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Prabal K. De [a] & Dilip Ratha [b]

[a] Department of Economics and Business, The City College of New York, New York, NY, USA

[b] The World Bank, Washington, DC, USA

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Impact of remittances on household income, asset and human capital: evidence from Sri Lanka

Prabal K. De[a]* and Dilip Ratha[b]

[a]*Department of Economics and Business, The City College of New York, New York, NY, USA;* [b]*The World Bank, Washington, DC, USA*

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This paper explores the developmental impacts of international remittance income on the recipient households. The empirical analysis proceeds in two parts. In the first part, we show that remittance income largely accrues to the families belonging to the bottom quintiles of the income distribution helping the recipient families move up the income ladder. In the second part, we show that remittance income has positive and significant effect on children health and education, but not on conspicuous consumption or asset accumulation. We argue that remittance income is targeted better and not as fungible as other sources of transfer income, as the senders closely monitor it. We use bias-corrected matching estimators to control for self-selection issues.

Keywords: remittances; development; South Asia; migration; asset formation

JEL Codes: F24; I2; O15; O53

1. Introduction

Developing countries received more than 325 billion dollars in remittances in 2010. In the recent past, international remittances have outpaced most traditionally important international financial flows such as official development assistance (ODA) and foreign direct investment (FDI) in some developing countries (Ratha, 2003; Yang, 2011). A large proportion of these remittance transfers occur at the household level when migrant workers send money to their families and friends living in their home countries. Anecdotal evidence on migrant workers supporting families and themselves and eventually climbing up the social ladder abound.[1]

Remittance flow is different from the other international financial flows such as ODA, foreign aid and FDI. While most of the development assistance is essentially official (though some of it can be construed as inter-agency flows, such as flows from foreign to domestic non-governmental organizations), and FDI is private institutional in nature, remittance is a purely private household-level flow. The amount and the potential use of remittance income are often decided upon jointly by the sender and the recipient. Unlike earned (and some forms of unearned) income, the recipients often do not have the full discretion to spend the remitted money in an unrestricted way. In many cases, remittance income is tied to specific uses. Unfortunately, surveys rarely collect data on the both sides of a remittance transaction making direct information on the motive unavailable. Moreover, due to fungibility of income, survey subjects do not report different sources for different categories of expenditure. This

*Corresponding author. Email: pde@ccny.cuny.edu

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lack of survey-based information forces us to infer on the use of remittance income from the observational data.

However, not all remittance payments may be tied to specific uses and the recipient may treat the money in the same way as any unrestricted transfer income such as unemployment benefits or pension. Moreover, even if the money is sent for some intended use, the sender may not be able to monitor the recipient perfectly. The second issue gives rise to a moral hazard problem – remittance flows may have unintended negative consequences. It can potentially lead to unproductive dependency on transfer income, laziness and conspicuous consumption owing to a moral hazard problem (Chami et al., 2008). At the macro level, remittance income may impact real exchange rate in a way that may be detrimental to the health of the recipient economy (Amuedo-Dorantes & Pozo, 2004).

The focus of the present study is to examine this polemic at the household level using detail household survey data and to make inference on the impacts of remittance in the context discussed above. We want to examine to what extent remittance flow is 'developmental' in nature – does it help ameliorate poverty and contribute to children's human capital formation? We also test the other conjecture in the literature that remittance recipient families accumulate durable assets meant for luxury consumption, such as motor vehicles and landholding.[2] As the first step, we test the hypothesis that income is fungible so that the effects of remittance income will be no different from the effects of other income. Our data reject this hypothesis. Then, we go onto test if outcomes for the remittance-recipient families are significantly different from the non-recipient families. While we find that remittance income contributes to an increase in human capital accumulation among children, we do not find any evidence that it significantly increases household asset accumulation.

The challenge in identifying the effects of remittance, as in any evaluation of a treatment, is that we do not observe one potential outcome for each agent – outcome of a recipient family in case it did not receive remittance and outcome of a non-recipient family in case it did receive remittance. Matching estimators allow us to estimate the unobserved potential outcome for each observation in the sample (and consequently, identify the effects of treatment under certain assumptions). The critical assumption here is that the treatment is random for individuals and households with similar values of the covariates, so that we could use the average outcome of some similar individuals or households who were not treated to estimate the untreated outcome. In other words, for each individual, matching estimators impute the missing outcome by finding other individuals in the data whose covariates are similar but who were not exposed to the treatment. This identification strategy comes with the caveat that even after controlling for many covariates, such as location, religion, and household characteristics, there may be individual unobserved characteristics of migrants that are not orthogonal to the migration and remittance-sending decisions. However, since we study households that are in the home country, individual characteristics of the migrants are less likely to affect the decisions of their households beyond the 'treatment' that is remittance sending. In the absence of experimental evidence, the other option is to look for instruments. There are several difficulties of using instruments in the current setting. First, unlike Latin American countries like Mexico, there is no long legacy of migration study and data collection process for Sri Lanka. Therefore, the popular instruments such as migrant networks in the destination country cannot be used here. Second, cross-section data rules out difference–indifference types of estimates. Finally, instrumental variable estimates, in the absence of strong identifying natural experiments, are also prone to bias. As Mckenzie et al. (2008) note, a bias-corrected matching estimator, similar to the one we have used, also works as a second best.

There is a small literature on the impacts of international remittances in Sri Lanka. Deshingkar (2006) shows how international remittance income acted as an insurance flow for the Sri Lankan economy. As far as other South Asian countries are concerned, in India, Rajan (2004) and Mallick (2011) discuss the impacts of migration and remittances on the recipient economy. One of the earliest papers that showed that remittance income helped poor people build some forms of assets was based on a data-set from Pakistan (Adams, 1998).

Remittance-development literature has flourished since then. In later studies in Guatemala and Ghana, (Adams, 2004, 2006) found evidence that though international remittance income helped reduce the level, depth and severity of poverty; they had a greater impact on reducing the severity as opposed to the level of poverty, where the severity of poverty is measured by squared poverty gap. In two later papers, (Adams & Cuecuecha, 2010a, 2010b) documented the developmental impacts of remittances in Indonesia and Guatemala, respectively. In Mexico, Amuedo-Dorantes and Pozo (2011a) found that for many households, remittance income helps in income smoothing. Walker and Brown (1995) found for the Tongan and western Samoan migrant households that remittances were not used exclusively for consumption purposes and played an important role in contributing to both savings and investment in the migrant-sending countries. They also found that remittances were not driven exclusively by altruistic sentiments and the need for family support, but also, among some migrant categories, by the motivation to invest. There appears to be substantial scope for policy intervention on the part of Pacific Island Governments to increase the flows of remittances into their economies. More recently, a study on the Pacific islands of Fiji and Tonga generally found that remittance income has led to a fall in poverty and economic inequality (Brown, 2008).

Estimating the effects of international remittances, Cox and Ureta (2003) found in El Salvador that remittance income not only lowered the propensity to dropout from school, but also was more effective in doing so compared to non-remittance income – result similar to what we have found. Mansuri (2006) also found that remittance income helps children's education, particularly for girls. In India, Mueller and Shariff (2011) have recently found similar positive effects of remittances, though such remittances were internal rather than international.

Many of these studies suffer from identification problems arising out of endogeneity of remittance income. Endogeneity problems may arise due to both simultaneity bias and omitted variables. The decision and amount to be remitted may depend on the various outcome variables such as children's education, asset building and changes in consumption pattern. Moreover, omitted variables may affect *both* remittance decision *and* outcome variables. A remitter may be a driven, enthusiastic and caring person who monitors her child's education directly.

Literature has often bypassed this issue, because without randomized control trials it is difficult to establish causality. Research using observational data has taken two routes – using instrumental variables that affect remittance, but not the outcome variables directly and using matching estimators that estimate the differences in outcome between the recipient families and the non-recipient families that are *similar* based on observable characteristics. For example, in order to estimate the impact of remittance income on the household welfare for the overseas Filipino workers, variations in exchange rates arising out of the East Asian currency crisis were used as an instrument for remittance income and showed that remittance income helps reduce poverty and acts as an insurance payment (Yang, 2008; Yang & Choi, 2007).[3] Another popular instrument has been constructed on the intuition of the historical events, such as railroad construction (Adams & Cuecuecha, 2010a), and destinations of migrant workers (Amuedo-Dorantes & Pozo, 2011b). Examples of the matching estimator can be found in Acosta (2006) and Esquivel and Huerta-Pineda (2007), who take the second route in estimating the effects of remittance on poverty and education and Mexico and El Salvador, respectively.

In the absence of either experimental or panel data, we employed two strategies to identify the effects of remittance income separately from other sources of income. First, we estimated an over-identified model, where both total income (including remittance income) *and* remittance income are included. The intuition is that if income is fungible, then remittance income should not show any additional significance in explaining the dependent variable over and above the effects of total income.

Second, we use matching estimators to control for any systemic difference between remittance-receiving families and other families and examine if remittance-receiving families' behaviour is different from the non-recipients. Matching estimators have been widely used in the programme evaluation. They impute the missing potential outcome by using average outcomes for individuals with 'similar' values for the covariates. Identification issues have been discussed in more detail in the empirical section of the paper.

We make two contributions to the literature. First, to our knowledge, this is one of the first studies that examine the behaviour and impacts of remittances in South Asia. Second, our identification strategies help to test the fungibility of income and directly assess the impacts of remittances vis-à-vis other sources of income. We also improve upon the propensity score matching method so far used in this literature. Even though the methodology is not free from caveats, such as roles played by unobserved heterogeneity, we believe that in the field of international migration where randomized trials are costly and difficult, such nuanced results from observational studies involving cross-section data advance our understanding.

The rest of the paper is organized in the following way. In the next section we will discuss the international migration and remittance profile for Sri Lanka, followed by a brief review of the related literature. Section 3 discusses the data-set used in this paper and provides an exploratory analysis of the data. The following two sections describe the empirical strategy and results, respectively. We conclude with a summary and policy implications of our results.

2. International migration and remittance in Sri Lanka

The trend in out-migration in Sri Lanka started in the late 1970s as an effect of slow growth in the domestic economy and large-scale oil production in the Gulf countries that demanded a large number of unskilled labours.[4] This trend was supplemented by a relatively recent trend in hiring female housemaids in those gulf countries. Table 1 shows these changing trends in terms of occupational mix for the migrants over time at a disaggregated level.

Keeping up with the increasing migration, international remittance inflow has increased steadily for Sri Lanka over the past few years. It has outpaced the other two important sources of external finance, such as ODA and FDI. Figure 1 illustrates this trend. While both ODA and FDI have remained flat over time, international remittance flow has increased, even in the face of global recession.

Table 1. Migration patterns in Sri Lanka.

Year	Occupational groups						
	Professional	Middle	Clerical	Skilled	Unskilled	Housemaid	Total
1994	262	833	1559	12586	8824	36104	60168
1999	1253	3161	6210	37277	43771	88063	179735
2004	1827	6561	6679	45926	43204	110512	214709
2009	2832	6388	6719	61321	50173	113678	241111

Source: Sri Lanka Bureau of Foreign Employment (2010)

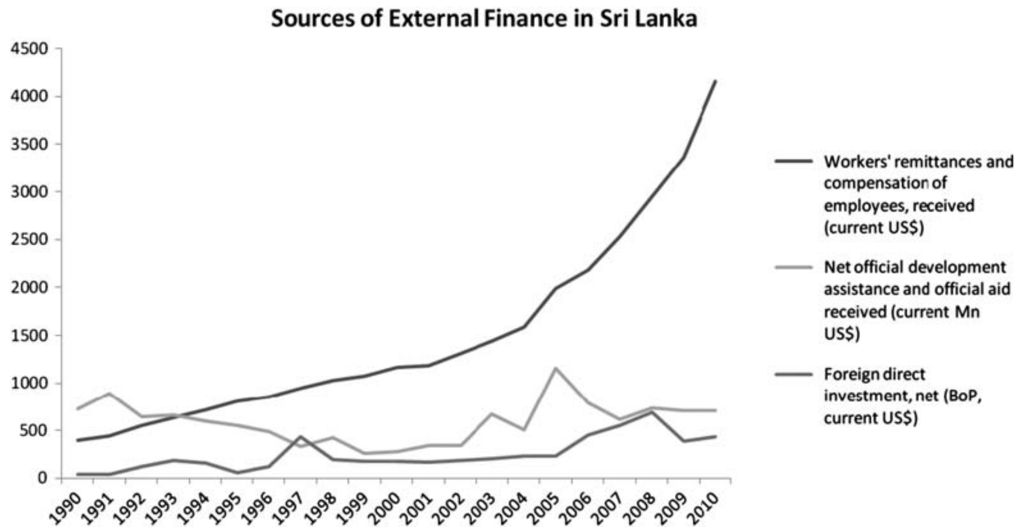

Figure 1. Various sources of external finance for Sri Lanka.
Source: World Bank (2012).

Though parts of this significant increase is due to better recording of remittances in recent times and increasing tendency to send money through legal channels owing to reduction of remittance fees and improvements in technology, anecdotal evidence suggests that a significant amount of remittances still flow through informal channels and go unrecorded. Therefore, the official remittance figures potentially underestimate the actual extent of money transfer.

3. The data-set and an exploratory analysis of data

The primary source of data for this study is the Sri Lanka Integrated Survey 1999–2000. The survey was conducted across all nine provinces in the country between October 1999 and the third quarter of 2000. The data are based on interviews of 7500 households and includes data on 35,181 individuals. The survey is comprehensive and dependable and contains information on a large number of variables, such as demographics, occupation, income, education, health and asset, holding allowing us to construct a data-set with various observable control variables.

There is a separate module for international migration, where current and past migration information such as destination country, year of departure and family migration history are recorded. Remittance income information is recorded in two modules. In the migration module, families were asked about the amount received in the last 12 months as international remittances. Remittance income is also included in the category ‘other transfer income’. There is no perfect 1:1 matching between migrant and remittance receiving families – some migrant families do not receive any remittances, while some families with no immediate family members abroad do have remittance income.

Table 2 shows the destination country profile for Sri Lankan migrants. It confirms the macro-level finding given in Table 1 that Gulf countries account for a majority of demand for migrant workers from Sri Lanka.

In Table 3, we compare various demographic, education and socio-economic characteristics across families that receive remittances and families that do not. The top panel, Panel A,

Table 2. Destination of international migrants from Sri Lanka.

Destination	Frequency	%
Kuwait	150	30.4
Saudi Arabia	117	23.7
UAE (Dubai)	44	8.92
Lebanon	41	8.32
Europe	40	8.11
Other middle Eastern	33	6.69
Baharain	13	2.64
America	11	2.23
Jordan	10	2.03
Maldive Islands	8	1.62
Oman	6	1.22
Singapore	4	0.81
Other Asian countries	4	0.81
Japan	3	0.61
India	2	0.41
Syria	2	0.41
Hong Kong	1	0.2
Iran	1	0.2
Iraq	1	0.2
Africa	1	0.2
Australia	1	0.2
Total	493	100

Source: Authors' calculations based on Government of Sri Lanka (2000).

reports characteristics of the household head. Not surprisingly, a lower proportion of households are headed by a male among the remittance recipient families as the male member is likely to be abroad. The average age of the household heads for non-recipient families is higher. While non-recipient family heads have lower inheritance in terms of land, they have a higher education level (measured in terms of the years of schooling). Interestingly, there are no significant differences between the remittance-recipient families and other families in terms of either income or the value of landholdings.

In terms of characteristics, there are no significant differences between the children of recipient vs. the children of non-recipient families in terms of enrollment and dropout (previously enrolled, but not currently enrolled). However, recipient family children access private tuition at a significantly higher rate. We control for most of these observed differences in our empirical analysis.

3.1. Income mobility

This section analyses the income dynamics of Sri Lankan households who received remittance income from abroad. If remittance income is received by families that are already wealthy, it may contribute little to upward income mobility or reduction in inequality. On the other hand, remittance income for poor families can help them climb up the income ladder.

Suppose we divide all the families into 10 income deciles according to their pre-remittance income such that the first decile contains the poorest 10% families and the tenth decile contains the richest 10%. Let us now include the remittance income for all the remittance-receiving families and re-draw the income distribution according to that income data. A straightforward measure of mobility will be the following – number of families in each decile from 1 to 9 that have moved up the income ladder according to the new distribution.

Table 3. Descriptive statistics.

Variable	Non-recipient	Recipient	*t*-stat	*p*-value
Panel A: characteristics of household heads				
Male	0.84	0.76	5.20***	0.00
	(0.37)	(0.43)		
Age	49.20	50.63	−2.56***	0.01
	(13.56)	(13.81)		
Married	0.82	0.76	3.82***	0.00
	(0.39)	(0.43)		
Father owned land	0.33	0.25	4.57***	0.00
	(0.47)	(0.43)		
Education (years of schooling)	7.77	8.01	−1.71*	0.09
	(3.31)	(3.17)		
Value of land holding	209,342.88	193,175.00	0.27	0.79
	(627,740.59)	(689,829.07)		
Income in current LKR	104,654.15	57,377.97	0.84	0.40
	(1,376,381.60)	(105,693.56)		
Panel B: characteristics of children of age 6–18				
Age	12.31	12.56	−1.80**	0.07
	(3.76)	(3.72)		
Male	0.51	0.50	0.78	0.43
	(0.50)	(0.50)		
Private tuition	0.33	0.46	−7.37***	0.00
	(0.47)	(0.50)		
Current enrollment	0.87	0.86	1.17	0.24
	(0.34)	(0.35)		
Never school	0.02	0.02	0.10	0.92
	(0.13)	(0.12)		

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.
Notes: Standard errors are in parenthesis.
Land holding and income are in current Sri Lankan rupees (LKR).

Pre-remittance Income Decile	**Post-remittance Income Decile**									
Decile	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
1	23	23	14	20	16	17	12	8	7	1	**141**
2	1	16	11	9	4	8	2	3	2	1	**57**
3			8	8	16	8	10	6	5	1	**62**
4				6	7	6	6	4	3		**32**
5					7	13	14	12	5	2	**53**
6					1	9	16	16	6	2	**50**
7							14	27	21	4	**66**
8							1	25	32	8	**66**
9								1	25	28	**54**
											581

Figure 2. Matrix of initial income decile and post-remittance income decile.

The basic matrix illustrating this information is presented in Figure 2. This matrix compares the income decile of a recipient family before receiving remittances with its income decile after receiving them. Each row and column in Figure 1 represents one decile of income distribution.

The rows represent the initial income decile the recipient families belong to as *if they did not receive any remittance income*. The entries along the diagonal show those recipient households who remained in the same decile before and after receiving remittance income. Off-diagonal entries show those families that moved between deciles. For example, the entry at the top of the first column indicates that 23 (16.3%) recipient households who were in the lowest decile before receiving remittances remained in the lowest quintile even after receiving it. This means 83.6% of the recipient families from the lowest quintile moved up in the income ladder after receiving remittances. Similarly, the second entry along the diagonal (i.e. second row and second column) shows that 28% = (16/57) ∗ 100) of the families from the second decile remained in the same strata after receiving remittances and 72% of these families moved to a different decile. Figure 3 summarizes the data on *upward mobility* – percentages of families moved up in the income ladder after receiving remittance income. In this figure, the bottom label indicates which decile the families came from and the bars show what percentage of the recipient families ended up in a higher decile. Figure 3 shows that though remittance income contributes to income mobility for families in all income strata, it is more pronounced for the lower half of the distribution. This is not surprising, as all families got a boost income from the baseline of no remittance income.

The problem in this type of analysis is that the potential income in the absence of migration is not controlled for. Migrants sending money from abroad would most likely have earned income in their home country if they had not migrated. In other words, we cannot observe the counterfactual income in the event that a migrant had not migrated.

There is no perfect methodology to create counterfactual income, particularly since we have a cross-section of data and no history of wage or other earning for the migrant workers. There have been two excellent attempts at estimating the counterfactual income. Barham and Boucher (1998) and Adams and Cuecuecha (2010a) create model-based prediction of income without migration. Since we do not have data to follow such methodology, we have adopted an ad hoc method of assigning counterfactual income to a migrant family – we assign to the family the median income of the income decile of the group to which they belong to according to the distribution of pre-remittance income. In particular, we follow the following two-step procedure to create a more refined measure of income mobility. In the first step, we create the income distribution of all families according to their pre-remittance income (for families not receiving any remittance income, this is same as the total household income). We then calculate the median income of each decile as the representative income of a particular income group. Next, for each income group, we add the median income to the pre-remittance income of the recipient families belonging to the respective income group. This income stream constitutes the counterfactual income (or potential outcome in the nomenclature of (Rosenbaum & Rubin, 1984)). In the second step, we perform the previous exercise summarized in Figures 1 and 2, but on the stream of counterfactual income and actual income. We

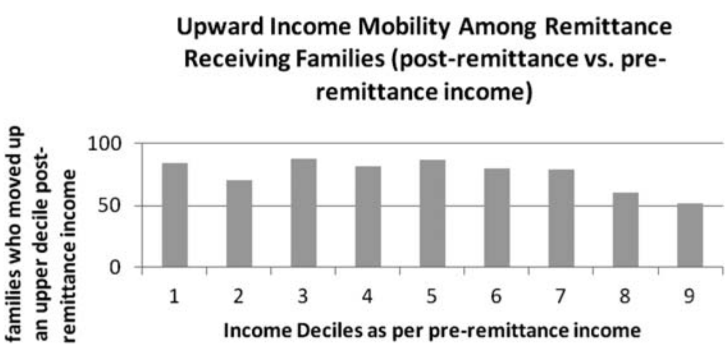

Figure 3. Upward income mobility among remittance receiving families.

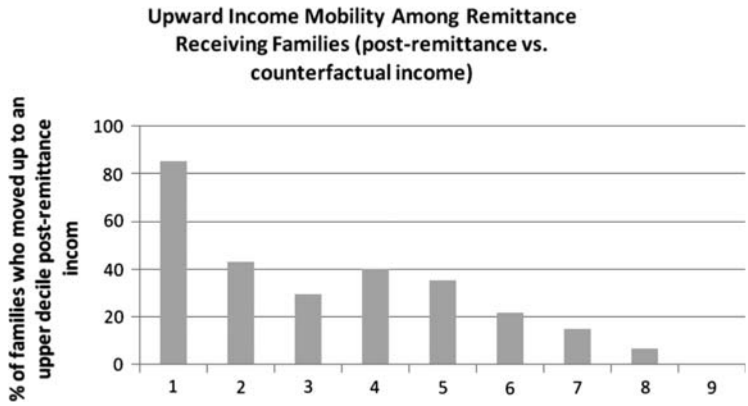

Figure 4. Upward income mobility with projected counterfactual income.

create 10 deciles of counterfactual income, locate the remittance-recipient families in various income strata, recalculate the income distribution according to the post-remittance income and calculate the percentage of families that have moved up the income ladder according to the latter distribution vis-à-vis the counterfactual distribution.[5]

The results are summarized in Figure 4. In this version of the mobility graph, we see that families in the lowest decile have the highest incidence of upward mobility. The overall message from this graph is that remittance income helped the poorer sections of the society leading to an amelioration of inequality.

4. Estimating the impacts of remittance income on education, health and asset accumulation

4.1. Specification for overidentified regressions

In examining the effects of remittance income on children's welfare in terms of education and health, we start with a linear specification where the dependent variable will be various individual welfare measures representing health and education. On the right hand side of the regression equation, we have remittance income, total income and a set of control variables. Therefore, our basic regression specification is:

$$Y_i = \mu + \beta \times R_i + X_i'\lambda + \varepsilon_i \tag{1}$$

where Y_i is the dependent variable in question for individual i, R_i is the remittance income and X_i is a vector of other covariates. The coefficient of interest throughout is β, the effect of remittance income of individual welfare. Finally, ε_i is the random error term. Depending on the outcome variable, we use either ordinary least squares or Probit model.

4.2. Outcome variables

We study two different classes of outcome variables – children's human capital in terms of education and health and family asset accumulation in terms of value of durable assets and land.

4.2.1. Children's human capital: health and education

In the first class, we use the anthropometric measure of weight of a child less than 5 years of age. Anthropometric measures, such as weight, height and body mass index, are becoming increasingly popular in the development literature as they give a direct signal about individual health and welfare. Further, since we have only cross-section data it makes less sense to work with the adults as marginal impact on their health indicators seems to be less significant for a year.

Our second measure is whether or not a school going child receives private tuition. The rationale behind this measure lies in the success of school education system in Sri Lanka. Sri Lanka has almost complete literacy and enrollment in school as seen in Table 2 and 97% of the students attend government-run schools. Therefore, traditional measure of enrollment is not effective here. Having a private tutor in this environment signals superior access to education. Unfortunately, we do not have any test score data to see if having a tutor directly translates itself into good scores. Since the outcome variable takes only binary values, we estimate a probit model.

4.2.2. Household asset accumulation and land holding

As discussed in the introduction, it has been argued that remittance income, being transfer income, goes into conspicuous consumption as idle asset building. Also, if the rich landed class of the society receives remittances and remittance contributes to further accumulation of such assets, it cannot be deemed as a development flow. Therefore, we use the measures of the value of durable assets and land holding to see if the effects of remittance income are different than those of the children's variables.

4.3. Explanatory variables

Independent variables vary depending on the outcome variables in the model concerned. We use a set of individual characteristics as well as household level characteristics. For every individual, we control for gender and age. We also control for family income, parental education, gender of the head of the household and remittance income.

To recall, according our *identification strategy* described above, if income is fungible and remittance income has no effects over and above the effects of total income including remittances, we should have $\beta = 0$. If β, however, is significantly different from zero, the aforementioned hypothesis cannot be rejected.[6]

4.4. Specification for matching estimators

Same set of outcome variables have been used in computing the matching estimators. To recall the basic logic of the matching estimators, each individual or household head belongs to either of the two groups – (1) remittance-recipient or (2) remittance non-recipient. Therefore, for each individual, there is an actual outcome and there is a potential outcome that we cannot observe. For example, potential outcome for a remittance-recipient child will be the one when she did not belong to a recipient family. Econometrically, the potential outcome for unit i is obtained by imputing the average of outcomes for its matches and then the difference between the treatment and control group is computed as an *average treatment effect.*

4.4.1. Matching variables

We use the same set of variables that have been used as control variables in our regression analysis above.

4.5. Identification issues

An ideal framework for assessing the causal effects of remittances would be to conduct an experimental trial in which individuals would be randomly assigned into international migration and stipulate that they send remittances to their families back home. Then families of these migrants can constitute the 'treated' group as remittance-receiving families and other non-recipient families can serve as controls. Practical considerations preclude such experiments in most of the cases.[7]

Problems with non-experimental, observational approaches are that the effects of remittances are confounded by omitted variables that influence both outcome variables and other control variables. For instance, a father may seek and obtain a job abroad because he cares about his children and makes sure to both send money home *and* monitor his child's progress regularly. There are reverse causality issues also. How much money someone sends may depend on the quality of children's health and education.

As an alternative to the experimental approach, several non-experimental methods have been proposed. This includes using an instrumental variable for migration and Heckman two-step procedure.[8] Though these studies deal mostly with migration and not remittances, and as we have argued above, they are not identical. There are two exceptions, Acosta (2006) and Esquivel and Huerta-Pineda (2007) find positive effects of remittances on reducing poverty among Mexican households and on education in El Salvador, respectively, using propensity score matching among other methods. As discussed below, we attempt to improve upon simple propensity matching methods by using more reliable bias-adjusted matching estimators.

In the absence of true exogenous variation that credibly serves as an instrument, we adopt two alternative identification strategies. Our first identification strategy stems from the intuition that remittance income flow is a special flow. Migrants who send money tend to monitor it closely. Therefore, it is not the same as, say, other transfer income a family receives. This leads us to an overidentification test. If income is fungible and a dollar is a dollar (in this case, Sri Lankan Rupee), then remittance income should have no impact on the outcome variables once the total income *including remittances* is controlled for. This strategy is similar to Thomas (1990), where he compared the effects of female vs. male income.

Our second identification strategy is to use the latest matching estimators. The major advantages of a matching procedure are that it does not require parametric functional form and exclusion restrictions. A matching estimator is based on a simple idea: for each recipient family, or a child belonging to a recipient family, the procedure finds a group of comparable families or individuals who have similar observable characteristics among the non-migrants. Within each set of matched individuals or families, one can then estimate the impact of remittances by the difference in the sample means. Therefore, matching estimators approximate the virtues of randomization mainly by balancing the distribution of the observed attributes across remittance-recipients and non-recipients. Dehejia and Wahba (1999, 2002) showed that matching provides a significantly closer estimate for the treatment effects than the standard parametric techniques. We use the latest matching estimators developed by Abadie, Drukker, Herr, and Imbens (2004) Abadie and Imbens (2002) with and without correction for bias. To our knowledge, this is the first attempt at estimating the effects of remittances in this framework.

5. Results

5.1. Results from overidentified models

Table 4 reports results from the estimation of the first set of overidentified models, where the dependent variables are weight of a child less than 5 years of age and private tuition decision for the students currently enrolled, respectively.

Table 4 shows us that weights of children less than 5 years of age are positively correlated with age and male sex. Female-headed households seem to have a positive significant impact on the health of the child. This is consistent with the findings of the intra-household decision-making literature. Further, while parental education has positive and significant impact on child health as expected, father's education has a stronger effect. Finally, total remittance income has a positive and significant impact on child health even after controlling for total income providing evidence that income may not be fungible between remittance and non-remittance income.[9]

If income is not fungible, remittance income is attached to specific type of expenditure and remittance income is used to accumulate expensive assets such as durable goods and

Table 4. Effects of remittances on children's human capital.

Variables	(1) Private tuition dummy	(2) Weight of children less than 5 years
Age	0.007	2549.473***
	[0.019]	[113.694]
Age squared		−211.557***
		[27.071]
Male dummy	−0.090**	408.523***
	[0.040]	[94.947]
Current grade	0.126***	
	[0.019]	
Father education	0.069***	38.339*
	[0.008]	[20.264]
Mother education	0.059***	27.125
	[0.008]	[20.518]
Male head of family	−0.352***	−20.747
	[0.095]	[138.709]
Log of total income	0.126***	160.656***
	[0.023]	[57.190]
Log of remittance income	0.041***	45.187**
	[0.008]	[21.348]
Observations	4694	1500
R^2		0.644

*$p<0.1$; **$p<0.05$; ***$p<0.01$.
Note: Robust standard errors in brackets.

Table 5. Effects of remittances on asset accumulation.

Variables	(1) Value of durable goods	(2) Value of land holding
Male	915.160	6266.117
	[6619.942]	[43,337.527]
Dummy for father Owning land	38,967.110***	62,522.382
	[10,889.917]	[39,678.901]
Highest education	11,545.205***	11,554.864**
	[1516.521]	[5544.962]
Log of total Income	88,062.045***	103,687.170*
	[21,839.486]	[53,145.946]
Log of total remittances	2989.627	−6882.295
	[1974.347]	[4298.829]
Observations	5193	1052
R^2	0.105	0.045

*$p<0.1$; **$p<0.05$; ***$p<0.01$.
Note: Robust standard errors in brackets.

land, then we would expect similar results for durable assets and landholding. However, as Table 5 shows, this is not the case. Table 5 shows the results from the specification where the dependent variables are values of a household head's durable assets and landholding, respectively.

However, none of these models took into account that remittance recipient families may potentially be different from the non-recipient families. Matching estimators attempt to correct this and provide a more accurate estimate of the impacts of remittance income.

5.2. *Results from matching estimators*

In this section, we show estimates for the average treatment effect (ATT) using different specifications. Table 6 shows results for children's human capital variables when matching is done on a wide set of covariates. We have used two groups of covariates for two dependent variables, respectively. For the private tuition decisions, we have used individual characteristics such as age, gender and current grade and region dummies. Covariates used for matching children less than 5 years of age consist of similar variables.

The simple matching estimator will be biased in finite samples when the matching is not exact. The bias-corrected matching estimator (nnmatch using the biasadj() option) adjusts the difference within the matches for the differences in their covariate values. Therefore, Table 6 also includes biased-corrected matching estimators along with the simple matching estimator. This also provides a robustness test. Finally, we have used four matched across all specification as is the general norm. The results are robust to alternative number of matches.

For the specifications at hand in Table 6, we conclude that the treatment effect or the effect of belonging to a remittance-recipient family is significantly greater than zero at the 1 or 5% levels for both the dependent variables at hand.

Similar analysis has been performed for the asset variables and as Table 7 shows, remittance income has no impacts on asset holding, implying that there is little evidence to support the view that remittance-recipient families accumulate assets using remittance income.

Table 6. Matching estimators for children's human capital.

		Private tuition		Child weight	
Estimator	*M*	ATT	SE	ATT	SE
Simple matching	4	0.150267***	0.03	493.1441**	246.52
Bias-adjusted	4	0.149297***	0.03	424.6501**	227.20
No. of observations		4835		1536	

*$p<0.1$; **$p<0.05$; ***$p<0.01$.
Note: SE: standard errors.

Table 7. Matching estimators for asset accumulation.

		Durable asset		Value of land holding	
Estimator	*M*	ATT	SE	ATT	SE
Simple matching	4	16,916.76	12021.74	−5078.658	4581.88
Bias-adjusted	4	17,346.96	12021.74	−5382.176	4581.88
No. of observations		5342		5411	

*$p<0.1$; **$p<0.05$; ***$p<0.01$.
Note: SE: standard errors.

Table 8. Results with covariate balancing.

	Child weight	Private tuition	Durable asset	Land holding
ATT	708.2235***	0.144904***	17961.05	0.0129504
SE	285.5364	0.022578	15013.26	0.0184446

*$p<0.1$; **$p<0.05$; ***$p<0.01$.
Notes: SE: standard errors.
ATT was estimated comparing remittance recipient families (treatment) with non-recipient (control) groups having created the covariate balance.

5.3. Sensitivity analysis

The previous estimates do not control for the problem of covariate imbalance – when the treatment and the control groups are observational, rather than being carefully designed for an experiment, values for pre-treatment variables may differ widely making the groups incomparable. By design, matching estimators try to exploit the covariates to find treatment and control units that are similar or balanced. However, there are three problems with this. First, in large data-sets, the covariate set can be so large that meaningfully matched sample may be small. Second, the process first chooses the matching method, produces estimates and then checks the resultant covariate balance. Third, it is model-dependent.

Iacus, King, and Porro (2012) and King, Blackwell, Iacus, and Porro (2010) propose a solution, coarsened exact matching (CEM), which attempts to create ex ante covariate balance. The procedure temporarily coarsens each variable into several strata, matches on these coarsened data and then only retains the original (uncoarsened) values of the matched data. It offers several advantages. First, the process involves creating matched data before the estimation process and hence model-independent (Ho, Imai, King, & Stuart, 2007). A simple average treatment effect can be estimated with the matched data now that the empirical distributions of the covariates in the groups are more similar. Second, in this process, adjusting the imbalance on one variable has no effect on the maximum imbalance of any other. However, the procedure of CEM nonetheless suffers from the same problem that matching estimators suffer from – there is a trade-off between the size of matching bin and the size of matched sample. While larger bins ensure more matched units, it creates less precise matches. In view of this, we believe the use of CEM will provide an excellent robustness test for our previous results coming from more conventional and widely used matching estimators.

The results are summarized in Table 8. As seen from the sign and significance of the coefficients, the results are qualitatively similar to our previous results. The ATT of remittance receipt is positive and significant for recipient family children's health and education variables. However, such effect is not significant for the various classes of assets.

6. Conclusion

International remittances have become a globally important financial flow in recent years. However, evidence on the developmental consequences of this essential transfer income at the household level is mixed. The questions we ask in this paper are whether remittance income (1) helps recipient families in moving up in the income ladder, (2) positively and significantly affects children's health and education and (3) is spent on buying luxurious durable assets and land. Using very detailed household level data from the Sri Lankan Integrated Survey, we find that remittance income does help in income mobility and children's human capital accumulation. However, we find no evidence that households use remittance income in building assets. Our identification is based on using bias-corrected matching estimators, whereby children from non-recipient families that are 'similar' to recipient families in terms of observable covariates are compared to their brethren belonging to the latter group.

To our knowledge, this is one of the first papers to discuss the implications of international remittances in the context of a South Asian country. As shown in the paper, both international migration and remittance inflow have been steadily growing in Sri Lanka making it an important source of foreign currency. This is also true for other South Asian countries such as India and Pakistan. Since these countries in the subcontinent are similar in many cultural, religious and economic aspects, our results are likely to have some external validity. Our evidence on the positive effects of remittance income calls for policies that ease remittance flow – reduction in fees or tax breaks. Future research should focus on better data collection, particularly longitudinal data. Surveys linking both segments of the family living in Sri Lanka and abroad will also be very useful in answering some of the questions that we could not address – monitoring of remittance income, response of remittance flow to family income shocks and children's human capital formation before and after migration and remittance receipt.

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Notes

1. For instance, Deparle (2007, June 24) reports that for many Filipino families, migrant workers sustain their families better. He also reports that remittances sustain economic activities and precipitate political change by migrant money in the west African country of Cape Verde (Deparle, 2007, April 22).
2. Arguably, the definition of 'luxury' item varies from society to society. In the context of a developing country like Sri Lanka in 2000, a car for personal consumption, for example, would be deemed a luxury item.
3. There is a rich literature on the impacts of international migration aside from remittances. However, even though they are closely related, the analysis at the household levels warrants different treatments. Many households in our sample do not qualify as a 'migrant household' as there is no immediate family member living abroad, but receive remittances from friends and extended families.
4. For an excellent review of the migration pattern from Sri Lanka, see Sriskandarajah (2002).
5. Note that while calculating the income distribution, *all* families are included regardless of their remittance status. Also note that families can potentially go into a lower income decile, while being positioned in the actual income distribution vis-à-vis the counterfactual one as median income may be higher than the actual remittance income. This cannot be ruled out on reality also – sometimes migrants find that income in their destination country is less than potential income foregone in the home country.
6. An equivalent way of testing this: we can take income *without remittances* and remittance income on the right hand side and test the null that the corresponding coefficients are equal. We have taken this approach because it is easier to test and interpret the null $\beta = 0$.
7. There are such experiments where potential migrants apply through visa lotteries.
8. See Mckenzie (2008) for various approaches.
9. We also tested an alternative specification where we used remittance income dummy (=1 if remittance receiving family, zero otherwise).

Notes on contributors

Dr. Prabal De is a faculty member at the Department of Economics and Business at The City College of City University of New York, NY. He conducts research in the area of development, labour and international economics.

Dr. Dilip Ratha is a Lead Economist at the World Bank Group, Washington DC. He is an internationally recognized scholar on migration and remittances. His latest co-edited book is *Migration and Remittances during the Global Financial Crisis and Beyond*, World Bank, Washington, DC.

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