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Article Title: Do remittances improve income inequality? An instrumental variable quantile analysis of the Senegalese case

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1.1 Introduction

That we have a disproportionate pattern of income distribution among households, nations and regions of the world is no longer a debate. The history of the world is one of constant series of revolt against inequality whether that of one people or nation vis-à-vis another or of one class within a geographical area against another (Walllerstein, 1975). World's inequality is a phenomenon about which most people and groups are quite conscious. However, the gap between the rich and the poor continues to widen and get intractable. Therefore, eliminating or narrowing the income gap is a core contemporary development challenge.

In Africa where poverty and inequality are the most important economic problems, extreme inequality leads to economic inefficiency and deprivation. The higher the income gap, the higher the proportion of the populace that are displaced and denied participation in meaningful, legitimate economic and social activities. Furthermore, extreme income disparities and poverty undermine social cohesion, mobilization and stability which are critical ingredients of economic development (Todaro and Smith, 2011). High inequality increases the rate of urbanization, migration, rent seeking, weakens institutions because of corruption and tends also to increase strife and upheavals.

The idea behind Official development assistance (ODA) or the 'foreign aid-growth links' grew out of the Harrod–Domar growth model. The model which was established by Chenery and Strout (1966), identified three gaps or constraints to economic growth of the less developed countries (LDCs) in which foreign assistance/aid is necessary to fill; the savings gap, the Trade balance gap and the Fiscal gap. Contemporary writers have described remittances as a type of development assistance from the developed to the developing world (Stojanov and Strielkowski, 2013). However, this assertion remain controversial since migration which gave birth to remittances could be highly selective and might leave the migrant sending countries' production in the hands of residual of unskilled labour force. With respect to the effects of migration and remittances on poverty and inequality, the main debates straddle Hirschman's trickling down effect (Hirschman, 1958), Myrdal cumulative causation of 'back wash spread effect hypothesis' (Myrdal, 1959) and Kuznets inverted U- hypothesis (Kuznets,1973). We situate the current work in line with these thoughts and focus on the effects of remittances on household income and its distribution.

Most studies on migration and remittances acknowledge the important developmental roles of remittances in recipient countries. Ratha (2003) portray Remittances as the most tangible and least controversial link between migration and development because of its stability and counter-cyclicality over time compared to other private flows. Trends of remittance flows among countries, especially from developed to developing countries have in recent times increased substantially even without accounting for remittances sent through informal channels. Sub-Saharan Africa is an important reference sub-region with respect to remittance receipt from Europe and North America. The World Bank estimates that remittance flows to the sub-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. Senegal is a suitable case for understanding how remittances affect sub-Saharan Africa being the country with the highest remittances share of GDP in the Sub- region. From 1998, up till 2009, the trend of remittances in Senegal strongly supports Ratha (2003) about the stability and counter-cyclicality of remittance flows. Both nominally and as a percentage of GDP (Figure 1), the trend of remittances remains strongly upward notwithstanding wide fluctuations in Senegalese nominal GDP within the period (Focus Migration, 2007). Remittance inflows averaged around 12 percent of GDP since 2007, contributing nearly as much as half of exports of goods and services, and over four times FDI inflows (World Bank, 2009).

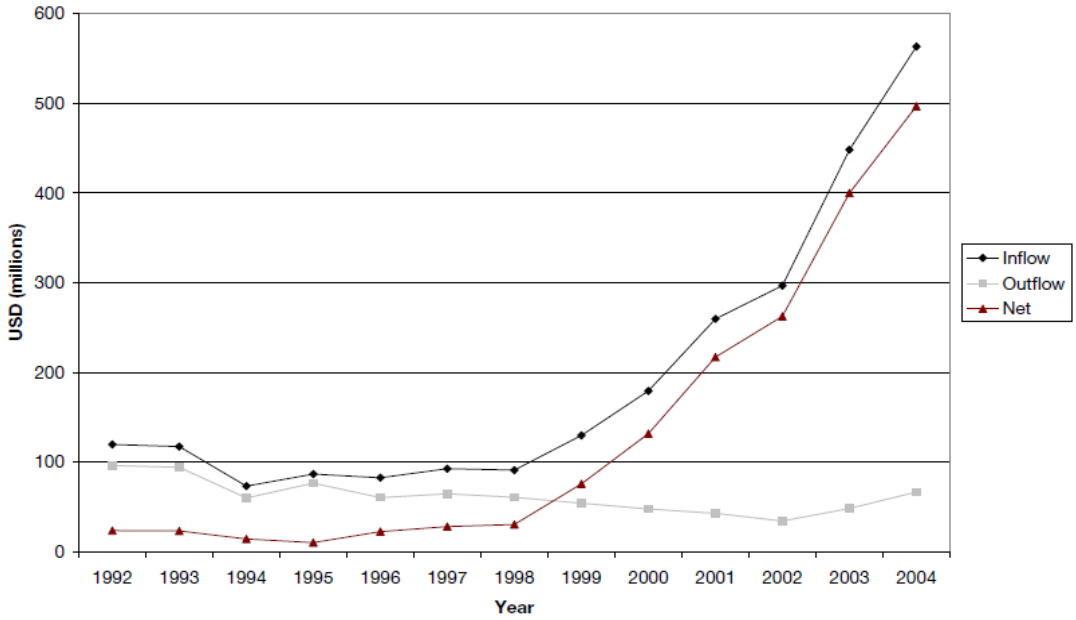

Figure 1: Trend of Remittance Flows in Senegal (1992 - 2004)

Source: IMF (2000) and (2006) in: Focus Migration, 2007

As migrant remittance flows increase, empirical research interests on the developmental roles of remittances increase as well, the result of which is a more abundant evidence on the impacts of remittances on the various dimensions of development. Impacts on growth and poverty are relatively well researched. As Bang et al. (2016) observed, there is more agreement than disagreement with regard to impact of remittances on growth and poverty; most of the evidence suggesting that remittance enhance growth and reduce poverty. Studies such as Catrinescu et al., 2009 and Feeny et al., 2014 support the poverty reduction hypothesis by emphasising that remittances stimulate financial development. Meanwhile, Giuliano and Ruiz-Arranz, 2009; Mundaca, 2009; Aggarwal et al. 2011; Chowdhury, 2011 focused on human capital formation and found that remittances enhance development through increasing educational expenditure at the household level and then Yang, 2008; Adams and Cuecuecha, 2010 and Lartey, 2013 found that remittances increases the level of physical investment, both by alleviating the credit constraints that restrict firms and by reducing macroeconomic volatility.

There is yet no convincing evidence of the impact of remittances on the welfare of the most economically vulnerable section of the recipient country population. In recent times empirical debates in migration literature have centred on the distributional impact of remittances. Most cross country studies report that remittances impact negatively on income distribution (Stark et al., 1986; Barhamand Boucher, 1998; Acosta et al., 2008). Some studies such as ((Taylor and Wyatt, 1996; Taylor et al., 2005; Koechlin and Leon, 2007) report positive impact while (Yang and Martínez, 2005) report no impact at all. Furthermore, the available evidence come mainly from other regions of the world; only very few studies have been conducted on the impact of remittances on income distribution in sub-Saharan Africa even as the region ranks highest in the world in remittance flows as well as income inequality. An obvious explanation for this is the lack of suitable data for meaningful empirical inference. A few studies undertaken in this region (such as Anyanwu, 2011) was based on cross country data and report that remittances widen income gap in the region. Therefore, there is need for more empirical evidence especially those employing micro data.

To improve understanding of migration and remittances in sub-Saharan Africa, the World Bank in collaboration with Africa Development bank conducted a highly representative cross-section migration survey that captures rich information about migrants and their households including

remittance sending and receipt. This was undertaken as part of the Africa migration project and used as case studies migration prevalent countries of Burkina Faso, Kenya, Nigeria, Senegal, South Africa, and Uganda. Bang et al. (2016) was the first to make contribution to the debate about the distributional impact of remittances in sub-Saharan Africa using these surveys. They concluded on the basis of the Kenyan sample that remittances reduce income inequality among households through its more than proportionate income enhancement for households at the lowest quintiles of income distribution. Specifically, although remittances have positive impacts at all quintiles of income distribution for the Kenyan sample, the impact at the lowest quartile is about fourfold the impact at the rest of the quintiles. The present paper follows this work closely and aims at assessing the impact of remittances on income distribution using the Senegalese sample. A unique feature of these surveys is that they allow for comparison across countries since the surveys were implemented during the same period, using similar sampling methodology and achieve similar outcome in terms of its representativeness. Any causal difference between any two of the samples therefore should reflect deep rooted fixed effect that policies should target.

2.1 Why remittances might impact on poverty and inequality

For remittances to affect the income distribution among the population, it must have differential impact on households at different levels on the population income distribution. In addition, it should also affect the productivity of the recipients or enhance the productivity of other factors possessed by the recipient. Theory recognises household's perception of income from remittance as a key factor because it mediates the impact of remittances on welfare by determining the use to which the households put remittance income: remittances replace compensation to local production activities of migrating workers and thus must outweigh such compensation or contain further production information in order to have meaningful impact on household welfare. Thus the debate about the contribution of remittances to household's welfare is not limited to the quantitative addition to the household income but that by its nature, remittances incorporate some additional information that enhance their values to the households. If income constraint is binding on households as is largely the case for most households in Sub-Saharan Africa, the contribution of migrant remittances to household's expenditure can evoke different income perception that will channel expenditure towards productive goods. Regarding this, three different perceptions are discussed in literature with their attendant use corollary: one is that remittances are transitory income and are spent on

investment goods such as human and physical investments. Empirical evidence supporting this perception include; Edward and Ureta (2003), Yang (2008), Mansour et al. (2011), Adams and Cuecuecha (2010) for the case of education; Adams and Cuecuecha (2010) for the case of housing and Woodruff and Zenteno (2007), Taylor and Mora (2006). The second perception is that remittance causes household members to reduce their labour supply and spend remittance income on consumption substituting for labour income. Studies that support this perception include; Chami et al. (2005) and Adams and Cuecuecha (2010). The third perception is that remittances are fungible and that they are treated the same way as income from traditional sources. This perception is supported by the following studies; Randazzo and Piracha, (2014), Castaldo and Reilly (2007), Zarate – Hoyos (2004). The discussion of perception of remittances so far explains the linkage between remittances and recipient's income and wellbeing but has nothing to say about recipient's income standing relative to others in the society.

Why remittances might affect the income distribution is that the perception of remittances may depend on the socio-economic context in which they are received: Adams et al. (2008) suggests that middle income households may better understand the value of remittances and use it more productively bearing in mind the transitory nature of it. But migration may induce very poor households to substitute remittances for labour income thereby cutting back on labour supply. Since remittance could cater for basic life needs, the recipient household's members are less inclined to work. This is consistent with remittances widening income disparity at least between the middle class and the extremely poor. However, some studies document evidence that remittances may relax the investment finance constraint in the presence of imperfect capital market: The link between investment capital and investment in productive assets is well documented especially in developing countries; Paulson and Townsend (2004) argue that lack of capital constrains Thailand households from starting businesses or expanding on existing ones. In Tunisia, Mesnard (2004) find positive relationship between temporary migration and the desire to start up business upon return. The receipt of remittances may also empower recipients to move away from less profitable occupations to more profitable ones on the basis of insurance provided by remittances. For instance, Acosta et al. (2008) argue that the receipt of remittances is associated with higher probability of being self-employed as opposed to being a wage earner. Thus, this supports the hypothesis that remittances are being used productively but much more, it suggests that low income households might benefit more than proportionately from remittances compared to higher income households. This is because if

remittances relax the invest finance constraint, its benefits should accrue more to the sample more constrained by finance which are the extremely poor households. However, access to remittances is not without costs: remittances are realised after the costs have been paid. Costs therefore mediate migration selection and receipt of remittances. Literature generally makes assumptions about the pattern of selection and makes perditions about the outcomes of migration on the sending households based on these assumptions. Three different assumptions can be distinguished: some studies assume negative selection by which migrant selection favours the low income households because they have lower opportunity cost of migration than the high income households. Studies in this class that further accept the transitory income household perception of remittances end up to predict that remittances reduce income inequality (see Taylor and Wyatt, 1996; Taylor et al. 2005; Zhu and Luo, 2008 and Zhu and Luo, 2010). Another strand of studies assumes negative selection but still rejects the transitory income perception in favour of the behavioural change perception in which households cut back on labour supply as they become remittance receiving households. This class of studies generally predict more income inequality arising from poor households becoming dependent on remittance after the episode of migration of a member or members. Thirdly, other class of studies assume positive selection by which high income household are more favoured in migration selection because they are more able to afford the direct costs of migration. Again, given the idea that higher income households better understand the nature of remittances and are more likely to put them to productive use, studies in this class support the hypothesis that remittances widen the income gap between the poor and the rich households (see Adams, 1989; Barham and Boucher, 1998; Acosta et al. 2008).

2.2 Empirical Studies on Remittances and Inequality

In general, studies that expressly model impact of remittances on income inequality tend to find contrasting results; The evidence is conflated by endogeneity arising from inability to compute counterfactual income on the basis of remittances status since remittance receiving households are not often drawn at random (see Ghosh, 2006; Ratha, 2007). For instance, the surveys conducted as part of Africa migration project show that Households that receive remittances may be richer to begin with, but may also have higher incomes because of migration and the receipt of remittances. Gupta et al., (2009) shows that more than half of households in Burkina Faso, Ghana, and Nigeria, and 30 percent of households in Senegal

receiving remittances from outside Africa are in the top two consumption quintiles. Secondly, the evidence is sensitive to methodology: Barham and Boucher (1998) developed analytical framework for the study of the relationship between remittances and inequality using regional dataset from Nicaragua. The framework disregarded the unitary household model and imputed income to individual household migrants rather than imputing incomes by household unit as in Adams (1989). Using this method, after the decomposition of Gini coefficient, they find that remittances increase inequality. A revaluation of the work based on Stark et al.'s (1986) approach, found that remittances decrease inequality. This marks the beginning of contrasting results in remittance – inequality studies and underscores the potential importance of methodology in the analysis of remittances. By estimating household consumption function on the basis of a panel of living standard measurement survey (LSMS) of Nepal, Acharya and Leon-Gonzalez (2012) simulate the impacts of remittance on poverty and inequality in Nepal. The results show that remittance reduces poverty and inequality conditional on participation of households belonging to the lower quintiles of income distribution and on the source of the remittances. Specifically, the result shows that remittances from India to Nepal as against other sources of remittances has the greatest impact on poverty and inequality due to the high participation of the poor in the nearby Nepal-India migration.

In Africa, one of the earliest studies of remittances and inequality is a cross country study by Anyanwu (2011). This paper investigates the impact of migrant remittances on income inequality in African countries, using a panel of five eight-year non-overlapping windows for the period 1960-2006. The results suggest that international migrant remittances have a significant positive impact on income inequality in African countries even after accounting for endogeneity. Specifically, after instrumenting for the possible endogeneity of remittances, a 10 percent increase in remittances as a percentage of GDP leads, on average, to a 0.013 percent increase in income inequality in Africa. The result is mediated by several macroeconomic indicators such as inflation and initial GDP and varies by sub-regions within the region.
Adams et al. (2008) used a household survey from Ghana conducted in 2005 and 2006 in another study of remittances' effect on poverty and inequality. As in Adams (2004), their strategy was to predict household expenditure figures for a counterfactual no-migration scenario. They found that remittances decrease the extent, depth and severity of poverty using the indices developed by Foster et al. (1984).

The work of Bang et al. (2016) remains a novelty in this area of research due to the application of instrumental variable quantile regression analysis to investigate the impact of remittances on income inequality. Based on the Kenyan sample, the results show a clear support to the hypothesis that remittances reduce poverty and inequality. Building on this idea, the present paper aims to investigate the role of remittances in income redistribution in Senegal using as in the case of Bang et al (2016) instrumental variable quantile regression analysis.

3.1 Data

The data for this analysis come from the Senegalese Migration Household survey conducted by World Bank in conjunction with African Development Bank as part of the African Migration Project (AMP).Information collected include the amount of remittances a household received in the last 12 months and the amount spent on food and other items for designated periods of time. It also collects information about migrants' and their households' demographic characteristics. Remittances include both international (cross-border) and national (within-country) person to person transfers of money by migrant member or non-member of a given household. The survey is nationally representative. A total of 2,100 households were interviewed from which information concerning 1,953 households were made available for analysis. From the question about the amount of remittances received by household we divided the sample into those who receive remittances and those who do not receive remittance from internal or international migration. After data cleaning, the number of households with suitable information for this study is 1,950. Out of this number, there were 1,051 households who did not receive any form of remittance (internal or international) and 902 households that received either internal or international remittance. The remittance variable in this analysis is a dummy variable capturing whether a household received remittance or not and not based on the quantity of remittances received as the quantity of remittance is known to be noisy and prone

to measurement error (see Bang et al. (2016)). The idea is that much of the variations in remittances derive from just having access to remittances and not on the quantitative amount of remittances received. Appendix A describes the variables for the empirical estimation.

3.2 Estimation Methods

The empirical estimation follows the model of household expenditure adopted from Bang et al., 2016 and specified as follows;

$$LnExppc_i = \beta_0 + \beta_1 Remittances_i + \beta_2 Age_i + \beta_3 Age_i^2 + \beta_4 Education_i + \beta_5 HHsize_i + \beta_6 FemaleHead_i + \beta_7 Urban_i + \sum_j \delta_j Occupation_{ij} + \sum_s \gamma_s Region_{is} + \varepsilon_i \quad (1)$$

Where the dependent variable is the natural logarithm of the per capita household expenditure per annum.[1] The explanatory variables are as summarized in Table 1 and $\varepsilon_i$is idiosyncratic error term.The model is estimated using instrumental variable quantile regression (IVQR) model developed by Chernozhukov and Hansen, (2008). This method is important for this study in two main ways; it provides a way of treating endogenous control variables such as remittance in this case. Then it provides opportunity to better describe behaviour of households at different income levels. Following previous studies, the IVQR model is specified as follows;

$$\in = D'\alpha(U) + X'\beta(U), \quad (2)$$

$$D = f(X, Z, V), \quad U|X, Z \sim Uniform(0,1), \quad (3)$$

$\in$ is the natural logarithm of per capita household expenditure being used in the current study to proxy household income. **U** is a catch all error term for all unobserved idiosyncratic factors affecting household expenditure and assumed to follow a uniform distribution (Du et al. 2014). **X** is a vector of all exogenous variables of the model, in this case; age of household head and

[1] Household expenditure is measured as the sum of food and non-food expenditure per annum. Food expenditure is measured in the past 1 week while non-food expenditure is measured in the past 6 months. Annual figures were derived from both and summed.

the square, education of household head, household size, gender of household head, location where the household resides in terms of urban or rural areas and also the precise location in a known region of Senegal and finally occupation of household head. **D** is the endogenous regressor assumed to be selected on **X**, **Z** and **V** where **Z** is an IV or group of IVs. While **V** is an error term affecting **D** (see Bang et al., 2016 for explanation of the preference of a dummy variable representing the receipt of remittances instead of its continuous form)**.** Causal identification therefore depends on the identification of valid instrument (s) to ensure random assignment to remittance treatment. The summary statistics for the variables are as presented on Table 1 while the description of the variables is presented in Appendix A.

This paper to the best of our knowledge is one of the pioneer empirical studies making use of the African Migration Project dataset to investigate the impact of remittances on income distribution. The paper follows the previous studies in treating remittance as a dummy variable since the continuous version is noisy and censored at zero.

3.2 Data Summary and Basic Statistics

The summary statistics for the sample is presented on Table 1. Average per capita annual expenditure in the sample is 282, 675 CFA (about $600).[2] This is about $400 less than the 2009 per capita income of Senegal as calculated by World Bank. Thus, the migration household survey data does not appropriately capture income situation in Senegal. However, the inequality index calculated on the basis of the data: 44.9% for the entire population of household (47.9% for non-remittance households and 42.6% for remittance households) is close for to the Gini index (40.3 %) calculated by World Bank for the country in 2011 (the closest year for which the data is available). There is about 5 percentage point difference between the inequality index calculated from the data compared to (World Bank, 2011) and

[2] Using the 2009 CFA/exchange rate of 472 CFA per US dollar (World Bank)

this difference is attributable to the fact that the survey was targeted on the basis of migration history and not necessarily to represent income distribution in the country.

Table 1: Summary Statistics for the Variables of the Model

Variable	Mean	Std. Dev.	Min	Max
Expenditure per capita	282,675	628,940.2	5,057.14	19,800,000
Per Capita EXP by Remittance HH	246,522.2	351,971.2	9,531.2	4770000
Per Capita EXP by non-Remittance HH	313,791.3	792,240.9	5,057.1	19,800,000
Share of Remittance Household	0.498	0.500	0.000	1.000
Household Size	10.265	5.896	1.000	24.000
Share Household Head Education>Secondary	0.382	0.486	0.000	1.000
Share of Urban Households	0.685	0.465	0.000	1.000
Household Network	0.106	0.308	0.000	1.000
Community Network	1.370	1.937	0.000	18.000
Non Agricultural Land ownership	0.202	0.401	0.000	1.000
Household Head Age in years	53.012	14.878	20.000	97.000
Share of Female Household Head	0.299	0.458	0.000	1.000
Occupation				
Manager	0.007	0.084	0.000	1.000
Professional Occupation	0.021	0.142	0.000	1.000
Technical Occupation	0.017	0.128	0.000	1.000
Service Occupation	0.021	0.145	0.000	1.000
Clerical Occupation	0.072	0.258	0.000	1.000
Agricultural Occupation	0.099	0.299	0.000	1.000
Craft Occupation	0.060	0.238	0.000	1.000
Operator Occupation	0.033	0.177	0.000	1.000
Elementary Occupation	0.047	0.212	0.000	1.000
Armed Forces	0.002	0.044	0.000	1.000
Other	0.007	0.081	0.000	1.000
Casual occupation	0.029	0.166	0.000	1.000
Region				
Dakar	0.300	0.152	0.000	1.000
Diourbel	0.130	0.337	0.000	1.000
Fatick	0.029	0.169	0.000	1.000
Kaolack	0.068	0.252	0.000	1.000
Kolda	0.021	0.143	0.000	1.000
Louga	0.086	0.280	0.000	1.000
Matam	0.138	0.345	0.000	1.000
St-louis	0.087	0.282	0.000	1.000
Tambacounda	0.027	0.162	0.000	1.000
Thies	0.083	0.275	0.000	1.000
Ziguinchor	0.020	0.141	0.000	1.000

To motivate the analysis in this paper, we first employ the Lorenz curve method (Blacklock and Smallwood, 1982) applied to the sample of cumulative household expenditure. The Lorenz curve shows the percentage of overall expenditure accounted for by a given percentage of the entire household population. If there is perfect distribution, each percentage of the household population will account for the same percentage of the expenditure.

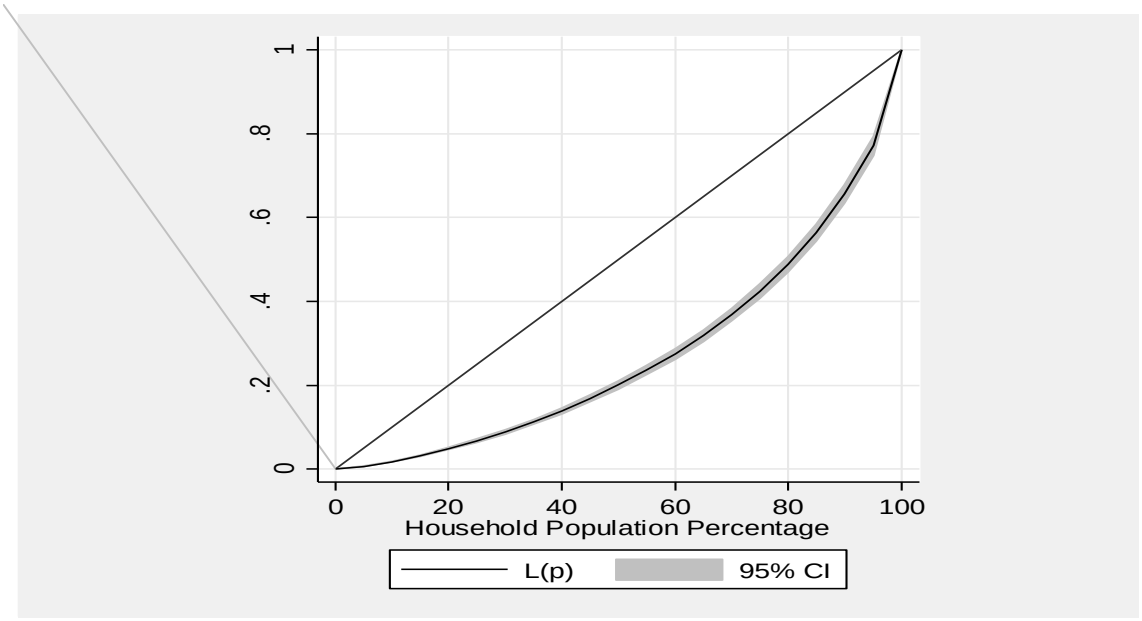

Figure 2a: Lorenz Curve (pooled Sample)

Source; Authors' calculation based on the Senegalese Migration Household Survey

Figure 2a shows the Lorenz curve for the entire 1950 household population. As can be seen from the figure, the expenditure distribution is highly unequal; 40% of the households share less than 20% of the cumulative expenditure of the population. The household population is further divided into remittance and non-remittance household samples and the Lorenz curve refitted separately to the two samples.

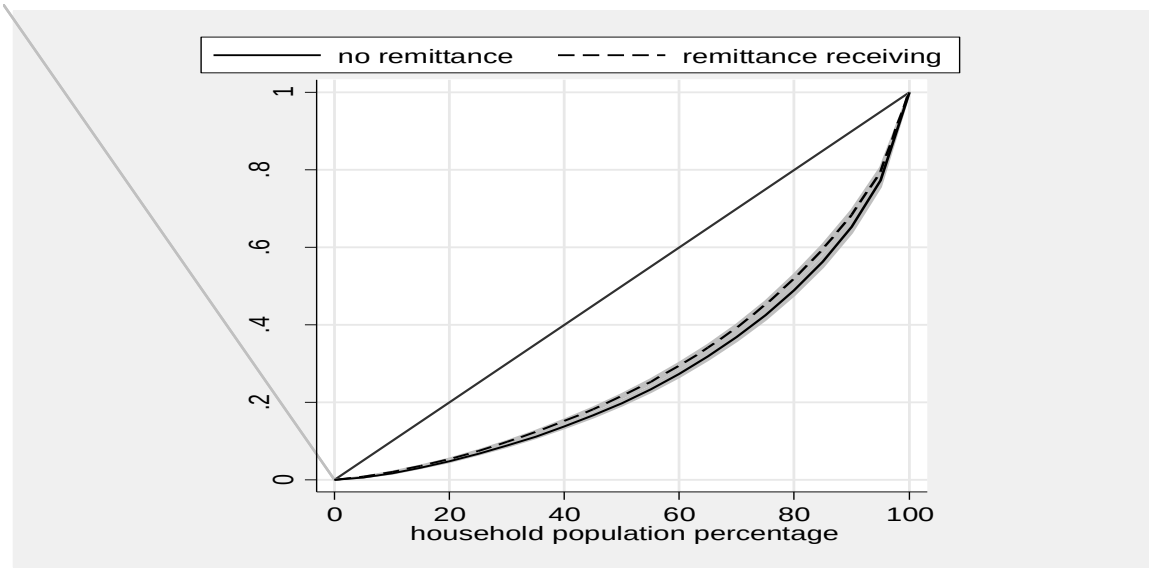

Figure 2b: Lorenz Curve by Remittance Status

Source: Authors' Calculation based on the Senegalese Migration Household Survey

As can be observed from Figure 2b, expenditure distribution among remittance receiving households is slightly less unequal than the non-remittance receiving households suggesting that remittances may be contributing to income redistribution among the Senegalese households. The two curves diverge from each other starting from 20 percent expenditure proportion and unite once more around 80 percent.

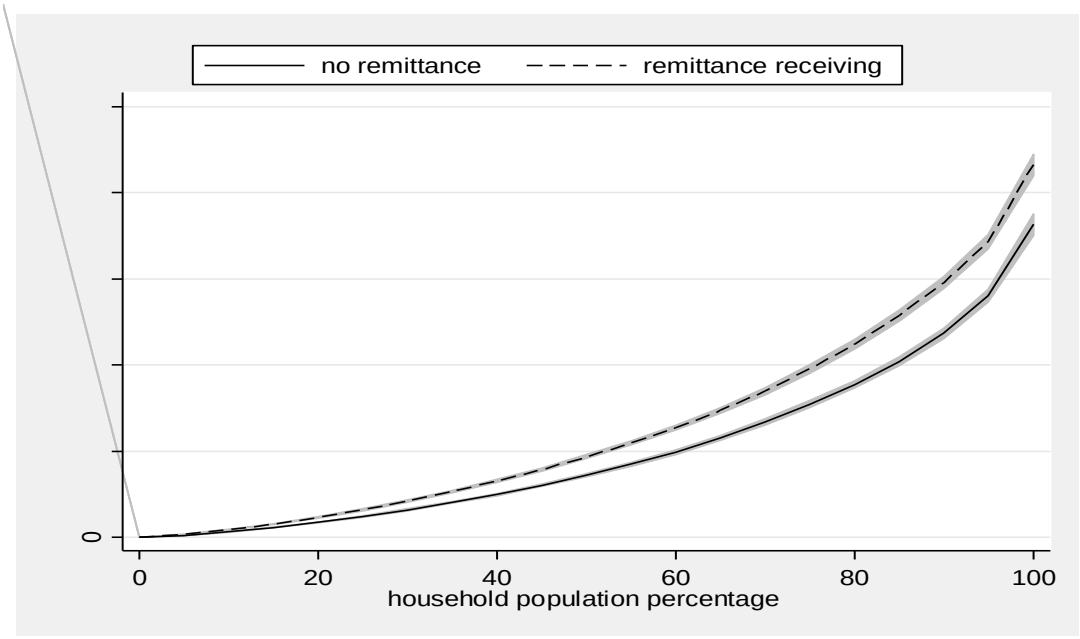

Figure 2c: Welfare Ordering of Lorenz Curves by Remittance Status

Source: Authors' Calculation based on the Senegalese Migration Household Survey

Since the dominance of one distribution over another in terms of the Lorenz curves does not have a clear implication from a welfare perspective, Figure 2c is computed on the basis of cumulative mean expenditure and it shows clearly that not only is the expenditure distribution for remittance receiving households less unequal than the expenditure distribution for non-remittance receiving households, it is also preferable from a welfare perspective.

However, the foregoing distribution analysis is only naive and is not an evidence of the impact of remittances on income distribution. Bearing in mind that neither of the samples above is a random sample due to sample selection bias in remittances receipt (World Bank 2006; Ratha 2007). For instance, households receiving remittance tends to be larger in size; the mean household size for non-remittance receiving household is 8.3 whereas remittance receiving households have 10.2 mean household size (see Appendix B for a summary of selectivity in the sample). With this in mind, care must be taken of the role endogeneity and selection bias may play on how remittances impact on the distribution of expenditures. In particular, in the case where negative selection leads to narrowing in incomes, we would expect that controlling for this selection bias would worsen income inequality. To achieve randomness, instrumental variable quantile approach suggested by Chernozhukov and Hansen (2008) was used; this methodology had earlier been applied for the analysis of inequality and wage dispersion by Bang et al. (2016) and Du et al. (2014) respectively.

3.3 The Choice of Instruments

A number of empirical studies had used unexpected rainfall shock as instrumental variable to control for selection in studies of migration and remittances (Adams and Cuecuecha, 2010; Bang et al. 2016). However, this instrument is potentially invalid or weak in sub-Saharan Africa context because of the following reason: rain fed agriculture provides employment to a large

proportion of the region's population and the agricultural industry remains largely subsistent and households save little or nothing so that current income is based on current production (Chauvin et al., 2012).The critical assumption motivating the use of rainfall as an IV is that rainfall affects household expenditure only through migratory remittance. However, this is clearly not the case given the scenario described above for the sub-Saharan Africa context or any context where rain fed agriculture is predominant. Other empirical studies employing rainfall shock as IV for different outcome variables such as conflict chooses this instrument for precisely reasons related to the violation of exclusion restriction in the migration case. For example, Miguel et al, 2004 justified their choice of instrument with the argument that in agriculturally dependent regions, negative rainfall shocks lower income which incites violence. In a migration and remittance case such as the current paper, household expenditure is used as a proxy for household income and since expenditure notwithstanding migration clearly derives from current income, exclusion restriction in this case may be violated and the instrument biased. In addition, Sarson, 2014 shows that this instrument is particularly problematic and that even when the exclusion restriction is violated it remains a strong predictor of the outcome variable.

Thus, rainfall shock was not employed as instrument in this work. To address the problem of endogenous remittance variable, we used three instrumental variables for Z in equation 3. They include; ownership of non-agricultural land, presence of any return migrant in household and community migration network defined as the total number of migrants including return migrants in a village minus the number in household. Non-agricultural land ownership as a form of asset holding of households has been employed in previous studies and justified to fulfil the relevant restriction by being associated with lower propensity to migrate and since it is not directly associated with productivity like its counterpart; non-agricultural land also fulfils

the exclusion restriction (see Adam and Cuecuecha, 2010; Bang et al, 2016). The other two IVs derive from network theory of migration (Mackenzie and Rapoport, 2007): the role of migration network defined as the accumulation of households with migration experience in a neighbourhood is to lower the information and other costs of migration without affecting households' income or expenditure. Some variants of this IV have been successfully applied in modelling migration in Senegal (Mezger and Cora, 2012; Jorgen and Hovde, 2013; Chort, 2011). Two variants are applied in the current work: the first is based on households and is a dummy variable which takes the value of 1 if there is at least one return migrant in a household and 0 otherwise. The second is a community network defined as the number of migrants (including current and return migrants) in a village minus the number existing in a given household. We assume that households in Senegal will form migration network on the basis of villages in which they live. Then we additionally take advantage of the presence of return migrants among the sample to construct the IVs used in the work.

Using these IVs and the exogenous variables, the conditional τ-quantile of log expenditure is thus expressed as follows;

$$\in \tau \ = D^{'}\alpha(\tau) + X^{'}\beta(\tau). \qquad (4)$$

The model is then estimated using the IVQR procedure. For full details about this procedure and its theories (see Chernozhukov and Hansen, 2008; Du et al, 2014 and Bang et al, 2016).[3]

4.1 Empirical Results

The empirical results are presented in Tables 2, 3 and 4. In Table 2, column 1, we present the result of a naive OLS regression where the logarithm of per capita household expenditure is regressed on its covariates including the endogenous regressor (remittance) without correction

[3] In particular, at the first stage of the estimation, the endogenous remittance variable is regressed on the IVs and other exogenous variables to be used in the second stage.

for the endogeneity of remittances receipt. In column 2, the result of a two stage OLS using the instruments described above is presented. The two results are similar in terms of the signs of the coefficients; all coefficients turn out with signs predicted by theory except the coefficient of household head gender which turns out to imply that female headed households have more expenditure per head than male headed households; this is a peculiar feature of the Senegalese sample.

Table 2: OLS and 2SLS Estimates

VARIABLES	(OLS) lnexppc	(IV/2SLS) lnexppc
Remittance	0.129***	2.575***
	(0.0363)	(0.736)
Household Size	-0.0415***	-0.0800***
	(0.00327)	(0.0128)
Household Education	0.295***	0.577***
	(0.0421)	(0.0913)
Household Head Age	-0.0201***	-0.00504
	(0.00734)	(0.0141)
Household Head Age sq	0.000189***	-0.584***
	(6.78e-05)	(0.220)
Female Household Head	0.149***	2.57e-05
	(0.0426)	(0.000131)
Urban	0.372***	0.760***
	(0.0445)	(0.245)
Occupation Dummies	Included	Included
Region Dummies	Included	Included
Constant	12.66***	11.88***
	(0.198)	(0.466)
Observations	1,950	1,950
R-squared	0.383	Na
Anderson Canon Corr. LM Statistic		15.574
P_Value		0.0004
Sargan statistic		0.018
P_Value		0.8927

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The female headed households are more likely than their male counterparts to situate in the topmost positions of the expenditure percentile (see Appendix B). Additionally, the female headed households are more likely to receive remittances than their male counterparts. The difference between the two results in Table 2, columns 1 and 2 lies in the magnitude of the coefficients and their precision. The coefficients in the IV estimation appear larger in magnitude giving an indication that the naive OLS is biased downwards by endogeneity. As the theory of instrumental variable suggests, the correction by instrumental variables comes with loss of precision through the increased standard errors of the coefficient estimates. Tables 3 and 4 contain another set of comparable results; Table 3 reports a traditional (no instrument) quantile regression of the logarithm of per capita expenditure on its covariates while Table 4 is the instrumented quantile regression estimates. The traditional quantile regression gives a picture of uniform impact of remittances on all quantiles of income distribution; the coefficients are not statistically different from one another but all coefficients are positive and significant. Thus, the results imply that remittances have positive impact on income poverty in Senegal but not implicated in income redistribution.

Table 3: Naive Quantile Regression Compared to OLS Estimates

VARIABLES	(1) OLS	(2) q10	(3) q25	(4) q50	(5) q75	(6) q90
Remittance	1.716	0.198***	0.189***	0.119***	0.0716	0.145**
	(0.348)	(0.0583)	(0.0425)	(0.0413)	(0.0499)	(0.0731)
Household Size	-0.066	-0.0420***	-0.0435***	-0.0412***	-0.0399***	-0.0329***
	(0.006)	(0.00644)	(0.00485)	(0.00449)	(0.00510)	(0.00615)
Head Education	0.299	0.215***	0.242***	0.283***	0.307***	0.373***
	(0.042)	(0.0763)	(0.0423)	(0.0543)	(0.0619)	(0.0856)
Head Age	-0.010	-0.00690	-0.00101	-0.0129	-0.0364***	-0.0216
	(0.008)	(0.0138)	(0.00901)	(0.0107)	(0.0108)	(0.0196)
Head Agesq	0.0002	7.30e-05	1.73e-05	0.000142	0.000334***	0.000186
	(0.000)	(0.000136)	(8.55e-05)	(9.88e-05)	(9.87e-05)	(0.000181)
Female Head	-0.299	0.150**	0.120**	0.169***	0.116*	0.205**
	(0.107)	(0.0685)	(0.0487)	(0.0559)	(0.0615)	(0.0921)
Urban	0.470	0.458***	0.286***	0.286***	0.380***	0.426***
	(0.049)	(0.0813)	(0.0566)	(0.0613)	(0.0692)	(0.0806)
Constant	12.013	11.37***	11.80***	12.42***	13.55***	13.61***
	(0.243)	(0.341)	(0.241)	(0.292)	(0.286)	(0.486)
Occupation Dummies	Included	Included	Included	Included	Included	Included
Region Dummies	Included	Included	Included	Included	Included	Included
Observations	1,950	1,950	1,950	1,950	1,950	1,950

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

However, this is a naive analysis: endogeneity and selection is well documented in remittance and migration research hence the use of IVs for its correction. With selection into receiving remittances corrected using instrumental variables, Table 2 reports the main linear regression results: Instruments relevance and validity was confirmed with Anderson – Conan and Sargan statistics respectively: as can be seen from the table, Anderson-Canon corr.LM statistics takes the value of 15.57 with pvalue of 0.0004 and Sargan statistics takes the value of 0.018 with pvalue of 0.8927 thus confirming that the chosen instruments are both strong and valid. The marked difference between the two quantile regression estimates can be seen from Tables 3 and 4:

Table 4: IVQR Compared to 2SLS Estimates

VARIABLES	(IV/2SLS) Lnexppc	(2) 10th Quantile	(3) 25th Quantile	(4) 50th Quantile	(5) 75th Quantile	(6) 90th Quantile
Remittance	2.575***	3.657***	1.282***	0.867*	1.339***	2.481***
	(0.736)	(0.580)	(0.424)	(0.499)	(0.500)	(0.628)
Household Size	-0.0800***	-0.0766***	-0.0596***	-0.0546***	-0.0603***	-0.0691***
	(0.0128)	(0.00952)	(0.00808)	(0.00884)	(0.00945)	(0.0113)
Head Education	0.577***	0.236***	0.256***	0.292***	0.334***	0.285***
	(0.0913)	(0.0783)	(0.0482)	(0.0589)	(0.0655)	(0.0847)
Head age	-0.00504	0.0172	0.00773	-0.00453	-0.0291**	-0.00640
	(0.0141)	(0.0134)	(0.0109)	(0.0121)	(0.0114)	(0.0155)
Head agesq	-0.584***	-0.000157	-6.59e-05	6.94e-05	0.000257**	3.27e-05
	(0.220)	(0.000130)	(0.000105)	(0.000112)	(0.000104)	(0.000145)
Female Head	2.57e-05	-0.467***	-0.154	-0.0326	-0.318**	-0.529***
	(0.000131)	(0.167)	(0.122)	(0.150)	(0.150)	(0.205)
Urban	0.760***	0.566***	0.368***	0.314***	0.472***	0.610***
	(0.245)	(0.0913)	(0.0681)	(0.0683)	(0.0655)	(0.0967)
Constant	11.88***	10.08***	11.21***	12.04***	13.00***	12.67***
	(0.466)	(0.430)	(0.338)	(0.389)	(0.362)	(0.447)
Occupation Dummies	Included	Included	Included	Included	Included	Included
Region Dummies	Included	Included	Included	Included	Included	Included
Observations	1,950	1,950	1,950	1,950	1,950	1,950

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from the instrumental variable quantile regression model shows that remittances have non-linear effect on income distribution: for households in the bottom 20% of the income distribution, expenditure rise by about 365% as a result of receiving remittances, for the households in the 50th and 75th quantile of the distribution, expenditure rises by about 87 and 134% respectively. The coefficients are statistically different from one another and this implies that remittances help households move out of extreme poverty and to catch up with the middle income households. Although the impact of remittance at 10th percentile is larger than the impact at the 90th percentile in absolute terms, this effect is not statistically different from the

effect at the 90th percentile suggesting the inability of remittances to close that gap between the extremely poor and extremely rich households in Senegal (see Figure 3 for illustration).

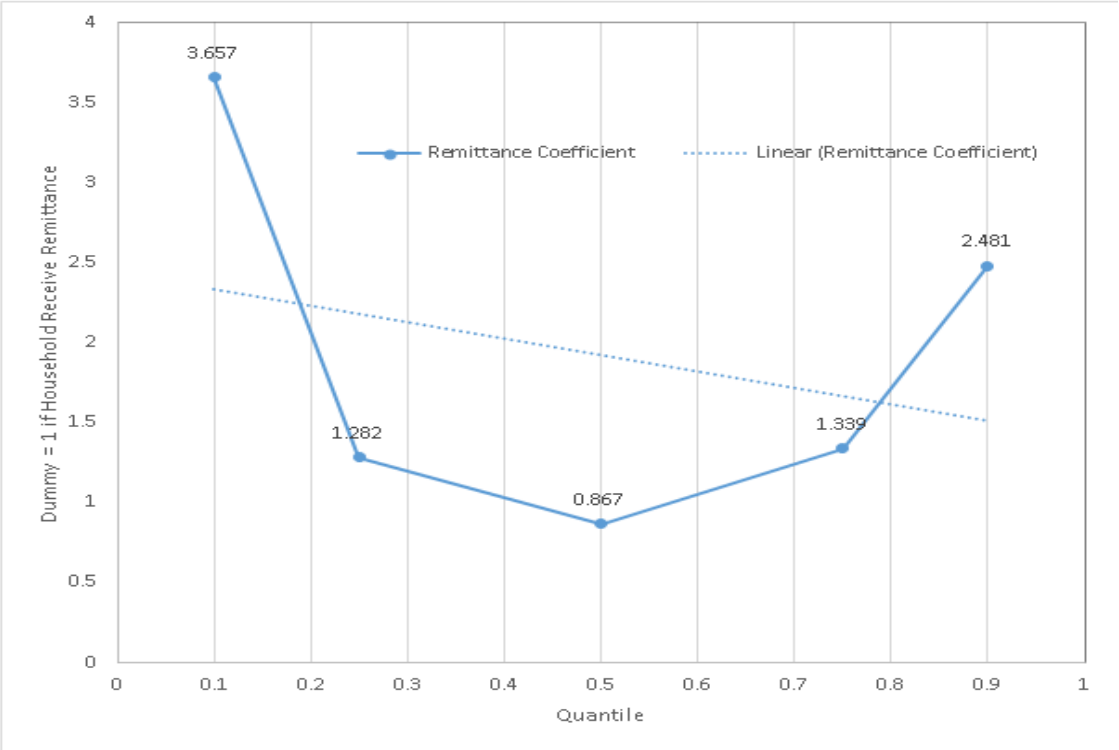

Figure 3: Instrumental Variable Quantile Regression: Remittance Coefficients by Quantiles

Other explanatory variables in the model confirm the existing literature on this topic: education positively impacts expenditures; household size negatively affects per capita expenditures; there is non-linear effect of age of household head on household per capita expenditure declining at first. This is in line the literature on permanent income hypothesis that mostly document dramatic decline in food expenditure at the time of retirement (Banks et al. 1998). In a unitary household setting, the positive association between per capita household expenditure is understandable given that age of household head will be positively associated with the probability of more numbers of income earners within the household.

5.0 Conclusion

We employed instrumental variable quantile regression method to estimate the impact of remittances on the expenditures of a sample of Senegalese households based on the 2009 Africa migration project survey. After instrumenting for endogenous remittances dummy variable and controlling for demographic and households' characteristics, we find positive and statistically significant effects of remittances on all quantiles of the income distribution. The effect at the median income group is a mild 87% being the quantile where the effect of remittances is the lowest. The highest impact is at the 10^{th} quantile where expenditure is increased by 366%. The effects decays gradually, reaching its lowest point at the median income and then rises steadily but never up to its magnitude at the 10^{th} quantile. Although this is largely similar to the results obtained by Bang et al. (2016) because we found some equilibrating influences coming from remittances to the income distribution of the two samples, the two results differ at least in one significant way: the present result does not suggest that remittance can bridge the income gap between the extremely rich and extremely poor households as Bang et al (2016) seem to suggest. The difference between the impacts at the 10^{th} quantile and the 90^{th} quantile is not significantly different from zero. This implies that remittances benefit the extremely poor households more than the middle income households and is capable of moving the poor up the income ladder towards the middle income households but never to the higher income households. Thus remittances only have mild influences on income inequality for this sample and can reduce income only between the very poor and the middle class.

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Appendix A: Variables Description

Variable	Description
Ln EXP_{PC}	Natural log of annual household expenditure (sum of food and non-food expenditure
Remittances	Dummy variable =1 if household received positive amount of cash remittance from abroad in the last 12 months, = 0 otherwise
Age	Household head age in years
Age^2	The squared age of Household head
Education	Indicator of the level of education of household head, = 1 if household head's education is higher than secondary school, = 0 if equal to secondary school or less
HHsize	The number of members in a given household including the migrant member
$Female_{\_Head}$	Indicator for a female headed household
Urban	Dummy =1 if household location is designated as urban, = 0 if designated as rural
Occupation	A group of indicator variables for job description of the household head
Region	A group of regional dummies
HH Network	Dummy = 1 if household has at least one return migrant, 0 otherwise
Com. Network	Number of migrants including return migrants in a village minus number in $household_i$
Non Agric.Land	Dummy = 1 if household owns non-agricultural land, 0 otherwise

Appendix B: Selection Based on Observables

Household Heads Characteristics								Migrant Characteristics					
Percentile	% Received Remittances	% Edu >Secondary[a]	%Edu >Secondary[b]	Mean Age[a]	Mean Age[b]	Female Head[a]	Female Head[b]	Mean Age	% Complete Primary	% Complete Secondary	% Complete University	% Male	Mean Years Abroad
1	26.7	21.4	17.1	50.1	51.0	18.3	37.1	31.3	2.0	1.0	0.2	10.4	6.6
2	39.6	26.8	21.5	49.6	49.9	28.1	47.7	34.3	2.3	2.0	1.0	13.4	5.7
3	39.6	21.5	18.6	50.8	50.3	28.2	39.0	34.2	3.2	1.9	0.8	12.0	6.9
4	38.7	25.4	18.1	51.6	55.1	23.2	27.3	34.1	2.1	1.9	1.0	11.8	6.8
5	39.4	31.2	20.9	51.0	49.9	24.7	32.8	33.5	1.4	2.2	0.7	11.2	6.6
6	51.4	32.7	28.0	53.0	53.5	29.8	43.0	35.1	2.9	2.7	1.1	15.3	7.1
7	50.7	43.1	35.9	52.7	53.2	34.0	48.1	36.2	2.7	3.5	2.2	14.3	7.3
8	50.6	42.0	36.6	55.0	55.6	30.5	43.1	35.6	3.4	3.7	2.0	13.6	7.0
9	49.0	51.5	46.9	54.5	54.1	34.5	43.9	36.4	2.1	4.4	1.8	13.6	7.7
10	56.0	56.9	48.1	56.1	57.6	35.9	47.6	36.3	2.7	4.9	2.6	14.7	8.2
Total (over sample)	46.3	38.3	33.7	53.0	53.9	29.9	42.8	35.2	2.6	3.1	1.5	13.4	7.2

[a]represents quantity calculated on the basis of household population (pooled sample of remittance and non-remittance households)

[b]represents quantity calculated on the basis of remittance receiving household sample only