A New Test of Educational Borrowing Constraints

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Abstract

Models of educational investment and borrowing typically treat the family as a unitary decision-maker. Doing so potentially conceals the nature of educational borrowing constraints, since adults with college-age children are likely at a life-cycle stage where credit constraints are not important. We instead propose a simple model of altruistic parents and their children, who make educational and non-educational investments and transfers. The model implies there is an inefficient level of educational investment for parent-child pairs who are intergenerationally constrained. Parents of these children do not pay the share of college expenses that is assumed by federal financial aid formulas. The model highlights a new way to test for the presence of educational borrowing constraints, which we implement making use of data from the Health and Retirement Study and the NLSY-97. The data are consistent with the presence of constraints for the children of parents who make no post-schooling gifts, or who have lower income and assets.

There has been long-standing interest in whether U.S. students have access to educational borrowing in college sufficient to support efficient human capital investment. Prior work found empirical relationships that were interpreted as being consistent with educational borrowing constraints (see, for example, Hauser, 1993; Manski and Wise, 1983; Card, 1999; Kane, 1994; Ellwood and Kane, 2000; and Kane and Rouse, 1999). Recently, however, many have been convinced, based on the work of Cameron and Heckman (1998, 2001), Cameron and Taber (2004), Carneiro and Heckman (2002), and Keane and Wolpin (2001) that U.S. educational credit markets are nearly complete. These studies show that children's schooling levels, or early labor market outcomes, are independent of parents' resources once one conditions for the child's ability.[1]

The model underlying the tests conducted by Carneiro and Heckman (2002) and others assumes that, in the presence of educational borrowing constraints, parents who are able to relieve barriers to their children's efficient educational investment do so. This assumption also appears in the practical context of U.S. college financial aid policy: students' federal assistance is determined based on their parents' presumed ability to pay, and standards for financial independence from parents are stringent. The point of departure for this paper is to question the assumption of a unitary parent-child decision-maker.[2] If parents and children are separate actors who make distinct decisions, they may have disagreements about financing education.

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[1] Carneiro and Heckman (2002) find that up to 8 percent of the relevant U.S. population may be short-run credit constrained.

[2] The literature on borrowing constraints and higher education generally assumes that families make unitary college decisions based on parents' resources and children's ability, perhaps owing to a lack of data on parents' actual college expenditures. Shea (2000) uses income shocks to identify the causal effect of parents' income on children's schooling, and finds an effect only for a low income subsample. Keane and Wolpin have detailed NLSY79 data on work while in school, but lack data on parents' college expenditures and so infer them from the resource-schooling relationship using model structure. Exceptions to this rule are Sauer (2003), who investigates the effects of parental transfers during law school reported in alumni surveys by University of Michigan law school graduates on borrowing and lifetime earnings, and Perozek (2005), who models and estimates the education decisions of a parent and multiple children using the HRS.

Moreover, parents are under no legal obligation to meet their expected contribution as specified in federal financial aid formulas.[3]

The specification of the underlying model of family behavior is fundamental when thinking about the importance of educational borrowing constraints. If parents and children act as a unitary decision-maker, it is not surprising that studies would find borrowing constraints to be an empirically negligible phenomenon. Parents of college age children are typically at a stage of the life-cycle where they have ample access to credit. There is considerable evidence, however, that key implications of the unitary model of intergenerational relationships are not supported in data (see, for example, Altonji, Hayashi, and Kotlikoff, 1992).

We instead propose a simple model of altruistic parents and their children, who make educational and non-educational investments and transfers. We assume that parents have access to complete credit markets, and thus may be able and willing or unwilling to relieve meaningful constraints for their children. Parents cannot, however, force repayment from children for earlier transfers.[4] The model generates potential disagreements between parents and children over the optimal investment in education, stemming from either the parent's lack of access to the returns to education or to the child's desire to rely too heavily on the parent.

The model produces two simple predictions that we examine using data from the Health and Retirement Study (HRS), with supplemental analysis based on the National Longitudinal Survey of Youth, 1997 Cohort (NLSY-97). First, when parents are relatively wealthy or altruistic and children's abilities are relatively modest, post-schooling cash transfers take place and available

[3] According to their parents, a third of all children in the Health and Retirement Study who got some post-secondary education did so without their parents' financial assistance. This distinction does not reflect only differences in need-based financial aid. A quarter of children whose parents held $200,000-$400,000 in assets in 2000 attended college without parental support, as did 16 percent of those whose parents' assets exceeded $400,000.
[4] McGarry and Schoeni (1995) and McGarry (1998) document the low rates of transfers from children to older parents. If parents cannot expect return transfers from children who make good on the education that they have financed, then a distinction may arise between parents' and children's interests in educational investment.

financial aid has no effect on children’s educational attainment. However, when parents are relatively poor or egoistic and children are relatively able, no post-schooling cash transfers occur and available financial aid does affect children’s educational attainment in equilibrium. In practical terms, given a policy that conditions aid on expected family contributions that are neither legally guaranteed nor universally offered, we investigate whether federally determined aid matters more to the education of children with less generous parents.

Our methods follow in a straightforward manner from the theory. We divide the sample into two groups based on whether or not post-schooling cash transfers are reported in the HRS. Though observing both children’s actual college financial aid and post-schooling cash transfers is an unrealistic data requirement, we have available to us a good proxy for financial aid. A parent’s *total* “expected family contribution” (EFC) to the education of all of her children in a given year in U.S. federal financial aid calculations depends only on her income and assets, and is invariant to the number of children she has in school at once. This means that the dollar amount of aid awarded to support the education of one child depends heavily on the overlap of that child’s college years with those of his siblings. As a result, we rely on the birth spacing of siblings as a proxy for variation in students’ federal aid.

As implied by our analytic model, we find a positive and statistically significant relationship between educational attainment and sibling overlap in college ages when no post-schooling cash transfers are reported, and no significant relationship when positive transfers are reported. The results hold across several HRS samples. The magnitude of the association implies a difference in educational attainment of nearly one semester between children with zero and four years of sibling overlap in college ages. The results are consistent with borrowing constraints for higher education being important for some children in families where parents are relatively poor or egoistic and children are relatively able. Becker and Murphy (1988) describe the consequences of the intergenerational constraint facing these households:

> "Parents who cannot leave debt can substitute their own consumption for their children's consumption by investing less in the children's human capital and instead saving more for old age. Therefore, in families without bequests, the equilibrium marginal rate of return on investments in children must exceed the rate on assets saved for old age; otherwise, parents would reallocate some resources from children to savings. These parents underinvest in the human capital of children."

II. A model of transfers with exogenous financial aid

The starting point for our model is the small theoretical literature on collective family schooling decisions. In order to generate an equilibrium that distinguishes between educational and cash transfers, and transfers made early and late, there must be scope for disagreement between parents and children over children's investments. Our model begins by adopting the intuition of Bruce and Waldman (1991).[5] Bruce and Waldman use repeated transfer opportunities to generate the threat of strategic over-reliance of a child on a conventionally altruistic parent. In this case the parent may prefer more education for the child due to the threat of over-reliance, but may also prefer less education for the child given that she has no access to the returns to the child's education.[6]

We build on Bruce and Waldman through explicit analysis of transfer behavior as family resources and altruism vary. The analysis of outcomes over the full range of possible family characteristics generates new understanding of transfers in the broader population, along with empirical predictions that can be examined using newly available transfer data.

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[5] Pollak (1988) uses preferences for education to motivate parents' investments, and observes that distinctions among transfer forms must rely on a disagreement between parents and children and that effective tied transfers cannot function as collateral or be resold.

[6] Lindbeck and Weibull (1988) model repeated transfer opportunities between agents with linked preferences and generate a similar strategic concern to that in Bruce and Waldman, though their context is quite different.

a. The Economic Environment

Consider a two period model where parents have altruistic concern for their children's utility. We assume that parents and children make independent, non-cooperative decisions. In particular, the parent moves first, choosing her consumption and physical capital investment, along with the dollar amounts of a cash transfer to the child and a tied transfer for college education. The child sees these choices and then decides how much to consume, invest in schooling, and save. In the second period, the parent again consumes and chooses a cash gift to the child; the child's only action is to consume the gift and the returns to his various investments. While the parent has full access to credit, we assume that the child cannot borrow against his future income.[7]

Define *a* as the total parent and child investment in physical capital, and define *e* as their total investment in the child's postsecondary education. Assume that the rate of return on physical capital is constant at *R* and the return to total human capital investment *e* is *h(e)* such that $h'(\cdot) > 0,\ h''(\cdot) < 0$ and $h'(0) > R.$ Assume also that the child receives financial aid τ, which augments family human capital investments. Hence $e = e^p + e^k + \tau$.[8]

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

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

where c_t^j represents the period *t* consumption of agent *j*, α expresses the parent's degree of purely altruistic concern for the child's welfare, and β is the rate at which each agent discounts

[7] As discussed in Brown *et al.* (2006), both assumptions – non-cooperative behavior and children have relatively limited ability to borrow – are necessary to obtain empirical predictions on the timing and magnitude of transfers.
[8] It will be crucial to our primary result regarding the effect of financial aid that federal and private support for post-secondary education is not inefficiently high, ensuring that $h'(\tau) \geq R$.

future utility. Single period utility of consumption for each agent, $u(\cdot)$, is such that $u'(\cdot) > 0,\ u''(\cdot) < 0$ and $u'(0) = +\infty.$

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

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

b. Period 2

The parent's problem in the second period is

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

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

$$g_2(Ra^p, Ra^k + h(e^p + e^k + \tau)) = \begin{cases} g_2 \text{ such that } u'(Ra^p - g_2) = \alpha u'(Ra^k + h(e^p + e^k + \tau) + g_2) \\ \qquad \text{where } u'(Ra^p) < \alpha u'(Ra^k + h(e^p + e^k + \tau)), \\ 0 \quad \text{otherwise.} \end{cases} \tag{1}$$

When the transfer that equates second period marginal utilities across generations is positive, the parent achieves her preferred allocation of the family's total final-stage resources.[9] The parent's altruism toward the child implies that the final transfer decreases with the child's assets and earnings, no matter what choices preceded them, so second period transfers, when made, are compensatory. When second period transfers are zero, as we see below, the child has no incentive to behave strategically, yet there likely is an intergenerational liquidity constraint that results in inefficient human capital investment.

c. Period 1: Child

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

$$\begin{aligned}
&\max_{c_1^k, c_2^k, e^k \geq 0, a^k \geq 0} \left\{ u(c_1^k) + \beta u(c_2^k) \right\} \\
&s.t.\ \ c_1^k + e^k + a^k \leq g_1, \\
&\qquad c_2^k = Ra^k + h(e^p + e^k + \tau) + g_2(Ra^p, Ra^k + h(e^p + e^k + \tau)) \text{ and} \\
&\qquad g_2(Ra^p, Ra^k + h(e^p + e^k + \tau)) \text{ as in (1).}
\end{aligned}$$

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

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

$$u'(c_1^k) = \beta \max\left\{R, h'(e^p + e^k + \tau)\right\}\left(1 + \frac{\partial g_2}{\partial(Ra^k + h(e^p + e^k + \tau))}\right)u'(c_2^k) \qquad (2)$$

[9] This surprisingly robust prediction is the focus of the theory and empirical analysis in Altonji, Hayashi and Kotlikoff (1997).

whenever $g_2 > 0$ and the e^k and a^k that meet (2) still satisfy $a^k \geq 0$ and $e^k \geq 0$.[10] Second, $a^k \geq 0$ and $e^k \geq 0$ both bind for the child if the parent chooses e^p, a^p and g_1 such that

$$u'(g_1) \geq \beta \max\left\{R, h'(e^p+\tau)\right\}\left(1+\frac{\partial g_2}{\partial(h(e^p+\tau))}\right)u'(h(e^p+\tau)+g_2(Ra^p, h(e^p+\tau))). \qquad (3)$$

This set of conditions will be useful in solving the parent's problem.

d. Period 1: Parent

In period 1, the parent chooses c_1^p, g_1, e^p and a^p to maximize his or her utility, subject to $c_1^p + a^p + e^p + g_1 \leq x^p$, $g_1 \geq 0$ and $e^p \geq 0$.[11] We note three features of the model in proposition 1.[12]

Proposition 1: *(i)* There exists a unique set of equilibrium consumption levels $\{c_1^p, c_2^p, c_1^k, c_2^k\}$. *(ii)* If $g_2 > 0$ in any equilibrium, then $h'(e^p + e^k + \tau) = R$ and the equilibrium transfers (e_p, g_2, g_1) are unique. *(iii)* If $g_2 \geq 0$ binds in any equilibrium, then $h'(e^p + e^k + \tau) > R$ and the equilibrium transfers need not be unique.

The solution partitions the parameter space into two regions, with equilibria that we call type I and type II. The parent can do no better than to choose c_1^p, g_1, e^p and a^p such that (3) holds and therefore $a^k \geq 0$ and $e^k \geq 0$ both bind for the child. Where possible, the parent's c_1^p, g_1, e^p and a^p meet conditions

$$\begin{array}{l} u'(c_1^p) = \alpha u'(c_1^k),\ u'(c_1^p) = \beta R u'(c_2^p),\ h'(e^p+\tau) = R, \text{ and } u'(c_2^p) = \alpha u'(c_2^k), \\ \text{where } c_1^p = x^p - g_1 - e^p - a^p,\ c_1^k = g_1,\ c_2^p = Ra^p - g_2, \text{ and } c_2^k = h(e^p+\tau) + g_2 \end{array} \qquad (4)$$

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[10] Recall the partial derivative $\frac{\partial g_2}{\partial(Ra^k + h(e^p + e^k + \tau))}$ is negative since second period transfers are compensatory.

[11] Our assumptions imply that $g_1 \geq 0$ does not bind at the parent's optimum: $u'(0) = +\infty$ and $\alpha > 0 \Rightarrow g_1 \geq 0$; $e^p \geq 0$, however, may bind. Key results in this paper hold even when the child has an endowment that can support first period consumption (Brown *et al.*, 2006).

[12] Proofs of all propositions are given in Appendix A.

with $g_2 \geq 0$. Where conditions (4) can be met only with $g_2 < 0$, the nonnegativity constraint binds. In this case, the equilibrium is instead described by

$$\begin{aligned} &u'(c_1^p) = \alpha u'(c_1^k),\ u'(c_1^p) = \beta R u'(c_2^p),\ \ h'(e^p + e^k + \tau) > R,\ u'(c_2^p) > \alpha u'(c_2^k), \\ &\text{and } u'(c_1^k) = \beta h'(e^p + e^k + \tau) u'(c_2^k), \text{where } c_1^p = x^p - g_1 - e^p - a^p, \\ &c_1^k = g_1,\ c_2^p = Ra^p, \text{ and } c_2^k = h(e^p + e^k + \tau). \end{aligned} \tag{5}$$

The type I equilibrium is one in which $g_2 > 0$ and $h'(e^p + e^k + \tau) = R$. It occurs where parents are relatively wealthy and altruistic, and children's return to human capital investment falls relatively quickly to the real interest rate. In this case, parents' second period transfer liabilities generate strategic concerns, and therefore the parent bears all responsibility for the investment in the child's education. The child realizes that the parent will be in the interior of the transfer region in the second period. Hence, given the opportunity, she would over-consume in the first period, as shown in equation (2). The parent takes this into account and makes a cash gift of only what she prefers for the child to consume in the first period. The parent ties to education all additional first period transfers, exhausting the region of educational investment that yields a return at or above the real interest rate. Overall, we find that families in the type I equilibrium face strategic concerns, and yet make efficient educational investments. Put differently, the type I equilibrium parent relieves the child's educational borrowing constraint.

The type II equilibrium is one in which $g_2 = 0$ and $h'(e^p + e^k + \tau) > R$.[13] It occurs when parents are relatively poor and egoistic, and a child's return to human capital investment falls relatively slowly with additional education. Here the parent is poor relative to his or her child and consequently intends not to make transfers in the second period. The absence of a second

[13] Note that there may exist a knife's-edge case in which $g_2 = 0$, though $g_2 \geq 0$ does not bind, and at the same time $h'(e^p + e^k + \tau) = R$.

period transfer means that child has no incentive to behave strategically. As a result, the parent and child agree on the intertemporal condition to be met by the child's consumption: $u'(c_1^k) = \beta h'(e^p + e^k + \tau) u'(c_2^k)$.

While parents and children agree on the intertemporal condition, the type II equilibrium is inefficient. The post-schooling consumption that the parent prefers to allocate to the child is less than the earnings produced by the efficient human capital investment. In other words, conditions (4) imply $c_2^k < h(e^*)$, where $e^* = h'^{-1}(R)$. Since the parent cannot reclaim the return to e^p invested in the child's education, the parent invests in human capital to support the child's second period consumption but physical capital to support her own. This leads the parent to tolerate the $h'(e^p + e^k + \tau) > R$ wedge in the investment returns, despite her unbounded access to credit. Thus families in the type II equilibrium face no strategic concerns, and yet are led by an intergenerational liquidity constraint to invest inefficiently in their children's human capital.

To summarize, Proposition 1 demonstrates the existence of an intergenerational liquidity constraint that leads to inefficient human capital investment for an observable group of families. We label these $g_2 = 0$ families intergenerationally constrained, and the $g_2 > 0$ families intergenerationally unconstrained.

Next we turn to the role of financial aid for post-secondary education in determining children's equilibrium educational attainment.

Proposition 2: *(i)* In any equilibrium in which $g_2 > 0$, $\frac{\partial(e^p + e^k)}{\partial \tau} = -1$; financial aid does not influence total educational attainment. *(ii)* In any equilibrium in which $g_2 \geq 0$ binds, $\frac{\partial(e^p + e^k)}{\partial \tau} > -1$; financial aid does influence total educational attainment.

Propositions 1 and 2 suggest a new strategy for examining educational borrowing constraints with the HRS. For households who are intergenerationally constrained, financial aid should influence educational attainment. Educational attainment should not be affected by financial aid for households who are not intergenerationally constrained.

Federal and private financial aid is generally a decreasing function of parents' resources, with some lower resource bound at which aid reaches the full cost of attendance. Suppose that τ is $\tau(x^p)$. Proposition 3 describes the effects of parents' wealth on children's educational attainment, incorporating the effects of financial aid.

Proposition 3: *(i)* Where $\tau'(x^p) < 0$, as long as x^p, α, τ and $h(\cdot)$ are such that $e^p + e^k = 0$ in equilibrium, $\frac{de}{dx^p} < 0$. *(ii)* Where $\tau'(x^p) = 0$, $\frac{de}{dx^p} \geq 0$.

Though several of the predictions of the above model overlap with those of Cameron and Heckman (1998, 2001) and Carneiro and Heckman (2002), Propositions 2 and 3 raise two points of disagreement. First, our model predicts that tuition subsidies will matter to the educational attainment of intergenerationally constrained children. Second, our model predicts that, fixing the child's ability, parental resources have no effect on educational attainment among intergenerationally unconstrained families. However, in an intergenerationally constrained family the parent's resources may decrease the child's education, as a result of financial aid policy, or increase the child's education, as a result of the parent's generosity. While many models of schooling choice imply positive effects of parents' wealth on children's schooling (for example, Keane and Wolpin, 2001, and Pollak, 1988), ours is the first to identify a subset of families where the effect of parents' wealth on children's education may be negative.[14] We turn to data from the HRS and NLSY-97 to examine these novel predictions.

[14] The spirit of the strategic concern in Bruce and Waldman (1991) goes in this direction, but they demonstrate that in equilibrium parents correct children's incentive to under-invest via the tied transfer.

III. The effects of financial aid on educational attainment in intergenerationally constrained and unconstrained families

The median year in which children in our HRS sample reach the age of 18 is 1977, with a substantial mass of children at college ages in the 1970s, 80s, and early 90s. The U.S. Higher Education Act of 1965 authorized support for students pursuing post-secondary, graduate, and professional education in the form of grants and subsidized loans. The HEA was reauthorized in 1968, 1972, 1976, 1980, 1986, 1992, 1998 and 2004. The 1992 reauthorization came with several major reforms. Before 1992, parents' EFC was calculated according to separate formulas for Pell Grants (the Pell Grant Index) and subsidized loans (the Congressional Methodology). After 1992 a common Federal Methodology was used.[15]

It would be difficult to trace and aggregate all of the historical details of U.S. financial aid policy over the relevant period for our sample children, and impossible to uncover parental asset and income information relevant to the financial aid formula at the potential date of college entry for each sample child. One consistent feature of the aid formula, however, allows us to infer a major component of within-family aid variation from family structure alone. Parents' total expected contribution to their children's college education in a given year is calculated based on their assets and income. Both before and after the 1992 reform, the EFC was independent of the number of children a parent had in college in a given year. As illustrated by lines 26-27 of Figure 1, the 2006-2007 EFC Formula A Regular Worksheet (IFAP 2006), once the family's Adjusted Available Income is determined based on income and assets, it is divided by the number of the family's children in college in the relevant academic year to yield the final expected family contribution. This means that there are large discontinuities in financial aid as a function of number of siblings in college.

[15] Helpful discussions of federal financial aid policy can be found in NCES (2004), Kane (1998), Kim (1999), Monks (2004), and Wu (2006).

Define *COA* as the cost of attending college for a given student, including tuition and fees, room and board, books and travel expenses. The objective of federal aid, in cooperation with most U.S. colleges, is to provide grants and loans that cover the cost of attendance after the individual student's expected family contribution is removed, *COA – (EFC/# children in college)*. This implies that for a lone student for whom *COA* > *EFC*, the amount of college costs not covered by aid is decreased by *EFC/2* dollars with the addition of the first sibling attending college in the same year. Depending on the size of the expected family contribution, this formula may create large swings in individual siblings' costs of college as family members age through the education process, and may be responsible for large differences in the costs of educating siblings within the same family.

We use the variation in college financial aid with children's birth spacing to proxy for children's unobserved aid levels.[16] Given that parental resources affect financial aid, families might want to declare their children's financial independence. The standards for independence, however, are strict. In order to declare independence a student must *(i)* reach age 24 by January of the academic year, or *(ii)* enroll in a graduate program, or *(iii)* be married, or *(iv)* have a dependent child or other dependents, or *(v)* be an orphan or ward of the court, or *(vi)* be a veteran of the U.S. Armed Forces (IFAP 2006). Thus a child under age 24 with living parents who decides not to make the expected family contribution has few options.[17] Following our finding that many parents with non-negligible assets report not paying for their children's college educations, we are interested in whether children of less generous parents respond to variation in available aid (based on sibling-years of overlap) by reducing their total schooling.

[16] Our use of child birth spacing is similar to the approaches taken by Kim (1999) and Monks (2004) to estimate the savings effects of the asset tax implicit in the federal financial aid formula.
[17] The child could, of course, work during college. Work hours compete with study hours, and the schooling attainment and earnings costs of this competition are demonstrated in Keane and Wolpin (2001).

a. The Health and Retirement Study

While information on the amount parents in fact pay for their children's education is not required for our empirical approach, we do need to know the dates of birth and educational attainment of all of a parent's children and we need a reasonable post-schooling period in which to observe post-schooling cash transfers. The HRS has complete sibling information and information on cash and educational transfers over broad windows of family history.

The HRS is a national panel study with an initial sample (in 1992) of 12,652 persons and 7,607 households. It oversamples blacks, Hispanics, and residents of Florida. The baseline 1992 study consisted of in-home, face-to-face interviews with the 1931-1941 birth cohort and their spouses, if married. Follow-up interviews were given by telephone in 1994, 1996, 1998, 2000, 2002 and 2004. Other cohorts, born before 1923 (Asset and Health Dynamics of the Oldest Old), between 1923 and 1930 (Children of the Depression), and between 1942 and 1947 (War Babies), were merged with (or added to) the main HRS cohort in 1998, creating a panel study of 22,000 persons over age 50 in the U.S. In the interest of sample size, the following analysis uses all cohorts for which the relevant information is available.

Our sample selection criteria include the requirement that we observe parents' household income and net worth and complete information on the education, date of birth, and relationship to the family of each child reported by the HRS respondent. We also require that children included in the estimation have at least one sibling. Finally, we include only children aged 24 or older at the 2000 survey in our estimation sample. The intention of this restriction is to allow the sample children time to complete their schooling, and to consider only cash transfers that take place following completion of the children's schooling.[18] This leaves us with a sample of 34,650

[18] The qualitative results are similar, and the sample is still quite large, where we require sample children to be aged 30 or older in 2000.

children representing 9468 HRS families.

Over the first three waves of the HRS, the questions on cash transfers varied. In Wave 1 (1992) the question asked about transfers exceeding $500 in the last 12 months, in Wave 2 (1994) it asked about transfers exceeding $100 in the last 12 months, and in waves 3 through 6 the questions asked about transfers exceeding $500 in the last 24 months. The specific question in 2000 (Wave 5) reads:

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

Those answering "yes" were then asked how much. While aggregating observed transfers over the first 5 waves would be ideal, the frequency with which transfer responses are missing grows quickly in the number of years used. Further, it is not clear how to aggregate over the first three waves due to the inconsistency of the question. We choose instead to rely on transfers reported by parents over the period 1998-2000 in response to the Wave 5 question quoted here. Responses to this question at the parent-child level are available for 34,373 of the 34,650 sample children.

It would be preferable, however, to use a measure of significant post-college transfers over a longer time period in the estimation. While no long-term retrospective question on major cash transfers to children is available in any of the HRS core surveys, Wave 2 of the HRS, fielded in 1994, does include a topical module on parent-child transfers. Module 7 of the Wave 2 survey asked 827 HRS respondents:

> "Other than contributions toward education expenses, have you ever given substantial gifts to your grown children?"

Those who answer yes are asked the total amount of these gifts. This is arguably the exact question we require to distinguish families with relatively wealthy or altruistic parents who have active post-schooling financial linkages from those with relatively poor or egoistic parents who likely have no post-schooling financial linkages. The drawback to this question, clearly, is that it was asked only of a small subsample. Thus we report estimates using both the shorter window of cash transfers observed for the full HRS sample and this longer transfer window observed only for Wave 2, Module 7 respondents. Responses to this question are available for 335 of the 9468 families for whom we have complete demographic and education information on multiple siblings aged 24 and older. These families include 1262 children. Thirty-seven percent of these children have parents who report ever having made substantial non-education gifts to a grown child.

From the demographic information on children we construct a series of child variables that we believe may influence the schooling attained by a young adult student, particularly relative to his or her siblings. These include the child's age in 2000, the child's gender, indicators for whether a child is an oldest child, a youngest child, and a step child of either parent, and the number of sibling-years of overlap for college-age children. Specifically, the child's sibling-years of overlap measure is the sum of the number of siblings the child had between the ages of 18 and 21 while he or she was 18 plus the number of siblings aged 18-21 while he or she was 19, and so on, until the child's age reached 21.

Table 1 gives descriptive information for these variables for both the entire HRS sample and for the Wave 2, Module 7 respondents. Thirty-two percent of core sample children have parents who made positive cash transfers to them or to a sibling between 1998 and 2000, and 37 percent of the children of module respondents have parents who ever made substantial non-educational transfers to their adult children. These variables are the basis of our post-schooling transfer distinctions in the estimation. Roughly half of each sample is female. The median child age in 2000 is 41 for both samples. Birth order indicators tell us that 29 (26) percent of core (module) sample children are oldest siblings, 26 (24) percent youngest, and 45 (50) percent are middle siblings. As many as 11.5 (13.6) percent of core (module) sample children are stepchildren of either the family respondent or his or her spouse in 2000. This does not indicate that this proportion of children were stepchildren while college decisions were being made, but stepchild status in 2000 does serve as some measure of both the likely influence of family structure on previous education choices and the relevance of the household asset characteristics we observe to those of the child's parents when the child was making education choices. We do not include other information available on the sample children, such as marital status or earnings in 2000, as these variables are likely to have been determined after the completion of the child's schooling.

The dependent variable in our primary empirical specification is the child's education. Core sample children have attained a mean of 13.8 and a median of 13.0 years of schooling. The large sample and broad range of ages give us a standard deviation of 6.88 years of schooling, despite the top-coding of schooling years to 17 for graduate and professional education.[19] The independent variable of interest is years of overlap with siblings. Its mean and median are 2.34 and 2.00 in the core sample and 2.63 and 2.00 in the module sample. There is substantial variation in sibling-years of overlap in both samples, with a standard deviation for this variable of roughly 2.13 years in each.

The fact that slightly over half of the core sample reached college age before 1980 is both a benefit and a drawback. The prediction that financial aid does not influence children's educational attainment wherever post-schooling transfers are positive applies to transfers occurring beyond the first few years after college, and so the long post-schooling window on transfers observed for many of these children improves our ability to distinguish between families in which post-schooling financial linkages are and are not active. However, the age of

[19] The youngest children in the sample are 24. The oldest 1.8 percent of children have reached retirement age.

the sample children also implies that the financial aid policy to which the majority of sample children were subject precedes the major reforms of HERA 1992. Fortunately, the key aspect of financial aid policy that we exploit – that the EFC varies discontinuously with the number of college-age children – has not varied in important ways over time.

b. Primary empirical specification and results

The goal of our empirical work is to determine whether college financial aid influences either the children of parents who do make post-schooling gifts or the children of parents who do not. Our model implies that financial aid will have a positive effect on the educational attainment of children whose parents make no subsequent gifts, but financial aid will have no effect on the educational attainment of children whose parents do make subsequent gifts to children. We therefore examine the correlation between children's years of schooling and our financial aid proxy conditioning on child characteristics using two separate subsamples. The first is one in which the parent makes a post-schooling transfer ($g_2 > 0$), and the second is one in which she does not ($g_2 = 0$). We do this with two samples: one uses parents' 1998-2000 giving to divide the full HRS sample into $g_2 > 0$ and $g_2 = 0$ groups, and the other uses parents' retrospective giving as reported in Wave 2, Module 7.

Many other factors may influence the difference in schooling between two arbitrarily chosen, unrelated students. Among other issues, different parents may have had different attitudes toward education, and may have made different investments in the students while they were younger. Heritable components of academic aptitude that the students received from their parents might differ. We would have a difficult time controlling adequately for these between-family differences using the HRS data. For these reasons, we estimate the dependence of educational attainment on child characteristics within families, using a fixed effects specification.

Our empirical model is

$$e_{is} = \omega_i + X_{is}\beta + \gamma o_{is} + \varepsilon_{is}, \qquad (6)$$

where families are indexed by $i = 1,\ldots,N$ and siblings in family i by $s = 1,\ldots,S_i$.[20] In this expression e_{is} represents the education of sibling s in family i, X_{is} is a vector of exogenous characteristics of sibling s in family i, and o_{is} represents the number of years of overlap in college ages that sibling s in family i shares with his or her siblings. Family fixed effect ω_i represents the unobservable contribution to educational attainment shared by the children of family i. The measures of fit reported with our fixed effect estimates reflect the estimation of a separate intercept value for each sample family.

The coefficient of interest in the fixed effect specification is γ, the effect of the overlap variable (which proxies for financial aid) on children's total schooling. Table 2 reports estimates for the gift and no-gift subsamples using the full HRS sample and the special module asked of Wave 2, Module 7 respondents. We find a coefficient on overlap of 0.0842 in the no gift full sample, which is significantly different from zero at the one percent level. The corresponding coefficient in the gift full sample is 0.0387, and is not significantly different from zero at standard confidence levels. A similar pattern emerges from the gift module results. The coefficient on overlap in the no gift module sample is 0.0941, and differs significantly from zero at the one percent level. The coefficient on overlap in the gift module sample is -0.0503 and is insignificant. Given the standard errors we can reject the null hypothesis that the overlap coefficient in the no gift full sample is equal to the point estimate for the coefficient in the gift

[20] Note that sibling numbers vary by family, creating an unbalanced panel. Numbers of siblings within a family range in the sample from 2 to 11.

full sample, but only at the 10 percent level of confidence. The case is much stronger for the module sample, however, where we can reject the null hypothesis that the no gift overlap coefficient is equal to the gift overlap coefficient at any standard confidence level.[21]

The magnitudes of the estimated overlap coefficients are similar in the two no-gift samples. The coefficient on overlap for the no gift group drawn from the Wave 2, Module 7 sample, for example, indicates that a college student with no siblings in college (during all four years) attains almost one semester less schooling than a student who has one sibling in college for each of the four years, all else equal. This implies there is a substantial effect of college financial aid on students' educational attainment in families of less generous parents. Our estimates indicate no effect of financial aid in the families of more generous parents. The estimated pattern of financial aid effects and parental generosity matches precisely the pattern suggested by the analytic model.

Other coefficients describe the effects of children's demographic characteristics at the time of schooling decisions on their attainments. Brothers get less schooling than their sisters on average, and this effect is significant at the five percent level in two of the samples. The implied difference in schooling between brothers and sisters on average is a third of a year or less. Controlling for birth order, older siblings get significantly less schooling than younger ones in both no-gift samples; one year more of age is associated with 3 and 5 hundredths of a year of school in the two samples. Stepchildren complete significantly more schooling than non-stepchildren in the full HRS sample, and the magnitude of the effect is large. Among the gift families, stepchildren earn one year more of schooling than non-stepchildren on average, and

[21] Note that whether a parent makes a transfer over a two year period (for example, 1998-2000) is an imperfect measure of whether a parent ever makes a transfer after her children have completed their schooling. Parents who are observed to make a transfer certainly fit the ever-transfer category, while parents who do not transfer over the two year period may make substantial transfers to their children earlier or later. If the predictions of the model are accurate, this can be expected to bias the estimated effect of sibling overlap, and therefore financial aid, downward from the true estimate for non-givers in the full sample.

among the no gift families stepchildren earn one half year more of schooling, on average.[22] Oldest children earn more education than their middle-child siblings on average, though the estimated coefficient on the oldest child indicator is significantly different from zero for only one of the four samples. There is no clear pattern in the level of schooling of youngest children relative to those of middle children.

The fixed effect estimates identified by variation in years of schooling between children in the same families, address several important data problems: namely our inability to observe either realized college aid or parents' financial characteristics while children are in college. It also fixes time-invariant characteristics of the family, such as time-invariant features of the home environment, parents' early investments in their children, and inherited academic aptitude. Later in the paper, in the subsection immediately before the conclusion, we discuss issues that arise from the fact that children within the same family have different ability and how that might affect our results. There we show that sibling overlap has only a modest, negative correlation with ability, which in turn is the opposite pattern one would need to see if unobserved ability were to explain our results.

c. Split the sample by income and net worth

In our analytic model, whether a parent makes a post-schooling transfer is an indicator of the type of equilibrium realized by the family. It is not, however, a direct measure of any of the primitive characteristics of the family that determine the equilibrium. These key primitive characteristics are parental affluence (x^p), child ability (the shape of $h(.)$), and parental altruism (α). While direct and reliable measures of child ability and parental altruism toward children are rare in household data, the HRS collects detailed information on respondents' income and assets,

[22] Behavior and outcomes within adult families have been found to vary greatly by whether a child is a stepchild of either parent in other contexts as well. See, for example, Light and McGarry (2004), Brown (2006), and Pezzin, Pollak, and Schone (2006).

allowing us to split the sample based on primitive family characteristic (from the standpoint of the model) x^p.

We estimate the same empirical model splitting the full HRS sample first on income and then on net worth, rather than on gift giving. While the model provides clear guidance for splitting the sample along the gift dimension, with the complicating factors of parental altruism and children's ability, it is not clear what level of parental income or assets would separate type 1 and type 2 equilibria. Recognizing these divisions are arbitrary, we choose two threshold values. First we split the sample into families in which the parent's household income is $25,000 or less in 2000 and those in which the parent's household income is more than $25,000 in 2000 and re-estimate the model described by (6). Then we split the sample into families in which the parent's household net worth is $100,000 or less in 2000 and those in which the parent's net worth is more than $100,000 in 2000 and re-estimate the model in (6). Note in Table 1 that these (round) values are close to the median income and net worth for the sample of $26,000 and $111,000, respectively.[23] We expect that high income or high net worth households are more likely to be in type 1 $(g_2 > 0)$ equilibria, while the other households are more likely to be in type 2 $(g_2 = 0)$ equilibria.

Table 3 reports estimates of expression (6) using these income and net worth sample splits. The estimate of overlap, γ, is similar when splitting the sample based on parental income and net worth as when splitting the sample based on post-schooling cash gifts. The estimated overlap coefficient is 0.1206 and significantly different from zero at the one percent level in the low income group. The analogous coefficient is small and insignificant in the high income group. For the low net worth group, the point estimate is 0.0935 and is significant again at the one percent

[23] Many of these households are retired, but we assume those with high retirement income also had high lifetime earnings.

level. In a minor deviation to the pattern observed so far, the coefficient on overlap for the high net worth group is a positive 0.0480 and is significant at the 10 percent level. We can clearly reject the null hypothesis that the overlap coefficient estimated for the high income group is equal to the coefficient estimated for the low income group at conventional levels of confidence. For the net worth groups, the most that we can say is that we can reject the null hypothesis that the overlap coefficient for the high net worth group is equal to the point estimate for the low net worth group, 0.0935, at the 10 percent level.

By and large, if we take the parent's income and assets as predictive of the type of equilibrium the family enters, the estimates based on income and net worth sample splits are consistent with the model predictions. Financial aid has a significant positive impact on the educational attainment of children of less affluent parents, but no effect on the education of children of more affluent parents.[24] The estimated magnitudes of the effect of financial aid are roughly consistent across the no gift, low income, and low net worth categories.

As noted in Monks (2004), the children of some very wealthy parents can expect no federal financial aid whether they have siblings in college or not. It is therefore possible that the unresponsiveness of the education of children from very wealthy families to financial aid is driving the zero estimates for the high income and net worth groups. For this reason, we re-estimate the Table 3 specification splitting the sample into income and into wealth quartiles. We find results similar to the Table 3 estimates for more affluent families in each.

d. Supplemental analyses with the NLSY-97

A substantial amount of important work on credit constraints and higher education has been conducted with NLSY data, particularly the NLSY-79. The reasons for this are clear. The

[24] The distinction between the effects of financial aid for children of high and low income families are broadly consistent with the results in Shea (2000) on the effects of income shocks for his low income and broader samples.

NLSY gathers rich information on children and their parents, following individuals through their high school and college years. The data include results from the Armed Forces Qualifying Test (AFQT), which has been shown by Neal and Johnson (1996) and others to be an excellent summary measure of ability. Ability plays a central role in current discussions of educational borrowing constraints.

There are two immediate problems that arise in using NLSY data to replicate the primary empirical specification described in Table 2. First, in the NLSY-79, the latest measure of g_2 is elicited when the children are 21 to 28 years old. As noted earlier, the ideal measure for identifying parents with active post-schooling financial linkages would gather information over a long post-college period. Second, the age distribution of the sampling frame is such that there are not enough siblings to estimate models with family fixed effects. Our framework nevertheless points to two specific implications that should hold in the NLSY data. We describe these below. But given neither is predicated on splitting the sample by g_2 and because the NLSY-97 offers considerably more recent data, we present preliminary results from the NLSY-97.

The NLSY-97 is a national panel survey of 8,984 youths who were born between 1980 and 1984. The first wave of the survey was conducted in 1997, at which time youths and one of their parents were interviewed in person. Youths have been interviewed annually since that time; 2004 is the last year for which data are currently available (making eight available waves). The sample reflects 6,748 cross-sectional respondents (designed to be representative of people living in the United States in 1997 and born in the years specified above), and 2,236 supplemental respondents resulting from an over-sampling of racial and ethnic minorities (blacks and

Hispanics).[25]

Our framework suggests two empirical implications we should observe in the NLSY-97 data. First, borrowing constraints will arise when families are intergenerationally constrained. These constraints arise when parents fail to meet their expected family contribution. This leads to a strong implication, demonstrated in Proposition 3: when parents make no contribution to college and their expected family contribution is positive, borrowing constraints imply the probability of completing college should *decline* with parental income. The intuition for the result is straightforward. Financial aid decreases with parental resources. Consequently, the expected family contribution increases with income, so when $e^p = 0$, students from families with greater resources will face a larger funding gap than students from families with fewer resources. This expected empirical pattern is precisely the opposite of the positive college-income gradient that many previous studies interpret as being consistent with credit constraints.

We impose four sample restrictions to look at this hypothesis. First, parents make no contributions for college ($e^p = 0$);[26] second, parental income in 1996 exceeds $15,000; third, all children in the sample have enrolled in at least one semester of school beyond high school; and fourth, no covariates or variables to select the sample are missing. The first criterion is necessary to yield an unambiguous empirical hypothesis.[27] The second criterion is necessary because, below some threshold of income, the expected family contribution is zero. As long as

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[25] http://www.nlsinfo.org/nlsy97/docs/97HTML00/97guide/chap1.htm

[26] We determine that parental support for college (e^p) is positive for a given college term when the respondent indicates that one or both of her parents provided financial assistance during that particular term (through 2004). Respondents with college experience whose parents do not provide assistance during *any* of the terms they are in college is our sample of $e^p = 0$ students.

[27] The expected relationship between income and educational attainment in the $e^p > 0$ subsample is ambiguous. Financial aid will decrease with income, but parental gifts presumably increase with income.

Among other reasons why the NLSY-97 work is preliminary, we have not attempted to exclude children with full athletic or academic scholarships from the $e^p = 0$ subsample. These students are not intergenerationally constrained.

institutions meet financial need through packages of grants and loans, parents with very low incomes would be expected to make no contribution to their children's higher education, yet their children would not be borrowing constrained. Fifteen thousand dollars is a conservative threshold below which the parent's expected family contribution is \$0. The third criterion arises because we select the sample on the condition $e^p = 0$. It is trivially true that parents provide no payments for higher education when their children never attend college. But these children may well not be intergenerationally constrained. To examine the sharp hypothesis of a *declining* relationship between income and college completion, we want to focus on families that are intergenerationally constrained. Descriptive statistics for the samples are given in Table 4.

We examine preliminary evidence for this hypothesis in the left-hand side of Table 5, which is estimated as a linear probability model. Parental income is indeed negatively related to college completion for incomes up to \$97,832, which includes 96 percent of the sample. This result is consistent with the existence of borrowing constraints for higher education. The coefficients of other covariates have the expected signs, but only the coefficients of female (which is strongly, positively correlated with college completion), AFQT and student age are significant at usual levels of confidence.

The second unambiguous implication we can examine with NLSY-97 data is that income should not affect the educational attainment of families with expected financial contributions of \$0, conditioning on ability and other factors thought to affect educational attainment. The intuition for this hypothesis is again straightforward. We assume educational institutions will provide grants (particularly Pell grants) and loans to students to meet the cost of attendance when federal formulas deem parents as being unable to contribute to college costs. To examine this we draw a sample where parental income is less than \$20,000 (in 2004/05) – the threshold below which the expected family contribution is zero, assuming the family pays no state or federal income tax and has no work-related expenses for dual-earner couples. We again drop all observations with missing values.

The results of this specification, which again is a linear probability model with college completion being the measure of educational attainment, are shown in the right-hand columns of Table 5. As hypothesized, the parental income terms are insignificant. The other coefficients have the expected signs. College completion is positively correlated with AFQT, mother's education (more than high school is the omitted category), age, female, and being black or Hispanic and negatively correlated with the number of siblings and broken home.

Taken together, we view the preliminary evidence from the NLSY-97 as being broadly consistent with the evidence from the HRS documenting the presence of borrowing constraints for a portion of children in families that are intergenerationally constrained.

In regressions not shown, but available on request, we also confirm that a modified version of the sibling overlap variable used in the HRS specifications is significantly, positively correlated with financial aid.[28] Specifically, we regress the financial aid a student receives in his or her first term of college on a set of covariates, including parental income, parental income squared, net worth, net worth squared, AFQT, AFQT squared, a constant, and a measure of sibling overlap. We measure the sibling overlap variable as the number of siblings who are college age (ages 18 through 21) at the time financial aid is being measured for the child in question. It is worth noting that the sibling overlap variable does not require the sibling to be in college at the time, since this information is not available in the HRS. Despite this limitation, the

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[28] We used the household and non-household rosters to construct information on respondents' siblings (so that we could get siblings living both in and out of the respondent's home). Siblings are defined to be biological, half, step, adoptive, or foster siblings.

Our measure of financial aid includes the dollar amount of any grants, scholarships, loans, work study, or other kinds of government/institutional aid a respondent received during his/her first term of post-secondary schooling.

coefficient of the overlap variable is $358 and it is significant at the 5 percent level.[29]

We also look at one final detail related to the HRS-based specifications using the NLSY-97, namely, whether the sibling overlap is correlated with AFQT. The issue here is that we do not have an ability measure in the HRS. This is one of the reasons why a within-family (fixed effect) specification is useful with the HRS, since it accounts for time-invariant family-specific ability differences that might arise from the home environment. Nevertheless, there are obviously ability differences between children within a family. If closely spaced children had significantly different ability than children with greater birth spacing, our HRS-based estimates might be biased. For this bias to explain most or all of the results, it must be the case that the ability levels of closely spaced children *exceed* the ability levels of children spaced apart in families where we do not observe post schooling transfers (constrained families, or families with $g_2 = 0$). Theory, if anything, would suggest the opposite, especially if families with closely spaced kids are resource-constrained over their life-cycle.

We examine the relationship between sibling overlap and AFQT making use of the NLSY-97. We regress AFQT on sibling overlap (measured in the same way we measure it in the HRS) and covariates that we expect to be correlated with AFQT, including mother's education, parental income, parental income squared, indicator variables for the number of siblings, female, black, Hispanic, broken home, living in an urban area, and living in the South. Sibling overlap is significantly correlated with AFQT, but the relationship is negative, and the empirical magnitude is -0.51, while the standard deviation of AFQT is 29.2 in the sample. Hence, we find it implausible that unobserved ability accounts for the empirical patterns we document in the HRS data.

[29] The mean financial aid for all NLSY-97 college students is slightly under $3,000.

IV. Conclusions

This paper presents a theory of efficient human capital investment, focusing on the roles of parent and child decisions, and financial aid. The theory implies that financial aid matters to the educational attainment of intergenerationally constrained children who receive no post-schooling gifts from their parents, but not to the attainment of intergenerationally unconstrained children. These effects rely on an asymmetry in the access of parents and their college-aged children to credit.

Estimates using data from the HRS and NLSY support each of the model's major predictions. Based on an idiosyncrasy in the dependence of U.S. financial aid on the number of children a parent has in college, we use years of overlap with siblings in college ages as a proxy for financial aid. We find that children whose parents are not observed to make post-schooling cash gifts or whose parents are less affluent respond to financial aid in their choice of schooling. Children of parents who do make gifts or who are more affluent do not. These results suggest that parents can relieve educational borrowing constraints for their children, but that they do not always choose to do so. They further indicate that parents and children make distinct choices regarding children's schooling, and that these choices may well be consequential for financial aid policy.

Two additional sharp predictions arise from the theory that we examine using the NLSY-97. First, when parents make no contribution to college and their expected family contribution is positive, borrowing constraints imply the probability of completing college should decline with parental income. Second, income should not affect the educational attainment of families with expected financial contributions of $0, conditioning on ability and other factors thought to affect educational attainment. Preliminary evidence is consistent with both of these predictions. We also provide evidence from the NLSY-97 that shows a sibling overlap variable, like the one we used with the HRS, is positively, significantly correlated with the receipt of financial aid; and that while sibling overlap is negatively correlated with AFQT, the magnitude of the relationship is small. Both results support underlying assumptions of the HRS-based analysis.

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Appendix: Proofs

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

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

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

Assume an equilibrium consisting of

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

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

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

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

Proof of Proposition 1:

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

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

$$\text{s.t.} \quad c_1^p + a^p + e^p + g_1 = x^p,\ c_2^p = Ra^p - g_2(Ra^p, h(e^p + \tau)), \tag{7}$$
$$c_2^k = h(e^p + \tau) + g_2(Ra^p, h(e^p + \tau)),\ g_2(Ra^p, h(e^p + \tau)) \text{ as in (1)},$$
$$\text{and } e^k \geq 0 \ \&\ a^k \geq 0 \text{ binding for the child.}$$

Recall that the requirement that condition (3) holds is equivalent to the requirement that $e^k \geq 0$ and $a^k \geq 0$ bind. Suppose that the parent is permitted to choose g_2 such that $u'(Ra^p - g_2) = \alpha u'(h(e^p + \tau) + g_2)$, even if this implies $g_2 < 0$. Without imposing (3), the parent's choice of (g_1, a^p, e^p) meets conditions

$$\begin{aligned} &u'(c_1^p) = \alpha u'(c_1^k),\ u'(c_1^p) = \beta R u'(c_2^p),\ h'(e^p + \tau) = R, \text{ and } u'(c_2^p) = \alpha u'(c_2^k), \\ &\text{where } c_1^p = x^p - g_1 - e^p - a^p,\ c_1^k = g_1,\ c_2^p = Ra^p - g_2, \text{ and } c_2^k = h(e^p + \tau) + g_2. \end{aligned} \quad (8)$$

Conditions (8) imply $u'(c_1^k) = \beta R u'(c_2^k)$. In transfer expression (1), $\frac{\partial g_2}{\partial(h(e^p + \tau))} \leq 0$. Given $h'(e^p + \tau) = R$ and $c_1^k = g_1$ in (8), it must be the case that

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

and therefore (3) is satisfied at the parent's preferred feasible (g_1, a^p, e^p). Conditions (8) are met by a unique set of consumption levels $\{c_1^p, c_2^p, c_1^k, c_2^k\}$. If conditions (8) can be met with $g_2 \geq 0$, then these consumption levels result from the parent's optimal actions given her resource constraints and the choices available to the child.

However, it is possible that conditions (8) cannot be met with $g_2 \geq 0$. Where $g_2 \geq 0$ binds for the parent, the solution to (7) is such that

$$\begin{aligned} &u'(c_1^p) = \alpha u'(c_1^k),\ u'(c_1^p) = \beta R u'(c_2^p),\ \ h'(e^p + \tau) > R,\ u'(c_2^p) > \alpha u'(c_2^k), \\ &\&\ u'(c_1^k) = \beta h'(e^p + \tau) u'(c_2^k), \\ &\text{where } c_1^p = x^p - g_1 - e^p - a^p,\ c_1^k = g_1,\ c_2^p = Ra^p,\ \&\ c_2^k = h(e^p + \tau). \end{aligned} \quad (9)$$

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

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

so that again (3) need not be imposed. Like conditions (8), conditions (9) are satisfied by a unique set of consumption levels $\{c_1^p, c_2^p, c_1^k, c_2^k\}$. In either case, Lemma 2 implies that the parent's lifetime welfare at this consumption vector, $u(c_1^p) + \beta u(c_2^p) + \alpha\left(u(c_1^k) + \beta u(c_2^k)\right)$, represents the maximum equilibrium welfare available to the parent given the resource constraints and the child's available choices. The uniqueness of the consumption levels that solve (7) implies that no other set of feasible consumption levels yields higher welfare for the parent, and therefore $\{c_1^p, c_2^p, c_1^k, c_2^k\}$ represents the family's unique equilibrium consumption, completing the proof of *(i)*.

We know, based on (8) and (9), that $\{c_1^p, c_2^p, c_1^k, c_2^k\}$ can be generated by only one set of parental choices $\{g_1, a^p, e^p, g_2\}$ at which $e^k \geq 0$ and $a^k \geq 0$ bind . It may still be the case, however, that this same consumption path can be supported by different transfers and investments where e^k and a^k take positive values. Define $\left\{c_1^p(0), c_2^p(0), c_1^k(0), c_2^k(0),\ g_1(0), a^p(0), e^p(0), g_2(0)\right\}$ as the values of $\left\{c_1^p, c_2^p, c_1^k, c_2^k, g_1, a^p, e^p, g_2\right\}$ in the only equilibrium in which $e^k + a^k = 0$. The parent transfers to the child through $g_1(0)$, $e^p(0)$, and $g_2(0)$. We seek to determine whether the same consumption is supported where the parent transfers some portion of $g_2(0)$ or $e^p(0)$ through g_1, expecting the child to save for herself or invest in her own education.

Where $g_2(0) > 0$, the answer is clear. The child's choices of e^k and a^k meet condition (2) where $e^k + a^k > 0$. Whenever $g_2(0) > 0$, (1), (2), and $h'(e^p) = R$ together imply $u'(c_1^k) < \beta R u'(c_2^k)$. However, among conditions (8) is the requirement that $u'(c_1^k) = \beta R u'(c_2^k)$. Thus whenever $g_2(0) > 0$, the parent and the child disagree on the child's optimal intertemporal consumption path. Allowing the child to save independently or invest in her own education will lead to consumption other than $\{c_1^p(0), c_2^p(0), c_1^k(0), c_2^k(0)\}$. Thus the $e^k + a^k = 0$ equilibrium is the only set of actions that supports the parent's preferred $\{c_1^p, c_2^p, c_1^k, c_2^k\}$. The parent chooses $\{g_1, a^p, e^p, g_2\} = \{g_1(0), a^p(0), e^p(0), g_2(0)\}$ as in (4) in this unique equilibrium, imposing $e^k + a^k = 0$ and $h'(e^p + \tau) = R$. This completes the proof of *(ii)*.

Where $g_2(0) = 0$, however, the parent may reallocate transfers and still achieve $\{c_1^p(0), c_2^p(0), c_1^k(0), c_2^k(0)\}$. Only the reallocation of e^p to g_1 must be considered. Define $\underline{e}$ such that $u'(Ra^p(0)) = \alpha u'(h(\underline{e} + \tau))$. Suppose that the parent increases g_1 to $g_1 = g_1(0) + \varepsilon$, where $\varepsilon \in \left(0, e^p(0) - \underline{e}\right]$, while maintaining $a^p = a^p(0)$ and $g_1 + e^p = g_1(0) + e^p(0)$. Since $e^p \geq \underline{e}$, the second period transfer is still zero. Further, the child's choice of $e^k = 0$ given $\left(g_1(0), a^p(0), e^p(0)\right)$ implies that she chooses an e^k at which $e^p + e^k \leq e^p(0)$ given $\left(g_1(0) + \varepsilon, a^p(0), e^p(0) - \varepsilon\right)$. Therefore, by conditions (9), $h'(e^p + e^k + \tau) > R$ and the child's condition (2) determining her choice of e^k reduces to

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

Since the above agrees with the intertemporal condition on the child's consumption in (9), we see that the parent's reallocation of $\varepsilon \in \left(0, e^p(0) - \underline{e}\right]$ from e^p to g_1 results in the same equilibrium $\{c_1^p(0), c_2^p(0), c_1^k(0), c_2^k(0)\}$. Finally, condition (2) and the definition of $\underline{e}$ together indicate that where p reallocates $\varepsilon \in \left(e^p(0) - \underline{e}, e^p(0)\right]$ from e^p to g_1 the child's educational investment may or may not be such that conditions (9) hold. Therefore where $g_2(0) = 0$ there does exist a continuum of

equilibria $\{g_1, a^p, e^p, a^k, e^k\} \in \left[\{g_1(0), a^p(0), e^p(0), 0, 0\},\ \{g_1(0) + e^p(0) - \underline{e}, a^p(0), \underline{e}, 0, e^p(0) - \underline{e}\} \right]$ that support the unique equilibrium values of $\{c_1^p, c_2^p, c_1^k, c_2^k\}$, and there may exist further equilibria
$\{g_1, a^p, e^p, a^k, e^k\} \in \left[\{g_1(0) + e^p(0) - \underline{e}, a^p(0), \underline{e}, 0, e^p(0) - \underline{e}\},\ \{g_1(0) + e^p(0), a^p(0), 0, 0, e^p(0)\} \right]$ that support the unique equilibrium values of $\{c_1^p, c_2^p, c_1^k, c_2^k\}$. Each possible equilibrium satisfies (9) and therefore implies $h'(e^p + e^k + \tau) > R$, completing the proof of *(iii)*.

Proof of Proposition 2*:* In the type I equilibrium,

$$h'(e^p + e^k + \tau) = R$$
$$\Rightarrow e^p + e^k = h'^{-1}(R) - \tau.$$

Since $h'^{-1}(R)$ is a fixed and exogenous level of investment, $\frac{\partial(e^p + e^k)}{\partial \tau} = -1$ and total educational investment is invariant to the child's financial aid.

The type II equilibrium requires only that $h'(e^p + e^k + \tau) > R$, and in it only $G_1 = g_1 + e^p$ is determined. Recall that $e = e^p + e^k + \tau$. Suppose $\frac{\partial(e^p + e^k)}{\partial \tau} \le -1$. Then $\frac{\partial e}{\partial \tau} \le 0$, $\frac{\partial c_2^k}{\partial \tau} = \frac{\partial h(e)}{\partial \tau} \le 0$ and $u'(c_1^k) = \beta h'(e) u'(h(e))$ from conditions (5) for the type II equilibrium implies $\frac{\partial c_1^k}{\partial \tau} \le 0$. With $u'(c_1^p) = \alpha u'(c_1^k)$ and $u'(c_1^p) = \beta R u'(c_2^p)$ from conditions (5), $\frac{\partial c_1^k}{\partial \tau} \le 0$ implies $\frac{\partial c_1^p}{\partial \tau} \le 0$ and $\frac{\partial c_2^p}{\partial \tau} \le 0$. Together these conditions imply $c_1^p + \frac{c_2^p}{R} + c_1^k + h^{-1}(c_2^k)$ is (weakly) decreasing in τ, contradicting the implication of $c_2^p = Ra^p$, $c_2^k = h(e)$ and the combined asset constraints of the problem that $c_1^p + \frac{c_2^p}{R} + c_1^k + h^{-1}(c_2^k) = x^p + \tau$. Therefore $\frac{\partial(e^p + e^k)}{\partial \tau} > -1$ in the type II equilibrium.

(i) Where $\tau'(x^p) < 0$, as long as x^p, α, τ and $h(\cdot)$ are such that $e^p + e^k = 0$ in equilibrium, $\frac{de}{dx^p} < 0$. *(ii)* Where $\tau'(x^p) = 0$, $\frac{de}{dx^p} \ge 0$.

Proof of Proposition 3*:* The $h'(\tau) > R$ assumption implies that wherever $e^p + e^k = 0$ in equilibrium, the family is in an equilibrium of type II. In the type II equilibrium,

$$\frac{de}{dx^p} = \frac{d(e^p + e^k)}{dx^p} + \frac{d\tau}{dx^p}. \qquad (10)$$

As long as x^p, α, τ and $h(\cdot)$ are such that $e^p + e^k = 0$ in equilibrium, $\frac{de}{dx^p} = \frac{d\tau}{dx^p} < 0$, completing the proof of *(i)*.

As before, in the type I equilibrium,

$$h'(e^p + e^k + \tau) = R$$
$$\Rightarrow e^p + e^k + \tau = e = h'^{-1}(R).$$

Since $e = h'^{-1}(R)$ is a fixed and exogenous level of investment, $\frac{de}{dx^p} = 0$ and total educational investment is invariant to the parent's wealth, as long as on x^p, α, τ and $h(\cdot)$ are such that the equilibrium is of type I.

In the type II equilibrium, however, (10) applies. No exogenously set condition on the relative returns fixes educational investment. The ambiguity of the allocation of G_1 to e^p and g_1, and the resulting ambiguity in the levels of e^p and e^k, imply ambiguous signs for $\frac{de^p}{dx^p}$ and $\frac{de^k}{dx^p}$. However, conditions (5) do imply $\frac{d(e^p + e^k)}{dx^p} > 0$ as long as $x^p + \tau(x^p)$ increases with x^p. Where we assume $\tau'(x^p) = 0$, then, for x^p, α, τ and $h(\cdot)$ such that the equilibrium is of type II, $\frac{de}{dx^p} = \frac{d(e^p + e^k)}{dx^p} > 0$, completing the proof of *(ii)*.

Table 1: Child-Level Descriptive Statistics for the Health and Retirement Study Samples

Variable	Sample	Sample size	Mean	Median	Standard deviation
Parent made any gift to children, 1998-2000	2000 Core	34,373	0.3223	0.0000	0.4712
Parent ever made major gift to child	1994 Module	1262	0.3700	0.0000	0.4988
Parent's 2000 household income	2000 Core	34,583	$42,105	$26,000	$65,372
	1994 Module	1262	$48,975	$35,000	$49,734
Parent's 2000 household net worth	2000 Core	34,597	$299,169	$111,000	$798,017
	1994 Module	1262	$309,531	$149,950	$571,914
Child years of education	2000 Core	34,650	13.80	13.00	6.881
	1994 Module	1262	13.30	12.00	2.194
Child gender (male = 1)	2000 Core	34,650	0.5001	1.0000	0.5000
	1994 Module	1262	0.4857	0.0000	0.5000
Child age in 2000	2000 Core	34,650	41.83	41.00	9.65
	1994 Module	1262	40.73	41.00	6.45
Step child of either parent indicator	2000 Core	34,650	0.1153	0.0000	0.3194
	1994 Module	1262	0.1363	0.0000	0.34
Oldest child indicator	2000 Core	34,650	0.2861	0.0000	0.4519
	1994 Module	1262	0.2647	0.0000	0.4413
Youngest child indicator	2000 Core	34,650	0.2616	0.0000	0.4395
	1994 Module	1262	0.2361	0.0000	0.4249
Years of overlap with siblings' college ages	2000 Core	34,650	2.337	2.000	2.134
	1994 Module	1262	2.631	2.000	2.141

Note: Sample children are aged 24 and older.

Table 2: Family Fixed Effect Estimates of Years of Schooling, HRS, Gift v. No Gift

	1998-2000 Gifts to Children		Transfer Module Gifts to Children	
	Gifts	No Gifts	Gifts	No Gifts
Independent variable	**Parameter (Std error)**	**Parameter (Std error)**	**Parameter (Std error)**	**Parameter (Std error)**
Child gender, male=1	-0.3302***	-0.0787	-0.2485	-0.3154**
	(0.1081)	(0.0750)	(0.1950)	(0.1339)
Child age	-0.0089	-0.0299***	-0.0077	-0.0489***
	(0.0162)	(0.0101)	(0.0290)	(0.0180)
Stepchild of either parent indicator	1.0077***	0.4707***	0.0019	-0.2034
	(0.2047)	(0.1596)	(0.3001)	(0.2472)
Oldest child indicator	0.2237	0.2334**	0.0793	0.2893
	(0.1446)	(0.1020)	(0.2595)	(0.1856)
Youngest child indicator	0.1411	-0.0773	0.1871	-0.0456
	(0.1550)	(0.1068)	(0.2652)	(0.1948)
Sibling-years of overlap	0.0387	0.0842***	-0.0503	0.0941**
in college ages	(0.0400)	(0.0256)	(0.0643)	(0.0458)
Number of Children	11,080	23,293	467	795
Number of Families	3278	6125	125	209
R-squared	0.5233	0.6016	0.5713	0.5946
Adjusted R-squared	0.3225	0.4593	0.4055	0.4450

* indicates significance at the 10 percent, ** at the 5 percent, and *** at the 1 percent level.

Table 3: Family Fixed Effect Estimates of Years of Schooling, HRS, Income & Net Worth

	Household Income		Household Net Worth	
	> 25,000	**<= 25,000**	**> 100,000**	**<= 100,000**
Independent variable	**Parameter (Std error)**	**Parameter (Std error)**	**Parameter (Std error)**	**Parameter (Std error)**
Child gender, male=1	-0.1143	-0.2111**	-0.0165	-0.3042***
	(0.0835)	(0.0922)	(0.0685)	(0.1044)
Child age	-0.0048	-0.0415***	-0.013	-0.0345**
	(0.0130)	(0.0119)	0.0106)	(0.0134)
Stepchild of either parent indicator	0.8965***	0.4708**	0.2800**	1.2796***
	(0.1490)	(0.2273)	(0.1322)	(0.2287)
Oldest child indicator	0.1372	0.3093**	0.2528***	0.1913
	(0.1124)	(0.1265)	(0.0924)	(0.1431)
Youngest child indicator	0.0551	-0.0682	0.0179	-0.0047
	(0.1189)	(0.1325)	(0.0971)	(0.1515)
Sibling-years of overlap	0.0186	0.1206***	0.0480*	0.0935***
in college ages	(0.0311)	(0.0305)	(0.0259)	(0.0339)
Number of Children	17,518	17,065	18,113	16,484
Number of Families	5141	4321	5353	4115
R-squared	0.5627	0.6632	0.6999	0.5771
Adjusted R-squared	0.3808	0.5488	0.5738	0.4361

* indicates significance at the 10 percent, ** at the 5 percent, and *** at the 1 percent level.

Table 4: Descriptive Statistics for the NLSY-97 Estimation Samples

	Parent Doesn't Pay for College, EFC > 0		All Parents, EFC = 0	
Variable Name	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Completed college	0.108	0.311	0.046	0.210
Parent's 1997 income, 1000s	46.902	30.877	8.253	5.402
AFQT	52.552	25.750	29.390	24.815
Mother's education < HS	0.171	0.377	0.438	0.496
Mother HS grad	0.376	0.485	0.350	0.477
Mother some college	0.453	0.498	0.212	0.409
Number of siblings	2.261	1.529	2.693	1.934
Female	0.525	0.500	0.543	0.498
Black	0.237	0.425	0.438	0.496
Hispanic	0.172	0.378	0.301	0.459
Broken home	0.483	0.500	0.818	0.386
Urban	0.721	0.449	0.790	0.407
South	0.327	0.469	0.471	0.499
12 years old in 1997 wave	0.196	0.398	0.230	0.421
13 years old in 1997 wave	0.202	0.402	0.220	0.414
14 years old in 1997 wave	0.213	0.410	0.215	0.411
15 years old in 1997 wave	0.209	0.407	0.190	0.392
16 years old in 1997 wave	0.180	0.384	0.146	0.353
	n=545		n=801	

Table 5: Linear Probability Estimates of College Completion, NLSY-97

	Parent Doesn't Pay for College, EFC > 0		All Parents, EFC = 0	
Independent variable	**Parameter**	**(Std Error)**	**Parameter**	**(Std Error)**
Parent's 1997 income, 1000s	-0.0023*	0.0011	-0.0078	0.0014
Parent's income (in 1000s) squared	0.0000116*	6.14E-06	-4.48E-05	3.98E-05
AFQT / 100	0.2014***	0.0577	0.1578***	0.0397
Mother's education < HS	0.0352	0.0404	-0.0194	0.0212
Mother HS grad	-0.0160	0.0282	-0.0273	0.0222
Number of siblings	-0.0044	0.0079	-0.0076*	0.0039
Female	0.0838***	0.0258	0.0128	0.0141
Black	0.0025	0.0338	0.0289	0.0194
Hispanic	0.0394	0.0402	0.0112	0.0209
Broken home	-0.0337	0.0269	-0.0522**	0.0232
Urban	-0.0598*	0.0336	0.0037	0.0201
South	-0.0150	0.0295	0.0009	0.0163
12 years old in 1997 wave	-0.1662***	0.0395	-0.0862***	0.0257
13 years old in 1997 wave	-0.1120***	0.0437	-0.0680**	0.0279
14 years old in 1997 wave	-0.0401	0.0483	-0.0264	0.0300
15 years old in 1997 wave	-0.0098	0.0499	-0.0052	0.0331
Constant	0.1612***	0.0683	0.1068**	0.0452
Number of Children	545		794	
R-squared	0.1105		0.2864	

* indicates significance at the 10 percent, ** at the 5 percent, and *** at the 1 percent level.

Figure 1

2006-2007 EFC FORMULA A: DEPENDENT STUDENT

REGULAR WORKSHEET Page 1 **A**

PARENTS' INCOME IN 2005	
1. Parents' Adjusted Gross Income (FAFSA/SAR #73) If negative, enter zero.	
2. a. Father's/stepfather's income earned from work (FAFSA/SAR #76) ______	
2. b. Mother's/stepmother's income earned from work (FAFSA/SAR #77) + ______	
Total parents' income earned from work =	
3. Parents' Taxable Income (If tax filers, enter the amount from line 1 above. If non-tax filers, enter the amount from line 2.)*	
4. Untaxed income and benefits:	
• Total from FAFSA Worksheet A (FAFSA/SAR #78) ______	
• Total from FAFSA Worksheet B (FAFSA/SAR #79) + ______	
Total untaxed income and benefits =	
5. Taxable and untaxed income (sum of line 3 and line 4)	
6. Total from FAFSA Worksheet C (FAFSA/SAR #80) −	
7. **TOTAL INCOME** (line 5 minus line 6) May be a negative number. =	
ALLOWANCES AGAINST PARENTS' INCOME	
8. 2005 U.S. income tax paid (FAFSA/SAR #74) (tax filers only) If negative, enter zero.	
9. State and other tax allowance (Table A1) If negative, enter zero. +	
10. Father's/stepfather's Social Security tax allowance (Table A2) +	
11. Mother's/stepmother's Social Security tax allowance (Table A2) +	
12. Income protection allowance (Table A3) +	
13. Employment expense allowance:	
• Two working parents: 35% of the lesser of the earned incomes, or $3,100, whichever is less	
• One-parent families: 35% of earned income, or $3,100, whichever is less	
• Two-parent families, one working parent: enter zero +	
14. **TOTAL ALLOWANCES** =	

*STOP HERE if **both** of the following are true: line 3 is $16,000 or less, **plus** the student **and** parents are eligible to file a 2005 IRS Form 1040A or 1040EZ (they are not required to file a 2005 Form 1040), or they are not required to file any income tax return. If both circumstances are true, the Expected Family Contribution is automatically zero.

AVAILABLE INCOME	
Total income (from line 7)	
Total allowances (from line 14) −	
15. **AVAILABLE INCOME (AI)** May be a negative number. =	
PARENTS' CONTRIBUTION FROM ASSETS	
16. Cash, savings & checking (FAFSA/SAR #81)	
17. Net worth of investments** (FAFSA/SAR #82) If negative, enter zero.	
18. Net worth of business and/or investment farm (FAFSA/SAR #83) If negative, enter zero.	
19. Adjusted net worth of business/farm (Calculate using Table A4.) +	
20. **Net worth** (sum of lines 16, 17, and 19) =	
21. Education savings and asset protection allowance (Table A5) −	
22. Discretionary net worth (line 20 minus line 21) =	
23. Asset conversion rate ×	.12
24. **CONTRIBUTION FROM ASSETS** If negative, enter zero. =	
PARENTS' CONTRIBUTION	
AVAILABLE INCOME (AI) (from line 15)	
CONTRIBUTION FROM ASSETS (from line 24) +	
25. **Adjusted Available Income (AAI)** May be a negative number. =	
26. **Total parents' contribution from AAI** (Calculate using Table A6.) If negative, enter zero.	
27. **Number in college in 2006-2007** (Exclude parents) (FAFSA/SAR #66) ÷	
28. **PARENTS' CONTRIBUTION** (standard contribution for nine month enrollment)*** If negative, enter zero. =	

**Do *not* include the family's home.

***To calculate the parents' contribution for other than nine month enrollment, see page 11.

continued on the next page