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The Impact of Remittances on Investment and Poverty in Ghana

RICHARD H. ADAMS JR.
Boston Institute for Developing Economies, Lexington, USA

and

ALFREDO CUECUECHA *
El Colegio de Tlaxcala, Mexico

Summary. — This paper analyzes the impact of internal remittances (from Ghana) and international remittances (from African or other countries) on investment and poverty in Ghana. It has three findings. First, when compared to what they would have spent without the receipt of remittances, households receiving remittances spend less at the margin on food. Second, households receiving remittances spend more at the margin on three investment goods: education, housing, and health. Third, the receipt of remittances greatly reduces likelihood of household poverty. These findings support the growing view that remittances can reduce poverty and increase investment in developing countries.

Key words — remittances, poverty, migration, self-selection, Sub-Saharan Africa, Ghana

1. INTRODUCTION

Remittances refer to the money and goods that are transmitted to households by migrant workers working outside of their origin communities. These resource transfers currently represent one of the key issues in economic development. While the total level of internal remittances in the developing world is unknown, in 2011 international remittances to the developing world amounted to US $350 billion (World Bank, 2011).

From the standpoint of economic development, two key questions surround these large remittance flows: (a) How are internal and international remittances spent or used by households in origin countries? and (b) What is the impact of these remittances on poverty in the developing world?

The purpose of this paper is to examine how internal and international remittances are spent or used by households in Ghana and their effect on poverty in that country by analyzing the results of the nationally-representative 2005–06 Ghana Living Standards Survey (GLSS 5). Ghana represents a good case study for examining these issues for at least three reasons. First, the 2005–06 Ghana Living Standards Survey (GLSS 5) provides the first nationally-representative household data on remittances in Ghana. The few previous studies on remittances in Ghana have all been based on small and unrepresentative household surveys. Second, past studies of remittances have been dominated by results from Latin America and Asia, and the impact of remittances on investment and poverty in Sub-Saharan African countries (like Ghana) is a relatively unexplored topic. Since household incomes in Ghana are a mere fraction of those in other remittance-receiving countries (such as Mexico and the Philippines), it is possible that remittances may be spent or used differently by households in Ghana. For example, in 2006 per capita GDP income in Ghana was only 10% that of Mexico and 40% that of the Philippines. [1] Third, using an international poverty line of $2.00/person/day, the poverty headcount index in Ghana is higher than that in many other developing countries: 53.6% (World Bank, 2010). It is therefore possible that internal and international remittances may have a very positive impact on reducing poverty in Ghana.

This paper is based on two methodologies, one for analyzing the impact of internal and international remittances on household investment in Ghana, and another for evaluating the effect of remittances on poverty in that country. Analyzing the impact of internal and international remittances on household investment faces the obvious challenge of selection, that is, households receiving remittances might have unobserved characteristics (e.g., more skilled, able, or motivated members) which are different from households not receiving remittances. To address this issue we use a two-stage multinomial logit model that tests for the existence of selection bias in the household receipt of remittances. The identification of this model is based on the use of instrumental variables. Since past research has found that historic distance to railroad lines and rates of employment creation in destination countries are important in the household receipt of remittances (e.g., Adams & Cuecuecha, 2010; Munshi, 2003; Woodruff & Zenteno, 2007), our identification strategy focuses on these variables.

This instrumental approach enables us to control for selection and to compare the predicted marginal budget shares for households conditional on their household characteristics and their receipt of remittances with the counterfactual marginal budget shares of households conditional on their household characteristics and on the hypothetical condition where they do not receive remittances. By comparing the predicted and counterfactual marginal budget shares of households we are able to pinpoint how households receiving remittances spend at the margin on a broad range of consumption and investment goods, including food, education, housing, and health.

Our methodology for analyzing the impact of internal and international remittances on poverty in Ghana not only faces the challenge of selection but also the problem of potential

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simultaneity. This problem exists because choices made by households that lead them to be poor may be correlated to their choice of whether or not to receive remittances. Moreover, household decisions on the receipt of remittances are made in the presence of unobserved heterogeneity. To address these concerns, we extend a methodology proposed by Carrasco (2001). Specifically, we use a multinomial probit model to calculate household probabilities of being poor and not being poor conditioning on the receipt of internal or international remittances. This allows us to obtain the average treatment effects of remittances on the probability of a household being poor or not being poor, conditioning on whether or not those remittances are internal or international.

The paper proceeds in seven further parts. Section 1 presents a brief literature review and Section 2 describes the data from Ghana. Section 3 discusses the choice of functional form for analyzing the marginal expenditure patterns of households receiving remittances. Section 4 describes and estimates the two-stage multinomial logit selection model, and Section 5 presents robustness checks on this model. Section 6 presents the multinomial probit model for estimating the choices of the household with respect to poverty. Section 7 concludes with the key findings and policy implications.

2. LITERATURE REVIEW

In the literature the question of how households spend or use remittances is a topic of lively debate. Some studies find that households spend most of their remittances on consumption goods (for example, food and consumer goods), and that these patterns of expenditure have little positive effect on local economies. For example, a review of the literature by Chami, Fullenkamp and Jahjah (2003, pp.10–11) reports that a "significant proportion, and often the majority" of remittances is spent on "status-oriented" consumption goods. These authors also find that the ways in which remittances are typically invested—in housing, land, and jewelry—are "not productive" to the economy as a whole.

However, these pessimistic findings are challenged by Adams and Cuecuecha (2010) in Guatemala, Yang (2008) in the Philippines and Osili (2004) in Nigeria. Using a two-stage Heckman model with instrumental variables, Adams and Cuecuecha (2010) find that households receiving international remittances spend less at the margin on one key consumption good—food—and more at the margin on two investment goods—education and housing—than what they would have spent on these goods without remittances. According to these authors, households receiving remittances spend more at the margin on investment goods because they treat their remittance earnings as transitory (rather than permanent) income, and the marginal propensity to invest out of transitory income is higher than that for other sources of income. Similarly, Yang (2008) uses a "natural experiment" and panel household data from the Philippines to show how remittances positively influence spending on investment. According to Yang (2008), changes in "nature"—in this case a 10% improvement in migrant exchange rate shocks—lead to a 5.5% increase in a household's expenditure on education. Finally, using matched data from both origin (Nigeria) and destination (United States) countries, Osili (2004) shows how international migrants invest in housing. At the mean Osili (2004) finds that a 10% increase in migrant income increases the probability of investing in housing by 3 percentage points in the country of origin. Considered as a whole, the findings of Adams and Cuecuecha (2010), Yang (2008) and Osili (2004) are important because they support a growing view that remittances can lead to increased investment in human and physical capital in remittance-receiving countries.

On the issue of remittances and poverty, the literature is a bit clearer: most studies find that remittances reduce poverty in the developing world. For example, using data from household surveys in 71 developing countries, Adams and Page (2005) report that, on average, a 10% increase in international remittances in a developing country will lead to a 3.5% decline in the share of people living in poverty. In a similar study using household survey data from 10 Latin American countries, Acosta, Calderon, Fajnzylber, and Lopez (2006) find that international remittances reduce poverty by 0.4% for each percentage point increase in the remittances to GDP ratio. Finally, at the country level, both Lopez-Cordova (2005) in Mexico and Lokshin, Bontch-Osmolovski, and Glinskaya (2010) in Nepal find that international remittances reduce poverty.

3. DATA

Data for this study come from the 2005–06 Ghana Living Standards Survey (GLSS 5), a nationally-representative survey of 8,000 households carried out by the Ghana Statistical Service (GSS). This survey, administered from September 2005 to September 2006, contains detailed information on all aspects of living conditions in Ghana, including income, expenditure, health, education, savings, and credit. As part of this survey, a supplemental migration and remittances module was administered to a nationally representative sub-sample of 4,000 households.[2] This module was designed to gather nationally-representative information on migration and remittances for the first time in Ghana.

This paper is based on the migration and remittances subsample of 4,000 households. Because of missing data, we dropped 59 households, resulting in a sample of 3,941 households.

Since our focus is on remittances, it is important to clarify how these income transfers are measured and defined. Data on remittances include transfers received by households in three forms: (1) money (cash); (2) non-food goods;[3] and (3) food. Most remittances come in the form of money (cash) (75% and 83% for internal and international remittances, respectively). However, smaller amounts come in the form of non-food goods (16% and 13% for internal and international remittances, respectively) and food (9% and 4% for internal and international remittances, respectively). While remittances in the form of non-food goods and food are less important, including them in the analysis is important because it leads to a more accurate measure of the total flow of remittances to households in Ghana.

In this study each household that is classified as receiving remittances—either internal (from Ghana) or international (from African or other countries)—is assumed to receive exactly the amount reported in the survey. Households which report having migrants but do not report receiving remittances are classified as non-remittance receiving households. Using this definition distinguishes our work from much of the previous literature on migration and remittances by focusing on the origin of income flows rather than the presence or absence of a migrant in the household. This approach seems sensible for three reasons: (1) only about one-half of all migrants in Ghana remit;[4] (2) about 50% of all remittance-receiving households in the survey do not have a migrant; and (3) if we attempted to measure differences according to migration cum remittances

behavior, the number of observations for each cell would be very small. In Ghana, where family ties are very strong, migration is different from remittances because households without migrants can receive internal or international remittances from relatives (e.g., cousins, aunts, uncles) and close friends. [5]

Table 1 presents summary data from the 2005–06 Ghana GLSS 5 Survey. Since we want to work with three exclusive groups of households, in this table and in all subsequent tables, we have dropped the 57 households that receive remittances from both internal and international sources. Of the remaining 3,884 households, 2,515 households (64.7%) receive no remittances, 1,159 households (29.8%) receive internal remittances (from Ghana), and 210 (5.4%) receive international remittances (from African or other countries).

Table 1 reveals several interesting contrasts between the three groups of households, that is, those receiving no remittances, those receiving internal remittances (from Ghana) and those receiving international remittances (from African or other countries). With respect to human capital, the table shows that households receiving international remittances generally have more human capital than households with no remittances, while households receiving internal remittances usually have less. The table also shows that while far more households receive internal rather than international remittances (1,159 *vs.* 210 households), remittances account for a much larger share of mean annual per capita expenditure in households receiving international rather than internal remittances (28.7% *vs.* 17.7%).

International remittances are large in Table 1 because most of these remittances come from countries outside of Africa (from Europe and the United States). In the 2005–06 Survey mean annual per capita international remittances received by households are 3,616,000 cedis/person/year and include remittances from both African countries and countries outside of Africa. However, mean annual per capita international remittances received from countries outside of Africa are about 4 times larger than those received from other African countries (10,400,000 *vs.* 2,483,000 cedis/person/year). By contrast, mean annual per capita internal remittances received from Ghana are much smaller (982,000 cedis/person/year).

Since we want to examine the impact of remittances on expenditure behavior, it is important to present the type of expenditure data contained in the 2005–06 Ghana Survey. Table 2 shows that the survey collected detailed information on six major categories of expenditure, and on several subdivisions within each category. While the time base over which these expenditures was measured varied (from last visit for most food items, to last 12 months for most durable goods), all expenditures were aggregated to obtain yearly values. For household durables (stove, refrigerator, automobile, etc.), annual use values were calculated to obtain an estimate of the cost of one year's use of that good. Annual use values were also calculated to obtain an estimate of the one year use value of housing (rented or owned).

Table 2 also presents average budget shares devoted to the six categories of expenditure for the three groups of households. On average, each of the three groups of households spends over 66% of their budget on the two categories of goods that are clearly consumption: food and consumer goods/durables.

Table 1. *Summary data on non-remittance and remittance-receiving households, Ghana, 2005–06 Source: 2005–06 Ghana GLSS 5 Survey*

Variable	Receive no remittances	Receive internal remittances (from Ghana)	Receive international remittances (from African or other countries)
	(1)	(2)	(3)
Human capital			
Number of household members over age 15 with primary school	0.35 (0.62)	0.32 (0.57)	0.21 (0.45)
Number of household members over age 15 with junior secondary school	0.72 (0.90)	0.55 (0.78)	0.89 (0.94)
Number of household members over age 15 with senior secondary school	0.11 (0.38)	0.07 (0.30)	0.23 (0.50)
Number of household members over age 15 with university	0.03 (0.22)	0.01 (0.10)	0.07 (0.27)
Household characteristics			
Age of household head (years)	43.38 (14.13)	48.42 (18.40)	45.34 (15.46)
Household size	4.19 (2.78)	3.68 (2.58)	3.28 (2.20)
Number of household males over age 15	1.18 (0.90)	0.91 (0.90)	0.97 (0.85)
Number of children under age 5	0.56 (0.81)	0.49 (0.73)	0.24 (0.52)
Mean annual per capita expenditure (including remittances) in thousand Ghanaian cedis	6,404 (7,615)	5,545 (4,699)	12,600 (11,500)
Remittances as percent of mean annual per capita expenditure (including remittances)	0	17.7	28.7
N	2,515	1,159	210

Notes: $N = 3{,}884$ households. All values are weighted; standard deviations in parentheses. In 2006, US$ 1.00 = 9,000 Ghanaian cedis.
* Significant at the 0.10 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

Table 2. *Expenditure categories in 2005–06 Ghana Survey Source: 2005–06 Ghana GLSS 5 Survey*

Category	Description	Examples	Average budget shares		
			Households receiving no remittances ($n = 2515$)	Households receiving internal remittances ($n = 1159$)	Households receiving international remittances ($n = 210$)
Food	Purchased food Non-purchased food	Maize, bread, cassava, milk, meat, fruit, vegetables Food from: own-production, gifts, donations, social programs	0.560	0.580	0.450
Consumer goods, durables	Consumer goods Household durables	Clothing, shoes, fabric Annual use value of stove, refrigerator, furniture, television, car	0.180	0.170	0.220
Housing	Housing value	Annual use value of housing (calculated from rental payments or imputed values)	0.032	0.034	0.034
Education	Educational expenses	Books, school supplies, uniforms, registration fees, travel to school	0.050	0.040	0.070
Health	Health expenses	Doctor and dentist fees, medicine, hospitalization, antibiotics	0.016	0.010	0.020
Other	Utilities Transport, communications Remittance expenses	Water, gas, electricity, telephone Bus and taxi fees, gasoline, faxes, postage Expenses on remittances	0.140	0.130	0.180
			1.000	1.000	1.000

4. CHOICE OF FUNCTIONAL FORM

To analyze the marginal expenditure patterns of remittance-receiving and non-receiving households, it is necessary to choose a proper functional form for the econometric model. The selected functional form must do several things. First, it must provide a good statistical fit to a wide range of goods, including food, consumer durables, housing, health, and education. Second, the selected form must mathematically allow for rising, falling, or constant marginal propensities to spend over a broad range of goods and expenditure levels. A model specification that imposes the same slope (or marginal budget share) at all levels of expenditure would not be adequate. Third, the chosen form should conform to the criterion of additivity (i.e., the sum of the marginal propensities for all goods should equal unity).

One useful functional form which meets all of these criteria is the Working–Leser model, which relates budget shares linearly to the logarithm of total expenditure. This model can be written as: [6]

$$C_i/EXP = \beta_i + a_i/EXP + \gamma_i(\log EXP) \quad (1)$$

where C_i/EXP is the share of expenditure on good i in total expenditure EXP. Adding up requires that $\Sigma C_i/EXP = 1$.

In comparing the expenditure behavior of households with different levels of income, various socioeconomic and locational factors other than expenditure must be taken into account. Part of the observed differences in expenditure behavior may be due, for example, to differences in household composition (family size, number of children, etc.), education, geographic region or (in this sample) receipt of internal or international remittances. These household characteristic variables need to be included in the model in a way that allows them to shift both the intercept and the slope of the Engel functions. Let Z_j denote the jth household characteristic variable and let μ_{ij} and λ_{ij} be constants. The complete model is then:

$$C_i/EXP = \beta_i + a_i/EXP + \gamma_i(\log EXP) + \Sigma_j[(\mu_{ij})Z_j/EXP + \lambda_{ij}(Z_j)] \quad (2)$$

From Eqn. (2) the marginal and average budget shares for the ith good (the MBS_i and ABS_i, respectively) can be derived as follows:

$$MBS_i = dC_i/dEXP = \beta_i + \gamma_i(1 + \log EXP) + \Sigma_j[(\gamma_{ij})(Z_j)] \quad (3)$$

$$ABS_i = C_i/EXP_i \quad (4)$$

5. ESTIMATING A TWO-STAGE MULTINOMIAL SELECTION MODEL

We now redefine the model in terms of the choices that households make. Assume that households choose between three states (s): (1) receive no remittances; (2) receive internal remittances (from Ghana); and (3) receive international remittances (from African or other countries). [7] Once households have chosen a state, they decide their optimal consumption shares C_{si}, where C_{si} is the optimal consumption share for households that choose $s = k$, in good i. On this basis, we have a polychotomous-choice model (Lee, 1983), where we have an equation like (2) for each type of expenditure good i that households choose and for each possible state s.

$$\frac{C_{si}}{EXP} = \beta_{si} + \frac{a_{si}}{EXP} + \gamma_{si}(\log EXP) + \sum_k \left[\frac{\mu_{sik}Z_k}{EXP} + \theta_{sik}Z_k\right] + u_{si} \quad (5)$$

Eqn. (5) might still have problems with selection bias. According to Dubin and McFadden (1984), if the choice model and the consumption model contain a correlated error component and if the choice model is estimated by a logit model, selection in the consumption model can be corrected by the addition of a term as follows: [8]

$$\frac{C_{si}}{EXP} = \beta_{si} + \frac{a_{si}}{EXP} + \gamma_{si}(\log EXP) + \sum_k \left[\frac{\mu_{sik} Z_k}{EXP} + \theta_{sik} Z_k\right] + \sum_{h \neq s} \pi_{sih} \lambda_{ih} + v_{si} \tag{6}$$

where $E(v_{si}|X,Z) = 0$; λ_{ih} represents the selection correction variable related to choice h.[9] Note that the parameter π_{sih} to be estimated is proportional to the correlation between the error terms of the consumption and the choice equation.

According to a recent review of the literature on selection bias (Bourguignon, Fournier, & Gurgand, 2007), the Dubin and McFadden method (1984) performs better than other selection methods in Monte Carlo experiments.[10] For this reason, the Dubin McFadden method will be used in this analysis.

The Dubin and McFadden method represents a generalization of the Heckman two-stage method of selection correction. As in the Heckman method, identification of Eqn. (6) in the Dubin and McFadden method depends on both the existence of instrumental variables and the non-linearity of the selection part of the model. In principle, the non-linearity of the selection part of the model is sufficient to identify the parameters of the model, because this non-linearity helps break the relation between the selection part and the rest of the expenditure equation. However, in this analysis we use instrumental variables to obtain independent variations in the first-stage choice equation that identify the second-stage expenditure equation.

To estimate the effect of remittances on the marginal spending behavior of households, we follow the literature on the evaluation of multiple treatments. This literature has shown that the pairwise comparison of treatments is enough to identify Average Treatment Effects on the Treated (ATT) (Lechner, 2002). Specifically, let the average treatment effect of treatment m compared to treatment l on the participants of treatment m be defined by:[11]

$$ATT_{ml} = E(MBS_m/s = m) - E(MBS_l/s = m) \tag{7}$$

where $E(MBS_m/s = m)$ represents the marginal budget share (MBS) estimated with the equation for households that choose action m, conditioning on the characteristics of households that choose action m. We also have that $E(MBS_l/s = m)$ represents the MBS estimated with the equation for individuals that choose action l, conditioning on the characteristics of households that choose action m. Adams and Cuecuecha (2010) show that the ATT is given by:

$$ATT_{ml} = \beta_m - \beta_l + (\gamma_m - \gamma_l)(1 + \log EXP) + \sum_k (\theta_{hk} - \theta_{lk}) Z_k + \sum_{h \neq m} \mu_{mh} \lambda_h - \mu_{lh,m} \lambda_{h,m} - \mu_{lm,m} \lambda_{m,m} \tag{8}$$

where all λ terms represent the selection correction variables related to the different choices involved in the estimation of the ATT.[12]

Each pairwise ATT is estimated for each household that is involved in the estimation of the given pairwise ATT. In particular, we estimate ATT_{13} and ATT_{23}:

$$ATT_{13} = E(MBS_1/s = 1) - E(MBS_3/s = 1),$$

which represents the effect in MBS produced by the receipt of internal remittances(from Ghana) (9)

$$ATT_{23} = E(MBS_2/s = 2) - E(MBS_3/s = 2),$$

which represents the effect in MBS produced by the receipt of international remittances(from African or other countries) (10)

In estimating Eqns. (9) and (10) there are as many ATT as households in choice $s = k$. Following Maddala (1983), we use the mean and standard error of the ATT estimated to obtain its significance.

To operationalize our two-stage selection model, it is necessary to identify variables that are distinct for the receipt of remittances in the first-stage choice equation, and for the determination of household income in the second-stage expenditure equation.

In the first-stage choice equation, it is difficult to identify variables that are truly exogenous to migration and the receipt of remittances. In the literature, the cleanest strategies for identifying exogenous variables affecting migration and the receipt of remittances have focused on short-term economic shocks. For example, Yang (2006, 2008) uses panel data from the 1997 Asian currency crisis to analyze how short-term changes in currency rates affect the value of international remittances received by Filipino households. Since our Ghana data come from a single, cross-sectional survey, we are not aware of any identifiable exogenous shocks to exploit in our data set.

To address the problem of endogenous variables, we construct two instrumental variables using information from supplemental sources of data. The first instrumental variable is the unexpected rate of job creation in the main destination countries or regions for the remittances that are received in Ghana times the age of household head. Our second instrument is the distance to the nearest railroad station built in 1930 times the age of household head. Our rationale for using these two instrumental variables is as follows.

With respect to job creation, the literature suggests that the rate of job creation in destination countries influences both migration flows from labor-sending countries (Cuecuecha & Rendon, 2012; Rendon & Cuecuecha, 2010) and the receipt of remittances in remittance-receiving countries (Adams & Cuecuecha, 2010). In this sense, the unexpected rate of job creation, obtained as the difference between an AR(1) process for the job creation rate and the observed job creation rate, represents a good instrumental variable because it represents a type of exogenous shock on the labor-sending country.

Data from the 2005–06 Ghana Survey list the country of origin for remittances received in Ghana.[13] Using these data and World Bank information on employment in four sets of main destination countries or regions—United Kingdom, United States, Europe, (Germany, France, Italy, and Spain) and Africa (South Africa and Nigeria)—we construct a time series variable on employment creation for 1995 to 2006. We then obtain the residuals from an AR(1) process and use that information to create the instrumental variable: unexpected rate of job creation in main destination countries for the year 2005.

To guarantee that this variable works as an instrument we include in the model as a control variable the mean level of male job creation during the period 1995–06 in countries of origin for the remittances received in Ghana. While this control variable is related to total job creation, it is different from the instrumental variable because it excludes female employment. Our goal here is to ensure that shocks prior to 2006 are included in the information for the receipt of remittances at the time of the 2005–06 Ghana Survey, so that the exogeneity of the instrumental variable is guaranteed.

To obtain variation by region in Ghana, we weight the unexpected rate of job creation for each destination country or region by the fraction of households that receive remittances from that place of origin. This generates variation at the regional level in Ghana. Finally, to create variation at

the household level we multiply the variable by the age of household head.

Data for our second instrumental variable—distance to the nearest railroad station built in 1930—comes from the Ghana Railway Corporation. The first railroad line in Ghana opened in 1898 and in 1923 the British built the Eastern Railway to transport minerals and cocoa to the coast. In Ghana distance to railroad lines in 1930 represents a good instrumental variable because it is related to migration costs in the past and to the need for sending migrants in the past, and therefore to the development of present-day migrant social networks, but it is not correlated with the expenditure patterns of households at the time of the 2005–06 Ghana Survey. We calculated distance to railroad lines for each household using the distance from the district capital to the nearest railroad line in 1930, using maps from the Ghana Railway Corporation. This type of instrument has been used before in the literature by Adams and Cuecuecha (2010) for Guatemala and Woodruff and Zenteno (2007) for Mexico.

Table 3 shows mean values for the two instrumental variables as well as for other aggregate variables that are used later in the study. The data in this table are presented for the ten administrative regions in Ghana.

Table 3 shows that the distance to railroad station variable is highest in the two regions with the highest poverty rates in Ghana: Upper East and Upper West. As might be expected, the table also reveals that one of these very poor regions—Upper West—also has the largest share of households receiving internal remittances. The table also shows that the two regions with the highest level of annual per capita expenditures—Greater Accra and Ashanti—also have the largest share of households receiving international remittances.

On the basis of the preceding, the first-stage choice function of the probability of a household receiving remittances can be estimated as: [14]

$$\begin{aligned}\text{Prob(Y = receive remittances)} &= \text{f[Human Capital(Number of household members with primary, junior secondary, senior secondary, and university education), Household Characteristics (Age, gender and ethnicity of household head, whether the household has children below age 5, number of household males and females over age 15, number of days with illness in last week by household members, total number of land acres owned by household, whether household lives in ecological zone), Aggregate Variables(Population in region times age of household head, mean male employment creation in main destination countries times age of household head, international migration rate in region in 1998–99 times age of household head), Instrumental Variables, Urban/Rural Dummy, Regional Variables]} \qquad (11)\end{aligned}$$

The rationale for including these variables in the first-stage equation follows the standard literature on migration and remittances. According to the basic human capital model, human capital variables are likely to affect migration and remittances because more educated people enjoy greater employment and expected income-earning possibilities in destination areas (Schultz, 1982; Todaro, 1976). In the literature household characteristics—such as age of household head and number of children—are also hypothesized to affect the probability of migration and the receipt of remittances. In particular, some analysts (Adams, 1993; Lipton, 1980) have suggested that migration is a life-cycle event in which households with older heads and fewer children under age 5 are more likely to participate. The number of males and females above age 15 measures the household members that are of working age and that would be available for migration. Total number of days with illness by household members is an important variable in Africa because of the AIDS pandemic. Finally, since urban/rural residence and geographic region may affect migration and the receipt of remittances, the model includes an urban/rural dummy and nine regional dummies (with Greater Accra region omitted).

The second-stage expenditure share equation can be estimated as:

$$\begin{aligned}C_{si}/EXP_i = {} & \beta_s + a_s/EXP_i + \gamma_s(\log EXP_i) \\ & + \mu_{s1}\text{AGEHD}_i/EXP_i + \lambda_{s1}\text{AGEHD}_i \\ & + \mu_{s2}\text{SEXHD}_i/EXP_i + \lambda_{s2}\text{SEXHD}_i \\ & + \mu_{s3}\text{ETH}_i/EXP_i + \lambda_{s3}\text{ETH}_i \\ & + \mu_{s4}\text{CHILD5}_i/EXP_i + \lambda_{s4}\text{CHILD5}_i \\ & + \mu_{s5}\text{MALE15}_i/EXP_i + \lambda_{s5}\text{MALE15}_i \\ & + \mu_{s6}\text{FEMALE15}_i/EXP_i + \lambda_{s6}\text{FEMALE15}_i \\ & + \mu_{s7}\text{EDPRIM}_i/EXP_i + \lambda_{s7}\text{EDPRIM}_i \\ & + \mu_{s8}\text{JRSEC}_i/EXP_i + \lambda_{si8}\text{JRSEC}_i \\ & + \mu_{s9}\text{EDSEC}_i/EXP_i + \lambda_{s9}\text{EDSEC}_i \\ & + \mu_{s10}\text{EDUNIV}_i/EXP_i + \lambda_{s10}\text{EDUNIV}_i \\ & + \mu_{s11}\text{ILL}_i/EXP_i + \lambda_{s11}\text{ILL}_i + \mu_{s12}\text{EZ}_i/EXP_i \\ & + \lambda_{s12}\text{EZ}_i + \mu_{s13}\text{LAND}_i/EXP_i + \lambda_{s13}\text{LAND}_i \\ & + \mu_{s14}\text{POP}_i/EXP_i + \lambda_{s14}\text{POP}_i \\ & + \mu_{s15}\text{MALEMP}_i/EXP_i + \lambda_{s15}\text{MALEMP}_i \\ & + \mu_{s16}\text{MIG98}_i/EXP_i + \lambda_{s16}\text{MIG98}_i\delta_{s0}\text{URB}_i \\ & + \sum_{j=1}^{9}\delta_{sj}\text{REG}_j + \sum_{h\neq m}\pi_{mh}\lambda_h + \text{v}_{si} \qquad (12)\end{aligned}$$

where C_{si} is annual per capita household expenditure on one of six expenditure categories defined above (food, consumer goods/durables, housing, education, health, or other) by households that chose category s, EXP is total annual per capita household expenditure, AGEHD is age of household head, SEXHD is gender of household head (MALE = 1), ETH is ethnicity of household head (ASANTE = 1), CHILD5 is number of children below age 5, MALE15 is number of household males above age 15 , FEMALE15 is number of household females above age 15, EDPRIM is number of household members over age 15 with primary education, JRSEC is number of household members over age 15 with junior secondary education , EDSEC is number of household members over age 15 with senior secondary education , EDUNIV is number of household members over age 15 with university education, ILL is total number of days with illness by household members, EZ is whether the household lives in an ecological zone, LAND is total land acres owned by the household, POP is the total population in the region times

Table 3. *Mean values for instrumental variables and selected aggregate variables, by Administrative Region, Ghana, 2005–06 Sources: (1) Ghana Railway Corporation, (3) GLSS 4 Survey , (1) (4) World Bank Economic Indicators, (5) (6) GLSS 5 Survey*

Region	Distance to railroad station in 1930 (1)	Unexpected job creation in main destination countries in 2005 (2)	International migration rate in 1998–99 (3)	Male employment growth in main destination countries in 2006 (4)	Households receiving internal remittances in 2005–06 (5)	Households receiving international remittances in 2005–06 (5)	Annual per capita household expenditure (million Ghanaian cedis) (5)	Poverty rate (6)
Western	28.96	−3264.72	2.99	175.68	31.5%	4.1%	6.342	24.9%
	(16.12)	(1153.90)	(1.06)	(62.09)	(46.5%)	(19.8%)	(4.719)	(43.3%)
Central	23.55	−1255.00	2.16	350.00	34.5%	6.0%	6.859	21.8%
	(6.71)	(437.94)	(0.75)	(122.13)	(47.6%)	(23.8%)	(6.174)	(41.4%)
Greater Accra	13.81	−1409.30	5.13	292.08	15.3%	10.5%	11.687	8.8%
	(11.99)	(473.69)	(1.73)	(98.17)	(36.0%)	(30.6%)	(17.013)	(28.4%)
Volta	62.98	−2996.81	2.77	326.77	37.5%	1.8%	4.911	41.4%
	(28.09)	(987.59)	(0.91)	(107.69)	(48.5%)	(13.3%)	(4.148)	(49.3%)
Eastern	15.26	−1320.28	3.72	322.82	31.4%	3.2%	6.056	19.8%
	(7.03)	(460.68)	(1.30)	(112.64)	(46.5%)	(17.6%)	(4.256)	(39.9%)
Ashanti	20.62	15940.43	5.88	1359.40	28.1%	10.8%	6.701	25.7%
	(11.32)	(5701.76)	(2.10)	(486.25)	(45.0%)	(31.1%)	(6.095)	(43.8%)
Brong Ahafo	50.61	6050.95	3.70	767.03	29.0%	6.1%	4.925	39.5%
	(9.86)	(2232.56)	(1.36)	(283.00)	(45.4%)	(23.9%)	(4.200)	(49.0%)
Northern	122.83	−5440.27	2.33	30.95	32.6%	0.0%	3.461	63.7%
	(25.35)	(1803.82)	(0.77)	(10.26)	(46.9%)	(0.0%)	(3.379)	(48.1%)
Upper East	177.18	−5777.75	0.00	49.27	25.3%	0.0%	2.364	77.6%
	(8.17)	(1794.35)	(0.00)	(15.30)	(43.5%)	(0.0%)	(2.110)	(41.8%)
Upper West	159.42	−5899.21	1.87	41.97	51.5%	0.0%	1.695	92.2%
	(9.23)	(2010.29)	(0.64)	(14.30)	(50.1%)	(0.0%)	(2.239)	(26.9%)

Notes: $N = 3{,}884$ households: 2,515 with no remittances, 1,159 with internal remittances (from Ghana), and 210 with international remittances (from African or other countries). In 2006, US$1.00 = 9,000 Ghanaian cedis. (1) Distance to railroad station is multiplied by age of household head to obtain variation per household, (2) Unexpected job creation growth obtained using AR (1) model to predict growth in employment (in GDP) in main destination countries using data from 1995 to 2006. Variable is multiplied by age of household head to obtain variation per household. (3) International migration rate obtained as the share of households having international migrants in 1998–99 in region multiplied by age of household head to obtain variation per household, (4) Male employment growth (GDP level) obtained by weighting employment in main destination countries by share of international migrants in region *i*th residing in country *j*th. Variable is multiplied by age of household head to obtain variation per household, (5) Own weighted calculation, (6) Poverty defined on the basis of a national poverty line of 3,066,000 cedis/person/year. See endnote (16) for details on this poverty line.

Table 4. *Multinomial logit selection model for Ghana*

Variable	Receive internal remittances (from Ghana)			Receive international remittances (from African or other countries)		
	Coefficient	Standard errors	Marginal effects	Coefficient	Standard errors	Marginal effects
Human capital						
Number of household members over age 15 with primary school education	0.029	0.069	0.006	−0.178	0.170	−8.7E−06
Number of household members over age 15 with junior secondary school education	0.005	0.066	0.001	0.098	0.107	4.5E−06
Number of household members over age 15 with secondary education	0.085	0.075	0.018	0.302***	0.093	1.3E−05
Number of household members over age 15 with university education	−0.749**	0.363	−0.156	0.220	0.241	2.1E−05
Household characteristics						
Sex of household head (male=1)	1.056***	0.128	0.221	0.658***	0.208	0.000016
Ethnicity of household head	−0.091	0.306	−0.019	0.899***	0.107	6.0E−05
Children below age 5 (dummy)	−0.006	0.073	−0.001	−0.429*	0.228	−2.0E−05
Number of household males over age 15	−0.136***	0.037	−0.028	−0.176***	0.048	−6.3E−06
Number of household females over age 15	−0.271***	0.081	−0.057	−0.141**	0.070	−2.8E−06
Control variable						
2006 Male employment creation in main destination countries ∗ Age of household head	0.004	0.003	0.001	0.014**	0.006	5.9E−07
Instruments for second stage						
Distance to railroad station in 1930 ∗ Age of household head	−0.007***	0.003	−0.001	0.006	0.006	3.6E−07
2005 Unexpected job creation in main destination countries ∗ Age of household head	−3.23E−04	2.03E−04	−6.75E−05	−9.70E−04***	3.68E−04	−4.1E−08
Constant	−3.850***	0.406		−2.386***	0.530	
Log likelihood	−2780					
Chi^2 test for joint significance of IV's	27.62***					
Pseudo *R*^2	11%					
N	3884					

Notes: Table reports the coefficients and marginal effects of a variable on the probability of a household receiving internal or international remittances. The model also includes: age of household head, number of days with illness in last week by household members, total number of land acres owned by household, whether household lives in ecological zone, population in region times age of household head, international migration rate in 1998–99 times age of household head, urban/rural dummy, nine regional dummy variables, the inverse of the expenditure of the household, and interactions of each of the variables with the inverse of the household expenditure. None of these variables are reported in the table. All values are weighted. Standard errors are clustered by region. They are bootstrapped standard errors (1,000 repetitions).

*Significant at the 0.10 level.

**Significant at the 0.05 level.

***Significant at the 0.01 level.

Table 5. *Household expenditure estimates (selection corrected) for households receiving no remittances*

Variable	Food	Consumer goods, durables	Housing	Education	Health	Other goods
Log total annual per capita household expenditure (log EXP)	−0.022	−0.005	−0.008	−0.017**	0.010**	0.042***
	(0.016)	(0.008)	(0.005)	(0.006)	(0.005)	(0.010)
Human capital						
Number of household members over age 15 with primary school education	−0.007	−0.013**	0.001	0.006	3.29E−04	0.013
	(0.013)	(0.006)	(0.001)	(0.009)	(2.11E−03)	(0.008)
Number of household members over age 15 with junior secondary school education	−0.031	0.008	−0.001	0.020***	−3.38E−04	0.005
	(0.017)	(0.009)	(0.002)	(0.003)	(4.68E−03)	(0.006)
Number of household members over age 15 with secondary education	−0.057**	−0.021	−0.002	0.076***	−0.006	0.011
	(0.025)	(0.014)	(0.004)	(0.019)	(0.003)	(0.012)
Number of household members over age 15 with university education	−0.210**	0.065	0.037	0.058	−0.002	0.053
	(0.082)	(0.050)	(0.033)	(0.054)	(0.017)	(0.069)
Household characteristics						
Sex of household head (male = 1)	−0.016	0.011	−0.004	0.009	0.005	−0.004
	(0.022)	(0.012)	(0.012)	(0.010)	(0.013)	(0.020)
Ethnicity of household head	0.009	0.005	−0.008**	−0.006	−0.011	0.010
	(0.021)	(0.015)	(0.003)	(0.012)	(0.006)	(0.011)
Children below age 5 (dummy)	0.010	0.002	−0.008***	−0.007	0.002	0.002
	(0.007)	(0.003)	(0.002)	(0.005)	(0.001)	(0.006)
Number of household males over age 15	0.007	−0.009	−0.003	0.007	−1.38E−04	−0.002
	(0.015)	(0.006)	(0.003)	(0.008)	(2.22E−03)	(0.009)
Number of household females over age 15	−0.007	−0.008	−0.006**	0.013*	−3.32E−04	0.008
	(0.008)	(0.007)	(0.003)	(0.006)	(3.90E−03)	(0.008)
Control variable						
2006 Male employment creation in main destination countries*Age of household head	9.53E−05**	−5.44E−05*	2.03E−05*	−3.20E−05*	1.12E−05	−4.04E−05
	(3.80E−05)	(2.63E−05)	(1.09E−05)	(1.66E−05)	(1.34E−05)	(3.11E−05)
Selection controls						
$\sigma_3\rho_{31}$	0.108	−0.129**	0.029	−0.036	−0.016	0.044
	(0.085)	(0.046)	(0.020)	(0.041)	(0.024)	(0.047)
$\sigma_3\rho_{32}$	−0.083	0.110**	−0.032**	0.037	0.017	−0.050
	(0.095)	(0.049)	(0.012)	(0.039)	(0.016)	(0.046)
Constant	0.857**	0.149	0.231	0.281*	−0.138	−0.381*
	(0.297)	(0.110)	(0.133)	(0.137)	(0.113)	(0.213)
σ_3	0.125	0.076	0.026	0.063	0.031	0.083
Chi^2 test for joint significance of selection controls	2.65	8.22***	4.83***	0.44	0.63	0.59
Adj. R^2	.28	.17	.45	.30	.07	.24

Notes: $N = 3{,}884$ households: 2,515 with no remittances, 1,159 with internal remittances (from Ghana), and 210 with international remittances (from African or other African countries). All values are weighted. The model also includes: age of household head, number of days with illness in last week by household members, total number of land acres owned by household, whether household lives in ecological zone, population in region times age of household head, international migration rate in 1998–99 times age of household head, urban/rural dummy, nine regional dummy variables, the inverse of the expenditure of the household, and interactions of each of the variables with the inverse of the household expenditure. None of these variables are reported in the table. All values are weighted. Standard errors are clustered by region. They are bootstrapped standard errors (1,000 repetitions). The first stage of the model is shown in Table 4.

* Significant at the 0.10 level.

** Significant at the 0.05 level.

*** Significant at the 0.01 level.

Table 6. *Household expenditure estimates (selection corrected) for households receiving internal remittances (from Ghana)*

Variable	Food	Consumer goods, Durables	Housing	Education	Health	Other goods
Log total annual per capita household expenditure (log EXP)	−0.142**	0.023	−0.010	0.026	0.003	0.100**
	(0.043)	(0.048)	(0.009)	(0.034)	(0.006)	(0.035)
Human capital						
Number of household members over age 15 with primary school education	−0.014	−0.064	0.011	0.037	−0.031**	0.061
	(0.049)	(0.043)	(0.007)	(0.045)	(0.010)	(0.048)
Number of household members over age 15 with junior secondary school education	−0.020	0.014	0.003	0.006	−0.002	−0.001
	(0.043)	(0.039)	(0.006)	(0.022)	(0.008)	(0.024)
Number of household members over age 15 with secondary education	0.067	−0.001	0.026	−0.011	−0.021	−0.059*
	(0.037)	(0.038)	(0.019)	(0.045)	(0.020)	(0.030)
Number of household members over age 15 with university education	−0.123	0.112	−0.013	0.025	0.007	−0.009
	(0.084)	(0.092)	(0.013)	(0.044)	(0.016)	(0.055)
Household characteristics						
Sex of household head (male = 1)	−0.075	−0.158	0.004	0.195*	−0.018	0.052
	(0.142)	(0.122)	(0.013)	(0.103)	(0.044)	(0.132)
Ethnicity of household head	−0.051	−0.018	−0.025	0.113	−0.020	0.001
	(0.096)	(0.099)	(0.014)	(0.081)	(0.050)	(0.113)
Children below age 5 (dummy)	−0.039	0.010	0.014	−0.075	0.010	0.081
	(0.048)	(0.068)	(0.015)	(0.066)	(0.021)	(0.102)
Number of household males over age 15	−0.050	0.015	−0.014	0.061	0.008	−0.021
	(0.037)	(0.072)	(0.009)	(0.039)	(0.012)	(0.017)
Number of household females over age 5	−0.068	0.063**	−0.015	0.024	0.012	−0.015
	(0.037)	(0.027)	(0.010)	(0.023)	(0.014)	(0.042)
Control variable						
2006 Male employment creation in main destination countries*Age of household head	2.10E−04	7.23E−05	1.76E−05	−1.15E−04	−6.19E−06	−1.79E−04
	(2.41E−04)	(2.78E−04)	(2.91E−05)	(1.90E−04)	(1.15E−04)	(2.44E−04)
Selection controls						
$\sigma_3\rho_{31}$	0.306	0.180	−0.033	−0.402	0.058	−0.110
	(0.395)	(0.413)	(0.037)	(0.240)	(0.123)	(0.230)
$\sigma_3\rho_{32}$	−0.274	−0.148	0.064*	0.323	−0.053	0.088
	(0.339)	(0.334)	(0.031)	(0.181)	(0.082)	(0.144)
Constant	3.025**	0.336	0.237*	−1.166	−0.020	−1.412
	(1.264)	(1.183)	(0.123)	(0.876)	(0.233)	(0.798)
σ_3	0.11	0.084	0.021	0.076	0.027	0.083
Chi^2 test for joint significance of selection controls	.44	.10	6.31**	1.59	.30	.27
Adj. R^2	.45	.39	.56	.52	.27	.38

Notes: $N = 3{,}884$ households, 1,159 with internal remittances (from Ghana), the rest are only used in the first stage of the method. The model also includes: age of household head, number of days with illness in last week by household members, total number of land acres owned by household, whether household lives in ecological zone, population in region times age of household head, international migration rate in 1998–99 times age of household head, urban/rural dummy, nine regional dummy variables, the inverse of the expenditure of the household, and interactions of each of the variables with the inverse of the household expenditure. None of these variables are reported in the table. All values are weighted. Standard errors are clustered by region. They are bootstrapped standard errors (1,000 repetitions). The first stage of the model is shown in Table 4.

*** Significant at the 0.01 level.

* Significant at the 0.10 level.

** Significant at the 0.05 level.

Table 7. *Household expenditure estimates (selection corrected) for households receiving international remittances (from African or other countries)*

Variable	Food	Consumer goods, durables	Housing	Education	Health	Other goods
Log total annual per capita household expenditure (log EXP)	−0.058**	0.039**	−0.009	−0.016***	−0.001	0.045***
	(0.022)	(0.017)	(0.006)	(0.005)	(0.002)	(0.012)
Human capital						
Number of household members over age 15 with primary school education	0.002	−0.001	−2.43E−05	−0.003	0.004*	−0.002
	(0.008)	(0.006)	(0.002)	(0.004)	(0.002)	(0.004)
Number of household members over age 15 with junior secondary school education	−0.039***	0.012***	−0.002	0.015***	0.001	0.012*
	(0.010)	(0.004)	(0.001)	(0.004)	(0.001)	(0.005)
Number of household members over age 15 with secondary education	−0.041*	0.028**	−0.006**	0.031***	−0.004	−0.008
	(0.020)	(0.012)	(0.003)	(0.005)	(0.002)	(0.010)
Number of household members over age 15 with university education	−0.111***	0.065***	0.003	0.031***	−0.003	0.014
	(0.023)	(0.012)	(0.007)	(0.005)	(0.003)	(0.020)
Household characteristics						
Sex of household head (male = 1)	−0.008	−0.023	−0.006*	0.035***	0.005	−0.003
	(0.031)	(0.032)	(0.004)	(0.007)	(0.005)	(0.033)
Ethnicity of household head	−0.054**	0.058***	−0.017***	0.022**	−0.009***	2.08E−04
	(0.023)	(0.012)	(0.005)	(0.009)	(0.002)	(0.021)
Children below age 5 (dummy)	0.007	0.008	−0.005*	−0.004	−0.001	−0.006*
	(0.009)	(0.009)	(0.002)	(0.002)	(0.001)	(0.003)
Number of household males over age 15	0.010	−0.010**	−0.003	0.011*	−0.003**	−0.005
	(0.011)	(0.004)	(0.002)	(0.005)	(0.001)	(0.005)
Number of household females over age 5	−0.014*	0.001	−0.007***	0.010**	−4.73E−04	0.011
	(0.007)	(0.006)	(0.002)	(0.003)	(0.001)	(0.007)
Control variable						
2006 Male employment creation in main destination countries*Age of household head	3.63E−05	−9.32E−06	1.83E−05***	−3.54E−05**	−8.21E−06**	−1.68E−06
	(4.29E−05)	(1.79E−05)	(5.00E−06)	(1.30E−05)	(3.44E−06)	(2.52E−05)
Selection controls						
	0.028	−0.071	0.027***	−0.001	0.015*	0.002
	(0.100)	(0.055)	(0.009)	(0.016)	(0.008)	(0.066)
$\sigma_3\rho_{31}$	−0.100	0.116**	−0.065***	0.068**	−0.012	−0.007
	(0.091)	(0.049)	(0.014)	(0.030)	(0.007)	(0.057)
$\sigma_3\rho_{32}$	1.314***	−0.373	0.213**	0.229**	0.024	−0.408*
	(0.380)	(0.298)	(0.093)	(0.079)	(0.030)	(0.189)
Constant	0.131	0.089	0.025	0.067	0.028	0.091
σ_3	1.96	4.41**	14.51***	3.71*	2.19	.02
Chi^2 test for joint significance of selection controls	.33	.14	.43	.28	.07	.27
Adj. R^2						

Notes: N = 3,884 households, 210 with international remittances (from African or other countries), the rest are only used in the first stage of the method. The model also includes: age of household head, number of days with illness in last week by household members, total number of land acres owned by household, whether household lives in ecological zone, population in region times age of household head, international migration rate in 1998–99 times age of household head, urban/rural dummy, nine regional dummy variables, the inverse of the expenditure of the household, and interactions of each of the variables with the inverse of the household expenditure. None of these variables are reported in the table. All values are weighted. Standard errors are clustered by region. They are bootstrapped standard errors (1,000 repetitions). The first stage of the model is shown in Table 4.

* Significant at the 0.10 level.

** Significant at the 0.05 level.

*** Significant at the 0.01 level.

Table 8. *Marginal budget shares on expenditure for non-remittance and remittance-receiving households, Ghana, 2005–06*

Expenditure category	No remittances	Receive internal remittances (from Ghana)		Receive international remittances (from African or other countries)	
	Estimated	Estimated	Counterfactual	Estimated	Counterfactual
Food	0.5130	0.5430	0.5483	0.5215	0.5346
Consumer goods/Durables	0.1707	0.1603	0.1698	0.1870	0.1664
Housing	0.0482	0.0428	0.0414	0.0453	0.0429
Education	0.0506	0.0427	0.0419	0.0368	0.0355
Health	0.0488	0.0427	0.0423	0.0448	0.0435
Other goods	0.1687	0.1685	0.1609	0.1646	0.1669
Total	1.0000	1.0000	1.0046	1.0000	0.9897

Notes: $N = 3{,}884$ households: 2,515 with no remittances, 1,159 with internal remittances (from Ghana), and 210 with international remittances (from African or other countries). Expenditure categories are defined in Table 2. Estimated MBS refers to using the MBS coefficients for type s households with households of type s. Counterfactual MBS obtained using the MBS coefficients for type l households with households of type s.

Table 9. *Pairwise Average Treatment Effects on the Treated (ATT), using the Dubin and McFadden method, Ghana, 2005–06*

Expenditure Category	Households in treatment "receive internal remittances" compared to expenditure without remittances	Households in treatment "receive international remittances" compared to expenditure without remittances
Food	−0.96% (−3.02)***	−2.44% (−3.6)***
Consumer goods/Durables	−5.58% (−6.1)***	12.35% (3.2)***
Housing	3.28% (5.1)***	5.68% (3.2)***
Education	1.89% (3.4)***	3.63% (4.3)***
Health	0.84% (3.7)***	3.04% (3.01)***
Other goods	4.74% (4.4)***	−1.36% (−3.5)***

Notes: $N = 3{,}884$ households: 2,515 with no remittances, 1,159 with internal remittances (from Ghana), and 210 with international remittances (from African or other countries). Expenditure categories defined in Table 2. Numbers in parenthesis are two tailed t-tests.
*** Significant at the 0.01 level.

age of household head, MALEMP is employment creation rate in top destination countries, MIG98 is the migration rate in region in 1998–99, URB is whether household lives in urban areas, and REG represents a set of nine regional dummies (with Greater Accra Region omitted).

In estimating the model we use household expenditure, rather than income data. We do this for several reasons. Since the purpose of the analysis is to estimate the impact of remittances on the marginal spending behavior of households, expenditure data are more useful than income data. Moreover, in developing country situations like Ghana, expenditures are often easier to measure than income because of the many problems inherent in defining and measuring income for the self-employed in agriculture, who represent such a large proportion of the labor force.

The model as a whole is identifiable because the instrumental variables, which are included in the first-stage equation, are excluded in the second-stage equation. However, this type of identification creates several potential econometric problems. For example, since the instrument provides independent information at the regional level, this information is shared by all individuals living in that region and thus generates correlation of observations within a region. We solve this problem by clustering standard errors by region. Another possible problem is that the estimation error which is introduced in the model by using a two-step procedure can inflate standard errors. To address this issue we implement a bootstrap procedure and these are the standard errors reported for the estimation of Eqn. (12).

Table 4 presents results from the first-stage choice equation of the multinomial logit selection model. The table shows the marginal effects of the variables included in the first stage equation, which are obtained from the coefficients included in the estimation.

The most important variables in Table 4 are the two instrumental variables. As might be expected, the table shows that distance to railroad station in 1930 has a negative and significant impact on the probability of receiving internal remittances. The table also shows that unexpected job creation in main destination countries in 2005 has a negative and significant impact on the probability of receiving international remittances. A chi square test of joint significance shows that the two instrumental variables—distance to railroad station together with unexpected job creation in main destination countries—are statistically significant at the 1% level.

Tables 5–7 show the results of the second-stage equation for each expenditure category and for each of the three types of household: households with no remittances (Table 5), households receiving internal remittances (from Ghana) (Table 6), and households receiving international remittances (from African or other countries) (Table 7).

The most important variable in these tables is the selection term, which is the $\sigma_s\rho_{si}$ variable. For households with no remittances (Table 5) the $\sigma_s\rho_{si}$ variable is significant for two

Table 10. *Testing for endogeneity and robustness: alternative specifications to obtain Pairwise Average Treatment Effects on the Treated (ATT), Ghana, 2005–06*

Expenditure category	Households in treatment "receive internal remittances" compared to expenditure without remittances			Households in treatment "receive international remittances" compared to expenditure without remittances		
	(a)	(b)	(c)	(a)	(b)	(c)
Food	−1.15% (−4.1)***	1.10% (1.1)	0.14% (0.165)	−0.27% (−.74)	−26.61% (−3.1)***	−33.38% (−3.8)***
Consumer goods/Durables	−4.86% (−3.1)***	−54.05% (−3.7)***	−50.41% (−5.2)***	7.66% (2.9)***	66.84% (3.3)***	88.77% (3.1)***
Housing	3.16% (3.9)***	192.31% (5.2)***	171.05% (7.8)***	5.68% (3.3)***	431.82% (4.1)***	431.82% (4.1)***
Education	1.99% (3.5)***	310.00% (4.1)***	350.00% (6.9)***	5.03% (3.5)***	−33.15% (6.4)***	−36.46% (2.9)***
Health	0.83% (3.1)***	84.62% (2.9)***	92.31% (3.2)***	3.27% (2.9)***	246.15% (3.5)***	215.38% (3.8)***
Other goods	4.41% (4.1)***	258.18% (3.3)***	248.19% (6.9)***	−0.43% (1.2)	126.54% (3.7)***	131.90% (3.9)***

Notes: $N = 3{,}884$ households: 2,515 with no remittances, 1,159 with internal remittances (from Ghana), and 210 with international remittances (from African or other countries). Column (a) excludes variable on the landholding of the household; column (b) excludes variables on the educational characteristics of the household; and column (c) excludes variables on both the landholding and the educational characteristics of the household. Expenditure categories defined in Table 2. Numbers in parenthesis are two tailed *t*-tests.
*** Significant at the 0.01 level.

expenditure categories and for households receiving internal remittances (Table 6) it is significant for one category. However, for households receiving international remittances (Table 7) this variable is significant for four expenditure categories. These results suggest that selectivity in unobservable components matters for all households. In other words, estimations ignoring the selectivity part of the model would be biased.

Table 8 takes the coefficients from Tables 5–7 and calculates the estimated marginal budget shares for the six categories of expenditure for each type of household. This table accounts for selectivity because it includes the derivative of the selection term with respect to household expenditure.

Table 8 also shows the counterfactual marginal budget shares used in the estimation of the two pairwise Average Treatment Effects on the Treated (ATT). The first counterfactual is $E(MBS_3/s = 1)$, which represents the expenditure that households with internal remittances (from Ghana) would have had without the receipt of remittances. It is obtained using the equation for expenditure shares for households that receive no remittances on households that receive internal remittances, taking into account the selection part that the household receives internal remittances. The second counterfactual is $E(MBS_3/s = 2)$ which represents the expenditure that households with international remittances (from African or other countries) would have had without the receipt of remittances.

Table 9 shows the Average Treatment Effects on the Treated (ATT) for the six categories of expenditure. Four results are noteworthy. First, compared to what they would have spent without the receipt of remittances, households receiving either internal or international remittances spend less at the margin on one key consumption good: food. At the mean, households receiving internal or international remittances spend 1% or 2.4% less at the margin, respectively, on food than what they would have spent without the receipt of remittances.[15] Second, households receiving either internal or international remittances spend more at the margin on one important investment good: education. At the mean, households receiving internal or international remittances spend 1.9% or 3.6% more at the margin, respectively, on education than what they would have spent without the receipt of remittances. These marginal increases in spending on education are important because they can help raise the level of human capital in Ghana. Third, households receiving either internal or international remittances spend more at the margin on housing. At the mean, households with internal or international remittances spend 3.3% or 5.7% more, respectively, on housing than what they would have spent without the receipt of remittances. Finally, households receiving either internal or international remittances spend more at the margin on health. At the mean, households with internal or international remittances spend 0.8% or 3% more, respectively, on health than what they would have without the receipt of remittances.

6. TESTING FOR ENDOGENEITY AND ROBUSTNESS OF RESULTS

The results in Table 9 are instructive but they are estimated using a model (Eqn. (12)) that includes several variables which may be endogenous and might therefore bias results. These possibly endogenous variables include those related to the human capital of household members and the landholdings of the household. On the one hand, these variables clearly represent investments made by the household and could be caused by the receipt of internal or international remittances. If this is the case, the results in Table 9 would suffer from endogeneity bias leading to either the under- or over-estimation of the actual effects of remittances. However, on the other hand, excluding these human capital and landholding variables may be wrong if the decision model by which households make choices about their investments includes the level of education of household members and the amount of land that they own. For example, it is likely that households with more educated members or more land will invest differently in education than households with no educated members or households that are landless.

To test for the endogeneity of variables in Tables 9 and 10 therefore presents three different types of estimations. The estimations in column (a) exclude all landholding variables from the model, those in column (b) exclude all human capital variables, and those in column (c) exclude both landholding and human capital variables.

Table 11. *Number of observations by poverty and remittance status, Ghana, 2005–06*

Remittance status	Poverty status	
	Poor	Not Poor
Receive international remittances	46	164
Receive internal remittances	540	619
No remittances	1,134	1,381

Notes: $N = 3{,}884$ households: 2,515 with no remittances, 1,159 with internal remittances (from Ghana), and 210 with international remittances (from African or other countries).

On the whole, the ATT results in Table 10 are similar to those in Table 9. With respect to food, while the size of the estimated results is typically larger than those in the previous table, Table 10 shows that in 4 out of 6 cases households receiving internal or international remittances spend less at the margin on food than what they would have spent without the receipt of remittances. Similarly, with respect to education, housing and health, in 16 out of 18 cases Table 10 shows that households receiving internal or international remittances spend significantly more at the margin on education, housing, and health than what they would have spent without the receipt of remittances.

In column (c) of Table 10, when both landholding and human capital variables are excluded from the model, the size of the estimated increases in marginal expenditures on education, health, and housing becomes quite large. These results suggest that the landholding and human capital variables are probably endogenous, but need to be included in the model to avoid over-estimating the size of the effects of remittances on household expenditures.

7. ESTIMATING A MULTINOMIAL PROBIT MODEL FOR REMITTANCES AND POVERTY

In this section, we analyze the impact of remittances on poverty in Ghana. Poverty is defined here on the basis of a national poverty line of 3,066,000 cedis/person/year, which is equal to the national poverty line used by the Ghana Statistical Service in 1998–99, updated by inflation. [16]

To pursue this analysis we use a modified version of the strategy suggested by Carrasco (2001). According to Carrasco (2001), the effect of an endogenous discrete variable on another discrete endogenous variable can be identified by modeling the joint decision process faced by the household. By modeling this decision process it is possible to control for the correlation between various household choices as well as the possible endogeneity of these choices. This enables us to identify the causal effects of receiving internal or international remittances on the probability of household poverty.

To implement the model we extend the polychotomous choice model presented in Section 4 as follows. After deciding whether or not to receive remittances, households wind up in one of six alternatives in a decision tree: (a) households receive international remittances and are poor; (b) households receive international remittances and are not poor; (c) households receive internal remittances and are poor; (d) households receive internal remittances and are not poor; (e) households do not receive remittances and are poor; or (f) households do not receive remittances and are not poor.

Table 11 shows the number of observations for households in each one of these six alternatives. As might be expected, most households fall into one of two alternatives: (a) they do not receive remittances and are poor; or (b) they do not receive remittances and are not poor.

With these household probabilities defined, the effect of remittances on poverty is identified as follows. For households receiving internal or international remittances, we identify the probability of receiving internal or international remittances and being poor, and we also identify the counterfactual probability of receiving internal or international remittances and not being poor. The difference between the two probabilities is then said to be the effect of remittances on the probability of being poor (Carrasco, 2001). [17]

It is important to emphasize that while our conceptual model establishes that the fact of being poor is exogenous to the receipt of remittances, in implementing the model we follow a more liberal view since our model allows for the possibility of correlation between the choices taken by the households. [18]

The multinomial probit model is estimated in two ways: first, using all the variables in the model (Eqn. (12)); and second, excluding the human capital variables because they might be endogenous. [19] Table 12 reports the results of estimating the probit model in these two ways to calculate Average Treatment Effects on the Treated (ATT) for the probability of being poor for households receiving internal or international

Table 12. *Pairwise Average Treatment Effects on the Treated (ATT), using the multinomial probit model with correlation between choices, Ghana, 2005–06*

Probability estimated	Households in treatment "receive internal remittances"		Households in treatment "receive international remittances"	
	(a)	(b)	(a)	(b)
Being poor and receiving internal remittances	17.6%	17.7%	–	
	(.511%)	(.51%)		
Not being poor and receiving internal remittances	21.2%	21.04%	–	
	(.422%)	(.41%)		
Being poor and receiving international remittances	–		.44%	.43%
			(.075%)	(.08%)
Not being poor and receiving international remittances	–		13.55%	13.28%
			(.608%)	(.58%)
ATT	−.0362***	−.0325***	−.131***	−.128***
	(−4.5)	(−4.1)	(−7.5)	(−4.8)
ATT (%)	−16.9%	−15.4%	−96.6%	−96.3%

Notes: $N = 3{,}884$ households: 2,515 with no remittances, 1,159 with internal remittances (from Ghana), and 210 with international remittances (from African or other countries). Column (a) includes all variables in the model (Eqn. (12)) and column (b) excludes variables on the educational characteristics of the household. Estimated probabilities are calculated from an Alternative Specific Multinomial Probit Model. Numbers in parenthesis are standard errors, except for the ATT row where they are two tailed *t*-tests.

*** Significant at the 0.01 level.

remittances in Ghana.[20] Column (a) of the table reports the ATT results using all the variables and column (b) reports the ATT results excluding the human capital variables.

Column (a) of Table 12 shows that the counterfactual probability of being poor and receiving internal remittances is 17.6%. The probability of not being poor and receiving internal remittances is 21.2% for the same set of households. Consequently, receiving internal remittances in Ghana reduces the probability of being poor by 16.9%.[21]

Column (a) of Table 12 also shows that the counterfactual probability of being poor and receiving international remittances is 0.44%. The probability of not being poor and receiving international remittances is 13.55%. In other words, receiving international remittances in Ghana reduces the probability of being poor by a very large 96.6%.[22]

In Ghana international remittances have a much larger impact on reducing the probability of poverty than internal remittances because the former are much larger in absolute value than the latter. According to Table 1, mean annual per capita remittances for households receiving international remittances (from African or other countries) are 3,616,000 cedis/person/year *versus* only 982,000 cedis/person/year for internal remittances. These figures reflect the very different wage and income-earning possibilities facing households receiving international remittances—especially from Europe and the United States—*versus* those facing households receiving remittances from Ghana. Because the remittances received by households from international sources are about 3½ times larger in absolute value than those received from within Ghana, international remittances have a much larger effect on reducing the probability of poverty than internal remittances.

Column (b) of Table 12 shows the ATT results when human capital variables are excluded from the estimating probit model. As explained in Section 5, these human capital variables may be endogenous and thus may generate biased estimations. The results in column (b) are quite similar to those in column (a), suggesting that the endogeneity of the human capital variables does not bias the results of the multinomial probit model.

8. CONCLUSION

Using data from the first nationally-representative household survey on remittances in Ghana, this paper has analyzed the impact of internal and international remittances on household investment and poverty in that country. Three key findings emerge.

First, when compared to what they would have spent without the receipt of remittances, households receiving either internal remittances (from Ghana) or international remittances (from African countries or other countries) spend less at the margin on one key consumption good: food. At the mean, households receiving internal or international remittances spend 1% or 2.4% less at the margin, respectively, on food than what they would have spent on this good without the receipt of remittances.

Second, households receiving either internal or international remittances spend more at the margin on three important investment goods: education, housing, and health. Compared to what they would have spent without the receipt of remittances, at the mean households receiving internal or international remittances spend 1.9% or 3.6% more at the margin on education, 3.3% or 5.7% more at the margin on housing, and 0.8% or 3% more at the margin on health. While these remittance-inspired increases in investment may seem small, it is important to note that they take place in a Sub-Saharan African country (Ghana) where household incomes are quite low and are only a fraction of household incomes in other remittance-receiving countries (e.g., Mexico and the Philippines).

Third, and finally, this paper finds that the receipt of remittances greatly reduces the likelihood of household poverty in Ghana. For households receiving internal remittances the likelihood of being poor falls by 17%, and for households receiving international remittances the likelihood of being poor falls by a very large 97%. In Ghana international remittances have a much larger impact on reducing the probability of poverty than internal remittances because they are about 3½ times larger in absolute value than internal remittances.

These findings hold when we control for potential selection in unobservable household characteristics, which is important in certain situations. These results also hold when we control for potential simultaneity, which is important because household decisions regarding the receipt of remittances may be correlated with other household decisions.

The findings of this study are important from a policy perspective because they support a growing view in the literature that remittances can have a positive impact on economic development by reducing poverty and increasing the level of household investment in human and physical capital. In Ghana households receiving internal or international remittances are less likely to be poor and spend less at the margin on one key consumption good: food. Instead of spending more of their marginal income on food, households receiving internal or international remittances in Ghana tend to view their remittance earnings as a temporary (and possibly uncertain) stream of income, one to be spent more on investment goods, like education, housing, and health. Over time it is likely that these remittance-inspired household-level investments in education, housing, and health can make a positive contribution to economic development from the "bottom-up."

NOTES

1. According to the World Bank (2010), in 2006 per capita GDP (PPP, constant 2005 international dollars) was $1,254 in Ghana, $3,152 in the Philippines, and $12,658 in Mexico.

2. This migration and remittances module included about 45 questions on the socio-economic characteristics of current migrants, including their age, educational status, occupation, and amount of remittances (cash, food, and non-food goods) sent home.

3. Non-food goods include such items as household appliances (stoves, refrigerators), vehicles, and equipment.

4. In the 2005–06 Ghana GLSS 5 Survey only 49% of internal migrants (within Ghana) and 68% of international migrants (to African or other countries) remit. These figures are similar to those observed in other countries. For example, in their study in the Dominican Republic, de la Briere, Sadoulet, de Janvry, and Lambert (2002) find that only one- half of all international migrants remit.

5. In the 2005–06 Ghana GLSS 5 Survey 56% of households receiving internal remittances (from Ghana) and 50% of households receiving international remittances (from African or other countries) do not have a migrant. On average, these non-migrant households receiving remittances receive less in per capita remittances than migrant households that receive remittances.

6. The functional form used in this analysis differs from the Working–Leser model because it includes an intercept in equation (1). In theory, C_i should always equal zero whenever total expenditure EXP is zero, and this restriction should be built into the function. But zero observations on EXP invariably lie well outside the sample range. Also, observing this restriction with the Working–Leser model can lead to poorer statistical fits. Including the intercept term in the model has little effect on the estimation of marginal budget shares for the average person, but it can make a significant difference for income redistribution results. For more on the Working–Leser model, see Prais and Houthakker (1971).

7. Ideally, we would like to model both the household decision of sending migrants and the household decision to receive remittances. However, as explained in the data section, this cannot be done because in the 2005–06 Ghana Survey only about one-half of all migrants remit and about one-half of all remittance receiving households have no migrant. Thus, if we attempted to analyze data according to migration cum remittance behavior, the number of observations for each cell would be very small.

8. The derivation for this equation is available from the authors upon request. The derivation follows Dubin and McFadden (1984) and Bourguignon, Fournier, and Gurgand (2007).

9. See Adams and Cuecuecha (2010) for a detailed explanation on the value of the λ_{ih} term.

10. According toBourguinon, Fournier and Gurgand (2007), the Dubin and McFadden method (1984) performs better than other methodologies, like the Lee method (1983), in Monte Carlo experiments, even when the Independence of Irrelevant Alternatives, implicit in models using the multinomial logit model, is violated.

11. This derivation applies to all goods i, therefore we abstract from it in this derivation.

12. The derivation of the term $\mu_{lh,m}\lambda_{h,m} + \mu_{lm,m}\lambda_{m,m}$ can be found in Adams and Cuecuecha (2010).

13. According to the 2005–06 Ghana Survey, the main countries or regions of origin for remittances received in Ghana are: the United Kingdom, the United States, the rest of Europe, and other African countries.

14. Household size is excluded in this equation to reduce the risk of using too many endogenous variables as control variables.

15. These percentage figures are calculated as follows: estimated ATT (θ^*_{kli}) (in Table 9) divided by the expected value of the counterfactual MBS ($E(MBS_{li}/s = k.)$) (in Table 8). The intuition is that the ATT shows the change in expenditure behavior produced by remittances, while the counterfactual MBS shows the expenditure behavior that the households would have had without the receipt of remittances.

16. The 1998–99 national poverty line in Ghana is 684,401 cedis/person/year, which is equivalent to the poverty headcount index of 39.9% that is cited as the 1998–99 poverty line for Ghana (Ghana Statistical Service, 2000: Table 2). This poverty line is defined as the level of per capita expenditures needed to meet the costs of basic food and non-food requirements in Ghana. For more details on this national poverty line, see Ghana Statistical Service (2000).

17. The Carrasco (2001) method allows us to estimate the effect of not being poor on the probability of receiving remittances. More information on this point is available from the authors upon request.

18. Implementation of this model follows ideas and algorithms presented in Bolduc (1999), Genz (1992), Geweke (1989), Hajivassilou and McFadden (1998), and Keane and Wolpin (1994).

19. For a detailed explanation about the multinomial probit model, see Cameron and Trivedi (2005).

20. Coefficients and marginal effects for the multinomial probit model are available from the authors upon request. They are not presented here for reasons of space.

21. This percentage figure is calculated as follows: $((17.6 - 21.2)/21.2) * 100 = 16.9\%$.

22. This percentage figure is calculated as follows: $((.44 - 13.55)/13.55) * 100 = 96.6\%$.

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