Parental Altruism and Inter Vivos Transfers: Theory and Evidence

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This paper uses PSID data on the extended family to test whether inter vivos transfers from parents to children are motivated by altruism. Specifically, the paper tests whether an increase by one dollar in the income of parents actively making transfers to a child coupled with a one-dollar reduction in that child's income results in the parents' increasing their transfer to the child by one dollar. This restriction on parental and child transfer-income derivatives is derived for the standard altruism model augmented to include uncertainty and liquidity constraints. These additional elements pin down the timing of inter vivos transfers. The method used to estimate income-transfer derivatives takes into account unob-

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served heterogeneity across families in the degree of altruism. The findings strongly reject the altruism hypothesis. Redistributing one dollar from a recipient child to donor parents leads to less than a 13-cent increase in the parents' transfer to the child, far less than the one-dollar increase implied by altruism.

I. Introduction

Family exchange is a fundamental economic issue. Families can redistribute income among their members, insure their members against economic risk, and extend their members credit.[1] Two motives compete to explain family exchange: altruism and self-interest. Distinguishing between the two matters. The effectiveness of government redistribution, the intergenerational transmission of inequality, and the degree of risk sharing all hinge on the nature and extent of family exchange.

This paper tests altruism. Specifically, it checks the following implication of altruism: reducing the income of donor parents by one dollar and increasing the income of a recipient child by one dollar reduces the amount transferred by one dollar. Ours is not the first test of transfer-income derivatives.[2] But it uses what we think are

[1] Barro (1974), Becker (1974, 1991), Ben-Porath (1980), Kotlikoff and Spivak (1981), Pollak (1985), and numerous other studies discuss the family's role in performing these functions.

[2] Cox and Rank (1992) use the National Survey of Family and Households to study transfers. They strongly reject the restriction on transfer-income derivatives. Their estimation method differs from ours in that they use Heckman's (1979) two-step estimator to correct for sample selection. This estimator is inappropriate for transfer models, which involve nonseparable error terms. Their data set also lacks direct measures of parents' income. The measurement error in their proxy for parents' income may be biasing downward their estimate of the effect on parents' transfers of an increase in their income, and the failure to adequately control for parents' income may lead to a positive bias in their estimate of the effect of the child's income on transfers. However, these biases would have to be large to square their results with the altruism model. With the exception of the study by Cox and Rank, we know of no previous empirical studies that have directly tested the transfer-income derivative restriction. Several studies have examined the effects of either parental income or the child's income on transfers, and a few have simultaneously estimated the effects of both parental and child's income without assessing the transfer-income derivative restriction. Dunn (1993) reviews these studies. A few generalizations may be made. First, with the exception of studies by Dunn (1993), Rosenzweig and Wolpin (1993, 1994), and Altonji, Hayashi, and Kotlikoff (1996), which use matched intergenerational panel data from the National Longitudinal Surveys of Labor Market Experience, most studies are based on a single cross-section survey that reports only the income of the donor. Second, few studies distinguish among the effects of permanent income and current income of both the parent and the child or control for the incomes of siblings. Third, most of the studies that examine transfer amounts use ordinary least squares (OLS), Tobit, or generalized Tobit as the estimation procedure. Cox (1987) estimates the response of parental transfers to the child's income but does not test the income-transfer derivative restriction. Gale and Scholz (1994) provide a useful descriptive analysis of transfer patterns using the Survey of Consumer Finances and other sources.

better data and a better econometric procedure. Our data set is the 1968–89 Panel Study of Income Dynamics (PSID), particularly the 1988 wave, which contains a supplemental survey on family transfers. The PSID collects separate panel data on parents and most of their adult children. Consequently, we can control for the principal theoretical determinants of money transfers: the current and permanent incomes of the parents, the child, and the child's siblings. We also control for unobserved heterogeneity by using Altonji and Ichimura's (1996) sample selection–corrected derivative estimator.

In Altonji, Hayashi, and Kotlikoff (1992), we used consumption data to test the joint hypotheses that (*a*) family economic links are motivated by altruism and (*b*) all families have operative altruistic linkages. Specifically, we examined the prediction that altruistically linked family members would share their incomes in deciding how much to consume. We found strong evidence that such income sharing, if it occurs, is not ubiquitous. The present study complements our previous work, as well as related consumption studies, by testing for altruism among just those parents who are actually transferring money to their children.[3]

Reliable estimation of transfer-income derivatives requires dealing with unobserved heterogeneity and sample selection bias and doing so without imposing strong functional form assumptions. As we illustrate, transfers are not likely to be an additively separable function of observed factors such as income and unobserved determinants. Consequently, standard estimation methods, such as the Tobit model or Heckman's two-step estimator, cannot be used. In contrast, our derivative estimator is robust to the functional form relating parental utility to consumption and to observed and unobserved preference characteristics. It is also robust to the distribution of unobserved heterogeneity and to certain types of measurement error in reported transfers.

One question about testing altruism with transfer data involves timing. Is the timing of parents' transfers determinant, or just their present value? The answer, in realistic settings, is that timing matters. Indeed, as we discuss in the text and prove in the Appendix, uncertainty about their child's future income leads parents to delay making transfers as long as possible. This preference for delay is balanced by other factors. Capital market imperfections, considered by Drazen (1978), Becker (1991), and Altig and Davis (1992), are one of them. In concert, these elements produce a time path of transfers

[3] See, e.g., Thomas (1990) and Browning (1992) on intrahousehold resource allocation and Abel and Kotlikoff (1994), Hayashi (1995), and Hayashi, Altonji, and Kotlikoff (1996) on intergenerational resource allocation and risk sharing.

that (*a*) balances the desire to delay transfers in order to resolve uncertainty against the desire to relieve recipients' liquidity constraints and (*b*) satisfies the transfer-income derivative restriction where current income is the relevant income measure.[4]

Our findings are striking. Our estimated transfer-income derivatives decisively fail to satisfy the restriction of altruism. In our data, a reduction in parents' income by one dollar reduces their transfer by less than five cents and a one-dollar increase in the child's income reduces the transfer she receives by less than eight cents. Consequently, shifting one dollar in current income from the parents to the child leads to less than a 13-cent reduction in the transfer. This, obviously, is a far cry from the one-dollar reduction predicted by the altruism model.

The paper is organized in the following manner. Section II discusses the timing of transfers in the context of a two-period model in which altruistic parents are uncertain about their child's future income, but may nonetheless make first-period transfers to relieve their child's liquidity constraint. Section III describes our method of controlling for unobserved heterogeneity in measuring transfer-income derivatives. Sections IV, V, and VI describe the data, present findings, and draw conclusions.

II. A Two-Period Model of Altruistic Inter Vivos Transfers

Consider a model in which parents and a child overlap for two periods. Parents care about their own consumption. They also care about their child's utility and are prepared to make transfers to her.[5] Whether and when they do so depends on the child's second-period income (which is uncertain as of the first period) as well as on the degree to which the child is liquidity-constrained. For example, the child may end up with sufficiently high second-period income that the parents transfer nothing to her in that period. Given this possibil-

[4] In their conclusion (p. 1219), Altig and Davis speculate that uncertainty about incomes and longevity will give parents an incentive to delay transfers. They also call for research on a model with both capital market imperfections and uncertainty. Although tax considerations can also pin down the timing of transfers, we leave them out of our analysis. Gift and estate taxes are a minor issue for most families since parents can shelter from taxes up to $1.2 million in bequests and up to $20,000 per child per year in gifts. Differences in parents' and children's marginal capital income tax rates are also likely to be small given the tax schedule of the late 1980s.

[5] They care neither about the amount per se transferred to the child (as in Blinder [1976] and Andreoni [1989]) nor about services provided them by their child (as in Bernheim, Shleifer, and Summers [1985] and Cox [1987]). For a recent survey of these and other theories of the family, see Bergstrom (1993).

ity and if their child is not liquidity-constrained, the parents will refrain from making any transfers in the first period until they have had a chance to observe their child's second-period income. There are two reasons for this. First, there is the chance that the child will strike it rich in the second period, in which case the parents will wish to make a negative transfer. Since parents cannot compel the repayment of past gifts, their best option is to wait and see whether their child really needs their help. This is true regardless of the child's likelihood of striking it rich. Even the prospect that their children will win the lottery will lead parents who would otherwise be indifferent to delay making their transfers. True, parents care about their children's utility and therefore want them to intertemporally optimize with respect to current and future consumption. But the parents do not need to make transfers to the child to get this to happen. Instead, the child will do this on her own because doing so is in her self-interest.

The second reason parents will wait to make transfers is to keep their child from overconsuming in period 1 in order to appear relatively poor and elicit a larger transfer in period 2.[6] This motivation to delay transfers also hinges on uncertainty about the child's second-period income. In the absence of uncertainty and liquidity constraints, the parents cannot affect their child's free-riding by delaying their transfers. Giving their child a dollar less in period 1 will not lead her to reduce her consumption in period 1 because she will realize that maintaining her period 1 consumption level will have no effect on her period 2 consumption. True, her own period 2 assets will be lower, but total period 2 family assets will remain the same. This means that her consumption in period 2, which is based on total family resources, will remain the same. Uncertainty alters the story. With uncertainty, the child knows that maintaining her period 1 consumption level in response to a one-dollar reduction in period 1 transfers will come at the cost of lower period 2 consumption in those second-period states of nature in which she has relatively high income and receives no transfers. So, with uncertainty, the parents can, in part, keep their child from overconsuming by delaying their transfers.

Liquidity constraints temper the parents' preference for delay. Now the child cannot intertemporally optimize without first-period transfers from the parents. In this case the parents, in period 1, trade off the benefits to their child of immediate transfers, which translate

[6] This is the Samaritan's dilemma analyzed by Buchanan (1975), Kotlikoff (1987), Laitner (1988), Lindbeck and Weibull (1988), Bruce and Waldman (1990), and others.

into immediate consumption, against the cost of being more likely to end up in the second period wishing they could get a transfer from their child. Thus, in the presence of uncertainty, first-period transfers, whether they are zero or positive, represent precisely the amount the parents wish to give in that period rather than the first installment on a certain present value of lifetime transfers that could just as well be paid with interest in the second period. As we show, when the first-period transfer is positive, the difference in the partial derivatives of the transfer with respect to the parents' first-period income and the child's first-period income equals one.

A. *The Model*

The parents have a time-separable utility function defined over their own and their child's consumption in periods 1 and 2, that is,

$$V_{p1} = u(c_{p1}) + \eta u(c_{k1}) + E_1[u(c_{p2}) + \eta u(c_{k2})], \tag{1}$$

where $u(\cdot)$ is the concave, point-in-time utility of consumption function, E_1 is the period 1 expectation operator, η is the weight the parents place on the child's utility, c_{p1} stands for consumption of the parents at time 1, and c_{k1} and the other consumption variables are defined analogously.[7] For simplicity, assume that only the second-period income of the child is uncertain.

The dynamic programming needed to maximize the parents' utility starts in period 2. When the parents and child enter that period, the child receives her previously uncertain second-period income, Y_{k2}. Given this value, the parents decide how much (including zero) to transfer to the child. The parents' second-period transfers can, thus, be written as a function of the parents' and child's second-period resource positions. The child, in turn, takes as given this period 2 transfer function as well as any period 1 transfer she receives in choosing the level of period 1 consumption that maximizes her lifetime utility. The child's optimum period 1 consumption can, consequently, be written as a function of her period 1 resource position, including period 1 transfers, and her parents' period 2 resource po-

[7] We also assume that $u'(0) = \infty$ to guarantee interior solutions to the parents' and child's consumption choice problem in periods 1 and 2. The point-in-time utility functions of the parents and child may differ. They may also depend on additional person- and time-specific preference shifters. But we ignore these possibilities, as well as the time preference factor, to simplify the notation. The analysis in the Appendix also goes through if the child cares about the parents. In this case, there are regimes in the first period and in the second period in which the child would make a transfer to the parent. The possibility that the child will return money in the second period if she turns out to be less needy than the parents reduces the parents' incentive to delay transfers to the second period.

sition. The parents use this period 1 child consumption function in deciding how much to consume and transfer in period 1.

The Appendix lays out this dynamic program and proves that first-period transfers will be positive only if the child is liquidity-constrained, a condition in which the child faces a higher cost of funds than her parents. In this circumstance, it is easy to see that the transfer-income derivative restriction applies. In the objective function and constraints that determine the model's consumption levels, c_{k1}, c_{p1}, c_{k2}, c_{p2}, and first- and second-period transfers, R_1, and R_2, the parents' and child's first-period incomes Y_{p1}, Y_{k1}, and R_1 appear in the linear combination $Y_{p1} - R_1$ or $Y_{k1} + R_1$. Consequently, if we increase Y_{p1} by ϵ and decrease Y_{k1} by ϵ, then R_1 will increase by ϵ and all the other variables will be unchanged. Hence we have

$$\frac{\partial R_1}{\partial Y_{p1}} - \frac{\partial R_1}{\partial Y_{k1}} = 1, \tag{2}$$

which forms the basis of our test of altruism.[8]

III. Econometric Issues and Methods

Our method for estimating income-transfer derivatives is based on the following version of (2):

$$\frac{\partial R(\mathbf{Z}, \boldsymbol{\eta})}{\partial Y_{pt}} - \frac{\partial R(\mathbf{Z}, \boldsymbol{\eta})}{\partial Y_{kt}} = 1, \tag{3}$$

which holds provided that R is positive. The terms Y_{pt} and Y_{kt} are the current nonasset income of the parents and child, respectively. The variable $\mathbf{Z}$ denotes the vector $\{Y_{pt}, Y_{kt}, \mathbf{X}\}$, where the vector $\mathbf{X}$ contains current wealth, the determinants of expected future income, and observed preference shifters. The variable $\boldsymbol{\eta}$ is redefined to be a vector (as opposed to a scalar function) of unobservable preference variables.

There are two problems in implementing a test based on (3). First, $\boldsymbol{\eta}$ is unobserved, so (3) cannot be evaluated for any particular family. Second, one needs to estimate the transfer-income derivatives that enter (3) taking account of the fact that the restriction (3) holds

[8] As we discuss below, the derivative restriction holds in an extended model in which parents may choose to invest in their child's human capital in period 0. At the other end of the life cycle, adding a period 3 to the model with uncertainty about whether the parents will survive does not change the result. Parents will make transfers in period 2 or period 1 or both if the children are liquidity-constrained and the restriction (2) will hold. The child will receive a bequest at the end of period 2 if the parent dies.

only when $R > 0$. Standard approaches to sample selection such as the Tobit model or Heckman's (1979) two-step estimator cannot be used to form consistent estimates of the derivatives with respect to Y_{pt} and Y_{kt} of $R(\mathbf{Z}, \eta \mid \mathbf{Z}, R > 0)$ because $R(\mathbf{Z}, \eta)$ cannot be written as the sum of functions of Y_{pt}, Y_{kt}, and $\mathbf{X}$ and a function of η.[9] Generalizing the maximum likelihood Tobit procedure to models that are nonseparable in $\mathbf{Z}$ and η and have nonnormal errors requires a specific assumption about how the unobservables interact with the observables. Using the wrong form could lead to a mistaken rejection of the restriction.

We deal with the first problem by basing our test on the expectation over η of the η-constant income derivatives. In so doing, we take advantage of the fact that under the null hypothesis the restriction (3) holds for all families with $R > 0$. We deal with the second problem by using Altonji and Ichimura's (1996) selection-corrected derivative estimator for nonseparable limited dependent variables models, which we now briefly describe as it applies to the transfer problem.

Let $\eta^*(\mathbf{Z})$ be the set of values of η such that $R > 0$ and $g(\eta)$ the density of η. We assume that the distribution of η is independent of $\mathbf{Z}$, although we note below that parental investments in human capital may invalidate this assumption. Let $P_R(\mathbf{Z})$ be the probability that R is greater than zero given $\mathbf{Z}$. For a given value of $\mathbf{Z}$, the expected value over observations with positive transfers of the difference in transfer-income derivatives is

$$\begin{aligned} E\left[\frac{\partial R(\mathbf{Z}, \eta)}{\partial Y_{pt}} - \frac{\partial R(\mathbf{Z}, \eta)}{\partial Y_{kt}} \middle| \mathbf{Z}, R > 0\right] &= \int_{\eta^*(\mathbf{Z})} \left[\frac{\partial R(\mathbf{Z}, \eta)}{\partial Y_{pt}} - \frac{\partial R(\mathbf{Z}, \eta)}{\partial Y_{kt}}\right] \cdot \frac{g(\eta)\,d\eta}{P_R(\mathbf{Z})} \\ &= \int_{\eta^*(\mathbf{Z})} 1 \cdot \frac{g(\eta)\,d\eta}{P_R(\mathbf{Z})} = 1, \end{aligned} \tag{4}$$

[9] A simple static model illustrates this point. Assume that the parents' utility, V^p, is logarithmic in their own consumption, c_p, and the consumption of their child, c_k, i.e., $V^p = \log c_p + \eta \log C_k$, where η is the unobserved relative weight the parents place on the child's log consumption and is distributed across parents according to the density $g(\eta)$. The condition for positive transfers from the parents to the child is $\eta > Y_k/Y_p$. The amount that is transferred, if transfers are positive, is $R = (-Y_k + \eta Y_p)/(1 + \eta)$. Note that the unobservable η enters the formula for R in a nonseparable way. This nonseparability between preferences and incomes is generic to the transfer models based on altruism.

where the last equality reflects the application of (3). Thus our answer to the first problem is to exploit the fact that since the restriction (3) is true for all η, it carries over to the expected value over η of (3).

To estimate the left-hand side of (4), we work with the conditional expectation function

$$\bar{R}(\mathbf{Z}) \equiv E[R(\mathbf{Z}, \eta) | \mathbf{Z}, R > 0] = \int_{\eta^*(\mathbf{Z})} R(\mathbf{Z}, \eta) \frac{g(\eta)d\eta}{P_R(\mathbf{Z})}, \quad (5)$$

which can be estimated given that R and $\mathbf{Z}$ are all observable. Specifically, we work with the derivatives of the conditional expectation function $\bar{R}(\mathbf{Z})$. Because selection into the sample with $R > 0$ is not random, we need to correct the income derivatives of $\bar{R}(\mathbf{Z})$ for sample selection. We begin by differentiating (5) with respect to Y_{jt} ($j = p, k$), obtaining

$$\frac{\partial \bar{R}}{\partial Y_{jt}} = E\left[\frac{\partial R}{\partial Y_{jt}}\middle| \mathbf{Z}, R > 0\right] + A_j^2(\mathbf{Z}) + A_j^3(\mathbf{Z}), \quad (6)$$

where

$$A_j^2(\mathbf{Z}) = R(\mathbf{Z}, \eta^*(\mathbf{Z})) \frac{g(\eta^*(\mathbf{Z}))}{P_R(\mathbf{Z})} \frac{\partial \eta^*(\mathbf{Z})}{\partial Y_{jt}} = 0 \quad (7)$$

by virtue of the fact that on the boundary transfers are zero. The term A_j^3 is more problematic:

$$\begin{aligned} A_j^3(\mathbf{Z}) &= \int_{\eta^*(\mathbf{Z})} R(\mathbf{Z}, \eta) \frac{g(\eta)}{P_R(\mathbf{Z})} \left[\frac{-\partial P_R(\mathbf{Z})/\partial Y_{jt}}{P_R(\mathbf{Z})}\right] d\eta \\ &= \frac{-\partial P_R(\mathbf{Z})/\partial Y_{jt}}{P_R(\mathbf{Z})} \bar{R}(\mathbf{Z}). \end{aligned} \quad (8)$$

Since $\partial P_R/\partial Y_{kt} < 0$ and $\partial P_R/\partial Y_{pt} > 0$, A_k^3 is positive and A_p^3 is negative.[10] Fortunately, one can estimate $A_j^3(\mathbf{Z})$ by first estimating $P_R(\mathbf{Z})$ from data on an indicator variable for $R > 0$ and $\mathbf{Z}$ and then substituting the estimate of $P_R(\mathbf{Z})$, the estimate of $\bar{R}(\mathbf{Z})$, and the associated estimates of the derivatives $\partial P_R/\partial Y_{jt}$ into (8). Consequently, our estimator of the difference in the transfer-income derivatives is

[10] Intuitively, higher (lower) values of the child's (parents') income shift the distribution of η over which transfers occur to include values that are associated with larger transfers for any given value of the child's and parents' income. The effects of selection are transparent in the example in n. 9, where η is a scalar. Transfers rise with η given Y_k and Y_p, and η must exceed Y_k/Y_p for a transfer to occur.

given by

$$E\left[\frac{\partial R(\mathbf{Z}, \eta)}{\partial Y_{pt}}\middle| \mathbf{Z}, R > 0\right] - E\left[\frac{\partial R(\mathbf{Z}, \eta)}{\partial Y_{kt}}\middle| \mathbf{Z}, R > 0\right] \\ = \left[\frac{\partial \bar{R}(\mathbf{Z})}{\partial Y_{pt}} - A_p^3(\mathbf{Z})\right] - \left[\frac{\partial \bar{R}(\mathbf{Z})}{\partial Y_{kt}} - A_k^3(\mathbf{Z})\right], \tag{9}$$

where we replace the terms on the right-hand side with sample estimates. Our test of the transfer-income derivative restriction compares our estimate of (9) to one for various values of $\mathbf{Z}$. The first and second terms in brackets are the estimators of $E[\partial R(\mathbf{Z}, \eta)/\partial Y_{pt} \mid \mathbf{Z}, R > 0]$ and $E[\partial R(\mathbf{Z}, \eta)/\partial Y_{kt} \mid \mathbf{Z}, R > 0]$.

A. *An Empirical Formulation*

Altonji and Ichimura (1996) discuss both parametric and nonparametric approaches to estimating $\bar{R}(\mathbf{Z})$ and $P_R(\mathbf{Z})$. Because of the large number of variables involved in our analysis and sample size considerations, we take a flexible parametric approach. Let θ_1 denote the parameters of the function $\bar{R}(\mathbf{Z}; \theta_1)$. We estimate these parameters by running the following least-squares regression on the sample for which $R > 0$:

$$R = \bar{R}(\mathbf{Z}; \theta_1) + u, \tag{10}$$

where u is uncorrelated with $\mathbf{Z}$ because $\bar{R}(\mathbf{Z}; \theta_1)$ is the conditional expectation of R. We specify $\bar{R}(\mathbf{Z}; \theta_1)$ to contain a third-order polynomial in the nonasset incomes of the parents and child with interactions among all first- and second-order terms, third-order polynomials in the assets of both parties and the product of the assets, and third-order polynomials in the permanent incomes Y_p and Y_k of the parents and child as well as the product of Y_p and Y_k. The function also includes a large number of demographic controls, which are listed in table 1 below and the notes to tables 5 and 6.

In choosing a flexible specification for $P_R(\mathbf{Z})$, we are guided by the fact that, as discussed by Amemiya (1981), a conditional probability function can always be approximated by the convolution of a particular conditional distribution function $\Phi(\cdot)$ and a function $h(\mathbf{Z}; \theta_2)$, provided that $h(\mathbf{Z}; \theta_2)$ is sufficiently flexible, with

$$P_R(\mathbf{Z}) = \Phi(h(\mathbf{Z}; \theta_2)). \tag{11}$$

We choose the standard normal conditional distribution function for $\Phi(\cdot)$ and a polynomial specification for $h(\mathbf{Z}; \theta_2)$ that is the same as the specification for $\bar{R}(\mathbf{Z}; \theta_1)$. In this case the elements of θ_2 are the coefficients of the probit index, and we can use standard probit estimation routines to estimate $P_R(\mathbf{Z})$. Given the flexibility in $h(\mathbf{Z}; \theta_2)$, we doubt whether allowing additional flexibility through either Φ or $h(\mathbf{Z}; \theta_2)$ would make much difference.

Inference is complicated by the fact that the derivative estimators are a complicated nonlinear function of $\hat{\theta}_1$ and $\hat{\theta}_2$. Furthermore, one must account for the fact that the samples used to estimate $\hat{\theta}_1$ and $\hat{\theta}_2$ contain more than one observation from some families, and heteroscedasticity is likely to be present in (10). While one can use the "delta method" to derive asymptotic standard errors for $E[\partial R(\mathbf{Z}, \eta)/\partial Y_{pt} \mid \mathbf{Z}, R > 0; \hat{\theta}_1, \hat{\theta}_2]$, $E[\partial R(\mathbf{Z}, \eta)/\partial Y_{kt} \mid \mathbf{Z}, R > 0; \hat{\theta}_1, \hat{\theta}_2]$, and their difference from the asymptotic joint distribution of $\hat{\theta}_1$ and $\hat{\theta}_2$, the approximation may not be reliable. Consequently, we use a bootstrap procedure to estimate the standard errors of these derivatives for various values of $\mathbf{Z}$ and for the sample average of the derivatives over the distribution of $\mathbf{Z}$ for those who receive transfers.[11] To simplify the notation, we refer to these derivatives as $E\partial R/\partial Y_{pt}$, $E\partial R/\partial Y_{kt}$, and $\Delta E\partial R/\partial Y_{jt}$.

B. *Controlling for Information about Future Income*

The derivatives in (3) hold constant variables in the information set used to forecast future income. Our econometric analysis tries to control for these variables. To the extent that it fails, the predicted difference in transfer-income derivatives will likely exceed one. Why? Because unobservables that raise future income are also likely to raise current income. Consequently, $\partial R/\partial Y_{pt}$ will be larger than if the unobservables had not changed because higher values of the

[11] We partition the sample by the number of observations from each extended family, lumping together the handful of observations from families with eight, nine, or 10 observations. Let N_j be the number of families with j observations in our actual sample. For each bootstrap replication m and each j, we draw with replacement from the sample until we obtain a new sample of N_j families. The mth bootstrap replication sample is the combination of the samples drawn for each j. By drawing the bootstrap samples so that N_j families come from each group j, we preserve the correlation structure that arises because the observations are clustered by families. We then implement the derivative estimator and compute estimates $E[\partial R(\mathbf{Z}, \eta)/\partial Y_{pt} \mid \mathbf{Z}, R > 0; \hat{\theta}_1^m, \hat{\theta}_2^m]$, $E[\partial R(\mathbf{Z}, \eta)/\partial Y_{kt} \mid \mathbf{Z}, R > 0; \hat{\theta}_1^m, \hat{\theta}_2^m]$, and the difference between them, where m denotes the particular bootstrap replication. We performed 125 bootstrap replications. We computed standard errors from the tenth and ninetieth percentile values of 125 derivative estimates. The standard errors are based on the assumption that the derivative estimator has a normal distribution and make use of the relationship between the variance of a normal and the distance between the tenth and ninetieth percentile values. Note that in tables 6 and 7 below we evaluate the derivatives at various values of Z. In the bootstrap replications we always use the distribution of the original sample to determine the points (such as the mean) at which to evaluate the derivatives.

parents' future income will induce the parents to make larger transfers in the present as well as in the future. While we could not sign the effect of the child's future income on current transfers in the model because of the role of liquidity constraints in the timing of transfers, $\partial R_1/\partial Y_{k1}$ will be smaller in the likely event that higher values of the child's future income reduce present as well as future transfers. We address the issues of measurement error in current income, assets, and transfers in Section V.

C. *Endogeneity of the Child's Income?*

The estimator we use assumes that the unobserved components of the preference vector η are independent of Y_{kt}. Parental investments in their child's human capital will influence current and permanent income of the child and may depend on η. The derivative restriction (3) will hold, but the endogeneity of Y_{kt} may lead to bias in the estimate of $E\partial R/\partial Y_{kt}$. The bias is likely to be positive, leading to an underestimate of $\Delta E\partial R/\partial Y_{jt}$.[12]

IV. Data

This section discusses the sample as well as the construction and quality of key variables.

A. *The Sample*

Our data are taken from the 1988 Panel Study of Income Dynamics, which includes a special supplement on transfers between relatives.[13] Using the PSID overcomes a key problem in the study of intergenera-

[12] Drazen (1978), Becker (1991), and others have investigated models in which altruistic parents choose between investing in a child's human capital and making monetary transfers when the child has left school. We have analyzed a three-period version of our model in which in period 0 parents may choose to make transfers to adolescent children to overcome liquidity constraints that would limit schooling investments or to induce children who are misinformed about the value of school to stay in school longer. Parents do not make all transfers in period 0 for the same reason that they wish to delay transfers in our two-period model. The restriction (2) holds for period 1 transfers even though the child's income and the parents' wealth will be affected by earlier investments, but the model implies that the child's income and the parents' wealth will depend on preferences η. Altonji and Ichimura (1996) provide a related estimator for the case of endogenous regressors when instruments are available. Their estimator is not practical in the current case given our relatively small sample size and the limited explanatory power of the instruments available to us, such as income innovations.

[13] Other recent papers using the PSID transfer data include Hill and Soldo (1993), Ioannides and Kan (1993), Schoeni (1993), Pollak (1994), and Altonji et al. (1996). We also make limited use of the wealth data from the 1989 wave of the PSID.

tional transfers, namely obtaining reliable data on the economic resources of both parents and adult children. Our sample consists of parents and their children who were in 1968 PSID families and were heads or wives of 1988 PSID households. Only about 2 percent of the children were students in 1988. We have 1988 data on the income and family composition of the households in which these individuals reside as well as pre-1988 data on their assets, health status, income, and other variables. Those 1988 households containing heads or wives who were children in the 1968 study are matched to the 1988 households of their parents. An observation consists of one such matched pair. Given that a child's mother and father may be in separate households, each child may appear in one or two records. Parents with multiple children appear in as many records as they have respondent children. The effective sample for most of the multivariate analyses consists of 3,402 parent-child pairs, including 687 pairs with positive transfers.[14]

B. *The Transfer Data*

Information on R is based on the following two-part question: (1) During 1987, did you/your family living here receive any loans, gifts, or support worth $100 or more from your parents? (2) About how much were those loans, gifts, or support worth altogether in 1987? Separate questions are asked about transfers from the father and transfers from the mother if the parents are divorced, and as noted above, we treat these transfers as separate observations. If the child is married at the time of the 1988 survey, the question is asked first about the husband's parents and then about the wife's parents. Persons who married into PSID households were not interviewed, so we use information on the transfers from either the wife's parents or the husband's parents depending on whether the wife or the husband was in the original 1968 PSID sample.[15]

Several points about this question deserve mention. First, the question specifically refers to loans. Nonetheless, we treat the responses as transfer measures since we have no evidence on the fraction of the transfers that are actually loans. In this regard, Altonji

[14] The distribution of parent household records by number of children is as follows: 644 parent households have been matched to only one child, 454 to two children, 235 to three children, 135 to four children, 60 to five children, 27 to six children, 11 to seven children, 7 to eight children, 0 to nine children, and 1 to ten children. The sample contains 3,018 children who are matched to one parent household and 192 children who are matched to two parent households.

[15] The respondent for a PSID household is usually either the head of the household or the spouse, so in some cases the husband provides information about transfers from the wife's parents, and vice versa.

et al. (1996) find that transfers are no more likely to be reported among those children who became new homeowners between the 1986 and 1987 or the 1987 and 1988 surveys. Second, in the interest of simplicity we ignore the $100 threshold in the question, although we doubt that this makes much difference.[16] Third, we have little direct information on the quality of the data. Presumably, the fact that the question directly asks about help from parents is an advantage over questions that do not specify the relationship.[17] Although the incidence of money transfers is higher than in most other studies,[18] we still think that there is substantial measurement error in the transfer reports. However, to repeat, our derivative estimator is robust to random failure to report transfers and to random variation in the fraction of transfers that households report.

C. *Income and Wealth Measures*

Nonasset net family income in 1987 is our measure of current income of the parents and the child (Y_{pt}, Y_{kt}). We exclude asset income because it may be affected by prior transfers but control for assets and permanent family income (including asset income) separately. We also use two alternative measures of permanent income: Y_p of the parents and Y_k of the kids. Both are based on the regression model

$$\log(Y_{it}) = \mathbf{X}_{yit}\beta + e_{it}, \tag{12}$$

where Y_{it} is the family income of person i in year t and the vector $\mathbf{X}_{yit}$ consists of a fourth-order polynomial in age, a set of marital status dummies, year dummies, and counts of number of children. The first measure assumes that $e_{it} = \nu_i + u_{it}$, where the serial correlation in u_{it} is assumed to be sufficiently weak to be ignored in computing permanent income. We first estimate the parameter β from gender-specific OLS regressions using all observations in which the person

[16] The derivative estimator may easily be modified to take this threshold into account by subtracting $100 from the reported transfers prior to estimation (see Altonji and Ichimura 1996). This would have no effect on the uncorrected derivative estimates in cols. 1 and 3 of tables 6 and 7 below and lead to only a small change in the corrected derivative estimates.

[17] In Altonji et al. (1996), we use the fact that the parents provide information on transfers given to others to check on the information provided by the children. The parental responses suggest a lower incidence of transfers. We argue that the fact that the question about money help provided to others does not identify the specific relationship to the recipient leads to underreporting.

[18] See Dunn (1993) for a recent survey.

was a head or wife.[19] We estimate ν_i as the mean of the residuals from the regression for each person. We obtain our first measure of permanent income for parents by adding the estimate of ν_i to the prediction from the regression for a person who is aged 40, is married, and had no children in 1988 and taking the antilog.[20] We call these measures $\bar{Y}_p$ and $\bar{Y}_k$, where the overbar reflects the fact that they are basically time averages of current and past income adjusted for demographic variables and time.

For the second measure, we model e_{it} as a third-order autoregressive process with coefficients that depend on a third-order polynomial in age, Age_{it} of person i in year t:

$$\begin{aligned} e_{it} = {} & (1, \text{Age}_{it}, \text{Age}^2_{it}, \text{Age}^3_{it})\gamma_1 e_{it-1} \\ & + (1, \text{Age}_{it}, \text{Age}^2_{it}, \text{Age}^3_{it})\gamma_2 e_{it-2} \\ & + (1, \text{Age}_{it}, \text{Age}^2_{it}, \text{Age}^3_{it})\gamma_3 e_{it-3} + u_{it}, \end{aligned}$$

where γ_1, γ_2, and γ_3 are 4×1 vectors of parameters and u_{it} is serially uncorrelated. We estimate β from (12) using OLS and estimate γ_1, γ_2, and γ_3 using the OLS residuals from the sample estimate of (12).[21] We then use the chain rule of forecasting to forecast future values of e for the periods $t + 1$ to $t + 6$; combine the forecasts into an index with weights that decline geometrically at rate 1/1.07 and sum to one; add the index to the prediction based on the estimate of (12) for a person who is aged 40, is married, and had no children in 1988; and take antilogs. We call these measures $\hat{Y}_p$ and $\hat{Y}_k$. They allow time dependence in the stochastic income component to depend on age and place more weight on the recent past than the time-averaged measures.

The quality of the permanent income measures deserves discussion. The minimum number and fifth percentile of the number of

[19] We use all those heads of household and wives in the PSID who have valid data in a given year rather than only those individuals in our matched intergenerational sample.

[20] We included all years of data in which respondents were either a head of household or the wife of the head. Consequently, if a divorce occurs, the data for women include observations from the years in which she was married as well as the later years. Note, however, that the regressions control for marital status. An alternative would be to use family income in the years since the most recent change in marital status. The measures $\hat{Y}_p$ and $\hat{Y}_k$ based on the autoregressive model discussed below do not place any weight on values of e_{it} that are more than three years in the past and, consequently, are less sensitive to this issue.

[21] The samples used to estimate the autoregression for e_{it} are restricted to observations for which three lags of income are available. Lagged family income residuals cannot be constructed for children who became heads or wives for the first time in 1986 or 1987 or for whom family income is missing for other reasons. To avoid dropping these observations, we set the 1985 value of e_{it} to the 1986 value (if available) or 1987 if not. We set missing data for 1986 equal to the 1987 value.

observations used to construct $\bar{Y}_p$ are 10 and 21, respectively. The fifth, fiftieth, and ninetieth percentiles for the number of observations used to construct $\bar{Y}_k$ are one, nine, and 18. The fact that these measures are averaged from several years of data suggests that transitory income and measurement error will have only a minor effect on them.[22]

Our measure of assets of the parents is based on the 1984 wealth supplement to the PSID, which is the most recent year prior to 1988 in which detailed information on assets was collected. Since this variable refers to the wealth of the head and wife (if present) of the individual's 1984 household, we interact this variable with a dummy equal to zero if the household head changed since 1984 and one otherwise and add the dummy variable to the list of controls. We construct the asset measure and a change in household head dummy for the child household in the same way. We also explore the issue of measurement error by experimenting with data from the 1989 wealth supplement.

In some of our estimation we use the average of permanent incomes of siblings who are heads or wives in the PSID as a control for the resources of siblings.[23]

Table 1 presents the unweighted means and standard deviations of selected variables for our sample and for the subsets with and without positive transfers. The means of age are 30.5 for the children and 58.7 for the parents. One implication of our model of the timing of transfers is that the transfer probability should fall with the age of the child as earnings rise relative to permanent income. This is consistent with the table as well as with the multivariate probits (not shown). Only 2.9 percent of the children who were heads of household and reported a positive transfer in 1987 were students at the time of the 1988 survey. The comparable percentage for wives is 0.6 percent. The percentages who were students in 1987 are similar, so few of the transfers would appear to be related to recent schooling expenditures.

[22] Note that the income from assets, annuities, and pensions is reflected in our permanent income measures. The annuity value of assets that do not generate an income stream, such as a home, will not be reflected in the permanent income measures but will be reflected in controls for wealth. Since asset income may be affected by past transfers, we also experiment with measures of permanent labor earnings of the husband and wife.

[23] When no independent siblings are present in the sample, we set the measure of sibling income to zero. We control for whether or not independent siblings are present with a dummy variable. All specifications include a control for the inverse of the number of siblings, whether or not they are in independent PSID households. Not surprisingly, transfers to a given child are negatively related to the number of siblings (see Altonji et al. 1996).

TABLE 1

MEANS BY TRANSFER CATEGORY

Variable	Total Sample ($N = 3{,}402$)	If No Transfer ($N = 2{,}715$)	If Transfer ($N = 687$)
Parent gave kid money 0/1 ($R > 0$)	.202	.000	1.000
Amount of money parent gave kid (R)	297.0	.000	1,507.8
	(2,064.5)	(.000)	(4,453.5)
Kid is unmarried female	.230	.228	.240
Kid is unmarried male	.167	.148	.245
Kid is married female	.304	.316	.256
Number of children in kid's household	1.237	1.318	.917
Number of children in single kid's household	.295	.307	.245
Parent is divorced, unmarried father	.023	.024	.019
Parent is divorced, remarried father	.043	.044	.038
Parent is widowed, unmarried father	.026	.028	.016
Parent is widowed, remarried father	.017	.019	.012
Parent is divorced, unmarried mother	.093	.094	.086
Parent is divorced, remarried mother	.05	.05	.049
Parent is widowed, unmarried mother	.184	.194	.144
Parent is widowed, remarried mother	.032	.035	.022
Parents married but live apart	.021	.023	.01
Kid reports race other than white	.357	.385	.246
Age of kid	30.527	30.891	29.087
	(5.802)	(5.786)	(5.642)
Age of parent	58.719	58.965	57.745
	(8.349)	(8.257)	(8.642)
Health of kid in 1988 (1 = excellent, 5 = poor)	2.096	2.117	2.016
	(.947)	(.956)	(.907)
Health of parent in 1988 (1 = excellent, 5 = poor)	3.115	3.171	2.894
	(1.173)	(1.176)	(1.135)
Distance to parent house (estimated)	141.454	139.432	149.447
	(210.737)	(209.739)	(214.604)
Parent resides with kid	.069	.063	.093
Parent lives with another relative	.018	.0200	.013
Inverse of number of kids	.273	.260	.321
	(.181)	(.173)	(.201)
Parent's permanent income: time-averaged method ($\bar{Y}_p$)	54.746	51.481	67.649
	(30.821)	(27.510)	(38.814)
Kid's permanent income: time-averaged method ($\bar{Y}_k$)	48.171	47.644	50.254
	(24.286)	(23.868)	(25.785)
Parent's permanent income: autoregressive method ($\hat{Y}_p$)	53.403	50.976	62.996
	(23.682)	(21.350)	(29.335)
Kid's permanent income: autoregressive method ($\hat{Y}_k$)	46.207	45.949	47.223
	(14.942)	(14.869)	(15.195)

NOTE.—Standard deviations are in parentheses. The sample is unweighted.

V. Results

This section is divided into five subsections. Subsection *A* describes the distribution of transfers. Subsection *B* presents a probit model of the probability of a transfer. Subsection *C* presents estimates of the transfer-income derivatives. Subsection *D* shows that these results are robust to a large number of changes in the specification, data, and estimation method. Subsection *E* discusses the source and interpretation of our findings.

A. The Distribution of Transfers

Table 2 reports the mean probability of a transfer and the mean, standard deviation, and fifth, twenty-fifth, median, seventy-fifth, and ninety-fifth percentiles of the distribution of positive transfers. It also reports corresponding statistics for the ratio of the transfer amount to the income of the parents and the income of the child. Tables 2, 3, and 4 aggregate transfers received from and given to parents living separately, so each person with living parents appears only once in the sample used to compute these tables.[24] For married couples the parents are either the parents of the husband or the parents of the wife, depending on whether the husband or the wife was a child in the original 1968 PSID sample.

The probability that R is positive is .23. The overall mean transfer is $421 (in 1988 dollars), and the mean and median of the positive transfers are $1,810 and $500. When R is positive, the median and ninety-fifth percentile of the ratio of R to the child's 1988 income are .022 and .372 for the sample with positive transfers. The median and ninety-fifth percentile of the ratio of R to the parents' 1988 income are .014 and .169.

Table 3 presents weighted estimates for the matched sample of the probability of transfers and the mean amount given a positive transfer by permanent income quintile of the parents and child using $\overline{Y}_p$ and $\overline{Y}_k$ as the measures. Mean income for each quintile is also shown.

[24] In practice, this makes little difference. We attempt to approximate a representative sample of independent children with one or more living parents by using the 1988 person weights in tables 2, 3, and 4. In tables 3 and 4 the incomes of parents living in separate households are the average of the two households. Statistics reported in the paper are based on unweighted samples unless otherwise indicated. The multivariate analyses are unweighted. The sample for tables 2, 3, and 4 is slightly larger than the samples for the other tables because it includes observations that are missing data on one or more variables needed for the multivariate analyses. The discrepancy between table 1 and table 2 in the probability of a transfer (.202 vs. .233) reflects aggregation across parents and weighting in table 2.

TABLE 2

DISTRIBUTION OF POSITIVE TRANSFERS

	Fraction > 0	Mean	Mean > 0	Standard Deviation > 0	5th Percentile	25th Percentile	Median	75th Percentile	95th Percentile	Maximum
Transfer amount	.233	421.20	1,810	26,833	100	200	500	1,000	5,000	50,000
Ratio to parent: time-averaged permanent income	.233	.0057	.0246	.3214	.0015	.0037	.0078	.0171	.0737	.6586
Ratio to kid: time-averaged permanent income	.233	.0091	.0390	.5163	.0017	.0046	.0102	.0236	.1341	.9567
Ratio to parent: autoregressive permanent income	.233	.0060	.0260	.3451	.0017	.0038	.0082	.0177	.0801	.7310
Ratio to kid: autoregressive permanent income	.233	.0088	.0377	.5063	.0020	.0047	.0094	.0224	.1228	.9921
Ratio to parent: current income	.231	.0122	.0527	.9605	.0022	.0061	.0141	.0374	.1687	3.084
Ratio to kid: current income	.233	.0200	.0859	1.147	.0027	.0089	.0216	.0579	.3724	2.314

NOTE.—Sample sizes vary slightly because of missing values. Estimates are weighted. Transfers from parents living in separate households are combined.

TABLE 3

PROBABILITY OF MONEY TRANSFER TO CHILD AND MEAN TRANSFER AMOUNT BY PERMANENT INCOME OF PARENT AND PERMANENT INCOME OF CHILD

	Permanent Income Quintile of Child					
Permanent Income Quintile of Parent	Lowest (23,821) (1)	Second (39,059) (2)	Third (49,746) (3)	Fourth (62,119) (4)	Highest (89,904) (5)	Total (52,926) (6)
Lowest (28,030):						
Probability	.150	.093	.114	.104	.194	.126
Mean	491	279	1,035	548	780	567
Second (42,864):						
Probability	.266	.215	.125	.176	.175	.193
Mean	724	1,589	2,083	2,722	558	1,477
Third (55,040):						
Probability	.257	.260	.232	.235	.190	.234
Mean	677	1,248	2,233	1,098	1,796	1,408
Fourth (69,505):						
Probability	.473	.331	.277	.250	.269	.302
Mean	1,201	1,110	3,536	930	747	1,465
Highest (109,639):						
Probability	.489	.371	.330	.280	.342	.345
Mean	2,707	2,243	4,214	1,862	3,434	3,015
Total (62,584):						
Probability	.268	.241	.220	.224	.268	.244
Mean	1,173	1,412	3,066	1,476	2,222	1,851

NOTE.—The permanent income measures are $\bar{Y}_p$ and $\bar{Y}_k$ and refer to family income. Transfers from parents living in separate households are combined. Estimates are weighted using the 1988 person weights of the children.

According to the table, the probability of a transfer is negatively related to the child's income when the parents' income quintile is held constant. The bottom row shows that there is no correlation if one does not hold the parents' quintile constant. The transfer amounts are essentially unrelated to the child's income when the parents' income is held constant. However, the bottom row shows that they increase substantially with Y_k when parents' income is not held constant. Evidently, the strength of the relationship between the child's income and the transfer amount is exaggerated by a failure to control for parental income.[25]

When the child's income is held constant, parents' income bears a positive relationship to the transfer probability and, in the case of a positive transfer, to the transfer amount. Column 6 shows that the probability of a transfer rises from .126 in the lowest quintile of Y_p, to .234 in the third quintile, and to .345 in the top quintile. The mean of the transfers also rises with parental income, from \$567 in the lowest quintile to \$3,015 in the highest. The relationship appears to be stronger than the relationship between transfers and the child's income. However, the increase in transfer amounts as the parents' income increases (with the child's income held constant) is only a small fraction of the increase in the parent's income, which has a mean of \$28,030 in the first quintile and \$109,639 in the fifth quintile.

Table 4 repeats table 3, but with permanent income replaced by current income. The results are qualitatively similar to those for permanent income. The main difference is a stronger negative relationship between the child's current income and the transfer probability. This partially reflects the fact that our permanent income measure adjusts for the age of the child, whereas our current income measure does not, and age has a negative effect on the transfer probability.

One way to summarize tables 3 and 4 is to regress the cell means for the transfer amounts against the cell means for the parents' income and the child's income. When the permanent income measures in table 3 are used, the coefficient (uncorrected OLS standard error) on parents' income is .025 (.006) and the coefficient on the child's income is .003 (.007). When table 4 is used, the coefficient on parents' current income is .017 (.007), whereas the coefficient on the child's income is .009 (.010). Thus inspection of tables 3 and 4 and the summary regressions suggest that $\Delta E \partial R / \partial Y_j$ is much closer to zero than the value of one implied by altruistic preferences. There

[25] We noted earlier that most previous studies use proxies for parental income that may not provide an adequate control.

TABLE 4

PROBABILITY OF MONEY TRANSFER TO CHILD AND MEAN TRANSFER AMOUNT BY CURRENT INCOME OF PARENT AND CURRENT INCOME OF CHILD

CURRENT INCOME QUINTILE OF PARENT	CURRENT INCOME QUINTILE OF CHILD: Lowest (23,821) (1)	Second (39,059) (2)	Third (49,746) (3)	Fourth (62,119) (4)	Highest (89,904) (5)	Total (52,926) (6)
Lowest (1,618):						
Probability	.156	.121	.172	.080	.156	.138
Mean	630	896	432	1,746	828	777
Second (19,176):						
Probability	.257	.176	.233	.100	.146	.182
Mean	403	4,681	3,320	636	1,911	2,337
Third (30,125):						
Probability	.336	.184	.252	.265	.174	.243
Mean	961	695	1,593	2,205	1,646	1,420
Fourth (46,019):						
Probability	.550	.330	.220	.291	.157	.299
Mean	1,111	2,224	753	674	1,212	1,217
Highest (100,371):						
Probability	.518	.393	.437	.299	.307	.377
Mean	2,420	2,689	1,822	2,779	4,865	2,885
Total (39,721):						
Probability	.321	.234	.261	.210	.192	.244
Mean	1,170	2,328	1,719	1,776	2,701	1,851

NOTE.—See note to table 3. The current income measure is family income.

are, of course, many problems with these simple cross tabulations. However, the basic results are qualitatively consistent with what we obtain below using the derivative estimator based on (9), although $E\partial R/\partial Y_{kt}$ is negative and statistically significant in the multivariate model.

B. *The Effects of Income and Wealth on the Probability of a Transfer*

Column 2 of table 5 reports probit estimates of the effects of the current and permanent income of the child and the parents on the probability that the child receives money from the parents and a detailed set of controls, with $\bar{Y}_p$ and $\bar{Y}_k$ used as the measures of Y_p and Y_k. In column 3 we use $\hat{Y}_p$ and $\hat{Y}_k$ as the measures with little effect on the results. Since the relationship between transfers and income is likely to be nonlinear, the model contains cubics in Y_{pt} and Y_{kt}, cubics in the measures of Y_p and Y_k, the product of Y_p and Y_k, cubics in the assets of both parties, and the product of the assets. The income and wealth variables are measured in \$1,000s.[26]

Column 2, row 2, of the table reports that, for this specification, the sample mean of the derivative of the transfer probability with respect to Y_{kt} is $-.0021$, which implies that a \$10,000 increase in the current family income of the child will lower the odds of a transfer by .021. Rows 3, 4, and 5 report the predicted transfer probability evaluated at the median, twentieth percentile, and eightieth percentile of Y_{kt}; the median of Y_p, Y_k, and Y_{pt}; and the mean of all other variables. The probability is .145 at the median of Y_{kt}, .176 at the twentieth percentile, and .116 at the eightieth percentile. Rows 8, 9, and 10 report a similar set of calculations on the effects of parental income Y_{pt}, showing that the transfer probability is .127 at the twentieth percentile of Y_{pt} and .183 at the eightieth percentile.

An increase in the permanent income of the child from the twentieth to the eightieth percentile has a small negative effect on the probability (rows 14 and 15). On the other hand, a comparable increase in the permanent income of the parents raises the transfer probability from .096 to .197 in rows 19 and 20, which is about double the effect of parents' current income. In column 1 we report estimates that exclude current income measures and wealth. They confirm a strong positive effect of the permanent income of the par-

[26] Rows 1, 6, 11, and 16 report the probit coefficient (standard error) on Y_{kt}, Y_{pt}, Y_k, and Y_p, respectively, for a model including only the linear terms in these variables. In col. 2 the coefficient (standard error) on Y_{kt} is $-.0044$ (.0021), the coefficient on Y_{pt} is .0036 (.0011), the coefficient on Y_k is $-.0021$ (.0016), and the coefficient on Y_p is .0075 (.0013).

TABLE 5

EFFECTS OF INCOME AND WEALTH ON THE PROBABILITY OF A TRANSFER: PROBIT ESTIMATES

	PERMANENT INCOME MEASURE*				
	$\bar{Y}_k$, $\bar{Y}_p$		$\hat{Y}_k$, $\hat{Y}_p$	Earnings (Time-Averaged)	
	(1)	(2)	(3)	(4)	(5)
Current income	excluded	nonasset income	nonasset income	earnings	excluded
Assets	excluded	yes	yes	yes	yes
	Effects of Kid's Current Income				
1. Probit coefficient, linear specification		−.0044 (.0021)	−.0039 (.0021)	−.0037 (.0022)	
2. Mean of derivatives		−.0021	−.0020	−.0020	
Probability of transfer:					
3. At median		.145	.145	.137	
4. At 20th percentile		.176	.176	.165	
5. At 80th percentile		.116	.117	.116	
	Effects of Parents' Current Income				
6. Probit coefficient, linear specification		.0036 (.0011)	.0039 (.0011)	.0047 (.0013)	
7. Mean of derivatives		.0014	.0016	.0016	
Probability of transfer:					
8. At median		.145	.145	.137	
9. At 20th percentile		.127	.124	.120	
10. At 80th percentile		.183	.186	.172	
	Effects of Kid's Permanent Income				
11. Probit coefficient, linear specification	−.0038 (.0012)	−.0021 (.0016)	−.0042 (.0028)	−.0106 (.0050)	−.0041 (.0013)
12. Mean of derivatives	−.0013	−.0003	−.0006	−.0027	−.0015
Probability of transfer:					
13. At median	.170	.145	.145	.137	.154
14. At 20th percentile	.198	.152	.149	.150	.181
15. At 80th percentile	.148	.139	.136	.120	.133
	Effects of Parents' Permanent Income				
16. Probit coefficient, linear specification	.0105 (.0010)	.0075 (.0013)	.0092 (.0017)	.0088 (.0023)	.0061 (.0010)
17. Mean of derivatives	.0036	.0024	.0028	.0039	.0025
Probability of transfer:					
18. At median	.170	.145	.145	.137	.154
19. At 20th percentile	.095	.096	.100	.101	.100
20. At 80th percentile	.262	.197	.192	.203	.215

TABLE 5 (*Continued*)

	Permanent Income Measure*				
	$\bar{Y}_k, \bar{Y}_p$		$\hat{Y}_k, \hat{Y}_p$	Earnings (Time-Averaged)	
	(1)	(2)	(3)	(4)	(5)
	Effects of Kid's Wealth				
21. Probit coefficient, linear specification	.00001 (.00069)	.00008 (.00069)	.00025 (.00066)	−.00028 (.00067)	
22. Mean of derivatives	.00005	.00005	.00014	−.00016	
Probability of transfer:					
23. At median	.145	.145	.137	.154	
24. At 20th percentile	.145	.144	.136	.155	
25. At 80th percentile	.146	.146	.140	.149	
	Effects of Parents' Wealth				
26. Probit coefficient, linear specification	.00040 (.00020)	.00041 (.00020)	.00072 (.00021)	.00067 (.00020)	
27. Mean of derivatives	.00054	.00056	.00080	.00076	
Probability of transfer:					
28. At median	.145	.145	.137	.154	
29. At 20th percentile	.120	.119	.104	.119	
30. At 80th percentile	.190	.190	.201	.219	

Note.—Conventional asymptotic standard errors for the probit estimator are in parentheses. They do not correct for correlation across observations involving siblings or mothers and fathers who are in separate households. The models also control for the demographic variables listed in table 1 and cubic polynomials in the age of the child and in the age of the parent. Col. 1 contains 3,402 observations and 687 positive transfers, cols. 2 and 3 contain 3,062 observations and 618 positive transfers, and col. 4 contains 2,850 observations and 601 positive transfers. Probit coefficients and standard errors for the linear specification come from models that contain only linear income (and wealth and current income) terms (rows 1, 6, 11, 16, 21, and 26). All other results are based on models that include a cubic in the income (and wealth) measures and an interaction between the level income terms. Wealth is measured in thousands of dollars. Probabilities are evaluated at the mean of the included variables and the median of the income and wealth variables.

* The methods used to construct the "time-averaged" permanent income measures $\bar{Y}_k$ and $\bar{Y}_p$ and the "autoregressive" measures $\hat{Y}_k$ and $\hat{Y}_p$ are described in Sec. IVC.

ents and a significant negative effect for the permanent income of the child on the odds of a transfer.[27]

[27] Columns 2 and 3, rows 23–25, report that the partial effect of the child's wealth is essentially zero, whereas an increase in parental wealth from the twentieth to the eightieth percentile raises the transfer probability from .120 to .190 (col. 2, rows 29–30). Since the assets of the kid, particularly early in the life cycle, may be heavily influenced by previous transfers, the coefficient on the child's assets is probably biased upward (toward a positive value) in the likely event that there are unobserved, serially correlated factors influencing monetary transfers. Parental assets will also be influenced by past monetary transfers and investments in human capital. As a result, serial correlation in the factors influencing transfers will lead to a downward bias in the coefficient on parental assets. On the other hand, if parents accumulate assets in anticipation of providing transfers to children, then the coefficient on parents' assets may be overstated in absolute terms. Also keep in mind that our measures of permanent income include income from assets, which makes it a bit difficult to interpret the asset variable separately. In col. 4 we report estimates after substituting

C. Estimates of the Effects of Income on Transfer Amounts

Table 6 reports the derivatives of transfers with respect to current nonasset income Y_{pt} and Y_{kt} of the parents and kids based on the estimator in Section III. In panel A we use $\overline{Y}_p$ and $\overline{Y}_k$ as the measures of permanent income. In panel B we report results using $\hat{Y}_p$ and $\hat{Y}_k$.[28] Columns 1 and 3 of the table report the uncorrected derivatives $\partial\overline{R}(\mathbf{Z})/\partial Y_{pt}$ and $\partial\overline{R}(\mathbf{Z})/\partial Y_{kt}$. Columns 2 and 4 report the corrected derivatives $E\partial R/\partial Y_{pt}$ and $E\partial R/\partial Y_{kt}$ based on (9). The sample selection correction factors are the terms defined in equation (8). The results indicate that the correction factors are often substantial relative to the uncorrected derivatives and almost always have the expected sign, with $A_p^3(\mathbf{Z}) < 0$ and $A_k^3(\mathbf{Z}) > 0$. Column 5 reports the estimates of the difference between $E\partial R/\partial Y_{pt}$ and $E\partial R/\partial Y_{kt}$ evaluated at various points.

In row 1 of panel A, we take the sample mean of all the terms evaluated at the values of **Z** for each observation in the sample with positive transfers. In row 2 of panel A, we evaluate the derivatives at the sample means of all variables. The corrected estimates of $E\partial R/\partial Y_{pt}$ and $E\partial R/\partial Y_{kt}$ evaluated at the sample means are .035 (.015) and −.088 (.036). The implied value for $\Delta E\partial R/\partial Y_{jt}$ is .123 (.037), which is far below one.[29] The corresponding estimate using the alternative measures of permanent income in panel B is .110. The sample average of $(E\partial R/\partial Y_{pt}) - (E\partial R/\partial Y_{kt})$ is .089 (row 1 of panel A), although the standard error is relatively large. The largest estimate of the difference in derivatives is .164, which we obtain when we use $\overline{Y}_p$ and $\overline{Y}_k$ as the controls for permanent income and

current earnings and permanent earnings of the head and wife (based on the fixed-effect specification) for family income and adding cubic specifications for net assets of the parents and the kids (measured in 1984). For the parents the effects of assets are larger when earnings are used, with a twentieth to eightieth percentile shift in wealth associated with a .097 increase in the transfer probability. The effect of the child's assets remains very small but becomes positive. In col. 5 we drop the current earnings measures and obtain results for permanent earnings analogous to those in col. 1 for permanent income. The effect of the child's assets becomes negative. The coefficient on the child's assets in col. 5, row 11, is based on a linear specification and is not statistically significant. However, the coefficients of the cubic specification in the child's assets are jointly significant, and the probability of a transfer falls from .155 for a child in the twentieth percentile of the wealth distribution to .149 for a child in the eightieth percentile.

[28] The specification of the nonasset income and asset terms in (10) and (11) appears following eq. (10). We include dummies for missing asset data for parents, the child, and either the parents or the child. We include the same demographic controls used in the probit models in table 5. The detailed regression estimates and probit estimates underlying the results in tables 6 and 7 are available on request.

[29] As described in Altonji et al. (1996), the Tobit estimate of the difference in derivatives is only .096.

TABLE 6

EFFECTS OF THE PARENTS' AND CHILD'S CURRENT INCOME ON TRANSFERS: DERIVATIVE ESTIMATOR FOR NONLINEAR LIMITED DEPENDENT VARIABLES MODELS

Evaluation Point	Parents' Income (Y_{pt}): Uncorrected Derivative* (1)	Parents' Income (Y_{pt}): Corrected Derivative† (2)	Child's Income (Y_{kt}): Uncorrected Derivative* (3)	Child's Income (Y_{kt}): Corrected Derivative† (4)	$\Delta E \partial R / \partial Y_{jt}$: Difference in Derivatives (Col. 2 − Col. 4) (5)
	A. Time-Averaged Measure of Permanent Income: $\bar{Y}_k$, $\bar{Y}_p$‡				
1. Average of derivatives	.014	.023	−.052	−.066	.089
	(.014)	(.077)	(.047)	(.091)	(.141)
2. Sample means	.009	.035	−.048	−.088	.123
	(.011)	(.015)	(.026)	(.036)	(.037)
3. Sample means: Y_{pt} = 80%, Y_{kt} = 20%	.006	.038	−.055	−.126	.164
	(.016)	(.018)	(.060)	(.079)	(.096)
4. Sample means: Y_{pt} = 20%, Y_{kt} = 80%	.020	.035	−.057	−.090	.125
	(.019)	(.023)	(.028)	(.033)	(.040)
	B. Autoregressive Measure of Permanent Income: $\hat{Y}_k$, $\hat{Y}_p$‡				
1. Average of derivatives	.016	.026	−.054	−.067	.093
	(.014)	(.070)	(.035)	(.120)	(.165)
2. Sample means	.010	.031	−.050	−.079	.110
	(.011)	(.014)	(.026)	(.034)	(.035)
3. Sample means: Y_{pt} = 80%, Y_{kt} = 20%	.007	.028	−.059	−.104	.132
	(.015)	(.018)	(.058)	(.077)	(.093)
4. Sample means: Y_{pt} = 20%, Y_{kt} = 80%	.021	.043	−.058	−.072	.115
	(.019)	(.022)	(.028)	(.031)	(.040)

NOTE.—See Sec. III for a description of the estimation procedure and the bootstrap method used to compute the standard errors (in parentheses). The sample used to estimate eq. (10) contains 666 observations. The sample used to estimate (11) contains 3,402 observations. Equations also control for permanent income of the parent, permanent income of the child, assets of the parent in 1984, and assets of the child in 1984; separate dummy variables for whether assets of the parent in 1984 are missing, assets of the child in 1984 are missing, or assets of either the parent or the child are missing; the demographic variables listed in table 1; and cubics in the age of the parent and the age of the child.

* $\partial \bar{R}(Z)/\partial Y_{jt}$; $j = p$ in col. 1 and k in col. 3.

† $[\partial \bar{R}(Z)/\partial Y_{jt}] + \{[\bar{R}(Z)\partial P_R(Z)/\partial Y_{jt}]/P_R(Z)\}$; $j = p$ in col. 2 and k in col. 4.

‡ Permanent income is calculated using the time-averaged method in panel A and the autoregressive method in panel B (see Sec. IVC).

evaluate the derivatives at the mean of X and the eightieth and twentieth percentile values of Y_{pt} and Y_{kt} (respectively).

In summary, the difference in the derivatives of transfers with respect to the current incomes of the parents and child is about .1 rather than the value of one implied by the altruism model. The result reflects two basic facts about the PSID data that are also consistent with evidence from other data sets, such as the National Longitudinal Survey (see Dunn's [1993] results and his survey of other studies). First, the derivative of transfer amounts with respect to parents' current income (and permanent income) is relatively small. A small value is perfectly consistent with the theory and depends on the form of preferences and the distribution of resources. However, altruism implies that in this case the derivative of the transfer amounts with respect to the child's income must be negative and large in absolute value. In fact, transfer amounts are not very responsive to the child's income. This basic fact does not appear to be the result of bias from selection into the sample with positive transfers, because our methodology corrects the effects of bias on the income derivatives.

In table 7 we drop the current income terms and report the derivatives with respect to Y_p and Y_k. Although the theory suggests that the current income of the child (with permanent income held constant) is the relevant variable, there are some pragmatic reasons having to do with measurement error to look at the derivatives with respect to permanent income. Also, the size of these derivatives provides information about the extent to which differences in permanent income are mitigated through transfers. In panel A, which is based on $\overline{Y}_k$ and $\overline{Y}_p$, $E\partial R/\partial Y_p$ is .037 at the sample mean with a standard error of .014, whereas $E\partial R/\partial Y_k$ is $-.017$ with a standard error of .009. It is also interesting to note that $E\partial R/\partial Y_{kt}$ ($-.088$ in row 2 of panel A of table 6) is substantially larger than $E\partial R/\partial Y_k$, whereas $E\partial R/\partial Y_p$ and $E\partial R/\partial Y_{pt}$ are very similar. This is consistent with the view that liquidity constraints are important for a substantial fraction of the younger households but not important for older households.

The estimate of $(E\partial R/\partial Y_p) - (E\partial R/\partial Y_k)$ is reported in column 5. At the sample mean this parameter is .053 with a standard error of .017, which is far below one. We obtain similar results using $\hat{Y}_k$ and $\hat{Y}_p$ in panel B, and the results are not very sensitive to where the derivatives are evaluated. We conclude that the flow of money transfers is only weakly related to the difference in the permanent incomes of parents and children.[30]

[30] When we control for current income, the derivative of transfers is positive for our measures of Y_p and negative but very small for Y_k. The positive transfer response to Y_p is predicted by the theoretical model. We are unable to sign the effect of an

The estimates of the effects of assets on transfers should also satisfy the derivative restriction, although the results should be taken with a large grain of salt given measurement error and the fact that the model implies that assets are a choice variable and will be influenced by past transfer behavior and preferences. Furthermore, the fact that the wealth distribution is highly skewed may reduce the robustness of the estimates. At the sample means, an extra dollar of parental assets raises the transfer amount by 1.1 cents (not shown). An increase in the child's assets leads to a transfer increase of 3.7 (.024) cents, which has the wrong sign. The difference in the derivatives is −.026 (.023), which is not significantly different from zero and is a far cry from one.[31]

D. *Additional Experiments*

In this subsection we examine the sensitivity of the results to changes in the specification and estimation methods.

Controlling for the Incomes and Numbers of Siblings

One objection to these results is that we have not controlled for the income of other relatives to whom the parents may be altruistically linked. We added the average of $\overline{Y}_k$ for siblings of the child who are in the sample and found that this has almost no effect on the difference in the derivatives.[32] We also added interactions between the income variables and 1/(1 + number of siblings) as well as the level and the square of the average income of siblings in this specification. In this analysis, we exclude people who have siblings but do not have siblings who were PSID split-offs. At the sample means for all variables except number of siblings, the difference in derivatives is .161 for only children and .113 for children with three siblings (table 8, panel A).

The decline in the difference in derivatives with the number of

increase in Y_k when Y_{kt} is held fixed. On one hand, higher future income exacerbates liquidity constraints and reduces the need for future transfers, leading the parent to increase the first-period transfer. On the other hand, higher future income means that the child has more resources to shift into the first period, lessening the marginal utility of first-period transfers. Cox (1990) presents a somewhat different model in which the child's future income has a positive effect on the transfer amount today.

[31] The derivatives evaluated at the eightieth percentile value for parental assets and the twentieth percentile value for the child's assets are similar. The estimates are not sensitive to replacing assets in 1984 with assets measured in 1989 or to the use of the 1984 asset measures to form instruments for the 1989 measures.

[32] Sibling income has a positive effect on transfers. In Altonji et al. (1996), we control for family fixed effects and find that richer siblings are less likely to receive money transfers from parents and more likely to give money transfers to parents.

TABLE 7

EFFECTS OF THE PARENTS' AND CHILD'S PERMANENT INCOME ON TRANSFERS

	PARENTS' INCOME (Y_p)		CHILD'S INCOME (Y_k)		$\Delta E\partial R/\partial Y_j$: DIFFERENCE IN DERIVATIVES (Col. 2 − Col. 4)
EVALUATION POINT	Uncorrected Derivative* (1)	Corrected Derivative† (2)	Uncorrected Derivative* (3)	Corrected Derivative† (4)	(5)
	A. Time-Averaged Measure of Permanent Income: $\overline{Y}_k$, $\overline{Y}_p$				
1. Average of derivatives	.026	.044	−.002	−.010	.054
	(.008)	(.009)	(.006)	(.006)	(.011)
2. Sample means	.013	.037	−.008	−.017	.053
	(.012)	(.014)	(.008)	(.009)	(.017)
3. Sample means: Y_p = 80%, Y_k = 20%	−.008	.006	.006	−.005	.011
	(.023)	(.025)	(.025)	(.027)	(.046)
4. Sample means: Y_p = 20%, Y_k = 80%	.049	.059	−.021	−.030	.089
	(.021)	(.022)	(.013)	(.013)	(.028)
	B. Autoregressive Measure of Permanent Income: $\hat{Y}_k$, $\hat{Y}_p$				
1. Average of derivatives	.031	.054	−.001	−.012	.066
	(.010)	(.011)	(.008)	(.009)	(.013)
2. Sample means	.018	.050	.006	−.009	.059
	(.012)	(.017)	(.015)	(.017)	(.027)
3. Sample means: Y_p = 80%, Y_k = 20%	−.000	.018	.025	.013	.005
	(.026)	(.030)	(.034)	(.038)	(.063)
4. Sample means: Y_p = 20%, Y_k = 80%	.068	.105	−.010	−.024	.129
	(.029)	(.029)	(.021)	(.021)	(.042)

NOTE.—See note to table 6. Current incomes of the parent and child are excluded.

* $\partial \overline{R}(\mathbf{Z})/\partial Y_j$; $j = p$ in col. 1 and k in col. 3.

† $[\partial \overline{R}(\mathbf{Z})/\partial Y_j] + \{[\overline{R}(\mathbf{Z})\partial P_R(\mathbf{Z})/\partial Y_j]/P_R(\mathbf{Z})\}$; $j = p$ in col. 2 and k in col. 4.

TABLE 8

ALTERNATIVE ESTIMATES OF THE EFFECT OF PARENTS' AND CHILD'S CURRENT INCOME ON TRANSFERS

Evaluation Point	$E\partial R/\partial Y_{pt}$	$E\partial R/\partial Y_{kt}$	$\Delta E\partial R/\partial Y_{jt}$
	A. Effects of the Parents' and Child's Income on Transfers by Number of Siblings*		
Sample mean	.028	−.087	.115
0 siblings	.017	−.144	.161
3 siblings	.031	−.082	.113
	B. Estimates Using Instruments for the Parents' and Child's Current Income†		
Sample mean	−.004	−.145	.141
	C. Estimates Using Net Assets in 1989 as the Wealth Measure‡		
Sample mean	.033	−.100	.133
	D. Estimates Using Instruments for the Parents' and Child's Current Income and 1989 Wealth§		
Sample mean	−.013	−.106	.119

NOTE.—All the results in the table are based on models that control for the demographic variables listed in table 1 and cubics in the age of the child and the parent.

* We added interactions between 1/(number of siblings + 1) and the linear current income terms, the permanent income terms, and assets of the parent and child to the probit model (11) and the regression model (10). The number of siblings is the number of siblings the child reports, regardless of whether they have become split-offs by 1988. All other variables are evaluated at the sample mean. Sample sizes used to estimate probit model (11) and regression model (10) are 2,914 and 560, respectively. The permanent income measures are $\hat{Y}_p$ and $\hat{Y}_k$ throughout the table.

† We replaced the level, square, cube, and the interaction terms involving the parents' and kid's current nonasset income with predicted values from a regression against the income of the parent and kid in the previous year, the average of the siblings' reports of their parents' income in 1987, the square and cube for this average, and all other variables in the transfer equation (including all terms involving permanent income and asset terms).

‡ We constructed the asset minus debt measure from the detailed information on assets and debts contained in the 1989 household information. We obtained similar results using the measure of net worth in 1989 provided on the public use tape. We set the measure of assets minus debt in 1989 to zero if data are missing or if the head of the household in 1989 is not the same as in 1988. We included three dummies for whether asset data are missing for the parent, the child, or either the parent or the child in the probit model (11) and the regression model (10). In 1989, 2.9 percent of the kids and 2.6 percent of the parents did not respond.

§ See n. † for the instruments used for current income. We used the same instruments for 1989 wealth. A dummy is assigned to parents and kids with missing data on 1989 wealth. The sample size for (11) is 3,402, and the sample size for (10) is 666. We evaluate the derivatives at the means of the predicted income and wealth measures among the sample of children receiving transfers. Restricting the sample to families with valid asset data in both 1984 and 1989 had little effect on the results.

children has implications for some alternative theories of transfers. One possible explanation for the failure of the test of income derivatives is that it is costly for parents to differentiate among children. Although it seems ad hoc, one could simply add an "aversion to inequality in transfer amounts" argument to the parental utility function in our model. This would break the restriction that $\Delta E\partial R/\partial Y_{jt}$ must equal one. It would also lower $E\partial R/\partial Y_{pt}$ because part of the increase in transfers would be wasted on rich children.

A modification to the basic altruism model that is perhaps more appealing on theoretical grounds and has similar implications involves the following assumptions. (1) Children care deeply about how much their parents love them.[33] (2) Children are hurt if they feel that the parents prefer a sibling. (3) Children have imperfect information about the actual needs of their siblings. (4) Children make inferences about their parents' feelings for them based on the amount of help that they and their siblings receive, and parental transfers cannot be fully hidden from other siblings. If these assumptions are correct, then altruistic parents whose utility functions do not depend directly on transfers may choose not to differentiate much among their children when giving gifts. They will be concerned about the utility losses associated with the inferences that children draw about parental preferences from the differentiated gifts. This type of signaling model is qualitatively consistent with a number of facts. First, it implies that bequests, which are public, will be less sensitive to the relative incomes of siblings than inter vivos transfers. The results of Menchik (1980) and Wilhelm (1996) show that bequests are evenly divided among children in most cases and insensitive to the relative incomes of the children. The results of Dunn (1993) and Altonji et al. (1996) show that transfers do depend on the relative incomes of siblings.

Since there is no information extraction problem in the case of only children, our finding that the difference in transfer-income derivatives is larger for only children is qualitatively consistent with the theory. However, the fact that the difference is only .161 even for only children and that the coefficient on parents' income is actually smaller for only children (.017 vs. .031 for persons with three siblings) suggests that costs of unequal treatment of children are only a minor part of the story.

Interactions with Other Demographic Variables

We also investigated the possibility that the income derivatives depend on demographic variables that influence the probability of a transfer. The results, reported in Altonji et al. (1995), show that the transfer-income derivatives are not very sensitive to the value of the transfer probability.

Measurement Error in Income

We noted earlier that measurement error in the current income of the parents and child could bias the results below the theoretical

[33] In the model in Sec. II, $u(c_k)$ would depend on the child's belief about η, which is based on parental behavior, including transfers given.

value of one. We investigated this issue by forming instruments for the level, square, cube, and the interaction terms involving the parents' and child's nonasset income. The instrumental variables consist of powers of the income in 1986 (which the parents and child report in the 1987 survey), the average of the siblings' reports of their parents' 1987 income, the square and cube of this average, and all other variables in the transfer equation (including all terms involving permanent income and assets).[34] At the sample mean the estimate of $E\partial R/\partial Y_{pt}$ is $-.004$, and $E\partial R/\partial Y_{kt}$ is $-.145$ (table 8, panel B). Thus the difference in derivatives is .149. This is 35 percent higher than the estimate that ignores measurement error, suggesting that there is a substantial amount of measurement error in the current income measures. However, measurement error does not go very far in squaring the estimated values of the difference in derivatives with the value of 1.0 predicted by the altruism model.

The Measure of Income

Our results were not very sensitive to the use of alternative measures of current family income, including after-tax family income, family income minus help from relatives, family income net of both taxes and help from relatives, and total family income (including income from assets).[35]

Measurement Error in Assets

The 1989 wave of the PSID contains a wealth supplement that asks questions very similar to the questions asked in 1984. We have reestimated the model substituting the 1989 measures for the 1984 measures. The estimate of $(E\partial R/\partial Y_{pt}) - (E\partial R/\partial Y_{kt})$ evaluated at the sample mean rises from .110 to .133 (table 8, panel C). When we form instruments for the current income variables *and* the 1989 asset measures using the instruments mentioned above along with the 1984 asset measures, at the sample means $E\partial R/\partial Y_{pt}$ is $-.013$,

[34] The 1988 supplement on transfers asked about the income of parents. We set the average of the sibling report of parents to zero and include a missing data dummy when the kid's reports of parental income are missing for all the siblings from a given family who are in the matched sample. We estimated prediction equations using the full sample used to estimate the probit model for the probability of a transfer and inserted the predicted values of the income terms into the probit model (11) and the regression model (10) for positive transfer amounts. Such two-stage approaches are usually inconsistent in nonlinear models, but we do not have an alternative to it.

[35] As noted above, the question about help from relatives is separate from questions about transfers in the 1988 transfer supplement.

which has the wrong sign but remains small; $E\partial R/\partial Y_{kt}$ is $-.106$, and the difference is .119 when evaluated at the sample means. In summary, there is little evidence that measurement error in wealth or income or both has a large effect on the income results.

Sensitivity to Outliers, Functional Form for Transfers and Income, and Estimation Method

We noted earlier that the distribution of transfers is skewed to the right. We have reestimated the model after excluding 35 cases of transfers in excess of $5,000. The results in panel A of table 9 show that this has the effect of *lowering* the transfer-income derivatives by about 60 percent.

Since the heavy skewness in the transfer distribution may be affecting the robustness of our estimates, we have also estimated the conditional expectation function $\overline{R}(Z)$ by first estimating a regression model for the log of transfers and then using the parameter estimates and the estimated error variance of that model to compute $\overline{R}(Z)$.[36] The results are close to but somewhat smaller than those in table 6, columns 2, 4, and 5.

The level of income is approximately lognormal, so a few large values of income could have a large effect on our estimates, particularly since we use a polynomial form. We estimated $\overline{R}(Z)$ from a regression model for the log of transfers as the dependent variable after replacing the polynomials in the levels of the current income and permanent income with polynomials in the logs. Observations with nonasset income below $1,000 are excluded. The average of the difference in derivatives declines from .093 (table 6, row 1) to .056 (not shown), and the difference in derivatives at the sample mean declines from .110 (table 6, row 2) to .041 (table 9, panel C).

As a final check, we used the least absolute deviation (LAD) regression to estimate the conditional mean function on the grounds that the LAD regression may be more robust even though it is an inconsistent estimator of the conditional mean function when errors are skewed. The income derivatives decline in absolute value (panel D). In summary, our basic conclusion that the income derivatives are small appears to be quite robust.

[36] See panel B of table 9. In going from the log regression model to the conditional expectation function (10) for the level of R, we assume that the error term in the *log* transfer equation is additive and has a lognormal distribution. We then use the formula for the expectation of a lognormal random variable.

TABLE 9

EXPERIMENTS WITH ALTERNATIVE FUNCTIONAL FORMS AND SAMPLE EXCLUSIONS

Panel	Functional Form and Sample Exclusions	Estimation Method for Transfer Eq. (10)	$E\partial R/\partial Y_{pt}$	$E\partial R/\partial Y_{ct}$	$\Delta E\partial R/\partial Y_{jt}$
A	Exclude 35 cases of transfers > $5,000; transfers and income in levels*	OLS	.013	−.02	.033
B	Transfers in logs, income in levels†	OLS	.012	−.034	.046
C	Transfers and income in logs, income > $1,000‡	OLS	.006	−.035	.041
D	Transfers and income in levels§	LAD	.002	−.008	.01

* The sample sizes for the probit model (11) and the regression model (10) are 3,367 and 631. The permanent income measures are $\hat{Y}_p$ and $\hat{Y}_t$ throughout the table.

† We estimated the conditional expectation function $\bar{R}(\mathbf{Z})$ by first estimating a regression model for the log of transfers and then using the parameter estimates and estimated error variance of that model to compute $\bar{R}(\mathbf{Z})$ under the assumption that the error term in the *log* transfer equation is additive and has a lognormal distribution. The sample sizes underlying (11) and (10) are 3,335 and 647.

‡ Observations with Y_{ct} and/or Y_{pt} below $1,000 were excluded. Polynomials in the logs of current income and permanent income were used in (10) and (11). See n. † for how the regression model for the log of transfers was used to estimate the conditional expectation function $\bar{R}(\mathbf{Z})$. The sample sizes underlying (11) and (10) are 3,309 and 636.

§ Least absolute deviation (LAD) regression was used to estimate (10). The sample sizes underlying (11) and (10) are 3,402 and 666.

E. *Discussion of Findings*

Are there additional problems with the data and methods or modifications to the model that can reconcile the empirical results with altruistic preferences? Measurement error in the transfer reports is one possibility. In Altonji et al. (1995) (see also Altonji and Ichimura 1996), we analyze a measurement error model in which some respondents randomly report their receipt of transfers and some who receive transfers report a random fraction ϵ of what they actually receive. We show that random reporting error of this type will bias the derivative estimator downward by the factor $1 - \bar{\epsilon}$, where $\bar{\epsilon}$ is the mean of ϵ, even if a fraction of transfer recipients fail to report transfers.[37] One can reconcile the estimates with the theory if respondents who report positive transfers on average report only 13 percent of the transfers they receive, that is, $\bar{\epsilon} = .13$. However, if one were to multiply average transfers of $1,810 by 1/.13, one would conclude that average transfers are, on average, $13,923 per year. This seems far too high, particularly given that many parents have more than one child. Underreporting of transfer amounts may be able to explain a part of the gap between .13 and one, but it does not seem likely that it can explain all or even most of it.

A second issue is the consequences for our test of departures from optimality in the timing of transfers. We show in Section II that the timing of transfers is determinant if future income (or needs) is uncertain and credit markets are imperfect. It may be, however, that the utility loss from minor variation in the timing is small for families with relatively stable income streams. Even for these families the model in Section II describes how transfer flows are determined over a period of time, and actual transfers should match the flow implied by the model if both are aggregated over a few years. However, some families may not make a transfer in the year we examine, and some may receive a transfer that is larger than what they receive in an average year over a period of 2 or 3 years (say).

Would such indeterminacy invalidate the test? We have considered the case in which both the frequency of transfer flows and the size of each transfer are positively related to the average transfer flow. We have also considered the case in which the frequency of

[37] Let R^* be the observed transfer amount. Altonji et al. (1995) consider the measurement error model $R^* = I\epsilon R$, where I is a Bernoulli random variable equal to one with fixed probability p_I and zero with probability $1 - p_I$, and ϵ is a positive random variable that is independent of R with a mean of $\bar{\epsilon}$ if $R > 0$. The estimator is consistent if $\bar{\epsilon} = 1$ even if a fraction of transfer recipients fail to report transfers. One may easily extend the analysis in Altonji et al. (1995) to show that if the probability of reporting a transfer is a positive function of the transfer amount and $\bar{\epsilon} = 1$, then the difference in derivatives will be positively biased.

transfer flows is independent of the average transfer flow. In both cases the transfer-income derivative test statistic derived will be greater than or equal to one if the altruism hypothesis is correct.[38] Consequently, indeterminacy in the timing of transfers seems, if anything, to strengthen the rejection of altruism.

We also investigated whether random variation around the optimal division between transfers in period t and bequests would affect the results.[39] We investigated a model in which transfers $R(\mathbf{Z})$ in t are equal to a positive random variable q times the value implied by our model, and bequests equal the value implied by the model plus $(1 - q)\beta(t)R(\mathbf{Z})$, where q has mean $\bar{q}$ and $\beta(t)$ is a discount factor chosen so that the present discount value of transfers plus bequests is not affected by q. In this case, $\Delta E\partial R/\partial Y_{jt}$ will equal $\bar{q}$ under the null. Consequently, random variation around the optimal timing, with $\bar{q}$ equal to one, has no effect on our analysis. A very large departure from optimality would be required to rationalize an estimate of the difference in transfer-income derivatives of .13 with the altruism model.[40]

If one accepts the results, it useful to ask what models are more consistent with them. One possibility is that preferences are altruistic, but parents know little about the incomes of their children. It is easy to show in a static model that this would reduce $E\partial R/\partial Y_{kt}$ in absolute value and reduce the difference in test statistics. However, given the estimates of $E\partial R/\partial Y_{pt}$, the parents would have to be almost completely ignorant of their child's current income for this explanation to work.[41]

A second possibility is that efforts by parents to "tax" Y_{kt} will distort the hours of work and effort decisions of children. This would appear to be an important issue if one takes our estimates of $E\partial R/\partial Y_{pt}$ of .03–.05 seriously. These estimates imply that parental preferences are such that they would prefer to reduce transfers by .95–.97 for

[38] Notes describing this analysis are available from the authors.

[39] We point out in n. 8 that adding a period 3 with uncertainty about whether the parents will survive to the model in Sec. II does not change the derivative restriction.

[40] The 1984 wave of the PSID has some limited information on expected inheritances that could be used to estimate the derivatives of bequests with respect to Y_{pt} and Y_{kt}, with the other variables held constant. Unfortunately, there are no comparable transfer data in that year.

[41] In Altonji et al. (1992), we studied the link between the distributions of income and consumption in the extended family and we found that replacing family income with the component of income that is predictable on the basis of schooling and the two-digit occupation actually strengthened the evidence against the joint hypothesis of altruistic preferences and operative altruistic links. This finding suggests that parents know quite a bit about the permanent incomes of their children, although it leaves open the possibility that they do not know much about current income conditional on permanent income.

each extra dollar of Y_{kt}. Thus the disincentive effects may be a major constraint on parental behavior, particularly if children are not very concerned about the utility of their parents. (If parents and children have the same objective function, there would be no disincentive effects.) In view of our findings, it would be interesting to draw on the optimal taxation literature to conduct an analysis of how large the child's labor supply response would have to be to square our low estimates of $E\partial R/\partial Y_{kt}$ and $E\partial R/\partial Y_{pt}$ with altruism. A third possibility is that the derivative restriction fails if parents and children can use bargaining strategies other than the reaction function that we assume.[42]

Given the large discrepancy between the results and the prediction of the basic altruism model, a satisfactory model of transfers is likely to involve factors in addition to altruism. First, suppose that parents get utility from R independently of the child's utility. This warm-glow motive tends to reduce the difference in derivatives. Second, Cox's (1987) theoretical analysis implies that, at least in a static context, the difference in derivatives is less than one if transfers are made in exchange for services from the child. Bernheim et al. (1985), Cox (1987), and Cox and Rank (1992) provide some direct evidence on child services (such as visits and phone calls) that supports a role for exchange. However, in Altonji et al. (1996), we analyze the 1988 PSID data on time help provided to parents and find that it has little relationship to the parents' income or wealth, in contrast to the predictions of simple exchange models. Also, we find that differences between siblings in the receipt of money transfers depend on the relative incomes of the siblings but have little to do with the relative amounts of time they spend helping their parents. Finally, we find that while sibling differences in distance from parents have a strong effect on flows of time help, they have little effect on flows of money help. In an exchange model, the reduction with distance in time flows should lead to a reduction in money flows.

[42] Bergstrom, Blume, and Varian (1986) (theorem 7 and p. 47, par. 2) consider a model that may be interpreted as a static model in which parents care about their own consumption and the consumption of each of their children, and the children care only about their own consumption. The model seems to imply that if there is a Nash equilibrium in the transfer amounts that involves a positive transfer R to a particular child j and perhaps other children, then following an exogenous increase in the parents' income of one dollar and a reduction of j's income by one dollar, transfers of $R + 1$ to child j and the original amounts to the other children are a Nash equilibrium. This suggests that the derivative restriction may carry over to some other bargaining models.

VI. Conclusion

This paper uses matched panel data on parents and their adult children and a new econometric methodology to produce consistent estimates of the derivatives of transfers with respect to the parents' income and the child's income. We then use our estimates to test a fundamental prediction of altruistic preferences: the difference in the derivatives should equal one. The paper's econometric approach may be useful in analyzing other consumer choice problems that involve overlapping budget constraints and limited dependent variables, such as estimating the effects of public transfers on private transfers or charitable giving, testing whether public transfers crowd out private transfers, and analyzing the effects of the endowments of the wife and husband on resource allocation within the household.

We find that parents increase their transfers by a few cents for each extra dollar of current or permanent income they have, which in itself is consistent with altruism. The inconsistency arises because we also find that parents reduce transfers by only a few cents for each extra dollar of income their child has. As we show in Section II, the difference in the transfer-income derivatives should be one, whereas our estimates are concentrated in the .04–.13 range depending on the choice of income measure and the point at which the derivatives are evaluated. Our results, which constitute a strong rejection of operative intergenerational altruism, are robust to changes in functional form, outliers, the number of siblings, the definition of current and permanent income, and measurement error in income and wealth.

Appendix

This Appendix shows that uncertainty about a child's future income leads parents to delay making transfers unless their child is liquidity-constrained. It also derives the transfer-income derivative restriction. Our model's utility function is

$$V_{p1} = u(c_{p1}) + \eta u(c_{k1}) + E_1[u(c_{p2}) + \eta u(c_{k2})], \qquad \text{(A1)}$$

where c indexes consumption, p indexes parents, k indexes the child, and 1 and 2 index periods 1 and 2. For future reference, Y is income, A is assets, and R is the transfer amount.

For simplicity, assume that parents have no second-period nonasset income, are not liquidity-constrained, and earn a zero rate of return on their savings. After learning the value of Y_{k2}, the parents choose the second-period transfer, R_2, to maximize their second-period utility; that is, they solve

$$\max_{R_2} u(A_{p2} - R_2) + \eta u(A_{k2} + Y_{k2} + R_2)$$
$$\text{subject to } R_2 \geq 0,\ A_{p2} - R_2 \geq 0,\ A_{k2} + Y_{k2} + R_2 \geq 0, \tag{A2}$$

where $u(\cdot)$ is strictly concave with $u'(0) = \infty$. In (A2), the child takes the transfer of the parents as given so that her second-period consumption is just $A_{k2} + Y_{k2} + R_2$.[43] The solution to (A2) satisfies

$$u'(c_{p2}) \geq \eta u'(c_{k2}), \tag{A3}$$

where $c_{p2} = A_{p2} - R_2$ and $c_{k2} = A_{k2} + Y_{k2} + R_2$. This equation holds as an equality and $R_2 > 0$ provided that Y_{k2} is less than or equal to a critical value, $\bar{Y}_{k2}$, that solves

$$u'(A_{p2}) = \eta u'(A_{k2} + \bar{Y}_{k2}). \tag{A4}$$

Equation (A4) implicitly defines $\bar{Y}_{k2}$ as a function of A_{p2} and A_{k2}. Denoting this function by $z(\cdot, \cdot)$, we get

$$\bar{Y}_{k2} = z(A_{p2}, A_{k2}). \tag{A5}$$

Parents' second-period utility can be expressed as one of two indirect utility functions:

$$\begin{aligned} &M(A_{p2} + A_{k2} + Y_{k2}) \quad \text{for } Y_{k2} \leq z(A_{p2}, A_{k2}), \\ &N(A_{p2}, A_{k2} + Y_{k2}) \quad \text{for } Y_{k2} > z(A_{p2}, A_{k2}). \end{aligned} \tag{A6}$$

Note that when $Y_{k2} = \bar{Y}_2$, the $M(\cdot)$ and $N(\cdot, \cdot)$ functions are equal.

Now consider the first period in which the child faces the intertemporal budget constraint:

$$A_{k2} = \rho(A_{k1} + Y_{k1} - c_{k1} + R_1), \tag{A7}$$

where the function $\rho(\cdot)$ determines the gross return on the child's saving. For levels of child saving above a critical value x^*, $\rho(x) = x$. That is, the child's gross return is simply the amount she saved, so her rate of return on additional saving is zero, the same value her parents are assumed to earn on their saving. For values of child saving below x^*, the child's rate of return on saving (as well as the interest rate she pays on borrowing) exceeds zero; that is, $\rho'(x) > 1$ when $x < x^*$. Finally, we assume that, for $x < x^*$, $\rho(\cdot)'' \leq 0$; that is, for $x < x^*$, $\rho(\cdot)$ is an increasing concave function with a marginal rate of return above one and an average rate of return below one. The value x^* could be negative but is probably positive. The properties of $\rho(\cdot)$ capture the idea of soft credit market constraints; borrowing rates are higher than lending rates and the cost of borrowing rises as one's net worth falls.

[43] Kotlikoff and Rosenthal (1993) make the alternative assumption that the child can refuse the receipt of a transfer as part of a strategy to induce the parents to increase their transfer.

Parents' assets obey

$$A_{p2} = A_{p1} + Y_{p1} - c_{p1} - R_1. \tag{A8}$$

Parents choose their first-period transfer, R_1, and their first-period consumption, c_{p1}, to solve

$$\max_{c_{p1}, R_1} u(c_{p1}) + \eta u(c_{k1}(A_{k1} + Y_{k1} + R_1, A_{p2})) + V(A_{p2}, A_{k2}|I_1), \tag{A9}$$

where $R_1 \leq 0$,

$$\begin{aligned} V(A_{p2}, A_{k2}|I_1) = &\int_0^{z(A_{p2}, A_{k2})} M(A_{p2} + A_{k2} + Y_{k2}) f(Y_{k2}|I_1) dY_{k2} \\ &+ \int_{z(A_{p2}, A_{k2})}^{\infty} N(A_{p2}, A_{k2} + Y_{k2}) f(Y_{k2}|I_1) dY_{k2}, \end{aligned} \tag{A10}$$

and

$$\begin{aligned} c_{k1}(A_{k1} + Y_{k1} + R_1, A_{p2}) \equiv &\operatorname*{argmax}_{c_{k1}} u(c_{k1}) \\ &+ \int_0^{z(A_{p2}, A_{k2})} u(A_{k2} + Y_{k2} + R_2(A_{p2}, A_{k2} + Y_{k2})) f(Y_{k2}|I_1) dY_{k2} \\ &+ \int_{z(A_{p2}, A_{k2})}^{\infty} u(A_{k2} + Y_{k2}) f(Y_{k2}|I_1) dY_{k2} \end{aligned} \tag{A11}$$

subject to (A7) and (A8). In (A10) and (A11), $f(Y_{k2} \mid I_1)$ is the density function for Y_{k2} conditional on the information I_1 available in period 1, which includes Y_{k1}, Y_{p1}, and other relevant variables. The function $V(\cdot, \cdot)$, which depends on I_1, is the expected utility of the parents conditional on their entering the second period with A_{p2} in assets and their child's entering the second period with A_{k2} in assets. The function $R_2(A_{p2}, A_{k2} + Y_{k2})$ relates transfers in the second period to second-period resources of the parent and child.

The solution to problem (A9) satisfies

$$u'(c_{p1}) - \eta u'(c_{k1}) \frac{\partial c_{k1}}{\partial A_{p2}} = \frac{\partial V}{\partial A_{p2}} \tag{A12}$$

and

$$\eta u'(c_{k1}) \left(\frac{\partial c_{k1}}{\partial R_1} - \frac{\partial c_{k1}}{\partial A_{p2}} \right) \leq \frac{\partial V}{\partial A_{p2}} - \frac{\partial V}{\partial A_{k2}} \rho'(\cdot) \left(1 - \frac{\partial c_{k1}}{\partial R_1} + \frac{\partial c_{k1}}{\partial A_{p2}} \right), \tag{A13}$$

where $\partial c_{k1}(\cdot)/\partial R_1$ is determined by differentiating the first-order conditions defining the solution to (A11). If (A13) holds as a strict inequality, first-period transfers, R_1, will be zero.

We shall now show that (A13) is a strict inequality and R_1 must be zero if two conditions hold. Condition 1 is that the child is not liquidity-constrained, which means that the child has a marginal interest rate of $\rho'(A_{k1} + Y_{k1} + R_1 - c_{k1}(\cdot, \cdot)) = 1$ when $R_1 = 0$. Note that in this case A_{k2} must exceed x^* since the interest rate is zero when the child is not liquidity-constrained. Condition 2 is that $f(Y_{k2} \mid I_1)$ is positive for at least some values of $Y_{k2} > z(A_{p2}, A_{k2})$ for all values of (A_{p2}, A_{k2}) that are feasible given first-period assets and income and that satisfy the no liquidity constraint condition $A_{k2} > x^*$. Condition 2 says that there are some states of the world in period 2 in which the parent will not want to make a second-period transfer. It means that parents have an incentive to delay transfers.

To see why these two conditions imply that (A13) holds as an inequality, consider the following two equalities:

$$\frac{\partial V}{\partial A_{k2}} = \eta E_1 u'(c_{k2}) \tag{A14}$$

and

$$E_1\left[u'(c_{k2})\left(1 + \frac{\partial R_2}{\partial A_{k2}}\right)\right] = \frac{u'(c_{k1})}{\rho'(A_{k1} + Y_{k1} + R_1 - c_{k1})}. \tag{A15}$$

Equation (A14) follows from differentiating (A10) with respect to A_{k2}. Equation (A15) is the first-order condition arising in problem (A11), where we use the fact that $\partial R_2/\partial A_{k2} = 0$ when $Y_{k2} > \bar{Y}_{k2}$. Setting $\rho'(\cdot)$ to one because we are considering the case of no liquidity constraints (condition 1) and using (A14) and (A15) to rewrite (A13) yields

$$\eta E_1\left[u'(c_{k2})\left(\frac{\partial R_2}{\partial A_{k2}}\right)\right]\left(\frac{\partial c_{k1}}{\partial R_1} - \frac{\partial c_{k1}}{\partial A_{p2}}\right) \leq \frac{\partial V}{\partial A_{p2}} - \frac{\partial V}{\partial A_{k2}}. \tag{A16}$$

By differentiating (A10), one may easily show that the right-hand side of (A16) is positive.[44] Consequently, first-period transfers must be zero if the left-hand side of (A16) is negative, which one may establish by differentiating (A15). To see this, let $W_2 = A_{p2} + Y_{k2} + A_{k2}$ be the sum of the parents' and child's resources in the second period. When $\rho'(\cdot) = 1$, (A15) may be rewritten as

$$u'(c_1) - \int_0^{z(A_{p2}, A_{k2})} u'(c_{k2}(W_2))\left[1 + \frac{\partial R_2(W_2)}{\partial A_{k2}}\right] f(Y_{k2} \mid I_1)\, dY_{k2}$$
$$- \int_{z(A_{p2}, A_{k2})}^{\infty} u'(A_{k2} + Y_{k2}) f(Y_{k2} \mid I_1)\, dY_{k2} = 0,$$

where we have used the fact that $R_2 = 0$ when $Y_{k2} < z(A_{p2}, A_{k2})$ and the fact that c_{k2} and R_2 depend on W_2 only when $Y_{k2} \geq z(A_{p2}, A_{k2})$. Differentiating with respect to R_1 and A_{p2} yields, respectively,

$$K_1 \frac{\partial c_{k1}}{\partial R_1} - K_2\left(1 - \frac{\partial c_{k1}}{\partial R_1}\right) - K_3\left(1 - \frac{\partial c_{k1}}{\partial R_1}\right) = 0 \tag{A17a}$$

[44] In differentiating (A10) with respect to A_{p2} and A_{k2} to sign the right-hand side of (A16), recall that $M(A_{p2} + A_{k2} + Y_{k2}) = N(A_{p2}, A_{k2} + Y_{k2})$. Also recall that in those states in which $Y_{k2} \leq \bar{Y}_{k2}$, $\partial M(A_{p2} + A_{k2} + Y_{k2})/\partial A_{p2} = \partial M(A_{p2} + A_{k2} + Y_{k2})/\partial A_{k2}$, whereas in those states in which $Y_{k2} > \bar{Y}_{k2}$, $\partial N(\cdot, \cdot)/\partial A_{p2} = u'(c_{p2}) > u'(c_{k2}) = \partial N(\cdot, \cdot)/\partial A_{k2}$.

and

$$K_1 \frac{\partial c_{k1}}{\partial A_{k2}} - K_2\left(1 - \frac{\partial c_{k1}}{\partial A_{k2}}\right) - K_3\left(\frac{\partial c_{k1}}{\partial A_{p2}}\right) = 0, \tag{A17b}$$

where $K_1 = u''(c_{k1})$, and

$$K_2 = \int_0^{z(A_{p2},A_{k2})} \left\{ u''(c_{k2}(W_2))\left[1 + \frac{\partial R_2(W_2)}{\partial A_{k2}}\right] + u'(c_{k2}(W_2))\left[\frac{\partial^2 R_2(W_2)}{\partial^2 A_{k2}}\right]\right\} f(Y_{k2}|I_1)\,dY_{k2},$$

$$K_3 = \int_{z(A_{p2},A_{k2})}^{\infty} u''(A_{k2} + Y_{k2}) f(Y_{k2}|I_1)\,dY_{k2}.$$

Using (A17a) and (A17b) to solve for $\partial c_{k1}/\partial R_1$ and $\partial c_{k1}/\partial A_{k2}$ and taking the difference establishes that

$$\frac{\partial c_{k1}}{\partial R_1} - \frac{\partial c_{k1}}{\partial A_{p2}} = \frac{K_3}{K_1 + K_2 + K_3} > 0. \tag{A18}$$

To establish the inequality in (A18), note first that the denominator $K_1 + K_2 + K_3$ is the second derivative of the child's first-period objective function (A11) with respect to c_{k1}, so $K_1 + K_2 + K_3 < 0$ at the value of c_{k1} chosen by the child. (The condition $u'(0) = \infty$ guarantees that the child's first-period problem has an interior solution.) The numerator $K_3 < 0$ because $u''(\cdot) < 0$ by concavity and because condition 2 says that $f(Y_{k1} \mid I_1)$ is positive for at least some values of $Y_{k2} > z(A_{p2}, A_{k2})$. The first-order condition (A3) for R_2 and concavity guarantee that $\partial R_2/\partial A_{k2} < 0$ when $Y_{k2} < z(A_{p2}, A_{k2})$, and $\partial R_2/\partial A_{k2} = 0$ if $Y_{k2} > z(A_{p2}, A_{k2})$. Consequently, the left-hand side of (A16) must be negative.

Note that the right-hand side of (A16) captures the option value to the parents of waiting to make a transfer; its positive sign means that the expected utility to parents of holding an extra dollar at the beginning of period 2 exceeds their expected utility from having their child hold an extra dollar. The negative sign of the left-hand side of (A16) reflects the parents' decision to hold back transfers to keep their child from overconsuming. The inclusion of the term $\partial R_2/\partial A_{k2}$ in (A15) and, as a consequence, (A16) captures the propensity of the child to free-ride on the parents' generosity by overconsuming when young.

Now take the case in which the child is liquidity-constrained; that is, $\rho'(A_{k1} + Y_{k1} + R_1 - c_{k1}(\cdot)) > 1$ when $R_1 = 0$. In this case, the left-hand side of (A16) and the last term on the right-hand side of (A16) are multiplied by $\rho'(\cdot)$. Although the negative sign of the left-hand side of (A16) remains, the right-hand side may now also be negative, leading the parents to make period 1 transfers. In this case, the marginal loss to the parents from reducing A_{p2} by a dollar and increasing A_{k2} by a dollar (i.e., from transferring a dollar), which is given by $(\partial V/\partial A_{k2}) - (\partial V/\partial A_{p2})$, is smaller than the marginal gain from being able to transfer to a child facing a value of ρ' in excess of one, which is given by $(\rho' - 1)(\partial V/\partial A_{k2})$.[45] The transfer income derivatives restriction $(\partial R_1/\partial Y_{p1}) - (\partial R_1/\partial Y_{k1}) = 1$ when $R_1 > 0$ follows immediately from the fact that Y_{p1}, Y_{k1}, and R_1 always enter the equations of the problem in the combinations $Y_{p1} - R_1$ and $Y_{k1} - R_1$. See (A7), (A8), and (A9).

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