Proceedings of the Australasian Conference on Business and Social Sciences 2015, Sydney
(in partnership with The Journal of Developing Areas)
ISBN 978-0-9925622-1-2

THE ECONOMIC IMPACT OF INTERNATIONAL REMITTANCES ON HOUSEHOLD CONSUMPTION AND INVESTMENT IN PAKISTAN

Tufail Khan Yousafzai
The Australian National University, Australia

ABSTRACT

This paper uses nationally representative household income and expenditure survey data for Pakistan to investigate how the receipt of international remittances affect the average and marginal spending behaviour of households on five different categories of goods: food, education, health, non-durables and durables. Two findings emerge. First, expenditure share on food for households that receive remittances would have been more if the households had not been receiving remittances. Similarly, less spending on the other four categories of education, health, non-durables and durables is predicted for remittances- receiving households had they not been receiving remittances. Second, households that receive remittances spend less at the margin on food and durables and more on education, health and non-durables. At the mean, compared to households that do not receive remittances, the households receiving remittances spend, at the margin, 10 per cent and 4 per cent less on consumption of food and durables, respectively. Moreover, the marginal increase in spending on education is 26 per cent more for a remittances-receiving household than for a non-receiving household. Finally, the households receiving remittances spend, at the margin, 14 per cent more on non-durables (which includes their spending on housing, and is thus akin to investment in physical capital) than the households with no remittances. A key feature of these results is the likely positive impact of remittances on economic development, by the way of increased spending on human capital or education as well as physical capital. Remittances-receiving households appear to look at the remittance earnings as a transitory income and therefore tend to spend remittances more on investment than consumption. This finding lends support to the permanent income hypothesis.

JEL Classifications: D12 and O12
Key Words: remittances, treatment effect, consumption, Pakistan
Corresponding Author's Email Address: tufail.khan@anu.edu.au

INTRODUCTION

During the last decade, the developing world has witnessed a phenomenal increase in the inflow of international remittances. In 2013, officially recorded international remittances to developing countries amounted to US $414 billion and were more than three times larger than the official development assistance received by these countries (World Bank, 2014). The ever-increasing magnitude of international remittances has drawn economists' interest in analysing the economic impact of these transfers on developing countries. While part of the research affirms a positive impact on poverty and health in developing countries, other studies indicate that remittances can have a negative effect on income inequality, education, labour supply and economic growth.

The purpose of this paper is to further investigate and refine the debate on two basic questions: how are remittances used by the recipients and do they have any impact on the economic development? The analysis is conducted using a nationally representative household budget survey in Pakistan, and by employing a counterfactual framework, to see how the average spending behaviour of the household would have differed had that household not produced a migrant. Also, the marginal spending behaviour of the remittances receiving and non-receiving households is compared on their consumption of a broad range of consumption and investment goods. Understanding that decision of a household member to migrate and remit money may not be taken at random, a two-stage Heckman model is used to address the selection in unobserveables.

The paper is organized as follows. Section 2 gives a literature review and section 3 describes the data. Section 4 discusses the choice of the functional form of the model, whereas section 5 explains the model estimation under the counterfactual framework and presents the two stage selection model used in this analysis. Section 6 specifies the model with the estimation results given in section 7. Section 8 gives a summary of the findings.

LITRATURE REVIEW

There have been many empirical studies seeking to understand the reasons for migrants' remitting money back home. Few of the motives include: altruism or the desire to help and care for those left behind (Brown & Poirine 2005); insurance, to mitigate against any adverse shocks that their families may face (de la Briere et al. 2002; Gubert 2002); and investment (de la Briere et al. 2002; Osili 2007). Though it is very difficult to empirically discriminate between these various motives for remitting, the literature on the use and economic impact of remittances is far more targeted. While there is general agreement that remittances reduce poverty in the developing world (Loshin et al. 2010; Adams 2006a; Adams & Page 2005; Taylor et al. 2005; Yang & Martinez 2006, among others), the impact of remittances on income inequality is debated. For instance, McKenzie and Rapoport (2007) find that income inequality reduces with the level of migration. Whereas the same finding is supported by Jones (1998), Adams (1992) finds a neutral effect for remittances on income distribution in rural Pakistan. However, other studies contest these findings and have reasoned that the Gini coefficient increases when remittance earnings are included in household income (Barham & Boucher 1998; Rodriquez 1998; Adams & Cuecuecha (2010b)).

The findings on the impact of remittances on health in developing countries are less controversial. Most studies find a favourable impact of remittances on infant mortality and child health. Duryea et al. (2005) find that international migration reduces infant mortality in the first month after the birth in large urban areas in Mexico. Reaching a slightly different conclusion, Hiderbrandt and Mckenzie (2005) find that remittances reduce infant mortality in rural areas in Mexico. Similarly, Arif (2004) finds that migration reduces infant and child mortality for female children in Pakistan. In contrast, the impact of remittances on education is controversial. Cox-Edwards and Ureta (2003) find that remittance earnings have a positive impact on school retention rates in El Salvador. On the other hand, McKenzie and Rapoprt (2006) find a negative effect on schooling attendance in the case of international migration in Mexico. Bilquees and Hamid (1981) find a mixed trend for school education in Pakistan. They observe that school attendance up to year 3 is higher for migrant families compared to non-migrant families. However, beyond year 3, the position reverses and more males in non-migrant families go to school as compared to migrant families.

To what extent the remittances-receiving households spend their remittances on investment and consumption is yet unresolved. Some studies find that the marginal propensity to consume on consumption goods (such as, food and durables) for remittances-receiving households is higher than for the non-receiving households. For example, Chami et al. (2003) conclude that remittances are, typically, not invested in a productive manner and often spent on 'status-oriented' consumption goods. In case of Pakistan, Gilani et al. (1981) show that remittances spending is more skewed towards consumption. They show that 62 per cent of remittances are spent on current consumption, 22 per cent on real estate purchase, 11.5 per cent is used for investing in physical capital while 1.4 per cent goes to financial investment. Adams (1998) shows that international remittances have a profound effect on asset accumulation in rural Pakistan. However, other studies conclude that remittances-receiving households have a tendency to invest more of their remittances on physical and human capital. For example, Adams and Cuecuecha (2010a) find that remittances-receiving households spend less at the margin on food consumption and more, at the margin, on education and housing.

International remittances can have different effects on labour markets in the developing world. On the one hand, remittances may ease up the liquidity constraints for the creation of small business by the receiving households. On the other hand, remittances may also increase the reservation wage of the members of the remittances-receiving households and, therefore can reduce labour force participation. For example, Kim (2007) finds that labour force participation in Jamaica decreases with remittances while Funkhouser (2006) has found the same result for Nicaragua. Likewise, Arif (2004) also finds that international migration has a negative and significant impact on labour force participation in Pakistan.

DATA

This paper uses the data from Pakistan Social and Living Standards Measurement Survey (PSLM) 2010-11, collected nationwide by the Government of Pakistan Federal Bureau of Statistics. The data comprises 16,339 households and is representative both at the national level and for urban and rural areas. The sample design consisted of two-stage stratified random sampling, with enumeration blocks and villages (the primary sampling units) in rural areas being selected in the first stage while households (the secondary sampling units) within the sample enumeration blocks/villages have been selected at random at the second stage. At both stages, probability proportional to size measure of sampling had been used. Accordingly, the data set comes with sampling weights for each household and the same have been used in this paper for carrying out estimations.[1]

Although the survey is comprehensive and covers the household's expenditure and income patterns, it is not a specialized survey of remittances. As regards remittances, the survey only gathers information relating to three basic questions: remittance received (in cash) from outside Pakistan, country of residence of remitters and relationship of the remitter with the head of the household. Neither does it have data on migrants' characteristics; only migrants who remit (and whose remittances are declared by the recipient households) are

ISBN 978-0-9925622-1-2

captured by the survey. Non-availability of data relating to migrants impedes us from observing the effect of migration on households' expenditure patterns. Notwithstanding the lack of information regarding individual migrant characteristics, the expenditure data included in the survey is of high quality. And this makes it possible to use the response to these three questions in examining the impact of remittances on households' expenditure patterns. Table 1 presents summary data on remittances-receiving and non-receiving households. Remittances-receiving households are defined as households receiving remittances from outside Pakistan (international remittances). Out of a total of 16,339 households, 871 households receive international remittances. For households receiving remittances, mean per capita expenditure is significantly higher than it is for non-receiving households. Moreover, the average assets holding for remittances receiving households is significantly higher than it is for non-receiving households. Remittances receiving households are proportionally higher in rural areas: 74.7 per cent of the remittances receiving households are located in rural areas as compared to 61.7 per cent of the non-receiving households.

TABLE 1. SUMMARY DATA ON REMITTANCE RECEIVING AND NON-RECEIVING HOUSEHOLDS

Variable	Households receiving remittances (remitdum=1) (mean)	Households not receiving remittances (remitdum=0) (mean)	Difference [=remitdum(0)-remitdum(1)]	p-value
Household size	7.171	6.654	-0.517	0.000***
Log of per capita expenditure	10.737	10.437	-0.3	0.000***
The household has members in the 0 to 10 years age group (1 = yes)	0.707	0.696	-0.011	0.717
The household has members in the 11to 19 years age group (1 = yes)	0.678	0.592	-0.086	0.000***
The household has members in the 20 to 60 years age group (1=yes)	0.988	0.986	-0.002	0.820
The household has members in the 61 and older years age group (1 = yes)	0.373	0.260	-0.113	0.000***
The household has members with primary level of education (1 = yes)	0.763	0.632	-0.131	0.000***
The household has members with secondary level of education (1 = yes)	0.464	0.345	-0.119	0.000***
The household has members with higher secondary level of education (1 = yes)	0.209	0.175	-0.034	0.004**
The household has members with Bachelor's degree level of education (1 = yes)	0.143	0.107	-0.036	0.025**
The household has members with Master's degree level of education (1 = yes)	0.053	0.054	0.0005	0.576
Total assets owned by the household (PKR)	3,042,649	1,620,982	-1,421,667	0.000***
Amount of loan owed by the household (PKR)	53,325	25,701	-27,624	0.000***
Province1 (=Punjab)	0.634	0.591	-0.043	0.000***
Province2 (=Sindh)	0.018	0.248	0.230	0.000***
Province3 (=Khyber Pakhtunkhwa)	0.332	0.112	-0.220	0.000***

ISBN 978-0-9925622-1-2

Province4 (=Baluchistan)	0.016	0.048	0.032	0.000***
Rural area (1=yes)	0.746	0.617	-0.129	0.001***

Source: Author's calculations based on Pakistan Social and Living Standards Measurement Survey (PSLM) 2010-1.
Notes: N=16,339 households; 871 households receive foreign remittances. All the values are weighted.
*** Significant at the 0.05 level.*
**** Significant at the 0.01 level.*

Table 2 presents information on five different categories of expenditure. The base period over which these expenditures were measured varied from the last 14 days for most food items to the last month and the last one year for non-durable and durable items. Therefore, all expenditures have been aggregated to yearly values. The table also shows households' average budget shares on these five categories of goods.

TABLE 2. EXPENDITURE PORTFOLIOS AND AVERAGE BUDGET SHARES

Category	Description	Examples	Average expenditure shares			p-value
			Households receiving remittances (remitdum=1)	Households not receiving remittances (remitdum=0)	Difference [=remitdum(0) -remitdum(1)]	
Food	Paid and consumed Unpaid and consumed	Milk and milk products, meat, wheat, rice; Wages and salaries consumed in kind; own production; receipt from assistance, gift or other sources	0.475	0.510	0.035	0.000***
Education	Educational expenditure	School/college fee and private tuition fee; books, stationary and professional society membership; hostel expenses.	0.039	0.022	-0.017	0.000***
Health	Medical care expenses	Medicine, doctor fees, hospitalization charges, dental care.	0.029	0.028	-0.001	0.037**
Non-durables	Household non-durables	Housing; fuel and lighting; personal care like bath soap, shampoo; personal transport and travelling; recreation; clothing, foot ware.	0.157	0.128	-0.029	0.000***

Durables	Household durables	Wrist watches, sun glasses, furniture, Television, car, computer, mobile.	0.026	0.014	-0.012	0.000***
Other goods	Household expenditure on other goods and services	Miscellaneous goods and services	0.275	0.299	0.024	0.000***

Source: Author's calculations based on Pakistan Social and Living Standards Measurement Survey (PSLM) 2010-11.
*Notes: ** Significant at the 0.05 level.*
**** Significant at the 0.01 level.*

CHOICE OF FUNCTIONAL FORM FOR THE MODEL

The analysis of marginal expenditure patterns of households requires an appropriate functional form for the econometric model. Broadly, the selection should be based upon two factors. First, it is desirable that the model possesses appropriate microeconomic foundations and second, it should have good statistical properties. A useful functional form, relating the expenditure shares to the logarithm of total expenditure is the Working-Leser model. This model is given by:[2]

$$C_{ij}/EXP_i = \beta_j + \alpha_j/EXP_i + \gamma_j(logEXP_i) \quad \text{for } i = 1 \; to \; N \text{ and } j = 1 \; to \; m \tag{1}$$

where C_{ij}/EXP_i is households i's share of expenditure on good j in its total expenditure EXP_i and $\sum_{j=1}^{k} C_{ij}/EXP_i = 1$.

Alternatively, equation (1) can be written as:

$$C_{ij} = \alpha_j + \beta_j EXP_i + \gamma_j(EXP_i)\log(EXP_i) \tag{2}$$

which is the Engel function. Theoretically, Engel functions can be defined as Marshallian demand functions, holding prices of all goods fixed. The empirical Engel function defined in equation (2) coincides with the theoretical Engel function, provided all the sampled households pay the same price for all goods. And, in cross sectional data, all the sampled households are assumed to face the same prices for all goods. [3] One obvious departure is the use of total expenditure instead of total income. This is because in surveys, households' incomes are prone to measurement error.[4] As regards the second factor, the chosen functional form should provide a decent statistical fit for different variety of goods, have the mathematical property of exhibiting variation in marginal propensities with respect to different varieties of goods and expenditure level, and should confirm to the additivity criterion (that is, marginal propensities for all goods should sum up to unity). Gauged on the above criteria, the Working-Leser model is an appropriate model to use.

However, in analysing the expenditure pattern of households with different levels of income, other socioeconomic and demographic variables influencing their behaviour must also be taken into account. Differences in observed expenditure may be partly explained by differences in income, but also by differences in family composition, educational status of household members, age composition of household members, liquidity constraints and whether the household receives remittances or not. Denoting the household h's characteristics by Z_h , with μ_{ij} being constants, equation (1) can be written as:

$$C_{ij}/EXP_i = \beta_j + \alpha_j/EXP_i + \gamma_j(logEXP_i) + \sum_h(\mu_{jh})(Z_h) \tag{3}$$

The marginal budget share for good 'j' can be derived from equation (3) as:

$$MBS_j = dC_{ij}/EXP_i = \beta_j + \gamma_j(1 + logEXP_i) + \sum_h(\mu_{jh})(Z_h) \tag{4}$$

Equation (4) shows by how much consumption share of good 'j' will change in response to one rupee increase in household expenditure, keeping constant household characteristics Z_h. The model, in this formulation, is the one used by Adams and Cuecuecha (2010a).

MODEL ESTIMATION

To estimate the effect of remittances on households expenditure behaviour, literature on treatment effects will be followed. Formally, treatment effects are best understood under the potential (counterfactual) framework. Defining treatment as the condition where the households have a remitter, remittances receiving households can be qualified as a 'treated' group, whereas non-receiving households will be akin to a 'control' group. Consider a household 'i' that did not receive treatment (has no remitter) so that we observe the budget share on a commodity group 'j' for this household to be y_{0i}. The potential outcome or the counterfactual for the same household would be y_{1i}, that we would have observed if this household had been exposed to treatment. And for a household receiving treatment, we observe y_{i1} so that y_{0i} would be potential outcome for that household. This means that, in observational data we either observe y_{0i} or y_{1i} for a given household with observable characteristics, $\boldsymbol{X}_i$. Let t_i be an indicator variable indicating treatment condition so that $t_i = 1$ if household 'i' received treatment and $t_i = 0$ otherwise, so that the observed expenditure share of household i on good 'j' is given by:

$$y_i = (1 - t_i)y_{0i} + t_i y_{1i} \text{ where,} \tag{5}$$
$$y_{0i} = E(y_{0i}) + \varepsilon_{0i}, \text{ and} \tag{6}$$
$$y_{1i} = E(y_{1i}) + \varepsilon_{1i} \tag{7}$$

where $\varepsilon_{0i}$and ε_{1i} are mean zero error terms.

This relation links together the observable and non-observable outcomes with the treatment indicator and is called the (Potential) Outcome Model. Since y_{1i} and y_{0i} are never both observed for the same household, research on causal effect tries to capture:

i. The potential outcome means (POMs), $\mathrm{E}(y_1)$ and $\mathrm{E}(y_0)$ of the treated and the untreated respectively[5],
ii. The average treatment effect (ATE), which is the mean of the difference $(y_1 - y_0)$ i.e ATE $= \mathrm{E}(y_1 - y_0)$. This is the average effect of moving the entire population from untreated to treated (Austin 2011),
iii. The average treatment effect on the treated (ATET), which is the mean of the difference $(y_1 - y_0)$ among those houeholds that receive the treatment $(\text{ATET} = \mathrm{E}(y_1 - y_0)|t_i = 1)$,
iv. The average treatment effect on non-treated (ATENT), is the average effect of treatment on randomly drawn sub population, selecting (or assigned) no treatment. $(\text{ATENT} = \mathrm{E}(y_1 - y_0)|t_i = 0)$.

Causal parameters are not as easy to measure as they are to describe. For example, the POM for the untreated can be calculated as:

$$\mathrm{E}(y_0) = \mathrm{E}((y_0|t_i = 0)\Pr(t_i = 0) + \mathrm{E}((y_0|t_i = 1)\Pr(t_i = 1) \tag{8}$$

Here, the term $\mathrm{E}((y_0|t_i = 1)$ is not identified by the data. By analogy, $\mathrm{E}(y_1|t_i = 0)$ is also not identified. And the objective is to recover consistent and efficient estimators for the treatment effects from the actually observed data. In a sample drawn randomly (which is rarely possible in observational data), the 'difference in mean' estimator is a consistent and unbiased estimator for ATE. This requires that (y_1, y_0) are independent of treatment variable, t_i $(\mathrm{E}(y_{0i}|t_i = 1) = \mathrm{E}(y_{0i}|t_i = 0)\ and\ \mathrm{E}(y_{1i}|t_i = 1) = \mathrm{E}(y_{1i}|t_i = 0))$. If this Random Assignment (RA) assumption is violated, the observed difference in outcomes between those with $t_i = 1$and $t_i = 0$ will equal $\mathrm{E}(y_{1i} - y_{0i}|t_i = 1)$ plus a bias term:

$$\begin{aligned}\mathrm{E}(y_i|t_i = 1) - \mathrm{E}(y_i|t_i = 0) &= \mathrm{E}(y_{1i}|t_i = 1) - \mathrm{E}(y_{0i}|t_i = 0)\\ &= \mathrm{E}(y_{1i}|t_i = 1) - \mathrm{E}(y_{0i}|t_i = 1) + \mathrm{E}(y_{0i}|t_i = 1) - \mathrm{E}(y_{0i}|t_i = 0)\\ &= \mathrm{E}(y_{1i} - y_{0i}|t_i = 1) + \mathrm{E}(y_{0i}|t_i = 1) - \mathrm{E}(y_{0i}|t_i = 0)\end{aligned} \tag{9}$$

The bias term disappears when the decision to migrate and remit money is determined in a manner independent of households' potential expenditure. But this independence assumption is not realistic, since the decision to migrate is taken in light of information (observable) about family circumstances and (unobservable) ability, motivation and the propensity to take risk. If selection bias is only due to observable characteristics of households such as household size, number of household members in different age categories, education level of household members, wealth status, geographic location etc, then knowledge of these covariates may be sufficient to identify the causal parameters. This assumption, known as Conditional (Mean) Independence (CMI), states that conditional on covariates, $\mathbf{x}_i$, the regressor of interest, t_i, is independent of potential outcomes and the condition of randomization is restored.[6] Then any causal effect (ATE, ATET, ATENT) can be consistently estimated from weighted conditional-on-$\boldsymbol{X}$ comparisons (Angrist 2004).[7]
From equations (5), (6) and (7), the observed expenditure share of household i can be written as:

$$y_i = \mathrm{E}(y_{0i}) + t_i\{\mathrm{E}(y_{1i}) - \mathrm{E}(y_{0i})\} + \varepsilon_{0i} + t_i(\varepsilon_{1i} - \varepsilon_{0i})$$
$$= \mathrm{E}(y_{0i}) + at_i + \varepsilon_{0i} + t_i(\varepsilon_{1i} - \varepsilon_{0i}) \quad (10)$$

Equation (10) is called the (potential) outcome equation. Here $a = ATE$.[8] Under the standard regularity conditions and assuming that:

$$\mathrm{E}\{\varepsilon_{0i} + t_i(\varepsilon_{1i} - \varepsilon_{0i})|\mathbf{x}_i, t_i\} = 0 \quad (11)$$

a can be estimated consistently by OLS. In this situation, t_i is exogenous.[9] However, when treatment is endogenous, (11) does not hold and OLS estimate will be biased. However, if the conditional mean independence assumption holds, we can write (8) as[10]:

$$\mathrm{E}(y_i)|\mathbf{x} = \mathrm{E}(y_{0i}) + at_i + g_0(\mathbf{x}) + t_i\{g_1(\mathbf{x}) - g_0(\mathbf{x})\} \quad (12)$$

where $g_0(\mathbf{x}) = \mathrm{E}(\varepsilon_{0i}|\mathbf{x})$, $g_1(\mathbf{x}) = \mathrm{E}(\varepsilon_{1i}|\mathbf{x})$

If the household-specific error components are decomposed into an observed component and unobserved term, we can write ε_{0i} and ε_{1i} in equations (6) and (7) as:

$$\varepsilon_{0i} = g_0(\mathbf{x}) + e_{0i} = \beta_0\mathbf{x}_i + e_{0i}, \qquad \mathrm{E}(e_{0i}|\mathbf{x}, t_i) = \mathrm{E}(e_{0i}|\mathbf{x}) = 0$$
$$\varepsilon_{1i} = g_1(\mathbf{x}) + e_{1i} = \beta_1\mathbf{x}_i + e_{ii}, \qquad \mathrm{E}(e_{1i}|\mathbf{x}, t_i) = \mathrm{E}(e_{1i}|\mathbf{x}) = 0 \quad (13)$$

where a linear functional form is assumed for g_0 and g_1. With these substitutions, we can write (10) as:

$$y_i = \mathrm{E}(y_{0i}) + at_i + g_0(\mathbf{x}) + t_i\{g_1(\mathbf{x}) - g_0(\mathbf{x})\} + e_{0i} + t_i(e_{1i} - e_{0i}), \text{ and} \quad (14)$$

$$y_i = \{\mathrm{E}(y_{0i}) - \beta_0\mathbf{x}_i\} + at_i + \beta_0\mathbf{x}_i + t_i\{\mathbf{x}_i - \mu_\mathbf{x}\}(\beta_1 - \beta_0) + e_{0i} + t_i(e_{1i} - e_{0i}), \text{ or}$$

$$y_i = \alpha_0 + at_i + \beta_0\mathbf{x}_i + t_i\{\mathbf{x}_i - \mu_\mathbf{x}\}\,\boldsymbol{\delta} + e_{0i} + t_i(e_{1i} - e_{0i}) \quad (15)$$

where $\alpha_0 = \{\mathrm{E}(y_{0i}) - \beta_0\mathbf{x}_i\}$ is the intercept; $\boldsymbol{\delta} = (\beta_1 - \beta_0)$ and $\mu_\mathbf{x} = E(\mathbf{x}_i)$
Equation (15) is a general representation of the outcome equation, taking into account both observable heterogeneity ($\beta_0 \neq \beta_1 \Rightarrow \boldsymbol{\delta} \neq 0$), and unobservable heterogeneity ($e_{1i} \neq e_{0i}$). If the CMI assumptions of (13) hold, we can write the conditional expectation of (15) as:

$$\mathrm{E}(y_i|\mathbf{x}, t_i) = \mathrm{E}(y_i)|\mathbf{x} = \mathrm{E}(y_{0i}) + at_i + \beta_0\mathbf{x}_i + t_i\{\mathbf{x}_i - \mu_\mathbf{x}\}\boldsymbol{\delta} + 0 \quad (16)$$

The last two terms in equation (16) represent the Control Function (CF): when added to the regression of y on a constant and the indicator variable, t_i, they control for possible selection bias, and the coefficient on t_i will give an estimate for ATE, which can be consistently estimated by OLS.

However, when the conditional mean assumption does not hold, CF regression will result in biased estimates of treatment parameters. This will happen if non-random assignment of households into treatment is not only due to observable characteristics, but also observables. Two classes of models are of particular suitability in this case: the Heckman Selection Model (HSM) and the Instrumental Variables Regression (IVR) approach. In a recent study, DeMaris (2014) compares the performance of HSM and IVR to that of Ordinary Least Squares (OLS) when both treatment and unmeasured confounding is present and absent. He finds that HSM outperforms IVR on account of mean square error estimate of treatment as well as power of detecting either unobserved confounding or treatment effect. In this paper, we focus on the estimation of average treatment effect and use the HSM for its estimation.
Assuming that households wish to maximize their utility, the decision to migrate and remit (assignment to treatment) is given by:

$$t_i = I(y_{1i} - y_{0i}) > 0 = I(\gamma_0 + \gamma_1\mathbf{x}_i + \gamma_2 Z_i + u_i > 0) \quad (17)$$

where $I(.)$ is an indicator function which implies that $t_i = 1$, if $\gamma_0 + \gamma_1\mathbf{x}_i + \gamma_2 Z_i + u_i > 0$ and $t_i = 0$, otherwise. Z_i is a vector of exogenous observed variables that affect assignment to treatment and u_i is the idiosyncratic component of the household that captures the unobservables that affect the treatment and having a variance, σ_u^2. Assuming $(u_i, \varepsilon_{0i}, \varepsilon_{1i})$ to be independent of $(\mathbf{x}_i, Z_i)$, with trivariate normal distribution, and assuming the conditional mean redundancy assumptions[11], i.e.,

$$E(\varepsilon_{0i}|\mathbf{x},Z) = E(\varepsilon_{0i}|\mathbf{x}) \text{ and } E(\varepsilon_{1i}|\mathbf{x},Z) = E(\varepsilon_{1i}|\mathbf{x}), \tag{18}$$

we can write the conditional expectation of y_i in equation (15) as:

$$\begin{aligned}\mathrm{E}(y_i|\mathbf{x},Z_i,t_i) = \mathrm{E}(y_{0i}) + at_i + \beta_0\mathbf{x}_i + t_i\{\mathbf{x}_i - \mu_{\mathbf{x}}\}\boldsymbol{\delta} + t_iE(e_{1i}|\mathbf{x},Z_i,t_i = 1)\\ +(1-t_i)E(e_{0i}|\mathbf{x},Z_i,t_i = 0)\end{aligned} \tag{19}$$

Under normality of the error terms, and normalizing σ_u^2 to unity so that $u_i \sim N(0,1)$, the two conditional expectations in equation (18) can be written as (for proof see Appendix):

$$\mathrm{E}(e_{1i}|\mathbf{x},Z_i,t_i = 1) = E(e_{1i}|u_i < q\gamma',) = \rho_{1u}\sigma_1\left\{\frac{\phi(q\gamma')}{1-\Phi(q\gamma')}\right\} \tag{20}$$

and

$$\mathrm{E}(e_{0i}|\mathbf{x},Z_i,t_i = 0) = E(e_{0i}|u_i < -q\gamma',) = \rho_{0u}\sigma_0\left\{\frac{-\phi(q\gamma')}{\Phi(q\gamma')}\right\} \tag{21}$$

where,

$$\lambda_i(q_i\gamma') = \mathrm{E}(u_i|\mathbf{x},Z_i,t_i) = t_i\frac{\phi(Z_i\gamma')}{1-\Phi(Z_i\gamma')} + (1-t_i)\frac{-\phi(Z_i\gamma')}{\Phi(-Z_i\gamma')} \tag{22}$$

Equation (19) along with (20) and (21) will estimate the model under both observable and unobservable heterogeneity. Here, ρ_{0u} and ρ_{1u} are the correlation coefficients between the pairs (e_{0i},u_i) and (e_{1i},u_i)[12], respectively; ${\sigma_0}^2$ and ${\sigma_1}^2$ are the respective variances of e_{0i} and e_{1i} , and λ_i is known as the inverse Mills ratio or the hazard function. $q\gamma \equiv \gamma_0 + \gamma_1\mathbf{x}_i + \gamma_2 Z_i$, $\phi(q\gamma')$ and $\Phi(q\gamma')$ are the density function and the distribution function of the standard normal evaluated at $q\gamma'$ ($\gamma' = \frac{\gamma}{\sigma_u}$).

The model can be estimated in two stages:

1. Run a probit regression of t_i on $(1,\mathbf{x}_i,Z_i)$ and get $(\hat{\phi}_i,\hat{\Phi}_i)$
2. Run an OLS of C_{ij}/EXP_i on $\left\{1,t_i,\mathbf{x}_i,t_i(\mathbf{x}_i-\mu_{\mathbf{x}}),\frac{t_i\hat{\phi}(q\gamma')}{1-\hat{\Phi}(q\gamma')},\ (1-t_i)\frac{-\hat{\phi}(Z_i\gamma')}{\hat{\Phi}(-Z_i\gamma')}\right\}$

The coefficient on t_i is a consistent estimator of a, the ATE (Wooldridge 2010, p.631). We use the *ivtreatreg* command developed by Cerulli (2014) for estimating the treatment effects. This command also estimates the conditional treatment parameters: ATE(x); ATET(x); and ATENT(x) as:

$$ATE(\mathbf{x}) = \mathrm{E}(y_1 - y_0|\mathbf{x}) = \boldsymbol{\alpha} + (\mathbf{x}-\bar{\mathbf{x}})\ \boldsymbol{\delta} \tag{23}$$

$$ATET(\mathbf{x}) = \mathrm{E}(y_1 - y_0|\mathbf{x},t_i = 1) = \{\boldsymbol{\alpha} + (\mathbf{x}-\bar{\mathbf{x}})\ \boldsymbol{\delta} + (\rho_{0u}+\rho_{1u})\boldsymbol{\lambda_1}(q\gamma')\}_{t_i=1} \tag{24}$$

$$ATENT(\mathbf{x}) = \mathrm{E}(y_1 - y_0|\mathbf{x},t_i = 0) = \{\boldsymbol{\alpha} + (\mathbf{x}-\bar{\mathbf{x}})\ \boldsymbol{\delta} + (\rho_{0u}+\rho_{1u})\boldsymbol{\lambda_0}(q\gamma')\}_{t_i=0} \tag{25}$$

MODEL SPECIFICATION

In the first stage, the probability that a household receives remittances is estimated using the following specification for the choice (selection) model:

Prob (Household=remittances)

= *f* [Household characteristics (household size × presence of household members in 0-10 years age group × presence of household members in 11-19 years age group × presence of household members in 20-60 years age group), Human Capital (presence of household members with primary level education × presence of household members with secondary level education × presence of household members with higher secondary level of education × presence of household members with a Bachelor's degree × presence of households with a Master's degree and above), Wealth characteristics (Value of total assets owned by the household × Value of total loan owed by the household) × Rural/Urban Dummy variable, Provincial Dummy variable]

The variables included in the first stage regression beget their inclusion from standard literature. Education is likely to affect the decision to migrate because the possibilities of higher earnings in destination areas increase with the level of education (Faggian et al. 2007; Ritsilä & Ovaskainen, 2001; Todaro, 1969). In the literature, one also finds a support for including the household characteristics in determining the likelihood to migrate. Households possess a set of resources that are fixed in the short run: land is fixed in the form of agricultural land, labour in the form of number, age and sex of its members; and capital, in the form of savings and wealth. A household, therefore, allocates its labour supply to different productive pursuits, including migration, to effectively utilize its combined resources (Massey et al. 1990; Harbison, 1981). Along with the dummy variables for the human capital variables and the household characteristics, a rural dummy is included to indicate whether or not the household belongs to rural area. Four provincial dummies are included for each of the four provinces. Finally, the wealth variables include the total assets owned and loan owed by the household. Total assets refer to the expected price the household would get from selling the assets in its possession and include personal agricultural land, livestock, sheep, goat, poultry and animals in personal possession for transportation, non-agricultural land or property in personal possession, residential building in personal possession and a shop or commercial building in personal possession.

The second stage regression specifies the expenditure shares and is estimated as:

$$\begin{aligned} C_{ij}/EXP_i = \beta_j &+ a_j(Remitdum) + \gamma_j(lpce) + \alpha_j(inv\_pce) + \mu_{j1}(age\_1) + \mu_{j2}(age\_2) + \mu_{j3}(age\_3) \\ &+ \mu_{j4}(age\_4) + \mu_{j5}(educ5) + \mu_{j6}(educ10) + \mu_{j7}(educ12) + \mu_{j8}(educ14) \\ &+ \mu_{j9}(educ16) + \mu_{j10}(totalassets) + \mu_{j11}(loan) + \mu_{j12}(SINDH) \\ &+ \mu_{j13}(KHYBER\_PAKHTUNKHWA) + \mu_{j14}(BALUCHISTAN) + \mu_{j15}(rural) + \mu_{j16}(\lambda_{0j}) \\ &+ \mu_{j17}(\lambda_{1j}) \qquad (26) \end{aligned}$$

Where C_{ij}/EXP_i is the share of household expenditure on the five categories defined in Table 2, $Remitdum$ is a dummy variable and is 1 if the household receives remittances from abroad (outside Pakistan), $lpce$ is the log of total annual per capita expenditure, inv_pce is the reciprocal of annual per capita expenditure, age_1 is one if the household has children below age 10, age_2 is one if the household has members between the age of 11-years and 19-years, age_3 is one if the household has members between the age of 20-years and 60-years, age_4 is one if the household has members above 60-years of age, $educ5$ is one if the household has members with primary level (5-years) education, $educ10$ is one if the household has members with secondary level (10-years) education, $educ12$ is one if the household has members with higher secondary level (12-years) of education, $educ14$ is one if the household has members with a Bachelor's degree, $educ16$ is one if the household has members with a Master's or above degree, $totalassets$ is the value of the total assets owned by the household in Pak Rupee (PKR), $loan$ is the loan owed by the household in PKR, $SINDH$, $KHYBER\_PAKHTUNKHWA$ and $BALUCHISTAN$ are the regional dummies for the respective three provinces (the dummy for the fourth province, PUNJAB, is omitted as it is used as a base category in estimation), $rural$ is one if the household belongs to rural region, λ_{0j} and λ_{1j} are the selection correction variables (as defined in equation (22)).

ESTIMATION RESULTS OF THE MODEL

The results from the first stage probit model are represented in Table 3. The results show some interesting features. For example, if the households have children below the age of 10 years, then there is more migration overseas and more households would receive remittances. Likewise, the presence of teenage members and/or aged family members also increases the likelihood of a family member migrating and the household receiving more remittances.

Having an elderly member above the age of 60 years also significantly increases the probability of a family member migrating and sending remittances. The human capital variables are even more interesting. Households having less educated members are more likely to have an emigrant member, whereas households with highly educated members are less likely to have a member migrating.

TABLE 3. PROBIT ESTIMATES FROM FIRST STAGE REGRESSION

Variable	Coefficient	Standard errors	Marginal effect
Household size	.0403***	.00981	0.004
There are children below 10 years in household (1=yes)	0.223***	.0553	0.020
There are members between 10 and 20 years in household (1=yes)	0.165***	.0523	0.015
There are members between 20 and 60 years in household (1=yes)	0.238	0.209	0.019
There are members older than 60 years in household (1=yes)	0.186***	.0485	0.018
There are household members with primary level education (1=yes)	0.148***	0.0515	0.013
There are household members with secondary level education (1= yes)	0.0887*	0.0478	0.008
There are household members with higher	-0.0956	0.0609	-0.008

secondary level education (1=yes)			
There are household members with Bachelor's degree level education (1=yes)	-0.0256	0.0727	-0.002
There are household members with Master's degree level or more education (1=yes)	-0.414***	0.102	-0.031
Total assets owned by the household (PKR)	-4.61e-09	3.89e-09	-4.34e-10
Amount of loan owed by the household (PKR)	7.34e-08	1.44e-07	6.90e-09
PUNJAB	Base Province		
SINDH	-1.049***	0.0991	-0.058
KHYBER PAKHTUNKHWA	0.533***	0.0461	0.063
BALUCHISTAN	-0.438***	0.0903	-0.031
Household belongs to rural area (1=yes)	0.253***	.0506	0.022
Constant	-5.736***	1.433	0
F-statistic	36.44		
N	16339		

*Notes: * p<0.10, ** p<0.05, *** p<0.010.*

For example, it is 1.3 per cent and about 1 per cent more likely for a household having a respective member or members with primary and secondary level education to migrate. However, it is 3 per cent less likely for a household having a member with at least master's level of education to have a migrating member. Thus, it can be reasoned that the tendency of international migration is more for a households having unskilled or semiskilled family composition. The regional variables are all strongly significant and reveal inter-provincial and intra-provincial preferences for migration. Compared to Punjab, which is the most populous province, households in the province of Sindh are 6 per cent less likely to migrate and send remittances, whereas, it is 6 per cent more likely for the households in Khyber Pakhtunkhwa to have a family member working overseas and remitting money. Similarly, rural households are expected more to have a migrant family member and therefore, more number of households in rural areas are likely to be receiving international remittances.

Table 4 presents the results of the second stage regression for each expenditure type. The results give the Average Treatment Effect (ATE), which is the coefficient for the binary variable of household receiving remittances or not. The average causal effect of remittances on a household is that it spends less on food and more on education, health, non-durables and durables. It is also observed that the coefficient for log of per capita expenditure is negative and highly significant for expenditure share on food. This indicates that the Engel's law holds. The most important variable is the inverse Mill's ration, λ_t which is the selection term in our model. The λ_t variable is significant for all expenditure categories, which suggests that selection in unobservables cannot be ruled out for households receiving remittances. Without this term included, the regression coefficients would have been biased.

TABLE 4. EXPENDITURE ESTIMATES, CORRECTED FOR SELECTION BIAS.

Variable	Food	Education	Health	Non-durables	Durables
Household receiving remittances (1=yes)	-0.120***	0.056***	0.003	0.087***	0.091***
Log of per capita expenditure	-0.145***	0.018***	-0.005***	0.054***	0.013***
Reciprocal of per capita expenditure	-2238.6***	311.6***	-122.5***	918.7***	389.9***
There are children below 10 years in household (1=yes)	-0.006***	0.007***	-0.002***	0.058***	-0.002***
There are members between 10 and 20 years in household (1=yes)	0.002	0.012***	-0.003***	0.052***	-0.003***
There are members between 20 and 60 years in household (1=yes)	-0.013**	0.006**	-0.012***	0.0337***	0.006**
There are members older than 60 years in household (1=yes)	0.009***	-0.005***	0.001*	-0.011***	-0.004***
There are household members with primary level education (1=yes)	-0.01***	0.005***	-0.0002	0.035***	0.002***

There are household members with secondary level education (1= yes)	-0.012***	0.007***	-0.002***	0.019***	-0.0006
There are household members with higher secondary level education (1=yes)	-0.015***	0.012***	-0.001	0.025***	0.003***
There are household members with Bachelor's degree level education (1=yes)	-0.016***	0.009***	-0.002*	0.028***	-0.0006
There are household members with Master's degree level or more education (1=yes)	-0.019***	0.015***	0.0003	0.013***	0.00002
Total assets owned by the household (PKR)	-1.19e-10	-2.77e-11	-4.98e-11	3.33e-11	-7.59e-11*
Amount of loan owed by the household (PKR)	-3.20e-08***	7.42e-09***	1.73e-08***	-5.87e-10	1.51e-08***
PUNJAB	Base province	Base province	Base province	Base province	Base province
SINDH	0.028***	-0.011***	-0.003***	-0.02***	0.0007
KHYBER PAKHTUNKHWA	0.033***	-0.006***	0.01***	-0.024***	-0.017***
BALUCHISTAN	0.041***	-0.014***	-0.01***	-0.012***	-0.002**
Household belongs to rural area (1=yes)	0.062***	-0.006***	0.002***	-0.055***	-0.001
λ_0	-0.094***	0.022***	0.027***	0.078***	0.113***
λ_1	0.046***	-0.021***	-0.0005	-0.029**	-0.035***
Constant	2.094***	-0.205***	0.106***	-0.575***	-0.156***
Adj. R-squared	0.474	0.231	0.065	0.28	0.098
N	16339	16339	16339	16339	16339

*Notes: * p<0.10, ** p<0.05, *** p<0.010.*

Figure 1 shows the distributions of the conditional treatment parameters: ATE(x), ATET(x) and ATENT(x) for the five categories of expenditure shares. For food, ATET(x) shows a distribution, which is more negative than the distribution of ATE(x) and ATENT(x). This predicts that the expenditure share on food for households who receive remittances would have been more if they had not been receiving remittances. Similarly, in respect to the other four categories of education, health, non-durables and durables, the distribution of ATET(x) predicts that the remittances receiving households would have been spending less on these goods had they not been receiving remittances.

FIGURE 1. DISTRIBUTION OF ATE(X) ATET(X) AND ATENT(X) FOR THE FIVE CATEOGRIES OF EXPENDITURE SHARES

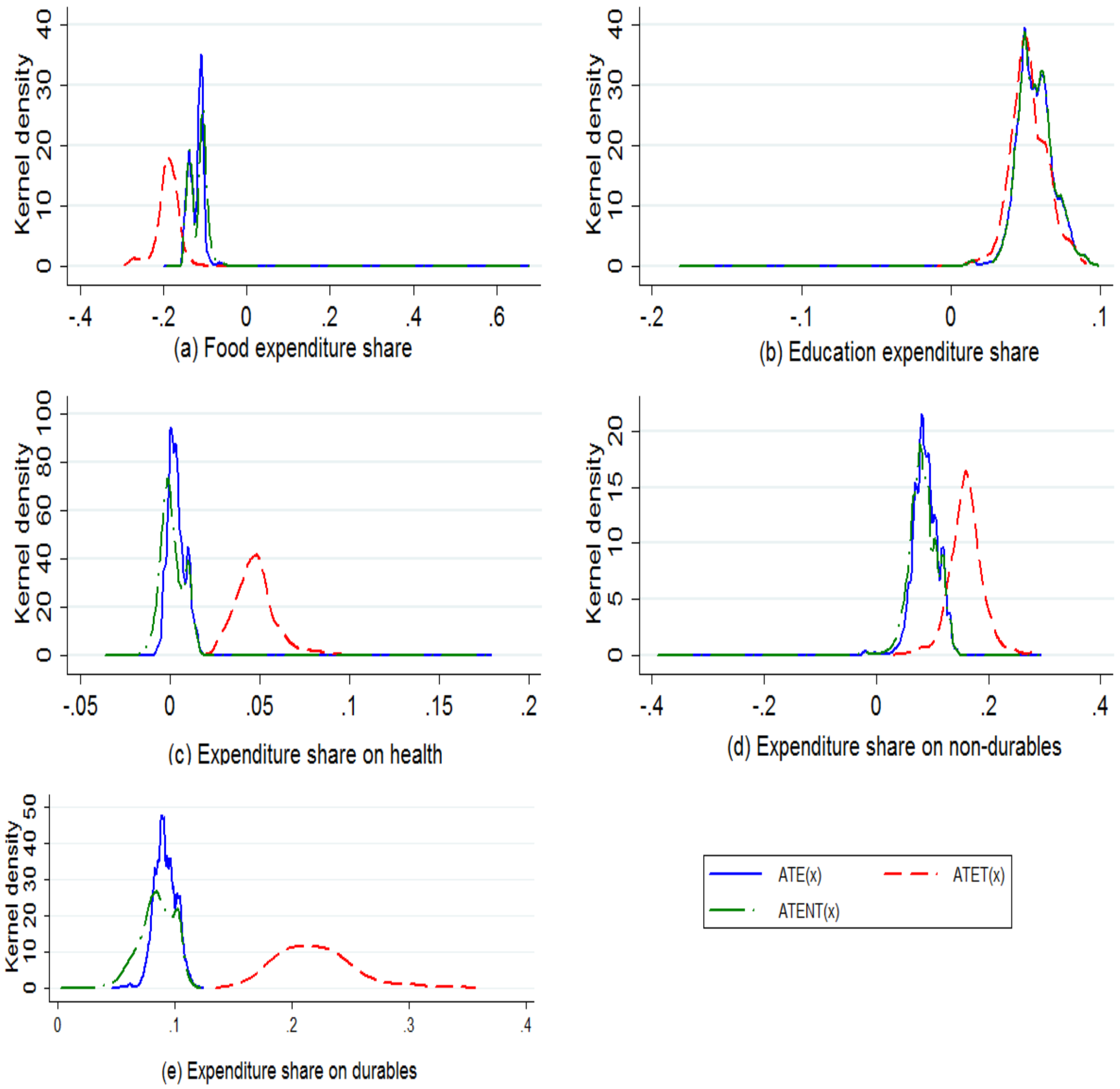

Table 5 estimates the marginal budget shares for each of the expenditure category defined in Table 2 and indicate the response in budget share of the individual expenditure category to a one Rupee increase in household expenditure.

TABLE 5. ESTIMATED MARGINAL BUDGET SHARES ON EXPENDITURE FOR REMITTANCE RECEIVING AND NON-RECEIVING HOUSEHOLDS, PAKISTAN, 2011

Expenditure category	Estimated marginal budget share of households receiving remittances	Estimated marginal budget share of households receiving no remittances	% change
Food	0.411	0.450	-9.94
Education	0.037	0.028	26.08
Health	0.025	0.023	5.82
Non-durables	0.166	0.142	14.32
Durables	0.00345	0.00346	-0.04

Note: The marginal budget shares are calculated using equation (4) and taking the coefficients from Table 4.
The results show that households, who receive remittances, spend less at the margin on food and durables and more on education, health and non-durables. At the mean, compared to households who do not receive

remittances, the households receiving remittances spend, at the margin, 10 per cent and 4 per cent less on consumption of food and durables, respectively. Moreover, the respective marginal increase in spending on education and health is 26 per cent and 6 per cent for remittances receiving households than the non-receiving households. Finally, the households receiving remittances spend, at the margin, 14 per cent more on non-durables (which includes their spending on housing) than the households with no remittances.

CONCLUSION

This paper has used nationally representative household income and expenditure survey data for Pakistan to investigate how the receipt of international remittances affect the average and marginal spending behaviour of the households on five different categories of goods: food, education, health, non-durables and durables. Two findings emerge.

First, expenditure share on food for households thay receive remittances would have been more if the households had not been receiving remittances. Similarly, less spending on the other four categories of education, health, non-durables and durables is predicted for remittances-receiving households had they not been receiving remittances. Second, households that receive remittances spend less at the margin on food and durables and more on education, health and non-durables. At the mean, compared to households that do not receive remittances, the households receiving remittances spend, at the margin, 10 per cent and 4 per cent less on consumption of food and non-durables, respectively. Moreover, the marginal increase in spending on education is 26 per cent more for remittances-receiving households than for a non-receiving household. Finally, the households receiving remittances spend, at the margin, 14 per cent more on non-durables (which includes their spending on housing, and is thus akin to investment in physical capital) than the households with no remittances.

A key feature of these results is the likely positive impact of remittances on economic development, by the way of increased spending on human capital or education as well as physical capital. Remittances receiving households appear to look at the remittance earnings as a transitory income and therefore tend to spend remittances more on investment than consumption. This finding lends support to the permanent income hypothesis. [13]

APPENDIX

$$\begin{aligned}\mathrm{E}(e_{1i}|\mathbf{x}, Z_i, t_i = 1) &= E(e_{1i}|u_i < q\gamma,) \\ &= E\left(e_{1i}\middle|\frac{u_i}{\sigma_u} < \frac{q\gamma}{\sigma_u}\right) \\ &= \sigma_1 E\left(\frac{e_{1i}}{\sigma_1}\middle|\frac{u_i}{\sigma_u} < \frac{q\gamma}{\sigma_u}\right)\end{aligned} \tag{i}$$

We want to have the expectation of e_{1i} given some value u_i. Given the normality of e_{0i}, e_{1i}, this is just equal to the regression coefficient

$$E(e_{1i}|u_i) = \frac{\sigma_{1u}}{\sigma_u^2} u_i \tag{ii}$$

Using this in equation (i) and having σ_u^2 normalized to unity, we get

$$E\left(\frac{e_{1i}}{\sigma_1}\middle|\frac{u_i}{\sigma_u}\right) = \frac{1}{\sigma_1}\cdot\frac{\sigma_{1u}}{\sigma_u^2}\cdot\left(\frac{u_i}{\sigma_u}\cdot\frac{\sigma_u}{1}\right) = \frac{\sigma_{1u}}{\sigma_1\sigma_u}\cdot\frac{u_i}{\sigma_u} = \rho_{1u}\frac{u_i}{\sigma_u} \tag{iii}$$

and

$$E\left(\frac{e_{0i}}{\sigma_0}\middle|\frac{u_i}{\sigma_u}\right) = \frac{1}{\sigma_0}\cdot\frac{\sigma_{0u}}{\sigma_u^2}\cdot\left(\frac{u_i}{\sigma_u}\cdot\frac{\sigma_u}{1}\right) = \frac{\sigma_{0u}}{\sigma_1\sigma_u}\cdot\frac{u_i}{\sigma_u} = \rho_{0u}\frac{u_i}{\sigma_u} \tag{iv}$$

σ_{0u} and $\sigma_{1u}$are the covariances of the error pairs (e_{0i}, u_i) and (e_{1i}, u_i) respectively, and, ρ_{0u} and ρ_{1u} are their respective correlation coefficients.

We now rewrite (i) as

$$\begin{aligned}\mathrm{E}(e_{1i}|\mathbf{x}, Z_i, t_i = 1) &= \sigma_1 E\left(\frac{e_{1i}}{\sigma_1}\middle|\frac{u_i}{\sigma_u} < \frac{q\gamma}{\sigma_u}\right) = \sigma_1\rho_{1u}E\left(\frac{u_i}{\sigma_u}\middle|\frac{u_i}{\sigma_u} < \frac{q\gamma}{\sigma_u}\right) \\ &= \rho_{1u}\sigma_1\frac{\phi(\frac{q\gamma}{\sigma_u})}{1-\Phi(\frac{q\gamma}{\sigma_u})} = \rho_{1u}\sigma_1\left\{\frac{\phi(q\gamma')}{1-\Phi(q\gamma')}\right\}\end{aligned} \tag{20}$$

ISBN 978-0-9925622-1-2

Similarly,

$$\mathrm{E}(e_{0i}|\mathbf{x}, Z_i, t_i = 0) = \sigma_0 E\left(\frac{e_{0i}}{\sigma_0}\middle|\frac{u_i}{\sigma_u} < -\frac{q\gamma}{\sigma_u}\right) = \sigma_0\rho_{0u} E\left(\frac{u_i}{\sigma_u}\middle|\frac{u_i}{\sigma_u} < -\frac{q\gamma}{\sigma_u}\right)$$
$$= \rho_{0u}\sigma_0 \frac{\phi(-\frac{q\gamma}{\sigma_u})}{\Phi(-\frac{q\gamma}{\sigma_u})} = \rho_{0u}\sigma_0 \left\{\frac{-\phi(q\gamma')}{\Phi(-q\gamma')}\right\} \qquad (21)$$

ENDNOTES

[1] The probability weights included in the data set usually incorporates corrections for non- response and non –coverage . It is therefore, not advisable to modify the probability weights.
[2] Originally proposed by Working (1943) the model was further elaborated by Leser (1963) and since then, has been widely used by others. See Deaton and Muellbauer (1980), Adams (2006b) and Adams and Cuecuecha (2010a).
[3] In cross sectional survey data, observed price variation entails no meaningful information on estimating demand responses to changes in prices of goods of same quality (Chern et al. 1993; George and King 1971)
[4] Engel and Kneip (1996) highlights that household diposable income measures are erratic in surveys. Agrarian economies are prone to severe measurement errors (Bhalotra & Attfield, 1998)
[5] For ease of reference, the subscript referring to household i is not used when measuring population parameters.
[6] Imbens (2004) refers to this as the confoundedness assumption, Rubin (1978) calls it the ignorabiltiy assumption
[7] Under the observable confounding covariates, $\mathbf{x}$, the conditional treatment parameters can be represented as; $\mathrm{ATE}_{\mathbf{x}} = \mathrm{E}(y_1 - y_0)|\mathbf{x}$; $\mathrm{ATET}_{\mathbf{x}} = \mathrm{E}(y_1 - y_0)|\mathbf{x}, t_i = 1$; $\mathrm{ATENT}_{\mathbf{x}} = \mathrm{E}(y_1 - y_0)|\mathbf{x}, t_i = 0$
[8] α is the average treatment effect of a "randomly" assigned household. There are no households that are randomly assigned, but the term is used to convey the idea that the unobservables affecting the treatment decision that are correlated with expenditure have been controlled for. Heckman (1990) refers to this as the experimental treatment average
[9] If the covariances for the pairs $(e_{0i,}u_i)$ and $(e_{1i,}u_i)$ are represented by σ_{0u} and σ_{1u}, respecitively then, under normality, a necessary and sufficient condition for (9) to hold is $\sigma_{1u} = \sigma_{0u} = 0$, which means that the unobservable components of the outcome equation are irrelevant to the treatment decision (Vella & Verbeek 1999).
[10] Conditional mean independence implies, $E(y_{0i}|\mathbf{x}, t_i) = E(y_{0i}|\mathbf{x})$; and $E(y_{1i}|\mathbf{x}, t_i) = E(y_{1i}|\mathbf{x})$
[11] The redundancy condition implies that Z is uncorrelated with $\varepsilon_{0i}$and ε_{1i}
[12] Imposing the restriction $\rho_{0u} = \rho_{1u}$ implies (unobservable) homogenous treatment effect; a sufficient condition for this to happen is that $e_{0i} = e_{1i}$, which means that the heterogeneity is only due to observables.
[13] A similar conclusion is drawn by Adams and Cuecuecha (2010a) in case of Guatemala.

REFERENCES

Adams, Jr., RH 1998, 'Remittances, investment, and rural asset accumulation in Pakistan', *Economic Development and Cultural Change*, vol. 47, no.1, pp. 155-173.

— 2006a, 'Remittances and poverty in Ghana', World Bank Research Working Paper 5433, World Bank, Washington, DC.

— 2006b, 'International remittances and the household: Analysis and review of global evidence', *Journal of African Economies*, vol. 15, no. 2, pp. 396-425.

Adams, RH Jr. & Cuecuesha, A 2010a, 'Remittances, household expenditure and investment in Guatemala', *World Development*, vol. 38, no. 11, pp. 1626-1641.

— 2010b, 'The economic impact of international remittances on poverty and household consumption and investment in Indonesia', World Bank Policy Research Working Paper 5433, World Bank, Washington, DC.

Adams, RH Jr. & Page, J 2005, 'Do international migration and remittances reduce poverty in developing countries?', *World Development*, vol.33, no. 10, pp. 1645-1669.

Arif, GM 2004, ' Effects of Overseas Migration on Household Consumption, Education, Health and Labour Supply in Pakistan' in *International Labour Migration from South Asia*, ed Hisaya Oda, Institute of Development Economics, Japan External Trade Organisation, Chiba, Japan.

Angrist, JD 2004, 'Treatment effect heterogeneity in theory and practice', *The Economic Journal*, vol. 114, no. 494, pp. C52-C83.

Austin, PC 2011, 'An introduction to propensity score methods for reducing the effects of confounding in observational studies', *Multivariate Behaviour Research*, vol. 46, no. 3, pp. 399-424.

Barham, B & Boucher, S 1998, 'Migration, remittances and inequality: estimating the net effects of migration on income distribution', *Journal of Development Economics*, vol. 53, no. 3, pp. 307-331.

Bilquees, F & Hamid, S 1981, 'Impact of international migration on women and children left behind: a case study of a Punjabi village', Research series report no. 115, Pakistan Institute of Development Economics, Islamabad.

Brown, R & Poirine, B 2005, 'A model of migrants' remittances with human capital investment and intrafamilial transfers', *International Migration Review*, vol. 39, no. 2, pp. 407-438.

Bhalotra, S & Attfield, C 1998, 'Intrahousehold resource allocation in rural Pakistan: A semiparametric analysis', *Journal of Applied Econometrics*, vol. 13, no. 5, pp. 463-480.

Chami, R, Fullenkamp, C, & Jahjah, S 2003, 'Are immigrant remittance flows a source of capital for development?', IMF Working Paper 03/189, International Monetary Fund, Washington, DC.

Cerrulli, G 2014, 'ivtreatreg: A command for fitting binary treatment models with heterogeneous response to treatment and unobservable selection'. *The Stata Journal*, vol. 14, no. 3, pp. 453-480.

Cox-Edwards, A & Ureta, M 2003, 'International migration, remittances and schooling: evidence from El Salvador', *Journal of Development Economics*, vol. 72, no. 2, pp. 429-461.

Deaton, A & Muellbauer, J 1980, 'An almost ideal demand system', *The American Economic Review*, vol. 70, no.3, pp.312-326.

de la Briere, B, Sadoulet, E, de Janvry, A, & Lambert, S 2002, 'The roles of destination, gender and household composition in explaining remittances: an analysis for the Dominican Sierra', *Journal of Development Economics*, vol. 68, no. 2, pp. 309-328.

DeMaris, A 2014, 'Combating unmeasured confounding in cross-sectional studies: Evaluating instrumental variable and Heckman selection models', *Psychological Methods*, vol. 19, no. 3, pp. 380-397.

Duryea, S, Lopez-Cordova, E, & Olmedo, A 2005, ' Migrant remittances and infant mortality: evidence from Mexico', Unpublished draft manuscript, Inter-American Development Bank, Washington, DC.

Engel, J & Kneip, A 1996, 'Recent approaches to estimating Engel curves', *Journal of Economics*, vol. 63, no. 2, pp.187-212.

Faggian, A, McCann, P, & Sheppard, S 2007, 'Human capital, higher education and graduate migration: an analysis of Scottish and Welsh students', *Urban Studies*, vol. 44, no.13, pp. 2511–2528.

Funkhouser, E 2006, ' The effect of emigration on the labour market outcomes of sender households: alongitudinal approach using data from Nicaragua', *Well-Being and Social Policy*, vol. 2, no. 2, pp. 5-25.

George, PS & King, GA 1971, 'Consumer demand for food commodities in the United States with projections for 1980', Giannini Foundation Monograph Number 26, University of California, Berkeley.

Gilani,I, Khan, MF, & Iqbal, M 1981, ' Labour migration from Pakistan to the Middle East and its impact on the domestic economy', Research series report no. 126, Pakistan Institute of Development Economics, Islamabad.

Gubert, F 2002, 'Do migrants insure those who stay behind? Evidence from the Kayes area (Western Mali)', *Oxford Development Studies*, vol. 30, no. 2, pp. 267-287.

Harbison, SF 1981, 'Family structure and family strategy in migration decision making', in *Migration decision making: Multidisciplinary approaches to microlevel studies in developed and developing countries*, eds GF DeJong & RW Gardener, Pergamon, New York, pp. 225-251.

Heckman, J 1990, 'Varieties of selection bias', *The American Economic Review*, vol. 80, no. 2, pp.313-318.

Hilderbrandt, N & McKenzie, D 2005, 'The effects of migration on child health in Mexico', *Economia*, vol. 6, no.1, pp. 257-289.

Imbens, GW 2004, 'Nonparametric estimation of average treatment effects under exogeneity: A review' *The Review of Economics and Statistics*, vol. 86, no. 1, pp. 4-29.

Jones, R 1998, ' Remittances and inequality: a question of migration stage and geographic scale', *Economic Geography*, vol. 74, no. 1, pp. 8-25.

Kim, N 2007, ' The impact of remittances on labour supply: the case of Jamaica', World Bank Policy Research Working Paper 4120, World Band, Washington, DC.

Leser, CE 1963, 'Forms of Engel functions', *Econometrica*, vol. 31, no. 4, pp. 694-703.

Loskshin, M, Bontch-Osmolovski, M, & Glinskaya, E 2010, ' Work-related migration and poverty reduction in Nepal', *Review of Development Economics*, vol.14, no.2, pp.323-332.

Massey, DS 1990, 'Social structure, household strategies, and the cumulative causation of migration', *Population Index*, vol. 25, no. 11, pp. 3-26.

McKenzie, D & Rapoprt, H 2007, 'Network effects and the dynamics of migration and inequality: theory and evidence from Mexico', *Journal of Development Economics*, vol.84, no. 1, pp. 1-24.

Osili, U 2007, 'Remittances and savings from international migration: theory and evidence using a matched sample', *Journal of Development Economics*, vol. 83, no.2, pp. 446-465.

Ritsilä, J & Ovaskainen, M 2001, 'Migration and regional centralization of human Capital', *Applied Economics*, vol.33, no.3, pp. 317–325.

Rodriquez, E 1998, 'International migration and income distribution in the Philippines', *Economic Development and Cultural Change*, vol.46, no. 2, pp. 329-350.

Rubin, DB 1978, 'Bayesian inference for causal effects: The role of randomization', *The Annals of Statistics*, vol.6, no. 1, pp. 34-58.

Taylor, JE, Mora, J, Adams, Jr., RH, & Lopez-Feldman, A 2005, 'Remittances, inequality and poverty: evidence from rural Mexico', Working Paper 05-003, Department of Agricultural Economics, University of California, Davis, CA.

Todaro,MP 1969, 'A model of labour migration and urban unemployment in less developed countries', *The American Economic Review*, Vol. 59, no.1, pp. 138-148.

Vella, F & Verbeek, M 1999, 'Estimating and interpreting models with endogenous treatment effects', *Journal of Business & Economic Statistics*, vol. 17, no. 4, pp. 473-478.

Wooldridge, JM 2010, *Econometric analysis of cross section and panel data*, Cambridge, Mass.

World Bank 2014, *Migration and remittances : recent developments and outlook*, Migration and development, brief no. 23, Washington, DC, World Bank Group. Available from: <http://documents.worldbank.org/curated/en/2014/10/20389478/migration-remittances-recent developments-outlook> [12 Februrary 2015].

Working, H 1943, 'Statistical laws of family expenditure', *Journal of American Statistical Association*, vol. 38, no. 221, pp. 43-56.

Yang, D & Martinez, C 2006, 'Remittances and poverty in migrants home areas: evidence from the Philippines', in C Ozden & M Schiff (eds), *International migration, remittances and the brain drain*, World Bank, Washington, DC, pp. 81-121.