wh.



Panel C. Regression of k0wh on household level characteristics

Dep. Var.: estimations of k0wh	Specification in Table 2 used to estimate k0wh							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
n_boy	-665.2 [329.4]**	-739.8 [340.0]**	-690.3 [339.5]**	-784.7 [295.7]***	-616.9 [307.3]**	-840.3 [383.9]**	-629.0 [256.3]**	-643.5 [312.0]**
n_girl	-707.9 [400.0]*	-790.4 [393.7]**	-710.8 [403.1]*	-724.2 [337.9]**	-591.5 [315.1]*	-779.0 [466.5]*	-454.8 [263.9]*	-517.0 [325.2]
literacy_fa	34.1 [92.4]	18.3 [94.1]	29.5 [93.2]	-8.9 [86.6]	8.6 [80.3]	24.7 [108.1]	-5.5 [69.8]	11.0 [81.0]
ttl_house	0.1 [0.1]***	0.1 [0.1]**	0.1 [0.1]**	0.1 [0.0]***	0.1 [0.0]**	0.2 [0.1]**	0.1 [0.0]**	0.1 [0.0]**
ttl_ag_equip	0.3 [0.1]***	0.3 [0.1]***	0.2 [0.1]***	0.3 [0.1]***	0.2 [0.1]***	0.3 [0.1]***	0.2 [0.1]***	0.3 [0.1]***
fengrun	427.0 [932.1]	512.8 [960.3]	479.1 [959.9]	418.5 [809.5]	543.3 [825.5]	669.4 [1,047.3]	482.1 [664.1]	576.3 [803.8]
chicheng	-1071.5 [875.9]	-1103.7 [903.6]	-1116.9 [903.4]	-589.7 [782.7]	-582.4 [773.1]	-1187.1 [1,010.1]	-369.0 [641.5]	-590.9 [762.7]
Obs	127	127	127	127	127	127	127	127
R-squared	0.38	0.38	0.36	0.38	0.33	0.37	0.36	0.36

TA3. Using Housholds with Land Division

	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1
edu_exp	-0.43 [0.22]**	-0.37 [0.19]*	-0.27 [0.16]	-0.27 [0.18]	-0.30 [0.19]	-0.29 [0.19]	-0.54 [0.25]**	-0.45 [0.2]**	-0.30 [0.19]
δs									
taller				0.09 [0.12]	0.06 [0.11]	0.07 [0.11]	0.09 [0.09]	0.06 [0.08]	0.11 [0.1]
live_in_post				0.25 [0.2]	0.21 [0.2]	0.19 [0.19]	0.16 [0.1]*	0.14 [0.09]	0.15 [0.1]
1st_son				-0.31 [0.14]**	-0.04 [0.13]	0.25 [0.13]*	-0.37 [0.09]***	-0.11 [0.09]	0.23 [0.1]**
Interaction with educational expenditure (edu_exp)									
taller							-0.03 [0.29]	-0.04 [0.27]	-0.12 [0.26]
live_in_post							0.93 [0.77]	0.46 [0.6]	0.32 [0.55]
1st_son							0.37 [0.3]	0.21 [0.26]	0.03 [0.23]
R-squared	0.82	0.87	0.88	0.86	0.86	0.87	0.87	0.87	0.87
F-test1†				0.00	0.35	0.01	0.00	0.52	0.38
F-test2‡							0.19	0.50	0.64

Note:

The regressions are based on sons sample with land divisions (172 observations in 83 households).

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

Table A4. Estimation Methods Comparison

Panel A. Least Square

	True Value		Estimation		
β	-0.30	-0.29	-0.30	-0.30	-0.30
		[0.099]	[0.096]	[0.104]	[0.106]
δ_s					
height	0.2	0.20			0.20
		[0.047]			[0.05]
live_in_post	0.4		0.40		0.40
			[0.063]		[0.076]
1st_son	-0.2			-0.20	-0.20
				[0.034]	[0.035]

Panel B. Quasi-differencing

	True Value		Estimation		
beta	-0.30	-0.28	-0.28	-0.31	-0.24
		[0.104]	[0.103]	[0.103]	[0.158]
height	0.2	0.27			0.39
		[0.056]			[0.666]
live_in_post	0.4		0.51		0.71
			[0.097]		[0.911]
1st_son	-0.2			-0.10	-0.03
				[0.046]**	[0.349]

Note:

Reported in the tables are the mean and standard deviation (in bracket) of the 500 simulations. The null hypothesis being tested is H_0 : estimate value = true value.

** means that the null can be rejected at 5 percent significance level.

Table A5. Transfers Regression (level-level specifications)

Panel A: Without Household Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.30 [0.08]***	-0.30 [0.08]***	-0.28 [0.08]***	-0.29 [0.08]***	-0.25 [0.08]***	-0.25 [0.08]***	-0.30 [0.08]***	-0.20 [0.08]**
taller		660.69 [416.12]						622.92 [410.47]
more_ag_expr			404.93 [553.03]					186.45 [564.47]
more_nonag_expr				378.79 [474.69]				638.08 [569.07]
live_in_pre					865.23 [696.08]			957.31 [811.19]
live_in_post						1498.27 [608.82]**		1412.04 [605.65]**
1st_son							51.92 [503.87]	69.23 [484.19]
R-squared	0.33	0.33	0.33	0.33	0.33	0.35	0.33	0.36

Panel B: With Household Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.38 [0.14]**	-0.38 [0.14]***	-0.37 [0.14]**	-0.37 [0.15]**	-0.35 [0.16]**	-0.32 [0.15]**	-0.38 [0.15]**	-0.30 [0.18]*
taller		491.72 [527.63]						487.29 [520.87]
more_ag_expr			63.09 [752.20]					-100.45 [820.57]
more_nonag_expr				98.52 [708.47]				238.68 [781.78]
live_in_pre					517.71 [972.00]			503.12 [1,029.51]
live_in_post						1146.18 [1,143.19]		1070.42 [1,158.68]
1st_son							-184.32 [846.33]	-228.35 [842.42]
R-squared	0.80	0.80	0.80	0.80	0.80	0.81	0.80	0.81

Note:

The regressions are based on sons sample with 264 observations in 127 households.

In panel A, family level attributes, such as father's years of schooling, total number of sons and daughters, and wealth indicators are controlled, but their coefficients are not reported to save space.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A6. Transfers Regression (log-log specifications)

Panel A: Without Household Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.05 [0.08]	-0.05 [0.08]	-0.03 [0.08]	-0.05 [0.08]	0.01 [0.08]	-0.02 [0.08]	-0.05 [0.08]	0.05 [0.08]
taller		0.07 [0.12]						0.06 [0.13]
more_ag_expr			0.16 [0.16]					0.09 [0.16]
more_nonag_expr				0.02 [0.13]				0.14 [0.13]
live_in_pre					0.40 [0.16]**			0.41 [0.16]**
live_in_post						0.44 [0.15]***		0.39 [0.15]***
1st_son							0.07 [0.14]	0.09 [0.14]
R-squared	0.34	0.34	0.34	0.34	0.36	0.36	0.34	0.38

Panel B: With Household Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.30 [0.15]*	-0.30 [0.16]*	-0.31 [0.16]*	-0.30 [0.15]**	-0.28 [0.16]*	-0.27 [0.15]*	-0.31 [0.16]*	-0.28 [0.16]*
taller		-0.02 [0.16]						-0.02 [0.16]
more_ag_expr			-0.08 [0.24]					-0.09 [0.25]
more_nonag_expr				-0.05 [0.18]				-0.03 [0.20]
live_in_pre					0.14 [0.29]			0.09 [0.32]
live_in_post						0.32 [0.27]		0.30 [0.29]
1st_son							0.17 [0.28]	0.16 [0.29]
R-squared	0.75	0.75	0.75	0.75	0.75	0.76	0.75	0.76

Note:

The regressions are based on sons sample with 264 observations in 127 households.

In panel A, family level attributes, such as father's years of schooling, total number of sons and daughters, and wealth indicators are controlled, but their coefficients are not reported to save space.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

Tabke A7. Reduced Form Regression - Expenditure replaced by Years of Schooling

	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1	d=0	d=0.05	d=0.1
yr_sch	-208.52 [206.33]	-183.42 [151.01]	-153.10 [138.97]	-63.02 [137.37]	-126.16 [147.66]	-95.79 [131.88]	-149.26 [176.26]	-104.26 [144.88]	-75.70 [130.6]
δ_s									
taller	0.16 [0.1]	0.10 [0.11]	0.07 [0.14]	0.22 [0.11]*	0.21 [0.11]**	0.22 [0.12]*	0.39 [0.12]***	0.41 [0.1]***	0.44 [0.1]***
live_in_post				0.40 [0.17]**	0.39 [0.18]**	0.36 [0.18]**	0.61 [0.17]***	0.56 [0.14]***	0.44 [0.11]***
1st_son				-0.22 [0.12]*	0.11 [0.11]	0.47 [0.13]***	-0.39 [0.11]***	0.04 [0.1]	0.65 [0.1]***
Interaction with educational expenditure (edu_exp)									
taller							-180.63 [126.67]	-149.36 [92]	-141.89 [75.08]*
live_in_post							-150.15 [160.45]	-66.82 [167.69]	13.56 [151.92]
1st_son							155.85 [115.46]	23.05 [88.46]	-111.22 [122.39]
R-squared	0.78	0.81	0.82	0.83	0.82	0.83	0.83	0.83	0.84
F-test1†	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
F-test2‡							1.00	1.00	1.00

Note:

The regressions are based on sons sample with 264 observations in 127 households.

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

† P value of the F test for the joint significance of kih.

‡ P value of the F test for the joint significance of the interaction terms.

Table A8. Adding Value of Land as Parts of the Transfers (log-log specifications with household fixed effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
edu_exp	-0.54	-0.55	-0.49	-0.53	-0.50	-0.49	-0.56	-0.44
	[0.15]***	[0.16]***	[0.17]***	[0.15]***	[0.16]***	[0.14]***	[0.16]***	[0.15]***
taller		-0.10						-0.10
		[0.17]						[0.16]
more_ag_expr			0.18					0.24
			[0.19]					[0.20]
more_nonag_expr				0.14				0.22
				[0.15]				[0.15]
live_in_pre					0.17			0.10
					[0.22]			[0.30]
live_in_post						0.47		0.44
						[0.26]*		[0.28]
1st_son							0.15	0.21
							[0.31]	[0.28]
R-squared	0.73	0.73	0.73	0.73	0.73	0.75	0.73	0.77

Note:

The regressions are based on sons sample with land divisions (172 observations in 83 households).

Robust standard errors in brackets, clustered at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%