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Parent–child bargaining, parental transfers, and the post-secondary education decision

Charlene Kalenkoski

Department of Economics, Ohio University, Athens, Ohio, USA

E-mail: kalenkos@ohio.edu

Schooling decisions are often modelled within a unitary preference framework. In this article, an alternative to the unitary preference model is proposed in which parents and child have conflicting preferences over parental transfers and the level of post-secondary schooling and participate in cooperative bargaining as a means of resolving this conflict. Comparisons of the implications of the bargaining and unitary preference models motivate tests of parental altruism and income pooling. To test these hypotheses, reduced form transfer and schooling equations are estimated using data from the High School and Beyond Surveys. The evidence suggests that the unitary preference model be rejected.

I. Introduction

The standard models used throughout the human capital literature to examine the educational and earnings outcomes achieved by children are unitary preference models, with either parents making all of the schooling decisions for their children or an individual child making all of the schooling decisions for himself, given some level of parental resources. The importance of these human capital decisions lies in the fact that they are major determinants of a child's future earnings, and hence, his consumption. These models, however, ignore or assume away the process by which parents and children resolve any disagreements.

Disagreements between parents and child may arise over whether or not the child should attend college, how much effort the child should expend if college is chosen, and how the financial cost of such an undertaking would be split between them. Parents may disregard their child's effort disutility, parents and child may have different rates of time preference, or the child may lack concern over his parents' consumption.

Sometimes, ignoring such disagreement may be appropriate. When a child is very young, he must rely completely on his parents for financial support. Hence, even if he disagrees with his parents, his parents are likely to have all of the bargaining power, and a model in which his parents make all decisions is appropriate. On the other hand, when a child is grown up and financially independent from his parents, he has all of the bargaining power. In this case, a model in which the adult child makes all of the decisions is appropriate. However, for a college-age child, the disposition of bargaining power is less clear. On the one hand, a college student has access to nonparental funds for post-secondary schooling, including his own earnings and financial aid. On the other hand, he may find it difficult to completely finance the level of schooling he desires with such resources. Time constraints limit the amount of time a student can work to pay for school. In addition, need-based financial aid for undergraduate students

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(including both grants and loans) is awarded assuming that parents make an Expected Parental Contribution (EPC) towards their child's post-secondary education. If parents do not pay, a student may be unable to cover the difference.[1] Federally-guaranteed student loans are also subject to loan maximums. Finally, private loans are often unattainable by students without parents willing to co-sign them. For students constrained by any of these factors, parental transfers matter, and it thus becomes important how disagreements with their parents are resolved.

This article addresses parent–child disagreement over the level and parental financing of post-secondary education by introducing conflicting preferences and parent–child bargaining into the modelling of the post-secondary education decision. A cooperative bargaining model is proposed in which parents' consumption, their child's consumption, and the child's level of post-secondary schooling are explicit choice variables and the level of parent-to-child transfers is an implicit choice variable. The implications of this bargaining model for the level of post-secondary schooling and the dollar value of parental transfers are then compared to those of the corresponding unitary preference model.

These comparisons lead to several testable hypotheses. First, the unitary preference model implies that only pooled income enters the demand function for schooling (the income pooling hypothesis), while the bargaining model allows parents' and child's incomes to enter separately. Thus, empirical evidence showing that parents' and child's incomes have different effects on the level of schooling would reject the unitary preference model but be consistent with the bargaining model. Second, while the unitary preference model allows only positive income effects and negative price effects on schooling, the bargaining model also allows negative income effects and positive price effects. Thus, empirical evidence of negative income effects or positive price effects would reject the unitary preference model but would be consistent with the bargaining model. Finally, while it is an implication of the unitary preference model that a 1 dollar increase in child's income along with a simultaneous 1 dollar reduction in parents' income reduces the level of parent-to-child transfers by 1 dollar (the parental altruism hypothesis), the bargaining model allows for both a reduction in transfers of less than or more than 1 dollar as well as an increase in transfers. Therefore, empirical evidence showing something other than a dollar reduction in transfers would be a rejection of the unitary preference model but would be consistent with the bargaining model.

In order to test these hypotheses, reduced form equations for transfers and schooling are estimated. In these estimations there are two important econometric issues that are addressed. First, these hypotheses must be tested for children in cooperating families, those families in which parents make a transfer. However, whether or not transfers are made is only observed if the child enrols in a post-secondary programme. Therefore, the reduced form equations for transfers and schooling are estimated on the subsample of respondents who both enrol in post-secondary school and receive parental transfers. This sample selection is addressed using a two-stage selectivity correction procedure. Second, because three of the right-hand-side variables in the transfer and schooling equations are potentially endogenous, the price of schooling, the dollar value of scholarships and grants received, and the child's income, predicted variables replace the actual variables in these equations.

The data used to test these hypotheses are restricted-use student-level data from the High School and Beyond Surveys conducted for the National Center for Education Statistics (NCES), US Department of Education, by the National Opinion Research Council (NORC). Respondents to this survey were high school sophomores in 1980 and were reinterviewed in 1982, 1984, 1986 and 1992. In addition to results for the full sample, results are provided for subsamples defined according to whether parents want more, parents want less, or there is no disagreement over the level of schooling. This is done in order to determine whether negative income effects and/or positive price effects for those groups most predisposed to them are revealed by the data.

This article proceeds as follows. Section II overviews the related schooling, intergenerational transfer, and family bargaining literatures. Section III presents both the unitary preference and bargaining models and compares and contrasts their implications. Section IV introduces the data and discusses the construction and relevance of key variables. Section V presents the econometric model and the hypotheses to be tested. Section VI describes and interprets the main empirical results as well as results from several sensitivity analyses. Section VII concludes with an overall interpretation of the results and directions for future research.

[1]Kalenkoski (2005) provides evidence that a substantial percentage of parents contribute less than their EPC.

II. Literature Review

Models used throughout the human capital literature to examine the educational and earnings outcomes achieved by children can be categorized into one of two types. Models of the first type assume that parents have total control over decisions regarding their child's human capital. In these models a child's earnings are determined entirely by his initial endowment, his parents' investments in his human capital, and his 'market luck'. Examples of such models include those of Becker and Tomes (1976, 1979, 1986) and Becker (1981, 1993). A major characteristic of these models is that they abstract from any sort of schooling decisions a child will eventually make for himself, relying on the assumption of parental altruism and Becker's Rotten Kid Theorem (Becker, 1974) to assume away any parent–child conflict.

The parental altruism assumed by the Rotten Kid Theorem is parents' complete acceptance of their child's preferences (i.e. goods that affect the child's utility enter into the parents' utility function only through the child's utility function). With regard to the post-secondary decision, however, this is probably not the case. A more realistic assumption is that parents may have paternalistic preferences (Pollak, 1988). With paternalistic preferences, a child's utility may enter his parents' utility function, but his parents may also have direct and conflicting preferences over goods, such as schooling, over which the child also has direct preferences. For example, parents may want their child to attend their college alma mater even though their child would rather attend a different school that all of his friends are attending. Or, parents may feel their child is too myopic when it comes to his education decisions. Alternatively, a child may want to go to college even though his parents would prefer him to work in the family business.

In contrast to this parent-as-decision maker type of model, the second type of human capital model focuses on a young adult's own schooling decisions (e.g. whether or not to attend college), given some pre-existing endowment determined both by inherent ability and previous investments by parents. Such a sequential parent-then-child approach has led to numerous regressions of schooling variables on standardized test scores, family background, and neighbourhood and peer characteristics. Recent examples include Tobias (2003) who investigates the effects of cognitive ability and high school quality on college entry decisions, Lemke and Rischall (2003) who use parental education as an instrument for schooling in a wage equation, Ioannides (2003) who analyzes the effects of parents' education and education level of census tract on an individual's education, and Rainey and Murova (2004) who examine the relationships between ACT scores and characteristics of school districts in Arkansas, Louisiana, Oklahoma, and Texas. An excellent survey of much of the earlier literature can be found in Haveman and Wolfe (1994, 1995).

Neither the parent-as-decision maker nor the child-as-decision maker models allow for disagreement between a parent and child to affect education decisions.[2] The intergenerational transfer literature, however, has not ignored such parent–child conflict. In this literature, parents are often assumed to be less than perfectly altruistic and children's concerns often directly conflict with their parents'. In these models, transfers are used as a strategic device by parents to regulate their children's behaviour. For example, in Bernheim *et al.* (1985), parents provide strategic bequests to their adult children to induce them to visit more often than they otherwise would. In Pollak (1988), parents provide strategic transfers to their children to increase their consumption of particular merit goods. More recently, Hao *et al.* (2000) formulate a bargaining model in which parents provide strategic transfers to their children to deter them from taking an action, in this case having a teen birth, that they deem undesirable.

Many empirical analyses in the transfer literature have attempted to determine whether the data are more consistent with the 'altruistic parents' models or with those in which parents are not so altruistic (Menchik, 1980; Wilhelm, 1996; Bernheim *et al.*, 1985; Cox and Rank, 1992; Altonji *et al.*, 1997; McGarry and Schoeni, 1995; McGarry, 2000). Their results cannot be generalized, however, because the studies differ widely across choice variables, age groups, whether or not in-kind transfers are considered, and whether the transfers considered are bequests or *inter-vivos* transfers. Looking at bequests made by parents to multiple children, Menchik (1980) finds that equal sharing among children is the rule, rather than the exception, a result which does not support the altruism model put forth by Becker and Tomes (1976). Wilhelm (1996) tests a more general model of parental altruism that is consistent with the extensive amount of equal division in the data, yet still rejects parental altruism. Bernheim *et al.* (1985), who also

[2] There are several studies that allow disagreement *between parents* to affect their children's human capital. For example, see Thomas (1994).

look at bequests, find that bequests are often used as compensation for services provided by beneficiaries, evidence inconsistent with the altruism model. Cox and Rank (1992) and Altonji *et al*. (1997) focus on *inter-vivos* transfers rather than bequests and test the implication of the altruism model that an increase in child's income by 1 dollar, along with a decrease in parents' income by 1 dollar, results in a reduction in parental transfers of 1 dollar, a result that does not hold in exchange models (models in which parents expect to obtain something for their transfers). They obtain results that are more consistent with exchange models than with altruistic models. However, analyzes of *inter-vivos* transfers by McGarry and Schoeni (1995) and McGarry (2000) do not reject the altruism model.

Another literature that focuses on conflict between household members is the family bargaining literature. The driving force behind this literature is the idea that the unitary preference model of household decision making is inappropriate in cases where household members (usually husbands and wives) have conflicting preferences, and a cooperative bargaining model in which the Nash bargaining solution is the method of resolving conflict is often proposed as an alternative. An important testable implication of this Nash model is that income is not pooled (Manser and Brown, 1980, McElroy and Horney, 1981). This means that household members' incomes enter separately into the Nash-bargained demand functions, unlike the unitary preference demand functions which depend only on total household income. It is important to note, however, that a rejection of income pooling is also an implication of other cooperative and noncooperative bargaining models, such as the collective model of Browning and Chiappori (1998) and the noncooperative models of Lundberg and Pollak (1994), so a rejection of income pooling does not support the Nash model over any particular alternative to the unitary preference model. It does, however, reject the unitary preference model and is consistent with bargaining.

While the primary focus of these family bargaining models has been intrahousehold allocations between husbands and wives, two studies focus on intra-household allocations between parents and children. McElroy (1985) uses a cooperative bargaining model to investigate the labour supply and household membership decisions of young adult males, while Pezzin and Schone (1998) investigate the intergenerational household formation, female labour supply, and informal caregiving decisions that arise in the context of adult children's care for elderly parents. The model presented in this article extends this research on parent–child bargaining.

This article makes both theoretical and empirical contributions to these three different literatures. First, this article contributes to the human capital literature by incorporating parent–child disagreement and cooperative bargaining as a method of resolving this disagreement into a model of post-secondary schooling. It also contributes to the intergenerational transfer literature by investigating *inter-vivos* transfers from parents to child and testing the parental altruism hypothesis within the new context of the post-secondary education decision. Finally, this article contributes to the family bargaining literature by applying the standard cooperative bargaining model to decisions regarding a child's post-secondary education and by testing the income pooling hypothesis within this new context.

III. Theoretical Models

Unitary preference model

The basic unitary preference model assumes a single decision maker household with utility function given by $W(c^{\mathrm{p}}, c^{\mathrm{c}}, s)$, where c^{p}, c^{c}, and s are, respectively, the parents' consumption, the child's consumption, and the child's level of schooling, and $W(\cdot)$ is the parents' utility function.[3,4,5] Assume this utility function is twice continuously differentiable, nondecreasing, and quasiconcave. The household's budget constraint is given by

$$c^{\mathrm{p}} \cdot p_{\mathrm{p}} + c^{\mathrm{c}} \cdot p_c + s \cdot p_s = M_p + M_c \qquad (1)$$

[3] Post-secondary schooling has aspects of both an investment good and a consumption good as both gains in future earnings and current social or psychic benefits may be derived from it. This model assumes that utility is a direct function of s in order to abstract from the particular mechanisms by which schooling affects utility. See Collins and Snell (2000) for a discussion of school attributes of interest to parents choosing secondary schools for their children in the UK.

[4] This utility function nests a more restricted specification, $W(c^{\mathrm{p}}, U^{\mathrm{c}}(c^{\mathrm{c}}, s))$, which would explicitly allow the child's preferences to enter the parents' utility function.

[5] A child-as-decision maker unitary preference model in which the child is independent and selfish would ignore parents' consumption, c^{p}, and treat parental transfers as an exogenous source of income. The parent-as-decision maker unitary preference model is discussed here because it treats transfers as endogenous, facilitating comparisons between the unitary preference and the bargaining framework.

where p_p, p_c, and p_s are the respective prices of parents' consumption, child's consumption, and schooling, M_p is the parents' exogenous income, and M_c is the child's exogenous income. Note that by assuming that the price of schooling and child's income are exogenous, the model abstracts from school quality and labour-leisure–schooling choices, although the potential endogeneity of these variables is addressed in the empirical analysis. Maximizing the household utility function, W, subject to (1) and assuming an interior solution yields the following demand functions:

$$c_u^{\mathrm{p}*} = c_u^{\mathrm{p}}(p_p, p_c, p_s, M_p + M_c) \tag{2a}$$

$$c_u^{\mathrm{c}*} = c_u^{\mathrm{c}}(p_p, p_c, p_s, M_p + M_c) \tag{2b}$$

$$s_u^* = s_u(p_p, p_c, p_s, M_p + M_c) \tag{2c}$$

where * indicates solution values and the u subscript refers to the unitary preference model (to distinguish these demand functions from the bargained demand functions to be described next). Note that only pooled income, $M_p + M_c$, enters these demand functions, indicating that only total income, not the source of income, affects the level of schooling demanded. This is the unitary preference model's pooled income hypothesis, and can also be written in terms of the following comparative statics:

$$\frac{\partial c_u^{\mathrm{p}*}}{\partial M_p} = \frac{\partial c_u^{\mathrm{p}*}}{\partial M_c} \tag{3a}$$

$$\frac{\partial c_u^{\mathrm{c}*}}{\partial M_p} = \frac{\partial c_u^{\mathrm{c}*}}{\partial M_c} \tag{3b}$$

$$\frac{\partial s_u^*}{\partial M_p} = \frac{\partial s_u^*}{\partial M_c}. \tag{3c}$$

Another interesting implication of the unitary preference model relates to transfers. Let t_u^* be the amount of transfers parents make to their child, where $t_u^* = M_p - c_u^{\mathrm{p}*} \cdot p_p$. Taking partial derivatives with respect to M_p and M_c, we have $\partial t_u^*/\partial M_p = 1 - p_p(\partial c_u^{\mathrm{p}*}/\partial M_p)$ and $\partial t_u^*/\partial M_c = -p_p(\partial c_u^{\mathrm{p}*}/\partial M_c)$. Subtracting $\partial t_u^*/\partial M_p$ from $\partial t_u^*/\partial M_c$ and substituting from (3a), the implication of the unitary preference model with respect to transfers is:

$$\frac{\partial t_u^*}{\partial M_c} - \frac{\partial t_u^*}{\partial M_p} = -1 + p_p\left(\frac{\partial c_u^{p*}}{\partial M_p} - \frac{\partial c_u^{p*}}{\partial M_c}\right) = -1 \tag{4}$$

indicating that a 1 dollar increase in child's income accompanied by a simultaneous 1-dollar decrease in parents' income results in a reduction in parental transfers of 1 dollar. Other studies have referred to this income derivative restriction as the parental altruism hypothesis (Cox and Rank, 1992; McGarry and Schoeni, 1995; Altonji *et al.*, 1997; McGarry 2000) because the unitary preference model is often justified by the assumption of an altruistic head of household (Becker, 1974).[6]

Bargaining model

The simple bargaining model of household decision making that is presented here adapts McElroy and Horney's (1981) husband–wife bargaining model and McElroy's (1985) parent–child bargaining model to a situation in which parents and child bargain over consumption and post-secondary schooling decisions. The model requires several assumptions:

Assumption 1: *A household consists of two decision makers. Parents present a united front and thus act as one decision maker. Their child acts as the other.*

Assumption 2: *Parents and child have two decision-making options. They may choose either to make their decisions independently and without regard for each other* (*sever their relationship*) *or to participate in cooperative bargaining with each other, thus making joint decisions.*

Assumption 3: *If the parent–child relationship is severed, parents and child each maximize their own twice continuously differentiable, nondecreasing, quasiconcave utility function subject to their own budget constraint.*

At the severed relationship threat point, parents choose c^{p} to maximize $U^{\mathrm{p}}(c^{\mathrm{p}})$ subject to $c^{\mathrm{p}} \cdot p_p = M_p$ with the resulting indirect utility function given by $V^{\mathrm{p}}(p_p, M_p)$, the maximum utility the parents can attain in the absence of cooperation. Simultaneously, yet independently, the child chooses c^{c} and s to maximize $U^{\mathrm{c}}(c^{\mathrm{c}}, s)$, subject to his or her budget constraint, $c^{\mathrm{c}} \cdot p_c + s \cdot p_s = M_c$. The indirect utility resulting from this maximization is given by $V^{\mathrm{c}}(p_c, p_s, M_c)$, and is the maximum utility the child can attain in the absence of cooperation. Note that because the relationship between parent and child is severed, no transfers are made from parents to child or vice versa.

[6] The unitary preference model has also been justified by assuming the household head has dictatorial control over all household decisions.

Assumption 4: *If the parent–child relationship is not severed, the utility of the parent depends on the child's consumption and schooling. However, the child is selfish and cares only about his or her own consumption and schooling.*[7]

If the parent–child relationship is not severed, the parents' utility function is given by $U^{\mathrm{p}}(c^{\mathrm{p}}, c^{\mathrm{c}}, s)$ and the child's utility function is given by $U^{c}(c^{c}, s)$. Note that the selfish child assumption implies that any transfers will flow in the direction from parents to children. It also ensures that cooperating families will be those in which parents make a positive transfer. While this assumption affects the sample used to conduct the empirical analysis, it is relaxed in a sensitivity analysis discussed in Section VI and does not qualitatively affect the results.

Assumption 5: *The Nash bargaining solution is obtained as the result of bargaining between the parents and their child.*

To obtain the Nash bargaining solution, the cooperative state utility functions and the parents' and child's threat points described above are combined into the following cooperative state 'family' utility function:

$$N = [U^{\mathrm{p}}(c^{\mathrm{p}}, c^{\mathrm{c}}, s) - V^{\mathrm{p}}(p_p, M_p)][U^{\mathrm{c}}(c^{\mathrm{c}}, s) - V^{\mathrm{c}}(p_c, p_s, M_c)] \tag{5}$$

where N denotes the Nash product function. This Nash product function has been called the utility-gain product function (McElroy and Horney, 1981) because the first term, $[U^{\mathrm{p}} - V_p]$, is the parents' gain from cooperation (the difference in the parents' utility between the cooperative and noncooperative states), and the second term, $[U^{\mathrm{c}} - V^{\mathrm{c}}]$, is the child's gain from cooperation.

The cooperative Nash bargaining solution is used because it is 'intended to treat situations involving two individuals whose interests are neither completely opposed nor completely coincident. The two individuals are supposed to be able to discuss this situation and agree on a rational joint plan of action, whereas in a noncooperative model it is impossible for the players to communicate or collaborate in any way (Nash, 1953).' Thus the cooperative approach seems to be more appropriate for family decision making.[8,9]

Maximizing (5) subject to the household budget constraint given in (1) yields the following bargained demand functions for consumption and schooling:

$$c_b^{\mathrm{p}*} = c_b^{\mathrm{p}}(p_p, p_c, p_s, M_p, M_c) \tag{6a}$$

$$c_b^{\mathrm{c}*} = c_b(p_p, p_c, p_s, M_p, M_c) \tag{6b}$$

$$s_b^{*} = s_b(p_p, p_c, p_s, M_p, M_c) \tag{6c}$$

where the subscript b refers to the bargaining model. Note that in this model M_p and M_c enter separately into the above demand functions. This is a rejection of the income pooling hypothesis of the unitary preference model, and can be written in terms of the following comparative statics:

$$\frac{\partial c_b^{p*}}{\partial M_p} \gtrless \frac{\partial c_b^{p*}}{\partial M_c} \tag{7a}$$

$$\frac{\partial c_b^{c*}}{\partial M_p} \gtrless \frac{\partial c_b^{c*}}{\partial M_c} \tag{7b}$$

$$\frac{\partial s_b^{*}}{\partial M_p} \gtrless \frac{\partial s_b^{*}}{\partial M_c}. \tag{7c}$$

This means that, unlike in the unitary preference model, the source of income matters. For example, an increase in parents' income brings with it an increase in bargaining power that is used to adjust the chosen levels of individual consumption and schooling to better suit the parents' own preferences. Similarly, an increase in child's income brings the child an increase in bargaining power that the child uses to better suit his preferences.

Another feature of the bargaining model is that it allows for negative income and positive price effects on the level of post-secondary schooling, while the unitary preference model does not. If parents want less schooling for their child than their child wants for himself, parents may exert their bargaining power so that less schooling is obtained than the child wants, resulting in an overall negative effect of parents' income on the child's post-secondary schooling. On the other hand, if the child wants less schooling than his parents want for him, the child may exert his bargaining power so that less schooling is obtained than the parents want. In this case, the child's income effect may be negative. Note that the price of schooling enters the child's threat point and that $\partial V^{\mathrm{c}}/\partial p_s < 0$. A positive price effect could occur then

[7] This is a commonly-made assumption that motivates Becker's (1974) Rotten Kid Theorem.
[8] Again, however, noncooperative models of family behaviour have been proposed (see Lundberg and Pollak, 1994).
[9] Seaton (2001) investigates conditions under which a type of model similar to Cournot oligopoly would be more appropriate than a bargaining model in describing family behaviour.

as a result of an increase in price decreasing the child's threat point relative to his parents', allowing parents that prefer more schooling to use their increase in relative bargaining power to increase the level of schooling. For example, parents may point out that schooling is too expensive for the student to go it alone, causing the child to submit to parental demands.

Another interesting implication of this bargaining model relates to transfers. Note that $t_b^* = M_p - c_b^{p*} \cdot p_p$ and that, taking partial derivatives with respect to M_p and M_c, we have $\partial t_b^*/\partial M_p = 1 - p_p(\partial c_b^{p*}/\partial M_p)$ and $\partial t_b^*/\partial M_c = -p_p(\partial c_b^{p*}/\partial M_c)$. Subtracting $\partial t_b^*/\partial M_p$ from $\partial t_b^*/\partial M_c$ and substituting from (7a), the implication of the bargaining model with respect to transfers is:

$$\frac{\partial t_b^*}{\partial M_c} - \frac{\partial t_b^*}{\partial M_p} = -1 + p_p\left(\frac{\partial c_c^{p*}}{\partial M_p} - \frac{\partial c_b^{p*}}{\partial M_c}\right) \gtreqless -1. \qquad (8)$$

In words, this means that a 1-dollar increase in child's income and a simultaneous 1-dollar decrease in parents' income do not necessarily result in a reduction of transfers of one dollar. Thus the altruism assumption of the unitary preference model is rejected. In fact, if $(\partial c_b^{p*}/\partial M_p - \partial c_b^{p*}/\partial M_c) > 0$ (parents' income has a greater effect on parents' consumption than their child's income does), then $\partial t_b^*/\partial M_c - \partial t_b^*/\partial M_p > -1$. That is, there is a reduction in transfers by less than one dollar or possibly even an increase in transfers. Again, this means that a change in the distribution of income in the family affects individual consumption and the level of schooling even if total income does not change.

IV. Econometric Model

To test the hypotheses presented in Section III, the following reduced form equations might be estimated:

$$t = X\beta_1 + \sigma_1 e_1 \qquad (9)$$

$$s = X\beta_2 + \sigma_2 e_2 \qquad (10)$$

where t is the level of parental transfers, s is the level of post-secondary schooling, X is a vector of explanatory variables that includes the price and income variables implied by (6a)–(6c) as well as demographic characteristics to control for preferences, β_1 and β_2 are vectors of coefficients, σ_1 and σ_2 are unknown scale parameters, and $e_i \sim N(0,1)$, $i = 1, 2$. As both t and s are chosen simultaneously, e_1 and e_2 are likely correlated. However, Equations 9 and 10 are estimated separately here using single-equation estimation techniques due to several complicating factors.

Assuming e_1 is uncorrelated with X, Equation 9 could be estimated using ordinary least squares (OLS), with the estimated coefficients on parents' and child's incomes used to test the unitary preference model's altruism hypothesis given by (4). When a continuous years of schooling variable is used to measure the level of schooling, Equation 10 could likewise be estimated using OLS to test the income pooling hypothesis given by (3c). However, when a dichotomous initial programme choice variable is used (e.g. one enrols in either a 4-year or a 2-year programme) and a linear probability model is estimated, the SEs must be corrected for heteroscedasticity.

OLS estimates of β_1 and β_2 are likely to be biased, however, if the error terms in (9) and (10) are correlated with X. One reason for concern is that, although the theoretical model treats the price of schooling and child's income as exogenous, these variables are in reality potentially endogenous. The price of schooling and the amount of scholarships and grants received may vary with the type, quality or the level of schooling chosen. In addition, although the theoretical model abstracts from the child's labour-leisure-schooling decision, if market work or leisure compete with schooling for the child's time, the child's income may also be endogenous. To address all of these endogeneity issues, predicted variables replace these potentially endogenous right-hand-side variables.

A second reason OLS coefficient estimates may be biased is that Equations 9 and 10 are estimated using a selected sample. This selection comes from two sources. First, the demand functions in (6a)–(6c) are valid only for those families in which the parents make a positive transfer. This is because, from Equation 5, parents and child cooperate if and only if $(U^p - V^p)(U^c - V^c) > 0$ and, because the child is selfish (parents' consumption does not enter into the term representing the child's gain from cooperation), cooperation is equivalent to parents making a positive transfer. Let t^* be a latent variable measuring the benefits from making a transfer. Because t^* depends on U^p, V^p, U^c, and V^c, all of which depend on X, a transfer receipt selection equation can be written:

$$t^* = X\theta_1 + v_1 \qquad (11)$$

where θ_1 is a vector of coefficients and $v_1 \sim N(0,1)$. Note that t^* is unobserved. However, if the

benefits of making a transfer are positive ($t^* > 0$), then a transfer is made. Let T be an indicator variable equal to 1 if $t^* > 0$ and equal to 0 otherwise.

Unfortunately, T is observed only for children enroled in post-secondary school. This is the second source of selection. Let s^* be a latent variable measuring the benefits from attending post-secondary school. Because the level of post-secondary schooling is a choice variable in the model, s^* depends on the same variables X that enter the right-hand-side of the schooling Equation 10. However, one exclusion restriction is necessary to identify the conditional bivariate probit that is estimated. Therefore, a post-secondary enrolment selection equation is written:

$$s^* = Z\theta_2 + v_2 \tag{12}$$

where Z is a vector of explanatory variables that includes X plus one additional variable, where this additional variable provides the exclusion restriction necessary for identification (to be discussed in the next section), θ_2 is a vector of coefficients, $v_2 \sim N(0, 1)$ and $\text{corr}(v_1, v_2) = \rho$. Although s^* is unobserved, if $s^* > 0$ then the child enrols. Let S be an indicator variable equal to 1 if $s^* > 0$ and equal to 0 otherwise. S is observed for all children.

An observation is thus a member of the select sample if $T = 1$ and $S = 1$. The regression function for the transfer Equation 9 for this subsample may be written as

$$E(t|X, \psi) = X\beta_1 + \sigma_1 E(e_1|X, \psi) \tag{13}$$

where ψ denotes the joint outcome of the two selection rules given by (11) and (12). A similar regression function can be written for Equation 10. Following Tunali (1986), (13) can be rewritten

$$E(t|X, \psi) = X\beta_1 + \alpha_1\lambda_1 + \alpha_2\lambda_2 + \sigma_1 w_1 \tag{14}$$

where α_1 and α_2 are regression coefficients, $w_1 = e_1 - \alpha_1\lambda_1 - \alpha_2\lambda_2$ with $E(w_1|t^* > 0, s^* > 0) = 0$, and λ_1 and λ_2 are highly nonlinear functions of θ_1, ρ, and θ_2. As Tunali notes, λ_1 and λ_2 are the double-selection analogues of the inverse Mill's ratio that arises in the context of single-selection. The parallel regression function for Equation 10 is given by

$$E(s|X, \psi) = X\beta_2 + \eta_1\lambda_1 + \eta_2\lambda_2 + \sigma_2 w_2 \tag{15}$$

where η_1 and η_2 are regression coefficients and $w_2 = e_2 - \eta_1\lambda_1 - \eta_2\lambda_2$ with $E(w_2|t^* > 0, s^* > 0) = 0$.

In order to estimate (14) and (15), the potentially endogenous variables in X need to be replaced by predicted variables and estimates of λ_1 and λ_2 must be constructed. Because there are three endogenous variables, three predicting equations must be estimated, and at least three instruments are needed. The predicting equations are discussed in detail in the empirical analysis. For now, let $\hat{X}$ denote the vector that includes the predicted variables. Then, to construct $\hat{\lambda}_1$ and $\hat{\lambda}_2$, a two stage procedure is followed. First, a conditional bivariate probit model in which T and S are the dependent variables and $\hat{X}$ and $\hat{Z}$ are the respective vectors of explanatory variables is estimated.[10] The resulting estimates $\hat{\rho}$, $\hat{\theta}_1$, and $\hat{\theta}_2$ are then substituted into the formulas for λ_1 and λ_2 to obtain $\hat{\lambda}_1$ and $\hat{\lambda}_2$. Finally, the following equations are then estimated

$$E(t|\hat{X}, \psi) = \hat{X}\beta_1 + \alpha_1\hat{\lambda}_1 + \alpha_2\hat{\lambda}_2 + \sigma_1 w_1 \tag{14'}$$

$$E(s|\hat{X}, \psi) = \hat{X}\beta_2 + \eta_1\hat{\lambda}_1 + \eta_2\hat{\lambda}_2 + \sigma_2 w_2. \tag{15'}$$

$\hat{\lambda}_1$ and $\hat{\lambda}_2$ are identified in Equations 14′ and 15′ by nonlinearities in the formulas used to construct them. Note that the errors are heteroscedastic because of their inclusion. In addition, corrections to the SEs should be made because of the substitution of the predicted variables for the potentially endogenous variables. To correct these SEs, a bootstrapping technique is used.[11]

V. Data

The High School and Beyond Surveys (HS&B), administered by the US Department of Education's National Center for Education Statistics, provide the data for the analysis. The base year survey was conducted in 1980 for both high school sophomores and seniors, with follow-up surveys for both the sophomore and senior cohorts conducted in 1982, 1984 and 1986, and an additional follow-up for the sophomore cohort in 1992. Although follow-ups did not occur every year, retrospective questions were asked in each of the follow-up years to fill in information relevant to nonsurvey years. To supplement the survey data, post-secondary education transcripts for the sophomore cohort were merged with their survey data. In order to take advantage of this transcript information, the analysis will focus only on the sophomore cohort.

The HS&B sophomore database contains 14 825 students, although only 5015 student observations are actually used in the analysis. First, respondents who did not participate in all of the first three surveys are dropped, leaving 12 423 respondents. This is done

[10] Recall that Z includes X and that is why Z is given the 'hat' designation.
[11] Estimated SEs are based on 200 replications.

because variables used in the analysis are taken from responses to the first three surveys.[12] An additional 6785 respondents are dropped because they are missing information on at least one key variable. Finally, an additional 623 respondents are dropped because they are either the only respondent from a particular high school with nonmissing information or, if there is more than one student from that high school with nonmissing information, there is no variation among these students in terms of their post-secondary enrolment status. Such within-school variation is necessary in order to use high school dummy variables as instruments in the predicting equations. In order to investigate whether this reduced sample is representative, the means of the demographic variables that can be measured for all students in the database are compared for the full sample and the analysis sample. Appendix Table A1 shows some differences. The analysis sample includes a larger proportion of females and a smaller proportion of minorities than does the full HS&B sample. It also includes a larger proportion of rural residents. There are also some differences in the proportions living in different regions of the country. While these differences are not enormous, caution should be used in generalizing the empirical results.

The dependent variable used in the transfer regression is the dollar value of parental transfers made during the 1982–83 academic year. This variable includes not only cash transfers made directly to the student but also tuition and fees, room and board, and other schooling-related expenses paid by the parent on the child's behalf. Unfortunately, parental transfers are observed only for those students who reported attending post-secondary school during the year, even though it is likely that some children who did not attend post-secondary school in that year did indeed receive transfers from their parents. This potential source of sample selection bias is addressed in the empirical analysis in Section VI.

The dependent variable used in the schooling regression is years of post-secondary schooling. To construct this variable, information on enrolment status that is provided in the HS&B database for every month during the 10-year period from June 1982 through June 1992 is used. Part-time enrolment is treated as ½ month. The number of months is then divided by 12 to obtain the number of years of post-secondary schooling. The strength of this variable is that it reports actual post-secondary education attained by the student, rather than just the initial programme attended by the child. Thus, if the child started out at a 2-year community college but had every intention of transferring to a 4-year programme, this would be captured by the years of post-secondary schooling variable. However, because the theoretical model on which the hypothesis tests are based considers only an initial single-period decision, to use this variable one must assume that all post-secondary education is decided at one point in time.

An alternative schooling variable used in a sensitivity analysis is the initial choice of post-secondary programme. This initial programme choice variable is a dichotomous variable that takes a value of 1 if the child was enroled in a 4-year post-secondary programme in October of 1982 (the fall semester following the typical cohort member's high school graduation) and a value of 0 if the child was enroled in a 2-year programme.[13] The strength of this variable lies in the fact that it is a single period measure and therefore more consistent with the single period decision assumed in the theoretical model than the years of post-secondary schooling variable. A weakness of this variable, however, is that it does not address intentional progression from a 2-year to a 4-year programme.

A key explanatory variable is parents' income. However, because only categorical family income rather than parents' income is reported in the HS&B database and a continuous measure is needed to conduct the hypothesis tests, a continuous parents' income variable needs to be constructed. Data from the internal version of the 1983 March Supplement to the Current Population Survey (CPS), which contains nontopcoded income information, are used to do this. First, a subsample is selected from the CPS to match the characteristics of the HS&B sample. This subsample includes persons aged 17–19 who are children of an interviewed head of household. For these children, parents' income and several variables expected to be correlated with parents' income are then constructed to match variables available in the HS&B data. These include family income category dummies, parents' highest education dummies, state dummies, an urban dummy, a dummy indicating whether the family was a traditional family during

[12] While data from three survey years are used, the analysis is a static one. A longitudinal analysis cannot be performed due to a lack of key data.

[13] Students choosing other programmes, e.g. a 1-year vocational programme, are excluded. An alternative way to define this programme choice variable allows it to take on a value of 1 if the child attends a 4-year programme and a value of 0 if the child attends any other post-secondary programme. Defining the initial programme choice variable in this way does not materially affect the results.

the child's senior year (the child lived with both his mother and father), the number of siblings, and the child's gender. Parents' income is then regressed on these variables using OLS. The regression results are reported in Appendix Table A2. Parents' income is then predicted by applying these CPS regression coefficients to the matching variables in the HS&B data and adding a random term created by generating a random variable with mean zero and variance one and multiplying it by the root mean squared error from the CPS regression. The major strength of this parents' income variable is that more information than just the student-reported family income category is used in its prediction. However, it is a predicted rather than an observed variable.

An alternative, and much cruder, parents' income variable is constructed in order to test the sensitivity of the results. This variable is constructed by subtracting the child's reported income from the midpoint of the reported family income range for all income categories except the top income category, '$50 000 and over'. As no midpoint is available for this category, child's reported income is instead subtracted from an estimate of average family income calculated using the internal, nontopcoded version of the 1983 March CPS data.

Child's income is another key explanatory variable. It is constructed from the child's survey responses to questions about the income he or she received from various sources in 1982, and includes all own and spousal earnings and nonlabour income except parental transfers, transfers from other relatives, and scholarships and grants. Parental transfers are excluded as they are a dependent variable in the analysis and do not enter into the child's threat point when bargaining with parents. Gifts from other relatives are excluded due to insufficient data. Scholarships and grants are also not included in the child's income as they are instead treated as a (negative) price variable in the analysis. The strength of this variable is that it includes all nontransfer income potentially available to the child (including a spouse's income, if one is present) and thus gives a very good picture of the child's bargaining position.

To test the sensitivity of the results, an alternative child's income variable is constructed by taking the simple average of the child's reported 1982 and 1983 incomes. This is done because, while the decision about post-secondary education was probably made in 1982 before the child graduated from high school, the academic period over which many of the other variables are measured is the 1982–83 academic year.

Other economic explanatory variables that enter into the schooling and transfer equations include the price of schooling and the dollar value of scholarships and grants received. The price of schooling is measured by the tuition and fees charged to the student by his post-secondary institution for the 1982–83 academic year, regardless of the source of payment. The scholarships and grants variable measures the total amount of scholarships and grants the student received for the 1982/83 academic year. An advantage of these individual-level variables over state-level averages is that they better represent the opportunity set faced by an individual student which may vary based on the student's ability, high school grades, and other personal and family characteristics. A disadvantage of the price of schooling and scholarship and grant variables, however, is that they are potentially endogenous. Another disadvantage of these variables is that they are reported only for those students attending post-secondary school. However, these issues are dealt with in the empirical analysis.

Key personal background variables include the child's standardized test score and high school GPA, gender and race dummies, the overall number of siblings and the number of older siblings (each topcoded at six siblings), a traditional family dummy, the number of rooms in the family home (topcoded at 10 rooms), and dummies for the parents' highest level of education.

Additional variables that do not enter the main regressions but enter as the dependent variables in the conditional bivariate probit used to correct for the two sources of sample selection include a transfer receipt dummy and an enrolment dummy. The receipt dummy takes on a value of 1 if the child received a transfer from his parents during the 1982/83 academic year and a value of 0 if he did not. The enrolment dummy takes on a value of 1 if the child enroled in post-secondary school during that year and a value of 0 if he did not enrol. A conditional bivariate probit is estimated because the receipt dummy is only observed if the child enroled during the 1982–83 academic year. An additional variable, the percent of the child's high school's 1978–79 class that is in college in 1980, is used to identify the conditional bivariate probit model. It is intended to proxy for the 'supply' of post-secondary education, i.e. the likelihood of being accepted into a post-secondary institution.

In Section VI, the key regression results are disaggregated according to whether parents want more, parents want less, or parents want the same level of post-secondary schooling for their children as their children expect for themselves. This is done in order to provide insight into how income coefficients differ according to the type of parent–child conflict, and to investigate whether negative income and

positive price effects on schooling exist for those individuals most predisposed to them. Variables used to subset the sample by disagreement status include the level of schooling the child expects to attain and the level of schooling he believes his parents want him to attain. Any difference between what parents want and what the child expects places a student into one of the disagreement groups. One caveat, however, is that the child is reporting an expectation, not necessarily a desire or preference. Therefore, if the child expects to attain more or less than he would wish given that he or she expects to compromise, then partitioning the sample based on these survey responses may be biased against including a student in one of the disagreement subsamples.

Sample statistics for all of the key analysis variables, including predicted variables to be discussed in Section VI, are given in appendix Table A3.

VI. Empirical Results

Predicted variables and selectivity correction

Before the transfer and schooling Equations 14′ and 15′, can be estimated, the potentially endogenous variables in X need to be replaced by predicted variables and the selectivity correction terms need to be constructed. Table 1 shows the predicting equations for the price of schooling (tuition and fees), the dollar value of scholarships and grants received, and the child's income.[14] Parents' income, parents' education, and student and family characteristics enter as explanatory variables in these predicting equations because they enter the main transfer and schooling equations (with the exception of parents' income, all as demographic controls to account for heterogenous preferences). In addition, for identification purposes, because there are three endogenous variables to be predicted, at least three variables must be included in the predicting equations that are excluded from the second stage transfer and schooling equations. Because of the unique nature of the HS&B data set, there are multiple students surveyed per school. Thus, 654 high school dummies are able to be used as instruments. In the price of schooling equation, these school dummies are intended to capture the average price of post-secondary schooling faced by students from a given high school or geographic area. In the scholarships and grants equation, they are intended to capture the average financial aid award faced by students from a given high school or geographic area. Finally, in the child's income equation, they are intended to control for local labour market conditions. In all three of these equations the high school dummies are jointly significant at the 1% level. Thus, they are correlated with the variables they are used to predict.

There is a potential overidentification problem, however. While only three instruments are needed, 654 are used and the results may be sensitive to the choice of instruments. Thus, a Hausman overidentification test is performed for each second-stage equation (the transfer and schooling equations) to determine the validity of the school dummy instruments used. Each test involves regressing second stage residuals on all of the predetermined variables in the system, including the high school dummies. The test results are reported with the second stage results in Tables 2 and 5. For the transfer equation, a Hausman Chi-squared statistic is calculated and determined to be below the critical value with a p-value of 0.7884, indicating that the transfer results are not sensitive to the choice of instruments. For the schooling equation, the calculated Hausman statistic also falls below the critical value with a p-value of 0.1600. Therefore, the schooling results are also not sensitive to the choice of instruments.

A disadvantage of the school dummy variables as instruments is that a child's high school may not be truly exogenous. Parental preferences that determine parental transfers and the child's level of post-secondary schooling may also determine the high school the child attends. To the extent that demographic controls do not adequately account for parental preferences, these instruments may not be valid. However, given the inclusion of so many parental demographic variables and the fact that the high school dummies are allowed to indirectly affect parental transfers and years of schooling via the price of schooling, the scholarship and grant award, and the child's income, this potential problem is likely minimized.

Other instrumenting strategies have been attempted, however. In one attempt, state dummies were used instead of high school dummies as these broader geographic variables are less likely to be

[14] It is important to note that there are alternative interpretations of the predicted 'price' variable. If school quality is thought to be constant, or adequately captured by the observable demographic characteristics included in the predicting equation, then this predicted price can be treated as a true price variable. If it is believed that higher tuition and fees are associated with higher quality schooling, and that the demographic characteristics included in the price regression do not adequately control for quality, then this variable is better thought of as a predicted expenditure. While the word 'price' is used in this discussion, it should be kept in mind that this may actually represent schooling expenditure.

Table 1. Predicting equations

	Price (tuition and fees)		Scholarships and grants		Child's income (in $10 000s)	
Explanatory variables	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat
Intercept	−1291.96	−0.93	−3580.42***	−3.90	0.42**	2.12
Parents' income (in $10 000s)	13.81	0.47	−84.05***	−4.36	0.01*	1.85
Standardized test score	11.44***	3.59	12.58***	5.98	0.00***	−4.40
Standardized high school GPA	1323.69***	9.09	1010.97***	10.54	−0.03*	−1.89
Gender dummy (1 = male, 0 = female)	76.68	0.71	188.93***	2.65	0.06***	3.17
Hispanic dummy	164.95	0.98	379.81***	3.41	−0.03	−1.06
Native American dummy	661.57	1.30	594.98*	1.78	−0.01	−0.10
Asian/Pacific Islander dummy	−61.36	−0.20	62.59	0.31	−0.11**	−2.06
African American dummy	568.24**	2.54	714.12***	4.84	−0.20***	−5.84
Number of siblings	−213.68***	−4.59	−24.85	−0.81	0.03***	4.03
Number of older siblings	74.86*	1.75	15.53	0.55	−0.02**	−2.50
Traditional family dummy	85.09	0.71	−198.63**	−2.50	−0.06***	−3.41
Rooms in home	127.57***	4.38	0.50	0.03	0.00	0.92
Parents' highest education dummies						
High school graduate	−181.89	−0.75	−83.10	−0.52	0.03	0.74
Less than 2 years vocational school	578.31***	3.05	633.50***	5.07	0.02	0.77
2+ years vocational school	283.96	1.51	322.87***	2.60	−0.05*	−1.72
Less than 2 years college	368.05**	2.00	270.77**	2.23	−0.05*	−1.82
2 or more years college	614.93***	3.58	236.07**	2.08	−0.04*	−1.73
4 or 5 year college degree	740.88***	3.77	567.19***	4.38	−0.09***	−3.03
Master's degree	951.48***	4.51	331.75**	2.39	−0.08**	−2.28
(654 school dummies not reported)						
λ	1571.12***	4.52	1243.20***	5.42		
R-squared	0.35		0.32		0.20	
Number of observations	3287		3287		5015	
	Tests of joint significance of instruments					
	F-stat [654, 2612]	*p*-Value	*F*-stat [654, 2612]	*p*-Value	*F*-stat [654, 4341]	*p*-Value
	1.75	0.0000	1.24	0.0002	1.35	0.0000

Source: High School and Beyond Survey data, National Center for Education Statistics, US Department of Education.
***indicates significance at 1% level.
**indicates significance at 5% level.
*indicates significance at 10% level.

Table 2. Transfers: regression results and hypothesis tests

	Double selection correction only		Predicted values and double selection correction	
Explanatory variables	Coefficient	*t*-Stat	Coefficient	*t*-Stat
Intercept	1770.77	1.06	−14705.12***	−2.82
Price	0.52***	10.77	–	–
Predicted price	–	–	1.06***	5.26
Scholarships and grants	−0.54***	−11.37	–	–
Predicted scholarships and grants	–	–	−0.94***	−3.30
Child's income (in $10 000s)	−845.75***	−4.33	–	–
Predicted child's income (in $10 000s)	–	–	−1654.86	−1.44
Parents' income (in $10 000s)	165.41***	3.31	574.35***	3.81
Standardized test score	1.75	0.36	38.13**	2.51
Standardized high school GPA	136.78	0.93	810.31	1.55
Gender dummy (1 = male, 0 = female)	174.34	0.86	−1508.17**	−2.51
Hispanic dummy	−163.09	−0.86	1035.51*	1.77
Native American dummy	521.36	0.84	−1282.83	−0.49
Asian/Pacific Islander dummy	336.66	1.38	1195.18	1.26
African American dummy	−43.35	−0.21	417.71	0.52
Number of siblings	−36.27	−0.35	−889.97***	−2.88
Number of older siblings	34.37	0.59	322.79*	1.68
Traditional family dummy	−172.22	193.92	1074.48*	1.92
Number of rooms in home	83.75**	2.25	268.20**	2.26
Parents' highest education dummies				
High school graduate	38.57	0.15	538.40	0.57
Less than 2 years vocational school	−126.31	−0.62	−699.66	−0.88
2+ years vocational school	−162.50	−0.89	142.29	0.18
Less than 2 years college	−134.11	−0.67	−381.51	−0.51
2 or more years college	235.10	1.08	1327.81*	1.74
4 or 5 year college degree	−168.18	−0.72	1045.43	1.24
Master's degree	−125.38	−0.40	1852.05**	2.20
λ_1	−1636.48	−1.17	13294.87***	2.92
λ_2	−165.45	−0.36	−865.10	−0.61
No. observations	1886		1886	
R-squared	0.39		0.25	

Test of altruism hypothesis

F-Stat [1, 1861]	*p*-Value	*t*-Stat [1861]	*p*-Value
1895.83	0.0000	6.35	0.0000

Specification tests

Exogeneity test X^2 [19]	*p*-Value	Overidentification test X^2 [583]	*p*-Value
25.10	0.1571	555.43	0.7884

Source: High School and Beyond Survey data, National Center for Education Statistics, US Department of Education.
***indicates significance at 1% level.
**indicates significance at 5% level.
*indicates significance at 10% level.

correlated with parental preferences regarding their child's education. While these state dummies were jointly significant in the price and scholarship and grant equations, they were not significant predictors of the child's income. Therefore, they could not be used as instruments. In another attempt, all available state and county level variables that could possibly affect the price of schooling, the scholarship and grant award, and/or the child's income were included. These variables included a county's overall unemployment rate, a county's per capita income, a state's average manufacturing wage, a state's youth unemployment rate, average in-state tuition charged by 4-year public colleges and universities in a state,

average tuition charged by 4-year private colleges and universities in the state, the percent of a state's college-age population enroled in an undergraduate programme, a state's average post-secondary faculty salary, the number of post-secondary institutions in a state, the percent of a state's population over 25 that has at least a bachelor's degree, and average government expenditure on higher education in a state. Most of these variables were individually significant in the predicting equations and were jointly significant in all three equations. However, the *R*-squares for these predicting equations were much lower than for the regressions with the high school dummy instruments, with the lowest R-squared of 0.05 for the child's income predicting equation. Therefore, while these instruments were also rejected in favour of the high school dummies, the second stage equations were estimated using these instruments as a sensitivity analysis, and the results compared to those presented here. While some of the coefficient estimates were affected in magnitude and statistical significance, probably due to the poor predictive ability of these instruments, the key results regarding parental altruism and income pooling were not affected.

Because the price of schooling and the dollar value of scholarships and grants received are observed only for those respondents enroled in post-secondary school, a single selectivity correction term λ has been included in their predicting equations and is identified on the basis of functional form. Note that the coefficient on the lambda term is large and significant in both equations. The results from the first-stage enrolment probit used to create this lambda term are reported in appendix Table A4.

The bivariate probit coefficients used to construct the two sample selection terms $\hat{\lambda}_1$ and $\hat{\lambda}_2$ used in the transfer and years of schooling equations are shown in Table A5.[15] Recall that while these terms are identified in the transfer and years of schooling equations by the nonlinearities in their construction (see Tunali, 1986 for the exact formulas), identification of the bivariate probit requires one exclusion restriction. That is, one variable must be included in one of the probit equations and excluded from the other. Therefore, the percent of the child's high school's 1978–79 senior class that was in college in 1980, a proxy for the local college acceptance rate, is included in the enrolment equation but is excluded from the receipt equation.[16]

Transfers

The parental transfer equation is estimated on the sample of post-secondary students who receive a transfer from their parents. Table 2 presents the results from two different specifications of this regression. Column (1) reports least squares results correct for two sources of sample selection and column (2) reports the results of a least squares specification that uses predicted variables in addition to correcting for selection. Robust SEs are used in calculating the *t*-statistics presented in the first specification and bootstrapped SEs are used in the second specification. Note that one of the selectivity correction terms is significant at the 1% level in the second specification. In the first specification, neither of the selectivity correction terms is significant, although one has a *t*-statistic over one. In order to determine whether use of predicted variables is appropriate, a Hausman exogeneity test is performed. The resulting Chi-squared statistic is below the critical value with a *p*-value of 0.1571, indicating the hypothesis that the right hand side variables are exogenous cannot be rejected at the standard level of significance. Therefore, the results from the first specification are emphasized.

The key coefficients for testing the parental altruism hypothesis are the coefficients on the income variables. Both parents' income and child's income are measured in tens of thousands of dollars. Therefore, the results in specification (1) indicate that an increase in child's income by \$10 000 results in a reduction in parental transfers of \$846 while an increase in parents' income by the same amount results in an increase in transfers of only \$165. Together, these estimated coefficients indicate that an increase in child's income by \$10 000, along with a simultaneous decrease in parents' income by \$10 000, results in a reduction in parental transfers of only \$1011. This estimate is \$8989 less than the reduction of \$10 000 implied by the parental altruism hypothesis, suggesting that this hypothesis, and thus the unitary preference model, be rejected. An *F* test that the child's income coefficient minus the parents' income coefficient equals −\$10 000 does in fact reject the parental altruism hypothesis at the 1% level of significance. Similar results are obtained for specification (2).

One possible explanation for the rejection of the parental altruism hypothesis is that measurement error may be biasing the parents' income coefficient

[15] The estimate of the correlation between the error terms in the receipt and enrolment probits, $\hat{\rho}$, is not statistically significant, suggesting that the two probit equations could have been estimated separately.
[16] A similar caution to that regarding the validity of the high school dummies as instruments also applies here.

Table 3. Transfers: comparisons by conflict status-double selection correction only

	Parents want more		No disagreement		Parents want less	
Explanatory variables	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat
Intercept	3584.36	0.87	−351.57	−0.18	8231.36*	1.66
Price	0.60***	7.54	0.52***	8.30	0.49***	5.02
Scholarships and grants	−0.70***	−6.18	−0.57***	−9.69	−0.28**	−2.36
Child's income (in $10 000s)	−814.35**	−2.13	−1105.45***	−3.92	822.10	0.97
Parents' income (in $10 000s)	102.77	0.91	232.47***	3.78	129.25	0.84
Standardized test score	−16.51	−1.35	9.47*	1.66	−0.06	0.00
Standardized high school GPA	365.07	1.06	148.04	0.80	−921.63	−1.63
Gender dummy (1 = male, 0 = female)	896.21*	1.81	−102.59	−0.42	−145.58	−0.27
Hispanic dummy	19.79	0.05	−272.67	−1.11	−157.97	−0.27
Asian/Pacific Islander dummy	−466.55	−0.93	598.87**	2.09	122.72	0.12
African American dummy	182.77	0.43	3.30	0.01	−915.41	−1.06
Number of siblings	164.99	0.67	−166.24	−1.34	133.88	0.46
Number of older siblings	19.43	0.17	61.57	0.84	−60.72	−0.32
Traditional family dummy	−604.36	−1.38	173.54	0.78	−879.13	−1.29
Number of rooms in home	8.51	0.09	137.53***	3.09	−0.30	0.00
Parents' highest education dummies						
High school graduate	814.82	1.02	24.97	0.08	−606.44	−0.92
Less than 2 years vocational school	−60.30	−0.13	−78.00	−0.30	−1365.97*	−1.67
2+ years vocational school	222.78	0.47	−259.55	−1.13	−1396.77**	−2.10
Less than 2 years college	46.69	0.12	−99.48	−0.39	−1271.93*	−1.66
2 or more years college	576.41	1.09	315.93	1.16	−745.40	−1.14
4 or 5 year college degree	5.50	0.01	−155.60	−0.54	−581.78	−0.79
Master's degree	−61.89	−0.09	−132.83	−0.35	−53.50	−0.06
λ_1	−4164.62	−1.31	326.76	0.20	−3979.76	−1.01
λ_2	567.31	0.49	−291.99	−0.53	−1075.50	−0.73
No. observations	341		1207		203	
R-squared	0.47		0.40		0.40	
	Test of altruism hypothesis					
	F-stat [1,317]	*p*-Value	*F*-stat [1,1183]	*p*-Value	*F*-stat [1,179]	*p*-Value
	507.75	0.0000	848.89	0.0000	157.81	0.0000

Source: High School and Beyond Survey data, National Center for Education Statistics, US Department of Education.
***indicates significance at 1% level.
**indicates significance at 5% level.
*indicates significance at 10% level.

and thus the total reduction in transfers toward zero. However, to bias a true total reduction of $10 000 to the level of $1011 that is estimated in specification (1), the measurement error variance of parents' income would have to account for 98% of the total variance of parents' income.[17] This level of measurement error is much larger than the 24% of the variation in parents' income that is unexplained by the CPS parents' income regression. Thus, even in the presence of measurement error, the unitary preference model can still be rejected.

Tables 3 and 4 show the transfer results disaggregated by disagreement status. Table 3 shows the results for specification (1) and Table 4 shows the results for specification (2). While specification (1) is the preferred specification given the Hausman exogeneity test result presented in Table 2, Table 4 is also included given the marginal *p*-value of 0.1571 on the exogeneity test. Recall that a child is asked how much schooling his or her parents want him or her to obtain and how much schooling he or she expects to obtain. In each table, column (1) gives the estimates of the transfer regression for the group of students whose parents want more schooling for them than they expect to obtain for themselves. Column (2) gives the estimates for those students who expect to obtain the level of schooling their parents desire. Finally, column (3) gives the estimates for those

[17] In specification (2), to bias a true total reduction of $10 000 to the level of $2229 that is estimated, the measurement error variance of parents' income would have to account for 93% of the total variance of parents' income.

Table 4. Transfers: comparisons by conflict status – predicted values and double selection correction

	Parents want more		No disagreement		Parents want less	
Explanatory variables	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat
Intercept	−7312.72	−0.79	−14345.19***	−2.69	−3110.32	−0.22
Predicted price	0.95***	3.28	1.01***	4.75	0.74*	1.84
Predicted scholarships and grants	−0.96***	−2.96	−0.89***	−3.20	−0.64	−1.37
Predicted child's income (in $10 000s)	−1755.84	−1.17	−1241.39	−1.12	−1385.93	−0.68
Parents' income (in $10 000s)	435.40*	1.70	566.26***	3.65	408.41	1.04
Standardized test score	11.62	0.48	37.13**	2.47	37.75	1.14
Standardized high school GPA	805.71	1.22	728.01	1.49	−577.79	−0.50
Gender dummy (1 = male, 0 = female)	−114.14	−0.11	−1594.95**	−2.54	−1092.13	−0.74
Hispanic dummy	972.63	1.06	738.01	1.34	540.22	0.40
Asian/Pacific Islander dummy	141.99	0.12	1287.96	1.45	618.88	0.26
African American dummy	543.25	0.65	392.93	0.54	−423.67	−0.29
Number of siblings	−297.97	−0.51	−924.32***	−3.05	−430.78	−0.58
Number of older siblings	168.02	0.63	303.37*	1.79	83.99	0.22
Traditional family dummy	−143.10	−0.16	1360.61**	2.26	−415.50	−0.29
Number of rooms in home	152.37	0.85	301.08***	2.87	196.47	0.78
Parents' highest education dummies:						
High school graduate	1081.78	0.89	377.10	0.45	−208.32	−0.13
Less than 2 years vocational school	−366.56	−0.45	−705.69	−0.98	−769.59	−0.56
2+ years vocational school	807.45	0.90	−147.23	−0.21	−862.18	−0.62
Less than 2 years college	−94.14	−0.11	−379.12	−0.59	−921.76	−0.70
2 or more years college	1079.97	1.04	1196.69*	1.66	−156.94	−0.11
4 or 5 year college degree	678.07	0.62	729.40	0.97	466.08	0.30
Master's degree	707.64	0.53	1490.73*	1.81	922.83	0.39
λ_1	5233.75	0.63	13294.93***	2.79	5730.31	0.45
λ_2	208.30	0.10	−1257.16	−1.01	−1087.03	−0.35
No. observations	341		1207		203	
R-squared	0.32		0.25		0.30	
	Test of altruism hypothesis					
	t-stat [317]	*p*-value	*t*-stat [1183]	*p*-value	*t*-stat [179]	*p*-value
	4.60	0.0000	6.92	0.0000	3.59	0.0004

Source: High School and Beyond Survey data, National Center for Education Statistics, US Department of Education.
***indicates significance at 1% level.
**indicates significance at 5% level.
*indicates significance at 10% level.

students whose parents want less schooling for them than they expect for themselves.

For each specification the parental altruism hypothesis, and thus the unitary preference model, is rejected for all three groups. However, while the rejection of the unitary preference model was expected for the parents want more and parents want less groups, it was unexpected for the no disagreement group. One possibility is that some students may be improperly classified into the no disagreement subgroup. Recall that students are asked how much schooling they *expect* to obtain, rather than how much they wish to obtain. If a child reports that he expects to obtain more schooling than he would wish given that he expects to bow to parental pressure (parents have all or most of the bargaining power), then a disagreement variable based on these survey responses is biased against indicating disagreement. Another possibility is that the level of post-secondary schooling is not the relevant source of disagreement. Rather, schooling-related transfers may be affected by disagreement over the total expenditures on schooling, which may depend on school quality and prestige, or the financing of the child's post-secondary education. Thus, if the source of disagreement is something other than the level of schooling, students may be improperly classified.

Years of post-secondary schooling

Recall that the years of post-secondary schooling variable is defined as the number of years of post-secondary schooling attained, given that some

Table 5. Years of post-secondary schooling: regression results and hypothesis tests

	Double selection correction only		Predicted values and double selection correction	
Explanatory variables	Coefficient	*t*-Stat	Coefficient	*t*-Stat
Intercept	−0.363170	−0.28	−5.575134*	−1.70
Price	0.000008	0.41	–	–
Predicted price	–	–	0.000202**	2.03
Scholarships and grants	0.000034	1.06	–	–
Predicted scholarships and grants	–	–	−0.000118	−0.76
Child's income (in $10 000s)	−0.568690***	−3.30	–	–
Predicted child's income (in $10 000s)	–	–	−0.423878	−0.68
Parents' income (in $10 000s)	0.024203	0.65	0.144606	1.51
Standardized test score	0.020382***	4.72	0.031507***	3.60
Standardized high school GPA	0.521078***	4.11	0.751508***	2.68
Gender dummy (1 = male, 0 = female)	0.344029**	2.29	−0.190982	−0.59
Hispanic dummy	0.326101*	1.93	0.699417*	1.94
Native American dummy	1.545911*	1.67	1.076848	0.62
Asian/Pacific Islander dummy	0.453772*	1.95	0.764994	1.57
African American dummy	0.438651**	2.02	0.588456	1.44
Number of siblings	−0.038406	−0.53	−0.293174	−1.59
Number of older siblings	−0.001072	−0.02	0.088359	0.92
Traditional family dummy	0.093257	0.62	0.489848	1.33
Number of rooms in home	0.038331	1.18	0.081199	1.34
Parents' highest education dummies				
High school graduate	−0.022518	−0.11	0.143329	0.32
Less than 2 years vocational school	0.229822	1.07	0.043881	0.10
2+ years vocational school	0.438398**	2.37	0.564531	1.43
Less than 2 years college	0.614364***	3.35	0.541032	1.36
2 or more years college	0.695015***	3.79	1.025734***	2.63
4 or 5 year college degree	0.797317***	3.89	1.182412***	2.60
Master's degree	0.869828***	3.47	1.451648***	2.58
λ_1	0.504403	0.52	5.130094*	1.70
λ_2	−0.102374	−0.25	−0.386840	−0.52
No. observations	1330		1330	
R-squared	0.22		0.21	

Test of income pooling hypothesis

F-Stat [1, 1305]	*p*-Value	*t*-Stat [1305]	*p*-Value
10.96	0.0010	−0.83	0.4056

Specification tests

Exogeneity test X^2 [19]	*p*-value	Overidentification test X^2[502]	*p*-value
10.16	0.9489	533.49	0.1600

Source: High School and Beyond Survey data, National Center for Education Statistics, US Department of Education.
***indicates significance at 1% level.
**indicates significance at 5% level.
*indicates significance at 10% level.

post-secondary schooling is undertaken, and that the years of post-secondary schooling regression is estimated for the sample of post-secondary students who receive a transfer (i.e. are cooperating with their parents). Table 5 presents the results from two different specifications of the years of post-secondary schooling regression. Column (1) reports least squares results that correct for two sources of sample selection and column (2) reports the results of a least squares specification that includes predicted variables in addition to selectivity correction terms. Robust SEs are used in calculating the *t*-statistics presented in the first specification and bootstrapped SEs are used in the second specification. One of the

selectivity correction terms is marginally significant in specification (2), but neither is significant in specification (1). A Hausman exogeneity test indicates that specification (1) cannot be rejected with a *p*-value of 0.9489. Thus, the results from specification (1) are emphasized.

The estimated income coefficients from this regression are used to test the income pooling hypothesis. In specification (1), the coefficient on child's income is negative and equal to −0.57, indicating that an increase in child's income of $10 000 reduces the child's years of schooling by over half a year. This result is statistically significant at the 1% level. The coefficient on parents' income, however, is positive but not statistically significant. An *F*-test rejects the income-pooling hypothesis and thus the unitary preference model at the 1% level of significance.

The estimated negative and significant child's income coefficient is an interesting result. While a positive coefficient is predicted by the unitary preference model, the negative coefficient is consistent with bargaining. Another interesting result is the positive and significant coefficient on the predicted price of schooling in specification (2) which implies that an increase of $1000 in the price of post-secondary schooling increases the number of years of post-secondary schooling obtained by 0.2. If the predicted price variable is measuring a true price of schooling, then such a positive effect is inconsistent with the unitary preference model but is consistent with the bargaining model. According to the bargaining model, an increase in the price of schooling decreases the child's threat point and thus increases the relative bargaining power of his parents. A positive bargaining effect occurs if parents use this increase in relative bargaining power to increase the level of schooling obtained. Given a large enough bargaining effect, the standard negative price effect can be overwhelmed, resulting in an overall positive effect of price on schooling as seen here. Another possibility, however, is that the predicted price variable is really a predicted schooling expenditure variable that incorporates education quality. As the predicted schooling expenditure increases, the years of schooling increases, perhaps because parents and children who spend more per year on education value education more and hence choose more of it. However, while the price coefficient is also positive in specification (1), it is much smaller and not significant in that specification.

Table 6 shows the results for years of post-secondary schooling disaggregated by disagreement status. Because of the inability to even marginally reject the exogeneity of the potentially endogenous variables, only the results from specification (1) are presented. For the parents want more group, neither the child's income nor the parents' income has a statistically significant effect on years of post-secondary schooling, and an F-test indicates that the income pooling hypothesis cannot be rejected. Note, however, that the estimated coefficient on child's income is negative, a sign consistent with bargaining. Recall that an increase in child's income increases a child's bargaining power and that a child whose parents want more schooling uses this increase in power to decrease the level of schooling. While not significant, the *t*-statistic is over one and statistical insignificance may be due to the small sample size of this subgroup.

For the no disagreement group, child's income is negative and highly significant, indicating that a $10 000 increase in child's income decreases years of post-secondary schooling attained by 0.76 years, while parents' income is positive but statistically insignificant. An *F*-test rejects income pooling for this group, and thus also rejects the unitary preference model. Like the transfer results for the no disagreement subgroup, this rejection was unexpected. However, as discussed earlier, this may be a result of improperly classifying respondents into disagreement subgroups or incorrectly identifying the source of disagreement between parents and children.

For the parents want less group, the coefficient on child's income is positive but insignificant, while the coefficient on parents' income is negative and insignificant. The absolute value of the *t*-statistic on parents' income is over one, however, and may simply be insignificant due to the small sample size of the parents want less group. Its sign is consistent with bargaining. Recall that an increase in parents' income increases parents' bargaining power, and because parents in this group prefer less schooling than their children, these parents use their bargaining power to decrease the level of post-secondary schooling, thus leading to an overall negative effect of parents' income on the level of post-secondary schooling.

Sensitivity analyses

The results of the preferred specifications in Tables 2 and 5 reject both the parental altruism hypothesis and the income pooling hypothesis and thus the unitary preference model. In order to determine whether these results are sensitive to alternative dependent and explanatory variables as well as an alternative assumption regarding preferences, several sensitivity analyses are performed.

Table 6. Years of post-secondary schooling: comparisons by conflict status

	Parents want more		No disagreement		Parents want less	
Explanatory variables	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat
Intercept	−0.431491	−0.10	−1.327593	−0.71	2.279070	0.72
Price	−0.000099	−1.51	0.000013	0.49	−0.000029	−0.54
Scholarships and grants	0.000049	0.43	0.000023	0.66	0.000161	1.40
Child's income (in $10 000s)	−0.648101	−1.11	−0.757796***	−3.26	0.212048	0.32
Parents' income (in $10 000s)	−0.001606	−0.01	0.056330	1.15	−0.091941	−1.06
Standardized test score	0.015599	1.24	0.022627***	3.73	0.014124	1.22
Standardized high school GPA	0.812533**	2.32	0.508269***	2.91	0.001206	0.00
Gender dummy (1 = male, 0 = female)	0.444189	0.85	0.233830	1.19	0.236893	0.64
Hispanic dummy	0.652394	1.27	0.420353*	1.89	−0.283805	−0.64
Asian/Pacific Islander dummy	0.498899	1.04	0.579862*	1.86	−0.042248	−0.06
African American dummy	0.240821	0.50	0.659855**	2.39	−0.494968	−0.79
Number of siblings	−0.147971	−0.62	−0.116691	−1.24	0.381936**	2.05
Number of older siblings	0.124438	0.85	0.022994	0.39	−0.378861***	−2.67
Traditional family dummy	−0.061278	−0.13	0.188455	1.04	0.722354	1.57
Number of rooms in home	0.067575	0.74	0.071917*	1.69	−0.022515	−0.28
Parents' highest education dummies						
High school graduate	0.139955	0.21	0.094728	0.36	−0.161759	−0.26
Less than 2 years vocational school	−0.307552	−0.46	0.347643	1.34	−0.450936	−0.72
2+ years vocational school	0.537090	0.95	0.344140	1.47	1.742976***	2.92
Less than 2 years college	0.771486	1.38	0.530779**	2.38	−0.003650	−0.01
2 or more years college	1.099961*	1.80	0.613434**	2.48	0.326695	0.64
4 or 5 year college degree	0.916519	1.37	0.771509***	2.82	0.902656*	1.78
Master's degree	1.087598	1.33	0.990922***	2.94	0.641516	0.96
λ_1	−0.816925	−0.25	1.853085	1.37	−0.078512	−0.03
λ_2	1.332262	1.17	−0.575468	−1.02	−1.344546	−1.00
No. observations	226		867		140	
R-squared	0.18		0.23		0.39	
	Test of income pooling hypothesis					
	F-Stat [1, 202]	*p*-Value	*F*-Stat [1, 843]	*p*-Value	*F*-Stat [1, 116]	*p*-Value
	1.13	0.2881	11.38	0.0008	0.21	0.6482

Source: High School and Beyond Survey data, National Center for Education Statistics, US Department of Education.
*** Indicates significance at 1% level.
** Indicates significance at 5% level.
* Indicates significance at 10% level.

Recall that the disadvantage of using the years of post-secondary schooling variable is the potential time inconsistency problem. Because the model presented in Section III is a static model, such a problem arises if post-secondary decisions are made at several different points in time rather than all at once. Therefore, an alternative level of schooling variable that takes on a value of 1 if a 4-year post-secondary programme is chosen and a value of 0 if a 1-year post-secondary programme is chosen, given that either a 1-year or a 4-year programme is chosen, is used to test the sensitivity of the results. In a linear probability model specification with this alternative dependent variable, the estimated coefficient on the child's income variable is significant while the estimated coefficient on parents' income is not and income pooling is marginally rejected with a *p*-value of 0.14. Thus the main conclusions drawn regarding the effects of individuals' incomes on post-secondary schooling are robust to the particular schooling variable that is chosen.

Because parents' income and child's income are key explanatory variables, it is necessary to test the robustness of the estimates and hypothesis tests to alternative constructions of these variables. Recall that the parents' income variable used in the primary analysis is predicted using the CPS coefficients in Appendix Table A2. An alternative variable that could be used, however, is constructed in a cruder manner by subtracting child's income from the midpoint of the family income range. While some of the point estimates in the transfer regression are

affected by the use of this alternative parents' income variable, the parental altruism hypothesis is still rejected. Similarly, although some coefficient estimates in the schooling regression are affected, the income pooling hypothesis is still rejected. Thus, using the alternative parents' income variable does not affect the hypothesis test results.

The child's income variable used in the primary analysis is the child's annual 1982 income. However, an alternative variable that could be used is the average of the child's 1982 and 1983 annual incomes. Both the transfer and the schooling results indicate that while the point estimates differ somewhat between the two alternatives, the hypothesis test results do not. With respect to transfers, the altruism hypothesis of the unitary preference model is rejected by the data. With respect to the years of post-secondary schooling regression, income pooling is rejected. Thus, using this alternative child's income variable does not affect the hypothesis test results.

The final sensitivity analysis concerns the assumption that equates parent–child cooperation with positive parental transfers. It is conceivable that parents may make zero transfers or even negative transfers to their child (i.e. transfers flow from child to parent) and still be making decisions jointly with their child. In order to determine whether this assumption affects the hypothesis test results, the years of schooling regression is re-estimated using the entire sample of post-secondary students, not just those receiving transfers. While some of the coefficient estimates differ, the conclusions drawn from the income pooling hypothesis test does not. The income pooling hypothesis is rejected.

VII. Conclusions

This article introduces parent–child conflict and cooperative bargaining as a means of resolving this conflict into the modelling of post-secondary education decisions. The implications of a cooperative bargaining model are compared to those of the corresponding unitary preference model, suggesting testable hypotheses regarding parental altruism and income pooling.

The results strongly reject the unitary preference model. Both the parental altruism and income pooling hypotheses are rejected by the data, and these results are robust to several different specifications of the relevant equations. In addition, some negative income and positive price effects are obtained, evidence that calls into question the unitary preference model but is consistent with bargaining, suggesting further exploration of bargaining models in this context.

An interesting result is that both the altruism and income pooling hypotheses are rejected for students in the 'no disagreement' subgroup. This may be due to misclassification of students into the disagreement status subgroups due to survey question wording or to misidentification of the true source of parent–child conflict. If the latter, this suggests further opportunity to study other potential sources of disagreement. Perhaps the initial decision to enrol or whether or not the student attends a public or private institution is the important source of disagreement. Alternatively, it may be how a child's post-secondary education is financed, i.e. how much parents pay for schooling and whether or not a child works and/or borrows to pay for school. Future research should focus on these potential alternative sources of disagreement.

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Appendix

Table A1. Full and analysis sample means

Variable name	Full sample	Analysis sample
Gender (male = 1, female = 0)	0.50	0.47
Hispanic	0.22	0.16
Native American	0.02	0.01
Asian/Pacific Islander	0.03	0.03
African American	0.14	0.09
Mid-Atlantic	0.18	0.20
East North Central	0.19	0.22
West North Central	0.07	0.09
South Atlantic	0.16	0.12
East South Central	0.04	0.04
West South Central	0.11	0.08
Mountain	0.05	0.04
Pacific	0.14	0.14
Urban	0.24	0.19
Rural	0.25	0.27
Not urban, not rural	0.51	0.54
Number of observations	14 825	5015

Source: High School and Beyond Survey data, National Center for Education Statistics, US Department of Education.

Table A2. CPS parents' income regression[a]

Explanatory variable	Parameter estimate	*t*-Stat
Intercept	3458.40**	2.27
Urban	635.90**	2.34
Gender	−451.46*	−1.89
Traditional family dummy	2735.07***	8.36
Siblings	−984.02***	−11.19
Family income categories		
$8000–$14 999	5122.61***	9.89
$15 000–$19 999	8960.31***	16.18
$20 000–$24 999	13069.00***	23.41
$25 000–$29 999	17206.00***	30.22
$30 000–$39 999	22662.00***	43.07
$40 000–$49 999	29480.00***	51.55
$50 000 or more	48692.00***	84.18
Parents' highest education categories		
High school graduate	1181.94***	3.45
Less than 2 years post-secondary	2043.49***	3.58
2–3 years post-secondary	1965.46***	4.15
4–5 year college degree	5964.93***	12.80
6 or more years post-secondary	11574.00***	20.85
(50 state dummies not reported)		
No. observations	6937	
R-squared	0.76	

Source: March Supplement to the Current Population Survey (internal version), US Bureau of the Census.
***indicates significance at 1% level.
**indicates significance at 5% level.
*indicates significance at 10% level.
[a]The dependent variable is measured in dollars.

Table A3. Key variable sample statistics

Variable name	No. observations	Mean	SD
Enrolment dummy (enrol = 1, not enrol = 0)	5015	0.66	0.48
Price	3287	2417.20	2623.10
Predicted price	5015	2238.59	1570.67
Scholarships and grants	3287	881.42	1686.88
Predicted scholarships and grants	5015	843.85	971.38
Child's income (in $10 000s)	5015	0.36	0.53
Predicted child's income (in $10 000s)	5015	0.36	0.24
Parents' income (in $10 000s)	5015	2.18	1.80
Transfer receipt dummy (receipt = 1, no receipt = 0)	3287	0.57	0.49
Transfer amount	1886	2871.70	2713.53
Years of post-secondary schooling	2337	3.67	1.83
Initial programme choice: (four-year = 1, two-year = 0)	2936	0.70	0.46

Source: High School and Beyond Survey data, National Center for Education Statistics, US Department of Education.

Table A4. Probit for selection correction of predicting equations

	Enrolment	
Explanatory variables	Coefficient	χ^2
Intercept	−3.5498***	38.45
Parents' income (in $10 000s)	0.01800	1.25
Standardized test score	0.01190***	91.88
Standardized high school GPA	0.96450***	344.98
Gender dummy (1 = male, 0 = female)	−0.01290	0.05
Hispanic dummy	0.17930**	5.05
Native American dummy	−0.02280	0.01
Asian/Pacific Islander dummy	0.77560***	13.91
African American dummy	0.64380***	33.83
Number of siblings	−0.13750***	38.30
Number of older siblings	0.06730***	9.82
Traditional family dummy	0.17600***	9.53
Number of rooms in home	0.05500***	14.26
Parents' highest education dummies		
High school graduate	0.08940	0.68
Less than 2 years vocational school	0.20350	5.65
2+ years vocational school	0.44530***	25.46
Less than 2 years college	0.38780***	20.54
2 or more years college	0.69310***	72.22
4 or 5 year college degree	0.88870***	73.19
Master's degree (654 school dummies not reported)	0.63020***	27.83
Log-likelihood	−2103	
No. observations	5015	

Source: High School and Beyond Survey data, National Center for Education Statistics, US Department of Education.
***indicates significance at 1% level.
**indicates significance at 5% level.

Table A5. Conditional bivariate probit for double selection correction

	Receipt (probit equation)		Enrolment (selection equation)	
Explanatory variables	Coefficient	z	Coefficient	z
Intercept	−0.75112**	−2.08	−2.78688***	−17.93
Predicted price	0.00006***	3.31	0.00001	−0.55
Predicted scholarships and grants	−0.00006*	−1.70	−0.00004	−1.41
Predicted child's income (in $10 000s)	−0.21004	−1.58	−0.45172***	−4.60
Parents' income (in $10 000s)	0.05065***	3.44	0.01729	1.23
Standardized test score	0.00487***	2.93	0.01128***	10.81
Standardized high school GPA	0.11962*	1.83	0.67075***	16.78
Gender dummy (1 = male, 0 = female)	−0.19658***	−4.06	−0.01655	−0.37
Hispanic dummy	0.15915**	2.26	0.15409**	2.56
Native American dummy	−0.15313	−0.65	0.01696	0.10
Asian/Pacific Islander dummy	0.13077	0.99	0.50254***	3.14
African American dummy	0.08732	0.89	0.47171***	5.75
Number of siblings	−0.10151***	−4.58	−0.08844***	−4.71
Number of older siblings	0.03600*	1.72	0.04802***	2.61
Traditional family dummy	0.14876**	2.54	0.13985***	2.84
Number of rooms in home	0.02215	1.62	0.03207***	2.67
Percent of high school class of 78–79 attending post-secondary school in 1980	–	–	0.00904***	8.90
Parents' highest education dummies				
High school graduate	0.07232	0.63	0.06187	0.67
Less than 2 years vocational school	−0.04443	−0.48	0.23892***	3.24
2+ years vocational school	0.05896	0.65	0.33979***	4.59
Less than 2 years college	−0.01782	−0.20	0.33272***	4.56
2 or more years college	0.16794*	1.92	0.58932***	8.56
4 or 5 year college degree	0.19041*	1.90	0.70591***	7.99
Master's degree	0.30161***	2.75	0.56585***	5.47
Log likelihood		−4533		
No. observations		5015		
Censored observations		1728		
Uncensored observations		3287		
			95% Confidence interval	
ρ		0.05808	−0.29608	0.39821
LR test of independent equations ($\rho = 0$)	$\chi^2 =$	0.10	Prob > $\chi^2 =$	0.7515

Source: High School and Beyond Survey data, National Center for Education Statistics, US Department of Education.
***indicates significance at 1% level.
**indicates significance at 5% level.
*indicates significance at 10% level.