A discusión

MOTIVES FOR MONEY-TRANSFERS WITHIN FAMILIES: THE ROLE OF TRANSFERS ON EDUCATION*

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ABSTRACT

This work presents a theoretical framework to study if the motive for money-transfers within families is altruism or exchange. We propose models which explicitly incorporate transfers on education as an additional family transfer. Our models allows us to discriminate between the two possible motivations in any situation. We also derive some econometric specifications from our models and report empirical evidence on them using data from the PSID, considering separately inter-vivos transfers and bequests. In both cases, we find evidence against the altruism hypothesis, but not against the exchange hypothesis, and these conclusions could not be reached without taking into account transfers on education. Finally, we also test the econometric specifications by comparing the conditional distribution of monetary family transfers induced by our models and their actual conditional distribution, and the degree of similarity between them proves to be reasonably good.

Keywords: Altruism, Intertemporal choice, Limited Dependent Variable Models.

1 Introduction

The nature and degree of transfers within a family is an important economic issue for various reasons, e.g. because the family plays a substantial role in redistributing income among its members; because the family can insure its members against economic risks, many of which may not be readily insurable in the market place, or even because family transfers can alleviate the individual's liquidity constraints. Understanding the motives that underlie the basic economic decision-making unit is of great importance to determining the outcomes of public policies like social security and debt-financed fiscal policies. The economic importance of family transfers was first emphasized by Barro (1974) and Becker (1974). They proposed a model in which family members are altruistic: i.e., there exists an individual, called "the parent", who cares about the well-being of other individuals, called "the children", and who share their incomes and provide one another with in-kind assistance of several kinds.

Many empirical studies have analyzed the existence of altruism within families by empirically studying the testable implications of Barro and Becker's model. Altonji et al. (1992) test the assumption of operative altruistic linkages between parents and children directly against the alternative of non-linkage. If parents and children are altruistically linked, their consumptions will be based on a collective budget constraint, and the distribution of consumption between parents and children will be independent of the distribution of their incomes, which implies the same marginal utility of income. In contrast to the altruism model, the non-altruistic pure life-cycle model predicts that the distribution of income is a critical determinant for the distribution of consumption, which implies different marginal utilities of income. Their empirical results show that the distribution of family resources matters for family consumption; thus, the null hypothesis of altruistic linkage is rejected. However, one's own resources do not seem to be the only determinant of consumption. Thus, the null hypothesis of a pure life-cycle model should also be rejected. Altonji et al., (1997), complement their previous work by testing for altruism only among those parents who are actually transferring money to their children. The implication of altruism that they test is whether reducing the income of a donor-parent by one dollar, and increasing the income of a recipient child by one dollar, reduces the transferred amount by one dollar. This is called a transfer-income derivatives test. Their estimations again fail to satisfy the restriction of altruism: i.e., shifting one dollar in current income from the parent to the child only leads to a thirteen-cent reduction in the transfer.

Another implication of the altruistic model is that the family is an income-equalizing institution. Tomes (1981), among others, tests this implication using data on bequests. He finds that bequests perform a compensatory role: i.e., the bequest received is inversely related to the recipient's income. This supports the altruism hypothesis. Menchik (1980), and David and Menchik (1985) also focus their analyses on bequests; however, they find that bequests tend to be split uniformly among recipients, which is evidence against altruism.

In contrast to these studies, other works have studied family transfers by considering alternative models in which the motivation that underlies the transfers is not altruism. Bernheim et al. (1985) propose a model that considers family transfers to be a pure exchange, since family members are considered to be selfish and therefore assist one another merely as a part of an arrangement: i.e., parents make transfers to children in return for the services they receive from them. The empirical studies that test these types of models use inter-vivos transfers rather than bequests, as the former are more likely to be intentionally chosen. Moreover, the percentage of families who make inter-vivos transfers is greater and their volumes are three times as great.

Cox (1987), and Cox and Rank (1992), present a more general model that allows for both altruistic and exchange motives in family transfers. Another contribution of their work is that they explicitly consider, separately, the decision to make a family transfer and the decision on the size of such a transfer after it has been decided. From their model, they derive comparative static results to determine whether the predicted behavior differs between altruism and exchange. Under exchange, the analysis is made by assuming that transfers are the payment for services. As such, they can be expressed as the product of an implicit price and a specific amount of services. They conclude that differences may appear in the predictions of the amounts that parents will decide to transfer. Family transfers always increase when the parents' incomes increase. However, an increase in the child's income induces a decrease in the amount of transfers if parents are motivated by altruism. This is not necessarily the case under exchange, however, as the sign of the e¤ect will now depend on the substitution of the amount of services and their implicit price. Their empirical …nding is that there is a positive relationship between the quantity of the transfers and recipient's income, which is consistent with exchange but contradicts the altruistic hypothesis. On the other hand, Cox and Japelli (1990) present a similar model which considers the role of the family to be a credit institution that alleviates liquidity constraints. They …nd that liquidity constraints are important to the decision to make a transfer, but not so to the amount of the transfer to be made, which is precisely what might allow us to distinguish between the two possible motivations. Hence, no clear evidence could be found to discriminate between them.

This paper presents a theoretical framework in which to study the motivation for family money-transfers, based on the model presented in Cox (1987). As we have pointed out before, a decline in transfers when child's income increases, is compatible with both altruism and exchange in Cox (1987) model. Our main contribution is that we propose models for family money-transfers that explicitly incorporate transfers on education as an additional family transfer, and this inclusion eventually leads to conclusions that allow us to discriminate between the two possible motivations that underlie family money-transfers in any situation.

We also derive some econometric speci…cations from our models and report on the empirical evidence obtained from them. Our data is taken from the 1968-1992 Panel Study of Income Dynamics, and particularly, the recently released 1988 wave, which contains a supplementary survey on family transfers. This database stores separate panel data on parents and most of their adult children. Consequently, we can identify the main theoretical determinants of money-transfers, namely, the current and permanent incomes of both parents and children. We analyze, separately, inter-vivos transfers and bequests. In both cases, we …nd evidence against the altruism hypothesis, whereas the exchange hypothesis is compatible with our results. Moreover, with our data-set, these conclusions could not be derived without considering the role of transfers on education. Finally, we also test the econometric speci…cation of our models by comparing the conditional distribution of family money-transfers induced by our models and their actual conditional distribution. The results we obtain reveal that the degree of similarity between actual and induced money-transfers conditional distributions is reasonably good.

The rest of the paper is organized as follows: In Section 2, we describe overlapping generation models for family money-transfers under altruism and exchange. In these models, two different types of transfers from a parent to a child are considered: education (first period), and money (second period). In Section 3, some alternative econometric specifications are derived from the theoretical models. These specifications are estimated using the PSID data, and the implications of the results are discussed. The proposed specifications are tested using a conditional Kolmogorov-Smirnov test. Finally, Section 4 concludes. Technical details are confined to Appendices 1 and 2.

2 Theoretical Framework for Family Transfers

2.1 The altruistic model

We present a two-period model of overlapping generations with an altruistic parent and a child. The parent cares about their own consumption in either period (c_i^p for $i = 1; 2$) and about the child's consumption in the second period (c^c). In the first period, the parent decides on the amount of money that is spent on education for the child (g, transfers for education), in a context of uncertainty about the child's future income. In the second period, the parent decides on the amount of money that is transferred to the adult child (b, money transfers). The key aspect of our model is that the altruism factor δ may depend on the transfers for education g decided in the first period; as we discuss below, this will allow us to analyze how transfers on education may affect the existence and the motivation for money transfers. Other authors have already considered variable altruism factors that depend on parental resources and other characteristics. For instance, Mulligan (1997) considers models in which income and the price of consumption affect parental concerns for their children; and Barro and Becker (1989) introduce fertility decisions in the modelling of altruistic transfers.

We assume that the parent's utility is separable. To maximize it, the dynamic programming starts in the second period. In this period the parent values their own consumption and the child's consumption. The problem which she faces is:

$$\max_{b} \; U(c_2^p) + \delta(g)V(c^c) \tag{1}$$
$$\text{s. to:} \quad c_2^p = Y_2^p - b$$
$$c^c = W^c + b$$
$$b \geq 0$$

where $U(\cdot)$ and $V(\cdot)$ are, respectively, parent and child utility functions, which are assumed to be concave. Observe that in the second period child's labor income W^c; parent's income in this period Y_2^p (which comes from returns on the savings decided in the first period and/or other resources) and transfers on education g (decided in the first period) are exogenous variables. As a solution to (1), monetary transfers $b(Y_2^p; W^c; \delta(g))$ are decided and the first-order condition

$$-U'(Y_2^p - b) + \delta(g)V'(W^c + b) \leq 0 \tag{2}$$

is satisfied. This condition holds with equality for interior solutions of monetary transfers. It follows from here that there exists a function $b^*(Y_2^p; W^c; \delta(g))$ such that the optimal solution for monetary transfers is:

$$b(Y_2^p; W^c; \delta(g)) = \begin{cases} 0 & \text{if } b^*(Y_2^p; W^c; \delta(g)) \leq 0 \\ b^*(Y_2^p; W^c; \delta(g)) & \text{if } b^*(Y_2^p; W^c; \delta(g)) > 0 \end{cases}$$

and the parent's second-period utility proves to be:

$$H(Y_2^p; W^c; \delta(g)) \equiv U(Y_2^p - b(Y_2^p; W^c; \delta(g))) + \delta(g)V(W^c + b(Y_2^p; W^c; \delta(g)))$$

In the first period, the problem which the parent maximizes is:

$$\max_{s;g} \; U(c_1^p) + \beta E[H(Y_2^p; W^c; \delta(g))] \tag{3}$$
$$\text{s. to:} \quad c_1^p = Y_1^p - g - s$$

where β is the inter-temporal discount factor, Y_1^p is the parent's income in the first period, s is the savings and the expectation is conditional with respect to Y_1^p and the characteristics of the parent Z. This expectation appears because W^c is unknown in this first period and Y_2^p might also be unknown: As a solution to (3) transfers on education $g(Y_1^p; Z)$ and savings $s(Y_1^p; Z)$ are decided on.

When the optimal solution for money transfers is positive, $\frac{\partial b}{\partial Y_2^p}$, $\frac{\partial b}{\partial W^c}$, $\frac{\partial b}{\partial g}$ are easily obtained by differentiating (2) (see Appendix 1). By the concavity of $U(\cdot)$ and $V(\cdot)$, $\frac{\partial b}{\partial Y_2^p} > 0$ and $\frac{\partial b}{\partial W^c} < 0$, i.e. higher parent's income and lower child's income lead to more money transfers, a typical result in an altruistic model. The adding-up condition $\frac{\partial b}{\partial Y_2^p} - \frac{\partial b}{\partial W^c} = 1$ is also satisfied, i.e. if the parent gains one dollar and the child loses the same amount, the money transfer will restore the initial optimal allocation; this is also a well-known result in altruistic models (see e.g. Becker 1974). Finally, $\frac{\partial b}{\partial g}$ has the same sign as $\delta'(g)$. If the altruism factor δ does not depend on transfers on education $\delta'(g) = 0$; hence $\frac{\partial b}{\partial g} = 0$ and our model collapses into the traditional altruism model. If δ does depend on transfers on education, the first-period education transfers and the second-period money transfers are compensatory[1], thus $\delta'(g) < 0$ and hence $\frac{\partial b}{\partial g} < 0$:

2.2 The exchange model

We also describe a two-period model here, with one parent and one child. The first-period problem has the same characteristics as the altruism model. In an exchange model, however, the parent does not care about the child's consumption possibilities in the second period, but does value the child's attention, (e.g., telephone calls or visits), and is willing to pay even more for them than she would pay for the same services in the market. Following Cox (1987), the money transfers b are then interpreted as payment for the child's attention, i.e., $b = px$, where x is the quantity of the services bought from the child and p is the implicit price of such services. As these services have an opportunity cost for the child, the implicit price will depend on the child's income W^c. On the other hand, from the parent's point of view, the price which she is willing to pay should be related to her previous decisions about the child; specifically, in our model we assume that the implicit price p may also depend on the transfers on education g decided on in the first period.

[1] Altruistic parents choose between investing in child's human capital and making money transfers when the child has left school (see e.g. Tomes 1981 or Becker 1974).

We also assume that the parent's utility is separable. In the second period the parent values their own consumption and the services received from the child. The problem which she faces is

$$\max_{b} \; U_1(c_2^p) + U_2(x) \tag{4}$$
$$\text{s. to:} \quad c_2^p = Y_2^p - b$$
$$b = px$$
$$b \geq 0$$

where $U_i(\cdot)$, for $i = 1, 2,$ are concave utility functions and $p \equiv p(W^c, g)$. Proceeding as before, the first-order condition which determines monetary transfers is:

$$-U_1'(Y_2^p - b) + \frac{1}{p}U_2'\left(\frac{b}{p}\right) \leq 0. \tag{5}$$

This condition holds with equality for interior solutions. As in the previous model, there exists a function $b^*(Y_2^p, p(W^c, g))$ such that

$$b(Y_2^p, p(W^c, g)) = \begin{cases} 0 & \text{if } b^*(Y_2^p, p(W^c, g)) \leq 0 \\ b^*(Y_2^p, p(W^c, g)) & \text{if } b^*(Y_2^p, p(W^c, g)) > 0 \end{cases}$$

and the parent's second-period utility proves to be:

$$H(Y_2^p, p(W^c, g)) \equiv U_1(Y_2^p - b(Y_2^p, p(W^c, g))) + U_2\left(\frac{b(Y_2^p, p(W^c, g))}{p(W^c, g)}\right).$$

In the first period, the problem which the parent maximizes is:

$$\max_{s,g} \; U(c_1^p) + \beta E[H(Y_2^p, p(W^c, g))] \tag{6}$$
$$\text{s. to:} \quad c_1^p = Y_1^p - g - s$$

where β is the inter-temporal discount factor, Y_1^p is the parent's income in the first period and s the savings. As a solution, transfers on education $g(Y_1^p, Z)$ and savings $s(Y_1^p, Z)$ are decided on.

When the optimal solution for money transfers is positive, $\frac{\partial b}{\partial Y_2^p}$, $\frac{\partial b}{\partial W^c}$, $\frac{\partial b}{\partial g}$ can be obtained by differentiating (5) (see Appendix 1). Again, by the concavity of $U_1(\cdot)$ and $U_2(\cdot)$, $\frac{\partial b}{\partial Y_2^p} > 0$. On the other hand, the signs of $\frac{\partial b}{\partial W^c}$ and $\frac{\partial b}{\partial g}$ depend on the signs of $\frac{\partial b}{\partial p}$, $\frac{\partial p}{\partial W^c}$ and $\frac{\partial p}{\partial g}$. Now, $\frac{\partial b}{\partial p}$ has the same sign as $-\alpha + \frac{b}{p}$, where $\alpha \equiv -\frac{U_2'(\frac{b}{p})}{U_2''(\frac{b}{p})}$ is the coefficient of risk aversion with respect to the child's services. If $\alpha = b/p$; what happens when $U_2(\cdot) = \ln(\cdot)$, then $\frac{\partial b}{\partial p} = 0$ and, therefore, $\frac{\partial b}{\partial W^c} = 0$ and $\frac{\partial b}{\partial g} = 0$. Otherwise, the signs of $\frac{\partial b}{\partial W^c}$ and $\frac{\partial b}{\partial g}$ depend on the signs of $-\alpha + \frac{b}{p}$, $\frac{\partial p}{\partial W^c}$ and $\frac{\partial p}{\partial g}$.

The implicit price p is an opportunity cost for the child and, hence, increases with the child's income i.e. $\frac{\partial p}{\partial W^c} > 0$. As for $\frac{\partial p}{\partial g}$, if p does not depend on transfers on education $\frac{\partial p}{\partial g} = 0$, hence $\frac{\partial b}{\partial g} = 0$ and our model collapses into the traditional exchange model. But if p does depend on g; the parent will be less willing to pay for services if transfers on education are high, i.e. $\frac{\partial p}{\partial g} < 0$. Hence, if $\alpha > b/p$ (high enough risk aversion), then $\frac{\partial b}{\partial p} < 0$ and therefore $\frac{\partial b}{\partial W^c} < 0$, $\frac{\partial b}{\partial g} > 0$, i.e. lower child's income and higher transfers on education lead to more money transfers. However, if $\alpha < b/p$ (low enough risk aversion), $\frac{\partial b}{\partial p} > 0$ and therefore $\frac{\partial b}{\partial W^c} > 0$, $\frac{\partial b}{\partial g} < 0$.

2.3 Comparative Summary

The objective of this work is to examine how the inclusion of transfers on education may help to discriminate between altruism and exchange. The two models we have described above, allow us to establish a relationship between second-period money transfers b, second-period parent's resources Y_2^p, child's labor income W^c and first-period transfers on education g. Note that, when transfers on education are relevant in the parent's decision, $\delta'(g) < 0$ in the altruism model and $\frac{\partial p}{\partial g} < 0$ in the exchange model, i.e., in both cases, the more transfers on education are made in the first period, the more reluctant the parent will be to transfer money to their child in the second period. However, the nature of the relationship between b; Y_2^p; W^c and g varies according to the underlying motivation. In Table 1 we summarize what this relationship is like when transfers on education are relevant in the second-period decision. The main conclusion drawn from this table is that it is possible to distinguish between the two alternative motivations because, under altruism, both $\frac{\partial b}{\partial W^c}$ and $\frac{\partial b}{\partial g}$ are negative, whereas in an exchange situation, they are either both zero or they have opposite signs.

Note that if transfers on education are not relevant in the second-period decision, i.e., if $\delta'(g) = 0$ in the altruism model or if $\frac{\partial p}{\partial g} = 0$ in the exchange model, we have the same situation as in Cox (1987): it might not be possible to distinguish between altruism and exchange, since the case $\frac{\partial b}{\partial W^c} < 0$ would be compatible with both models. When we incorporate transfers on education, once again $\frac{\partial b}{\partial W^c}$ might not allow us to distinguish between altruism and exchange, since a negative sign would be compatible with both models. But even in this case, however, if transfers on education are relevant it is possible to distinguish between the two different motivations by simply observing the sign of $\frac{\partial b}{\partial g}$:

TABLE 1: Relationship between Money-Transfers and the Decision Variables

Model	Altruism	Exchange		
	$\delta'(g) < 0$	$\alpha < b/p$	$\alpha = b/p$	$\alpha > b/p$
$\partial b/\partial Y_2^p$	+	+	+	+
$\partial b/\partial W^c$	−	+	0	−
$\partial b/\partial g$	−	−	0	+

3 Econometric Analysis of Family Transfers

3.1 Data

We first discuss our database to better explain which econometric model will be more appropriate. Our data comes from the 1968-92 Panel Study of Income Dynamics (PSID), which includes a special supplement on transfers between relatives. We have selected those 1968 observations that satisfy: i) that the head of the household was still alive in 1988; and ii) that the oldest child had already left home in or before 1988, and had positive labor income in 1988. The total number of observations in our sample is 485. An observation consists of a matched pair "parent/oldest child", and when we use the term "family" we refer to the household where the parent lives. For each observation, we have information about the family income for each year from 1968 to 1988, the father's level of education in 1968, the level of education attained by the child in 1988, the child's labor income in 1988, the child's age in 1988, and the money-transfers from the family to the child in 1988. In all cases, the level of education is a discrete variable that ranges from 1 to 8.

We want to consider two di¤erent transfers: education and money. Transfers on education are de…ned as the total amount spent by a parent on a child's education. Although this variable is not directly observable, we do observe the level of education attained by the child, which should correlate rather closely to the transfers made by the parent for the child's education. On the other hand, two di¤erent types of money transfers will be considered: i.e., inter-vivos transfers and bequests. The former type of transfer includes gifts and the monetary equivalent of the time the parent devotes to the child, which is computed with the mean wage per hour w (we consider $w = 3.7$; which is the value obtained from 1988 PSID data). Bequests are de…ned as the answer to the following question, included in the PSID: "Suppose your parents were to sell all of their major possessions (including their home), turn all their investments and other assets into cash, and pay all their debts. Would they have something left over, would they break even, or be in debt? What would they have left?"

In Table 2, we report the mean and standard deviations of the variables of interest. In our theoretical models we have considered two variables of family income, one for each period: Y_1^p, Y_2^p. There are several possible ways of de…ning these variables from the data. To check the robustness of our results, we have considered various de…nitions. Speci…cally, for Y_1^p we consider the family's mean income between 1968-1972, and between 1968-1977; and for Y_2^p we consider the family's mean income between 1968-1988, between 1974-1988, and between 1979-1988. These variables are also included in Table 2.

The descriptive statistics contained in Table 2 reveal that: (i) the mean level of the child's education is greater than that of the parents'; (ii) the proportion of children receiving inter-vivos transfers is greater than the proportion of children receiving bequests; (iii) many families do not devote any resources to money family transfers and, hence, limited dependent variable models will have to be used.

TABLE 2: Mean and Standard Deviation of Selected variables

Not.	Variable[a]		Mean	St. Dev.
Y^p_{68-72}	Family Mean Income in 1968-1972		11.9246	6.8852
Y^p_{68-77}	Family Mean Income in 1968-1977		14.2824	7.9043
Y^p_{68-88}	Family Mean Income in 1968-1988		22.2890	11.7518
Y^p_{74-88}	Family Mean Income in 1974-1988		26.2713	14.4998
Y^p_{79-88}	Family Mean Income in 1979-1988		30.4680	17.8406
W^c	Child's Labour Income in 1988		29.2524	19.9661
A	Child's Age in 1988		33.4454	6.2035
F	Father's Level of Education		4.4660	1.9112
E	Child's Level of Education		5.5833	1.5150
	Gift Transfers		0.4951	2.0638
	Positive Gift Transfers	p = 0.280[b]	1.7526	3.5969
	Time Transfers		0.4153	1.2705
	Positive Time Transfers	p = 0.383[b]	1.0828	1.8699
b	Inter-vivos Transfers		0.9104	2.4173
	Positive Inter-vivos Transfers	p = 0.539[b]	1.7179	3.1071
b	Bequests		77.780	209.387
	Positive Bequests	p = 0.398[b]	195.455	295.632

[a] All monetary variables are measured in Thousand Dollars
[b] Proportion of non-zero observations

3.2 Econometric Specifications

To facilitate comparisons, we first consider two econometric specifications for money family transfers that do not include transfers on education. If we assume that δ is constant in (1), the solution to the second-period problem are money transfers $b(Y^p_2; W^c)$. As there is a non-negativity restriction for b; the first specification we consider is:

Specification 1:

$$b^*_i = \exp(\beta_0 + \beta_1 \ln Y^p_{2i} + \beta_2 \ln W^c_i + u_i) - 1;$$

$$b_i = \begin{cases} b^*_i & \text{if } b^*_i > 0; \\ 0 & \text{otherwise,} \end{cases}$$

where b^* is a latent variable and u is an error term. This specification is a log-linear "tobit" model, similar to one of the models introduced in Cragg (1971)[2]. Note that we include the term -1 in the expression for b^* to make the non-negativity restriction $b^* > 0$ equivalent to $\beta_0 + \beta_1 \ln Y_2^p + \beta_2 \ln W^c + u > 0$. We estimate this specification by maximum likelihood, assuming that the distribution of the error term u, conditional on the exogenous variables Y_2^p, W^c, is normal with mean 0. The resulting log-likelihood function is described in Appendix 2.

As in related literature, we also consider a specification in which the decision to give money transfers is considered separately from the quantity which is decided to transfer: the money-transfer takes place if the parent decides to give a transfer and the quantity which he would like to transfer is positive. Hence, the second specification that we consider is:

Specification 2:

$$b_i^* = \exp(\beta_0 + \beta_1 \ln Y_{2i}^p + \beta_2 \ln W_i^c + u_{1i}) - 1;$$
$$d_i = \exp(\gamma_0 + \gamma_1 \ln Y_{2i}^p + \gamma_2 \ln W_i^c + u_{2i}) - 1;$$
$$b_i = \begin{cases} b_i^* & \text{if } d_i > 0 \text{ and } b_i^* > 0; \\ 0 & \text{otherwise,} \end{cases}$$

where d is the decision variable and u_2 is another error term. This specification is also estimated by maximum likelihood assuming that the joint distribution of the error terms $(u_1, u_2)'$, conditional on the exogenous variables Y_2^p, W^c, is normal with mean 0. For identifiability, it is also necessary to assume that the conditional variance of u_2 is 1. The log-likelihood function is described in Appendix 2.

Let us consider now specifications that take transfers on education into account. Under both altruism and exchange, second-period money transfers b eventually depend on second-period family income Y_2^p, child's labor income W^c and first-period transfers on education g; on the other hand, first-period transfers on education g eventually depend on first-period family income Y_1^p and other characteristics of the family Z. As g is not directly observable, we introduce another equation relating g to the child's level of education,

[2] We also estimate linear "tobit" models for all specifications. The conclusions derived from them are very similar to the ones we present here, but the specification test carried out in Section 3.4 yields slightly worse results for the linear "tobit" model then for the log-linear one.

measured from 1 to 8. Additionally, to avoid biases in the estimation, we include an equation relating g to W^c; as in related literature, this equation is assumed to be log-linear (see, e.g., Loury 1981). Hence we consider:

Specification 3:

$$
\begin{aligned}
&\ln g_i = \gamma_0 + \gamma_1 \ln Y^p_{1i} + \gamma_2 \ln F_i + u_{1i};\\
&E_i = j \quad \text{if } \ln g_i + u_{2i} \in (\mu_{j-2}, \mu_{j-1}]; \quad \text{for } j = 1, \ldots, 8;\\
&\ln W^c_i = \theta_0 + \theta_1 \ln g_i + \theta_2 \ln A_i + u_{3i};\\
&b^*_i = \exp(\beta_0 + \beta_1 \ln Y^p_{2i} + \beta_2 \ln W^c_i + \beta_3 \ln g_i + u_{4i}) - 1;\\
&b_i = \begin{cases} b^*_i & \text{if } b^*_i > 0\\ 0 & \text{otherwise,}\end{cases}
\end{aligned}
$$

where F is the father's level of education, E is the child's level of education, A is the child's age in 1988, u_1, u_2, u_3, u_4 are error terms, and $\mu_{-1} \equiv -\infty$; $\mu_0 \equiv 0$; $\mu_7 \equiv +\infty$. Observe that no intercept or slope parameters are included in the equation relating E and g because they would not be identifiable since g is not observable; for the same reason, only six threshold parameters μ are included. In order to examine which assumptions on the error terms are required, we derive the relationships between E, W^c, b^* and the observable exogenous variables Y^p_1, F, A, Y^p_2 that follow from the specification:

$$
\begin{aligned}
&\Pr\{E_i = j\} = \Pr\{\gamma' Z_i + v_{1i} \in (\mu_{j-2}, \mu_{j-1}]\}; \quad \text{for } j = 1, \ldots, 8;\\
&\ln W^c_i = \theta_0 + \theta_1(\gamma' Z_i) + \theta_2 \ln A_i + v_{2i};\\
&\ln(b^*_i + 1) = \beta_0 + \beta_1 \ln Y^p_{2i} + \beta_2\{\theta_0 + \theta_1(\gamma' Z_i) + \theta_2 \ln A_i\} + \beta_3 \gamma' Z_i + v_{3i};
\end{aligned}
$$

where $\gamma \equiv (\gamma_0, \gamma_1, \gamma_2)'$, $Z \equiv (1, \ln Y^p_1, \ln F)'$, $\mu_{-1} \equiv -\infty$; $\mu_0 \equiv 0$; $\mu_7 \equiv +\infty$, $v_1 \equiv u_1 + u_2$; $v_2 \equiv \theta_1 u_1 + u_3$, $v_3 \equiv \beta_2 u_3 + (\beta_2\theta_1 + \beta_3)u_1 + u_4$. Hence, we assume that the joint distribution of the error terms $(v_1, v_2, v_3)'$ conditional on the exogenous variables is normal with mean 0. For identifiability, it is also necessary to assume that the conditional variance of v_1 is 1. This specification is also estimated by maximum likelihood. The log-likelihood function is also described in Appendix 2.

Finally, in this context, it is also possible to consider the decision to make transfers and the quantity to be transferred separately, introducing a decision equation as was done before:

$$\text{Specification 4:} \quad \begin{aligned} &\ln g_i = \gamma_0 + \gamma_1 \ln Y^p_{1i} + \gamma_2 \ln F_i + u_{1i}; \\ &E_i = j \quad \text{if } \ln g_i + u_{2i} \in (\mu_{j-2}, \mu_{j-1}]; \quad \text{for } j = 1, \ldots, 8; \\ &\ln W^c_i = \theta_0 + \theta_1 \ln g_i + \theta_2 \ln A_i + u_{3i}; \\ &b^*_i = \exp(\beta_0 + \beta_1 \ln Y^p_{2i} + \beta_2 \ln W^c_i + \beta_3 \ln g_i + u_{4i}) - 1; \\ &d_i = \exp(\lambda_0 + \lambda_1 \ln Y^p_{2i} + \lambda_2 \ln W^c_i + \lambda_3 \ln g_i + u_{5i}) - 1; \\ &b_i = \begin{cases} b^*_i & \text{if } d_i > 0 \text{ and } b^*_i > 0; \\ 0 & \text{otherwise,} \end{cases} \end{aligned}$$

In this specification, the relationships between E, W^c and the observable exogenous variables $Y^p_1; F; A; Y^p_2$ are the same as in Specification 3, and the relationship between d and the exogenous variables is:

$$\ln(d_i + 1) = \lambda_0 + \lambda_1 \ln Y^p_{2i} + \lambda_2 \{\theta_0 + \theta_1(\gamma' Z_i) + \theta_2 \ln A_i\} + \lambda_3 \gamma' Z_i + v_{4i};$$

where $v_4 \equiv \lambda_2 u_3 + (\lambda_2 \theta_1 + \lambda_3) u_1 + u_5$. Hence, we now assume that the joint distribution of the error terms $(v_1; v_2; v_3; v_4)'$ conditional on the exogenous variables is normal with mean 0. For identifiability, it is also necessary to assume that the conditional variances of v_1 and v_4 are 1. Once again, this specification is estimated by maximum likelihood, and the log-likelihood function is also described in Appendix 2.

3.3 Empirical Results

We are interested in two different types of family money-transfers: inter-vivos and bequests. For each specification, therefore, we first present the results for inter-vivos transfers as a dependent variable, and then the results for bequests as a dependent variable. Additionally, we have considered various possible choices for each parent's income variable. All monetary variables haven been used in thousand dollars. In all subsequent tables, estimates are reported with their t-statistics, which have been computed with outer-product based standard errors.[3]

In Tables 3, 4, 5 and 6 we report the results obtained from modelling inter-vivos transfers.

[3] All maximum likelihood estimates have been obtained using GAUSS CML routines. Programs are available from the authors upon request.

TABLE 3: Specification 1 with Inter-vivos Transfers

Estimates with t-statistics into brackets

	$Y_2^p = Y_{79-88}^p$	$Y_2^p = Y_{74-88}^p$	$Y_2^p = Y_{68-88}^p$
β_0	0.0250 (0.074)	-0.1665 (0.472)	-0.2077 (-0.591)
β_1	0.2589 (2.880)	0.3378 (3.441)	0.3734 (3.652)
β_2	-0.2709 (-4.127)	-0.2782 (-4.269)	-0.2822 (-4.334)
Mean Log-Likelihood	-1.41418	-1.41019	-1.40860

TABLE 4: Specification 2 with Inter-vivos Transfers

Estimates with t-statistics into brackets

	$Y_2^p = Y_{79-88}^p$	$Y_2^p = Y_{74-88}^p$	$Y_2^p = Y_{68-88}^p$
β_0	0.0247 (0.068)	-0.1659 (-0.450)	-0.1899 (-0.536)
β_1	0.2612 (2.726)	0.3400 (3.337)	0.3769 (3.680)
β_2	-0.2695 (-3.506)	-0.2764 (-3.770)	-0.2863 (-4.353)
λ_0	0.0272 (0.062)	-0.1800 (-0.435)	-0.2381 (-0.613)
λ_1	0.2763 (2.170)	0.3621 (2.988)	0.3988 (3.438)
λ_2	-0.2918 (-2.462)	-0.3014 (-2.928)	-0.3016 (-3.899)
Mean Log-Likelihood	-1.40762	-1.40292	-1.40014

In Specifications 1 and 2 we consider three possible choices for Y_2^p: the family mean income in 1979-1988, in 1974-1988, and in 1968-1988, denoted by Y_{79-88}^p, Y_{74-88}^p and Y_{68-88}^p, respectively. In these two specifications the parameter that might allow us to discriminate between exchange and altruism is β_2, coefficient of $\ln W^c$. But here this coefficient proves to be negative and significant, so there is no evidence against altruism nor evidence against exchange either. The estimate of β_1, coefficient of $\ln Y_2^p$, is positive and significant in all cases. All choices for Y_2^p that have been considered produce similar results. The inclusion of a decision equation in Specification 2 does not yield any change in the conclusions. In fact, the estimates of β and $\gamma = var(u_1)^{1/2}$ are very similar, indicating that b^* and d are almost identical except for a scale factor, and hence the decision equation seems redundant here.

TABLE 5. Specification 3 with Intervivos Transfers
Estimates with t-statistics into brackets

	$Y_1^p = Y_{68-72}^p$ $Y_2^p = Y_{68-88}^p$	$Y_1^p = Y_{68-77}^p$ $Y_2^p = Y_{68-88}^p$
γ_0	1.2319 (2.476)	1.2141 (2.304)
γ_1	0.5370 (4.788)	0.4644 (3.568)
γ_2	0.6381 (5.361)	0.7089 (5.656)
θ_0	-0.6472 (-1.097)	-0.5924 (-0.980)
θ_1	0.2379 (4.176)	0.2183 (3.588)
θ_2	0.8584 (5.051)	0.8614 (5.074)
β_0	2.0696 (2.135)	2.0295 (2.030)
β_1	0.2015 (1.426)	0.1696 (1.184)
β_2	-1.2773 (-3.401)	-1.2520 (-3.363)
β_3	0.4071 (2.441)	0.4231 (2.490)
Mean Log-Likelihood	-4.00755	-4.01721

In Specifications 3 and 4 we consider two possible choices for Y_1^p: the family mean income in 1968-1972, and in 1968-1977, denoted by Y_{68-72}^p and Y_{68-77}^p, respectively; on the other hand, we only report the results for $Y_2^p = Y_{68-88}^p$, as the results when considering $Y_2^p = Y_{79-88}^p$ or $Y_2^p = Y_{74-88}^p$ are similar to these. What we first observe in the estimations of Specifications 3 and 4 is that, in all cases, the parameters in the equation that determines the transfers on education g have their expected signs and magnitudes: they are positive and highly significant. The parameters in the equation that determines the child's labor earnings W^c also have their expected signs and magnitudes. In the equation which determines b, the estimate of β_2, coefficient of $\ln W^c$, is negative and significant, which is compatible with both the altruism and the exchange hypotheses. The estimate of β_3, coefficient of $\ln g$, is positive and significant in all cases; hence, the altruism hypothesis is rejected. However, there is no evidence against exchange, although the estimate of β_1, coefficient of $\ln Y_2^p$, should be expected to be more significant.

TABLE 6: Specification 4 with Intervivos Transfers

Estimates with t-statistics into brackets

	$Y_1^p = Y^p_{68-72}$ $Y_2^p = Y^p_{68-88}$	$Y_1^p = Y^p_{68-77}$ $Y_2^p = Y^p_{68-88}$
γ_0	1.2319 (2.447)	1.2145 (2.280)
γ_1	0.5370 (4.756)	0.4643 (3.548)
γ_2	0.6381 (5.337)	0.7090 (5.591)
θ_0	−0.6472 (−1.088)	−0.5885 (−0.965)
θ_1	0.2380 (4.144)	0.2183 (3.574)
θ_2	0.8586 (4.972)	0.8605 (4.996)
β_0	2.0700 (1.978)	2.0346 (1.880)
β_1	0.2023 (1.407)	0.1709 (1.143)
β_2	−1.2755 (−3.041)	−1.2517 (−3.014)
β_3	0.4083 (2.036)	0.4246 (2.031)
λ_0	2.2357 (1.635)	2.1990 (1.502)
λ_1	0.2157 (1.333)	0.1819 (1.001)
λ_2	−1.3814 (−2.501)	−1.3571 (−2.444)
λ_3	0.4379 (1.745)	0.4560 (1.695)
Mean Log-Likelihood	−3.99818	−4.00771

In the results for Specification 4 we observe that the inclusion of a decision equation yields no change in the conclusions, and again the estimates of β and $\gamma = var(v_3)^{1/2}$ are very similar. Moreover, the gain of the additional equation, in terms of likelihood, is extremely small, indicating that the decision equation is also redundant here.

To sum up, when analyzing the motives for inter-vivos transfers, the specifications without transfers on education do not allow us to discriminate between exchange or altruism, but the inclusion of transfers on education provides evidence compatible with exchange, but not with altruism.

In Tables 7, 8, 9 and 10 we report the results from modelling bequests. Greater caution is necessary on interpreting these results, as the dependent variable here is not a real money-transfer, but a potential inheritance.

TABLE 7: Specification 1 with Bequests

Estimates with t-statistics into brackets

	$Y_2^p = Y_{79-88}^p$	$Y_2^p = Y_{74-88}^p$	$Y_2^p = Y_{68-88}^p$
β_0	-7.1062 (-3.169)	-7.2102 (-3.149)	-7.1544 (-3.173)
β_1	1.9703 (3.217)	2.0503 (3.178)	2.1467 (3.209)
β_2	-0.0626 (-0.165)	-0.0248 (-0.066)	-0.0315 (-0.084)
Mean Log-Likelihood	-3.36696	-3.36725	-3.36698

In the results for Specification 1, we observe that the estimate of β_2, coefficient of $\ln W^c$; is negative but clearly non-significant, what casts doubts on the validity of the altruism hypothesis. The inclusion of a decision equation in Specification 2 does play a role here, as the parent's income variable proves to have a much greater influence on the quantity to be transferred once the decision to make the transfer has been made.

TABLE 8: Specification 2 with Bequests

Estimates with t-statistics into brackets

	$Y_2^p = Y^p_{79-88}$	$Y_2^p = Y^p_{74-88}$	$Y_2^p = Y^p_{68-88}$
β_0	0.3756 (0.408)	−0.0022 (−0.020)	−0.0862 (−0.096)
β_1	1.2073 (6.424)	1.3636 (10.667)	1.4865 (7.142)
β_2	0.0015 (0.010)	0.0215 (0.155)	0.0019 (0.014)
λ_0	−1.2131 (−2.839)	−1.1972 (−2.806)	−1.1776 (−2.802)
λ_1	0.3020 (2.421)	0.3030 (2.355)	0.3122 (2.356)
λ_2	−0.0132 (−0.144)	−0.0062 (−0.072)	−0.0061 (−0.072)
Mean Log-Likelihood	−3.10926	−3.10446	−3.10027

In Specifications 3 and 4 we report the results considering $Y_1^p = Y^p_{68-72}$ or Y^p_{68-77}, and $Y_2^p = Y^p_{68-88}$; as before, very similar results were obtained with all other possible choices for these variables. The parameters in the equations that determine g and W^c have again their expected signs and magnitudes. In Specification 3, in the equation which determines b we observe that the estimates of β_2 and β_3, coefficients of $\ln W^c$ and $\ln g$, have opposite signs but both are non-significant. The estimate of β_1, coefficient of $\ln Y_2^p$, is significant at the 10% level, though not at the usual 5% level. This set of results excludes against the altruism hypothesis, but is compatible with the exchange one. Observe also that the only variable which could be deemed as relevant to determine bequests is parent's income, what is quite a natural result if we consider how the variable "bequests" has been defined.

In Specification 4 we observe that the inclusion of a decision equation does not seem to play an important role here, as all parameters in the equation which determines d prove to be non-significant, and the estimates of the coefficients of $\ln Y_2^p$, $\ln W^c$ and $\ln g$ in the equation which determines b are very similar to those obtained in Specification 3.

TABLE 9. Specification 3 with Bequests

Estimates with t-statistics into brackets

	$Y_1^p = Y^p_{68-72}$ $Y_2^p = Y^p_{68-88}$	$Y_1^p = Y^p_{68-77}$ $Y_2^p = Y^p_{68-88}$
γ_0	1.2216 (2.468)	1.2220 (2.336)
γ_1	0.5331 (4.781)	0.4475 (3.472)
γ_2	0.6414 (5.341)	0.7228 (5.732)
θ_0	-0.6420 (-1.100)	-0.5746 (-0.959)
θ_1	0.2376 (4.199)	0.2161 (3.566)
θ_2	0.8583 (5.108)	0.8594 (5.117)
β_0	-3.4621 (-0.776)	-2.8542 (-0.612)
β_1	1.4308 (1.719)	1.6567 (1.922)
β_2	-1.6745 (-0.981)	-1.7609 (-1.018)
β_3	1.0857 (1.296)	0.7834 (0.954)
Mean Log-Likelihood	-5.97412	-5.98411

To sum up, the results for bequests are not as conclusive as in the case of inter-vivos transfers, mainly because many of the estimated parameters are non-significant. However, results continue to be compatible with the exchange hypothesis, and again there is evidence against the altruism hypothesis. These conclusions can be drawn even without incorporating transfers on education, though this inclusion strengthens them as the predicted signs derived from the exchange model in this context coincide with the estimated signs. A possible reason which might explain why results are less conclusive for bequests is because our theoretical framework has been devised for intentional money-transfers and might not be entirely appropriate to model these hypothetical bequests.

TABLE 10: Specification 4 with Bequests

Estimates with t-statistics into brackets

	$Y_1^p = Y_{68-72}^p$ $Y_2^p = Y_{68-88}^p$	$Y_1^p = Y_{68-77}^p$ $Y_2^p = Y_{68-88}^p$
γ_0	2.4526 (0.045)	2.6236 (0.023)
γ_1	0.5185 (4.504)	0.4711 (3.606)
γ_2	0.6476 (5.290)	0.6865 (5.440)
θ_0	-1.0610 (-0.082)	-1.0271 (-0.041)
θ_1	0.2381 (4.085)	0.2240 (3.599)
θ_2	0.8943 (5.383)	0.8905 (5.335)
β_0	-6.9282 (-0.106)	-6.7559 (-0.049)
β_1	1.5978 (2.237)	1.3702 (1.901)
β_2	-1.4430 (-0.762)	-0.9392 (-0.676)
β_3	1.2065 (1.714)	1.2062 (1.688)
λ_0	0.2815 (0.011)	-0.2217 (-0.008)
λ_1	-0.0144 (-0.046)	0.2356 (1.121)
λ_2	-0.8694 (-1.563)	-0.6359 (-1.317)
λ_3	0.4783 (1.399)	0.2593 (1.325)
Mean Log-Likelihood	-5.81790	-5.80958

3.4 Specification Analysis: Conditional Distribution of Money-Transfers

The econometric specifications that have been used are fully parametric. Hence, each of them provides a parametric specification of the conditional distribution function of the money-transfers b. A possible way to analyze the validity of each econometric specification is to test whether the induced parametric conditional distribution function of b is correct. By doing this we will not only examine if the econometric model is acceptable, but we will also derive relevant statistical information about money-transfers.

Andrews (1997) proposes to test the null hypothesis "the specified parametric conditional distribution function is correct" versus the general alternative that it is not correct using a conditional Kolmogorov-Smirnov statistic (CKS_n). This statistic compares the conditional empirical distribution function and the estimated parametric conditional distribution function. Specifically, it is defined as:

$$CKS_n = \max_{1 \le j \le n} \left| \frac{1}{\sqrt{n}} \sum_{i=1}^{n} \left[I(b_i \le b_j) - F(b_j \mid X_i; \hat{\psi}) \right] I(X_i \le X_j) \right|;$$

where $I(A)$ is the indicator function of event A, which is 1 if A is true or 0 otherwise; $F(\cdot \mid X; \psi)$ is the specified distribution function of b conditional on the exogenous variables X; which is assumed to depend on the parameter vector ψ; and $\hat{\psi}$ is a root-n-consistent estimator of ψ. The null hypothesis of correct econometric specification is rejected with significance level α if $CKS_n \ge c_{\alpha;n}$, where $c_{\alpha;n}$ is a critical value obtained by bootstrap according to the procedure described in Andrews (1997).

In our case, in Specifications 1 and 3, the conditional distribution function of b induced by the parametric specification is:

$$F(b \mid X; \psi) = \begin{cases} 0 & \text{if } b < 0 \\ \Phi\left\{\frac{\ln(b+1) - \mu}{\sigma}\right\} & \text{if } b \ge 0 \end{cases}$$

where $\Phi(\cdot)$ is the standard normal distribution function; in Specification 1, $\mu = \beta_0 + \beta_1 \ln Y_2^p + \beta_2 \ln W^c$ and $\sigma = var(u)$; in Specification 3, $\mu = \beta_0 + \beta_1 \ln Y_2^p + \beta_2 \{\theta_0 + \theta_1(\gamma' Z) + \theta_2 \ln A\} + \beta_3 \gamma' Z$ and $\sigma = var(v_3)$: Observe that in Specification 1 the exogenous variables are $X = (Y_2^p; W^c)'$, whereas in Specification 3 the exogenous variables are $X = (Y_1^p; F; A; Y_2^p)'$.

In Specifications 2 and 4, the conditional distribution function of b induced by the parametric specification is:

$$F(b \mid X; \psi) = \begin{cases} 0 & \text{if } b < 0 \\ \Phi(-\varphi) + \Phi\left(\frac{\ln(b+1) - \mu}{\sigma}\right) - \Phi^*\left\{\frac{\ln(b+1) - \mu}{\sigma}; -\varphi; \rho\right\} & \text{if } b \ge 0 \end{cases}$$

where ©ª(¢; ¢; ½) is the standard bivariate normal distribution function with correlation coe¢cient ½; in Speci…cation 2, ' = ¸$_0$ + ¸$_1$ ln Y_2^p + ¸$_2$ ln W^c; ¹ is as in Speci…cation 1, ¾ = var(u_1) and ½ is the correlation coe¢cient between u_1 and u_2; in Speci…cation 4, ' = ¸$_0$ + ¸$_1$ ln Y_2^p + ¸$_2$fµ$_0$ + µ$_1$(°^{0}Z) + µ$_2$ ln Ag + ¸$_3$°^{0}Z, ¹ is as in Speci…cation 3, ¾ = var(v_3) and ½ is the correlation coe¢cient between v_3 and v_4. The exogenous variables in Speci…cation 2 are the same as in Speci…cation 1, and in Speci…cation 4 are the same as in Speci…cation 3.

In Tables 11 and 12 we report the CKS_n statistics, the bootstrap critical values at the 5% and 10% signi…cance levels and the bootstrap p-values for all speci…cations. These results were derived with 500 bootstrap replications.

TABLE 11: Speci…cation Test for Inter-Vivos Transfers

	Test-Statistic	$c_{0:90}$	$c_{0:95}$	P–Value
	Speci…cation 1			
$Y_2^p = Y^p_{79¡88}$	1:4020	1:058	1:190	0:018
$Y_2^p = Y^p_{74¡88}$	1:3526	1:059	1:209	0:020
$Y_2^p = Y^p_{68¡88}$	1:3622	1:041	1:164	0:022
	Speci…cation 2			
$Y_2^p = Y^p_{79¡88}$	1:4954	0:941	1:046	0:004
$Y_2^p = Y^p_{74¡88}$	1:4591	0:922	1:011	0:002
$Y_2^p = Y^p_{68¡88}$	1:4546	0:905	1:040	0:002
	Speci…cation 3			
$Y_1^p = Y^p_{68¡72}$; $Y_2^p = Y^p_{68¡88}$	0:6430	0:640	0:694	0:102
$Y_1^p = Y^p_{68¡77}$; $Y_2^p = Y^p_{68¡88}$	0:6315	0:638	0:691	0:106
	Speci…cation 4			
$Y_1^p = Y^p_{68¡72}$; $Y_2^p = Y^p_{68¡88}$	0:6621	0:627	0:674	0:062
$Y_1^p = Y^p_{68¡77}$; $Y_2^p = Y^p_{68¡88}$	0:6594	0:622	0:678	0:064

TABLE 12: Specification Test for Bequests

	Test-Statistic	$c_{0.90}$	$c_{0.95}$	P–Value
Specification 1				
$Y_2^p = Y_{79-88}^p$	2.1465	1.697	1.811	0.006
$Y_2^p = Y_{74-88}^p$	2.1110	1.692	1.752	0.008
$Y_2^p = Y_{68-88}^p$	2.0843	1.709	1.743	0.008
Specification 2				
$Y_2^p = Y_{79-88}^p$	1.4478	1.367	1.497	0.070
$Y_2^p = Y_{74-88}^p$	1.3896	1.361	1.482	0.088
$Y_2^p = Y_{68-88}^p$	1.3842	1.364	1.488	0.092
Specification 3				
$Y_1^p = Y_{68-72}^p;\ Y_2^p = Y_{68-88}^p$	1.1223	1.174	1.287	0.176
$Y_1^p = Y_{68-77}^p;\ Y_2^p = Y_{68-88}^p$	1.1289	1.167	1.289	0.168
Specification 4				
$Y_1^p = Y_{68-72}^p;\ Y_2^p = Y_{68-88}^p$	0.9959	1.101	1.198	0.194
$Y_1^p = Y_{68-77}^p;\ Y_2^p = Y_{68-88}^p$	0.9960	1.112	1.204	0.198

When modelling inter-vivos transfers as a dependent variable, Specifications 1 and 2 do not induce a statistically acceptable conditional distribution function for money-transfers; however, the p-values for Specifications 3 and 4 are above 0.05, and hence they are not rejected with usual significance levels, though it is worth noting that the inclusion of a decision equation does not lead to a better fit, what casts doubts again on the suitability of such an inclusion here. When using bequests as a dependent variable, only Specification 1 is rejected and, unlike in the previous case, the specifications with a decision equation lead to a better fit. Comparing the results of Tables 11 and 12, we observe that the test-statistics obtained for bequests are greater, what is not a surprise taking into account that the magnitude and dispersion of the dependent variable is much greater then (see Table 2). However, in terms of p-values, a better fit is obtained for bequests, possibly because there is then a high correlation between the dependent variable and parent's income in the second period, which is one of the explanatory variables.

We have also used the CKS_n statistic to test if the parametric conditional distribution functions of E and $\ln W^c$ induced by Specifications 3 and 4 are correct. In both cases, the null hypothesis is not rejected at the 5% significance level. Finally, specific tests for homoskedasticity were performed separately for the equations which relate E; $\ln W^c$ and b with the exogenous variables (Specifications 3 and 4), and for the equation which relates d with the exogenous variables (Specification 4); we used the general formulation proposed by Harvey (1976) and Wald statistics (see e.g. Greene 1997, Section 19.4.1), and did not reject the null hypothesis of homoskedasticity at the 5% significance level in any case.

4 Conclusions

The main objective of this work is to explain the motivation behind family money-transfers. Two principal alternative explanations have appeared in the related literature. One of them is that family members are altruistic; the other one considers family money-transfers as an exchange, which is part of an arrangement. The empirical literature on this topic is inconclusive. Our contribution is that we include in the model transfers on education, decided before family money-transfers take place. We prove that this inclusion helps to discriminate between these two motives for family transfers. Our empirical results using PSID data reveal evidence against altruism, but are consistent with the exchange hypothesis. This conclusion holds with the two kinds of monetary transfers which we consider, inter-vivos family transfers and bequests, though in the latter case our results are less conclusive, and this conclusion cannot be reached if the effect of transfers on education is ignored. Additionally, among other specifications tests, we use the statistic proposed in Andrews (1997) to test if the parametric conditional distribution of money-transfers derived from each econometric specification is correct. This test is performed comparing the estimated parametric conditional distribution function with the empirical one; our results reveal that the degree of similarity between them is reasonably good in all specifications which explicitly include transfers on education.

APPENDIX 1: Comparative Statics

We compute the partial derivatives of the behavioral equation corresponding to the second period problem for interior solution of monetary transfers in both scenarios: the altruistic and the exchange model. We start with the altruistic model. Differentiating of the first order condition (2), evaluated in the optimal interior solution $b(Y_2^p; W^c; \delta(g))$, denoted for simplicity b, yields:

$$\begin{aligned} 0 \;=\;& db\left(U''(Y_2^p - b) + \delta(g)V''(W^c + b)\right) + dg\left(\delta'(g)V'(W^c + b)\right) \\ &+ dY_2^p\left(-U''(Y_2^p - b)\right) + dW^c\left(\delta(g)V''(W^c + b)\right) \end{aligned}$$

If $\delta'(g) \leq 0$, this equation implies the following partial derivatives:

$$\begin{aligned} \frac{db}{dY_2^p} &= \frac{U''(Y_2^p - b)}{U''(Y_2^p - b) + \delta(g)V''(W^c + b)} > 0; \\ \frac{db}{dW^c} &= \frac{-\delta(g)V''(W^c + b)}{U''(Y_2^p - b) + \delta(g)V''(W^c + b)} < 0; \\ \frac{db}{dg} &= \frac{-\delta'(g)V'(W^c + b)}{U''(Y_2^p - b) + \delta(g)V''(W^c + b)} \leq 0. \end{aligned}$$

In the exchange model we differentiate the first order condition (5) for the interior solution, obtaining:

$$\begin{aligned} 0 \;=\;& db\left(U_1''(Y_2^p - b) + \left(\frac{1}{p}\right)^2 U_2''\left(\frac{b}{p}\right)\right) + \\ & dp\left(-\left(\frac{1}{p}\right)^2 U_2'\left(\frac{b}{p}\right) - \left(\frac{1}{p}\right)^3 bU_2''\left(\frac{b}{p}\right)\right) + dY_2^p\left(-U_1''(Y_2^p - b)\right) \end{aligned}$$

This equation implies the following comparative static:

$$\begin{aligned} \frac{db}{dY_2^p} &= \frac{U_1''(Y_2^p - b)}{U_1''(Y_2^p - b) + \left(\frac{1}{p}\right)^2 U_2''\left(\frac{b}{p}\right)} > 0; \\ \frac{db}{dp} &= \frac{U_2'\left(\frac{b}{p}\right) + \frac{b}{p}U_2''\left(\frac{b}{p}\right)}{U_1''(Y_2^p - b)p^2 + U_2''\left(\frac{b}{p}\right)} \gtreqless 0 \iff \frac{U_2'\left(\frac{b}{p}\right)}{U_2''\left(\frac{b}{p}\right)} + \frac{b}{p} \gtreqless 0. \end{aligned}$$

APPENDIX 2: Likelihood Functions

Likelihood Function for Specification 1: Following the same reasoning as in Amemiya (1985, Section 10.2):

$$L_1 = \prod_{b_i=0} \Pr(b_i = 0) \prod_{b_i>0} f(b_i);$$

where $f(\cdot)$ is the density of b_i^*. If σ^2 denotes the variance of u_i and $m_{bi} \equiv \beta_0 + \beta_1 \ln Y_{2i}^p + \beta_2 \ln W_i^c$, then:

$$\ln L_1 = \sum_{b_i=0} \ln \Phi(-\frac{m_{bi}}{\sigma}) + \sum_{b_i>0} \{-\ln(b_i+1) - \frac{1}{2}\ln(2\pi\sigma^2) - \frac{[\ln(b_i+1) - m_{bi}]^2}{2\sigma^2}\};$$

where $\Phi(\cdot)$ is the standard normal distribution function.

Likelihood Function for Specification 2: In this case:

$$L_2 = \prod_{b_i=0} \Pr(d_i \le 0 \text{ or } b_i \le 0) \prod_{b_i>0} f(b_i \mid d_i > 0; b_i > 0) \Pr(d_i > 0; b_i > 0);$$

where $f(\cdot)$ is the density of b_i^*. Reasoning as in Amemiya (1985, Section 10.7), the i-th term in the second factor can be expressed as $f(b_i)\Pr(d_i > 0 \mid b_i)$. Hence, if σ^2 denotes the variance of u_{1i} and ρ the correlation coefficient between u_{1i} and u_{2i}, m_{bi} is as before and $m_{di} = \gamma_0 + \gamma_1 \ln Y_{2i}^p + \gamma_2 \ln W_i^c$, then:

$$\ln L_2 = \sum_{b_i=0} \ln[\Phi(-\frac{m_{bi}}{\sigma}) + \Phi(-m_{di}) - \Phi^*(-\frac{m_{bi}}{\sigma}; -m_{di}; \rho)] +$$

$$\sum_{b_i>0} -\ln(b_i+1) - \frac{1}{2}\ln(2\pi\sigma^2) - \frac{[\ln(b_i+1) - m_{bi}]^2}{2\sigma^2} + \ln \Phi(\frac{m_{di} + \frac{\rho}{\sigma}[\ln(b_i+1) - m_{bi}]}{(1-\rho^2)^{1/2}});$$

where $\Phi^*(\cdot;\cdot;\rho)$ is the bivariate standard normal distribution function.

Likelihood Function for Specification 3: We must obtain:

$$L_3 = \prod_{j=1}^{8} \left[\prod_{E_i=j;\, b_i=0} f(\ln W_i^c \mid E_i = j; b_i = 0) \Pr(E_i = j; b_i = 0) \times \right.$$

$$\left.\prod_{E_i=j;\, b_i>0} f(\ln W_i^c; b_i \mid E_i = j; b_i > 0)\Pr(E_i = j; b_i > 0)\right] ;$$

where $f(\cdot \mid E_i = j; b_i = 0)$ is the conditional density of $\ln W_i^c$ given $E_i = j; b_i = 0$, and $f(\cdot;\cdot \mid E_i = j; b_i > 0)$ is the conditional density of $(\ln W_i^c; b_i^*)'$ given $E_i = j; b_i > 0$. Rearranging terms as in the previous case, the likelihood function can also be expressed as:

$$L_3 = \prod_{j=1}^{2}\left[\prod_{E_i=j;\, b_i=0} f(\ln W_i^c)\Pr(E_i = j; b_i = 0 \mid \ln W_i^c) \times \right.$$

$$\left.\prod_{E_i=j;\, b_i>0} f(\ln W_i^c; b_i)\Pr(E_i = j \mid \ln W_i^c; b_i)\right],$$

where $f(\cdot)$ is the density of $\ln W_i^c$ and $f(\cdot;\cdot)$ is the conditional density of $(\ln W_i^c; b_i^*)'$. If we denote $e_i \equiv \gamma' Z_i + v_{1i}$, $m_{ei} \equiv \gamma' Z_i$, $m_{wi} \equiv \theta_0 + \theta_1 m_{ei} + \theta_2 \ln A_i$, $m_{bi} \equiv \beta_0 + \beta_1 \ln Y_{2i}^p + \beta_2 m_{wi} + \beta_3 m_{ei}$, then the joint distribution of $(e_i, \ln W_i^c; \ln(b_i^* + 1))'$ conditional on the exogenous variables is normal with mean $(m_{ei}; m_{wi}; m_{bi})'$ and variance-covariance matrix whose $(j;k)$ element is $\rho_{jk}\sigma_j\sigma_k$, where ρ_{jk} denotes the correlation coefficient between v_{ji} and v_{ki}; and σ_k^2 the variance of v_{ki} (for $j;k = 1;2;3$) and, in this case, $\sigma_1^2 = 1$. Using the properties of the normal distribution, then we deduce that:

$$\ln L_3 = \sum_{j=1}^{2}\left[\sum_{E_i=j;\, b_i=0}\left\{-\frac{1}{2}\ln(2\pi\sigma_2^2) - \frac{(\ln W_i^c - m_{wi})^2}{2\sigma_2^2} + \right.\right.$$

$$\left. + \ln[\Phi^*(\frac{\mu_{j-1} - \tilde{m}_{ei}}{(1-\rho_{12}^2)^{1/2}}; \frac{-\tilde{m}_{bi}}{\sigma_3(1-\rho_{23}^2)^{1/2}}; \tilde{\rho}) - \Phi^*(\frac{\mu_{j-2} - \tilde{m}_{ei}}{(1-\rho_{12}^2)^{1/2}}; \frac{-\tilde{m}_{bi}}{\sigma_3(1-\rho_{23}^2)^{1/2}}; \tilde{\rho})]\right\} +$$

$$\sum_{E_i=j;\, b_i>0}\left\{-\ln(b_i + 1) - \ln(2\pi) - \frac{1}{2}\ln[\sigma_2^2\sigma_3^2(1-\rho_{23}^2)] + \right.$$

$$\frac{\rho_{23}(\ln W_i^c - m_{wi})[\ln(b_i + 1) - m_{bi}]}{\sigma_2\sigma_3(1-\rho_{23}^2)} - \frac{(\ln W_i^c - m_{wi})^2}{2\sigma_2^2(1-\rho_{23}^2)} - \frac{[\ln(b_i + 1) - m_{bi}]^2}{2\sigma_3^2(1-\rho_{23}^2)} +$$

$$\left.\left.\ln[\Phi(\frac{\mu_{j-1} - m_{*i}}{\sigma_*}) - \Phi(\frac{\mu_{j-2} - m_{*i}}{\sigma_*})]\right\}\right] ;$$

where we denote:

$$m^*_{ei} \equiv m_{ei} + \rho_{12}(\ln W_i^c - m_{wi})/\sigma_2;$$
$$m^*_{bi} \equiv m_{bi} + \sigma_3\rho_{23}(\ln W_i^c - m_{wi})/\sigma_2;$$
$$\rho_* \equiv (\rho_{13} - \rho_{23}\rho_{12})/[(1-\rho_{23}^2)(1-\rho_{12}^2)]^{1/2};$$
$$m_{*i} \equiv m_{ei} + (\rho_{12} - \rho_{13}\rho_{23})(\ln W_i^c - m_{wi})/[\sigma_2(1-\rho_{23}^2)] + (\rho_{13} - \rho_{12}\rho_{23})[\ln(b_i+1) - m_{bi}]/[\sigma_3(1-\rho_{23}^2)];$$
$$\sigma_*^2 \equiv 1 - (\rho_{12}^2 + \rho_{13}^2 - 2\rho_{12}\rho_{23}\rho_{13})/(1-\rho_{23}^2).$$

Likelihood Function for Specification 4: We must now obtain:

$$L_4 = \prod_{j=1} \left[\prod_{E_i=j;\, b_i=0} f(\ln W_i^c \mid E_i = j; b_i = 0)\Pr(E_i = j; b_i = 0) \times \prod_{E_i=j;\, b_i>0} f(\ln W_i^c; b_i \mid E_i = j; d_i > 0; b_i^* > 0)\Pr(E_i = j; d_i > 0; b_i^* > 0) \right];$$

where $f(\cdot \mid E_i = j; b_i = 0)$ is the conditional density of $\ln W_i^c$ given $E_i = j; b_i = 0$, and $f(\cdot;\cdot \mid E_i = j; d_i > 0; b_i^* > 0)$ is the conditional density of $(\ln W_i^c; b_i)'$ given $E_i = j; d_i > 0; b_i^* > 0$. Reasoning as before, the likelihood function can also be expressed as:

$$L_4 = \prod_{j=1} \left[\prod_{E_i=j;\, b_i=0} f(\ln W_i^c)\Pr(\{E_i = j; d_i \leq 0\} \cup \{E_i = j; b_i^* \leq 0\} \mid \ln W_i^c) \times \prod_{E_i=j;\, b_i>0} f(\ln W_i^c; b_i)\Pr(E_i = j; d_i > 0 \mid \ln W_i^c; b_i) \right],$$

where $f(\cdot)$ is the conditional density of $\ln W_i^c$ and $f(\cdot;\cdot)$ is the conditional density of $(\ln W_i^c; b_i^*)'$. If we denote e_i, m_{ei}, m_{wi}, m_{bi} as before, and $m_{di} \equiv \beta_0 + \beta_1 \ln Y_{2i}^p + \beta_2 m_{wi} + \beta_3 m_{ei}$, then the joint distribution of $(e_i; \ln W_i^c; \ln(b_i^* + 1); \ln(d_i + 1))'$ conditional on the exogenous variables is normal with mean $(m_{ei}; m_{wi}; m_{bi}; m_{di})'$ and variance-covariance matrix whose $(j;k)$ element is $\rho_{jk}\sigma_j\sigma_k$, where ρ_{jk} denotes the correlation coefficient between v_{ji} and v_{ki}; and σ_k^2 the variance of v_{ki} (for $j;k = 1;2;3;4$) and, in this case, $\sigma_1^2 = 1$, $\sigma_4^2 = 1$. Using the properties of the normal distribution, then we deduce that:

$$\ln L_4 = \sum_{j=1} \left[\sum_{E_i=j;\, b_i=0} \left\{ -\frac{1}{2}\ln(2\pi\sigma_2^2) - \frac{(\ln W_i^c - m_{wi})^2}{2\sigma_2^2} + \right.\right.$$

$$
\begin{aligned}
&+\ln\Bigg(\Phi^*\Big(\frac{\gamma_{j-1}-\tilde m_{ei}}{(1-\rho_{12}^2)^{1/2}},\frac{-\tilde m_{bi}}{\sigma_3(1-\rho_{23}^2)^{1/2}};\tilde\rho_{13}\Big)-\Phi^*\Big(\frac{\gamma_{j-2}-\tilde m_{ei}}{(1-\rho_{12}^2)^{1/2}},\frac{-\tilde m_{bi}}{\sigma_3(1-\rho_{23}^2)^{1/2}};\tilde\rho_{13}\Big)\\
&\quad+\Phi^*\Big(\frac{\gamma_{j-1}-\tilde m_{ei}}{(1-\rho_{12}^2)^{1/2}},\frac{-\tilde m_{di}}{(1-\rho_{24}^2)^{1/2}};\tilde\rho_{14}\Big)-\Phi^*\Big(\frac{\gamma_{j-2}-\tilde m_{ei}}{(1-\rho_{12}^2)^{1/2}},\frac{-\tilde m_{di}}{(1-\rho_{24}^2)^{1/2}};\tilde\rho_{14}\Big)\\
&\quad-\Phi^{**}\Big(\frac{\gamma_{j-1}-\tilde m_{ei}}{(1-\rho_{12}^2)^{1/2}},\frac{-\tilde m_{bi}}{\sigma_3(1-\rho_{23}^2)^{1/2}},\frac{-\tilde m_{di}}{(1-\rho_{24}^2)^{1/2}};\tilde\rho_{13},\tilde\rho_{34},\tilde\rho_{14}\Big)\\
&\quad+\Phi^{**}\Big(\frac{\gamma_{j-2}-\tilde m_{ei}}{(1-\rho_{12}^2)^{1/2}},\frac{-\tilde m_{bi}}{\sigma_3(1-\rho_{23}^2)^{1/2}},\frac{-\tilde m_{di}}{(1-\rho_{24}^2)^{1/2}};\tilde\rho_{13},\tilde\rho_{34},\tilde\rho_{14}\Big)\Bigg)+\\
&\sum_{E_i=j;\,b_i>0}\Bigg\{-\ln(b_i+1)-\ln(2\pi)-\frac{1}{2}\ln[\sigma_2^2\sigma_3^2(1-\rho_{23}^2)]+\\
&\frac{\rho_{23}(\ln W_i^c-m_{wi})[\ln(b_i+1)-m_{bi}]}{\sigma_2\sigma_3(1-\rho_{23}^2)}-\frac{(\ln W_i^c-m_{wi})^2}{2\sigma_2^2(1-\rho_{23}^2)}-\frac{[\ln(b_i+1)-m_{bi}]^2}{2\sigma_3^2(1-\rho_{23}^2)}+\\
&\quad\ln\Big[\Phi^*\Big(\frac{\gamma_{j-1}-m^*_{ei}}{\sigma_{*e}},\frac{m^*_{di}}{\sigma_{*d}};-\rho_*\Big)-\Phi^*\Big(\frac{\gamma_{j-2}-m^*_{ei}}{\sigma_{*e}},\frac{m^*_{di}}{\sigma_{*d}};-\rho_*\Big)\Big]\Bigg\};
\end{aligned}
$$

where $\tilde m_{ei}$ and $\tilde m_{bi}$ are defined as before, $\Phi^{**}(\cdot,\cdot,\cdot;\tilde\rho_{13},\tilde\rho_{34},\tilde\rho_{14})$ is the trivariate standard normal distribution function, and now we denote:

$$
\begin{aligned}
\tilde m_{di} &\equiv m_{di}+\rho_{24}(\ln W_i^c-m_{wi})/\sigma_2;\\
\rho_{\cdot jk} &\equiv (\rho_{jk}-\rho_{2j}\rho_{2k})/[(1-\rho_{2j}^2)(1-\rho_{2k}^2)]^{1/2}; \qquad \text{for } j,k=1,3,4;\\
m_{*ei} &\equiv m_{ei}+(\rho_{12}-\rho_{13}\rho_{23})(\ln W_i^c-m_{wi})/[\sigma_2(1-\rho_{23}^2)]+\\
&\quad+(\rho_{13}-\rho_{12}\rho_{23})[\ln(b_i+1)-m_{bi}]/[\sigma_3(1-\rho_{23}^2)];\\
m_{*di} &\equiv m_{di}+(\rho_{24}-\rho_{23}\rho_{34})(\ln W_i^c-m_{wi})/[\sigma_2(1-\rho_{23}^2)]+\\
&\quad+(\rho_{34}-\rho_{23}\rho_{24})[\ln(b_i+1)-m_{bi}]/[\sigma_3(1-\rho_{23}^2)];\\
\sigma_{*e}^2 &\equiv 1-(\rho_{12}^2+\rho_{13}^2-2\rho_{12}\rho_{13}\rho_{23})/(1-\rho_{23}^2);\\
\sigma_{*d}^2 &\equiv 1-(\rho_{24}^2+\rho_{34}^2-2\rho_{23}\rho_{24}\rho_{34})/(1-\rho_{23}^2);\\
\rho_* &\equiv \frac{\rho_{12}\rho_{24}+\rho_{13}\rho_{34}-\rho_{23}(\rho_{12}\rho_{34}+\rho_{13}\rho_{24})-\rho_{14}(1-\rho_{23}^2)}{\left(\rho_{12}^2+\rho_{13}^2+\rho_{23}^2-1-2\rho_{12}\rho_{13}\rho_{23}\right)^{1/2}\left(\rho_{23}^2+\rho_{24}^2+\rho_{34}^2-1-2\rho_{23}\rho_{24}\rho_{34}\right)^{1/2}}
\end{aligned}
$$

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