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Do remittances improve income inequality? An instrumental variable quantile analysis of the Kenyan case☆

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ABSTRACT

The impact of remittances on income inequality constitutes a keenly debated topic in the development literature. Yet, a consensus still has not evolved on the issue. This paper explores the argument that the adverse distributional impact of remittances obtained by a number of studies could partially be due to the failure to control for existing differentials in the ability to migrate. We test the impact of remittances on household expenditures using data from the Kenyan Migration Household Survey and employing an instrumental variable quantile regression model to control for the unequal access to migration of rich and poor households. Our results indicate that while remittances increase household expenditure at all levels of the expenditure distribution, the impact is unambiguously greatest for poorer households. Hence, remittances, in and of themselves, improve both poverty and the distribution of income. This suggests that if remittances are to provide an impetus to development, recipient economies need to alleviate the credit constraints that restrict access to migration for the poor and the ability to send money home once the access bar has been overcome.

1. Introduction

Transnational remittance flows have increased substantially over the last three decades. According to the World Bank, nominal personal remittances totaled just under $18 billion worldwide in 1980 and comprised about 0.3% of world GDP. By 2012, they had grown to about $480 billion and more than doubled their share of world GDP to 0.7%. The trend is particularly true of Sub-Saharan Africa. The World Bank estimates that remittance flows to the region have increased steadily over the last three decades from about 0.5% of regional GDP in 1980 to over 2% in 2012, with six of the top 25 countries with the greatest remittance share of GDP in 2009 being located in this region.[1] Kenya presents a good example of the regional trend, having received less than $20 million in remittances in 1980 but as much as $1.7 billion in 2009, comprising about 5.4% of its GDP. On average, the nation has received 10% of all remittance flows to Sub-Saharan Africa over the period 2004–2009 (Ngugi, 2011). Yet to the best of our knowledge, there is not a single contribution that assesses the distributional impact of remittances in the Kenyan economy. The present paper is intended to fill this void.

Given the sheer magnitude of global remittance flows, it is not surprising that there is a vast literature that seeks to investigate their economic impact in recipient societies, notably on growth, poverty, and the distribution of income. With notable exceptions (Chami et al., 2005; Barajas et al., 2009; Rao and Hassan, 2011), the balance of the literature finds that remittances have had a positive impact on economic growth (Catrinescu et al., 2009; Ziesemer, 2012; Feeny et al., 2014particularly by stimulating financial development (Giuliano and Ruiz-Arranz, 2009; Mundaca, 2009; Aggarwal et al. 2011; Chowdhury, 2011)[2]; enhancing human capital formation by increasing educational expenditure at the household level (Yang, 2008; Adams and Cuecuecha, 2010); and increasing the level of investment (Lartey, 2013), both by

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[1] These are Lesotho, Togo, Cape Verde, Guinea-Bissau, Senegal, and Gambia, with Nigeria ranking tenth in terms of the dollar value of remittance inflows.

[2] See Coulibaly (2015) for conflicting evidence in the context of Sub-Saharan Africa.

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alleviating the credit constraints that restrict firms and by reducing macroeconomic volatility.

However, there is far less consensus regarding the extent to which remittances benefit the most economically vulnerable section of the recipient country population. In fact, the distributional impact of remittances constitutes a key debate in the migration literature, with results from cross-national and country studies ranging from documenting an adverse impact of remittances on income inequality (Stark et al., 1986; Adams, 1989; Barham and Boucher, 1998; Mishra, 2007; Acosta et al., 2008) to no impact (Yang and Martínez, 2005) to a positive impact of such transfers (Taylor and Wyatt, 1996; Taylor et al., 2005; Koechlin and Leon, 2007; Zhu and Xubei, 2010). It is to this debate that we direct our contribution.

Our study measures the impact of remittances on inequality in Kenya using the Migration Household Survey conducted by the University of Nairobi and the World Bank in 2009. The analysis is motivated by the idea that the adverse distributional impact of remittances documented by a section of the literature arises essentially from the favorable selection of emigrants: The substantial costs of migration (Chiswick, 1999) and international transfers (Freund and Spatafora, 2008) along with the increasing skill-selectivity of immigration policy in many destination countries (Rapoport and Bertoli, 2015) rule out the option of migrating and sending money for all but the highest skilled, who are also more likely to be drawn from the upper reaches of the income distribution. It is this asymmetric access to migration that leads to remittances magnifying existing differentials in income and wealth (Stark et al., 1986, 1988), there being nothing inherently unequalizing about such flows.

The present paper is the first to apply the methodology of quantile regression to an exploration of the distributional impact of remittances. As noted by Ebeke and Le Goff (2011), studies based on household data have typically used one of two empirical strategies. The first (Stark et al., 1986; Taylor, 1992; Taylor and Wyatt, 1996; Yang and Martínez, 2005; Wouterse, 2008) assumes remittances to be exogenous and decomposes the Gini coefficient of income or expenditure distribution according to the impact of different exogenous sources of income, including remittances. Assuming all other sources of income as constant, this allows one to isolate the marginal impact of remittances on the Gini coefficient. The second strategy (Barham and Boucher, 1998; Adams et al., 2008; Adams and Cuecuecha, 2010) treats remittances as endogenous and explicitly models the selection bias in migration described above.

While our study is conceptually close to the second line of literature, it improves upon the empirical methodology in two important aspects: First, the least squares methodology used in existing studies ignores the possibility that the marginal impact of remittances on household expenditure may differ for households at different levels of the conditional expenditure distribution. Our methodology of quantile regression provides a natural choice of technique for addressing this heterogeneity (Koenker, 2005). Second, in tracing the heterogeneous impact of remittances on household expenditure at various points of the conditional distribution, we are able to address the impact of remittances on poverty and inequality simultaneously in one unified model.[3]

The key challenge to implementing our strategy is to address the endogeneity arising from the differential access to migration. As such, we use the instrumental variables technique for quantile regression introduced by Chernozhukov and Hansen (2004, 2005, 2008). As in any study seeking to employ instrumental variables, we face a challenge in finding instruments that are both valid and strong. From the University of Nairobi microdata, we use indicator variables for whether a household held nonagricultural land and whether a household owned a cellphone. In addition, and following a substantial literature (Munshi, 2003; Adams and Cuecuecha, 2010), we include a measure of unexpected rainfall shocks defined as the deviation from the long run precipitation trend at the 1-degree geographic resolution level from version 7 of the Global Precipitation Climatology Centre (GPCC).[4]

We find that receiving remittances increases expenditures for households at all levels of the distribution, thereby lessening the impacts of poverty. Moreover, controlling for differences in households' access to remittances, we find remittances to increase expenditures by the greatest proportion for *poor* households, accordingly narrowing the distribution of income. Our results imply that the adverse impact of remittances on inequality documented by previous studies may be the result of inequities in access to migration as opposed to dependence on remittances by poor households.

2. The impact of remittances on poverty and inequality

Theoretical studies point to three possible outcomes regarding the impact of remittances on income inequality, which we summarize in Fig. 1. These hypotheses hinge on the self-selection of immigrants and whether households spend remittances on consumption or investment. The first, which is assumes that immigrants will be negatively selected and that their families in the home region will spend a significant portion of the remittances on investment, predicts that remittances will reduce both poverty and income inequality. The second, which also assumes negative selection, claims that households rely on remittances primarily for consumption and become dependent on remittances. Thus, remittances will worsen both poverty and income inequality. The last hypothesis predicts that positive selection will correspond to a bias in remittances that favors higher-income households.[5] Hence, remittances may either improve or worsen poverty but will worsen income distribution. In the remainder of this section, we discuss the empirical evidence for these hypotheses, beginning with those for poverty.

A. Poverty

Several studies have found remittances to reduce the level of poverty in a society. Among these, Jones (1998) finds that remittances reduced poverty in rural Mexico. More recently, Du et al. (2005) find that in China remittances increased a receiving household's income by about 8.5–13.1% while also reducing poverty, whereas Yang and Martínez (2005) find a poverty-reducing impact from remittances for the Philippines. For a cross-country sample, Adams and Page (2005) find that increasing remittances per capita by 10% results in a 3.5% reduction in extreme poverty. Meanwhile, a couple of dissenting studies have found remittances to increase poverty. Acosta et al. (2008) find that remittances have worsened poverty by a small margin for countries in Latin America, while Acosta et al. (2009) find that remittances lead to an appreciation in real exchange rates, which has in turn left poor households worse off.

Several studies focus on the impact of remittances in countries in sub-Saharan Africa. One of the earliest of these studies, Gustafsson and Makonnen (1993) find that remittances significantly alleviated poverty for the African nation of Lesotho. More recently, Adams et al. (2008) show that remittances have reduced poverty in Ghana, and that the magnitude of the reduction in poverty is greater from international remittances than it is from remittances that have been sent from within Ghana. Chiwuzulum Odozi et al. (2010) and Beyene (2014) find similar results for Nigeria and Ethiopia, respectively. In a cross-country study,

[3] Quantile regression has become a commonly used method for measuring impacts of various factors on income distribution. Examples include Angrist et al. (2006), Machado and Mata (2005), and Nguyen et al. (2007).

[4] The GPCC precipitation dataset has been compiled by Schneider et al. (2015) and can be downloaded from the GPCC FTP site, ftp.dwd.de/pub/data/gpcc/html/fulldata_v7_doi_download.html.

[5] This might be the case either because the relatively well-off are more able to finance migration costs, or because the well-off are most adversely impacted by inefficient institutions. This will not only widen income inequality, but also worsen poverty by raising prices and appreciating the exchange rate.

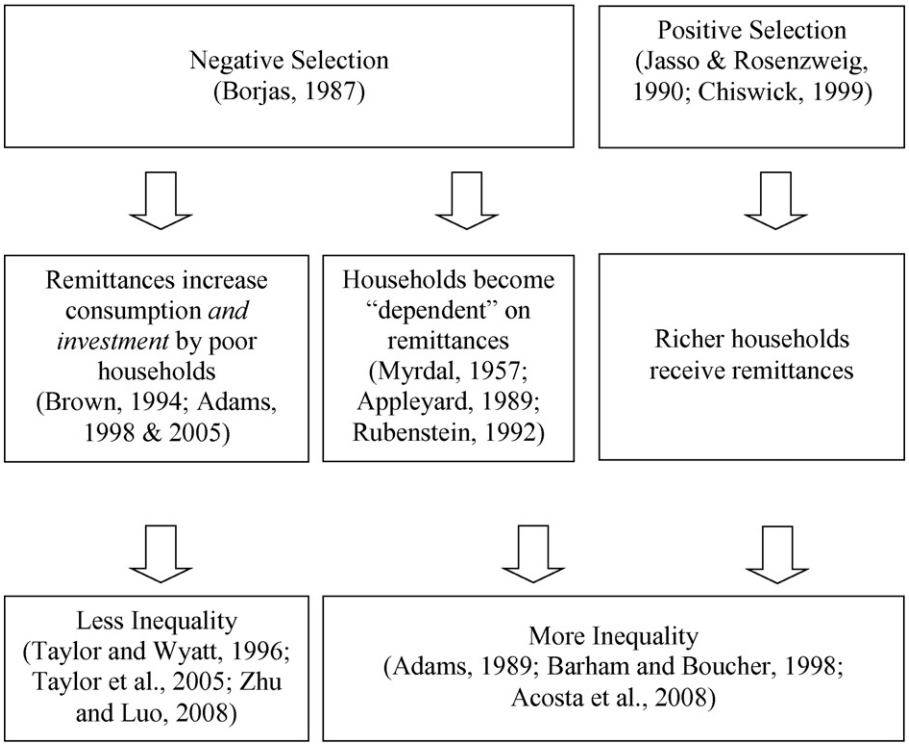

Fig. 1. Summary of hypotheses.

Anyanwu and Erhijakpor (2010) show that remittances have reduced poverty based on a sample of 33 African countries from 1990 to 2006.

Over the long run, the impact of remittances on poverty may depend on the extent to which remittances increase savings as well as investments in physical and human capital. Looking at poor households in the South Pacific, Brown (1994) finds that remittances have increased investment and improved the relative standing of poor households, to which Adams (1998 and 2005) adds supporting evidence for Pakistan and Guatemala. The impacts may also depend on the attributes of the communities from which immigrants migrate as well as the choice of destination. For example, Stark et al. (1986, 1988) find that villages that received remittances from mostly from internal migrants experienced an equalization of incomes, while those that received remittances from migrants living in the United States experienced a widening of incomes.

B. Inequality

Even if remittances reduce poverty, much of this impact may be because remittances enhance economic performance, rather than because they improve the relative position of poor households with respect to rich ones.[6] As a result, there is less agreement in the literature regarding the effect of remittances on income inequality.

Many studies tackle the question of the impact of remittances on income inequality by looking at the concentration of remittances themselves and find that remittances are highly concentrated among richer households. For example, Adams (1989) is among the first to find that remittances widen income inequality using data from surveys of Egyptian households. Barham and Boucher (1998) find similar results for Nicaragua, while Mishra (2007) and Acosta et al. (2008) draw similar conclusions for Mexico and Latin America as a whole, respectively. McCormick and Wahba (2003) find that (relatively richer) urban areas received more remittances than rural areas. Other studies decompose a region's Gini coefficient, and find that remittances may reduce inequality for some regions. For example, Taylor and Wyatt (1996) and Taylor et al. (2005) find remittances to equalize incomes for rural communities in Mexico, especially as the number of migrants increases, while Zhu and Luo (2008) find a similar result for rural villages in China.

As with poverty, several studies test the impacts of remittances on inequality for African nations. In a cross-country study, Anyanwu (2011) finds that remittances have reduced income inequality in Africa during the period 1960–2006. Focusing on households in Nigeria, Chiwuzulum Odozi et al. (2010)also find that remittances reduce income inequality. However, Beyene (2014) finds no significant impact on inequality from remittances for Ethiopia, whereas Wouterse (2010) finds that, although remittances from within Africa reduced inequality for communities in Burkina Faso, intercontinental remittances have actually increased inequality, even though these remittances more effectively reduced poverty.

The purpose of this paper is to measure the effects of receiving remittances on the income distribution in Kenya. Following several other studies of inequality,[7] we do this by analyzing differences in expenditures by households that receive remittances and those that do not at various levels of the distribution using a quantile regression. In the process, we hope to be able to assess the validity of the three hypotheses about remittances and income inequality. We propose that for both poverty and of income distribution the impacts of remittances will depend more on whether a household receives any remittances at all than on whether a typical household receives one additional dollar from remittances.

To support this conjecture, we have plotted the distribution of values for (logged) remittances per capita for our sample of Kenyan households in Fig. 2a and b. In these graphs, the bars represent the counts of the number of households receiving that level of remittances, whereas

[6] As noted before, this may be due to the fact that migration opportunities (and hence remittances) are more accessible to middle- and upper-class households due to migration policies, moving costs, and wealth constraints (Chiswick, 1978; Chiquiar and Hanson, 2002; Bollard et al., 2011).

[7] See, for example, Buchinsky (1994a, 1994b); Martins and Pereira (2004a, 2004b), and Melly (2005).

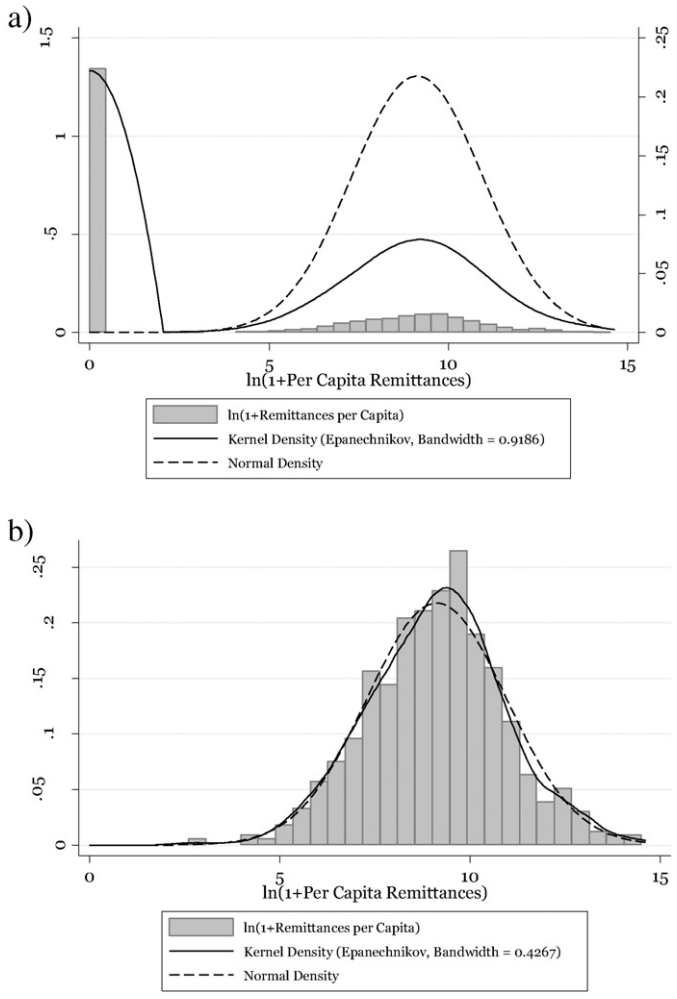

Fig. 2. a. Empirical distribution of ln(1 + remittances per cap.) — all values. b. Empirical distribution of ln(1 + remittances per cap.) — positive values only.

the solid and dashed lines represent the empirical kernel density and corresponding normal approximation, respectively. To deal with households that received no remittances, we have computed the variable as ln[1 + Remittances]. Fig. 2a includes zero-remittance households; Fig. 2b does not.

Notice from Fig. 2a that households that received no remittances at all occupy substantial mass in the distribution of remittances, and that this makes the distribution appear to be highly skewed. However, when we narrow our focus to those households that received remittances, the distribution becomes smooth and bell-shaped – well-approximated by a normal density. Notice also that the observations receiving no remittances (ln[1 + Remittances] = 0) are far removed from the mean value of the households that did receive remittances.[8] Thus, we would like to suggest that much of the variation in remittances themselves derives from whether a household has access to remittances, as opposed to how much remittances the various households receive.

Bearing in mind the crucial role of access to migration opportunities, we ask the question: How much higher would a quantile of the expenditures distribution have been if households near that quantile had received remittances? However, as we have already mentioned, the endogenous selection of migrants may influence the impact of observed remittances on the distribution of expenditures, and any estimate of the impact of remittances should take this endogeneity into account. In particular, in the case where positive selection leads to a divergence in incomes, we would expect that controlling for this selection bias would lessen or even reverse the negative impact of remittances on inequality. To achieve this, we use the instrumental variable quantile approach suggested by Chernozhukov and Hansen (2005, 2008) and implemented for the analysis of inequality and wage dispersion by Harding and Lamarche (2009).

3. Data

All of the data for the specifications that we estimate come from the 2009 Kenya Migration Household Survey conducted by the University of Nairobi in cooperation with the World Bank. This dataset is available in the World Bank Microdata Library.[9] The dataset consists of 1942 households with information about the household characteristics, including its construction, rooms, ownership, number of family and non-family member residents, ownership of durable goods and property, total expenditures, how much the household received in total remittances, and how remittances the household received were spent. In addition, the dataset documents individual characteristics of the residents of the household, including labor force status, occupation, education, age, relationship to the household's head, religion, ethnicity, and information about each member of the household's migration experience.

Using these data, we propose the following model of household expenditures:

$$\begin{aligned}\ln(\text{Expenditures\_per\_Capita}_i) = {} & \beta_0 + \beta_1 \text{Remittances}_i + \beta_2 \text{Age}_i \\ & + \beta_3 \text{Age}_i^2 + \beta_4 \text{Education}_i + \beta_5 \text{Size}_i \\ & + \beta_6 \text{Gender}_i + \beta_7 \text{Rural}_i \\ & + \textstyle\sum_j \delta_j \text{Occupation}_{ij} + e_i,\end{aligned}$$

where the dependent variable is the natural log of the sum of household *i*'s per capita food expenditures (Question 3.2.1) and its per capita nonfood expenditures (Questions 3.2.6 through 3.2.24, aggregated by the collectors) over the last 12 months.[10] Our explanatory variable of interest, remittances, is an indicator variable equal to one if the household under observation received any amount of remittances in the last 12 months, and equal to zero if it did not (Question 5.21).[11]

As controls, we include a number of characteristics of the household and its head, including (1) the age of the household head and its square (Question 1.4); (2) the maximum number of years of education attained by either the household head or his or her spouses (Question 1.10); (3) the number of members in the household; (4) the gender of the head of the household (Question 1.3); (5) a dummy variable indicating whether the household is located in an urban, as opposed to rural area; (6) dummy variables indicating the household head's occupation

[8] Among the households in our sample that received remittances, the mean value of ln(1 + Remittances) is 9.128 with a standard deviation of 1.832. So, the mean value of logged per capita remittances is about four standard deviations of the distribution above zero. Including zero-remittance households reduces the mean value to 3.571 and raises the standard deviation to 4.601.

[9] The dataset is publicly available for download at the World Bank's Microdata Library website at: http://microdata.worldbank.org/index.php/catalog/94. Plaza et al. (2011) provide the methodological details.

[10] Food expenditures are reported for the last week, whereas nonfood expenditures are reported for the last six months. To normalize this to an annual measure, we convert the food expenditures and nonfood expenditures as: Expenditures p.c.$_i$ = 52(weekly food expend.$_i$) + 2(biannual nonfood expend.$_i$).

[11] We express remittances as a dummy for three reasons: First, doing so is consistent with our argument that access to remittances is a key issue, as opposed to marginal impacts of additional shillings of remittances. Second, the instrumental quantile regression technique we use to capture unequal effects of access has been developed with binary treatments in mind (Chernozhukov and Hansen, 2005, 2008). Lastly, as other studies have documented, the amount households receive in remittances is subject to some degree of measurement error (Adams and Cuecuecha, 2010; Zarate-Hoyos, 2004). Some of the measurement error could result from the fact that some households (and especially the poorest remittance-receiving households) receive much of their remittances as durable goods brought back to the home by return migrants.

Table 1
Sample summary statistics [number of observations = 1861].

Variable	Mean	Std. dev.	Skew	Kurtosis	Min	Max
Expenditures p.c.	139,939	477,648	9.730	124.037	650	8,515,200
No migrants	98,241	362,613	8.739	88.202	650	4,658,000
Internal migrants only	68,040	110,573	5.339	43.691	1,300	1,280,800
International migrants	243,811	678,478	6.807	61.242	1,920	8,515,200
Internal & int'l migrants	212,548	760,561	8.658	84.627	4,107	7,770,052
ln(expenditures pc)	10.750	1.237	0.789	4.251	6.477	15.957
Remittances (dummy)	0.391	0.488	0.446	1.199	0.000	1.000
Remittances p.c.	22,935	190,107	23.002	639.380	0.000	6,000,000
HH head age	47.557	15.759	0.302	2.205	18	90
HH head age^2	2,509.887	1,595.518	0.839	3.040	324	8,100
Education	8.251	5.275	0.086	2.230	0	25
HH size	4.214	2.308	0.958	4.814	1	20
HH head gender	0.312	0.464	0.811	1.657	0	1
Urban	0.510	0.500	−0.042	1.002	0	1
Manager occupation	0.046	0.209	4.352	19.942	0	1
Professional occ.	0.121	0.326	2.326	6.409	0	1
Technician occupation	0.037	0.189	4.900	25.010	0	1
Clerical occupation	0.032	0.175	5.346	29.575	0	1
Service occupation	0.153	0.360	1.926	4.711	0	1
Agriculture occ.	0.156	0.363	1.892	4.581	0	1
Craft occupation	0.037	0.189	4.900	25.010	0	1
Operator occupation	0.008	0.086	11.399	130.936	0	1
Elementary occ.	0.080	0.271	3.095	10.577	0	1
Armed forces occ.	0.009	0.095	10.319	107.480	0	1
Casual Occupation	0.027	0.162	5.852	35.248	0	1
Nonagricultural land	0.797	0.402	−1.480	3.190	0	1
Cellphone ownership	0.195	0.396	1.539	3.369	0	1
Precipitation from trend	−1.873	4.373	−2.962	17.992	−29.008	2.613

(Question 1.13)[12]; and (7) dummy variables indicating the ethnic group or tribe with which the household head self-identifies (Question 1.8). Combining these variables leaves us a sample of 1861 households, with 81 households (about 4.4% of the original dataset) dropping from our sample as a result of missing values.

Table 1 reports the summary statistics for the households in our final sample. The average household in our sample spent about 140,000 Kenyan shillings (KES, about $1,800) per capita annually.[13] This is almost double the Gross National Income (GNI) per capita listed by the World Bank for Kenya in 2009 of about 72,000 KES. In that sense, the World Bank micro-survey data are not fully representative of Kenya as a whole. Part of this is because the data are targeted towards communities with higher migration rates, and indeed the data show that households without a member on migration spent under 100,000 KES. As expected, households with members who have migrated internationally spent much more than average, almost 250,000 KES. However, as we have emphasized already, access to migration and remittance opportunities matters: households with only internal migrants spent less than 70,000 — less than those with international migrants, and even much less than those with no migrants at all. By controlling for endogeneity in whether a household receives remittances or not, we hope to be able to control for precisely these types of disparities in access to the benefits of migration.

Despite the fact that our sample includes households more prone to migrating, and the fact that the households in our sample are relatively better off when compared with a representative sample of Kenyan households, poverty is still a serious issue for many households in our dataset. For example, households near the 25th percentile of our sample spend just under 20,000 KES/year, which translates to less than one dollar per day (about $260/year) at official exchange rates. Hence, a substantial number of households in our sample survive on incomes below the global threshold for extreme poverty. Changes in these households' circumstances that would improve their consumption opportunities would amount to a substantial reduction in poverty.

The average household in our sample had about 4.2 people living in it, with the highest educational attainment in the household averaging 8.2 years, and 39% them receiving remittances. Almost 70% of the household heads in our sample are male and they have an average age of 47.7 years. About 51% of the households are located in rural areas.

Since we recognize that households do not receive remittances at random, and any estimates may be biased due to the fact that households decisions to send members abroad is inherently endogenous, we will use an instrumental variables quantile regression technique, which we will briefly describe in the next section.

4. Accounting for endogeneity in a quantile regression

Since the impact of remittances may differ across the distribution of expenditures, and at the same time remittances themselves may be endogenous, we implement the instrumental variables quantile regression (IVQR) estimator described by Chernozhukov and Hansen (2004, 2005 and 2008) and operationalized by Kwak (2010). In this section, we elaborate on this methodology and our rationale for using it.

Our rationale for using quantile regression stems from the fact that quantile regression is, ultimately, the best way to address the question, "How does receiving remittances impact income distribution, given that the impact of the former is likely to differ over the conditional distribution of the latter." The advantages of quantile regression as the most appropriate choice of technique for our purpose have already been well-documented in the literature (Koenker, 2005). Further, it is very critical to account for possible endogeneity. To purge our estimates of this source of potential bias, we will need to use instruments for remittances. Since instrumental variables techniques for quantile regression are relatively new to the literature, we spend the remainder of this section discussing our implementation of IVQR.[14]

[12] The occupations listed are: managers; professionals; technicians/associate professionals; clerical support workers; agriculture/forestry/fishery workers; craft/related trades workers; plant/machine operators/assemblers; elementary occupations; armed forces; and casual laborers. We created a twelfth category for "did not answer" to minimize the number of observations lost due to missing data.

[13] In 2009, the year of the survey, the Kenyan Schilling officially traded at about 77 KES/USD.

[14] We refer readers who are interested in a more complete technical discussion of the subject to Chernozhukov and Hansen (2005 and 2008, and references therein).

Consider linear quantile model of an outcome variable, Y, conditional on a treatment variable, d, and a vector of controls, $\mathbf{x}$, given by

$$Y = q(d, \mathbf{x}, u) = \alpha_\tau d + \mathbf{x}'\beta_\tau + u, \quad (1)$$

where u represents a non-separable error term. In our case, the treatment variable, d, represents an indicator variable equal to 1 if a household received remittances in the last year, and 0 otherwise. We assume remittances to be endogenously determined by the following function:

$$d = \delta(\mathbf{x}, \mathbf{z}, v) = \mathbf{x}'\theta_\tau + \mathbf{z}'\pi_\tau + v, \quad (2)$$

where $\delta(\cdot)$ is an unknown function, z, is a vector of excluded instruments that are correlated with the treatment variable, d, but not correlated with the outcome variable (Y), and v is a vector of unobservable characteristics that depends on u. We further assume that the distribution of u conditional on x and z is uniform on the measure (0,1).

The quantile regression model at the τ^{th} quantile of Y is identified by

$$P[Y \leq q\,(d, \mathrm{x}, u)|\mathrm{z}, \mathrm{x}] = \tau. \quad (3)$$

This leads to the simplified objective function

$$\arg \min_{\alpha_\tau, \beta_\tau, \gamma_\tau} E\left(\rho_\tau\left[y - \alpha_\tau d - x'\beta_\tau - z'\gamma_\tau\right]\right), \quad (4)$$

where $\rho_\tau(\cdot)$ is a weighted absolute value function that solves the τ^{th} quantile of Y in the sample. Our implementation of the estimator derived from this objective function follows that described by Kwak (2010).[15]

The instruments we use to control for endogeneity in which households receive remittances are nonagricultural land ownership, cell phone ownership, and unexpected rainfall shocks calculated as the deviation from the long run precipitation trend at the 1-degree geographic resolution level from version 7 of the Global Precipitation Climatology Centre (GPCC).[16] As explained by Adams and Cuecuecha (2010) in the context of the Guatemalan economy, rainfall constitutes a critical input for agricultural production, so that an unexpected deviation from the usual level may cause crop failure and hence, migration out of rural areas.

Nonagricultural land ownership is an indicator variable taking the value 1 if a household owns any amount of nonagricultural land. Our rationale for using nonagricultural land ownership is that households with more holdings of assets will be less in need of remittances to obtain credit and insure against risk, and therefore less likely to send family members abroad with the goal of receiving remittances.[17] However, theoretical and empirical studies of migration suggest that rural, agricultural-based households are most likely to have surplus labor and therefore simultaneously migrate in search of remittances while also having have lower income per capita. To purge our instrument at this potential source of invalidity, we only consider nonagricultural land ownership.

[15] Kwak's (2010) implementation procedure involves three steps: (1) Estimate the first stage using least squares;(2) estimate the τ^{th} quantile of Y using predicted values of d; (3) conduct a grid search around those estimated values to find estimates that minimize the objective functions of both stages at τ.

[16] GPCC (ftp://ftp.dwd.de/pub/data/gpcc/html/fulldata_v7_doi_download.html) reports precipitation at 1-degree levels of resolution for latitudes on the half-unit (e.g. {(89.5N, 0.5E), (88.5, 0.5E)…, (89.5S, 279.5 W)}. To calculate the deviation from the trend, we first calculated the trend for each coordinate latitude from GPCC using an AR(1) process for the monthly precipitation data going back to 1901. We then took the average deviation from trend for 2009 and matched these deviations with the coordinates of 94 unique place names from the "cunit" variable in the World Bank's remittances micro-dataset indexed on the website http://www.mapcoordinates.net.

[17] This pattern is in fact what we observe when we apply a probit regression to the binary remittances variable: Nonagricultural land holdings reduce the probability of receiving remittances by almost 10 percentage points, on average.

Table 2
Means regressions [number of observations = 1861].

Variables	OLS	IV/2SLS^
Remittances	0.257***	2.248***
	(0.0492)	(0.443)
Age	0.0396***	0.0523***
	(0.00872)	(0.0125)
Age^2	−0.000248***	−0.000474***
	(8.60e-05)	(0.000133)
Education	0.0460***	0.0520***
	(0.00521)	(0.00710)
Household size	−0.182***	−0.196***
	(0.0120)	(0.0164)
Female	0.00284	−0.428***
	(0.0527)	(0.124)
Rural	−0.439***	−0.531***
	(0.0487)	(0.0671)
Constant	9.891***	9.144***
	(0.205)	(0.329)
Occupation	Yes	Yes
R-squared	0.402	NA
Log-likelihood (model)	−2558	−3159
Log-likelihood (null)	−3036	
Kleibergen–Paap		38.65
P-value		2.06e-08
Hansen J		0.630
P-value		0.730

IV/2SLS^: 'Remittances' variable is based on the instrumental variable method [specifically, remittances were regressed on nonagricultural LAND ownership, cellphone ownership, and precipitation from trend, as well as the other control variables].
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Cell phone ownership is a dummy variable equal to one if the household owns a cell phone and zero if it does not. The intuition behind this variable is that mobile money transfers have become increasingly popular as a means for transmitting formal remittances, especially with the introduction of the M-PESA program in 2007 that provides a platform for making electronic transfers of relatively small amounts via a mobile device and has come to be used by more than half the adult population of Kenya by 2009.[18]

To demonstrate the impact of endogeneity in remittances, and to test the validity of these instruments, we have run both ordinary least squares (OLS) and instrumental variables/two-stage least squares (IV/2SLS) estimations of our basic model. We report the results of this preliminary exercise in Table 2. Three important findings emerge: First, the stark difference (by about a factor of nine) between the OLS coefficient and the IV/2SLS models suggests strong evidence for endogeneity and support our hypothesis that the true impact of remittances is confounded by differentials in the opportunity to migrate; second, the Kleibergen–Paap Test for weak instruments takes a value of 38.647 and a P value of less than 0.0001 confirms the strength of the instruments; and finally the Hansen J test for instrument validity takes a value of 0.630 and a P value of 0.730 confirms the validity of the instruments.

5. Empirics

Table 3 report the results of the Standard Quantile Regression [columns (1)–(5)] and IVQR model [columns (6)–(10)] for selected quantiles. These results confirm the existing literature with respect to the effects of the control variables: education positively impacts expenditures; household size negatively affects per capita expenditures; age positively impacts expenditures, but with diminishing returns; rural areas spend less.

[18] For more on the M-PESA program, see the Finance and Private Sector Development Brief of the World Bank at:
http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTPROGRAMS/EXTFINRES/0,,contentMDK:22594763~pagePK:64168182~piPK:64168060~theSitePK:478060,00.html

Table 3
Regression results by selected quantiles (dependent variable: ln[annual expenditures per capita]).

	Standard quantile regression					Instrumental variable quantile regression				
Variables	(1) 0.10	(2) 0.25	(3) 0.50	(4) 0.75	(5) 0.90	(6) 0.10	(7) 0.25	(8) 0.50	(9) 0.75	(10) 0.90
Remittances^	0.206***	0.223***	0.246***	0.347***	0.395***	7.350***	2.127***	1.721***	2.266***	1.593**
	(0.0749)	(0.0580)	(0.0512)	(0.0697)	(0.112)	(2.045)	(0.605)	(0.500)	(0.619)	(0.672)
Age	0.0234*	0.0325***	0.0331***	0.0434***	0.0523**	0.0131	0.0438**	0.0541***	0.0509***	0.0424**
	(0.0141)	(0.0109)	(0.00961)	(0.0131)	(0.0210)	(0.0585)	(0.0173)	(0.0143)	(0.0177)	(0.0192)
Age squared	−0.000104	−0.000207*	−0.000186*	−0.000278**	−0.000337	−0.000142	−0.000453**	−0.000509***	−0.000411**	−0.000285
	(0.000140)	(0.000109)	(9.59e-05)	(0.000130)	(0.000210)	(0.000614)	(0.000182)	(0.000150)	(0.000186)	(0.000202)
Education	0.0409***	0.0357***	0.0413***	0.0445***	0.0515***	0.0246	0.0428***	0.0405***	0.0521***	0.0555***
	(0.00757)	(0.00586)	(0.00518)	(0.00704)	(0.0113)	(0.0313)	(0.00927)	(0.00767)	(0.00949)	(0.0103)
Household size	−0.175***	−0.178***	−0.177***	−0.180***	−0.186***	−0.167**	−0.200***	−0.222***	−0.189***	−0.173***
	(0.0159)	(0.0123)	(0.0109)	(0.0148)	(0.0238)	(0.0661)	(0.0196)	(0.0162)	(0.0200)	(0.0217)
Gender	0.0452	0.0838	−0.0450	−0.0125	0.00108	−0.527	−0.692***	−0.343**	−0.303*	−0.0792
	(0.0810)	(0.0627)	(0.0554)	(0.0753)	(0.121)	(0.548)	(0.162)	(0.134)	(0.166)	(0.180)
Rural household	−0.222***	−0.316***	−0.404***	−0.446***	−0.701***	−0.486	−0.487***	−0.487***	−0.401***	−0.660***
	(0.0750)	(0.0580)	(0.0513)	(0.0697)	(0.112)	(0.319)	(0.0943)	(0.0780)	(0.0965)	(0.105)
Constant	9.253***	9.718***	10.41***	10.70***	11.54***	3.840**	8.815***	9.602***	9.764***	10.75***
	(0.376)	(0.291)	(0.257)	(0.350)	(0.562)	(1.554)	(0.460)	(0.380)	(0.470)	(0.511)
Occupation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861

Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.
^ For models presented in columns (6–10), 'Remittances' variable is based on the instrumental variable method [specifically, remittances were regressed on nonagricultural land ownership, cellphone ownership, and precipitation from trend, as well as the other controls included in the second stage].

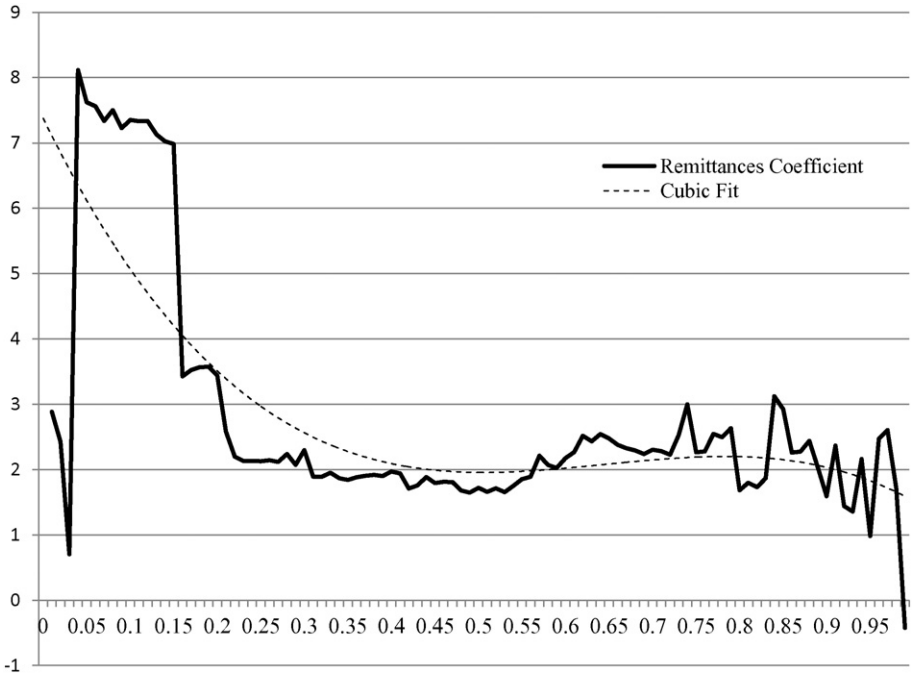

Fig. 3. Instrumental variables quantile regression remittances dummy coefficient by quantile.

With regard to remittances, we see that remittances have a strong and statistically significant effect at all levels of the distribution. As shown in Table 2 and illustrated in Fig. 3 for the IVQR model, households that receive remittances are able to spend between 20 and 40% more according to the standard quantile model and between about two and seven times as much per capita in the IVQR model compared with similar households that do not receive remittances. Thus, independent of how the benefits of remittances are distributed, remittances yield substantial benefits at all levels of the distribution.

Across the distribution, the standard quantile regression [columns (1) – (5)], which does *not* account for differential access to the benefits of migration between rich and poor households, suggests that it is rich households that benefit most from remittances. This is because remittances raise the conditional 75th and 90th quantiles by 35 and 40%, respectively; whereas remittances increase the tenth and 25th quantiles by just 20 and 22%, respectively.[19]

[19] These impacts are also statistically different from one another. The test statistic for the test of the remittances coefficient in the 10th quantile regression being equal to the corresponding coefficient at the 90th percentile is about 2.67, with a P-value of 0.00755. The difference between the 10th and 75th percentiles obtains a test statistic of 2.38 with a P-value of about 0.017.

However, we see from the IVQR results [columns(6)–(10)] the poorest households actually stand to benefit the most when they receive remittances. As evidence of this, we point to the fact that remittances raise the level of the conditional quantile by about 735% at the 10th percentile; they raise the conditional 25th percentile by a little over 200%; they raise the conditional 50th percentile by about 170%; raise the conditional 75th percentile by about 225%; and they raise the 90th percentile by about 160%.

Crucially, the IVQR results control for the fact that households that already spend more (because they also earn more) are also the households, which are most likely to migrate and receive remittances. One reason for the differential in the opportunity to benefit from remittances arises in part due to financial constraints such as the sheer cost of migrating and credit market imperfections that prevent low-income households from borrowing to cover the costs. Another reason for differential opportunities is migration policies in the host country, which may include quotas, administrative barriers, and policies that set explicit preferences for skilled (and therefore usually higher-income) migrants.

From this, we conclude that the impact of having the opportunity to receive remittances carries with it the prospect of substantially reducing both the level of income inequality and the incidence of extreme poverty within a region. In fact, previous studies of the impact of remittances on income inequality that find a widening effect of remittances on income distribution are likely to be flawed due to the bias that endogeneity in remittances introduces. Once we instrument for endogeneity in remittances, we show that remittances themselves make expenditures more equal. We interpret this result as evidence that the unequalizing effects of remittances arise mostly because of disparities in households' access to migration and channels they might be able to use to send remittances home to their families, which in turn may be functions of institutions in the home countries and policies in the host country.

The same results indicate that previous studies may have understated the poverty-reducing potential for remittances due to a failure to account for the endogeneity in households' decisions to migrate and send remittances. Thus, even if we take the distributional findings described above with a high degree of skepticism, there is still good reason to believe that remittances benefit poor households by a substantially larger margin than previous household studies that do not control for endogeneity suggest.[20]

6. Conclusion

We use an instrumental variable quantile regression methodology to measure the impact of remittances on the expenditures for a sample of Kenyan households taken in 2009 when remittances are endogenous. Controlling for these factors, we find that the impact of remittances is positive, large, and statistically significant. We also find that the impact of remittances is largest for the poorest households in our sample. These results imply that the poverty-reducing effects of remittances may be understated by models that only consider the impacts of remittances on average incomes or expenditures, or even quantile models that consider remittances to be fully exogenous.

Accounting for endogeneity, we are able to find a strong equalizing impact for remittances on the distribution of expenditures. IVQR results show that poor households at the 10th percentile of total expenditures that receive remittances were able to spend 730% more than comparable households that did not receive remittances compared with about a 200% at the 25th percentile and above. This indicates a narrowing in the distribution of income.

Previous studies have tended to find that remittances do help poor households slightly by increasing expenditures overall, but many have also found that the benefits of remittances have disproportionately benefitted richer households and therefore have widened the distribution of income. Our results add a twist to this finding. We find that the widening in the distribution of expenditures that may be coming from remittances may in fact be due to disparities in the *access* to the benefits of migration and the opportunity to remit in the first place. These disparities in access to migration and remittances can be explained by differences in the relative costs and benefits of migration for rich and poor households as well as by differences between rich and poor households in terms of their ability to finance the costs of migration. Once we account for these disparities in households' access to migration, remittances lessen inequality.

This interpretation of our results leads to some potential policy implications. Poor households may face difficulty benefitting from remittances because they are unable to finance the move. This bias might be partially overcome by improving access to credit for poorer households so that these households can overcome wealth constraints that stand in the way of migration. Also, migration restrictions by developed countries make migration more costly to poorer families than they do for richer ones. To curb this source of selection bias, our results would also favor reducing restrictions on economic migration. However, we realize that the liberalization of migration policies may face political opposition due to the potential impact on low-skilled wages in developed countries. Therefore, it is important to emphasize that it may be possible that these economic and political costs can be mitigated by the fact that open migration policies enacted by advanced countries can reduce poverty abroad and also improve efficiency at home. This will tend to reduce the need for foreign aid and may actually cost less in the long run than providing aid.

It is also important to note that our study focuses on a relatively small and narrow sample of households in Kenya that were surveyed in 2009. While our results shed new light on the nature of remittances and their impact on income distribution, more studies are needed. Additional country studies would be needed to test the external validity of the findings we have presented, and improved cross-country studies may also be helpful.

[20] Using our same dataset, a standard quantile regression model predicts a slight widening of the income distribution, with households at the bottom of the distribution spending about 20% more when they receive remittances and richer ones spending and nearly 40% more. Accounting for endogeneity both magnifies the overall effect of remittances at all quantiles and suggests a stronger effect for poor households than the standard quantile regression.

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