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Article (Accepted Version)

Jena, Farai (2018) Migrant remittances and physical investment purchases: evidence from Kenyan households. *Journal of Development Studies*, 54 (2). pp. 312-326. ISSN 0022-0388

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Migrant Remittances and Physical Investment Purchases: Evidence from Kenyan Households

Abstract

This paper investigates the impact of remittances on household decisions to purchase physical investments in Kenya using household survey data. An instrumental variables approach is employed using rainfall variation and mobile network coverage as instruments to control for the endogeneity of remittances. The empirical evidence obtained is suggestive of remittances having a positive and significant effect on the decisions by households to purchase physical investments.

I. Introduction

There is no general consensus in the literature regarding what remittances are used for at the receiving household level. For example, some studies argue that remittances are mainly spent on immediate consumption goods such as food and utilities (e.g., see Chami *et al.* 2003; Simiyu 2013), while an alternative view in the literature argues households consider remittances to be a form of transitory income which will be spent more at the margin on human and physical capital investments than on consumption goods (e.g., see Glytsos 2002; León-Ledesma and Piracha 2004; Woodruff and Zenteno 2007; Adams and Cuecuecha 2013). This implies that remittances may potentially contribute positively to local economic development (e.g., see Adams 1998) and poverty reduction (e.g., see Maimbo and Ratha 2005). However, even when remittances are spent on consumption goods such as food, they may still enhance the well-being of households and enable them to reduce poverty directly and engage in productive activities that facilitate poverty reduction.

The current paper contributes to one of the long-standing debates in the literature concerning the uses of remittances by households. In particular, we investigate whether Kenyan households utilize remittances in a “productive” manner through investing in physical capital. This is a relatively

under-researched topic and one that is germane to current debates within the literature. It is generally acknowledged that the evidence on the uses of remittances for investments based on household surveys is somewhat limited for Africa (see Ratha *et al.* 2011). It is especially the case that there are few empirical studies that explicitly investigate whether remittances are used for the acquisition of physical investments instead of being consumed immediately.

Kenya provides a particularly compelling context to undertake empirical research on remittance uses as there are only a few studies that have conducted similar research hitherto (e.g., Simiyu *op cit.*). However, remittances are playing an increasingly prominent role in the economy. External remittances are the fourth-largest source of foreign exchange for the Kenyan economy after revenue from tea, horticulture and tourism (e.g., see Bett 2013). The International Organization for Migration (IOM) reports that while revenue to the government from traditional exports such as tea and coffee has diminished in the past five years, remittance inflows continue to increase. On average, Kenya receives 60 per cent of all remittances to East Africa and 10 per cent of those to Sub-Saharan Africa (Ngugi 2011). World Bank estimates suggest that Kenya was the third largest recipient of remittances in Sub-Saharan Africa in 2010, with only Nigeria and Sudan having larger remittance inflows. Remittance flows into Kenya are estimated to have been about USD 1.8 billion, exceeding net official development assistance (ODA) and net foreign direct investment (FDI), which were USD 1.4 billion and USD 0.1 billion respectively. Kenya was also among the top ten remittance recipient countries as a percentage of GDP, with remittances amounting to 5.4% of its GDP. A 2006 World Bank study estimates that remittances reduced the number of people living in absolute poverty (defined here as less than one US dollar per day) in Kenya by about two per cent. In a 2010 World Bank-Central Bank of Kenya survey 14% of Kenyan adults report they regularly receive remittances. The survey estimates that each adult receives an average of USD 735 from abroad per year. A quarter of respondents who receive remittances in the survey revealed that they rely on them to cover at least some of their daily expenses such as food, clothing, housing, utilities, and medicine.

Historically, internal remittances in Kenya have played an important role as sources of income for migrant sending households (see, e.g., Barber 1988; Knowles and Anker 1977). Studies such as Hoddinott (1992 and 1994), Knowles and Anker (1981), and Johnson and Whitelaw (1974) reveal that the remittances sent by internal migrants play a pivotal role in supporting the origin households. Internal remittances continue to enable Kenyan households to diversify their income sources (e.g., see Francis 2002; Sindi and Kirimu 2006; Plaza *et al.* 2011). Internal remittances have also attracted more attention in Kenya in recent years with the introduction of the M-PESA mobile money service in 2007 (see, e.g., Jack and Suri 2011; Mas and Radcliffe 2011).

Despite the prominence of both internal and international remittances in the Kenyan economy, to the author's knowledge, no empirical study has assessed the effect of remittances on the acquisition of physical investments. The current paper aims to fill these lacunae in the literature using a household survey specifically designed to capture migration and remittance flows in order to make inferences about remittance uses in a way no previous survey has done to date for Kenya. The allocation of remittances towards physical investments is a valuable research topic to explore for Kenya. For example, physical investments may provide direct and indirect benefits through enabling households to undertake activities that potentially generate employment at the household or community level, or improve farming and other productivity. Also, the acquisition of physical investments may boost local businesses if their demand is met locally. Thus, these types of investment are likely to have multiplier effects in the local economy.

The paper is structured as follows. Section II provides a brief review of the literature relating to the uses of remittances with a specific focus on productive investments. Section III presents and briefly discusses the data and summary statistics for the key variables used in the econometric analysis. In section IV the econometric methodologies used to undertake the analysis are discussed. Section V presents and discusses the empirical results. Finally, section VI provides some concluding remarks.

II. Literature review

There is some evidence in the existing literature supporting the use of remittances for the acquisition of physical investments. For example, Adams and Cuecuecha (2010) find that Guatemalan households that receive remittances spend more at the margin on housing. Remittances are shown to play a role in financing the capital of microenterprises in urban Mexico (Woodruff and Zenteno 2007), and in rural Pakistan, remittances have been shown to increase the propensity to invest in agricultural land (Adams 1998). Amuedo-Dorantes and Pozo (2014) examine the role that the uncertainty of remittance income has on asset accumulation in Mexico. The study finds that both the size and the uncertainty of remittances increase asset accumulation among recipient households.

However, the evidence on the use of remittances for investment in the context of Africa is limited (Ratha *et al.* 2011). In the case of Kenya, most of the evidence draws on early studies and is somewhat mixed. For example, Rempel and Lobdell (1978) investigate the uses of internal remittances sent to rural households in Kenya. They find little evidence of urban-rural remittances providing a significant impetus to rural economic development. However, this study has been criticized for failing to account for the fungibility of the financial resources of rural households (see Collier and Lal 1984). Their analysis is also based on self-reported data on the uses of remittances. However, self-reported remittance use by households is generally unreliable and unlikely to convey an accurate effect of remittance receipt on the expenditure behaviour of households.

In contrast, Collier and Lal (*op cit.*) report for rural Kenya that internal remittances enable the recipient households to hold more productive capital than non-recipient ones. Kiiru (2010) suggests that internal and international remittances in Kenya are often allocated to income generating activities and expenditures related to education, health, housing and food. Remittances have also been shown to provide a social safety net for Kenyan households (Lacroix 2011).

In a recent study, Simiyu (2013) investigates the effect of internal and international remittances on household expenditure categories using panel data for 2007 and 2009 for a sample of rural households from the Rift Valley and Nyanza provinces of Kenya. The results obtained indicate that remittances are mainly used for immediate consumption needs such as utilities and transportation costs. The study finds that remittances exert a negative impact on education expenditure as a share of total household expenditure, but impact positively on food, health and other household expenditure categories. The author attributes this finding to the small size of remittances which means they can generally only be spent on daily consumption needs and necessities. However, the study is quite restricted in its analysis especially as the sample used is relatively small comprising just 295 households drawn from only two of the eight provinces in Kenya.

Descriptive statistics based on household survey data collected as part of the Africa Migration Project reveal that a significant proportion of international remittances are spent on land purchases, building a house, business, improving a farm, agricultural equipment, and other investments.ⁱ For international remittances, investment in these items as a share of total remittances represented 36 per cent in Burkina Faso, 55 per cent in Kenya, 57 per cent in Nigeria, 16 per cent in Senegal, and 20 per cent in Uganda (see Ratha *et al. op. cit.*). In addition, a substantial share of remittances sent by migrants resident in other African countries was also used for these purposes in the case of Burkina Faso, Kenya, Nigeria, and Uganda. However, the study indicates that the share of internal remittances allocated towards these investments was much lower in all the countries surveyed, with the exception of Nigeria and Kenya. The statistics contained in this study are based on what items the households surveyed are reported to have used the remittances received. However, as already noted it is acknowledged that self-reported remittance uses are unreliable as households tend to either report their use of remittances inaccurately or ignore fungibility. Therefore, the current study contributes to the existing literature by employing empirical techniques that enable us to more accurately identify the uses of remittances to purchase physical investments.

Adams and Cuecuecha (2013) use household survey data from the 2005/6 Ghana Living Standards Survey (GLSS 5) to investigate the impact of internal and international remittances on household expenditure behaviour. They find that households receiving remittances in Ghana spend more at the margin on housing and human capital investments.

Osili (2004) uses the U.S.-Nigeria survey conducted in 1997 to analyse migrants' housing investments in their communities of origin. The study finds that older migrants are more likely to invest in housing in their home town and to devote a larger share of their household income to housing investments.

The literature review provides a summary of studies that have examined the effect of remittances on the acquisition of physical investments and related goods. The empirical approaches taken by these studies differ. However, the literature is useful in enabling us to identify the key variables to use in the regression models and also guides the definitions of these variables. As discussed above, few studies on Kenya have investigated the effects of remittances using empirical rather than descriptive techniques. Hence, the current analysis contributes to the literature by employing empirical techniques that enable the effects of remittances on the acquisition of physical investments to be identified more robustly.

III. Data and summary statistics

The data used in this paper are obtained from the 2009 Migration and Remittances Household Survey in Kenya and were collected between late October and mid-December 2009. The survey is a single-round, cross-sectional survey capturing information about households with internal, external, and no migrants. It was conducted as part of the Africa Migration Project, which was jointly undertaken by the African Development Bank and the World Bank to improve understanding of migration and remittances in Sub-Saharan Africa. The University of Nairobi was the primary institutional investigator for the survey.

A main caveat of the survey is that it is not nationally representative because to ensure that households with external migrants were adequately captured, migrant households were over-sampled in the initial stage (see Plaza *et al.* 2009). Selected households were then classified into external, internal, or non-migrant households. Finally, each of these three groups of households were treated as an independent sub-frame and random sampling was then used to select households within each group. A total of 1,942 households in 17 districtsⁱⁱ were surveyed within the eight provinces of Kenya. To account for the survey design the standard errors reported in the current paper are clustered by district and migrant status.ⁱⁱⁱ

The main respondent to the survey was the head of the household, or his/her representative. Of the households that were surveyed, 49% were urban based and 51% rural. The largest proportion of households were non-migrant (35%), followed by external (30%), internal (29%), and both internal and external (6%). At the individual level, information was obtained on a total of 8,343 non-migrants and 2,245 migrants whose information was reported by the household head. A local survey firm in Kenya conducted the fieldwork, which involved collecting the data, validating and inputting the responses, and then constructing datasets subsequently provided in STATA format. Jena (2016) provides additional description of the data employed.

In the analysis undertaken here, the dependent variable of primary interest assumes a value of one if the household purchased physical investments and zero otherwise. In this study, physical investments refer to those outlays for which the individual expects to enjoy some pecuniary return in the future. Physical investments comprise the establishment of a business/opening of a store,^{iv} the purchase of productive assets such as a sewing machine or water pump, and purchasing farming equipment such as trucks, tractors, and spraying machines.^v The amount of money spent on these items over the previous six months is reported by the household. Thus, we construct a dummy variable capturing whether a household purchased physical investments in the previous six months.

Table I provides a list of the items contained in the physical investments expenditure category and the proportion of households in the survey reporting to have purchased each item.

Table I: Description of physical investments

Goods/commodities	Proportion
Setting up a business/opening a store	0.068
Productive assets (e.g., sewing machine, water pump)	0.023
Farming equipment (e.g., trucks, tractor, ox plough, harvester, spraying machines, water pumps)	0.066

The explanatory variables included in the regression models comprise the age, gender, education level, and employment status of the household head. Measures were also computed for the total expenditure per capita of the household, the number of children less than seven years, the number of elderly people greater than 59 years, and the household size. The explanatory variable relating to the receipt of remittances by the household is of primary concern for the current analysis. A variable was constructed to measure whether the household received any cash remittances in the 12 months prior to the interview date.

A limitation inherent in the data is that there is no information on household income levels and thus we use the logarithm of household expenditure per capita as a proxy for the income level of the household.^{vi} An extensive literature exists in support of the theoretical underpinnings of consumption expenditures as a measure of current and long-run household welfare (see, e.g., Deaton 1997; Deaton and Muellbauer 1986; Deaton and Zaidi 2002). Another data limitation is that expenditure items are reported for the past six months but remittances received by the household are reported for the period relating to the previous 12 months. This means that the incidence of physical investment purchases are understated in the dependent variable.^{vii}

Table II presents summary statistics for the variables discussed above. After the elimination of some observations due to missing responses, the final sample of usable data comprises 1,864 households, of which 45% received remittances.^{viii}

Table II: Summary statistics of main explanatory variables

	Combined	No-remittances (0)	Remittances (1)	t-test/z-score [†]
<i>Dependent variable:</i>				
= 1 if household purchased physical investments	0.16 (0.37)	0.13 (0.33)	0.21 (0.41)	-4.82***
<i>Explanatory variables:</i>				
Log of total household expenditure per capita	10.913(1.267)	10.867 (1.349)	10.969 (1.157)	-1.73**
= 1 if household received cash remittances	0.449 (0.50)			
Head age < 30	0.139 (0.346)	0.157 (0.364)	0.117 (0.321)	2.52***
Head age 30 to 40	0.208 (0.406)	0.245 (0.431)	0.163 (0.370)	4.38***
Head age 40 to 50	0.203 (0.402)	0.220 (0.414)	0.182 (0.386)	2.60**
Head age 50 to 60	0.189 (0.391)	0.193 (0.395)	0.183 (0.391)	0.55
Head age > 60	0.258 (0.437)	0.180 (0.384)	0.352 (0.478)	-8.63***
χ^2 test (head age)				78.18***
= 1 if head is male	0.687 (0.464)	0.775 (0.412)	0.578 (0.494)	9.32***
= 1 if head has primary education	0.346 (0.476)	0.340 (0.474)	0.354 (0.478)	-0.62
= 1 if head has secondary education	0.383 (0.486)	0.385 (0.487)	0.380 (0.486)	0.21
= 1 if head has university education	0.114 (0.318)	0.137 (0.344)	0.086 (0.281)	3.47***
χ^2 test (head education)				15.24***
= 1 if head is employed	0.334 (0.472)	0.409 (0.492)	0.243 (0.429)	7.69***
= 1 if head is self-employed	0.381 (0.486)	0.382 (0.486)	0.381 (0.486)	0.03
= 1 if head is unemployed	0.156 (0.363)	0.120 (0.325)	0.200 (0.400)	-4.75***
χ^2 test (head employment)				86.55***
No. of children in household	0.597 (0.871)	0.637 (0.878)	0.548 (0.861)	2.18**
Household size	4.260 (2.336)	4.171 (2.363)	4.368 (2.298)	-1.809**
= 1 if household located in urban area	0.486 (0.500)	0.537 (0.500)	0.423 (0.494)	4.95***
N	1864	1027	837	

Notes to the table:

(i) Standard deviations are reported in parentheses. (ii) [†] The hypothesis under test here is: $H_0: \mu_0 = \mu_1$ for continuous or $H_0: \pi_0 = \pi_1$ for discrete. The column provides the t-ratios/z-scores for mean/proportion differences between remittance receiving and non-receiving households. (iii) *, **, *** represent the statistical significance of the differences for the 10%, 5% and 1% significance levels respectively. (iv) The χ^2 tests are testing for differences between remittance receiving and non-receiving households for multinomial categorical variables.

III. Empirical methodology

An important issue to consider for the empirical analysis is the potential endogeneity of the remittances variable. This endogeneity may arise due to the presence of variables that affect both the receipt of remittances by households as well as their expenditure. Failure to control for the endogeneity of remittances is likely to result in biased estimates for the effects of remittances on

expenditure. In addition, the dependent variable for the physical investments purchases is binary. Thus, we employ the recursive bivariate probit model to address both these issues.

The bivariate probit model treats the household's investment and purchase decisions within a discrete choice framework. It accounts for the endogeneity of remittances by modelling the receipt of remittances and the purchase of physical investments simultaneously and through also including the binary remittance variable in the purchase model. It has been established in the literature, both theoretically and empirically, that simultaneous likelihood estimation methods are superior in efficiency terms to conventional two-stage instrumental variable procedures in cases where the researcher is interested in estimating the effect on a binary outcome of a binary endogenous variable (e.g., Wooldridge 2010; Bhattacharya *et al.* 2006; Freedman and Sekhon 2010). We thus employ the simultaneous recursive bivariate probit model (see Maddala 1986). Moreover, a discrete choice model provides a suitable approach for this analysis since our interest lies primarily in the discrete choices made by households in purchasing physical investments. At the same time, the use of a discrete outcome model enables us to overcome the censorship problem of household expenditures on physical investments as it focuses on whether a decision was made, and not how much was spent. The bivariate probit model therefore provides a suitable empirical strategy as it permits us to model the two processes simultaneously while taking into account the discrete nature of both in addition to the endogeneity of the remittance outcome variable.

The recursive bivariate probit model can be formally presented as follows:

$$y_{i0}^* = x_i' \beta_0 + u_{i0} \quad (1)$$

$$y_{i1}^* = z_i' \beta_1 + y_{i0} \beta_2 + u_{i1} \quad (2)$$

where u_{i0} and u_{i1} are assumed to be correlated, such that $\text{corr}(u_{i0}, u_{i1}) = \rho$. y_{i0}^* and y_{i1}^* are latent dependent variables that determine the propensity of a household to receive remittances and

spend on physical investments. x_i and z_i are vectors of explanatory variables. Two observable binary indicator variables can be defined to represent the latent variables y_{i0}^* and y_{i1}^* as follows:

$$y_{i0} = \begin{cases} 1 & \text{if } y_{i0}^* > 0 \\ 0 & \text{if } y_{i0}^* \leq 0 \end{cases} \quad (3)$$

$$y_{i1} = \begin{cases} 1 & \text{if } y_{i1}^* > 0 \\ 0 & \text{if } y_{i1}^* \leq 0 \end{cases} \quad (4)$$

where y_{i0} (included in expression (2)) and y_{i1} represent whether the household received remittances and the actual decision of whether to spend on physical investments. The empirical focus is on obtaining empirical estimates for the parameter β_2 , the parameter corresponding to the endogenous variable y_{i0} . The parameters for the latent relationship can be estimated by Maximum Likelihood techniques. Because both y_{i0} and y_{i1} are observed for all i , a bivariate probit model with full observability is thus used here. Four possible combinations of observed outcomes exist. From (3) and (4), the probabilities P_{jk} for $j, k = 0, 1$ associated with each of the combinations for any set of parameters are:

$$P_{i00} = \Phi_2(-x_i'\beta_0, -z_i'\beta_1; \rho) \quad (5)$$

$$P_{i11} = \Phi_2(x_i'\beta_0, z_i'\beta_1 + \beta_2; \rho) \quad (6)$$

$$P_{i01} = \Phi_2(-x_i'\beta_0, z_i'\beta_1 + \beta_2; -\rho) \quad (7)$$

$$P_{i10} = \Phi_2(x_i'\beta_0, -z_i'\beta_1; -\rho) \quad (8)$$

where $\Phi_2(\cdot)$ is the cumulative bivariate normal distribution function operator and ρ is the correlation parameter between the unobservables.

The likelihood function for the bivariate probit is given by:

$$L(\beta_0, \beta_1, \beta_2, \rho) = \prod_{i=1}^N P_{i00}^{(1-y_{i0})(1-y_{i1})} \cdot P_{i01}^{(1-y_{i0})y_{i1}} \cdot P_{i10}^{y_{i0}(1-y_{i1})} \cdot P_{i11}^{y_{i0}y_{i1}} \quad (9)$$

The parameters of this function can be estimated using conventional algorithms.

IV. Empirical results

To ensure identification of the parameters of the primary models of interest, we include variables in the remittances model that do not feature in the physical investments model. These instrumental variables should be relevant in predicting the remittance variable but orthogonal to the error term in the latent model for the purchase equation. The following variables are found to be suitable instruments: (i) the variation in rainfall over the past 20 years measured at the district level, and (ii) the number of Safaricom mobile phone towers measured in 2009 at the province level.

Daily rainfall measurements were obtained from the NASA Prediction of Worldwide Energy Resource database using district level geo-coordinates for the 17 districts in the survey. The standard deviation was then computed using historical data dating back 20 years. Studies such as Adams and Cuecuecha (2011) and Munshi (2003) have used changes in rainfall patterns as instruments for migration and the receipt of remittances. This is because rainfall tends to be a good predictor of economic performance especially for a country like Kenya which relies heavily on revenue from tea, coffee and horticulture (see Bett 2013). In addition, agriculture comprises about 30% of the GDP in Kenya (World Bank 2015). Thus, migration is likely to increase with higher rainfall variance. This would have a positive effect on the receipt of remittances in subsequent years. However, historic rainfall patterns are not expected to influence current household purchase decisions.^{ix}

The variable capturing Safaricom coverage in 2009 is a measure of the number of mobile phone towers at the province level as reported in Jack and Suri (2011). Safaricom was the leading communications company in Kenya in 2009 and launched a mobile banking service called M-PESA that allows Kenyans to transfer money via SMS. Provinces with more towers have good mobile network coverage. Higher coverage is likely to facilitate the receipt of remittances and thus be positively correlated to remittance receipt. We interact the mobile coverage variable with a dummy indicating whether a household is located in an urban or rural area. We expect that having good

coverage increases the probability of remittance receipt particularly for rural areas as urban residents have access to more diverse channels of remittance receipt.^x However, the amount of coverage can be reasonably expected to be exogenous to physical investment purchase decisions.

We now check for the relevance of these instruments using the ‘rule-of-thumb’ F-value of 10 suggested by Staiger and Stock (1994). A linear probability model (LPM) is used in the first stage to conduct the relevance tests. An LPM model is also employed in the second stage to test for the orthogonality of the instruments.^{xi} On the basis of the foregoing, the instruments satisfy the relevance criterion but are found to be weak.^{xii} The variables are also found to be orthogonal to the error process in the second stage LPM equation using the Hansen test statistic. Thus, the instruments could be interpreted as valid for the current application in a statistical sense. The test results are provided in Table III.

We now test whether the remittance variable is exogenous in the purchase decision equation. Table III provides a summary of the different tests used to test for the exogeneity of the remittance variable in the model. The Wu-Hausman test for exogeneity is upheld.^{xiii} The estimate for ρ in the bivariate probit model leads to a rejection of the exogeneity of the remittance variable, albeit at the 10% level of significance. Thus, the bivariate probit model with endogenous remittances is the preferred model.

Table III: Testing the exogeneity of the remittance binary variable

Remittance binary variable:	
F-test for instrument relevance	F(2, 262) = 5.60 Prob > F = 0.0041
Hansen statistic (overidentification test of all instruments)	Chi-sq(2) = 0.045 P-val = 0.8325
Underidentification test (Anderson canon. corr. LM statistic)	Chi-sq(2) = 31.036 P-val = 0.0000
Weak identification test (Cragg-Donald Wald F statistic):	15.662
Stock-Yogo weak ID test critical values: 10% maximal IV size	19.93
15% maximal IV size	11.59
20% maximal IV size	8.75
25% maximal IV size	7.25

Sargan statistic (overidentification test of all instruments)	Chi-sq(1) = 0.078 P-val = 0.7795
Wu-Hausman test for exogeneity	F(1,1850) = 1.13118 P-value = 0.28766
Durbin-Wu-Hausman chi-square test	Chi-sq(1) = 1.13904 P-value = 0.28585
Bivariate probit likelihood-ratio test ($\rho = 0$)	chi2(1) = 2.75655 Prob > chi2 = 0.0969

Notes to the table: (i) Rainfall variation and number of Safaricom mobile towers interacted with a dummy variable capturing whether a household is in a rural area are used as instruments (ii) See table V in the appendix for the first stage results.

Table IV reports impact effects for the univariate and bivariate probit models. The estimates in the table reveal that the receipt of remittances, compared to non-receipt, increases the probability of purchasing physical investments by at least six percentage points.^{xiv} This corresponds to an approximately 34% increase in the probability of purchasing physical investments relative to the mean.

Table IV: Univariate and bivariate probit model (impact effects)

VARIABLES	Probit	Biprobit
= 1 if household received cash remittances	0.0587*** (0.0186)	0.0897*** (0.0083)
Other variables included	Yes	Yes
Observations	1,864	1,864
Pseudo R2	0.0953	
Wald test of $\rho=0$:		chi2(1) = 2.75655 (P-value = 0.0969)

Notes to the table:

- (i) ***, ** and * denote statistical significance from zero at the 0.01, 0.05 and 0.10 level respectively using two-tailed tests. (ii) Standard errors clustered by district and migrant status are reported in parentheses. (iii) The regression models also include other explanatory variables that are not shown here in order to conserve space (see table V in the appendix).

Several robustness checks are undertaken using various specifications of the model to ensure that the results hold. The results are reported in table VI in the appendix. Firstly, explanatory variables such as the employment status of the household head, the number of children in the

household and the size of the household may be arguably endogenous to purchase decisions.

Specification I reports the key estimates for the specification where potentially endogenous variables are excluded from the models. The estimates reveal that the key results are robust to the exclusion of potentially endogenous variables for the combined category.

Secondly, the motivation for migration is an important consideration to take into account. For example, whether a migrant left for education or work may lead to substantial differences in both the receipt of remittances by the household and the decision to purchase physical investments. The survey contains a question regarding the primary reason for the migrant living outside the household. As a robustness check, only households with responses relating to job prospects as motivators for the migration of a household member are taken to be migrant households. Specification II shows that the results obtained are robust to this definition of migrant households.

Another concern may relate to selection bias in the decision of whether to migrate. To control for this potential selection bias, we restrict the sample to only those households with migrants and estimate the effects of remittance receipt conditional on migration. Specification III shows that there is a statistically significant positive effect for the receipt of remittances on the purchases of physical investments conditional on migration.

Another way to check if selection bias may be driving our main results is to restrict the sample to only non-remittance receiving households and include a variable capturing whether the household has a migrant. We find that having a migrant does not have a statistically significant effect on the decision to purchase physical investments for those households that did not receive remittances (see specification IV). Thus, there do not seem to be systematic differences in the purchase behaviour of migrant and non-migrant households. This further serves to abate concerns that selection bias may be driving the key results obtained in this analysis.

In addition, it may be argued that the receipt of remittances is picking up the effect of unobservable differences in households that receive remittances and those that do not, rather than the effect of the remittances themselves. Specification V reports estimates where the amount of remittances received is used as the key explanatory variable. A positive effect is obtained for this continuous remittance measure for all cases. Thus, it seems that the actual remittances received are driving household decisions, rather than differences in unobservable variables. The results also hold when both the continuous and binary remittance variables are included in the model (see specification VI).

Lastly, as discussed previously, in the survey expenditures are reported for the past six months while remittances are reported for the past 12 months. This discrepancy in the reporting timeframe may yield biased coefficients for the remittance variable in the regression model. Specification VII in the appendix reports estimates that are obtained when remittances are re-scaled to their six-month equivalent.^{xv}

Overall, the various checks that we conduct show that the key findings of a positive effect for the receipt of remittances on the purchase of physical investments are robust. Nonetheless, given data limitations discussed previously we are cautious not to draw strong conclusions from our empirical findings. We acknowledge that different conclusions may have been reached had the survey employed been more representative.

V. Summary and conclusions

In this paper discrete household decisions in terms of purchasing physical investments are analysed while treating the binary remittances variable endogenously. The findings reveal that the receipt of remittances increases the probability of purchasing physical investments.

Overall, the empirical findings in this paper reveal that remittances exert a significant effect on the purchase of physical investments. The permanent income hypothesis postulates that if

remittances represent permanent income, households are more likely to spend them on commodities requiring additional and recurrent purchases in the future (e.g., utilities, food, and non-food purchases such as clothing). The finding that remittances have a positive effect on the purchase of physical investments seems to suggest that households view remittances as windfall or transitory income.

Finally, the use of remittances for the acquisition of physical investments is tentatively suggestive that remittances may potentially contribute towards poverty reduction at the household level and the enhancement of local economic development. For example, physical investments could be used to generate income thus contributing towards income source diversification and perhaps generating employment for household members. Alternatively, physical investment goods could be sourced locally potentially boosting local businesses. However, more evidence on the nature of these local economic multipliers is clearly required prior to offering a definitive conclusion on this issue.

Table V: First stage regressions

VARIABLES	Physical investments	= 1 if received remittances
Log of total household expenditure per capita (predicted)	0.00124 (0.0160)	0.211*** (0.0268)
Head age < 30	-0.0243 (0.0319)	-0.0457 (0.0454)
Head age 30 to 40	0.000301 (0.0318)	-0.0676 (0.0413)
Head age 40 to 50	-0.00110 (0.0275)	-0.0642* (0.0370)
Head age 50 to 60	-0.00261 (0.0247)	-0.0879** (0.0357)
= 1 if head has secondary education	0.0747*** (0.0218)	-0.0727*** (0.0280)
= 1 if head has university education	0.0869** (0.0361)	-0.381*** (0.0624)
= 1 if head is employed	-0.0486** (0.0245)	-0.234*** (0.0352)
= 1 if head is self-employed	0.0391 (0.0244)	-0.119*** (0.0324)
No. of children in household	0.0253* (0.0133)	0.00550 (0.0167)
Household size	0.00808 (0.00568)	0.0399*** (0.00742)
Instrumental variables:		
District level rainfall variation	0.0111 (0.0112)	0.0386* (0.0208)
Rural * Number of Safaricom towers in province	0.000109 (9.91e-05)	0.000529*** (0.000182)
Observations	1,864	1,864
R-squared	0.026	0.112

Notes to the table:

- (i) ***, ** and * denote statistical significance from zero at the 0.01, 0.05 and 0.10 level respectively using two-tailed tests.
(ii) Standard errors clustered by district and migrant status are reported in parentheses.

Table VI: Robustness checks

VARIABLES	Probit	Biprobit
Specification I		
= 1 if household received cash remittances	0.0822*** (0.0186)	0.0825 (0.0519)
Other variables included	Yes	Yes
Observations	1,864	1,864
Pseudo R ²	0.0725	
Wald test of $\rho = 0$		chi2(1) = .169109 (P-value = 0.6809)
Specification II		
= 1 if household received cash remittances	0.0716*** (0.0217)	0.0975*** (0.010)
Other variables included	Yes	Yes
Observations	1,569	1,569
Pseudo R ²	0.1023	
Wald test of $\rho = 0$		chi2(1) = 2.67262 (p-value = 0.1021)
Specification III		
= 1 if household received cash remittances	0.0469* (0.0243)	0.1261** (0.0140)
Other variables included	Yes	Yes
Observations	1,208	1,208
Pseudo R ²	0.0980	
Wald test of $\rho = 0$		chi2(1) = .274742 (P-value = 0.6002)
Specification IV		
= 1 if migrant household	0.0166 (0.0236)	F
Other variables included	Yes	
Observations	1,027	
Pseudo R ²	0.0938	
Specification V		
Total amount of cash remittances received	5.83e-08** (2.75e-08)	2.54e-08 * (0.0000)
Other variables included	Yes	Yes
Observations	1,864	1,864
Pseudo R ²	0.0013	
Wald test of $\rho = 0$		chi2(1) = 17.9934 (p-value = 0.0000)

Specification VI		
Total amount of cash remittances received	4.58e-08*	3.14e-09
	(2.73e-08)	(0.0000)
= 1 if household received cash remittances	0.0516***	0.0876***
	(0.0192)	(0.0083)
Other variables included	Yes	Yes
Observations	1,864	1,864
Pseudo R ²	0.0989	
Wald test of $\rho = 0$		chi2(1) = 3.09764 (p-value = 0.0784)
Specification VII		
Total amount of cash remittances received (6 month equivalent)	1.17e-07**	5.08e-08 *
	(5.50e-08)	(0.0000)
Other variables included	Yes	Yes
Observations	1,864	1,864
Pseudo R ²	0.0940	
Wald test of $\rho = 0$		chi2(1) = 17.9934 (p-value = 0.0000)

Notes to the table:

- (i) ***, ** and * denote statistical significance from zero at the 0.01, 0.05 and 0.10 level respectively using two-tailed tests. (ii) Standard errors clustered by district and migrant status are reported in parentheses. (iii) The regression models also includes other explanatory variables that are not shown here in order to conserve space (see table V in the appendix) (iv) f indicates the estimates were not computed due to a lack of relevant instrumental variables.

Figure 1: Number of migrant households and rainfall standard deviation by district

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ⁱ We classify these commodities under "physical investments" in the current paper.

ⁱⁱ These districts are Kiambu, Kisii, Machakos, Nakuru, Nairobi, Rachuonyo, Thika, Garissa, Lugari, Malindi, Embu, Siaya, Kilifi, Kakamega, Migori, Vihiga, and Mombasa.

ⁱⁱⁱ The author would like to thank an anonymous referee of the journal for this suggestion.

^{iv} The survey does not distinguish between the setting up of a business and the opening of a store. We classify these as physical investments as it seems reasonable that such activities will mostly likely involve the acquisition of some form of business inventory. Examples of common micro-business set-ups in Kenya include retailing, food and drink production and

other artisanry (see, e.g., Ronge *et al.* 2002). Moreover, studies in the literature typically classify business investments as physical investments (see, e.g., Amuedo-Dorantes and Pozo 2014).

^v After some deliberation housing purchase was excluded from the physical investments category. As highlighted by an anonymous referee of this journal, in aggregate data housing purchase is likely to follow a different stochastic process from that of physical investments because at the household level choices are very different from each other. Studies such as Ozili (2004) study investment in housing separate from physical investment. In the current study, only a small sample of households purchased housing therefore we are unable to study this type of investment separately.

^{vi} We use predicted expenditure values to account for the endogeneity of expenditure.

^{vii} Unfortunately, we are unable to resolve this challenge as we cannot redress this feature of the dataset. However, we conduct some checks to ensure that the findings of our analysis are robust to the rescaling of remittances.

^{viii} Only 71 households were eliminated due to missing observations. Households with missing observations appear to be random as there do not seem to be any systematic differences in characteristics between these and the rest of the households in the survey.

^{ix} As highlighted by an anonymous referee of the journal, it is possible that a high variance of rainfall made some areas poor such that households may not afford to send migrants thus violating the monotonicity assumption. The variance of rainfall is plotted against the number of migrants by district to investigate this. Figure 1 in the appendix reveals that there is no obvious correlation between migrant numbers and rainfall patterns except for two outliers representing Nairobi and Lugari districts which have a very large and small number of migrants, respectively. Nairobi district is an obvious outlier given its large population, strong economic performance, and high education levels relative to other districts. On the other hand, Lugari district is unique in that in 2009 it was a relatively new, largely rural, district. It experienced large numbers of in-migration (about 40% of the population) due to its high agricultural potential (see Kenya 1999 Population and Housing Census, 2002). This may explain the small number of households with migrants relative to other districts in the sample. Moreover, a statistically insignificant correlation coefficient (p -value = 0.3574) is obtained when the outliers are excluded.

^x Urban areas in Kenya have more money transfer agents such as Western Union and Money Gram and are also likely to have more financial institutions such as banks through which money can be transmitted easily. Jack and Suri (2011) show that M-PESA uptake was particularly large among Kenyans residing in rural areas.

^{xi} It is acknowledged that this represents a modelling convenience as the aforementioned tests are only strictly appropriate for use when the first and second stage models have continuous dependent variables. However, we believe the approach provides some approximate insights regarding the validity of the instrument set used here and has been employed in the literature by studies such as Ambrosius and Cuecuecha (2016).

^{xii} The F-test for instrument relevance falls below the rule-of-thumb of 10 suggested by Staiger and Stock (1994). Moreira (2003) proposes a Conditional Likelihood Ratio (CLR) test that is robust to the use of weak instruments within an IV framework. The key results obtained here do not alter when the CLR test is employed.

^{xiii} However, given the weak instruments, the power of the Wu-Hausman test is acknowledged to be poor and therefore we proceed to employ an IV strategy.

^{xiv} Conditional IV regression estimates that are robust to the use of weak instruments are comparable to the results obtained here.

^{xv} We acknowledge that taking remittances to be equally distributed across the first and second six months is a strong assumption. However, the main results hold and may be less biased than prior to rescaling.