Tied Transfers

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Since Becker (1974) a great deal has been written about financial transfers from parents to children. The reasons for this are clear. Parental investments are a central input into children's human capital and well being. Parental transfers have the potential to undo or reinforce the public safety net, and hence may influence the behavioral effects of public transfers. And financial transfers may influence the evolution of inequality in the Uniter States either directly or through their effect on educational attainment.[1]

A much smaller literature examines *inter vivos* transfers that are tied to expenses associated with higher education.[2] The existence of tied transfers raises a puzzle, because in-kind transfers constrain the choice set whereas cash transfers do not.[3] At least 50 percent of the families in the datasets we examine make educational transfers and the mean amount, conditional on giving, exceeds $28,000. Moreover, educational transfers are more common and larger than cash transfers. Given their importance, writing down and testing models of tied transfers is an essential building block to fully understanding the financial relationships between parents and children.

Tied and cash transfers, when they occur, represent operative economic linkages between generations. They may result from cooperative or noncooperative relationships between parents and children. Using data from the Panel Study of Income Dynamics (PSID), Altonji, Hayashi and Kotlikoff (1992) provide evidence against the income pooling implications of models of

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[1] The New York Times, for example, notes that "At prestigious universities around the country, from flagship state colleges to the Ivy League, more and more students from upper-income families are edging out those from the middle class, according to university data" ("As Wealthy Fill Top Colleges, New Efforts to Level the Field," David Leonhardt, April 22, 2004).

[2] We use the term "tied transfers" to refer to in-kind transfers tied to specific purposes.

[3] We generally think individuals prefer cash to in-kind transfers of the same market value. A similar puzzle arises from the government's use of in-kind rather than cash transfers. See Coate (1995) and Brown (2004) for discussions of these issues in the context of government income transfer programs.

altruistic transfers in which intergenerational linkages are uniformly operative. We examine this issue in Section 1, finding, like Altonji et al., that operative linkages must not characterize all of the extended families in our sample. We extend the argument to include the rejection of a standard class of cooperative models of behavior. Altonji et al. also argue that parental resources have only modest effects on adult children's consumption beyond their effects on children's incomes. Given these results, starting in section 2 we examine empirical implications that arise from a simple non-cooperative game between children and parents. Our model predicts conditions under which post-schooling economic linkages will and will not be operative, and that the dependence of children's post-schooling consumption on their parents' resources may be due in part or in full to educational investments.

Our approach builds on the work of Altig and Davis (1992) and Bruce and Waldman (1990). Like Altig and Davis, we emphasize market imperfections as one of the key factors determining the timing and magnitude of transfers. Like Bruce and Waldman, our framework shows why a large portion of parent-child transfers are tied and in doing so, offers a theory about the timing of transfers.[4] We extend previous work by allowing a human capital investment decision and uncertainty in children's earnings, both features being essential for obtaining our empirical predictions.[5]

Our model makes three testable empirical predictions. First, of total college expenditures for the child, the fraction paid by the parents increases with the level of parental wealth and altruism. The intuition is that wealthier and more altruistic parents have a greater economic

[4] The standard economic environment where altruistic parents make transfers in order to equate marginal utilities across generations makes no predictions about the form, timing and the magnitude of intergenerational transfers.

[5] Further, the equilibrium outcome within the family may not necessarily be Pareto efficient. This raises the possibility that market interventions could improve the wellbeing of some types of families.

incentive to curtail strategic behavior on the part of their children and do so by tying a larger share of total transfers. This effectively minimizes the child's ability to engage in strategic behavior.

Second, if tying transfers is an effective strategy that some parents can use to mitigate strategic behavior, tied transfers and subsequent cash transfers ought to be negatively correlated. Put differently, tied transfers must "buy" something – what they buy (in some circumstances) is smaller subsequent cash transfers.

Third, educational transfers as a percentage of total parental transfers (cash and tied) is decreasing in parental wealth. Even when parents and children behave non-cooperatively, both have an incentive to invest in education until their return to the child's education equals the market rate of return. Once this level of investment is achieved, further transfers are made in the form of cash.

We examine these empirical propositions using data from the Health and Retirement Study (HRS) and the Wisconsin Longitudinal Study (WLS). Few datasets distinguish cash and tied transfers and have the necessary information to examine the empirical predictions. Only the HRS has the information to examine how the fraction of total educational expenditures paid for by the parent varies with the income, wealth, and altruism of the parent, since the WLS does not have information on the child's contribution to higher educational expenses. The WLS is best suited for examining the second and third empirical propositions, since it includes information on specific dollar amounts of cash and tied transfers for multiple-child families, which allows us to estimate models with fixed effects that account for unobserved parental altruism.[6]

As we discuss below, other models of parent-child interactions can generate one or two of these implications. But these alternatives do not, in a straightforward manner, yield all three. The data are consistent with all three implications, suggesting that the model, where children behave noncooperatively in the presence of capital market imperfections, provides a useful framework for examining household transfer patterns. Our results also provide new information on factors affecting the timing and composition of financial transfers between parents and children.

I. Income Pooling Tests

There are two common approaches used to analyze the relationships between family members: (i) a model in which decisions are made cooperatively by family members, leading to allocations that are on the ex-ante Pareto frontier (see, for example, Browning and Chiappori 1998); or (ii) a model in which family members do not cooperate (see, for example, Bruce and Waldman, 1990). Commonly used models that employ each of these modes of interaction imply that parents and children pool income. In this section, we briefly consider an empirical test of the income pooling implication, which we use in Section 2 to guide our modeling choices.

Though Altonji, Hayashi, and Kotlikoff (1992) provide a rejection of income pooling in the extended family, we replicate their test here for three reasons. First, since the objective of this paper is to explain transfers from parents to children, we drop from the sample split-offs that are the outcome of divorce and we focus on parents and their split-off children. Second, the tests of

[6] The HRS does not yet separate information on tied and cash transfers, though the information will eventually be available for a subsample that participated in the Human Capital Mail Survey. Consequently, we cannot use the

the non-cooperative model used in the next sections can only be implemented using the 1994-2000 HRS waves and WLS data beginning in 1992-93. To make the results as comparable as possible, we perform the pooling test using the 1993 wave of the PSID.[7] Altonji, Hayashi, and Kotlikoff use data from 1985. Lastly, we will test whether pooling is rejected for all extended families or only for extended families that include parents, children, parents in law, and their children. To that end we will use two different samples: (i) the entire sample of parents and children and (ii) the sample of never-married children and their parents.

The pooling test is thoroughly described in Altonji, Hayashi, and Kotlikoff, so here we only outline the main idea. We also elaborate on our interpretation of the results as a rejection both of operative intergenerational transfer linkages for the full sample, as in Altonji, Hayashi, and Kotlikoff, and of cooperative behavior with income-independent Pareto weights.[8] Under each of these conditions, only aggregate resources of the extended family should affect parents' and children's decisions. Consequently, after controlling for family resources, the allocation of income between parents and children should have no influence on their behavior. To see this consider an extended family composed of a child and a parent with utility functions U^k and $U^p + \alpha U^k$, where α is the altruism parameter. Observe that under efficiency, the behavior of the extended family can be described using the following Pareto problem:

HRS to examine the second and third empirical propositions.

[7] The PSID began in 1968. It is a longitudinal study of a representative sample of U.S. individuals (men, women, and children) and the family units in which they reside. The PSID is a natural data set to use for a test of efficiency because it provides information on the annual income and food consumption of both parents' and children's own families. The data on adult children are from the split-off families who have moved out of the original PSID households since 1968. By the 1993 wave of the PSID, we can identify 4,510 original families (some without children) and 5,467 split-off families, and merge them to get the data of parent-children household pairs. After dropping missing observations from the covariates of our empirical models, we have 3,427 parent-child pairs generated by 1,380 original families.

$$\max E\left[\mu^p \sum_{t=1}^{T} \beta^t U^p(c_t^p) + \mu^k \sum_{t=1}^{T} \beta^t U^k(c_t^k)\right]$$
$$s.t.\ c_t^p + c_t^k + b_t = y_t^p + y_t^k + R_t b_{t-1} \text{ for each } t \text{ and } \omega$$

where c_t^p, c_t^k, and b_t denote consumption of the parent, consumption of the child, and family saving, and ω is a possible realization of the variables that characterize the economy. The variables μ^p and μ^k are the weights assigned to the preferences of the parent and child, where μ^k is a combination of Pareto weights and the altruism parameter α.

Let $\lambda_{t,\omega}$ denote the multiplier of the budget constraint if the realization ω prevails in period t and let $\varepsilon_{t,\omega}^p$ and $\varepsilon_{t,\omega}^k$ be the logarithms of multiplicative measurement error terms in the observed parent's and child's consumption, respectively. Then, if utility exhibits constant relative risk aversion $U(c) = \frac{c^{1-\gamma}}{1-\gamma}$, the first order conditions of the Pareto problem can be written as follows (suppressing the dependence on ω for ease of exposition):

$$\log(c_t^p) = -\frac{1}{\gamma}\log\lambda_t + \frac{1}{\gamma}\log\mu^p + \varepsilon_{t,\omega}^p, \tag{1}$$

and

$$\log(c_t^k) = -\frac{1}{\gamma}\log\lambda_t + \frac{1}{\gamma}\log\mu^k + \varepsilon_{t,\omega}^k. \tag{2}$$

As long as the Pareto weights do not depend on the individual incomes, the first order conditions indicate that individual consumption depends only on the total amount of resources available in

[8] Others have drawn more general implications from Altonji, Hayashi, and Kotlikoff (1992). Townsend (1994, p. 585) points out, "For them, altruism is a way to motivate the models and to select candidate families, but it is the full risk-bearing implications for consumption which are being examined."

period t, which are captured by the multiplier λ_t. The allocation of individual income (after fixing the total amount) should not affect the parent's and child's consumption.

Alternatively, consider a noncooperative model of parent-child interaction with the above preferences and budgets in which the parent chooses to make a strictly positive transfer to the child. Where the transfer is positive, the parent chooses both her own and the child's consumption given total family resources to be consumed in the period. The parent's intratemporal allocation problem is equivalent to $\max_{c_t^p, c_t^k}\{\mu^p U(c_t^p) + \mu^k U(c_t^k)\}$ s.t. $c_t^p + c_t^p \le Y_t$, where here we interpret μ^p and μ^k as the parent's preference weights on own and child's utility and Y_t as family resources to be consumed in *t*. Therefore once again the parent's marginal utility of true consumption $c_t^i \varepsilon_{t,\omega}^i,\ i = p, k,$ is such that $u'(c_t^i \varepsilon_{t,\omega}^i) = \frac{\lambda_t}{\mu^i}$, and once again assuming CRRA preferences we arrive at expressions (1) and (2).[9] Where parents make strictly positive transfers, extended families behave within the period as if they are pooling income.

Therefore, following Altonji, Hayashi, and Kotlikoff (1992) we test the income pooling implication of both the simple cooperative model and the noncooperative model with operative transfers by estimating the consumption equations (1) and (2) treating the multiplier λ_t as a family fixed effect and adding individual income to the equations. The pooling implication is rejected if the coefficient on individual income is statistically significant.

a. Data and results

[9] Note that dynamics may distort the intertemporal margin in such a model, but generally the intratemporal margin in the period of the positive transfer remains undistorted. This is evident in the dynamic transfer model of Altonji, Hayashi, and Kotlikoff (1997), for example, and in Section 2 of this paper.

Households included in the sample satisfy the following restrictions: the household was included in the original 1968 sample or the household is a split-off child of one of the original households; and data for the parents and children are available in the 1993 wave.

Since the PSID collects only data on food consumption, we assume that other consumption goods are separable from food consumption. Hence, like Altonji, Hayaski and Kotlikoff (1992), we only use food consumption to implement the pooling test. Food consumption is computed by adding the three food expenditure variables available in the 1993 wave: (i) annual food expenditure for food used at home; (ii) annual food expenditure for meals away from home; and (iii) the value of food stamps.[10] Individual income is calculated as total family income less transfers received by the household head from family members living outside the household. In the estimation we control for the demographic variables that are used in Altonji, Hayashi, and Kotlikoff (1992).[11]

Results for specifications estimated with the entire sample and with a sample of never-married split-off children and their parents are summarized in Table 1.[12] The results are similar to those obtained by Altonji, Hayashi, and Kotlikoff (1992). The pooling implication is rejected since individual income explains a large fraction of the variation in individual consumption even after controlling for aggregate family resources. When the sample is restricted to never-married split-off children and their parents, the evidence against pooling is a bit weaker. After controlling for family resources the coefficient on individual income is roughly half the coefficient estimated

[10] The qualitative results do not change when we use just (i), or (i) plus (ii) as the dependent variable.
[11] Specifically, we condition on the number of males and females in the household in 10 age-brackets, dummies for the household's race, dummies for the household's marital status, a fourth-order polynomial in the age of the head, a dummy for the sex of the head, a dummy for whether the household is a child or parent household, the square of the number of children, the number of adults squared, and the square of the household's size.
[12] Descriptive statistics for the PSID are given in Appendix Table 1. Detailed results for one specification given in Table 1 are giving in Appendix Table 4.

using the entire sample, though it remains significant at usual levels of confidence. This suggests that the two models of transfer behavior described in this section, the first in which families cooperate using Pareto weights that are independent of individual incomes and the second in which families do not cooperate but transfers are operative in all cases, do not adequately describe the behavior of the families we observe in the PSID. Consequently, to be able to understand transfers from parents to children one requires a model that relies on neither the described class of cooperative behavior nor on post-schooling transfer linkages that are operative for most or all families.

II. A model of tied transfers

Our model builds on Bruce and Waldman (1991), who write down a model of repeated parent-child transfer opportunities. Under fairly general conditions, they show that even a non-paternalistic parent, if sufficiently wealthy and altruistic, will value the ability to tie transfers to investments. The reason is that gifts of investments lower children's reliance on their parents. Our model shares this intuition.

Our framework allows for a human capital investment decision and uncertainty in children's earnings. Having an explicit human capital investment decision allows us to disentangle the human capital production function from parents' preferences, which helps us generate empirical predictions that can be examined with data.[13] Children may invest in their own human capital. Parents may make tied educational transfers, or cash transfers when children are acquiring human capital, or cash transfers later on when children are out of school. Parents' behavior is

[13] Pollak (1988) presents a model of tied transfers and focuses on paternalistic preferences. Specifically, the parent's utility depends on the goods consumed by the child, rather than simply depending on the child's welfare. Our approach ensures that any distinction between the roles of tied and cash transfers does not arise from preferences.

affected by their endowment, children's ability and by the degree of altruism toward the child. And children may end up with inefficient human capital investment, even when the parent has access to the tied transfer mechanism. We show that uncertainty in children's earnings plays a crucial role in determining the timing of transfers

We start our discussion with an analytic model, where there is no uncertainty over the child's earnings, that provides the essential intuition. We then incorporate uncertainty in child earnings and develop our key empirical predictions using numerical methods.[14]

a. The Economic Environment

Consider a two period model where parents are altruistic about the welfare of their children, caring about their children's utility. In the first period, parents decide how much in cash and educational transfers to pass on to their children and in the second period, decide how much in cash transfers to give to them. Given our rejection of income pooling, we assume that parents and children behave non-cooperatively. In particular, the parent moves first and decides how much in tied and cash transfers to give the child. The child sees these transfers and then decides how much to consume and save. In the second period, the parent first decides how much in cash to give the child and the child then decides how much to consume. We also assume that the child cannot borrow against his or her future income.[15]

Preferences undoubtedly play some role in understanding tied transfers, but we focus on other aspects of the problem that yield falsifiable implications.

[14] Our work is similar to Perozek (1996) in that she writes down a model of non-cooperative behavior between parents and children and derives empirical predictions from the model. We assume that parental expenditures and children's expenditures on education are perfect substitutes while Perozek assumes that they are complementary inputs. The empirical focus of the two papers is also somewhat different, as Perozek examines differences in educational investments across families with different numbers of children.

[15] While our two assumptions – non-cooperative behavior, and children cannot borrow against future income – are realistic, both assumptions are necessary to obtain empirical predictions on the timing and magnitude of transfers.

Consider a parent and child choosing investment in physical capital, *a*, and investment in the child's postsecondary education, *e*. Assume that the rate of return on physical capital is constant at *R* and the return to total human capital investment *e* is *h(e)* such that

$h'(\cdot) > 0,\ h''(\cdot) < 0$ and $h'(0) > R.$

The parent, *p*, and child, *k*, have utilities of consumption in the two periods given by

$$U^k(c_1^k, c_2^k) = u(c_1^k) + \beta u(c_2^k) \text{ and}$$
$$U^p(c_1^p, c_2^p, c_1^k, c_2^k) = u(c_1^p) + \beta u(c_2^p) + \alpha\left(u(c_1^k) + \beta u(c_2^k)\right),$$

where c_t^j represents the period *t* consumption of agent *j*, α expresses the parent's degree of purely altruistic concern for the child's welfare, and β is the rate at which each agent discounts future utility. Single period utility of consumption for each agent, $u(\cdot)$, is such that

$u'(\cdot) > 0,\ u''(\cdot) < 0$ and $u'(0) = +\infty.$

The parent acts as a Stackleberg leader, moving first in period 1, choosing c_1^p, a^p, e^p and first period transfer to the child g_1, subject to constraints $c_1^p + a^p + e^p + g_1 \le x^p$, $g_1 \ge 0$ and $e^p \ge 0$. As a result of the one-sided altruism and non-cooperative interaction between the parent and the child, the parent is unable to draw resources from the child either through a negative transfer or through negative investment in the child's education. The non-negativity of cash transfers in the second period will play a crucial role in determining equilibrium investments.

The child takes the parent's choices of c_1^p, a^p and e^p as given, choosing c_1^k, a^k and e^k subject to constraints $c_1^k + a^k + e^k \le g_1$, $e^k \ge 0$ and $a^k \ge 0$. In the second period, the parent determines consumption c_2^p and the amount of the second period cash transfer to the child, g_2, subject to constraints $c_2^p + g_1 \le Ra^p$ and $g_2 \ge 0$. The child consumes his total resources, so that

$c_2^k = Ra^k + h(e^p + e^k) + g_2$.

b. Period 2

The parent's problem in the second period is

$$\max_{g_2 \ge 0} \left\{ u(Ra^p - g_2) + \alpha u(Ra^k + h(e^p + e^k) + g_2) \right\},$$

and the optimal transfer, given the second period resources of the parent and child, is

$$g_2(Ra^p, Ra^k + h(e^p + e^k)) = \begin{cases} g_2 \text{ such that } u'(Ra^p - g_2) = \alpha u'(Ra^k + h(e^p + e^k) + g_2) \\ \qquad \text{where } u'(Ra^p) < \alpha u'(Ra^k + h(e^p + e^k)), \\ 0 \quad \text{otherwise.} \end{cases} \tag{3}$$

When the transfer that equates second period marginal utilities across generations is positive, the parent achieves his or her preferred allocation of the family's total final-stage resources. The important feature of this second period transfer is that it is compensatory. The parent's altruism toward the child implies that the final transfer decreases with the child's assets and earnings.

c. Period 1: Child

In the first period, the child determines his or her own consumption, saving, and educational investment given the $(g_1,\ a^p,\ e^p)$ chosen by the parent. The child's problem is

$$\max_{c_1^k, c_2^k, e^k \ge 0, a^k \ge 0} \left\{ u(c_1^k) + \beta u(c_2^k) \right\}$$

$$\begin{aligned} s.t.\ \ & c_1^k + e^k + a^k \le g_1, \\ & c_2^k = Ra^k + h(e^p + e^k) + g_2(Ra^p, Ra^k + h(e^p + e^k)) \text{ and} \\ & g_2(Ra^p, Ra^k + h(e^p + e^k)) \text{ as in (3).} \end{aligned}$$

The function $g_2(Ra^p,\ Ra^k + h(e^p + e^k))$ is continuous but non-differentiable where $\alpha u'(Ra^k + h(e^p + e^k)) = u'(Ra^p)$. This non-differentiability creates two segments of the family's problem, representing the regions in which second period transfers do and do not take place.

We learn two useful things from the child's first order conditions. First, the child will over-consume in the first period in order to achieve consumption path $\{c_1^k, c_2^k\}$ such that

$$u'(c_1^k) = \beta \max\left\{R, h'(e^p + e^k)\right\}\left(1 + \tfrac{\partial g_2}{\partial (Ra^k + h(e^p + e^k))}\right)u'(c_2^k) \quad (4)$$

whenever $g_2 > 0$ and the child can choose e^k and a^k to meet (4) and still satisfy $a^k \geq 0$ and $e^k \geq 0$. Second, $a^k \geq 0$ and $e^k \geq 0$ both bind for the child if the parent chooses $e^p,\ a^p$ and g_1 such that

$$u'(g_1) \geq \beta \max\left\{R, h'(e^p)\right\}\left(1 + \tfrac{\partial g_2}{\partial (h(e^p))}\right)u'(h(e^p) + g_2(Ra^p, h(e^p))). \quad (5)$$

Recalling expression (3), we see that if e^p, a^p and g_1 satisfy both

$$\alpha u'(h(e^p)) \geq u'(Ra^p) \quad (6)$$

and (5), then $g_2(Ra^p, Ra^k + h(e^p + e^k)) \geq 0$ does not bind in period 2 and both $e^k \geq 0$ and $a^k \geq 0$ bind at the child's optimum. If e^p, a^p and g_1 satisfy (5) but not (6), then both $e^k \geq 0$ and $a^k \geq 0$ still bind at the child's optimum, but $g_2(Ra^p, Ra^k + h(e^p + e^k)) \geq 0$ binds in period 2. This set of conditions will be useful in solving the parent's problem.

d. Period 1: Parent

In period 1, the parent chooses c_1^p, g_1, e^p and a^p to maximize his or her utility, subject to $c_1^p + a^p + e^p + g_1 \leq x^p$, $g_1 \geq 0$ and $e^p \geq 0$.[16]

Proposition 1*:* *(i)* There exists a unique set of equilibrium consumption levels $\{c_1^p, c_2^p, c_1^k, c_2^k\}$.

(ii) If $g_2 > 0$ in any equilibrium, then $\frac{e^p}{e^p + e^k} = 1$ and the equilibrium is unique. *(iii)* If $g_2 = 0$ in any equilibrium, then $\frac{e^p}{e^p + e^k} \in [0,1]$ and the equilibrium need not be unique.

Proof: See Appendix A.

The first type of equilibrium is one in which $g_2 > 0$ and $\frac{e^p}{e^p + e^k} = 1$. In this case, parents' second period transfer liabilities generate strategic concerns, and therefore the parent bears all responsibility for the investment in the child's education. The child realizes that the parent will be in the interior of the transfer region in the second period and hence over-consumes in the first period to extract as much as possible from the parent. The parent, in turn, takes this into account and gives as much as possible in tied transfers in the first period. The value of the tied transfer is such that the marginal return to an additional dollar equals the real interest rate.

The second type of equilibrium is one in which $g_2 = 0$ and $\frac{e^p}{e^p + e^k} \in [0,1]$. Here the parent is poor relative to his or her child and consequently intends not to make transfers in the second period. In this equilibrium the parent and child agree on the inter-temporal condition to be met by the child's consumption and the family's net investment in the child's education. In this

[16] Note that the assumptions throughout the problem imply that $g_1 \geq 0$ and $e^p \geq 0$ do not bind at the parent's

region, the child does not have an incentive to behave strategically. The fact that the parent and child each prefer for $e^p + e^k$ to meet $u'(g_1 - e^k) = \beta h'(e^p + e^k)u'(h(e^p + e^k))$ implies that if the parent decreased her choice of e^p by \$1 and increased her choice of g_1 by \$1, then the child would allocate the entire increase in the first period gift to e^k. Thus only $g_1 + e^p$ is determined for families in the second type of equilibrium. What happens here is that since the parent and the child "agree," the parent simply transfers an amount in the first period and is indifferent to what part is tied and what part is cash. Indeed, only the total sum is determinate.

The indeterminacy in the second type of equilibrium can be eliminated by moving from the deterministic model presented above to a more realistic stochastic model where second period child income is uncertain.

e. A Stochastic Version of the Model

The analytic model sharply distinguishes families by whether or not they will make cash transfers in period 2. Those that will interact strategically with their children. Those that will not do not need to worry about strategy. This sharp separation of families into type, however, is too stark when trying to match model with data. As Proposition 1 above demonstrates, if the parent knows with certainty that he or she will transfer nothing in period 2, then the amount of tied transfers in period 1 is indeterminate. To obtain sharper predictions, we add to the model uncertainty in children's earnings. Families surely do not know the future incomes of their children at the time they make educational investments. If second period child income is uncertain, this expands the fraction of families where strategic concerns come into play. Adding

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optimum: $u'(0) = +\infty$ and $\alpha > 0 \Rightarrow g_1 \geq 0$; $u'(0) = +\infty$, $\alpha > 0$ and $h'(0) > R \Rightarrow e^p > 0$.

uncertain second period child income is sufficient to generate two strong empirical predictions that we describe below.

Consider a shock to the child's earnings, θ, which is realized in period 2 and drawn from a distribution $\Theta(\theta)$. We assume that the shock is i.i.d.

In period 1 the child solves

$$V_k(g_1, e^p, a^p) = \max_{c_1^k, e^k \geq 0, a^k \geq 0} \left\{ u(c_1^k) + \beta \int u(c_2^k) d\Theta(\theta) \right\}$$

$$s.t.\;\; c_1^k + e^k + a^k \leq g_1,$$

$$c_2^k = Ra^k + \theta h(e^p + e^k) + g_2(Ra^p, Ra^k + \theta h(e^p + e^k)).$$

Notice the dependence of g_2 on θ. This makes the second period gift uncertain and plays a crucial role in determining optimal first period transfers. The parent in the first period solves

$$\max_{c_1^p, e^p \geq 0, a^p \geq 0} \left\{ u(c_1^p) + \beta u(c_2^p) + \alpha V_k(g_1, e^p, a^p) \right\}$$

$$s.t.\;\; c_1^p + e^p + a^p + g_1 \leq x^p,$$

$$c_2^p = Ra^p - g_2(Ra^p, Ra^k + \theta h(e^p + e^k)).$$

For simplicity, we assume there is no uncertainty in the parent's income. Note that the term a^p appears as a state variable in the child's problem. The child keeps track of the parent's second period wealth to ascertain how much he or she will receive from his parent. If the parent is in the $g_2 > 0$ region, then a higher a^p will induce a higher transfer and hence lead to strategic behavior. However, the presence of uncertainty in the model (and the fact that these earnings shocks are uninsurable) exacerbates strategic considerations. The parent understands that some state of the world could be realized in period 2 that would require some transfer to the child. The child recognizes this and is therefore more willing to over-consume. This creates an incentive for the parent to tie part of the period 1 transfer, removing the indeterminacy of the analytic version of the model.

We solve the model numerically and our testable implications do not depend on the specific parameter values that we pick. We assume that the utility function is of the CRRA variety and the shock to earnings is log-normally distributed. Specifically, $U(c)=\frac{c^{1-\gamma}}{1-\gamma}$, $h(e)=e^{\phi}$ and $\theta \sim \log N(\mu_\theta, \sigma^2{}_\theta)$. Our predictions hold for $\gamma \in [1,5]$ and $\phi \in [0.4, 0.99]$.[17]

f. Testable Implications

The stochastic version of the model makes three key predictions that we take to the data. First, the model implies that wealthier (higher x^p) or more altruistic parents (higher α) will invest more in their children's education as a fraction of total educational expenditures. Children of wealthier or more altruistic parents realize that they have more to gain by trying to manipulate their parents, relative to children of parents who are less wealthy or less altruistic. The wealthier or more altruistic parents respond by spending more on their children's education.

Specifically, our model predicts that $\frac{e^p}{e^p+e^k}$ is increasing in parental wealth and in parental altruism. Furthermore, concavity of the human capital production function also guarantees that this relationship is concave.

Recall that we consider three sources of heterogeneity: parental wealth (and income), parental altruism, and the ability of children. Tied and subsequent cash transfers (e^p and g_2) will be positively correlated if parental resources are the only underlying source of variation in

[17] Our numerical analysis has examined these specific ranges of parameters – we are sure that the three central empirical predictions hold for a broader range of parameters than these.

the data. Similarly, tied and cash transfers will be positively correlated if parental altruism is the only source of variation in the data. Thus, in empirical work it is necessary to condition on parental wealth, income, and altruism when examining the correlation between tied and cash transfers. If we focus our attention on the sample of parents for whom g_2 is positive, parents who end up in equilibrium giving more in e^p (and they will end up giving more in e^p, the higher their children's ability) will, on average, compensate for it by reducing their subsequent cash transfers. Thus, our second empirical prediction is that, conditional on parental resources and the degree of altruism, tied transfers, e^p, and subsequent cash transfers, g_2, are negatively correlated. Since there are shocks to children's earnings realized in period 2, there will be parents who make second period transfers, simply because their children have received a bad draw and not because they want to compensate them for lower first period transfers. Consequently, our numerical results also suggest that this degree of correlation between tied transfers and subsequent cash transfers must be less than 1.

Our third empirical prediction is that the share of total transfers that the parent ties to education, $\frac{e^p}{e^p + g_1 + g_2}$, is decreasing in the parent's wealth. The range of second period child income realizations for which positive transfers take place is larger for wealthier parents, and therefore the strategic benefit to tying transfers is greater for wealthier parents. However, the concavity of the human capital production function and the relatively low marginal utility of own consumption for wealthier parents overwhelm their strategic incentives, generating a $\frac{e^p}{e^p + g_1 + g_2}$ profile that decreases monotonically in parental wealth.

III. Tests of the model propositions[18]

Only a handful of datasets in the United States have information on both cash and tied transfers for representative samples of the population. To examine the empirical propositions, we focus on two data sets: the Health and Retirement Study (HRS) and the Wisconsin Longitudinal Study (WLS). Only the HRS has information needed to examine how the fraction of total educational expenditures paid for by the parent varies with the income, wealth and altruism of the parent.[19] The WLS is best suited for examining the second and third empirical propositions, since it includes information on specific dollar amounts of cash and tied transfers for multiple-child families, which allows us to estimate models with fixed effects that account for unobserved parental altruism.[20] We describe the datasets and empirical estimates below.

a. The Health and Retirement Study (HRS)

The HRS is a national panel study with an initial sample (in 1992) of 12,652 persons and 7,607 households.[21] It oversamples blacks, Hispanics, and residents of Florida. The baseline 1992 study consisted of in-home, face-to-face interviews with the 1931-1941 birth cohort and their spouses, if married. Follow-up interviews were given by telephone in 1994, 1996, 1998, 2000, and 2002.

Over the first three waves, the questions on financial and tied transfers varied. In Wave 1

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[18] Descriptive statistics for the datasets used in the paper are given in Appendix Tables 1 (PSID), 2 (HRS), and 3 (WLS).

[19] The WLS, for example, does not have information on the child's contribution to higher educational expenses. Consequently, it cannot be used to examine the first empirical proposition.

[20] The HRS does not yet separate information on tied and cash transfers, though the information will eventually be available for a subsample that participated in the Human Capital Mail Survey. Consequently, we cannot use the HRS to examine the second empirical proposition.

[21] The survey covers a wide range of topics, including batteries of questions on health and cognitive conditions and status; retirement plans and perspectives; attitudes, preferences, expectations, and subjective probabilities; family structure and transfers; employment status and job history; job demands and requirements; disability; demographic background; housing; income and net worth; and health insurance and pension plans.

(1992) the question asked about transfers exceeding $500 in the last 12 months, in Wave 2 (1994) it asked about transfers exceeding $100 in the last 12 months, and in waves 3 through 6 the questions asked about transfers exceeding $500 in the last 24 months. The specific question in 2000 (Wave 5), for example, reads:

> "Including help with education but not shared housing or shared food (or any deed to a house), in the last 2 years did [the Respondent or Spouse] give financial help totaling $500 or more to any of their children or grandchildren?"

Those answering "yes" were then asked how much. The 2000 wave of the HRS also asked specifically about educational transfers for each child, but the amounts were not elicited. Rather, parents were asked if they paid "none, some, or most or all" of the costs associated with education beyond high school.

Additional information on tied transfers comes from the 2001 Human Capital Mail Survey (HUMS) of the HRS. A subset of HRS respondents received and returned the HUMS, which included a question on the percent of each child's college tuition paid by the parent. The benefit of this measure is that it provides continuous information on the parent's share of investment; its drawback is that we observe the percent of tuition in the HUMS for only 2,166 of the 7,139 general survey children who have attended college by 2000.

The HRS also contains an unusual proxy measure for the parent's degree of altruism. Modules in the 1996 and 2000 HRS ask respondents about the conditions under which they would be willing to give to a variety of individuals and organizations. The survey question that we employ as a measure of each parent's economic altruism toward her children is the following:

> Suppose that [your child/one of your children] had only [one half/three-quarters/one third] as much income to live on per person as you do. Would you be willing to give your child 5% of your own family income per month, to help out until things changed – which might be several years?

Since roughly ninety percent of parents replied that they would transfer to a child with one-third or one-half of their income, we focus on responses for the hypothetical case in which the child has three-quarters of the parent's income. Sixty-two percent of parents in our sample responded positively to this version of the question in either 1996 or 2000.

b. Wealthier and more altruistic parents finance greater shares of their children's education.

Our empirical model examines the share of educational expenses paid for by the parent conditioning on family demographic characteristics and parents' assets and reported degree of economic altruism

$$\frac{e^p}{e^p + e^k} = X\beta + \phi \cdot \chi(\alpha_{3/4}) + W\delta + \varepsilon, \qquad (7)$$

where W is a vector of measures of the parents' affluence, including the parent's household income, income squared, and net worth. The measure of $\frac{e^p}{e^p + e^k}$ used in the ordered logistic specification shown in Table 2 is the HRS 2000 wave information on whether the parent paid for none, some, or all of the child's post-secondary education expenses. The measure of $\frac{e^p}{e^p + e^k}$ used in Table 3 is the percent of the child's tuition paid by the parent as reported in the HUMS subsample. The covariates included in X are parent's age, number of children, and indicator variables for the parent's educational attainment, race and ethnicity. We also include in X the child's age, gender, and whether he or she is a stepchild.

The key coefficients of interest in Table 2 are the δ vector of coefficients on the parent's income, income squared, and net worth and the ϕ coefficient on the indicator for the parent's willingness to make an altruistic transfer to the child. The tied transfers model implies that the elements in δ should reflect an increasing share of educational investment from the parent as the parent's income and wealth increases, and that ϕ should reflect a positive effect of the parent's degree of economic altruism on the parent's share of educational investment.

The Table 2 estimates indicate a significantly positive conditional correlation of parents' educational investment shares and their income and net worth. The effect of a marginal dollar of income on the outcome of interest, here the probability of a greater transfer share, is positive (at a decreasing rate) for all incomes below $1.67 million, which includes all but the highest incomes observed in the sample. The estimated coefficient on net worth implies that, at sample mean characteristics, an increase of $100,000 in household net worth is associated with a 1.1 percentage point increase in the probability that the parent pays for all of the child's schooling, and a 0.99 percentage point decrease in the probability that the parent pays for none of the child's schooling.

The correlation between the measure of parental altruism and parents' investment shares, evaluated when $\chi(\alpha_{3/4})=1$ and where $\chi(\alpha_{3/4})=0$ and at the sample mean of all other characteristics, is 6.9 percent. Put differently the parent who reports that she would give transfers to a child with ¾ of her income is 6.9 percentage points more likely to pay for all of her child's schooling than a parent who would not give. A similar calculation implies that a parent who would give transfers to a child with ¾ of her income is 6.5 percentage points *less* likely to not pay for any of her child's schooling.

Table 3 presents similar regressions to those presented in Table 2, but using as the dependent variable the HRS HUMS question about the percentage of the child's educational expenses paid for by parents.[22] As in Table 2, the coefficients on income and net worth in Table 3 are significantly, positively correlated with the percent of the child's tuition paid by the parent. The effect of the marginal dollar of income on the percent of covered tuition increases at a decreasing rate, and, at the reported point estimates for the coefficients on income and income squared, it is positive for almost the entire range of incomes in the sample. The indicator variable for whether the parent would transfer to a child with ¾ of her income is associated with a 6.49 percentage point increase in the share of tuition paid by the parent. Together, Tables 2 and 3 provide evidence of a generally large, significant positive association between parental assets and the shares of investment in children's human capital, and between parental altruism and shares of human capital investment.

[22] Given the continuous dependent variable, we estimate OLS models. Results are similar if we estimate two-limit Tobit models.

c. The Wisconsin Longitudinal Survey

Given a specific parental endowment, degree of parental altruism, and human capital production function, the stochastic version of the model predicts a unique level of human capital investment (the same is true in the model without uncertainty when $g_2 > 0$). Further, the model predicts that the parent achieves greater transfer savings by investing up to $e^p = h'^{-1}(R)$ where the child is more able, which is to say the efficient level of investment is higher. Thus, in a collection of parent-child pairs with fixed x^p and α but varying child ability, and in which positive post-education transfers occur, we should observe a negative association between cash and tied transfers. In equilibrium, it should be the case that tied transfers buy increased independence for the child, and therefore transfer savings to the parent. The model also predicts that educational transfers as a percentage of total parental transfers (cash and tied) is decreasing in parental wealth.

To test these implications we need data on the dollar amounts of tied transfers and subsequent cash transfers. Although the 2000 HRS and HUMS provide information on parental share of educational investments, they do not yet report the exact dollar amounts of educational transfers. Therefore, we test the second empirical proposition using the intergenerational transfer data in the WLS, which contain the dollar amount of educational transfers.[23] We do not have good measures of child ability in the WLS (or in the HRS, for that matter). Our strategy, therefore, is to compare the interactions between a single WLS parent and two or more of her children. Doing so, we are comparing parent-child pairs in which the parent's per-child economic resources are identical. We argue that in this instance we are also comparing parent-

[23] The WLS, however, does not report total educational expenses or information that can be used in calculating

child pairs in which the degree of parental altruism is similar. If educational investments made by the parent serve the purpose implied by the strategic model of tied transfers, then we should see significant savings in post-education cash transfers associated with a dollar of tied transfers in within-family estimates of the dependence of cash on tied transfers.

The WLS is a long-term study of a random sample of 10,317 men and women who graduated from Wisconsin high schools in 1957 and of their randomly selected brothers and sisters.[24] Data were collected from the original respondents or their parents in 1957, 1964, 1975, and 1992. The WLS has enjoyed remarkably high rates of response and sample retention; for example, in the 1992 wave 87 percent of the 9,741 surviving members of the original sample were interviewed. In the 1993 wave, the sample was expanded to include a randomly selected sibling of every respondent.[25]

In the 1992 and 1993 WLS surveys, respondents and selected siblings were asked to report monetary transfers made to their parents and children since 1975 and the reason for the transfer. Possible reasons included: down payment for a home, to increase wealth or reduce debt, payments for housing or other living expenses, educational expenses, or to spend any way the recipient wanted. Sixty-three percent of respondents and 56 percent of siblings reported making at least one transfer to their children.

d. Among parents facing strategic concerns, tied transfers reduce the magnitude of subsequent cash transfers.

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shares of educational investment; and therefore it is not used to test the first implication.

[24]The WLS data provide a full record of social background, youthful aspirations, schooling, military service, family formation, labor market experiences, and social participation of the original respondents. In 1992 the survey was also extended to obtain detailed occupational histories and job characteristics; incomes, assets, and interhousehold transfers; social and economic characteristics of parents, siblings, and children, and descriptions of the respondents' relationships with them; and extensive information about mental and physical health and well-being.

[25] In 1977, the study design was expanded with the collection of parallel interview data for a highly stratified subsample of 2,429 siblings of the primary respondents.

Families are included in the estimation sample based on the availability of all relevant transfer and demographic information for at least two children, along with the requirement that positive parent-child cash transfers take place. In addition, in an attempt to measure tied transfers for only completed post-secondary schooling, the children sample is confined to those who attended at least some college and were not in schools at the time of interview.[26]

Our empirical specification is a fixed effect model

$$g_2 = X\beta + \lambda e^p + \omega, \tag{8}$$

where g_2 now represents all cash transfers to the child made between 1975 and 1992 following the child's completion of schooling.[27] The fixed effect is for each family: recall, parent-child pairs are the unit of observation. The tied transfer represented in expression (6) is the amount of the transfers made over this period that the parent reports were for educational expenses. The covariates, X, include child age and indicators for whether the child is the oldest, youngest, male, adopted, married, or living with his or her parents.

The fixed effect estimates are shown in Table 4. Tied transfers are significantly, negatively correlated with cash transfers within WLS families. The coefficient on tied transfer indicates a substantial offset of subsequent cash transfers resulting from transfers for education. One dollar of tied transfers saves the parent an average of $.36 in cash transfers between the year in which the child completes school and 1992. Presumably the transfer savings associated with educational expenditures do not terminate in 1992 for this relatively young sample, and so the

[26] Because children's education was not reported for all the WLS sibling respondents – only a small subset of the sibling sample interviewed by mail surveys reported children's education – we restrict the sample to primary WLS respondents and their children.

[27] WLS graduates were generally between the ages of 36 and 53 over this period. Using the survey questions on the years each transfer was made, our g_2 measure excludes cash transfers made in the same year or prior to the year when educational transfers were given. Put differently, g_2 does not include g_1.

total return to the tied dollar for the parent will include transfer savings in excess of $.36, as well as the parent's benefit from the influence of the tied dollar on the child's lifetime earnings.[28] Thus, as implied by the theory, we observe significant savings in post-education cash transfers associated with a dollar of tied transfers, fixing parental resources and altruism.

e. Transfers for education as a percentage of total transfers

The third model implication is that educational transfers as a percentage of total parental cash and tied transfers are decreasing in parental wealth. We restrict the sample to those who made either a tied or cash transfer and estimate the correlations between educational transfers (as a percentage of total transfers) and net worth (and income) using a two-limit Tobit empirical model. More than one-third of households in the sample are at corners where they give no tied transfers and more than one-third of households make all their transfers in tied form.

Table 5 shows two specifications, one with the child's educational attainment, the other without. The child's educational attainment is clearly not exogenous when considering parental transfers for higher education, so we focus on the second panel of Table 5, where the child's educational attainment is excluded.

Several characteristics are correlated with a greater percentage of total transfers being tied. Educational achievement is strongly, positively correlated with parental educational attainment. They are negatively correlated with male children, older children, married children, and the child being adopted. As hypothesized, tied transfers (as a percentage of total transfers) are negatively correlated with parental income and negatively correlated with parental net worth. The latter

[28] We can get some sense of the fraction of lifetime cash transfers received by the WLS respondent's children at the time we observe them in our data by "moving back" a generation and looking at the timing of transfer *receipts* of WLS respondents. Sixty-four percent of their transfer receipts occurred after they were 40. Forty is the oldest age of the transfer recipients in our sample.

coefficient is significant at only the 8 percent level.

f. Discussion

There are few prior models of tied and cash transfers from parents to children to which to compare our specification and results. Two early approaches that represent substantial progress on the subject of transfers for college are seen in Pollak (1988) and Bruce and Waldman (1991). Neither, however, produces testable predictions analogous to the three predictions described above. Pollak is the first to demonstrate that, in order to explain the widely observed phenomenon of tied educational transfers, one must provide reasons both for the disagreement between parents and children over the optimal educational investment and for the child's inability to "cash out" the tied transfer through resale or borrowing. He relies on paternalistic preferences to drive the disagreement between parents and children. As a result, any observed educational transfer may be rationalized using the parent's preferences.

Bruce and Waldman's model is the first to motivate the necessary disagreement between parents and children using more standard objectives and the strategic concern that emerges for parents from simple noncooperative interaction. In doing so, they focus on the $g_2 > 0$ case, in which parents are relatively wealthy and altruistic, and their children's abilities are relatively modest. This leads to the prediction that parents pay the entire cost of their children's education, which is counter to the first prediction we test and easily contradicted by the data.[29] In general, we have not found another model of educational transfers in the literature that supports the three testable predictions described above.

IV. Conclusions

In this paper we present a theory of the timing and magnitude of cash and tied transfers, with an explicit focus on tied educational transfers. The theory yields three testable implications. Empirical models estimated with data from the HRS and WLS support to these implications, suggesting that the framework used in the paper, wherein children behave non-cooperatively in the presence of capital market imperfections, provides a useful benchmark with which to analyze household transfer patterns. The magnitude and timing of parental transfers reflects the desire not only to smooth marginal utilities across generations but also to relieve liquidity constraints and limit children's ability to manipulate parents. Indeed, if the parent has sufficient resources, by altering the timing of transfers, efficiency in the allocation of resources within the family can be restored.

Models of parent-child interactions that assume cooperative behavior result in an efficient allocation of resources within the family. A direct consequence is that these models make no predictions about the timing of transfers. As we demonstrate, the addition of uncertainty into the non-cooperative model generates a rich set of predictions that we can take to the data. The theory presented here, which the data support, uniquely determines the timing of transfers. We also present new empirical work on an understudied, but quantitatively important part of the literature on inter-family transfers. The share (not just the level) of higher educational expenses paid by parents increases with measures of parental altruism and wealth, and parental investments in higher education appear to reduce subsequent cash transfers.

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[29] This unrealistic prediction is clearly the result of a judicious simplification given their objectives. In fact, our model can be read as an extension of theirs in order to consider the strategic and credit concerns of poor families along with those of rich ones.

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Appendix 1: Proofs

Lemma 1: If $g_2 > 0$ in equilibrium, then it must be the case that $a^k = 0$.

The intuition behind lemma 1 is that, since both the parent and the child earn return *R* on physical capital investment, the parent who anticipates a positive second period gift will always prefer to save for the child. A proof of lemma 1 is available form the authors.

Lemma 2: In the first period, the parent can do no better than to choose (g_1, a^p, e^p) to maximize $\left\{u(c_1^p) + \beta u(c_2^p) + \alpha\left(u(g_1) + \beta u(c_2^k)\right)\right\}$ subject to $c_1^p + a^p + e^p + g_1 = x^p$, $c_2^p = Ra^p - g_2(Ra^p, h(e^p))$, $c_2^k = h(e^p) + g_2(Ra^p, h(e^p))$, $g_2(Ra^p, h(e^p))$ as in (3), and $e^k \geq 0$ and $a^k \geq 0$ binding for the child.

Assume an equilibrium consisting of

$$(e^p, a^p, g_1, e^k, a^k, g_2(Ra^p, Ra^k + h(e^p + e^k)))$$

where $e^k + a^k > 0$, and associated consumption levels

$$\{c_1^p, c_2^p, c_1^k, c_2^k\} = \{x^p - g_1 - e^p - a^p, Ra^p - g_2(Ra^p, Ra^k + h(e^p + e^k)),$$
$$g_1 - e^k - a^k, Ra^k + h(e^p + e^k) + g_2(Ra^p, Ra^k + h(e^p + e^k))\}.$$

We find that the parent can replicate the consumption paths of any such equilibrium by deviating from the equilibrium in period 1 to choose first period transfer $\tilde{g}_1 = g_1 - a^k - e^k$, savings $\tilde{a}^p = a^p + a^k$ and human capital investment $\tilde{e}^p = e^p + e^k$. In the deviation, constraints $e^k \geq 0$ and $a^k \geq 0$ bind for the child. The parent can replicate any feasible consumption path by choosing (g_1, a^p, e^p) in the first period such that $e^k \geq 0$ and $a^k \geq 0$ bind, and therefore the parent can do no better than to choose her most preferred period 1 (g_1, a^p, e^p) subject to $e^k \geq 0$ and $a^k \geq 0$ binding for the child. A formal proof of lemma 2 is available from the authors.

Proof of Proposition 1:

Proof Given Lemma 2, consider the parent's solution to

$$\max_{g_1, a^p, e^p} \left\{ u(c_1^p) + \beta u(c_2^p) + \alpha \left(u(g_1) + \beta u(c_2^k) \right) \right\}$$

s.t. $c_1^p + a^p + e^p + g_1 = x^p$, $c_2^p = Ra^p - g_2(Ra^p, h(e^p))$, $c_2^k = h(e^p) + g_2(Ra^p, h(e^p))$, (9)

$g_2(Ra^p, h(e^p))$ as in (1), and $e^k \geq 0$ and $a^k \geq 0$ binding for the child.

Recall that the requirement that condition (5) holds is equivalent to the requirement that $e^k \geq 0$ and $a^k \geq 0$ bind. Suppose that the parent is permitted to choose g_2 such that $u'(Ra^p - g_2) = \alpha u'(h(e^p) + g_2)$, even if this implies $g_2 < 0$. Without imposing (5), the parent's choice of (g_1, a^p, e^p) meets conditions

$$\begin{gathered} u'(c_1^p) = \alpha u'(c_1^k),\ u'(c_1^p) = \beta R u'(c_2^p),\ h'(e^p) = R, \text{ and } u'(c_2^p) = \alpha u'(c_2^k), \\ \text{where } c_1^p = x^p - g_1 - e^p - a^p,\ c_1^k = g_1,\ c_2^p = Ra^p - g_2, \text{ and } c_2^k = h(e^p) + g_2. \end{gathered} \tag{10}$$

Conditions (10) imply $u'(c_1^k) = \beta R u'(c_2^k)$. In transfer expression (3), $\frac{\partial g_2}{\partial(h(e^p))} \leq 0$. Given $h'(e^p) = R$ and $c_1^k = g_1$ in (10), it must be the case that

$$\begin{aligned} & u'(c_1^k) = \beta R u'(c_2^k) \\ & \Rightarrow u'(g_1) \geq \beta \max\{h'(e^p), R\} \left(1 + \frac{\partial g_2}{\partial(h(e^p))} \right) u'(c_2^k) \end{aligned}$$

and therefore (5) is satisfied at the parent's preferred feasible (g_1, a^p, e^p). Conditions (10) are met by a unique set of consumption levels $\{c_1^p, c_2^p, c_1^k, c_2^k\}$. If conditions (10) can be met with $g_2 \geq 0$, then these consumption levels result from the parent's optimal actions given her resource constraints and the choices available to the child.

However, it is possible that conditions (10) cannot be met with $g_2 \geq 0$. Where $g_2 \geq 0$ binds for the parent, the solution to (9) is such that

$$\begin{gathered} u'(c_1^p) = \alpha u'(c_1^k), u'(c_1^p) = \beta R u'(c_2^p),\ \ h'(e^p) > R,\ u'(c_2^p) > \alpha u'(c_2^k), \text{ and} \\ u'(c_1^k) = \beta h'(e^p) u'(c_2^k), \text{ where } c_1^p = x^p - g_1 - e^p - a^p,\ c_1^k = g_1,\ c_2^p = Ra^p, \text{ and } c_2^k = h(e^p). \end{gathered} \tag{11}$$

Note that $h'(e^p) > R$, $u'(c_1^k) = \beta h'(e^p) u'(c_2^k)$, $\frac{\partial g_2}{\partial(h(e^p))} \leq 0$, and $c_1^k = g_1$ together imply

$$\begin{aligned} u'(g_1) &= \beta h'(e^p) u'(c_2^k) \\ &\geq \beta \max\{h'(e^p), R\} \left(1 + \frac{\partial g_2}{\partial(h(e^p))} \right) u'(c_2^k), \end{aligned}$$

so that again (5) need not be imposed. Like conditions (10), conditions (11) are satisfied by a unique set of consumption levels $\{c_1^p, c_2^p, c_1^k, c_2^k\}$. In either case, proposition 2 implies that the parent's lifetime welfare at this consumption vector, $u(c_1^p) + \beta u(c_2^p) + \alpha\left(u(c_1^k) + \beta u(c_2^k)\right)$, represents the maximum equilibrium welfare available to the parent given the resource constraints and the child's available choices. The uniqueness of the consumption levels that solve (9) implies that no other set of feasible consumption levels yields higher welfare for the parent, and therefore $\{c_1^p, c_2^p, c_1^k, c_2^k\}$ represents the family's unique equilibrium consumption, completing the proof of *(i)*.

We know, based on (10) and (11), that $\{c_1^p, c_2^p, c_1^k, c_2^k\}$ can be generated by only one set of parental choices $\{g_1, a^p, e^p, g_2\}$ at which $e^k \geq 0$ and $a^k \geq 0$ bind. It may still be the case, however, that this same consumption path can be supported by different transfers and investments where e^k and a^k take positive values. Define $\left\{c_1^p(0), c_2^p(0), c_1^k(0), c_2^k(0),\ g_1(0), a^p(0), e^p(0), g_2(0)\right\}$ as the values of $\left\{c_1^p, c_2^p, c_1^k, c_2^k, g_1, a^p, e^p, g_2\right\}$ in the only equilibrium in which $e^k + a^k = 0$. The parent transfers to the child through $g_1(0)$, $e^p(0)$, and $g_2(0)$. We seek to determine whether the same consumption is supported where the parent transfers some portion of $g_2(0)$ or $e^p(0)$ through g_1, expecting the child to save for herself or invest in her own education.

Where $g_2(0) > 0$, the answer is clear. The child's choices of e^k and a^k meet condition (4) where $e^k + a^k > 0$. Whenever $g_2(0) > 0$, (3), (4), and $h'(e^p) = R$ together imply $u'(c_1^k) < \beta R u'(c_2^k)$. However, among conditions (10) is the requirement that $u'(c_1^k) = \beta R u'(c_2^k)$. Thus whenever $g_2(0) > 0$, the parent and the child disagree on the child's optimal intertemporal consumption path. Allowing the child to save independently or invest in her own education will lead to consumption other than $\{c_1^p(0), c_2^p(0), c_1^k(0), c_2^k(0)\}$. Thus the $e^k + a^k = 0$ equilibrium is the only set of actions that supports the parent's preferred $\{c_1^p, c_2^p, c_1^k, c_2^k\}$. The parent chooses $\{g_1, a^p, e^p, g_2\} = \{g_1(0), a^p(0), e^p(0), g_2(0)\}$ as in (8) in this unique equilibrium, imposing $e^k + a^k = 0$ and therefore $\dfrac{e^p}{e^p + e^k} = 1$. This completes the proof of *(ii)*.

Where $g_2(0) = 0$, however, the parent may reallocate transfers and still achieve $\{c_1^p(0), c_2^p(0), c_1^k(0), c_2^k(0)\}$. Only the reallocation of e^p to g_1 must be considered. Define $\underline{e}$ such that $u'(Ra^p(0)) = \alpha u'(h(\underline{e}))$. Suppose that the parent increases g_1 to $g_1 = g_1(0) + \varepsilon$, where $\varepsilon \in \left(0, e^p(0) - \underline{e}\right]$, while maintaining $a^p = a^p(0)$ and $g_1 + e^p = g_1(0) + e^p(0)$. Since $e^p \geq \underline{e}$, the second period transfer is still zero. Further, the child's choice of $e^k = 0$ given $\left(g_1(0), a^p(0), e^p(0)\right)$ implies that she chooses an e^k at which $e^p + e^k \leq e^p(0)$ given $\left(g_1(0) + \varepsilon, a^p(0), e^p(0) - \varepsilon\right)$. Therefore, by conditions (11), $h'(e^p + e^k) > R$ and the child's condition (4) determining her choice of e^k reduces to

$$u'(c_1^k) = \beta h'(e^p + e^k) u'(c_2^k).$$

Since the above agrees with the intertemporal condition on the child's consumption in (11), we see that the parent's reallocation of $\varepsilon \in \left(0, e^p(0) - \underline{e}\right]$ from e^p to g_1 results in the same equilibrium $\{c_1^p(0), c_2^p(0), c_1^k(0), c_2^k(0)\}$. Finally, condition (4) and the definition of $\underline{e}$ together indicate that where *p* reallocates $\varepsilon \in \left(e^p(0) - \underline{e}, e^p(0)\right]$ from e^p to g_1 the child's educational investment may or may not be such that conditions (11) hold. Therefore where $g_2(0) = 0$ there does exist a continuum of equilibria $\{g_1, a^p, e^p, a^k, e^k\} \in \left[\{g_1(0), a^p(0), e^p(0), 0, 0\},\ \{g_1(0) + e^p(0) - \underline{e}, a^p(0), \underline{e}, 0, e^p(0) - \underline{e}\}\right]$ that support the unique equilibrium values of $\{c_1^p, c_2^p, c_1^k, c_2^k\}$, and there may exist further equilibria $\{g_1, a^p, e^p, a^k, e^k\} \in \left[\{g_1(0) + e^p(0) - \underline{e}, a^p(0), \underline{e}, 0, e^p(0) - \underline{e}\},\ \{g_1(0) + e^p(0), a^p(0), 0, 0, e^p(0)\}\right]$ that support the unique equilibrium values of $\{c_1^p, c_2^p, c_1^k, c_2^k\}$. These values imply $\frac{e^p}{e^p + e^k} \in [0,1]$, completing the proof of *(iii)*.

Table 1: Income pooling tests--regression estimates of (log) income on (log) food consumption

Sample	Fixed effect		No fixed effect		Sample size	Number of dynasties
	Log	Level	Log	Level		
All split-off children	0.097	0.013	0.118	0.018	4404	1355
	(11.56)	(11.36)	(12.27)	(8.27)		
Unmarried split-off children only	0.052	0.011	0.091	0.019	1220	533
	(2.91)	(4.25)	(6.16)	(5.19)		

Note: Numbers in parentheses are *t* statistics testing the null hypothesis that the coefficient is zero.

Table 2: Ordered Logit Estimates of the Fraction of Tuition Paid by Parents, HRS Sample

	Large Sample			Sample with Altruism Question		
Dep. Var.: Parent paid none (0), some (1), or all (2) of the college expenses	**Parameter**	**Standard error**	**T-statistic**	**Parameter**	**Standard error**	**T-statistic**
Intercept 2	-2.632	0.439	-6.00	3.661	0.963	3.80
Intercept 1	-0.914	0.438	-2.09	1.872	0.960	1.95
Parents age	0.056	0.007	7.54	0.072	0.017	4.28
Number of children	-0.176	0.012	-15.27	-0.219	0.028	-7.79
Black	0.021	0.065	0.32	0.086	0.167	0.52
Hispanic	-0.075	0.108	-0.69	0.225	0.355	0.63
Less than high school education	-0.342	0.070	-4.86	-0.107	0.183	-0.58
Some college	0.175	0.060	2.90	-0.006	0.130	-0.05
College graduate	0.421	0.077	5.44	0.183	0.166	1.10
Post-college education	0.442	0.078	5.65	0.311	0.161	1.92
Household income / 10^3	0.005	0.001	7.42	0.004	0.001	2.97
Household income squared / 10^9	-0.003	0.001	-4.31	-0.003	0.001	-2.02
Household net worth / 10^6	0.488	0.053	9.25	0.710	0.131	5.41
Child is a male	-0.177	0.045	-3.92	-0.368	0.101	-3.65
Child age	-0.039	0.005	-7.72	-0.039	0.012	-3.37
Child is a stepchild	-0.460	0.080	-5.74	-0.597	0.176	-3.39
If your child had only 3/4 of your income, would you give them 5% of yours?				0.325	0.107	3.04
Number of observations	7139			1467		
Log likelihood	-7213.09			-1463.67		

Table 3: OLS Regressions on the Percentage of Tuition Paid by Parents, HRS Sample

	Large Sample			Sample with Altruism Question		
Dependent variable: The percentage of tuition paid by parents	**Parameter**	**Standard error**	**T-statistic**	**Parameter**	**Standard error**	**T-statistic**
Intercept	11.426	15.196	0.75	49.937	32.409	1.54
Parent age	0.914	0.260	3.52	0.314	0.577	0.54
Number of children	-3.395	0.460	-7.39	-6.082	1.077	-5.64
Black	-9.563	2.615	-3.66	-7.720	6.505	-1.19
Hispanic	-1.088	4.697	-0.23	37.504	26.611	1.41
Less than high school education	-4.133	2.910	-1.42	-3.870	7.052	-0.55
Some college	3.168	2.237	1.42	-4.508	4.720	-0.95
College graduate	13.118	2.692	4.87	13.116	5.314	2.47
Post-college education	8.511	2.626	3.24	0.404	5.347	0.08
Household income / 10^3	0.134	0.018	7.64	0.221	0.051	4.35
Household income squared / 10^9	-0.076	0.015	-5.16	-0.392	0.092	-4.28
Household net worth / 10^6	2.729	0.598	4.56	1.319	0.665	1.98
Child is a male	-2.859	1.666	-1.72	-10.530	3.478	-3.03
Child age	-0.514	0.190	-2.70	-0.330	0.430	-0.77
Child is a stepchild	-3.398	2.809	-1.21	12.855	5.970	2.15
If your child had only 3/4 of your income, would you give them 5% of yours?				6.486	3.749	1.73
Number of observations	2166			464		
Adj R-squared	0.137			0.186		

Table 4: Correlates of Cash Transfers, Including a Family-Specific Effect, WLS Sample

Dependent variable: Amount of cash transfer receipt		Coefficient	Standard error	T-statistic
Age of child		225	632	0.36
Gender of child (male)		2,722	1,748	1.56
Oldest child		190	1,926	0.10
Youngest child		-1,599	2,570	-0.62
Adopted child		6,146	8,928	0.69
Marital status of child (currently married)		323	2,011	0.16
The child lives with parents		-5,608	4,076	-1.38
Amount of tied transfer receipt		-0.36	0.09	-4.10
Intercept		5,515	17,818	0.31
Fixed-effects (within) regression	Number of observations =	783		
Group variable (i): HHID1	Number of groups =	365		
R-sq: within = 0.0608	Observations per group: min =	2		
	avg =	2		
	max =	4		

Note: We conditioned the sample on having a positive cash transfer receipt and at least some college education but not being in school.

Table 5: Two-Limit Tobit Regressions of the Percentage of Total Transfers Accounted for by Education Transfers. WLS Data.						
	Coefficient	**Standard Error**	**t-Statistic**	**Coefficient**	**Standard Error**	**t-Statistic**
Parental Age	-0.85	0.72	-1.18	-0.66	0.86	-0.77
Number of Children	-4.55	1.53	-2.97	-9.69	1.81	-5.35
Less than High School	-26.37	10.63	-2.48	-62.73	12.33	-5.09
Some College	6.88	6.17	1.12	27.73	7.35	3.77
College Grad	23.85	6.53	3.65	72.89	7.91	9.21
More than College	14.77	6.58	2.24	71.63	7.92	9.05
IQ	-0.48	0.17	-2.90	0.29	0.20	1.46
Income (in 1000s)	-0.42	0.10	-3.96	-0.26	0.13	-2.09
Income Squared	0.81	0.33	2.44	0.37	0.40	0.92
Net Worth	-0.02	0.01	-2.90	-0.02	0.01	-1.76
Child Male	-17.91	4.23	-4.23	-27.46	5.06	-5.43
Child's Age	-9.76	0.86	-11.36	-12.91	1.02	-12.62
Child Less than High School	-65.91	22.69	-2.90			
Child Some College	131.67	6.75	19.51			
Child College Grad	194.82	7.03	27.72			
Child More than College	212.39	9.53	22.28			
Child Lives with Parents	15.50	8.56	1.81	1.57	10.21	0.15
Child Married	-12.79	4.53	-2.83	-11.36	5.38	-2.11
Child Adopted	-1.50	11.69	-0.13	-51.69	13.87	-3.73
Constant	354.79	47.72	7.43	480.89	56.73	8.48
N =	4826			4873		
Log Likelihood =	-9537.74			-10249.10		
Pseudo R^2 =	0.09			0.03		
Left censored =	1714			1744		
Righ censored =	1961			1976		

Appendix Table 1: Summary Statistics for analyses based on the 1993 Panel Study of Income Dynamics

	All Child Households		Single Child Households		Parent Households		All Households	
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Total annual household food expenditure	5228	2878	3842	2465	5075	2900	5181	2885
Total annual household income	41322	37504	22686	25144	34101	52934	39100	42971
Household head lists race as "Black"	0.238	0.426	0.335	0.472	0.199	0.399	0.226	0.418
Household head lists race as "Asian or Pacific Islander"	0.005	0.070	0.010	0.100	0.005	0.072	0.005	0.071
Household head lists race as "American Indian, Aleut, or Esk	0.006	0.074	0.004	0.066	0.011	0.105	0.007	0.085
Household head lists race as "Latino"	0.029	0.167	0.041	0.198	0.028	0.165	0.028	0.166
Household head lists race as "Other"	0.012	0.108	0.022	0.146	0.013	0.115	0.012	0.110
Age of household head	35.645	9.952	28.988	6.626	55.598	13.734	41.784	14.539
Household head is female	0.179	0.383	0.438	0.497	0.297	0.457	0.215	0.411
Household head is married	0.610	0.488	**NA**	**NA**	0.622	0.485	0.614	0.487
Number of children in household	1.120	1.218	0.450	0.934	0.466	0.934	0.919	1.178
Number of adults in household	1.827	0.643	1.355	0.617	1.996	0.808	1.879	0.702
Household size (adults and children)	2.947	1.518	1.805	1.218	2.463	1.322	2.798	1.477

Note: Child households represent children who have moved out of their parents' home. Single Children have moved out but have never been married.
Parent and child information is collected via the 1993 head of household.

Panel 2: Summary Statistics (weighted) for analyses based on the 1993 Panel Study of Income Dynamics

	All Child Households		Single Child Households		Parent Households		All Households	
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Total annual household food expenditure	5229	2920	3722	2280	5045	2917	5160	2920
Total annual household income	44558	40470	27537	30318	37832	60199	42055	48855
Household head lists race as "Black"	0.082	0.274	0.139	0.346	0.059	0.235	0.073	0.261
Household head lists race as "Asian or Pacific Islander"	0.006	0.077	0.015	0.122	0.005	0.069	0.006	0.074
Household head lists race as "American Indian, Aleut, or Esk	0.007	0.083	0.002	0.044	0.004	0.065	0.006	0.076
Household head lists race as "Latino"	0.008	0.092	0.011	0.106	0.006	0.078	0.008	0.087
Household head lists race as "Other"	0.007	0.081	0.010	0.100	0.007	0.082	0.007	0.081
Age of household head	36.222	9.936	29.678	6.707	60.175	11.446	45.137	15.646
Household head is female	0.202	0.401	0.440	0.497	0.257	0.437	0.222	0.416
Household head is married	0.553	0.497	**NA**	**NA**	0.660	0.474	0.593	0.491
Number of children in household	0.936	1.151	0.187	0.569	0.184	0.568	0.656	1.041
Number of adults in household	1.706	0.628	1.184	0.433	1.902	0.711	1.779	0.667
Household size (adults and children)	2.641	1.506	1.371	0.782	2.087	0.957	2.435	1.355

Note: Child households represent children who have moved out of their parents' home. Single Children have moved out but have never been married.
Parent and child information is collected via the 1993 head of household.

Appendix Table 2: Sample Statistics for the Analysis Based on the Health and Retirement Study

Variable	Sample size	Mean	Standard deviation
Parent age	15,499	64.18	3.60
Number of children	15,499	4.81	2.56
Black	15,499	0.19	0.39
Hispanic	15,499	0.09	0.28
Less than high school education	15,499	0.32	0.47
High school graduate	15,499	0.35	0.48
Some college	15,499	0.18	0.39
College graduate	15,499	0.07	0.26
Post-college education	15,499	0.07	0.26
Household income	15,499	47.02	63.80
Household net worth	15,499	309.10	811.10
Child is a male	15,499	0.51	0.50
Child is a stepchild	15,499	0.13	0.34
Child age	15,499	38.73	5.17
Child less than high school education	15,499	0.14	0.35
Child is a high school graduate	15,499	0.39	0.49
Child has some college	15,499	0.22	0.41
Child is a college graduate	15,499	0.17	0.37
Child has a post-college education	15,499	0.08	0.27
Cash transfers post-college "G2"	5,285	1.93	8.20
Did child receive cash transfers?	5,285	0.29	0.45
Parent paid none (0), some (1), or all (2) of the college expenses of the child	7,329	1.01	0.80
Total fraction of educational expenses paid by parents	2,240	47.21	41.52
If your child had only 3/4 of your income, would you give them 5% of yours?	2,848	0.62	0.49
Cash transfers 93-94	9,497	387.24	2,099.71
Cash transfers 95-96	11,490	751.67	3,852.26
Cash transfers 97-98	11,583	672.15	3,888.57
Cash transfers 1999-2000	11,878	716.86	4,429.05
Did child receive cash transfers in 1999-2000?	11,878	0.15	0.35
Did your child attend an out-of-state public university?	2,272	0.09	0.29
Did your child attend a private university?	2,272	0.15	0.36

Note: We conditioned the children sample on being aged 30 or older.
Parent information is collected from the primary respondents if available, and their spouses or partners if not.

Appendix Table 3: Sample Statistics for the Analysis Based on the Wisconsin Longitudinal Study

Variable	Sample size	Mean	Standard deviation
Age of child	1,724	27.85	2.89
Gender of child (male)	1,724	0.52	0.50
Oldest child	1,724	0.43	0.50
Youngest child	1,724	0.22	0.42
Adopted child	1,724	0.03	0.18
Marital status of child (currently married)	1,724	0.60	0.49
The child lives with parents	1,724	0.06	0.24
Amount of tied transfer receipt	1,724	10,158	18,817
Amount of cash tranfer receipt	1,724	9,289	24,217

Note: We conditioned the sample on having a positive cash transfer receipt and at least some college education but not being in school. The amount of cash transfer receipt does not include any cash transfer amount received before receiving tied transfers.

Appendix Table 4: Table 1 Test of Efficiency Detail

Dependent variable: Log of annual household food expenditure	Parameter	Standard error	T-statistic
Log of total household income	0.097	0.008	11.56
Household head lists race as "Black"	-0.140	0.097	-1.43
Household head lists race as "American Indian, Aleut, or Eskimo"	0.231	0.127	1.82
Household head lists race as "Asian or Pacific Islander"	0.306	0.185	1.65
Household head lists race as "Latino"	-0.053	0.079	-0.67
Household head lists race as "Other"	-0.060	0.091	-0.66
age of head	-0.053	0.071	-0.75
age of head^2	0.002	0.002	0.69
age of head^3	0.000	0.000	-0.58
age of head^4	0.000	0.000	0.45
Household head is female	-0.140	0.043	-3.28
Household head is married	-0.042	0.032	-1.3
Parent household	-0.003	0.026	-0.12
Number of children in household	-0.230	0.069	-3.36
Number of children squared	0.025	0.008	3.04
Number of adults in household squared	-0.009	0.014	-0.6
Household size	0.465	0.058	8.03
Household size squared	-0.029	0.006	-5.08
Number of males in household (0,25]	-0.117	0.049	-2.4
Number of males in household (25,30]	-0.098	0.043	-2.27
Number of males in household (30,33]	-0.089	0.045	-1.95
Number of males in household (33,36]	-0.053	0.046	-1.14
Number of males in household (36,40]	-0.027	0.045	-0.62
Number of males in household (40,44]	-0.028	0.048	-0.59
Number of males in household (44,49]	0.013	0.052	0.25
Number of males in household (49,59]	-0.103	0.056	-1.85
Number of males in household (59,69]	0.031	0.051	0.61
Number of females in household (0,25]	-0.171	0.047	-3.64
Number of females in household (25,30]	-0.009	0.043	-0.21
Number of females in household (30,33]	0.013	0.051	0.26
Number of females in household (33,36]	0.059	0.051	1.15
Number of females in household (36,40]	0.033	0.044	0.75
Number of females in household (40,44]	0.072	0.053	1.34
Number of females in household (44,49]	-0.047	0.057	-0.83
Number of females in household (49,59]	-0.111	0.054	-2.06
Number of females in household (59,69]	-0.162	0.059	-2.75
Average family fixed effect	7.329	0.789	9.29
Number of observations	4404		
Number of dynasties	1355		
R-squared	0.3317		

Note: Family fixed-effects regression with all split-off children