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Do Migrant Remittances Affect Household Purchases of Physical Investments and Durable Goods? Evidence for Kenya

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Abstract: This paper investigates the impact of remittances on household decisions to purchase physical investments and durable goods in Kenya using household survey data. Remittances are found to be endogenous in the durable goods case and their effects are estimated using bivariate and IV probit models. In the physical investments case, remittances are found to be exogenous and remittance effects are estimated using univariate probit models. The evidence obtained is supportive of remittances having a positive and significant effect on the decisions by households to purchase physical investments and durable goods.

JEL classification: D12

Key words: migrant remittances; household expenditure; physical investments; durable goods

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 (see, e.g., Chami *et al.* 2003; Simiyu 2013), while an alternative view in the literature asserts 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 (see, e.g., 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 (see, e.g., Adams 1998) and poverty reduction (see, e.g., 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 and/or allocating them to goods that are not immediately consumed (i.e., durable goods). 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 (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 and commodities that yield utility over time 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 such 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 (see, e.g., 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. Inward 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 households of origin. Internal remittances continue to enable Kenyan households to diversify their income sources (see, e.g., 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 and durable goods. The current paper aims to fill these lacunae in the literature through the use of 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 for Kenya to date. The allocation of remittances towards physical investments and durable goods is a valuable research topic to explore for the case of Kenya. For example, physical investments may provide direct benefits to households through improved housing services or increasing the housing stock of the local community. Indirect benefits include 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 durable goods 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) use panel data from the Mexican *Encuesta Nacional de Ingresos y Gastos de los Hogares* (ENIGH) to examine the role that the uncertainty of remittance income (captured by the coefficient of variation of household remittance income) has on asset accumulation (defined as human, physical, or financial assets). 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 being a significant means to rural economic development. However, this study has been criticized for failing to take into account the fungibility of the financial resources of rural households (see Collier and Lal 1984). Their analysis is also based on rural households reporting to have used remittances for the following purposes: school fees (12 per cent), debt re-payment (2 per cent), farm maintenance (4 per cent), and supporting family and friends (96 per cent). 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 (1984) 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. A set of budget share equations for different expenditure categories are estimated using a household fixed effects model and a remittance variable is added as an independent variable in each equation. The use of a fixed effects model allows the endogeneity of remittances to be controlled for. 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 basic necessities. However, the study is quite restricted in its analysis especially as the sample used is relatively small comprising just 295 households and is 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 remittances¹ are spent on land purchases, building a house, business, improving a farm, agricultural equipment, and other investments.² 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 of the countries surveyed, with the exception of Nigeria and Kenya. The statistics contained in this study are based on what the households surveyed 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.

¹ The study defines international remittances as remittances sent by those migrants resident outside of Africa.

² We classify these commodities under “physical investments” in the current paper.

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 and durable goods.

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 the expenditure behaviour of households. 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 employs probit and tobit models. In the probit model, the dependent variable measures whether or not a migrant initiated housing investments in the community of origin. The dependent variable for the tobit model is the share of a migrant's annual income devoted to housing investments in the home town. 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 findings also suggest that migrants invest in order to preserve and maintain membership rights in the home community. In addition, the study reveals that housing investments play an important role in signalling migrants' resources and support of their home family.

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 our 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 and durable goods 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.³ The University of Nairobi was the primary institutional investigator for the survey.

A total of 1,942 households in 17 districts⁴ were surveyed in the eight provinces of Kenya. 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.

In the analysis undertaken here, there are two binary dependent variables of primary interest. These binary variables assume a value of one if the household purchased physical investments (durable goods) and zero otherwise. Items such as household appliances, vehicles, mobile phones, computers, and electronic goods are classified as durable goods. Physical investments comprise the

³ Similar surveys were undertaken in Burkina Faso, Nigeria, Senegal, and Uganda.

⁴ These districts are Kiambu, Kisii, Machakos, Nakuru, Nairobi, Rachuonyo, Thika, Garissa, Lugari, Malindi, Embu, Siaya, Kilifi, Kakamega, Migori, Vihiga, and Mombasa.

establishment of a business/opening of a store,⁵ the purchase of a house or a tract of land, the purchase of productive assets such as a sewing machine or water pump, and purchasing farming equipment such as trucks, tractors, and spraying machines. 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 or not a household purchased physical investments or durable goods in the previous six months.

The distinction between durable goods and physical investments merits some discussion here. In this study, durable goods refer to expenditure on consumer goods used to meet more long term needs. Physical investments refer to those outlays for which the individual expects to enjoy some pecuniary return in the future. There is some debate in the literature regarding whether expenditure on housing should be classified under durable goods (see Adams 1991)⁶ or physical investments (see Taylor and Mora 2006; Adams and Cuecuecha 2010). We classify expenditure on housing as a physical investment as we take the view that new and improved housing offers possible economic returns to the household and can also provide a direct stimulus to the local construction industry. The classification of housing in the physical investments category seems justifiable within the Kenyan context where there is a huge shortfall in housing provision by the government to the extent that housing development plays an important role in providing local employment (albeit on a short-term basis), boosting the demand for local housing inputs as well as providing rental accommodation (see, e.g., Mitullah 2013). Table 1 provides a list of the items contained in the physical investments and durable goods expenditure categories.

Table 1: Description of expenditure categories

Categories	Goods/commodities
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⁵ The survey does not distinguish between the setting up of a business and 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).

⁶ Adams (1991) classifies housing expenses as both durable goods and investments.

Durables	Household appliances (e.g., furniture, kitchen ware, refrigerators, air conditioners, bedding, carpet) Car/motorcycle/vehicle/tuk tuk Cell phone/mobile phone (initial cost) Computer Other electronic goods (e.g., DVDs, TV)
Physical investments	Setting up a business/opening a store House or land purchase Productive assets (e.g., sewing machine, water pump) Farming equipment (e.g., trucks, tractor, ox plough, harvester, spraying machines, water pumps)

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. Additional explanatory variables include dummy variables capturing whether a household is located in an urban or a rural area, whether or not a household was interviewed in December, and controls for the regional location.

The explanatory variables relating to the receipt of remittances by the household are of primary concern for the current analysis. A variable was constructed to measure whether or not the household received any cash remittances and the amount of cash remittances in Kenyan shillings received by the household 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. 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 month period. This means that the incidents of durable

goods and physical investment purchases are understated in the dependent variables.

Unfortunately, we are unable to resolve this challenge as we cannot redress this feature of the dataset.

Table 2 presents summary statistics for the variables discussed above. The table also reports t-tests/z-scores for the differences in means/proportions for remittance receiving versus non-receiving households. After the elimination of some observations due to missing responses, the final sample of usable data consists of 1,864 households, of which 45% received remittances.

The table reveals more remittance receiving households purchased physical investments and durables goods than non-receiving households. Remittance receiving households appear to have higher per capita expenditure compared to non-receiving households. In addition, households that received remittances tend to have older heads and a lower proportion of male heads compared to those that did not. We also note from the table that a higher proportion of households that did not receive remittances have heads with university education compared to those that did. The proportion of households that received remittances is lower for the case of employed heads and higher for unemployed heads. Remittance receiving households are found to be larger in size but to have fewer children than non-receiving households. Finally, more urban households received remittances than rural households.

Table 2: Summary statistics of main explanatory variables

	Combined	No-remittances (0)	Remittances (1)	t-test/z-score [†]
<i>Dependent variables:</i>				
= 1 if household purchased physical investments	0.16 (0.37)	0.12 (0.33)	0.21 (0.41)	-4.94***
= 1 if household purchased durable goods	0.50 (0.50)	0.47 (0.50)	0.53 (0.50)	-2.50***
<i>Explanatory variables:</i>				
Log of total household expenditure per capita	10.908 (1.264)	10.861 (1.345)	10.966 (1.155)	-1.78**
Total cash remittances received	72603 (548906)			
= 1 if household received cash remittances	0.450 (0.50)			
Head age < 30	0.139 (0.347)	0.158 (0.365)	0.117 (0.322)	2.52***
Head age 30 to 40	0.209 (0.407)	0.246 (0.431)	0.164 (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***
= 1 if household interviewed in December	0.350(0.477)	0.328 (0.470)	0.376 (0.485)	-2.17**
N	1864	1027	837	

Notes to the table:

- (i) Standard deviations are reported in parentheses.
- (ii) † The hypothesis under test here is: $H_0: \mu_0 = \mu_1 / H_0: \pi_0 = \pi_1$. 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 categorical variables.

IV. 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 the receipt of remittances by households as well as their expenditure on certain categories. Failure to control for the endogeneity of remittances is likely to result in biased estimates for the effects of remittances on commodity expenditures. In addition, the dependent variables for the physical investments and durable goods expenditure categories are binary. The empirical methods we employ therefore attempt to address both these issues.

Recursive bivariate probit model

We employ the bivariate probit model to analyse the effect of the receipt of remittances on the decision by the household to purchase durable goods and physical investments. In this case we treat the household's investment and purchase decisions within a discrete choice framework. The bivariate probit model accounts for the endogeneity of remittances by modelling the receipt of remittances and the purchase of physical investments (durable goods) simultaneously and through also including the binary remittance variable in the physical investments (durable goods) model. A simultaneous model is therefore apposite. For example, migrants may send remittances explicitly for the purchase of a specific commodity. At the same time, the decision by households to spend on that commodity may be influenced by the receipt of remittances. It thus seems appropriate to analyse the receipt of remittances and the decision to spend on a certain category as a two-equation system.

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 employ the simultaneous recursive bivariate probit model (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 and durables goods. At the same time, the use of a discrete outcome model enables us to overcome the censorship problem of household expenditures on durable goods and physical investments as it focuses on whether or not 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 remittances 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 durable goods or physical investments respectively. 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 or not the household received remittances and the actual decision of whether or not to spend on physical investments or durable goods respectively. 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 (ML) 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 probit model

An alternative way to approach this issue is to treat the remittances in their levels form. This is potentially informative as the use of a remittance dummy variable may conflate a number of different factors other than remittance income and, moreover, does not capture the scale of the remittances received.

In order to correct for the potential endogeneity of the remittance levels variable, we employ a more standard instrumental variables (IV) approach. The first stage entails estimating a reduced form model of the level of remittances received on all the variables included in the main regression as well as a set of instrumental variables. Predicted remittances are obtained from this first stage and then used as an explanatory variable in the primary regression model of interest in place of the endogenous remittances variable. It may be argued that the use of OLS in this first stage may seem inappropriate due to the censored nature of the remittances variable. In the current application, the use of a tobit model, sometimes argued as a more appropriate one for censored data, is unsuitable as it is found to be mis-specified for the current application.⁷ The use of a mis-specified model in the first stage has implications for the consistency of estimates in the second stage model (see Angrist 2001). The use of an OLS model in the first stage followed by a probit model in the second is

⁷ The likelihood ratio test, based on Lin and Schmidt (1984) yields a test statistic of 372 for this application.

equivalent to using an IV probit model (Wooldridge 2010 p. 591). This is the method we also employ in the empirical analysis to complement the bivariate probit analysis.

The IV probit model can be formally presented as follows:

$$y_{i1}^* = y_{i2}\beta_1 + x'_{i1}\beta_2 + u_i \quad (10)$$

$$y_{i2} = x'_{i1}\pi_1 + x'_{i2}\pi_2 + v_i \quad (11)$$

where $i = 1, \dots, N$ households, y_{i1}^* is a latent dependent variable that captures the i th household's propensity to spend on physical investments (durable goods). y_{i2} is the endogenous remittance variable, x_{i1} is a vector of exogenous variables, x_{i2} is a vector of instrumental variables, and the equation for y_{i2} is expressed in its reduced form. The u_i and v_i represent the error terms of the latent and remittance levels models respectively. β_1 and β_2 are parameter vectors for the variables from the main model and π_1 and π_2 are vectors containing the reduced-form parameters. The IV probit model is a recursive model as y_{i2} appears in the equation for y_{i1}^* , but not *vice versa*. We do not observe y_{i1}^* but we do observe its observable counterpart as follows:

$$y_{i1} = \begin{cases} 1 & \text{if } y_{i1}^* > 0 \\ 0 & \text{if } y_{i1}^* \leq 0 \end{cases} \quad (12)$$

where y_{i1} represents the actual decision to spend or not on physical investments (or durable goods). Thus, the probability of spending on physical investments (or durable goods) for the i th household can be represented as follows:

$$Prob[y_{i1} = 1] = \Phi(\beta_1 y_{i2} + x'_{i1}\beta_2) \quad (13)$$

where $\Phi(\cdot)$ denotes the standard normal cumulative distribution function operator.

V. Empirical results

We estimate bivariate and IV probit models using the binary and continuous remittance variables respectively. In order to ensure identification of the parameters of the primary models of research interest, we include variables in the remittances models that do not feature in the physical investments (or durable goods) models. These instrumental variables should be relevant in predicting the remittance variable but orthogonal to the error term in the latent model for the physical investments (or durable goods) equations. The following dummy variables are found to be suitable instruments for both the bivariate and IV probit models: (i) the gender of the household head, (ii) whether or not the household possesses an ATM card, and (iii) if the household has any migrants that are located externally.⁸ We 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. In the case of the binary remittance variable, an LPM model is also employed in the second stage to test for the orthogonality of the instruments. 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 we adopt provides some approximate insights regarding the validity of the instrument set used here.

On the basis of the foregoing, the instrumental variables satisfy the relevance criterion as they are highly correlated with the remittance variable in all cases. The variables are also found to be orthogonal to the error process in the second stage LPM equation (i.e., the purchasing decision equations) using the Hansen test statistic. Thus, the instruments could be interpreted as valid for the current application in a statistical sense given the important caveats noted above. The test results are provided in Table 3. However, we also need a narrative as to why these variables provide plausible identifying instruments in the current application. Firstly, the literature suggests that

⁸ In the sample, 63% of household heads are male, 47% of households have an ATM card and 55% of households have external migrants.

female headed households are often more economically disadvantaged than households headed by males (see, e.g., Carling 2008) and thus more likely to receive remittances. However, male/female headship may not necessarily affect the decision to purchase physical investments or durable goods in a direct manner. Secondly, the ownership of an ATM card can be considered a proxy for access to money transfer services and the ease of remittance transmissions by migrants. However, ATM card ownership is not expected to have a direct effect on the decision of the household to purchase physical investments and/or durable goods. Thirdly, due to the greater wage advantage, external migrants are more likely to be able to afford to send remittances to the household of origin. There is extensive evidence in the literature that points to a strong positive correlation between labour market earnings and remittances (see, e.g., Liu and Reilly 2004). However, the location of migrants does not necessarily directly affect the decision to purchase physical investments or durable goods.

We use the log of total per capita expenditure in the durable goods (physical investments) models, as it is quite standard to use a scale measure like household expenditure in this manner when estimating demand models. However, it can be argued that the expenditure variable is endogenous. It is customary to use household assets as instruments for household expenditure (see, e.g., Filmer and Pritchett 2001). We employ an instrumental variables approach to correct for the endogeneity of expenditure using a set of asset ownership indicators as instruments. Indicators capturing whether or not the household owns the following assets are used as instrumental variables in the case of physical investments: tuk tuk, radio, television, refrigerator, air conditioner, computer, mobile phone and non-mobile phone.⁹ The following variables are used to instrument expenditure in the case of the durable goods model: dummy variables capturing whether or not the household owns other buildings (besides the main house) and non-agricultural land.¹⁰

⁹ These variables are found to be jointly statistically significant in the reduced form expenditure model ($F(8, 1836) = 44.97$) and insignificant in the physical investments model.

¹⁰ These variables are found to be jointly statistically significant in the reduced form expenditure model ($F(2, 1842) = 25.73$) and insignificant in the durable goods model.

We now test whether or not the remittance variables are exogenous in the purchase decision equations of interest here. Table 3 provides a summary of the different tests used to test for the exogeneity of the remittance variables in the various models. The Wu-Hausman test for exogeneity is upheld for the physical investments category for both the continuous and binary remittance variables. In addition, the exogeneity of the remittance variables for the physical investments category is confirmed by the insignificance of the estimate for ρ in the bivariate probit model and the non-rejection of the Wald test for exogeneity in the IV probit model. This suggests that the univariate probit models with exogenous remittances are the preferred models in the physical investments case. However, for the durable goods category, the Wu-Hausman test reveals that remittances are endogenous for both the binary and continuous remittance variables at the 10% and 5% level of significance respectively. The endogeneity of this variable is also confirmed by the finding of a significant ρ for the durable goods bivariate probit model and the rejection of the Wald test for exogeneity test in the IV probit model. As such, the bivariate and IV probit models represent the more suitable specification in the durable goods case.

Thus, the receipt of remittances is found to be exogenous to the purchase of physical investments. The exogeneity of remittances implies that the receipt of remittances influences the decision by the household to spend on physical investments but not *vice-versa*. Thus, it seems that households make the choice to purchase physical investments contingent upon the receipt of remittances. In other words, households do not purchase physical investments and then in turn receive remittances. Rather, they decide to spend on physical investments on receiving remittances. Thus, the exogeneity of remittances here is consistent with the view that it is the remitter who influences the spending of the remittances they send by specifying their use on physical investments, as opposed to the household itself anticipating or demanding that remittances be sent for this purpose. Consequently, we could interpret remittances received for the purposes of purchasing physical investments as windfall or transitory income as the way in which they are sent precludes them from being part of the permanent income of the household.

Table 3: Testing the exogeneity of the remittances variables

	Physical investments	Durable goods
Remittance binary variable:		
F-test for instrument relevance	F(3, 1841) = 65.72 p-value = 0.000	F(3, 1841) = 45.15 p-value = 0.000
Hansen statistic (overidentification test of all instruments)	$\chi^2_2 = 3.27$ p-value = 0.195	$\chi^2_2 = 2.35$ p-value = 0.308
Wu-Hausman test for exogeneity	F(1,1842) = 1.852 p-value = 0.174	F(1,1842) = 3.228 p-value = 0.073
Biprobit likelihood-ratio test ($\rho = 0$)	$\chi^2_2 = 0.360$ p-value = 0.549	$\chi^2_2 = 6.417$ p-value = 0.0113
Remittance continuous variable:		
F-test for instrument relevance	F(3, 1841) = 10.91 p-value = 0.000	F(3, 1841) = 11.89 p-value = 0.000
Hansen J statistic (overidentification test of all instruments)	$\chi^2_2 = 3.31$ p-value = 0.191	$\chi^2_2 = 0.50$ p-value = 0.781
Wu-Hausman test for exogeneity	F(1,1834) = 0.063 p-value = 0.802	F(1,1842) = 4.400 p-value = 0.036
IV probit exogeneity test	$\chi^2_1 = 0.19$ p-value = 0.660	$\chi^2_1 = 3.23$ p-value = 0.072

Notes to the table:

- (i) The tests reported here are undertaken for models where the log of total expenditure is instrumented using a set of asset ownership indicators and used as an identifying instrument in the purchase models.

On the other hand, the endogeneity of remittances in the case of durable goods indicates that the unobservables determining the receipt of remittances and those determining the decision to purchase durable goods are positively correlated. Thus, the decision by the household to purchase durable goods is influenced by the receipt of remittances, and the purchase of durable goods also results in the household receiving remittances. As in the case of physical investments, this could be interpreted to imply that remittances are sent with instructions by the remitter to purchase durable goods. At the same time the decision by the household to purchase durable goods induces a corresponding response by migrants to send remittances. Hence, remittances represent transitory income here for the same reasons as discussed above for physical investments.

However, remittances also represent expected or predictable income since the decision of the household to purchase durable goods animates the receipt of remittances. Hence, the endogeneity of remittances here seems to imply that there is also a reciprocal supply of remittances by migrants

when households purchase durable goods. Thus, households are more prone to purchase durable goods in the case where they expect remittances to be a regular part of their income. Considering that durable goods are consumable, this finding seems to be consistent with the permanent income hypothesis which postulates that regular and permanent increases in income tend to be consumed rather than saved as individuals expect to have access to such income over the long term. However, the fact the durable goods are consumable over a long time period, rather than immediately, distinguishes them from other short term consumable goods such as food, utilities and clothing.

Table 4 reports impact effects for the physical investments univariate probit models (see table A1 in the appendix for the full sets of results). Specification I reports the effects for the case where the binary remittances variable is the variable of main interest. In specification II, the estimated marginal effects for the continuous remittances variable are reported.

Table 4: Univariate probit models for physical investments (marginal/impact effects)

Variables	Specification I	Specification II
= 1 if household received cash remittances	0.059*** (0.018)	†
Total cash remittances received	†	5.83e-08** (2.49e-08)
Other variables included	Yes	Yes
Regional dummies	Yes	Yes
N	1,864	1,864

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) Robust standard errors are reported in parentheses.
- (iii) † denotes not applicable in estimation.
- (iv) The regression models also include other explanatory variables that are not shown here in order to conserve space (see table A1 in the appendix).

The estimates in the table reveal that the receipt of remittances, compared to non-receipt, increases the probability of purchasing physical investments by about six percentage points, on average and *ceteris paribus*. Given that the mean is 0.16, this corresponds to a 38% increase in the probability of purchasing physical investments relative to the mean. In addition, a 10,000 shilling increase in annual remittances is shown to increase the probability of purchasing physical investments by at least 0.06 of one percentage point, on average and *ceteris paribus*, which is equivalent to a 0.36 per cent increase in the probability of purchasing physical investments relative to the mean. Hence, the receipt of remittances therefore induces Kenyan households to allocate spending on physical investments, though the effect is modest.

Table 5 provides bivariate (specification I) and IV (specification II) probit model impact effects for the durable goods category (see table A2 in the appendix for the full sets of results). Specification I reveals that the receipt of remittances increases the probability of purchasing durable goods by about 17 percentage points. This corresponds to an increase of 34% in the probability of purchasing durable goods relative to the mean. In specification II we see that a 10,000 shilling increase in annual remittances increases the probability of purchasing durable goods by 0.5 of one percentage point, on average and *ceteris paribus*. This corresponds to an increase of one per cent relative to the mean.

The findings suggest that the remittance level effects for durable goods are larger in magnitude than for physical investments. A possible explanation for this could be the reciprocal nature of the relationship between the demand for durable goods and the receipt of remittances as suggested by the endogeneity of remittances in the model. That is, households that receive remittances increase their demand for durable goods and also remittances are specifically sent to enable households to acquire such. On the other hand, the demand for physical investments is shown to be one way. Thus, the larger effect of remittances on durable goods compared to physical investments purchases may be a result of the demand for durable goods by both remitters and recipient households.

Table 5: Bivariate and IV probit models for durable goods (impact effects)

Variables	I: Bivariate probit model	II: IV probit model
= 1 if household received cash remittances	0.1712 ** (0.0667)	†
Total cash remittances received	†	5.12e-07*** (1.45e-07)
Other variables included	Yes	Yes
Regional dummies	Yes	Yes
N	1,864	1,864

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) Robust standard errors are reported in parentheses.
- (iii) † denotes not applicable in estimation.
- (iv) The regression model also includes other explanatory variables that are not shown here in order to conserve space (see table A2 in the appendix).

VI. Summary and conclusions

In this paper we analysed discrete household decisions in terms of purchasing physical investments and durable goods while treating the binary and continuous remittances variables endogenously. However, we obtain evidence that remittances are exogenous in the case of the physical investments category. Thus, we treat remittances exogenously in the univariate probit models for this case. For the durable goods category, remittances are found to be endogenous and thus bivariate and IV probit models are employed to estimate the effect of remittances on the purchase of durable goods. The findings reveal that the receipt of remittances increases the probability of purchasing durable goods and physical investments.

Overall, the empirical findings in this paper reveal that remittances have a significant effect on the purchase of physical investments and durable goods. 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 evidence for the use of remittances towards the acquisition of durable goods and the endogeneity of remittances detected here could be interpreted

as providing support that households regard remittances as part of their regular income. However, even though durable goods are consumable, it is acknowledged that they yield longer-term utility compared to the aforementioned commodities. The finding that remittances are exogenous and have a positive effect on the purchase of physical investment goods implies that households view remittances as windfall or transitory income. Thus, as *per* the permanent income hypothesis, households do not consider remittances to be part of their permanent budget when they purchase physical investments. The finding of remittances being both permanent and transitory income may indicate uncertainty on the part of households as to what type of income remittances represent. However, this is something that is not pursued in the current research though it is suggested as a potential agenda for future research.

Finally, the use of remittances for the acquisition of durable goods and 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, durable goods and physical investment goods could be sourced locally thus 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.

Appendix

Table A1: Univariate probit models for physical investments (marginal/impact effects)

Variables	Specification I	Specification II
Predicted log of total household expenditure per capita	0.0691*** (0.0223)	0.0850*** (0.0211)
Head age < 30	0.0216 (0.0325)	0.0225 (0.0325)
Head age 30 to 40	0.0448 (0.0288)	0.0436 (0.0290)
Head age 40 to 50	0.0239 (0.0266)	0.0207 (0.0266)
Head age 50 to 60	0.0235 (0.0262)	0.0200 (0.0261)
= 1 if head has secondary education	0.0399** (0.0202)	0.0328 (0.0200)
= 1 if head has university education	0.0440 (0.0410)	0.0143 (0.0399)
= 1 if head is employed	-0.0373 (0.0248)	-0.0468* (0.0248)
= 1 if head is self-employed	0.0441** (0.0207)	0.0386* (0.0209)

No. of children in household	0.0317*** (0.0121)	0.0314*** (0.0121)
Household size	0.0165*** (0.00540)	0.0193*** (0.00532)
= 1 if household located in urban area	-0.0601*** (0.0205)	-0.0671*** (0.0203)
= 1 if household received cash remittances	0.0587*** (0.0177)	†
Total cash remittances received	†	5.83e-08** (2.49e-08)
Regional dummies included	Yes	Yes
N	1,864	1,864

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) Robust standard errors are reported in parentheses.
- (iii) † denotes not applicable in estimation.

Table A2: Bivariate (conditional marginal/impact effects) and IV probit models (marginal/impact effects) for durable goods

Variables	Bivariate model	IV probit model
Predicted log of total household expenditure per capita	0.2404*** (0.0754)	0.0750 (0.0949)
Head age < 30	0.2498*** (0.0381)	0.195*** (0.0650)
Head age 30 to 40	0.1981*** (0.0387)	0.128** (0.0605)
Head age 40 to 50	0.1587*** (0.0376)	0.108** (0.0493)
Head age 50 to 60	0.0100*** (0.0369)	0.0831** (0.0381)
= 1 if head has secondary education	-0.0440 (0.0433)	0.00844 (0.0410)
= 1 if head has university education	-0.1621 (0.1072)	-0.0384 (0.0951)
= 1 if head is employed	-0.0586 (0.0390)	-0.0152 (0.0415)
= 1 if head is self-employed	-0.0347 (0.0318)	-0.0198 (0.0295)
No. of children in household	0.0245 (0.0205)	-0.00533 (0.0220)
Household size	0.0557***	0.0297*

	(0.0119)	(0.0158)
= 1 if household located in urban area	-0.1032***	-0.0432
	(0.0378)	(0.0413)
= 1 if household received cash remittances	0.1712**	†
	(0.0667)	
Total cash remittances received	†	5.12e-07***
		(1.45e-07)
Regional dummies included	Yes	Yes
N	1864	1864

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) Robust standard errors are reported in parentheses.
- (iii) † denotes not applicable in estimation.
- (iv) Conditional marginal/impact effects are reported for the bivariate probit model (see Greene 1998 and 2003; Park 2010). However, the impact effect for the remittance receipt binary variable is an unconditional effect since the receipt of remittances is already conditioned for in estimating the bivariate probit model.

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