# How Widespread Are Non-Linear Crowding Out Effects?

# The Response of Private Transfers to Income in Four Developing Countries

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**Abstract**

This paper investigates whether there is a non-linear relationship between income and the private transfers received by households in developing countries. If private transfers are unresponsive to household income, expansion of public social security and other transfer programs is unlikely to crowd out private transfers, contrary to concerns first raised by Barro and Becker. There is little existing evidence for crowding out effects in the literature, but this may be because they have been obscured by methods that ignore non-linearities. If donors switch from altruistic motivations to exchange motivations as recipient income increases, a sharp non-linear relationship between private transfers and income may result. In fact, threshold regression techniques find such non-linearity in the Philippines and after accounting for these there is evidence of serious crowding out, with 30 to 80 percent of private transfers potentially displaced for low-income households [Cox, D., Hansen, B., and Jimenez, E., 2004, How responsive are private transfers to income? Evidence from a laissez-faire economy, *Journal of Public Economics*.]. To see if these non-linear effects occur more widely, semiparametric and threshold regression methods are used to model private transfers in four developing countries—China, Indonesia, Papua New Guinea, and Vietnam. The results of our paper suggest that non-linear crowding-out effects are *not* important features of transfer behaviour in these countries. The transfer derivatives under a variety of assumptions only range between 0 and -0.08. If our results are valid, expansions of public social security to cover the poorest households need not be stymied by offsetting private responses.

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## I. Introduction

According to the influential hypothesis of Barro (1974) and Becker (1974), public social security interventions may be neutralized by the offsetting response of private transfers. This "crowding out" could occur if altruistic donors reduce their transfers as public interventions increase the incomes of recipient groups. For example, rather than benefiting the elderly, a public pension program might reduce the burden on working families who had previously contributed to their aged parents (Lampman and Smeeding, 1983). Concerns about crowding out are particularly relevant to the developing countries that are beginning to construct formal pension and social security systems. Indeed, according to the World Bank, anywhere between 20-91 percent of private transfers might be displaced by expansions of formal safety nets in developing and transition economies, although this wide range comes from a limited set of one-off studies rather than a comprehensive evaluation (World Bank, 2001).

A key parameter for evaluating the crowding out hypothesis is the *transfer derivative*, which shows by how much in-coming private transfers change as the resources of the recipient increases. Most existing evidence suggests that transfer derivatives are small, making crowding out unlikely. For example, Cox and Jakubson (1995) estimate that a one dollar increase in public welfare spending in the United States would result in no more than a 12 cent reduction in private transfers. Altonji, Hayashi, and Kotlikoff (1997) find that parents increase transfers to a child by only 13 cents for every one-dollar reduction in that child's income.

Recently, Cox, Hansen and Jimenez (2004) have suggested that the failure to find economically significant transfer derivatives may be because economists have looked in the wrong places and used the wrong methods. Developed countries may be the wrong place to look because they have experienced a century of large public transfers so most private transfers have

probably long since been crowded out.[1] For example, Roberts (1984) suggests that charity, which is one form of private transfers, was crowded out by public relief programs in the United States in the 1930s. But in developing countries private transfers are still very widespread, reaching up to one-half of the population in some cases (World Bank, 2001). Perhaps as a result, crowding out effects seem larger in developing countries. For example, Jensen (2003) estimates that each rand increase in public pension income for the elderly in South Africa leads to a 0.25-0.30 rand reduction in transfers made by children.

But even in developing countries, significant transfer derivatives may be disguised if economists use inappropriate empirical methods. Donor households may have several different motives for the private transfers they make, so econometric models of transfers that assume a single, linear regime may be mis-specified. Instead, if donors switch from altruistic motivations to self-interested exchange motivations as recipient income increases, a sharp non-linear relationship between private transfers and income may result. Cox et al. (2004) use threshold regression techniques to find such a non-linear relationship in the Philippines, where transfer derivatives are estimated to be approximately -0.4 for the poorest households but almost zero for richer households. For large families within a subset of the sample's poorest households, transfer derivatives are in the range -0.66 to -1.06. Based on these results, Cox et al. (2004) suggest that the crowding out problem for public redistribution policy first posed by Barro and Becker is likely to be important. If this finding for the Philippines is robust, expansions of public transfers in developing countries may not improve welfare for the poor.

[1] Public pensions were introduced in New Zealand in 1898 and in the United Kingdom in 1908. In the United States, the 1935 Social Security Act marked the start of a significant expansion in public transfers although pensions for state and local government employees dated from the 1890s.

The purpose of this article is to see whether the non-linearities found by Cox et al. (2004) in the Philippines occur more widely in developing countries. An evaluation is needed because there appear to be only three other studies of non-linear transfer derivatives in developing countries. Kaufmann and Lindauer (1986) find a transfer derivative of -0.55 below a threshold level of income needed to satisfy basic needs, and a derivative of zero above that threshold. However, this evidence comes from a sample of just 500 households in a single city (Santa Ana) in El Salvador, so it is not clear if it would hold more generally. Maitra and Ray (2003) find that for South African households below the poverty line, a rand of public pension income reduces private transfer receipts by -0.09 rand but for those above the poverty line there is no crowding out. It is not clear if this evidence is supportive of Cox et al.'s findings from the Philippines because even below the poverty line, the transfer derivative is small.[2] Kazianga (2006) shows that transfer derivatives do not vary greatly across income quartiles in Burkina Faso and that crowding out may be minimal. However, unlike Cox et al. (2004) the study by Kazianga imposes the knot points for the spline rather than allowing the data to determine them, so it is not clear how strongly the findings contradict those from the Philippines.

The approach used here is to econometrically model the determinants of private transfers using household surveys from several different developing countries. By using a consistent set of estimation methods on similar sets of data, one source of variability in estimated transfer derivatives is removed. The selected countries (China, Indonesia, Papua New Guinea, and Vietnam) all have household surveys with comprehensive information on private transfers, public social security and incomes from private sources. These are all countries in which private

[2] Moreover, the transfer derivative with respect to other (private) income also is positive and statistically significantly higher for poor households than for those above the poverty line which is not consistent with the findings of Cox et al. (2004).

transfers are important, as they are throughout Asia where there are strong norms about family support for the elderly (Kwon, 1999; Benjamin et al. 2000) and about community support for the poor (Scott, 1976).

Despite these norms, there continues to be academic debate about whether transfers in some of these countries reflect altruistic motivations. For example, Secondi (1997) suggests that altruism does not explain the patterns of private transfers in China while Lee and Xiao (1998) find strong support for the hypothesis that altruistic, need-based transfers are made by Chinese children to their parents. Similarly, it has been claimed that in urban Papua New Guinea voluntary transfers do not act as an effective safety net (Mounsell-Davis, 1993) although contrary evidence of targeting towards the poor, the ill and the unemployed is provided by Gibson, Boe-Gibson and Scrimgeour (1998). Thus, even though the main purpose of the current paper is to assess the robustness of the finding of Cox et al. (2004), that there are large, and non-linear, transfer derivatives it may also provide evidence that is relevant to debates in the selected countries about the motivations for private transfers and the likely implications of expansions in public social security.

To meet these goals, the rest of the paper is organized as follows. The next section briefly sketches a framework for understanding and estimating the determinants of private transfers, setting up hypotheses about the conditions under which transfers will be crowded out as income rises and the conditions under which they will not. This section draws heavily on the work of Cox et al. (2004). Section III describes the data sets—from Indonesia, Vietnam, China and Papua New Guinea (PNG)—that form the heart of the empirical work in this paper. The fourth and fifth sections specify the empirical model and discuss the basic results of the regression analysis. The last two sections examine the nature of the non-linearity that are in the data and conclude.

## II. A Framework for Observing Non-Linear Transfer Derivatives

Donors may have several different motives for the private transfers they make, but most econometric studies of transfers have assumed that a single (linear) regime operates (Cox et al., 2004). Instead, there may be strong crowding out effects of private transfers in some parts of the income distribution, where altruistic motivations predominate, but not in other parts, where exchange motivations predominate. These localised crowding out effects may be disguised when estimation methods are not sensitive to non-linearities and regime shifts. A prediction of non-linear transfer derivatives can be derived from either a risk sharing model or an augmented altruistic model that allows exchange motivated transfers.

The augmented altruistic model can be illustrated by considering the relationship between a person providing transfers—the *donor*—and the *recipient* of these transfers. The donor obtains utility from his own consumption, from any *services* the recipient provides in exchange for transfers, *s*, and from the well being of the recipient, *V*. The well-being of the recipient depends on her consumption, $C_r$, and the services she provides to the donor, $V(C_r, s)$, where $\partial V/\partial s < 0$.[3] The recipient's budget constraint is $C_r = I_r + T$ where $I_r$ is her pre-transfer income and $T$ is the transfer she receives. For altruistically motivated transfers, $\partial T/\partial I_r < 0$. As the recipient's pre-transfer income rises, a smaller transfer is needed to get her consumption to the level that is optimal from the donor's point of view.

At some threshold level of the recipient's pre-transfer income, *K*, the transfers switch from altruistic to exchange-related motivations. Otherwise, declining altruistic transfers would

[3] Services, in the spirit of Cox et al. (2004), are broadly defined and include in-kind transfers of labor; mutual insurance loans; and/or paying of respect or exhibition of other social behavior.

violate a participation constraint. Specifically, for there to be a relationship, the transfers the donor provides and the services he demands have to allow the recipient's welfare to be no lower than it would be if the recipient were to end the relationship, $V(I_r, 0)$. One way for the donor to keep the recipient in the relationship when recipient pre-transfer income begins to exceed the threshold, $(I_r > K)$ is by increasing exchange-related transfers (that is, it is no longer altruism). But eventually this positive transfer derivative becomes negative again when income level $I_r'$ is reached, due to opposing effects of higher $I_r$ on the supply and implicit price of services to the recipient (Cox, 1987). The result of these switching motivations is a non-linear and non-monotonic relationship, made up of a linear segment followed by an inverted-U-shape (see Figure 1, following Cox et al., 2004, p. 2199).

To estimate the relationship between the recipient's income and transfers that is implied by the figure, Cox et al. (2004) use a linear spline-model.[4] This involves defining a dummy variable, $d_1$, which takes the value 1 if $I_r \leq K$ and another dummy variable $d_2$ which takes the value 1 if $I_r > K$. For a fixed $K$ the continuous linear spline is a linear function of the variables $(I_r - K) * d_1(K)$ and $(I_r - K) * d_2(K)$, holding constant any other determinants of transfers (e.g., education, age and other characteristics of the household's income-earning stream). Because the threshold $K$ is not known, however, non-linear least squares is needed. Specifically, for a range of possible values of $K$ the model is estimated by OLS, yielding the sum of squared errors as a function of $K$. The conditional least squares estimate of $K$ is then found by searching over $K$ and selecting the value which gave the lowest sum of squared errors.

[4] A quadratic specification for the region $I_r > K$ was rejected in favour of a single linear term.

This spline function approach also is used in this paper to search for non-linear transfer derivatives. In addition, non-parametric and semi-parametric techniques also are used because these may be more flexible than the spline function. Consider first the semi-parametric (or partially linear) model:

$$T = m(I_r) + \beta X + u. \tag{1}$$

Transfers respond to pre-transfer income according to some unknown functional form, $m(\ )$, that may be either linear or non-linear, with or without kinks, while the other covariates, $X$, are assumed to have linear effects on transfers. The estimation takes place in two steps. First, the data are sorted in ascending order of pre-transfer income, $I_r$. Then $\beta$ is obtained by least squares estimation of the first-differenced equation:

$$\begin{aligned} T_i - T_{i-1} &= (X_i - X_{i-1})\beta + \left((I_{r,i}) - (I_{r,i-1})\right) + u_i - u_{i-1} \\ &\cong \quad (X_i - X_{i-1})\beta + u_i - u_{i-1}. \end{aligned} \tag{2}$$

Differencing allows one to (approximately) remove the non-parametric effects of income from the data and analyze the parametric portion of the model as if the non-parametric part was never there to begin with (Yatchew, 2003). The parameters from the initial linear regression on the first-differenced data, $\hat{\beta}_{diff}$, are then used to remove the estimated parametric effects from the original data. Once this is done, non-parametric techniques can be applied to the ordered pairs $\left(T_i - X_i\hat{\beta}_{diff},\ I_{r,i}\right)$ and consistency and other properties of the estimator remain valid because

$$T_i - X_i\hat{\beta}_{diff} = X_i\left(\beta - \hat{\beta}_{diff}\right) + m(I_{r,i}) + u_i \quad \cong \ m(I_{r,i}) + u_i. \tag{3}$$

In other words, $\hat{\beta}_{diff}$ converges sufficiently quickly to $\beta$ that the approximation in the last part of equation (3) leaves the asymptotic arguments unaffected (Yatchew, 2003).

Standard nonparametric techniques can be used to estimate equation (3), which is then interpreted as a semiparametric estimator because of the removal of the partially linear portion of

the model. To compare the results of the (semiparametric) analysis that controls for observable covariates, we also use our data with an unconditional nonparametric estimator. The comparison of the semiparametric and nonparametric results can test whether adjusting for the (linear) covariates affects the *shape* of the relationship between income and transfers. The particular nonparametric estimator used is LOWESS, which estimates the function, $m(I_r)=E(T|I_r)$, by computing an estimate of the location of transfers, $T$, within a specific band of recipient pre-transfer income $I_r$. For each point $(I_r^i, T^i)$ on a scatterplot, the smoothed point $(I_r^i, \hat{T}^i)$ is formed from a locally weighted regression of a first order polynomial. The weights come from a *tricube* function (Cleveland, 1979) which decreases for points further away from $(I_r^i, T^i)$, becoming zero at the boundary. This procedure is then repeated but with a new set of weights defined for each $(I_r^i, T^i)$ based on the size of the residual $(T^i, \hat{T}^i)$, where larger residuals have smaller weights to guard against outliers distorting the smoothed plots. The smoothness of the plots is also affected by the bandwidth, which is the proportion of the sample used for calculating the smoothed values for each point.

## III. Data

We use data from six sets of household surveys from four countries to search for non-linearities in the relationship between private transfers and the pre-transfer income of recipient households. The surveys are from the rural *and* urban sectors of Indonesia and Vietnam, the rural sector of China and the urban sector of Papua New Guinea. Most of the surveys are recent: 1997 for Indonesia; 1998 for Vietnam; and 2000 for China. Only the Papua New Guinea survey is somewhat dated (1988), but even then it is the same vintage as the Philippines survey (1988) used by Cox et al. (2004). A single cross-section is used for each survey, even though those for

Indonesia and Vietnam are part of longer term panels. The variables are defined to be as close as possible to the variables used by Cox et al. (2004) for the Philippines seeing as our main purpose is to test if the non-linear relationship that they find holds more widely. Descriptive statistics for the variables used in the analysis are in Appendix Table 1. Full details on the surveys and the construction of the variables are reported in Appendix I.

To meet our goals, we believe the four study countries are appropriate. All four of the countries that are the source of the data are poorer than the Philippines, both currently and for 1988, which is when the data used in the paper by Cox et al. (2004) were collected. With the exception of Vietnam, each of the selected countries spend less than one percent of their GDP on public social security and welfare. Two of the countries spend smaller proportions of GDP and government expenditure on public social security than is currently spent in the Philippines and two of them spend slightly more (Table 1). Because their public transfer systems are so small, these countries, like the Philippines, should be suitable candidates for studying crowding out. The comparison of their public welfare spending with that in rich countries also indicates why it may have proved so difficult to find evidence of crowding out in the developed countries; when about 10 to 15 percent of GDP is allocated to public transfers, as it is in the United States and the United Kingdom, there may be few private transfers left to crowd out.

The case of Vietnam deserves comment because of the relatively high share of government expenditures and GDP allocated to public transfers in this low-income country. Part of the expenditures comes from the Social Guarantee Fund, which provides income transfers to ex-soldiers and others who contributed to the re-unification of Vietnam. These transfers are not necessarily a needs-based redistribution, although many of the recipients are poor. Additionally, since 1995 the Vietnam Social Insurance and Vietnam Health Insurance schemes have been

operating and the social insurance scheme now covers about 14 percent of the labour force (World Bank, 2000). Nevertheless, despite these non-trivial levels, public transfers are still less than one-half the value of private, inter-household transfers (Cox, 2002). Thus, even though the government is allocating a relatively high level of GDP to public transfers, Vietnam should still be a relevant case for studying the potential for crowding out effects.

In contrast to public transfers, private transfers are pervasive in these developing Asian economies. The data show that between a little less than one quarter (rural Vietnam—22 percent) and two-thirds (urban Papua New Guinea—65 percent) of households in the selected samples receive private transfers (Table 2, row 1). Similar proportions are observed to be making transfers (row 2). Many households also both give *and* receive transfers during the same survey period, so a clearer picture may come from those that are either net recipients or net donors. The share of net recipients ranges from 21 percent in rural Vietnam to 40 percent in urban Papua New Guinea (row 3). The net donors have a similar patterns, ranging from 10 percent in rural China to 48 percent in urban Indonesia (row 4), although the share of observed donor households is less than recipient ones (row 4 < row 3, except for in Indonesia) possibly because of asymmetric receiving-giving patterns (that is, there are more recipients since a single donor often gives to more than one household).

For households that are net recipients of private transfers, the *median* income share for the transfers is approximately 10 percent of total, post-transfer income (ranging from 8 to 10 percent—Table 2, row 5). This estimate is somewhat lower than other studies which typically estimate the *mean* of the ratio of transfers to post transfer income (for example, Cox 2002, Table 2). However, the mean can be affected by a few households where transfer receipts exceed post-transfer income. For example, using the *mean* for urban Vietnam, the ratio of transfers to

post transfer income for net recipients is 19.9 percent, compared with the *median* ratio of only 10.2 percent. Nevertheless, even for the median recipient, the private transfer is an important source of income.

## IV. Specification and Linear Estimation Results

The empirical approach of this paper is designed to replicate as close as possible the approach used by Cox et al. (2004) in the Philippines. The basic model that is estimated in Cox et al. (2004) and this paper is:

Net transfers = f(Pre-transfer income, Other income variables, Education; Other Household and Regional Characteristics) (4)

We also followed Cox et al. (2004) in omitting the top two percent of household incomes from each sample, in case there was undue influence of the extremely wealthy on the results.

In addition to pre-transfer income, we also control for three dimensions of the household's income profile. First, we include a dummy variable for households with zero pre-transfer income to see if there is additional targeting of transfers to the very poor (or to those that suffered a particularly severe shock). The level of retirement income and a dummy for the presence of retirement income are used to account for any differential behavior of retirees.

In addition to income, we account for a number of other factors that ex-ante could have an effect on transfers. As educational variables in Cox et al. (2004) were all significant for rural households and those for higher levels of education were significant for urban households, we add a series of five dummy variables for the household head's educational attainment level (primary graduate; some secondary; secondary graduate; some tertiary; tertiary graduate vs. those that did not graduate from primary school as the base). A number of other household characteristics also were included in the transfer equation, such as the age, gender and marital

status of the household head. Further dummy variables control for whether the household head is employed and whether husband and wife are both employed. In addition, household size and composition, and a varying number of regional fixed effects are controlled for. Details of these variables are reported in Appendix Table 1.

**Linear Estimation Results**

When the transfer function (equation (1)) is constrained to be *linear in pre-transfer incomes*, the estimated transfer derivatives are universally small (Table 3, row 1). For example, in urban Indonesia an extra 100 Rupiah of pre-transfer income would reduce transfer receipts by only eight Rupiah (-0.080—column 1). In urban Papua New Guinea the response is even more sluggish, with recipients losing just four Kina of transfers for every 100 Kina increase in pre-transfer income (-0.043—column 6). An even lower response is found in Vietnam (in both the urban and rural samples); the transfer derivatives are not statistically significantly different from zero (columns 3 and 4). Thus, to the extent that the linear model is appropriate, even in these low-income settings with large private transfers and limited public transfers, crowding out does not seem to be such an important economic phenomenon.

The results embodied in the coefficients of the other income variables in the model also do not seem to provide much persuasive evidence that potential for crowding out is important (Table 3, rows 2 to 4). In the cases of Indonesia (rural and urban), urban Vietnam and PNG, there is no statistically significant targeting of private transfers to households with zero pre-transfer income (columns 1 to 3; 6). In rural Vietnam and rural China, the coefficient is positive but only significant at the 10 percent level. Even in these cases, it should be noted that while the magnitudes of the coefficients for rural Vietnam and rural China are large, the results have to be interpreted with care since only 1.6 percent of households in rural Vietnam and 0.3 percent of

households in rural China had zero income (Appendix Table 1); in other words, the coefficients are based on few observations. Importantly, from a policy perspective, this lack of targeting of private transfers towards the extreme poor (that is, those with no income) suggests that there may not be too much of the giving displaced if more accurately targeted public transfers were introduced.

In some countries there appears to be some substitution between retirement income and private transfers (Table 3, rows 3 and 4). The most notable effect is the case of rural Indonesia. We estimate that there is a 32 Rupiah reduction in private transfers for every 100 Rupiah increase in retirement income (-0.324—column 2). In rural Vietnam there is an 11.5 Dong reduction for every 100 Dong increase in retirement income. However, these coefficients are also only significant at the 10 percent level, and as in the case of the "has no income" variable, this affects relatively few people (e.g., only 2.4 percent of households in rural Indonesia receive retirement income).[5] In rural China the presence, but not the amount, of retirement income appears to reduce private transfer receipts (for the 1.5 percent of households that have access to retirement income).

A sensitivity analysis was carried out on the estimated (linear) effect of pre-transfer income by re-estimating Table 3 without the other income variables (Appendix Table 2). This simplified specification may be appropriate because most of the other income variables in the model had coefficients that were not statistically significant. However, this caused only modest changes in two of the estimated transfer derivatives. For example, the coefficient for rural Indonesia becomes -0.073 (from -0.69 in Table 3); the coefficient for urban Papua New Guinea becomes -0.047 (from -0.043 in Table 3).

[5] This is similar to the rate of substitution found by Jensen (2003) for public pension income in South Africa.

Alternatively, we also conducted another type of sensitivity analysis because of the possibility of measurement error attenuating the linear transfer derivatives towards zero. To account for this effect, we use an instrumental variables (IV) estimation approach.[6] In this analysis the instruments used were dwelling characteristics, such as size and number of rooms, and in all cases the *F*-test from the first stage regression showed these to be highly correlated with pre-transfer income. Over-identification tests support the validity of this set of instruments. Even when accounting for the potential effect of measurement error and reverse causality, we find little evidence of severe crowding out. In other words, the results reported in Table 4 provide no support for the idea that the small value of the transfer derivatives in the previous OLS results is because of a biased estimator. In fact, in all cases the IV estimates of the transfer derivatives become less negative (Table 4, row 1 versus Table 3, row 1); the coefficients either become positive or insignificant (that is, statistically zero).[7]

Although not the main focus of the paper, some of the results for the characteristics other than income warrant comment (Table 3). With the exception of rural China, households in which the heads are more highly educated appear to receive more transfers, conditional on income. It should be noted, however, the definition of the education attainment varies across the surveys (somewhat more than for other variables), which may affect the interpretation of these findings. The only evidence of transfers being targeted to households headed by the elderly is from rural Vietnam, despite previous evidence in the literature for this effect in Indonesia (Ravallion and Dearden, 1988). Households in which the head is married (or married and female, as in rural China) receive higher transfers in four of the samples, and this seems to matter more than the

[6] This approach is also used by Kazianga (2006) to deal with concerns about measurement error and reverse causality.

[7] It should be noted that the Hausman tests are insignificant in all cases so there is no reason to prefer these positive transfer derivatives in Table 4 over the statistically insignificant ones found in Table 3.

gender of the household head (except for rural China). There is some evidence that families with more young children receive lower transfers, while those with more adults receive more transfers. This pattern could reflect some implicit views about equivalence scales held by the donors (Olken, 2005). Transfers are targeted towards households where the head is unemployed in three of the samples (both sectors of Vietnam and urban Papua New Guinea).

## V. Are There Non-Linear Transfer Derivatives?

The results of the nonparametric and semiparametric analysis are fairly clear (Figure 2, Panels A to F) and largely consistent with the results of the OLS models reported above. In the case of urban and rural Indonesia, rural China and urban PNG (panels A, B, E and F), the non parametric analysis (the solid line in each panel of Figure 2) traces out a relationship between pretransfer income and net transfers receives that shows there is some crowding out effect. However, in each of the cases the slope appears to be small, less than around -0.1. In other words, there is some fall in transfers as a family's pretransfer income rises, but it is not large. In the cases of urban and rural Vietnam, the nonparametric analysis is either upward sloping or flat over most of the income range (panels C and D).

The nonparametric analysis (top, solid line) also demonstrates that there is no universal relationship between transfers and pre-transfer income that looks nonlinear in a way that is hypothesized in Figure 1. For example, in PNG, there is initially a fall in transfers across the first quartile (Figure 2, panel F). Throughout the second and quartiles the response is minimal, or near zero; the response in for those relatively well-off in the sample's fourth quartile begins to rise. In the nonparametic analysis, there are also some nonlinearities found in urban and rural Vietnam

and to a lesser extent in rural China (Panels C to E). For both urban and rural Indonesia the nonparametric line is nearly linear.

However, once the other covariates are accounted for using the semiparametric estimator the pattern disappears for all countries (Figure 2, panels A to F, dashed line). Specifically, after holding constant the effects of education, age, family demographics and regional characteristics, there is basically a linear relationship between net transfer receipts and pre-transfer income. In other words, there is really no evidence in the semiparametric analysis that would support the prediction of the mixed motivation for transfers model (that is, a shift from altruism at low income levels to exchange at higher levels of income). At least for low levels of income, these findings are consistent as those found in Kazianga (2006).

**Spline Model**

The spline analysis of the threshold coefficients (that is, the estimate of the point at which there is a nonlinearity in the relationship between transfer receipts and pre-transfer income) initially suggests that there may be non-linearities in the transfer derivative as predicted by the mixed motivation hypothesis. When the same linear spline model that Cox et al. (2004) used is estimated, in fact, we do find a significant threshold effect in five out of the six models (Table 5, columns 1 to 4; 6). Only in the case of rural China is there not a significant threshold. The threshold parameters of urban and rural Indonesia, rural Vietnam and urban PNG are significant at the 5% or 1% level. When there is a significant threshold, the implication is that the relationship between transfers and pre-transfer income changes.

Closer inspection, however, shows that while there may be nonlinearities, they are not consistent with the hypothesis of the mixed motivation model. In the case of the countries in which the threshold coefficient is significant (that is, all but rural China), in four out of the five

case the threshold is at a level that is far beyond the mean (nearly double the mean in the cases of urban and rural Indonesia and urban PNG; and higher than the mean in the case of urban Vietnam—Table 5, row 1 versus Appendix Table 1, row 2). There findings imply that although there maybe a nonlinearity, for most of those people in the income distribution that we are concerned about (that is those that are not relatively rich), the relationship between pretransfer income and transfer receipts is linear.

In addition, even disregarding the magnitude of the threshold, when comparing the slopes of the relationship between transfers and pre-transfer income below the threshold (Table 5, row 2) and those above the threshold (Table 5, row 3), the pattern is not consistent with the mixed motivation model. For example, in the case of urban and rural Indonesia, the slope is more negative after the threshold (not less negative as predicted by the mixed motivation hypothesis). In the case of urban and rural Vietnam, the point estimates of the coefficient on the pre-transfer income variable below the threshold is positive (and it is smaller below the threshold). Only in urban PNG (which is somewhat consistent with the semiparametric result), is there a negative slope before the threshold and more positive (or zero) slope after the threshold.

Perhaps most importantly, in none of our case studies (including urban PNG) is there much evidence of severe crowding out. In the four cases in which the coefficients on the pre-transfer income variable is negative for poor households (that is, below the threshold—Table 5, row 2, columns 1, 2, 5 and 6), the magnitude of the coefficient never exceeds -0.083 (for urban PNG). This means in the place where the crowding out is most severe, for every 100 Kina by which pre-transfer income is raised, transfers only drop by 8.3 Kina. In urban and rural Indonesia and rural China the drop is around 5 or less. In urban and rural Vietnam there is no decline. In short, our results, while similar to those in the work of Kazianga (2006) in Burkina Faso, differ

substantially from those in Cox et al. (2004). Since at low levels of income crowding out is minimal, this suggests that public transfers targeting poor households may be effective.

## VI. Conclusions

The research reported in this article has followed the recommendation of Cox et al. (2004, p. 2217) that "future work on private transfers should focus on sharp non-linear relationships, preferably in settings where public transfers are small." Specifically, we examined how responsive private transfers are to the pre-transfer income of recipient households in six different samples from four developing countries. When a linear model is used, these transfer derivatives are uniformly small. This finding is consistent with most previous evidence with linear models, and implies that crowding out problems are unlikely because private transfers respond so sluggishly to changes in pre-transfer incomes.

While the scope for crowding out may be disguised by a failure to detect non-linearities that does not seem to be the case in the samples studied in this paper. Following the method used by Cox et al. (2004) and also using a more flexible semiparametric method did not reveal any sharp non-linearities. Only urban Papua New Guinea follows the pattern found in the Philippines, but with much smaller non-linearities. For example, the threshold in urban Papua New Guinea is found at the $87^{th}$ percentile. Moreover, the transfer derivative for the poorer households is -0.083 compared with 0.04 (or 0, since the standard error of the coefficient is large relative to the magnitude of the coefficient) for the richest 13 percent of households. This is quite different than the pattern found in the Philippines where the threshold occurred at a lower income and the difference in transfer derivatives above and below the threshold was much greater.

Based on these findings, there is not a very compelling case for the widespread presence of potential crowding out effects. Thus, the crowding out problem for public redistribution policy first posed by Barro and Becker may not so important. This is good news for those policy makers that propose using public transfer schemes to try to increase the incomes of the poor.

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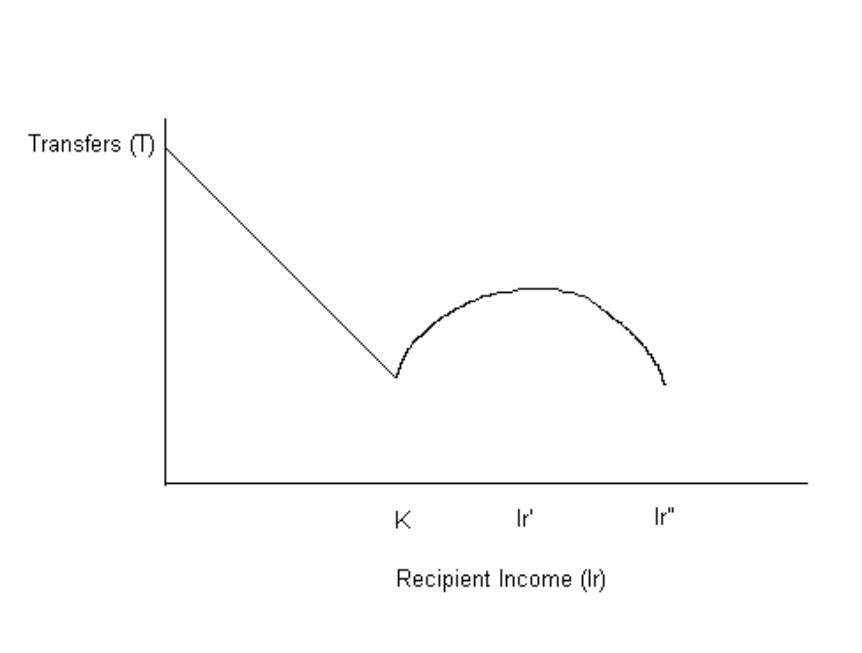
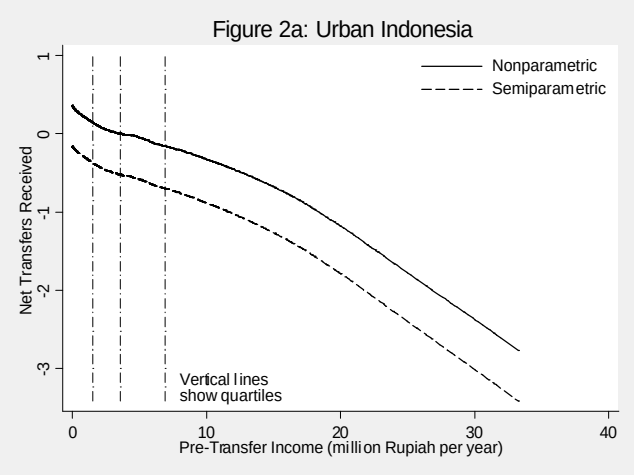
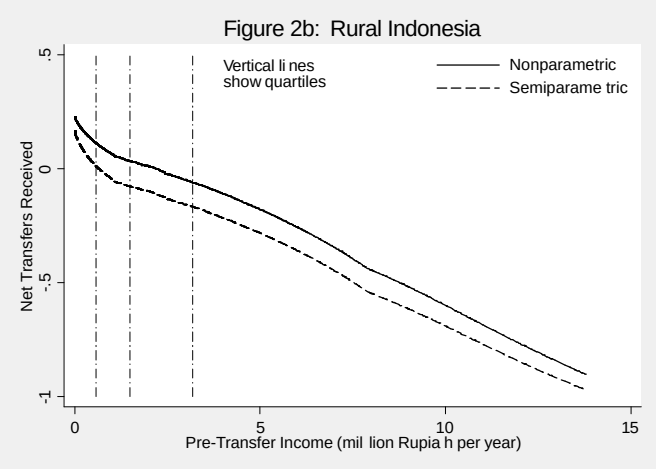
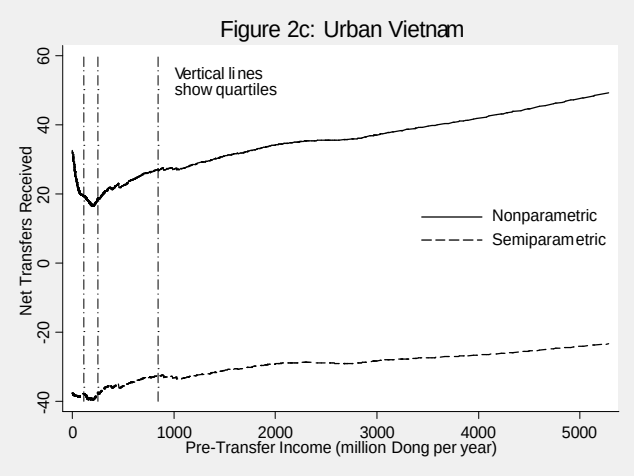


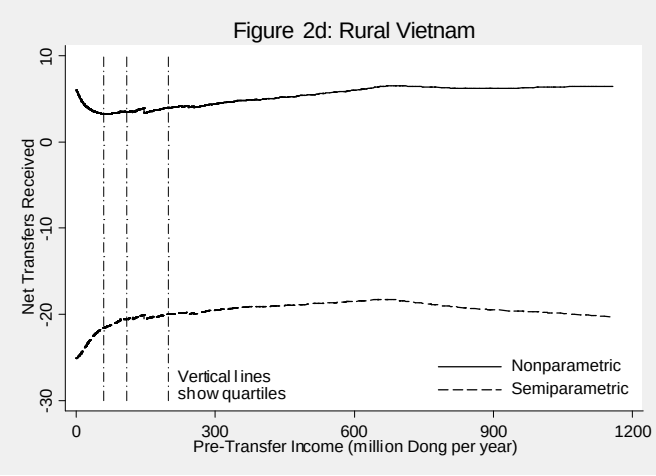

Source: Cox et al. (2004).

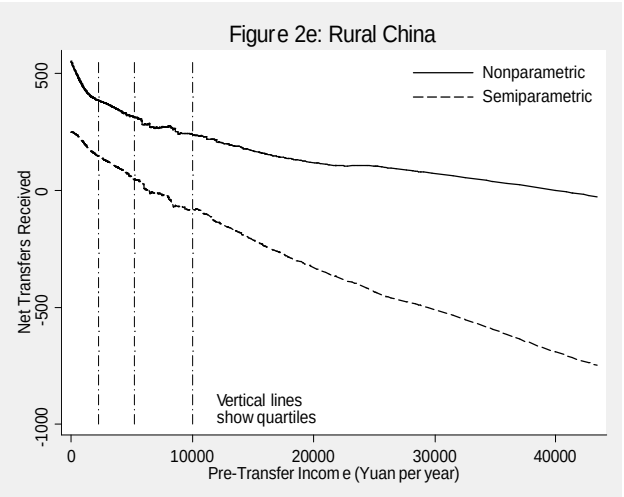
Figure 1. Predicted Pattern of the Relationship between Transfers and Recipient Income Under a "Switching Motivations for Transfer" Model.



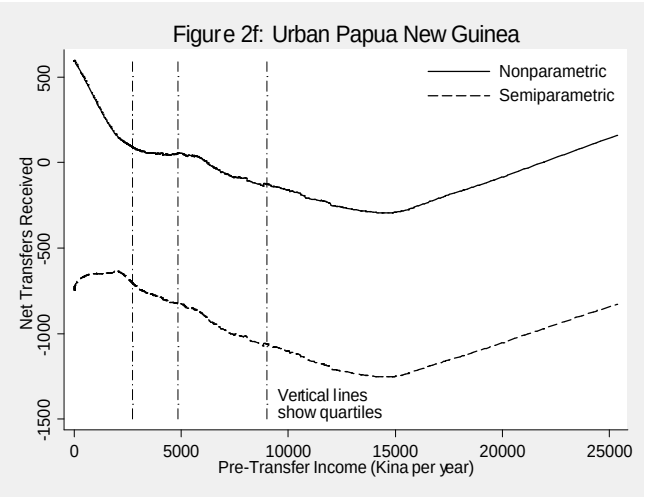




Figure 2. Nonparametric and Semiparametric Estimates of the Relationship between Transfer Receipts and Pre-transfer Income in Four Countries

**Table 1. Importance of Public Social Security in Selected Countries, 1988.**

| Country | Year | Social Security and Welfare Payments as % of: Government Expenditure | GDP | Per Capita GDP ($PPP)[a] |
|---|---|---|---|---|
| **Comparison Countries** | | | | |
| United States | 1998 | 28.7 | 9.8 | 30,600 |
| United Kingdom | 1998 | 36.4 | 14.5 | 21,140 |
| Philippines | 1988 | 0.8 | 0.1 | 3,070 |
| Philippines | 1998 | 4.4 | 0.9 | 3,500 |
| **Sample Countries, This Study** | | | | |
| China | 1998 | 2.7 | 0.4 | 3,120 |
| Indonesia | 1998 | 5.0 | 0.9 | 2,680 |
| Papua New Guinea | 1988 | 0.5 | 0.1 | 1,990 |
| Vietnam | 1998 | 12.1 | 2.3 | 1,720 |

Source: Asian Development Bank *Key Indicators* and International Monetary Fund *Government Finance Statistics Yearbook.*

[a] In international prices from the World Bank *World Development Indicators.*

**Table 2. Characteristics of Private Transfers in Four Asian Developing Countries.**

| | Urban Indonesia | Rural Indonesia | Urban Vietnam | Rural Vietnam | Rural China | Urban PNG |
|---|---|---|---|---|---|---|
| *Prevalence*[a] | | | (percent) | | | |
| Percent receiving gross transfers | 49 | 53 | 38 | 22 | 44 | 65 |
| Percent giving gross transfers | 57 | 52 | 22 | 18 | 53 | 66 |
| Percent who are net recipients | 32 | 37 | 36 | 21 | 30 | 40 |
| Percent who are net donors | 48 | 43 | 17 | 15 | 10 | 39 |
| *Intensity (income shares)*[b] | | | | | | |
| Net receipts for recipients | 8 | 10 | 10 | 10 | 10 | 9 |
| Net outlays for net donors | 6 | 7 | 2 | 3 | 3 | 6 |

*Notes:*

[a] As a percentage of all households in the sample.

[b] Median of the ratio of net receipts (outlays) to post-transfer income for households who were net recipients (net donors).

**Table 3. Linear Estimates of Net Transfer Functions using Ordinary Least Squares** [a]

| | Urban Indonesia | Rural Indonesia | Urban Vietnam | Rural Vietnam | Rural China | Urban PNG |
|---|---|---|---|---|---|---|
| **Pre-transfer income** | -0.080 | -0.069 | 0.003 | 0.003 | -0.019 | -0.043 |
| | (0.019)** | (0.010)** | (0.004) | (0.006) | (0.005)** | (0.013)** |
| **Other income variables** | | | | | | |
| Has no income | 0.123 | 0.112 | 15.354 | 7.781 | 929.861 | 438.473 |
| | (0.113) | (0.088) | (10.614) | (4.221)+ | (562.378)+ | (405.634) |
| Retirement income | -0.049 | -0.324 | -0.180 | -0.115 | 0.001 | -0.755 |
| | (0.059) | (0.178)+ | (0.159) | (0.061)+ | (0.027) | (1.053) |
| Has retirement income | -0.022 | 0.639 | -4.595 | -2.224 | -585.185 | -75.111 |
| | (0.150) | (0.390) | (9.113) | (2.698) | (261.507)* | (380.045) |
| **Education** | | | | | | |
| Primary graduate | -0.151 | 0.062 | 13.520 | 0.408 | -52.740 | 98.657 |
| | (0.103) | (0.031)* | (9.517) | (1.292) | (112.192) | (126.522) |
| Some secondary | 0.187 | 0.277 | 18.214 | 4.137 | -44.621 | 79.790 |
| | (0.246) | (0.237) | (6.672)** | (1.512)** | (83.753) | (118.669) |
| Secondary graduate | 0.050 | 0.033 | 29.323 | 6.306 | 35.657 | 147.581 |
| | (0.124) | (0.061) | (10.878)** | (3.360)+ | (144.612) | (150.199) |
| Some tertiary | 0.041 | -0.049 | 19.043 | -6.531 | 302.095 | 18.253 |
| | (0.461) | (0.176) | (15.278) | (18.924) | (244.662) | (177.553) |
| University graduate | -0.105 | 0.211 | 34.913 | 5.726 | -307.790 | 410.827 |
| | (0.266) | (0.193) | (17.409)* | (4.352) | (126.887)* | (204.670)* |
| **Other characteristics** | | | | | | |
| Age of household head | 0.001 | 0.000 | 0.350 | 0.191 | 4.160 | 7.189 |
| | (0.003) | (0.000) | (0.316) | (0.066)** | (4.126) | (4.529) |
| Female household head | 0.182 | 0.087 | 15.237 | 3.371 | -418.710 | 449.709 |
| | (0.138) | (0.054) | (9.256)+ | (2.128) | (177.167)* | (478.769) |
| Married | 0.171 | 0.081 | 18.919 | 8.159 | -41.884 | 166.780 |
| | (0.128) | (0.048)+ | (10.061)+ | (3.312)* | (224.678) | (227.331) |
| Married & female-headed | 0.014 | 0.227 | -3.915 | 5.710 | 568.200 | -530.167 |
| | (0.226) | (0.150) | (11.763) | (4.296) | (333.510)+ | (511.818) |
| No. of children < 1 yr | -0.010 | -0.159 | -3.780 | -2.800 | 81.145 | -132.270 |
| | (0.135) | (0.078)* | (7.813) | (1.465)+ | (89.948) | (114.534) |
| No. of children 1-6 yrs | 0.010 | -0.042 | 2.635 | 2.982 | -6.038 | -44.286 |
| | (0.062) | (0.021)* | (5.706) | (1.322)* | (69.177) | (38.470) |
| No. of children 7-14 yrs | 0.009 | 0.005 | -3.910 | 1.688 | -60.894 | -34.749 |
| | (0.039) | (0.016) | (3.315) | (0.671)* | (48.949) | (32.745) |
| Number of adults | 0.075 | 0.013 | -0.347 | -0.564 | 149.790 | 139.681 |
| | (0.025)** | (0.011) | (1.964) | (0.486) | (37.904)** | (39.823)** |
| Husband & wife both work | 0.067 | 0.006 | -17.495 | -9.479 | -96.049 | 118.117 |
| | (0.090) | (0.035) | (8.376)* | (3.376)** | (175.131) | (94.875) |
| Head not employed | 0.080 | 0.059 | 17.519 | 8.970 | -333.091 | 487.338 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (0.109) | (0.052) | (7.962)* | (4.123)* | (202.767) | (186.06)** |
| Constant | -0.276 | 0.026 | -22.408 | -12.421 | -225.943 | -666.417 |
| | (0.203) | (0.071) | (21.534) | (4.855)* | (279.382) | (246.15)** |
| Regional effects | 12 | 11 | 6 | 7 | 5 | 5 |
| $R^2$ | 0.041 | 0.068 | 0.038 | 0.038 | 0.080 | 0.085 |
| No. of observations | 3291 | 3879 | 1656 | 4072 | 1103 | 1060 |

*Notes:* Heteroscedasticity-robust standard errors in ( ), **=significant at 1% level, *=significant at 5% level, +=significant at 10% level. The sample excludes the top two percent of household incomes.

[a] Dependent variable, net transfers, is gross transfers received minus gross transfers given. This dependent variable and all other monetary values (including the transfer and other income variables) are denominated in millions of Rupiah for Indonesia, millions of Dong for Vietnam, Yuan for China and Kina for Papua New Guinea.

**Table 4. Linear Instrumental Variables Estimates of Net Transfer Functions**

| | Urban Indonesia | Rural Indonesia | Urban Vietnam | Rural Vietnam | Rural China | Urban PNG |
|---|---|---|---|---|---|---|
| **Pre-transfer income** | -0.004 | -0.013 | 0.117 | 0.055 | -0.037 | -0.043 |
| | (0.044) | (0.035) | (0.032)** | (0.027)* | (0.027) | (0.036) |
| **Other income variables** | | | | | | |
| Has no income | 0.379 | 0.192 | 60.355 | 11.032 | 831.766 | 439.969 |
| | (0.177)* | (0.108)+ | (17.68)** | (4.287)* | (601.540) | (379.748) |
| Retirement income | -0.086 | -0.346 | -0.002 | -0.102 | 0.001 | -0.758 |
| | (0.063) | (0.182)+ | (0.240) | (0.062)** | (0.028) | (1.073) |
| Has retirement income | 0.038 | 0.611 | 2.357 | -1.578 | -627.937 | -74.807 |
| | (0.153) | (0.393) | (13.685) | (2.781) | (277.194)* | (375.616) |
| **Other control variables** | [included but not reported—see Table 3] | | | | | |
| *F*-test 1st stage instruments [a] | 22.33** | 49.15** | 10.05** | 88.94** | 17.85** | 21.54** |
| Over-identification test [b] | 0.64 | 2.65 | 5.74 | 0.10 | 0.39 | 8.95 |
| Hausman test (OLS vs IV) [c] | 3.74 | 2.92 | 20.17 | 4.02 | 0.48 | 0.03 |

*Notes:* Each equation also includes the other variables listed in Table 3. Also see notes in Table 3 for other notes on definition of dependent variable and selected explanatory variables.

[a] Instruments for pre-transfer income are variables measuring the size and quality of the dwelling. The F-test is for excluding these instruments in the first stage model.

[b] Sargan test from a regression of the IV residuals on the full set of instruments, distributed as chi-squared in the number of over-identifying restrictions.

[c] Hausman test for significant differences between the vector of efficient (OLS) and consistent (IV) estimates, distributed as $\bullet^2_{(k)}$.

**Table 5. Single-Knot Spline Function Estimates of Net Transfer Functions.**

| | Urban Indonesia | Rural Indonesia | Urban Vietnam | Rural Vietnam | Rural China | Urban PNG |
|---|---|---|---|---|---|---|
| Income threshold (K) | 11.24 | 5.24 | 848.17 | 65.63 | 25450 | 12376 |
| | (4.87)** | (1.95)** | (529.51)+ | (31.12)* | (25910) | (2524)** |
| **Pre-transfer income below K** | -0.051 | -0.050 | 0.023 | 0.061 | -0.042 | -0.083 |
| | (0.016)** | (0.012)** | (0.018) | (0.036)+ | (0.008)** | (0.016)** |
| **Pre-transfer income above K** | -0.118 | -0.098 | -0.002 | 0.002 | -0.004 | 0.040 |
| | (0.056)* | (0.033)** | (0.006) | (0.006) | (0.069) | (0.044) |
| **Other Income Variables** | | | | | | |
| Has no income | 0.215 | 0.137 | 28.284 | 9.363 | 757.622 | 736.144 |
| | (0.112)* | (0.088) | (10.080)** | (4.170)* | (680.10) | (580.830) |
| Retirement income | -0.045 | -0.323 | -0.178 | -0.117 | -0.041 | -0.649 |
| | (0.058) | (0.175)+ | (0.158) | (0.061)+ | (0.038) | (1.208) |
| Has retirement income | -0.031 | 0.641 | -5.507 | -2.100 | -223.383 | -187.972 |
| | (0.149) | (0.387)+ | (9.048) | (2.684) | (276.198) | (423.560) |
| **Other control variables** | [included but not reported—see Table 3] | | | | | |
| Threshold quantile [a] | 0.886 | 0.877 | 0.751 | 0.300 | 0.970 | 0.867 |
| $R^2$ | 0.042 | 0.069 | 0.034 | 0.035 | 0.081 | 0.106 |

*Notes:* Each equation also includes the other variables listed in Table 3. For other notes see Table 3.

[a] The proportion of the sample with incomes below the income threshold (K) where the spline function kinks.

## Appendix I: Description of the Datasets

### *Indonesia*

The Indonesian data are drawn from the second wave of the Indonesian Family Life Survey (IFLS-2) conducted in 1997. The IFLS is an on-going longitudinal survey of individuals, households, families, communities and facilities that collects extensive and detailed socioeconomic information on the lives of the respondents. In particular, the survey asks respondents to report on a variety of transfers, both in-kind and cash during the 12 months prior to the survey period. The first wave of the sample was collected in 1993 and is a representative of approximately 83 percent of the Indonesian population living in 13 provinces on the islands of Sumatra, Java, Bali, West Nusa Tenggara, Kalimantan and Sulawesi. We treat IFLS-2 as a single cross-sectional survey in our analysis, to maintain comparability with the other countries that do not have panel elements. The survey covers 7,620 households. After excluding households with the top 2 percent of incomes and with negative incomes, our sample reduces to 7170 households (3879 in the rural sector and 3291 in the urban sector). The major variables are defined as follows. Net transfers is the total value of cash and in- kind transfers received from persons outside of the household minus the total value of cash and in-kind transfers given. Transfers from parents, children, and siblings are counted only if they are not listed on the household roster. Pre-transfer income includes income from wages, profits from farm and non-farm businesses, rent income from household assets, farm and non-farm businesses assets and income from other sources, which includes retirement income, income from scholarships, insurance payouts, lottery winnings, interest from rotating credit schemes and bonus income. Adults are defined as all household members aged 15 or older, and children are those aged 14 or less. The employment status of the household head and their spouse refers to whether they had held any job at anytime in the previous 12 months. The instruments used to identifyI income in the instrumental variable regressions are the number of rooms, size of the house, roof type and floor type of the dwelling.

### *Vietnam*

The Vietnamese data come from the 1997/1998 Viet Nam Living Standards Survey (VLSS), based on a sample of 6002 households in 194 rural and urban communes. Net remittances are remittances received less assistance expenses. Our pre-transfer income variable includes wages, profits from agricultural and non-agricultural household businesses, rent income and income from miscellaneous sources such as interest, dividends, lottery winnings, sales of jewellery, property, durables, and other household goods. Imputed income from the household's own dwelling, which was constructed by the Viet Nam General Statistical Office, is also added. The value of home-made products consumed by the household is treated as an income. Retirement income is loosely defined as income from social insurance schemes which come from the government (which may include disability benefits but these cannot be separated in the raw data). Adults comprise all those household members who are at least 15 years of age and children are those 14 years old or younger. Children are in turn classified into 3 age groups: less than 1 year olds, 1-6 years old, and 7-14 year olds. Heads of households are sorted into 5 categories based on their schooling achievement: some primary education or less, completed primary education, some secondary education, completed secondary education, some tertiary education, and completed university education. Employment status of the household head and

their spouse refers to whether the household head or spouse held any job at anytime during 12 month period prior to the survey. We use 7 regional dummies for Northeast, Northwest, North Central Coast, South Central Coast, Central Highlands, Southeast and Mekong River Delta; in the analysis, the Red River Delta region is the excluded category.

***China***

The data from China is a nationally representative sample of 60 villages in six provinces of rural China conducted by the Center for Chinese Agricultural Policy (CCAP), Chinese Academy of Sciences, UC Davis and the University of Toronto in 2000.[8] The survey covers 1199 households and gathers detailed information on household demographic characteristics, wealth, agricultural production, non-farm activities and investment. In addition, the survey also asks households about transfers during the 12 months prior to the survey period. After excluding households with the top 2 percent of incomes and those with negative incomes, our sample reduces to 1103 households. We defined our major variables as follows: net transfers is the total value of cash and in- kind transfers received from persons outside of the household minus the total value of cash and in-kind transfers given. Transfers from parents, children, siblings, relative and spouses are counted only if they are not listed on the household roster. Pre-transfer income includes income from wages, income from animal husbandry, profits from farm and non farm businesses, and income from other sources, which includes interest income, rental income, and income from asset sales, pensions and subsidies. The instruments used to identify income in the instrumental variable regression are the number of rooms and size of the house. We defined adults as all household members aged 15 or older, and children are those aged 14 or less. For the educational variables, the completion of grade 6 indicated a primary school graduate, and the completion of grade 12 indicated a secondary school graduate.

***Papua New Guinea***

The urban Papua New Guinea data are taken from the Urban Household Survey, carried out in the nation's largest urban areas in 1987/8. The starting sample is 1,094 households that have full information on transfers, income and demographics. After excluding households with the top 2% of incomes and those with negative incomes the sample reduces to 1,060. The survey asked households about income and transfers that they received or gave during the two weeks before the survey; these are then "grossed" up to represent annual figures. The major variables are defined as follows: net transfers is the total value of cash and in-kind transfers received from persons outside of the household minus the total value of cash and in-kind transfers given. Transfers from absent spouses are counted only if the spouse is not listed on the household roster. Pre-transfer income includes income from wages, profit from formal businesses and net revenue from small-scale, informal activities. The instruments for income in the instrumental variable regression are the number of rooms and floor area of the dwelling and a set of dummy variables indicating the type of dwelling as ascertained by the interviewer (high cost, low cost, makeshift, or traditional). For the control variables, retirement income was retrieved from the recorded components of "other" income. For the educational variables, the completion of grade 6 indicated a primary school graduate and the completion of grade 10 a secondary school graduate.

[8] The provinces are *Hebei, Liaoning, Shaanxi, Zhejiang, Hubei* and *Sichuan*.

**Appendix Table 1. Descriptive Statistics from Six Surveys in Four Countries.**

| | Urban Indonesia | Rural Indonesia | Urban Vietnam | Rural Vietnam | Rural China | Urban PNG |
|---|---|---|---|---|---|---|
| Net transfers received | -0.066 | -0.008 | 24.442 | 3.886 | 292.978 | 10.024 |
| | (2.146) | (0.902) | (111.756) | (40.171) | (1109.621) | (143.307) |
| Pre-transfer income | 5.125 | 2.377 | 717.7 | 167.1 | 7264.486 | 6390.7 |
| | (5.330) | (2.603) | (1014.253) | (178.726) | (7001.815) | (5188.343) |
| Has no income | 0.038 | 0.036 | 0.037 | 0.016 | 0.003 | 0.031 |
| | (0.190) | (0.187) | (0.190) | (0.125) | (0.052) | (0.174) |
| Retirement income | 0.228 | 0.058 | 10.374 | 3.608 | 83.358 | 4.094 |
| | (1.020) | (0.455) | (26.031) | (13.636) | (788.997) | (51.446) |
| Has retirement income | 0.090 | 0.024 | 0.194 | 0.091 | 0.015 | 0.010 |
| | (0.286) | (0.154) | (0.395) | (0.288) | (0.120) | (0.101) |
| Primary graduate | 0.225 | 0.232 | 0.098 | 0.132 | 0.151 | 0.166 |
| | (0.418) | (0.422) | (0.297) | (0.338) | (0.359) | (0.372) |
| Some secondary | 0.030 | 0.018 | 0.400 | 0.417 | 0.385 | 0.158 |
| | (0.172) | (0.132) | (0.490) | (0.493) | (0.487) | (0.365) |
| Secondary graduate | 0.320 | 0.131 | 0.178 | 0.072 | 0.076 | 0.157 |
| | (0.467) | (0.337) | (0.382) | (0.259) | (0.265) | (0.364) |
| Some tertiary | 0.010 | 0.003 | 0.034 | 0.006 | 0.017 | 0.132 |
| | (0.098) | (0.053) | (0.182) | (0.077) | (0.130) | (0.339) |
| University graduate | 0.035 | 0.008 | 0.068 | 0.005 | 0.058 | 0.058 |
| | (0.184) | (0.089) | (0.252) | (0.072) | (0.279) | (0.235) |
| Age of household head | 46.548 | 47.699 | 49.821 | 47.299 | 45.249 | 37.386 |
| | (13.921) | (20.976) | (13.441) | (13.867) | (10.943) | (10.694) |
| Female household head | 0.177 | 0.163 | 0.402 | 0.218 | 0.033 | 0.039 |
| | (0.382) | (0.369) | (0.490) | (0.413) | (0.178) | (0.193) |
| Married | 0.799 | 0.830 | 0.766 | 0.818 | 0.930 | 0.877 |
| | (0.401) | (0.375) | (0.423) | (0.386) | (0.255) | (0.328) |
| Married & female-headed | 0.021 | 0.028 | 0.209 | 0.066 | 0.024 | 0.015 |
| | (0.142) | (0.166) | (0.407) | (0.248) | (0.152) | (0.122) |
| No. of children < 1 yr | 0.047 | 0.050 | 0.052 | 0.072 | 0.024 | 0.161 |
| | (0.212) | (0.220) | (0.225) | (0.264) | (0.158) | (0.368) |
| No. of children 1-6 yrs | 0.379 | 0.445 | 0.364 | 0.561 | 0.155 | 1.097 |
| | (0.645) | (0.697) | (0.614) | (0.790) | (0.405) | (1.251) |
| No. of children 7-14 yrs | 0.679 | 0.766 | 0.680 | 1.065 | 0.516 | 1.225 |
| | (0.916) | (0.970) | (0.867) | (1.089) | (0.721) | (1.292) |
| Number of adults | 3.979 | 3.446 | 3.363 | 3.154 | 3.868 | 3.296 |
| | (2.093) | (1.638) | (1.588) | (1.403) | (1.720) | (2.144) |
| Husband & wife both work | 0.293 | 0.339 | 0.525 | 0.719 | 0.859 | 0.303 |
| | (0.455) | (0.473) | (0.500) | (0.449) | (0.349) | (0.460) |
| Head not employed | 0.178 | 0.112 | 0.213 | 0.084 | 0.031 | 0.117 |
| | (0.383) | (0.315) | (0.409) | (0.277) | (0.173) | (0.322) |
| No. of observations | 3291 | 3879 | 1656 | 4072 | 1103 | 1060 |

*Note:* Monetary values are denominated in millions of Rupiah for Indonesia, millions of Dong for Vietnam, Yuan for China and Kina for Papua New Guinea.

**Appendix Table 2. Sensitivity Analysis of Linear Estimates of Net Transfer Functions**

| | Urban Indonesia | Rural Indonesia | Urban Vietnam | Rural Vietnam | Rural China | Urban PNG |
|---|---|---|---|---|---|---|
| **Pre-transfer income** | -0.081 | -0.073 | 0.004 | 0.004 | -0.019 | -0.047 |
| | (0.019)** | (0.011)** | (0.004) | (0.006) | (0.004)** | (0.013)** |
| **Education** | | | | | | |
| Primary graduate | -0.159 | 0.057 | 11.401 | 0.089 | -55.520 | 103.712 |
| | (0.102) | (0.030)* | (9.421) | (1.294) | (112.728) | (127.142) |
| Some secondary | 0.192 | 0.291 | 14.652 | 3.348 | -48.781 | 86.490 |
| | (0.246) | (0.238) | (6.425)** | (1.447)* | (84.594) | (118.394) |
| Secondary graduate | 0.038 | 0.021 | 25.921 | 5.036 | 37.105 | 160.383 |
| | (0.125) | (0.061) | (10.567)** | (3.323) | (144.349) | (154.342) |
| Some tertiary | 0.062 | -0.049 | 14.392 | -8.242 | 364.988 | 38.732 |
| | (0.452) | (0.176) | (15.097) | (19.078) | (235.303) | (178.158) |
| University graduate | -0.122 | 0.206 | 29.044 | 0.456 | -316.752 | 446.866 |
| | (0.267) | (0.185) | (17.869)* | (4.077) | (127.276)* | (204.798)* |
| **Other characteristics** | | | | | | |
| Age of household head | 0.001 | 0.000 | 0.196 | 0.156 | 3.305 | 7.059 |
| | (0.003) | (0.000) | (0.274) | (0.063)* | (4.085) | (4.384) |
| Female household head | 0.169 | 0.087 | 14.807 | 3.151 | -434.167 | 430.244 |
| | (0.135) | (0.054) | (9.292) | (2.134) | (178.705)* | (475.980) |
| Married | 0.142 | 0.062 | 16.834 | 7.403 | -77.187 | 153.768 |
| | (0.128) | (0.049) | (9.815)+ | (3.288)* | (229.497) | (224.080) |
| Married & female-headed | 0.038 | 0.215 | -4.898 | 5.118 | 399.735 | -495.723 |
| | (0.223) | (0.150) | (11.722) | (4.292) | (306.205) | (508.450) |
| No. of children < 1 yr | -0.008 | -0.156 | -3.724 | -2.772 | 81.970 | -127.018 |
| | (0.135) | (0.078)* | (7.846) | (1.461)+ | (90.402) | (113.856) |
| No. of children 1-6 yrs | 0.011 | -0.039 | 2.575 | 3.071 | -10.152 | -43.796 |
| | (0.062) | (0.021)* | (5.719) | (1.328)* | (68.886) | (38.389) |
| No. of children 7-14 yrs | 0.012 | 0.008 | -3.532 | 1.809 | -64.082 | -33.533 |
| | (0.039) | (0.017) | (3.305) | (0.686)** | (48.714) | (32.701) |
| Number of adults | 0.075 | 0.011 | -0.680 | -0.673 | 148.173 | 136.514 |
| | (0.025)** | (0.011) | (1.963) | (0.487) | (37.611)** | (39.804)** |
| Husband & wife both work | 0.073 | 0.010 | -16.986 | -9.252 | -86.493 | 125.858 |
| | (0.091) | (0.036) | (8.328)* | (3.371)** | (176.066) | (94.385) |
| Head not employed | 0.053 | 0.054 | 18.464 | 9.788 | -273.600 | 570.655 |
| | (0.107) | (0.058) | (7.784)* | (3.985)* | (211.091) | (195.428)** |
| Constant | -0.224 | 0.047 | -13.020 | -10.338 | -150.552 | -630.948 |
| | (0.201) | (0.074) | (20.000) | (4.788)* | (273.707) | (241.545)** |
| Regional effects | 12 | 11 | 6 | 7 | 5 | 5 |
| $R^2$ | 0.040 | 0.057 | 0.030 | 0.032 | 0.078 | 0.081 |
| No. of observations | 3291 | 3879 | 1656 | 4072 | 1103 | 1060 |

*Notes:* See Table 3.