

# Motives for Household Private Transfers in Rural Burkina Faso

Harounan Kazianga\*

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Economic Growth Center  
Yale University

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### **Abstract**

This paper explores the motives for inter-household private transfers in rural Burkina Faso. Given the importance of private transfers in household income, quantitatively evaluating the response of private transfers to recipient incomes is informative for the design and the implementation of public interventions, such as poverty alleviation programs, which often include transfer programs. To the extent that private transfers interact with public ones, the overall impact of public transfers might be offset, leaving income distribution unchanged. I use the transfers model proposed by Cox, and two national surveys from Burkina to test whether private transfers are motivated by altruism, exchanges or by risk sharing objectives. The econometric estimations control for income endogeneity via instrumental variables, and attempt to control for censoring in the transfer data and potential non-linearities of the transfer functions. The main results are as follows. The key findings are as follows. First, there is a negative relationship between transfers and recipient income, although the relationship is weak for low income households. Second, I find that both permanent and transitory income components significantly affect transfers, thus suggesting that inter-household transfers are not exclusively driven by risk sharing motives. Third, donors are found to transfer out of transitory income, but to condition both their transfer decisions and the size of transfers on recipient permanent income. Overall, it appears that neither exchanges, altruism or risk sharing motives considered taken separately can completely explain inter-household private transfers in rural Burkina. From a policy perspective, the results suggest that policy interventions that target only income in the lowest bracket are susceptible to less crowding out effect compared to policies which seek to tax high income households and redistribute the proceeds to low income.

# 1 Introduction

This paper analyzes the relationships between private transfers and household resources in Burkina Faso in an effort to examine how private transfers are affected by changes in recipient incomes. There are several reasons why private income transfers between households are important, especially for a poor but reforming economy like Burkina Faso. First, private old-age support can act like social security for many elderly household members. Second, private transfers have been found to act like credit markets in helping households overcome borrowing constraints (Cox, 1990; Udry, 1990). Third private transfers assist households in coping with risk (Cox, Eser and Jimenez, 1998; Morduch, 1999; Townsend, 1994). In sum, in developing countries, private transfers perform some of the functions that public transfers and financial markets do in developed countries.

In a country like Burkina, where private transfers represent a substantial fraction of households' income, understanding the determinants of private transfers is informative in evaluating the impact of public programs, such as poverty alleviation policies, which often carry important resource transfer components. An examination of two national surveys reported in table (1), indicates that about 39 percent of the households surveyed in 1994 and 42 percent of those surveyed in 1998 report some transfer activity, either as donor, recipient, or both<sup>1</sup>. Transfers contributed on average to 33 percent and to 19 percent in recipient households income in 1994 and 1998, respectively. Most households who participated in transfers were recipient only: 23 percent received transfers in 1994 and 28 percent in 1998. This suggests that eventual interactions between private and public transfers might impact the welfare of a large fraction of the population.

The paper sets out to examine household survey data to test whether transfer flows follow a pattern consistent with some of the predictions of theory. Specifically, the paper asks whether private transfers in the context of rural Burkina are consistent with altruistic, exchange, risk sharing motives or some combination of the three. These three motives have been used to rationalize household private transfers behavior. Since Becker's seminal work

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<sup>1</sup>These surveys are the first and second Priority Surveys conducted by the Institut National de la Statistique et de la Demographie.

on social interactions (Becker, 1974), it is recognized that altruism can explain transfers observed among relatives. For instance, altruistic motives can be used to explain the tendency for parents to invest in children's education, for children to support parents in old age, or for family members with higher incomes to support those with lower incomes (Stark 1996; Lee 1994; Willis 1982). On the other hand, such behaviors can also be explained by self-interested motivations, consistent with exchange relationships. For example, parents may invest in children in anticipation of future old-age support, and high earners may support those with low earnings in anticipation of a subsequent reversal of fortunes or in compensation for services that the later provide (Lucas and Stark, 1985; Stark and Falk, 1998). Moreover, if households engage into informal risk sharing arrangements, transfers can be used to smooth consumption against idiosyncratic shocks (e.g. Cochrane, 1991; Townsend, 1994). To summarize, private transfers can be determined by altruistic, by exchange motives, or by risk sharing objectives.

For policy purpose, different transfer motives imply different predictions regarding the relationship between private transfers and recipient pre-transfer income (Cox, 1987; Cox and Jakubson, 1995), which in turn lead to distinct policy implications. First, under altruism, public transfers reduce the transfers received, given the recipient pre-transfer income. For instance if government were to initiate a transfer program targeting the poor, transfer flows from the wealthier to the poor may be reduced. It is then possible that welfare levels remain unchanged for low income households and increase for high income households. This crowding out effect can potentially offset the effects of public interventions in places where private transfers are already important (Cox, Hansen and Emmanuel, 2002).

Second, if transfers are motivated by exchanges where the recipient receives transfers in compensation for some services that he provides to the donor, public transfers will not necessarily displace private ones (Cox, 1987). Under certain circumstances, which are discussed later, it is possible that public transfers crowd in private transfers. Cox et al. (2002) provide some evidence using Filipino data that at high income levels, public transfers do indeed increase private ones.

Finally under the complete risk sharing hypothesis, targeted public transfers are likely to displace private ones if the public interventions are initiated in response to transitory shocks. This is an implication of the risk sharing model that predicts that idiosyncratic changes and not permanent incomes are pooled (e.g. Cochrane, 1991; Townsend, 1994). Hence, only transfers perceived as transitory may enter the risk sharing pool. For instance, relief programs or unemployment insurance programs might crowd out private transfers, while pension programs which tend to be permanent may have a little effect.

Previous studies provide mixed results on the existence and the magnitude of the crowding out effect. A number of studies (e.g. Cox and Jakubson, 1995; Cox and Rank, 1992; Altonji, Hayashi and Kotlikoff, 1997) have found a significant but small effect of public transfers on private ones. In contrast other studies (e.g. Cox and Jimenez, 1992, 1995; Cox et al., 2002) found a substantial effect of the displacement of private transfers by public ones. The literature offers three alternative explanations. First, analysis using data from developed countries are less likely to find significant crowding effect because public transfers have already reduced private ones (Cox et al., 2002). Second, the response of private transfers might differ depending on the type of public interventions. For instance, Cox and Jimenez (1995) estimate that an unemployment insurance system would have a strong crowding out effect in the Philippines, while the degree of crowding out associated with pensions is much less significant. Third, it is possible that transfers be motivated by altruism when recipient income is low, and then exchange motives become determinant when the recipient income reaches a certain threshold (Cox et al., 2002). These non-linearities, when not properly controlled, may affect estimated transfer function parameters.

In this paper, the transfers model developed by Cox (1987) is used to motivate the empirical work. Then the relationship between net transfers and recipient pre-transfer income is explored using both parametric and semi-parametric regressions, and controlling for household characteristics. Data used come from two national surveys conducted in 1994 and 1998 by the Burkinabe national statistical institute. The main findings can be summarized in the following three points. First, transfers flow from more affluent to less affluent households, thus reducing income inequality. Second, both permanent and transitory income

components are found to significantly affect transfers, thus suggesting that inter-household transfers are not exclusively driven by risk sharing motives. The final estimates imply that increase of 1 unit in permanent or in transitory income is met with a reduction of less than .2 unit in transfers <sup>2</sup>. Donors seem to transfer out of transitory income, but condition both their transfer decisions and the size of transfers on recipient permanent income. The empirical findings suggest that policy interventions that target only income in the lowest bracket are susceptible to less crowding out effect compared to policies, which seek to tax high income households and redistribute the proceeds to low income. Finally, the partial linear estimates suggest that below an annual income level of about CFA Franc 25000 per adult, transfers received are decreasing with pre-transfers income. Above this threshold, transfers received are concave in recipient income, with the turning point situated around CFA Franc 35000 per adult per year. In sum, the results indicate a negative relationship between private transfers and income. Hence the effects of public interventions seeking to redistribute income may be partly offset, if the interactions between private and public transfers are ignored.

The second section presents the theoretical framework used to motivate the empirical specifications. The third section describes the data used. The fourth section presents the empirical specifications. The fifth section discusses the empirical results, and the sixth section concludes.

## 2 Theoretical framework

The analytical framework developed by Cox (1987) is used to motivate transfers functions, which relate transfers received to the recipient income. The model generates two predictions on the relationship between the recipient income and the amount transfer received. On the one hand, if transfers are altruistically motivated, then transfers received should decrease as the recipient income increases. On the other hand, transfers received will decrease as

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<sup>2</sup>All units are expressed in local currency or CFA Franc, which stands for Franc de la Communaute Fianciere Africaine. A currency tied to the Euro (through the French Franc) and used by 14 West and Central African countries of the former franc zone.

recipient income rises if exchanges were the underlying motive. Moreover, under certain circumstances, the model allows transfers to rise with recipient income.

Formally, assume that there are two individuals, the donor denoted by  $d$  and the recipient denoted  $r$ . The amount of transfer is  $T$  and the recipient provides some services  $S$  to the donor, which by assumption do not have market substitute. Furthermore, I assume a one-sided altruism from the donor. The donor utility  $U$  is increasing in his consumption of an aggregate good  $C_d$ , the amount of services consumed  $S$  and the recipient utility  $V$ . The last relationship captures altruism in the model. The recipient utility  $V$  is increasing in his consumption  $C_r$  and decreasing in  $S$ . The donor solves the following program:

$$U_d = U(C_d, S, V(C_r, S)) \quad (1a)$$

$$C_d = I_d - T \quad (1b)$$

$$C_r = I_r + T \quad (1c)$$

$$V(I_r + T, S) \geq V_0(I_r, 0) \quad (1d)$$

Where equations (1b) and (1c) represent the budget constraints faced by the donor and the recipient respectively. Equation (1d) is the participation constraint, which states that the recipient entering in the relationship must not lower his utility. Cox (1987) shows this programs generates two regimes, depending on whether the participation constraint is binding or not.

Under the first regime, the participation constraint is not binding ( $V > V_0$ ). The transfers are then altruistically motivated, and the recipient is more than compensated for his services. The net transfers received decrease with the recipient income. Assuming interior solution, the predicted relationship between transfers and income is  $\partial T / \partial I_d - \partial T / \partial I_r = 1$ , which is the transfer income derivative tested by Altonji et al. (1997). In other words, conditioned upon transfers been made, a decrease of 1 unit in the donor income followed by an increase in the recipient income, leaves the transfer amount unchanged.

Under the second regime, the participation constraint is binding (for instance the recipient pre-transfer income is high enough), the transfers are motivated by exchanges, and the recipient is compensated for his services. This regime can be pictured as if transfers were made in order to compensate services  $S$  which have an implicit price  $P$ . Thus the relationship between transfers and services is expressed as:  $T = PS$ . Cox shows that transfers first increase with income and then fall, thus generating an inverted U shape<sup>3</sup>.

Although most papers test for altruism or exchanges in the data, it is possible that both motives co-exist in the same data set. Recipients whose income is very low (for instance below to subsistence) may be getting transfers for altruistic motives, as the donors might not expect nothing in return. In contrast recipients with relatively high income level (for instance above subsistence level) might have to pay back for the transfers that they are getting, i.e. transfers are motivated by exchanges. As I discuss later, the co-existence of the two transfer regimes may induce non-linearities in the transfer function, thus making the estimates very sensitive to specification errors.

The model presented here does not distinguish between permanent and transitory income components, and thus does not explicitly consider risk sharing motives. However, in the empirical work, permanent and transitory incomes will enter the transfers function separately. This specification is then used to explore the role of transfers in risk sharing. From the risk sharing model (Cochrane, 1991; Townsend, 1994), if the sole purpose of transfers were coping with unpredicted income shocks, then only transitory income affect transfers, and permanent income should not be a significant determinant of transfers<sup>4</sup>.

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<sup>3</sup>More formally, the argument proceeds as follows:

$$\frac{\partial T}{\partial I_r} = \frac{\partial S}{\partial I_r} P + \frac{\partial P}{\partial I_r} S$$

The first term in the right hand side is negative, and the second term positive. Thus, the overall effect depends whether the price or the quantity effect dominates. Cox shows that the price effect will initially dominate, and then the quantity effect dominates as recipient decreases the quantity of services at certain pre-transfer income level. Thus, the transfers first increase with income and then fall. One should note the argument is that this pattern is consistent with exchanges motivated transfers, but does not constitute a proof of exchanges motivated transfers, since other behavior may generate similar empirical pattern (for instance see Lucas and Stark (1985) for the relationship between remittances and home household income in Botswana.

<sup>4</sup>This hypothesis can be understood through the risk sharing literature. In the formal risk sharing model (Townsend, 1994; Cochrane, 1991; Mace, 1991), changes in income, and not permanent income, are redistributed to smooth individual consumption within the insurance group.

In conclusion, two theoretical predictions are explored. First there is a negative linear relationship between transfers and recipient income under a first regime where recipient income is very low. And, at a certain threshold transfers become motivated by exchanges, with transfers received the shadow price of service increasing as the recipient income rises. Finally, from the risk sharing model, transfers received are determined by transitory and not by permanent income.

### 3 Data and Descriptive statistics

The paper uses the two rounds of the national priority surveys conducted in 1994 and in 1998. The two surveys are very similar in the scope of the information collected, the sampling design and coverage. The surveys are closely related to the World Bank LSMS, and are intended to be nationally representative and the sample selection uses a two-stage stratified random sampling. The number of households interviewed is 8700 in 1994 and 8478 in 1998. Only the sample of rural households is used in this study. This consists of usable data for 5001 households in 1994 and 5523 in 1998.

The surveys collected information on household and individual characteristics, employment status, expenditures and income. Information on transfers was collected at the household level. Transfers given were collected along the consumption module with a recall period covering the month preceding the survey, while transfers received were collected along with the income module with a recall period covering the previous 12 months. There are two issues related to these differences in the recall periods. First, if seasonal variations are important, then transfers given are more likely to be misreported. Second, if intra-annual inflation is important, then nominal values of transfers given and received might be reflecting in fact different real values Paxson (1992).

Annual transfers given are obtained by multiplying monthly values by 12. This procedure would not be valid if there is a strong seasonal pattern in transfers so that the probability of reporting a non-zero transfer is affected by the month when the survey has been conducted. In table (2), I report both the frequency of non-zero transfers given and transfer size for each

month. It is apparent from table (2) that the frequency of transfer flow is stable across the two years. In each year, about 15 percent of the surveyed household report positive transfers given, although the 1994 survey has been conducted between October and January, and the 1998 survey between May and July. In columns (3) and (4), I report the unconditional mean of transfer size and a t-test whether there is a significant difference between the average mean in a given month and that of the remaining months. Although in 1998 one cannot reject that mean transfers are equal across survey months, in 1994 mean transfers reported in November and December are different from that reported in January and in October. A potential explanation of these differences is that harvest occurs in November and December, and most transfers are given during this period. However, this is consistent with the transfers given in January being higher than those given in December. Since there is no clear pattern in these differences, I will attribute them to sampling errors.

Descriptive statistics are reported in tables (3) and (4), and a summary of all the variables used in the analysis is presented in table (11) in the appendix. Table (3) reports private transfers expressed in local currency units (CFA Franc) per adult. The pre-transfer income is the estimated income per adult before transfers, and post-transfer income include net transfers received <sup>5</sup>. In both 1994 and 1998, recipients have the lowest pre-transfer average income per adult. After transfers, this group has average income higher than the autarkic group which does not participate in private transfer transactions. For recipients, transfers received represent 34 percent of pre-transfer income in 1994 and 19 percent in 1998. Next, the sample is split by tercile using non-durable expenditures per adult as a wealth indicator. Net transfers are positive for the lowest and the middle income class, and negative for the upper income class. This suggests that transfers flow from wealthier to poor households, and thus may have an equalizing effect. Note that, although the absolute numbers differ between the two years, the qualitative pattern is similar, suggesting a rather stable pattern of private transfers over time.

Further evidence of the equalizing effects of transfers is provided in table (4). The table reports pre- and post-transfers income and consumption inequality as measured by

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<sup>5</sup>Net transfer is calculated as transfer received minus transfer given

Gini and Theil maximum entropy coefficients. The point estimates are reported along with bootstrapped standard errors <sup>6</sup>. In both years, transfers alter substantially welfare distribution whether expressed in income or in expenditures. Considering income inequality, the Gini coefficient drops from .571 to .555 in 1994 and from .497 to .474 in 1998 after net transfers are taken into account. Distribution of expenditures is also responsive to transfers. The Gini coefficient drops from .396 to .374 in 1994 and from .383 to .362 in 1998. The Theil inequality measure also indicates a similar pattern. Transfers have an equalizing effect on both income and expenditure distributions. Cox and Jimenez (1995) have reached to similar conclusions for the Philippines.

## 4 Empirical strategies

I start with a general specification of the transfer function, which follows Altonji et al. (1997) and Altonji and Ichimura (2000):

$$T = m(I_r, I_d, X, \varepsilon) \quad (2)$$

Where  $T$  is net transfers received,  $I_r$  is the recipient income,  $I_d$  is the donor income,  $X$  is a set of controls describing household characteristics which contribute to determine transfer flows. The empirical issues evolve around the functional form of  $m$  (especially the relationship between transfers and income), the non-separability of the error term with respect to the other covariates, and the fact that both the recipient and the donor incomes enter the transfer function, while information is available only for one transfer partner. The next subsections discuss how these issues are addressed.

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<sup>6</sup>Bootstrap consisted of 500 replications, correcting for the two step sampling process

## 4.1 Spline specification

The first specification uses a spline regressions (Greene, 1997), which allows the income parameter to vary over different income quartiles. Formally, the spline regression is expressed as follows<sup>7</sup>:

$$T_i = \sum_k^4 \gamma_k I_i \cdot I(I_i \in k) + \beta X_i + \varepsilon_i \quad (3)$$

Where  $T_i$  is net transfer received by household  $i$ ,  $k$  indicates pre-transfer income quartiles,  $I_i$  is household  $i$ 's pre-transfer income,  $I$  is an index variable which is equal to one for  $I_i$  falling in quartile  $k$  and zero otherwise, and  $X$  is a set of variables that affect transfers received. A similar specification has been used by Cox and Jimenez (1995) and also by Cox et al. (2002), however Cox et al. (2002) do not impose the spline's knots a priori.

As it is apparent from table (1), more than half of the surveyed households neither give nor receive transfers, suggesting that transfers do not adjust smoothly to changes in income. There are both theoretical and econometrical motivations to account explicitly for this large fraction of corner households. Transactions costs associated with transfers as described by Honore, Kyriazidou and Udry (1997) or by Udry (1994), would imply that positive transfers are observed only when latent transfers exceed the transaction costs. Alternatively, this pattern may rise if transfers take place within networks, and there are fixed costs associated with network participation. Regardless of the theoretical explanations, ignoring the presence of the large number of zero values will result in biased inference similar to what occurs with censoring. Following Udry (1994), I use Rosett's friction model (Rosett, 1959) to account for the presence non-participant households.

$$T = \begin{cases} T^* & \text{if } T^* > \tau; \\ 0, & \text{if } -\tau \leq T^* \leq \tau; \\ T^*, & \text{if } T^* < -\tau \end{cases} \quad (4)$$

Where  $T^*$  is latent net transfer,  $\tau$  is unobserved positive transaction costs, and  $T$  denotes

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<sup>7</sup>From here after, I will include only one party's income when writing the transfer function, since there is no information on the other's party including her income. The omitted variable bias resulting from omitting the second party's income is discussed later

the parametric transfer function as defined in (3) <sup>8</sup>. The transactions cost set thresholds that the latent transfers (positive or negative) must exceed in order for one to observed any transfer. This model is estimated by maximum likelihood methods using the likelihood function proposed by Maddala (Maddala, 1983, pages 163-164 ).

## 4.2 Altonji-Ichimura estimator

The specifications above impose that unobservables summarized in the error term enter the transfers function in a separable manner. However, Altonji et al. (1997) show that unless one imposes strong assumptions on the utility function,  $X$  and  $\epsilon$  are non-separable in the transfer function. It follows that specifications that impose separability between  $X$  and  $\epsilon$  may be biased, and the direction of the bias is unknown. This motivates a third estimation strategy, which is based on a semi-parametric estimator developed by Altonji and Ichimura (2000) applied by (Altonji et al., 1997). The objective is to recover an estimate of the population average of the marginal effect  $E \left[ \frac{\partial T^*(I)}{\partial I_i} | I, T > 0 \right]$  for the self-selected subsample with positive transfers. Altonji and Ichimura (2000) and Altonji et al. (1997) show that an estimate of this expression can be obtained as follows:

$$E \left[ \frac{\partial T^*(X, \epsilon)}{\partial I_i} | X, T > 0 \right] = \frac{\partial \bar{T}(X, \epsilon)}{\partial I_i} + \frac{\partial P(T(X, \epsilon) > 0 | X)}{\partial I_i} \cdot \frac{\bar{T}(X, \epsilon)}{P(T > 0)} \quad (5)$$

The A-I estimator is implemented by replacing the right side in (5) with estimates obtained using a global polynomial (in income) approximation to the regression function  $E [T(X, \epsilon) | X, T > 0]$  and the probability function  $P(T(I_i, \epsilon) > 0 | X)$ , where income and other covariates are included in  $X$  <sup>9</sup>. Because I have information only for one transfer partner, the left hand side of (5) is evaluated separately for donors and recipients. An approximation of the expression  $\partial T / \partial I_d - \partial T / \partial I_r$  is given as:  $E \left[ \frac{\partial T^*(I_d)}{\partial I_d} | I_d, T > 0 \right] - E \left[ \frac{\partial T^*(I_r)}{\partial I_r} | I_r, T > 0 \right]$  <sup>10</sup>.

In implementing the A-I estimator, the probability of giving is corrected for the recall period. In particular, I take into account the fact that the probability of giving transfer

<sup>8</sup>Recall that by convention, transfers given are negative and transfers received are positive

<sup>9</sup>I follow Altonji et al. (1997) and use the bootstrap to compute the standard errors.

<sup>10</sup>To the extent that the unobserved transfer partners may not be included in the sample, this approximation will be inconsistent. Future versions of this paper will take into account the urban sample as well

would have been different if the recall period was the previous 12 months. In any given month, denote the probability of given by  $p_m$ , so that the probability of not given is  $1 - p_m$ . Assuming that the probability of observing non-zero transfer given in any two months is independent <sup>11</sup>:

$$P_a(T > 0) = 1 - (1 - P_m)^{12} \quad (6)$$

### 4.3 Partial linear estimation

As an alternative to the spline specification, I use a partial linear specification where the transfer function is specified as follows:

$$T = g(Ir) + \beta X + \epsilon \quad (7)$$

Where no assumption is imposed on  $g$  but smoothness and continuity in  $I_r$ . The function  $g$  is estimated non-parametrically after partialling out the effects of the other covariates (Robinson, 1988) <sup>12</sup>. Compared to specification (2), equation (7) imposes that the transfer function is linear in all other covariates but the recipient income, and the error term is additive.

The estimation proceeds in two steps as follows. First the parameter  $\beta$  is estimated by estimating separately the nonparametric relationships between  $T$  and  $I$ , and between  $X$  and  $I$ , by forming the residuals, and regressing the residuals of  $T$  on those of  $X$ . Second, the estimated  $\hat{\beta}$  is used to estimate the function  $g$ . The nonparametric estimator used here is the Fan (1992) locally weighted least square estimator with a quartic kernel. The two steps are written as:

$$\hat{\beta} = \left[ \sum_{i=1}^N (X_i - \hat{E}[X_i|I_i])(X_i - \hat{E}[X_i|I_i])' \right]^{-1} \left[ \sum_{i=1}^N (X_i - \hat{E}[X_i|I_i])(T_i - \hat{E}[T_i|I_i]) \right]' \quad (8)$$

<sup>11</sup>Although the independence assumption is too strong, it guarantees simplicity

<sup>12</sup>See for example Dufo (2000) and Dufo and Udry (2001) for applications using the estimator

$$\hat{g}(I_i) = \hat{E}[T_i/I_i] - E[X_i|I_i]\hat{\beta} \quad (9)$$

#### 4.4 Endogeneity of income and household size/composition

There are at least three concerns with income which is the key variable in the transfer function. First, it is well documented that income is measured with errors, especially in developing rural areas where income from various activities are difficult to evaluate. Second if household expect transfers<sup>13</sup>, then they might adjust their labor and hence their income accordingly, in such a way that transfers determine income, leading to reverse causality. Third, both the recipient and the donor incomes enter the transfer function, while in my dataset income is never observed for the two transfer partners. This results into an omitted variable bias, whose size and sign depend on the correlation between the recipient and the donor income.

To correct the first two sources of bias, I instrument income following the approach used by Paxson (1992) to analyze household savings in Thailand. The technique merges long run regional rainfall data with the household level information. Assuming that current rainfall deviation from its long run mean is unpredictable, permanent household characteristics and annual decisions such as farm size and type of crops grown interacted with current deviations in rainfall provides a measure of the transitory income. The approach has also the advantage of leading to a decomposition of income in permanent and transitory elements. In the context of this paper, the main identifying assumption is that rainfall deviations affect transfers only through its effect on income. Formally, denoting permanent by  $P$  and transitory by  $S$ , the income equation is written as:

$$I_{ir} = \beta_t + \beta_0 + \beta_1 X_{irt}^P + \beta_2 X_{irt}^S + \varepsilon_{irt} \quad (10)$$

Where  $X^P$  represent characteristics which are permanent to the household and  $X^S$  represent characteristics which determine transitory income. As determinants of permanent

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<sup>13</sup>for instance, the household purposely sends some of his members in different locations to work and remit resources

income I use the household demographic variables, the head education and gender, the livestock possessions (cattle, goat and sheep), the farm and other productive equipment. The transitory income determinants are rainfall deviations in the region, and the type of crops grown. The estimated parameters are used to fit separately permanent and transitory incomes. The residual is the “unexplained” part of income (Paxson, 1992).

Estimates of this equation are presented table (12) of the appendix along with the  $F$  test on the joint significance of the instruments. The  $F$  test statistic is equal to 25.95, suggesting that the instruments used have a relative strong power in explaining observed income variations across households. Furthermore, the variables included explain 34 percent of the variations of income, with an adjusted  $R^2$  of 33 percent indicating that relative strong explanatory power of the model is not simply due to the number of variables included <sup>14</sup>.

Controlling for the omitted variable bias is less obvious. To illustrate the difficulty associated with controlling for this type of bias in the specific context, consider a linear specification of the transfer function as follows:

$$T_i = \alpha_0 + \alpha_1 I_{ri} + \alpha_2 I_{di} + \varepsilon_i \quad (11)$$

We abstract from the zero censoring and other specification issues, so that OLS can be used to get consistent estimates from (11). When information on one party is missing, then instead of (11) one estimates the following:

$$T_i = \alpha_0 + \alpha_1 I_{ri} + \mu_i \quad (12)$$

where  $\mu_i = \varepsilon_i + \alpha_2 I_{di}$

The estimates are consistent only if the omitted variable (the donor income) is not correlated with any covariate in equation (12). However, in general one might expect non-zero correlation between the donor and the recipient incomes, or between specific income components. Indeed, it may be that these correlations motivate transfers at the first place. If we assume that only incomes are correlated, then the omitted variable bias can be expressed

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<sup>14</sup>Income is gross income and not farm profit.—Acknowledge Rosenzweig and Wolpin (2000)’s criticism on this instrumenting method.

in standard form as:

$$\hat{\alpha}_1 = \alpha_1 + \alpha_2 \frac{\text{cov}(I_r, I_d)}{\text{var}(I_r)} \quad (13)$$

In general, we expect  $\alpha_2$  to be positive, thus implying that the sign of the bias is determined by the numerator in the last term at the right hand side of (13). Moreover, one can think of  $\alpha_2 = 1$  as the limiting case, when the donor transfers all increment in his income to the recipient<sup>15</sup>. This implies that the bias will be at most:  $\frac{\text{cov}(I_r, I_d)}{\text{var}(I_r)}$ .

From equation (13), it is apparent under which conditions, instrumenting might not attenuate the omitted variable bias. In particular, instrumenting does not reduce the bias if instrumenting variables are correlated between the donor and the recipient and the variance is similar to that of income. Table (5) provides some estimates of  $\frac{\text{cov}(I_r, I_d)}{\text{var}(I_r)}$  for observed income, predicted permanent income, and predicted transitory income. The implied upper limit of the bias is .15. After instrumenting the bias increases for permanent income (.17) and decreases for transitory income (.01)<sup>16</sup>. Cox and Rank (1992) and Cox and Jimenez (1998) compared estimates of (12) and (13), and concluded that the bias is positive and small. It appears that, instrumenting attenuates the bias for transitory income but increases it for permanent income<sup>17</sup>.

In discussing the omitted variable bias, I have assumed that the transfer function is actually linear and OLS would have delivered consistent estimates, in absence of omitted variables. However, the estimation strategies discussed previously do not rely extensively on OLS. It is not clear whether the omitted variable bias given by equation (13) is still valid under limited dependent variable, in particular when one uses the friction model.

I do not pursue an analytical derivation of the bias which takes into account the censoring of the dependant variable. Instead, I use Monte Carlo simulations to explore how sensitive is the bias under alternative estimation strategies: OLS applied to the net transfers, Tobit ap-

<sup>15</sup>Or  $\partial T/\partial I_r = 0$  in the relationship:  $\partial T/\partial I_d - \partial T/\partial I_r = 1$ .

<sup>16</sup>This is a supporting argument for the definition of transitory income used. If these are really unanticipated shocks, then there are expected to be orthogonal to the error term, what seems to be the case

<sup>17</sup>It is worth noting that  $\frac{\text{cov}(I_r, I_d)}{\text{var}(I_r)}$  may be positive here because I use the rural sample. For instance, correlation between recipient and donor income may be negative when the transfers flow from cities and from other countries into rural areas. If the covariance is actually negative, then the estimates will imply less crowding out than there is actually is

plied to one side gross transfers, and Rosett Tobit applied to net transfers. The experiments assumes that the data generation process follows an equation like (11) where  $\alpha_1 = -.3$  and  $\alpha_2 = .3$ . The estimated version is equation (12), which corresponds to omitting the donor's income. In the first set of experiments assumes zero covariance between donor and recipient income. The second set of experiment assume that covariance is .25 between recipient and donor income. Estimations using OLS, Tobit and Rosett Tobit are reported in table (6) for different sample sizes. Beneath the row reporting the estimates , are reported the standard errors and the absolute deviations from the true values. The experiments suggest that OLS outperform the other estimations methods if recipient and donor incomes are not correlated. However when recipient and donor incomes are correlated, Rosett Tobit outperforms both OLS and the standard Tobit both in terms of consistency and efficiency. Moreover the relative performance of the Rosett Tobit increases with the sample size. In light of these results, and given my sample size and the likelihood that income is probably correlated, I treat the Rosett Tobit results as my preferred estimates <sup>18</sup>.

An additional concern with respect to identification is household size and composition. Although there is a number of reasons why one may not treat the household composition as given, the concern is even more serious with respect to transfers. Indeed, if observed household structure results from migration decisions and transfers received are correlated with the number of migrated members, then the coefficients of household composition are biased<sup>19</sup>. More specifically, if one admits a positive relationship between transfers received and the number of household members who have migrated, then the direction of the bias depends how observed household composition is related with the numbers of migrant members <sup>20</sup>. I do not attempt to control for the endogeneity of household structure with respect

<sup>18</sup>I do not present the Tobit estimates as the results are not significantly changed.

<sup>19</sup>for instance female headship, smaller size

<sup>20</sup>Using the transfer function, the bias can be characterized as follows:

$$E(T|x) = \beta_1 + \beta_2 x + \beta_3 E(m|x)$$

Where  $x$  is observed household members, and  $m$  is the number of household members who have migrated, which is unobserved in the survey (hence unavailable to the researcher). Let abstract from other explanatory variables and maintain that  $\beta_3 > 0$ . Then OLS lead to an upward bias if  $\frac{\partial m}{\partial x} > 0$ , to a downward bias if  $\frac{\partial m}{\partial x} < 0$  and to unbiased estimates if  $\frac{\partial m}{\partial x} = 0$ . For instance, if I suppose that small households are small because of out-migration, then the estimates are upward biased. On the other hand, it may be that only at certain size that households let members migrate, in this case the bias will be upward.

to transfers. Thus, the coefficients associated with these variables should be interpreted as correlations, providing at best only some suggestive evidence on the directions of the causal relationships.

## 5 Results and discussions

### 5.1 Probit analysis of transfers incidence

To begin, this section explores the determinants of transfer decisions. Table (7) reports Probit estimates of the incidence of transfers<sup>21</sup>. The dependant variable in columns (1) and (3) is one if the household received some transfer and zero otherwise. In columns (2) and (4) the dependant variable is one if the household gave some transfer and zero otherwise. Columns (1) and (2) presents separate Probit estimates for positive and negative transfers. In columns (3) and (4), a bivariate Probit. The bivariate probit differs from the probit by allowing for arbitrary correlation between the error terms of the two equations.

The estimated correlation coefficient from the bivariate probit ( $\rho$ ) is negative with large numerical value (-.95) and statistically significant<sup>22</sup>. Hence, the bivariate probit estimated are preferred, although they are in the same range with the probit estimates. It can be inferred from the estimated  $\rho$  that transfer recipients and donors are very diverse in terms of the transfer decision after controlling for the observed characteristics. In particular, the likelihood of observing a household both as donor and recipient is reduced, suggesting low occurrence of reciprocal transfers in the data. However, actual reciprocal pattern in the transfer flows may be concealed by the cross-sectional nature of the data or by the difference in the recall period of positive and negative transfers. Alternatively, it is possible that the type of transfers which are measured in the survey (money and staple grains) are reciprocated with other forms of transfers which are not registered by the survey (See

<sup>21</sup>All regressions include month dummies in attempt to control for intra-annual inflation

<sup>22</sup>Note that the correlation between the errors terms may be driven by omitted variables.

$$e_{ir} = \mu_{ir} + \zeta_1 y_i^d$$

$$e_{id} = \mu_{id} + \zeta_2 y_i^r$$

where  $\mu$  is pure error term,  $y_d$  is donor income and  $y_r$  is recipient income. To the extent that  $y_d$  and  $y_r$  are correlated,  $e_{ip}$  and  $e_{ir}$  will be correlated by construction.

Ioannides and Kan, 2000, for money and time transfers in the US).

The coefficients associated with permanent and transitory incomes are precisely estimated (all significant at the one percent level) with the right signs. There is a significant positive effect of the donor income and a negative and significant effect of the recipient income on the odds of transfers. Moreover, the results suggest that permanent and transitory incomes differ in their importance in transfer decisions. Permanent income is more important in determining the probability of transfer received, whereas transitory income is of greater importance in transfer given (for example, in column (3) the coefficient of permanent income is about twice the size of that transitory income). A  $\chi^2$  statistic on the equality between permanent and transitory income coefficients in each equation is reported in the next to the last row. This hypothesis is rejected at the one percent level for transfers received, and at the ten percent level for transfers given. A priori, the relatively higher importance of permanent income in the equation of transfers received runs against the hypothesis that transfers are used to share risk. Alternatively, to the extent that permanent characteristics are easier to observed than idiosyncratic shocks, it is more efficient for the donor to condition his transfer decisions on the recipient permanent income.

Turning to household composition, the presence of adults in the household consistently increases the odd of transferring out (column 4) and decreases the odd of transfer in (column 3), although the later effects are not statistically significant. To the extent that household composition may be changing over the household life cycle, this suggests a possible connection between transfer flows and the household life cycle. Female headed households are more likely to receive than to give transfers, and this is consistent with findings reported in previous studies (Cox et al., 2002; Cox and Jimenez, 1992). Education has no significant effect on transfer decision, however given the proportion of household heads with zero education, it is likely that education effect could not be consistently estimated. As discussed previously, both the household composition and head characteristics may result from household decisions, so that causal relationships could not be inferred from these estimates.

The variable *ruralresid* is calculated as the number of individuals who have migrated from region *i* to other rural areas divided by the number of households currently residing in

province  $i$ . The variable  $cityresid$  is calculated the same way, except that it takes migrant to the city. From the estimates in column (3),  $ruralresid$  is positive in column (3) while  $cityresid$  is negative, suggesting that the odds of receiving transfer are larger the more the region out-migrants reside in rural areas. The converse holds for the number of out-migrant living in urban areas. However, it is possible that these variables are conveying information related to regional economic opportunities. For example, economically more disadvantaged regions are more likely to supply migrants to other rural regions, and get in turn more remittances.

## 5.2 Spline specification

Table (8) show estimated transfer functions. The first and second columns report estimates ignoring the censoring, with the difference that income is instrumented in the second column. The two remaining columns parallel the first two, but use the Rosett Tobit in an attempt to control for the non-participation constraint. The friction coefficients in columns (3) and (4) are significant at the one percent level, suggesting that the estimates contained in columns (1) and (2), which ignore the censoring are probably biased. Based on the significance of the friction coefficients and the Monte Carlo simulations, I treat the Rosett specification as my preferred one, and consequently the discussion focuses on these censoring adjusted estimates.

In the fourth column, income is instrumented using the instruments described in subsection (4.4). The estimates imply that for households in the lowest quartile, income has almost no effect on net transfers (the estimated coefficient is .035 and not statistically significant). For the remaining income groups, transfers response to income increases from the second to the third quartiles (from -.21 to -.33) and declines at highest income level (-.17 for the fourth quartile). The coefficients reported in column (3) are in general larger in magnitude than those of column (4), suggesting that measurement errors in income are substantial. The pattern that emerges is an increasing (and negative) transfer response to income from the first to the third quartile. In the fourth quartile transfer response to income remains negative, although it is smaller compared the estimates of the second and third quartiles.

In table (9), permanent and transitory income components are allowed to enter the transfer functions separately. The estimation results are presented only for the friction model<sup>23</sup>. Consider the hypothesis that inter-household transfers are driven by risk sharing motives. If so, permanent income should not matter after controlling for transitory income. From columns (1) and (2), permanent income still has a relatively large and significant effect, controlling for transitory and unexplained income. A possible interpretation of these results is that transfers are not dominated by risk sharing (or insurance) motives.

Columns (2) and (3) examine whether positive and negative income shocks have symmetric effects (in magnitude) on transfers given and received. If transitory income increases by one unit, net transfers drops by .2 unit, or equivalently transfers given out increase by .2 unit. The coefficient is precisely estimated and stable across the two specifications presented in columns (2) and (3). If transitory income decreases by one unit transfers received increase by .16 to .18 unit, although the coefficient is imprecisely estimated. Furthermore, the parameter is sensitive to functional form specification. However, while transfers given consecutive to positive shocks are under the control of the household being observed, transfers received in compensation of negative shocks are to a greater degree determined by the unobserved transfer partner. It is then possible that the omitted variable bias be larger for the later estimate.

For the remaining covariates, tables (8) and (9) have similar qualitative implications, so I restrict the discussion to table (9). Like the transfer decision estimates, the presence of adults significantly reduce transfer size receive, whereas the presence of children tend to have a positive (except female children between 6 and 11), although insignificant effect on transfer received. This suggests that transfer pattern changes over the household life cycle. The effect of the household head age provides additional support to the connection between transfer flows and the household life cycle. The head age and its squared term are jointly significant and the signs imply a *U* shaped transfer pattern, which is consistent with old age support role of transfers. As expected, there is positive correlation between transfers received and female headship (e.g. Cox and Jimenez, 1992). But as already discussed, the

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<sup>23</sup>Estimation results ignoring the censoring are reported in the appendix

effects of household composition and head characteristics must be interpreted with caution.

### 5.3 Results from the A-I estimator

Estimated transfer reactions based on the A-I estimator are presented in table (10), for permanent and transitory income, respectively. Columns (1) and (2) present transfer response to recipient and donor permanent income, respectively. Column (3) report the difference between columns (2) and (1), which is an estimate of the transfer response to a increase in one unit in the recipient income followed by a similar decrease in the donor income. Corresponding results are presented in columns (4)-(6) for transitory income. The derivatives are evaluated at the sample mean, and for each income quartile. The standard errors (reported in brackets for the sample average estimates) indicate that the coefficients are precisely estimated<sup>24</sup>.

First, consider the transfer reaction to permanent as shown in column (1) for recipient and column (2) for donors. On the one hand, if recipient income increases by ten percent, transfers are reduced by one percent. On the other hand, if donor permanent income decrease by ten percent, transfers are cut back by .3 percent. This suggests that transfers are more responsive to changes in recipient permanent income than to changes in the donor permanent income. Looking across income quartiles, transfer reaction to income is relatively larger for households in the lowest income bracket. For instance, for households in first quartile, if pre-transfer permanent income increases by 10%, transfers received decrease by 1.3 percent, whereas transfers decrease only by .6% following 10% in permanent income for the richest households (i.e. the fourth quartile).

Columns (4)-(6) show the reaction of transfer to transitory income. On average, if transitory income increases by 10 %, transfers received decrease by .85 %, while transfer given increase by 2.1 %. Together, columns (4) and (5) indicate that the response of transfer received to recipient transitory income decreases with income level, while the response to transfers given to donor transitory income increases with donor income levels. In other words, for similar positive income shocks transfer reduction is larger for poor households

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<sup>24</sup>Future versions will provide standard errors for estimates at income quartiles

than rich households, and for similar positive income shocks, rich households transfer more. The relatively larger effect of donor transitory income is consistent with the results in table (9), where it is found that negative transitory income has smaller and insignificant effect.

Estimated transfers derivatives are reported in columns (3) and (6) for permanent and transitory income, respectively. Consider that transfers flow from the 4<sup>th</sup> to the 1<sup>st</sup> quartile. Thus, the estimates imply that if transitory income drops of one unit in the 4<sup>th</sup> quartile and increases of one unit in the 1<sup>st</sup>, then there is a reduction of .48 unit in transfer flows. Similar changes in permanent income imply a that transfers are reduced by .15 unit, a figure which is close to that reported by Altonji et al. (1997) for the US. There is some suggestive evidence that donors transfers out more of transitory income than permanent income, but transfers donated are conditioned more on recipient permanent income than his transitory income.

#### 5.4 Partial linear estimations

The partial linear estimate of transfer response to income, based on the estimation method described in subsection (4.3), is shown in figure (1). I use predicted permanent income, and I do not distinguish between permanent and transitory income.

It is apparent that transfer response to income is not linear. It can be seen that below CFA 5000 per adult, transfer is almost insensitive to income. This is consistent with the Rosett Tobit estimates. There is a sharp and negative response of transfer to income, for income range between 5000 and 25000 per adult. Finally, for income above 25000 transfer increases slightly with income, and then decreases as when income exceeds 32500.

The figure can be reconciled with the theoretical framework presented in section. Altruistic motives are important for low-income households, but become weaker for higher income groups. In particular, above CFA 25000, exchange motives seem to be the main driving factor of transfers. Cox et al. (2002) reach similar conclusions for the Philippines.

## 6 Conclusion

This paper studies the motives of private transfers in rural Burkina Faso. To this end, Cox's transfers model is used to motivate the estimation of transfer functions. By decomposing income into permanent and transitory components using the framework suggested by Paxson (1992), I also explore the connection between transfers and risk sharing.

The empirical work uses two national surveys conducted in 1994 and 1998, which contain information on two-sided inter-household transfer. The econometric methods recognize the censored nature of the transfer variables and the non-linearities in the transfer reaction to income. The empirical findings suggest that private transfers are skewed towards poorer households, i.e. transfers flow from the relatively more affluent to the less affluent households. As expected, there is a significant and negative relationship between transfers and recipient income.

There is some suggestive evidence that insurance motives are not the dominant factor in explaining inter-household transfers. In fact, permanent income does matter as much as transitory income. Particularly, it is apparent that donors transfer out transitory income than permanent income, but they condition transfer more on the recipient permanent income than his transitory income. Such behavior could arise if the donor dominates the relationship and have better information on the recipient transitory income than on his transitory income.

The results shed some light on issues pertaining to public policies. Whether private transfers are crowded out by public ones will depend to a greater extent on the design of public policies, and which component of income is targeted. Public interventions which focus on increasing income in the lowest brackets while leaving income unchanged for the highest quartile are less likely to crowd out private transfers to the poor, compared to policies which tax higher income households and then redistribute the proceeds to low income households.

As poor households display larger propensity to transfer out transitory income than permanent income, it could be inferred that programs which are intended to cope with transitory shocks (e.g. relief programs, unemployment insurance) may have more unintended beneficiaries (for instance, the public transfers are perceived as positive income shocks and

enter the risk sharing pool). Whether the unintended beneficiaries are wealthier households will depend on the composition of poor household transfer networks. Alternatively, programs targeting the permanent component of income seems to have the highest crowding out effect for poor people. The net welfare gains will depend on who the donors were at the first place. From policy makers perspective, the net gains from public programs targeting the poor, depend not only on the transfer response to income, but also the relative wealth of poor household social network. Although such information is unavailable in the survey used in this study, carefully collecting in future surveys may be useful in assessing the effectiveness of public programs.

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Table 1: Household participation in transfers, 1994 and 1998

	1994	1998
Non participants	61.72	57.40
As recipients only	23.01	27.59
As donors only	8.35	9.02
As Both	6.92	5.99
Number households	5001	5523

Table 2: Monthly distribution of transfer given

	(1)	(2)	(3)	(4)
	Frequency	Transfer size	t-test	N
1994	15.27	2922.28		5003
October	11.11	2191.49	0.68	207
November	16.12	3759.10	1.70	1526
December	14.86	2178.10	2.32	1686
January	15.43	3005.26	0.19	1581
1998	15.01	3047.60		5523
May	11.61	2658.28	0.80	1266
June	17.09	3111.39	0.20	2130
July	14.95	3215.43	0.50	2127

Table 3: Transfer impact on household income

	Income		Net Transfer	Perc. income
	Pre-transfer	Post-transfer		
1994				
Non Participants	46899	46899	0	0.0
Recipients	43363	57895	14532	33.5
Donors	111859	88195	-23664	-21.2
Both recipients and donors	95751	95182	-569	-0.6
Low tercile	37031	39409	2379	6.4
Middle tercile	47375	50296	2921	6.2
Upper tercile	80259	78940	-1319	-1.6
1998				
Non Participants	90152	90152	0	0.0
Recipients	64635	76733	12098	18.7
Donors	176434	153733	-22701	-12.9
Both recipients and donors	133303	132465	-838	-0.6
Low tercile	56686.89	60390.47	3704	6.5
Middle tercile	80561.59	83297.7	2736	3.4
Upper tercile	143182.1	140465.9	-2716	-1.9

Table 4: Transfers effects on income and expenditure distribution

	Gini		Theil	
	Point estimate	Sd. Error	Point estimate	Sd. Error
Pre-transfer income				
1994	0.571	0.011	0.621	0.029
1998	0.497	0.009	0.449	0.021
Post-transfer income				
1994	0.555	0.011	0.585	0.030
1998	0.474	0.009	0.408	0.019
Pre-transfer expenditure				
1994	0.396	0.009	0.294	0.020
1998	0.383	0.011	0.279	0.021
Post-transfer expenditure				
1994	0.374	0.009	0.258	0.017
1998	0.362	0.010	0.245	0.018

Table 5: Evaluation of the effects of the omitted variable  
Covariance      Variance      Bias factor

Income	1.40E+10	93193436176	0.15
Transitory income	6.80E+09	39307463773	0.17
Permanent income	1.50E+09	1.12468E+11	0.01

Table 6: Monte Carlo evaluation of omitted variable bias

Sample size	$\widehat{Cov}(I_d, I_r) = 0$			$\widehat{Cov}(I_d, I_r) = .25$		
	OLS	Tobit	Rosett	OLS	Tobit	Rosett
100	-0.302	-0.333	-0.379	-0.226	-0.250	-0.286
	[.107]	[.124]	[.141]	[.107]	[.122]	[.141]
1000	-0.302	-0.333	-0.378	-0.227	-0.251	-0.286
	[.085]	[.101]	[.129]	[.104]	[.105]	[.112]
10000	-0.302	-0.333	-0.378	-0.227	-0.251	-0.286
	[.033]	[.038]	[.043]	[.033]	[.038]	[.043]
10000	-0.299	-0.330	-0.374	-0.224	-0.248	-0.281
	[.026]	[.042]	[.0795]	[.073]	[.052]	[.036]
10000	-0.299	-0.330	-0.374	-0.224	-0.248	-0.281
	[.010]	[.012]	[.013]	[.011]	[.012]	[.014]
10000	-0.299	-0.330	-0.374	-0.224	-0.248	-0.281
	[.008]	[.030]	[.074]	[.076]	[.052]	[.019]

Figure 1: Net transfers response to pre-transfer permanent income

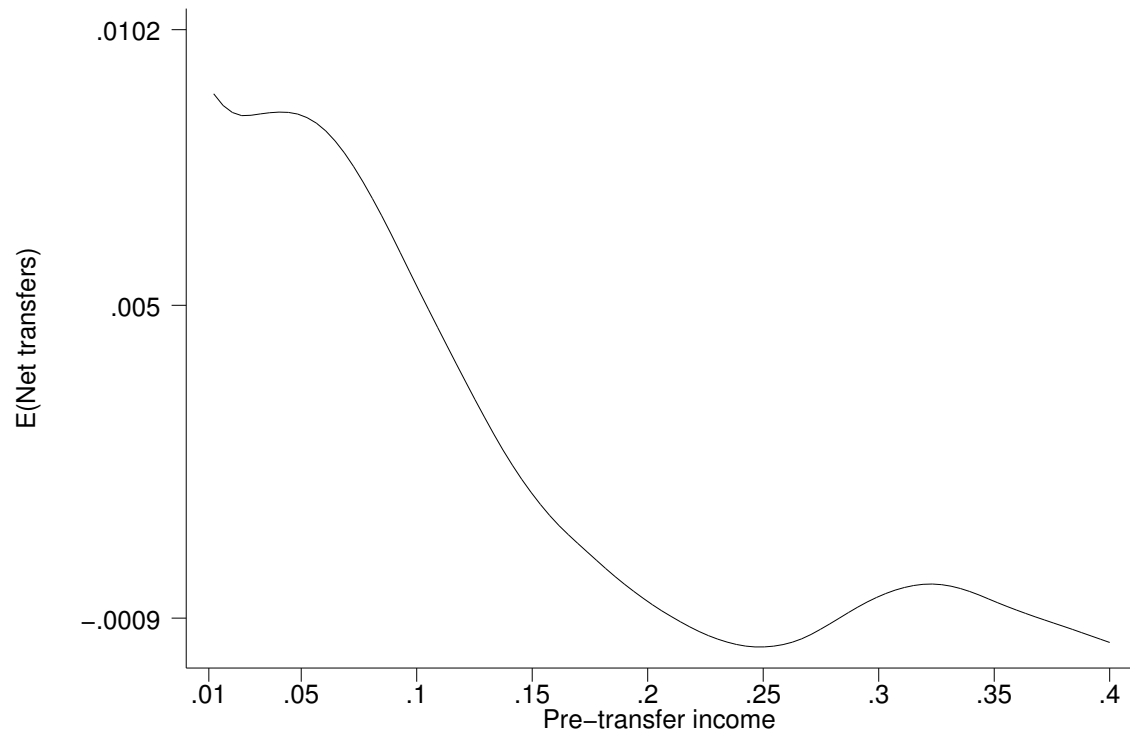


Table 7: Determinants of one directional transfer decision

	(1)	(2)	(3)	(4)
	Bivariate probit			
	Direction of the transfers			
	positive (In)	negative (Out)	positive (In)	negative (Out)
Permanent income	-0.0554 [9.88]***	0.0574 [10.13]***	-0.0579 [10.11]***	0.0574 [10.10]***
Transitory income	-0.0249 [3.67]***	0.0703 [9.25]***	-0.0251 [3.69]***	0.0728 [9.45]***
Unexplained income	-0.00359 [3.47]***	0.00681 [7.99]***	-0.00406 [2.54]**	0.00732 [8.41]***
Children males 6-11	-0.0103 [0.21]	0.00177 [0.03]	-0.0125 [0.26]	0.000158 [0.00]
Children females 6-11	-0.0818 [1.59]	-0.00622 [0.10]	-0.0791 [1.52]	-0.00368 [0.06]
Children males 12-15	0.0183 [0.21]	-0.0240 [0.22]	0.0329 [0.37]	-0.0195 [0.18]
Children females 12-15	0.324 [3.63]***	0.0913 [0.82]	0.343 [3.78]***	0.102 [0.91]
Adult males 16-64	-0.401 [3.03]***	0.976 [5.59]***	-0.375 [2.82]***	0.976 [5.56]***
Adult females 16-66	0.0192 [0.14]	1.253 [6.82]***	0.0217 [0.16]	1.222 [6.67]***
Adult males 65 +	-0.00841 [0.06]	0.947 [5.29]***	-0.000919 [0.01]	0.976 [5.40]***
Adult females 65 +	-0.128 [1.08]	1.038 [7.07]***	-0.124 [1.04]	1.020 [6.95]***
Age household head	-0.00840 [1.55]	0.00743 [1.02]	-0.00895 [1.64]	0.0106 [1.42]
Age household head squared	0.015 [2.71]***	-0.013 [1.70]*	0.016 [2.81]***	-0.016 [2.09]**
Education	-0.00082 [0.35]	0.00190 [0.77]	-0.00109 [0.44]	0.00206 [0.80]
gender	-0.622 [9.01]***	0.249 [2.34]**	-0.627 [9.08]***	0.206 [1.90]*
Ruralresid	0.847 [17.98]***	-0.124 [1.96]*	0.860 [18.07]***	-0.112 [1.74]*
City	-0.853 [10.71]***	-0.100 [0.96]	-0.864 [10.80]***	-0.129 [1.20]
Cattle	-0.057 [5.13]***	-0.022 [1.02]	-0.056 [5.30]***	-0.022 [1.13]
Goat	-0.012 [4.88]***	0.000 [2.34]**	0.012 [4.70]***	-0.002 [2.36]**
Farm. Equipment	0.348 [2.89]***	-0.090 [0.07]	0.363 [2.70]***	-0.090 [0.41]
Other Asset	-0.029 [7.09]***	0.171 [1.62]	-0.037 [7.30]***	0.169 [1.61]
Constant	-0.402 [0.74]	-3.449 [3.65]***	-0.410 [0.95]	-3.461 [3.60]***
$\rho$	[1.77]*	[11.77]***	[1.79]*	[11.72]***
			-0.946 [13.01]	
LR test $\rho = 0$			773.72	
$\chi^2(1) [\beta_{yp} = \beta_{yt}]$	[11.29]***	[3.67]*	[9.86]***	[2.77]*
Observations	10528	10528	10528	10528

Absolute value of z statistics in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1

Dependant variable: columns 1& 3: 1 if household received transfer, 0 otherwise; columns 2&4: 1 if household gave transfers, 0 otherwise.

Table 8: Transfer response to income

	(1)		(2)		(3)		(4)	
	Spline		Spline with friction		Spline with friction		Spline with friction	
	Obs. Income	Pred. income	Obs. Income	Pred. income	Obs. Income	Pred. income	Obs. Income	Pred. income
Income, 1 <sup>st</sup> quartile	-0.0538 [1.06]	0.018 [0.63]	-0.254 [1.91]*	-0.035 [0.45]	-0.254 [1.91]*	-0.035 [0.45]	-0.254 [1.91]*	-0.035 [0.45]
Income, 2 <sup>nd</sup> quartile	-0.0101 [0.29]	-0.052 [1.32]	-0.416 [4.51]***	-0.210 [2.04]**	-0.416 [4.51]***	-0.210 [2.04]**	-0.416 [4.51]***	-0.210 [2.04]**
Income, 3 <sup>rd</sup> quartile	-0.109 [6.56]***	-0.040 [1.42]	-0.382 [8.59]***	-0.334 [4.53]***	-0.382 [8.59]***	-0.334 [4.53]***	-0.382 [8.59]***	-0.334 [4.53]***
Income, 4 <sup>th</sup> quartile	-0.0300 [15.33]***	-0.092 [9.50]***	-0.0345 [7.63]***	-0.172 [6.77]***	-0.0345 [7.63]***	-0.172 [6.77]***	-0.0345 [7.63]***	-0.172 [6.77]***
Children males 6-11	903.270 [0.97]	1104.673 [1.18]	1685.677 [0.69]	2023.283 [0.82]	1685.677 [0.69]	2023.283 [0.82]	1685.677 [0.69]	2023.283 [0.82]
Children females 6-11	-150.530 [0.16]	-76.855 [0.08]	-1276.681 [0.50]	-763.527 [0.30]	-1276.681 [0.50]	-763.527 [0.30]	-1276.681 [0.50]	-763.527 [0.30]
Children males 12-15	645.215 [0.39]	838.826 [0.50]	1611.563 [0.37]	1785.867 [0.41]	1611.563 [0.37]	1785.867 [0.41]	1611.563 [0.37]	1785.867 [0.41]
Children females 12-15	2119.205 [1.25]	2232.583 [1.31]	7581.708 [1.70]*	7310.810 [1.63]	7581.708 [1.70]*	7310.810 [1.63]	7581.708 [1.70]*	7310.810 [1.63]
Adult males 16-64	-10796.400 [4.43]***	-10500.400 [4.24]***	-33831.000 [5.25]***	-35989.100 [5.50]***	-33831.000 [5.25]***	-35989.100 [5.50]***	-33831.000 [5.25]***	-35989.100 [5.50]***
Adult females 16-66	-11049.300 [4.88]***	-12065.500 [5.18]***	-28611.400 [4.78]***	-34558.800 [5.61]***	-28611.400 [4.78]***	-34558.800 [5.61]***	-28611.400 [4.78]***	-34558.800 [5.61]***
Adult males 65 +	-4332.242 [1.69]*	-4487.635 [1.72]*	-18697.300 [2.76]***	-21257.200 [3.10]***	-18697.300 [2.76]***	-21257.200 [3.10]***	-18697.300 [2.76]***	-21257.200 [3.10]***
Adult females 65 +	-8262.553 [3.99]***	-8972.706 [4.21]***	-25971.700 [4.74]***	-30196.700 [5.35]***	-25971.700 [4.74]***	-30196.700 [5.35]***	-25971.700 [4.74]***	-30196.700 [5.35]***
Age household head	-108.451 [1.02]	-139.863 [1.30]	-381.192 [1.37]	-466.839 [1.66]*	-381.192 [1.37]	-466.839 [1.66]*	-381.192 [1.37]	-466.839 [1.66]*
Age household head squared	87.525 [0.81]	118.186 [1.08]	529.816 [1.86]*	603.035 [2.10]**	529.816 [1.86]*	603.035 [2.10]**	529.816 [1.86]*	603.035 [2.10]**
Education	-36.841 [0.82]	-27.087 [0.60]	-107.063 [0.91]	-69.648 [0.59]	-107.063 [0.91]	-69.648 [0.59]	-107.063 [0.91]	-69.648 [0.59]
gender	-8822.300 [6.34]***	-9486.354 [6.75]***	-23252.000 [6.33]***	-24815.900 [6.70]***	-23252.000 [6.33]***	-24815.900 [6.70]***	-23252.000 [6.33]***	-24815.900 [6.70]***
1998	1883.583 [2.03]**	338.702 [0.40]	13450.005 [5.49]***	8409.993 [3.76]***	13450.005 [5.49]***	8409.993 [3.76]***	13450.005 [5.49]***	8409.993 [3.76]***
Ruralresid	6213.899 [6.71]***	5365.883 [5.66]***	28001.964 [11.21]***	25165.799 [9.90]***	28001.964 [11.21]***	25165.799 [9.90]***	28001.964 [11.21]***	25165.799 [9.90]***
City	-4935.435 [3.58]***	-4066.855 [2.89]***	-18395.800 [5.07]***	-16061.100 [4.35]***	-18395.800 [5.07]***	-16061.100 [4.35]***	-18395.800 [5.07]***	-16061.100 [4.35]***
Constant	27072.225 [8.26]***	27907.111 [8.10]***	79732.231 [9.15]***	85819.858 [9.38]***	79732.231 [9.15]***	85819.858 [9.38]***	79732.231 [9.15]***	85819.858 [9.38]***
Friction coef.			51346.625 [9.15]***	67070.291 [48.46]***	51346.625 [9.15]***	67070.291 [48.46]***	51346.625 [9.15]***	67070.291 [48.46]***
Observations	10528	10528	10528	10528	10528	10528	10528	10528
R-squared	0.05	0.03						
Constant income parameters	8.41	7.43	130.04	9.34	130.04	9.34	130.04	9.34

Absolute value of t statistics in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 9: Transfer response to permanent and transitory income

	(1)	(2)	(3)
Permanent income	-0.202	-0.202	
	[10.86]***	[10.69]***	
Income, 1 <sup>st</sup> quartile			-0.049
			[0.54]
Income, 2 <sup>nd</sup> quartile			-0.400
			[3.30]***
Income, 3 <sup>rd</sup> quartile			-0.230
			[2.52]**
Income, 4 <sup>th</sup> quartile			-0.166
			[5.16]***
Transitory income	-0.193		
	[6.06]***		
Unexplained income	-0.040	-0.040	-0.041
	[9.43]***	[9.42]***	[9.45]***
Positive transitory income		-0.197	-0.201
		[5.62]***	[5.71]***
Negative transitory income		-0.159	-0.181
		[1.00]	[1.13]
Children males 6-11	1881.119	1869.849	2057.948
	[0.77]	[0.77]	[0.84]
Children females 6-11	-525.223	-530.928	-452.047
	[0.21]	[0.21]	[0.18]
Children males 12-15	1734.816	1729.327	1841.032
	[0.40]	[0.40]	[0.42]
Children females 12-15	7349.738	7300.154	7461.095
	[1.61]	[1.60]	[1.63]
Adult males 16-64	-37323.000	-37289.800	-38071.200
	[5.78]***	[5.77]***	[5.87]***
Adult females 16-66	-35929.300	-35836.000	-36913.900
	[5.81]***	[5.78]***	[5.92]***
Adult males 65 +	-22139.200	-22126.300	-22887.600
	[3.27]***	[3.26]***	[3.37]***
Adult females 65 +	-31392.500	-31334.500	-32201.000
	[5.55]***	[5.54]***	[5.63]***
Head age	-437.998	-438.295	-445.401
	[1.58]	[1.58]	[1.60]
Head age 2	568.703	569.349	572.976
	[2.01]**	[2.01]**	[2.02]**
Head education	-69.667	-69.794	-68.082
	[0.59]	[0.59]	[0.58]
Head gender	-23978.000	-23973.100	-23750.700
	[6.56]***	[6.56]***	[6.49]***
1998	8786.789	8785.425	7919.377
	[5.92]***	[5.92]***	[4.95]***
ruralresid	26080.440	26018.372	25729.467
	[10.47]***	[10.38]***	[10.03]***
cityresid	-17541.300	-17499.600	-17394.400
	[4.85]***	[4.83]***	[4.66]***
Constant	93485.164	93506.728	51279.982
	[10.36]***	[10.36]***	[10.14]***
Friction coef.	51258.319	51258.148	93779.873
	[10.36]***	[10.36]***	[48.58]***
Observations	10528	10528	10528
Symmetric shock effects		0.05	6.26

Absolute value of t statistics in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 10: Transfer derivatives: AI-Estimators

	(1)	(2)	(3)	(4)	(5)	(6)
	Permanent income			Transitory income		
	$\frac{\partial T}{\partial I_r}$	$\frac{\partial T}{\partial I_d}$	(2)-(1)	$\frac{\partial T}{\partial I_r}$	$\frac{\partial T}{\partial I_d}$	(5)-(4)
Sample average	-0.103	0.038	0.141	-0.085	0.210	0.296
	[.01]	[.012]	[.015]	[.02]	[.04]	[.05]
1 <sup>st</sup> quartile	-0.127	0.055	0.182	-0.103	0.155	0.258
2 <sup>nd</sup> quartile	-0.099	0.046	0.145	-0.110	0.178	0.288
3 <sup>rd</sup> quartile	-0.083	0.039	0.122	-0.086	0.186	0.272
4 <sup>th</sup> quartile	-0.060	0.022	0.081	-0.036	0.378	0.414

Standard errors in brackets

## Appendix

Table 11: Summary of variables used in estimations

Variables	mean	sd	min	max
Pre-transfer income	75137.360	100444.900	1025.000	1521608.000
Children,0-5	1.798	1.796	0.000	20.000
6-11				
Males	0.895	1.106	0.000	10.000
Females	0.815	1.027	0.000	13.000
12-15				
Males	0.338	0.615	0.000	6.000
Females	0.305	0.581	0.000	8.000
16-64				
Males	1.845	1.419	0.000	18.000
Females	2.210	1.658	0.000	21.000
≥64				
Males	0.173	0.401	0.000	6.000
Females	0.159	0.427	0.000	7.000
Head				
Age	48.223	15.171	15.000	99.000
Age squared/100	25.556	15.659	2.250	98.010
Education (years)	0.664	5.786	0.000	7.000
Instruments				
Cattle (numbers)	3.119	9.210	0.000	250.000
Goat and sheep (number)	8.896	12.629	0.000	280.000
Other asset	0.205	0.421	0.000	2.000
Farm instruments	2.559	1.394	0.000	7.000
Rain deviation	-42.870	97.977	-288.913	296.502
Positive deviation	23.456	43.918	0.000	296.502
Negative deviation	-66.326	67.521	-288.913	0.000

Table 12: First stage regression

Kid 0-5	6937.072 [2.07]**
Kid male 6-11	6972.296 [1.45]
Kid females 6-11	2450.056 [0.48]
Kid males 12-15	-7590.168 [0.96]
Kid females 12-15	-4110.078 [0.50]
Adult males 16-64	30882.423 [7.38]***
Adult females 16-64	27532.091 [6.60]***
Adult males $\geq 64$	20039.388 [1.35]
Adult females $\geq 64$	6300.048 [0.58]
Head age	-344.722 [0.24]
Head age squared	-143.522 [0.10]
Head education	1790.164 [2.93]***
Head gender	-64179.193 [2.68]***
Year 1998	80865.529 [8.95]***
<b>Instruments</b>	
Cattle	6379.295 [9.21]***
Goat	1041.226 [2.30]**
Farm asset	66212.262 [13.99]***
Other asset	-248.707 [0.02]
Millet	9479.913 [0.71]
Maize	17491.158 [1.56]

Sorghum	-63899.011 [4.09]***
Rice	141422.665 [9.71]***
Cowpea	13120.513 [1.15]
Peanut	12491.961 [1.11]
Cotton	146760.408 [8.20]***
Rainfall deviation	-762.697 [3.09]***
Rainfall deviation squared	-550.559 [2.64]***
<i>Rainfall deviation interacted with</i>	
Kid 0-5	-42.114 [1.34]
Kid male 6-11	39.059 [0.75]
Kid females 6-11	-5.807 [0.10]
Kid males 12-15	10.958 [0.13]
Kid females 12-15	-85.924 [0.96]
Adult males 16-64	57.079 [1.43]
Adult females 16-64	27.700 [0.69]
Adult males $\geq 64$	178.866 [1.46]
Adult females $\geq 64$	-217.156 [1.88]*
kid 0-15/adult 16+	125.209 [0.91]
Cattle	1.111 [0.22]
Goat	-13.191 [3.06]***
Farm asset	208.482 [4.88]***
Other asset	-16.259

	[0.15]
Millet	134.776
	[1.30]
Maize	4.347
	[0.04]
Sorghum	99.576
	[0.91]
Rice	-66.001
	[0.72]
Cowpea	-55.448
	[0.60]
Peanut	-295.145
	[2.23]**
Cotton	-25.105
	[0.12]
<i>Rainfall deviation squared interacted with</i>	
Kid 0-5	-23.896
	[1.05]
Kid male 6-11	21.265
	[0.58]
Kid females 6-11	19.093
	[0.50]
Kid males 12-15	86.471
	[1.56]
Kid females 12-15	30.511
	[0.50]
Adult males 16-64	-35.222
	[1.17]
Adult females 16-64	-9.560
	[0.34]
Adult males >64	-67.584
	[0.78]
Adult females >64	-76.084
	[1.04]
kid 0-15/adult 16+	-38.383
	[0.43]
Cattle	2.090
	[0.41]
Goat	1.282
	[0.39]
Farm asset	74.626
	[2.78]***
Other asset	13.218

	[0.16]
Millet	66.510
	[0.93]
Maize	247.585
	[2.12]**
Sorghum	-279.772
	[3.03]***
Rice	-48.501
	[0.68]
Cowpea	19.470
	[0.27]
Peanut	-252.472
	[2.01]**
Cotton	229.892
	[1.37]
Constant	-118668.694
	[1.83]*
Observations	10514.00
R-squared	0.34
Ad. R-squared	0.33
F (54,10400) test instruments	24.95

Absolute value of t statistics in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Regression includes also province dummies not shown.

Table 13: Transfer response to permanent and transitory income: unadjusted for censoring

	(1)	(2)	(3)
Permanent income	-0.066	-0.066	
	[9.50]***	[9.37]***	
Income, 1 <sup>st</sup> quartile			0.002
			[0.04]
Income, 2 <sup>nd</sup> quartile			-0.062
			[1.34]
Income, 3 <sup>rd</sup> quartile			-0.020
			[0.59]
Income, 4 <sup>th</sup> quartile			-0.101
			[8.21]***
Transitory income	-0.058		
	[4.81]***		
Unexplained income	-0.030	-0.030	-0.030
	[16.40]***	[16.39]***	[16.17]***
Positive transitory income		-0.059	-0.054
		[4.43]***	[4.11]***
Negative transitory income		-0.052	-0.045
		[0.86]	[0.74]
Children males 6-11	1091.104	1089.262	1024.053
	[1.18]	[1.17]	[1.10]
Children females 6-11	105.925	104.897	128.834
	[0.11]	[0.11]	[0.13]
Children males 12-15	902.469	901.566	798.153
	[0.54]	[0.54]	[0.48]
Children females 12-15	2661.918	2653.744	2535.101
	[1.54]	[1.53]	[1.46]
Adult males 16-64	-11855.900	-11850.600	-11333.400
	[4.85]***	[4.85]***	[4.63]***
Adult females 16-66	-13496.700	-13481.400	-12804.000
	[5.76]***	[5.74]***	[5.44]***
Adult males 65 +	-5401.804	-5399.477	-5285.598
	[2.10]**	[2.10]**	[2.05]**
Adult females 65 +	-10453.700	-10444.200	-9406.708
	[4.90]***	[4.89]***	[4.37]***
Head age	-130.165	-130.204	-137.569
	[1.23]	[1.23]	[1.30]
Head age 2	97.089	97.183	114.810
	[0.90]	[0.90]	[1.06]
Head education	-23.275	-23.297	-24.878
	[0.52]	[0.52]	[0.55]
Head gender	-8685.738	-8684.758	-8903.641
	[6.26]***	[6.26]***	[6.41]***
1998	1710.641	1710.431	1154.166
	[3.06]***	[3.05]***	[1.91]*
ruralresid	6088.663	6078.352	5485.846
	[6.56]***	[6.51]***	[5.75]***
City	-5481.337	-5474.384	-4340.926
	[3.98]***	[3.97]***	[3.06]***
Constant	32062.711	32066.053	29468.435
	[9.46]***	[9.46]***	[8.50]***
Observations	10528	10528	10528
R-squared	0.06	0.06	0.06
Symmetric shock effects		0.01	0.02

Absolute value of t statistics in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%