

**HOW DO INTERNATIONAL REMITTANCES AFFECT POVERTY
IN DEVELOPING COUNTRIES?
A QUANTILE REGRESSION ANALYSIS**

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This study investigates the effect of a surging increase in international remittances on poverty in developing countries. For this purpose, we analyzed panel data for 66 developing countries from 1981 to 2005 using a quantile regression analysis. Our results suggested that international remittances have an uneven effect across poverty quantiles for developing countries. We found that the poverty alleviating effect of remittances was more pronounced in the worst off group or those in the highest quantile (90th quantile) of poverty.

Keywords: Remittances, Poverty Education, Developing Countries, Quantile Regression
JEL classification: D3, O12, O15, O5

1. INTRODUCTION

Over the past three decades, payments made by foreign workers to their families in their home countries, known as *remittances*, have attracted considerable attention from government policymakers, academics, and the media because this phenomenon is depicted as generating continuous, robust economic growth in the home countries. Such international remittances have begun to exceed official development assistance (ODA) by a significant margin. They are now reputed to be the second highest source of external funding next to foreign direct investment (Ratha and Maimbo, 2005).¹ Remittances and compensation for employees in developing countries has grown dramatically, from around US\$400 million in 1970 to US\$194 billion in 2005 (WDI,

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¹ In an economy heavily dependent on remittances, the level of remittances might even exceed the level of foreign direct investment (IFAD, 2007; and OSAA, 2005).

2008). The recently revised estimates of the World Bank for remittance flows for 2007 indicated that US\$251 billion was transferred to developing countries. This indicates that remittances increased by 11% from their 2006 levels (Ratha *et al.*, 2008).

The primary function of the Millennium Development Goal for eradicating extreme poverty and hunger has been to reduce the proportion of people living in extreme poverty (people with an income less than or equal to US\$1.00 dollar a day) in half between 1990 and 2015 (UN, 2008). Poverty is by far the most disturbing issue the world is confronted with. Many argue that the best way to lift people out of poverty is to increase income levels. The counter-argument is that alleviating poverty will not be accomplished instantaneously with a wave of an imaginary wand, because poverty is rooted in factors that are many and complex. In spite of the complexity, remittances are able to increase incomes of families left behind by migrant workers and represent an important channel for alleviating poverty. Nevertheless, the question remains: Are the poor truly benefiting from these remittances? From a macro perspective, most remittances flow to developing countries. Remittances sent to developing countries in 2007 accounted for almost 75% of all remittances worldwide (WDI, 2008).

Previous studies have explored the impact of income transfers on poverty. On a positive note, recipient households can use remittances to fund current consumption, finance asset accumulation, or savings to serve as insurance against income shocks (Chami *et al.*, 2008; Yang and Choi, 2007). Others have argued that remittances fuel economic development, alleviate poverty, smooth patterns of consumption, and exert a multiplier effect through increased household spending (Acosta *et al.*, 2008; Gupta *et al.*, 2009). Conversely, poor households may not benefit from remittances in the long-term if they do not have the capacity to migrate. In this case, remittances can increase income inequality between them and families that can minimally afford to send some family members overseas to work (Lipton, 1980; Stahl, 1982; Adams, 1989). Moreover, a potential moral hazard attaches to the possibility of the increased income in migrants' households might subject home countries to the risk of contracting the "Dutch disease", which could retard the home countries economy. These arguments suggest that the negative implication of remittances must not be disregarded (Chami *et al.*, 2003; Naiditch and Vranceanu, 2009; Chami *et al.*, 2008).

In the literature, studies on the effects of remittances on poverty have primarily applied to specific regions or countries. Consequently, there have been few studies covering a wide range of developing countries. Thus, this study fills this gap by covering a broad range of developing countries with the main objective of analyzing the impact of international remittances on poverty in those countries. This study will add to the literature by scoring two major points of distinction. First, we use a concise and representative account of remittances. Chami *et al.* (2008) suggested using remittances series in the WDI as the most comprehensive series reflecting the inflow of remittances to developing countries. Second, aside from the conventional conditional mean regression, the impacts of remittances on poverty were evaluated across various poverty level distributions using quantile regression (Koenker, 2005). To the best of our

knowledge, this is the first study to attempt to analyze the impact of remittances on poverty in developing countries using quantile regression.

The remainder of the paper is organized as follows. In part 2, we review recent trends in remittances and poverty. In part 3, we review the findings of related studies pertaining to the effects of remittances on poverty. In part 4, we explain the methodology for capturing the effects of remittances over a range of poverty dimensions. In part 5, we estimate the impact of remittances on poverty. In the final section of the paper, our conclusions based on our findings are presented.

2. RECENT TRENDS IN REMITTANCES AND POVERTY

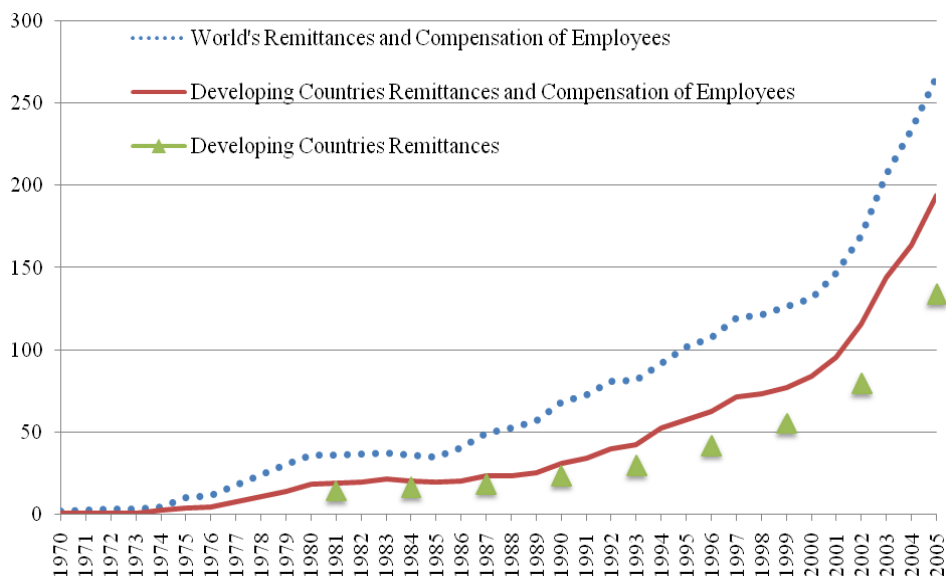
2.1. Trends in Remittances

In the relevant literature, remittances are measured by reference to three components: workers' remittances, employee compensation, and migrant transfers. A common practice among researchers studying the effects of remittances is to sum all three components into one series and represent the sum as the level of remittances. Chami *et al.* (2008) argued, however, that such a practice is problematic and leads to a serious misspecification and faulty conclusions. Their analysis showed that workers' remittances represent counter-cyclical behavior while employee compensation and migrants' transfers do not support counter-cyclical behavior.² Thus, employee compensation and migrants' transfers are more consistent with the behavior of private capital flows than with the concept of remittances as unrequited monetary transfer (Chami *et al.*, 2008).³ Therefore, summing the three series is not a good option, as the resulting series does not conform to the concept of remittances. The authors recommended using only workers' remittances as the appropriate measure. Workers' remittances closely conform to the concept of unrequited transfers between residents of two countries with familial motivations. Accordingly, this study focuses on and uses only worker's remittances as the main variable reflecting international remittances sent by migrant workers to their families in developing countries.

² Counter-cyclical behavior means that a decline (or increase) in the recipient country's economic activity is associated with an increase (or decline) in remittance flows to that country. Counter-cyclical behavior supports the altruistic motivation of remittances.

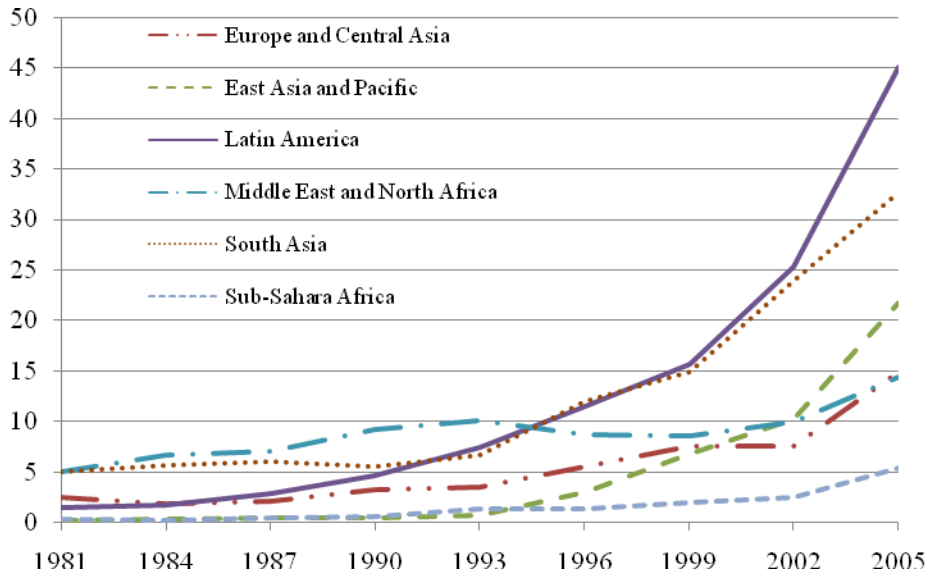
³ Workers' remittances consist of current transfers by migrants who are employed in, and considered as residents of, the countries that host them. Employee compensation consists of wages, salaries, and other benefits earned by individuals in countries other than those in which they reside for work performed for and paid for by residents of those countries. Migrants' transfers are contra-entries to the flow of goods and changes in the financial items that arise from individuals' change in residence from one country to another. This applies more naturally to capital transfers between nongovernmental sectors (Chami *et al.*, 2008).

From a global perspective, the world's remittances and employee compensation rose significantly, from around US\$2 billion in the 1970s to more than US\$250 billion by 2005 (Figure 1). The level of remittances in developing countries increased in accordance with this worldwide trend. Figure 1 shows that, in 1981, reported workers' remittances in developing countries totaled approximately US\$14 billion, while in 2005 remittances channeled through formal institutions were reported to total approximately US\$134 billion. In terms of regional groupings, six main aggregates were considered based on WDI groupings: Latin American countries (LAC), East Asia and Pacific region (EAP), Europe and Central Asia (ECA), Middle East and North Africa (MENA), South Asia (SA), and Sub-Saharan Africa (SSA). In 2005, LAC had the highest level of remittances, followed by SA (Figure 2). EAP exhibited a low level of workers' remittances from 1981 into the early 1990s, but developed into a constantly increasing trend since 1993, as we observed. This region now ranks third in terms of remittances among the regional aggregates. Slow growth continues to characterize SSA in terms of remittances received.



Source: World Development Indicator (WDI, 2008).

Figure1. Worldwide Worker's Remittances, 1970-2005 (in billions of US dollars)



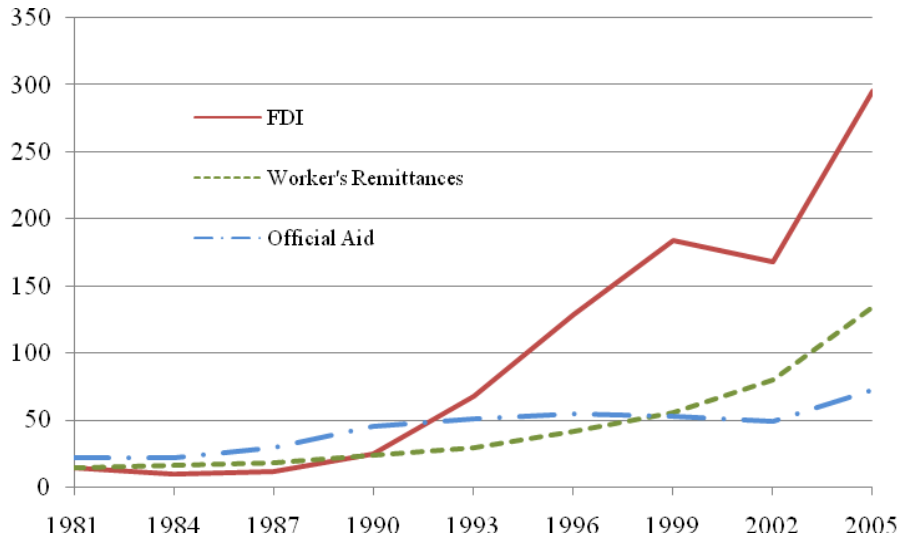
Source: World Development Indicator (WDI, 2008).

Note: Regions are categorized based on WDI's groupings.

Figure 2. Workers' Remittances by Region, 1981-2005 (in billions of U.S. Dollars)

With respect to individual countries, India ranks first among countries receiving remittances, at US\$21.03 billion, followed by Mexico with US\$20.28 billion, the Philippines with US\$10.67 billion, and China with US\$5.49 billion in 2005 (WDI, 2008). Meanwhile, in terms of the ratio of remittances to a country's GDP, small island countries rank higher, with Tonga having the highest ratio of remittances to GDP of 28.57% (WDI, 2008).

Aside from the rapid increase in remittances, those flowing to developing countries now rank as the second largest source of external funding next to foreign direct investment (FDI). In 1999, the level of remittances surpassed the level of official aid and from then on, it has consistently exceeded official aid (Figure 3). Workers' remittances were twice as high as official aid in 2005. Remittances were reported to be nearly US\$135 billion while official aid totaled around US\$73 billion. This indicates the growing importance of remittances in a country's balance of payments. In comparison with FDI and official aid, remittance recipients are households, not institutions. Such a huge amount of remittances has been directly affecting the income levels of households in developing countries.



Source: Authors calculation based on WDI (2008).

Figure 3. Workers' Remittances, FDI, and ODA Inflow to Developing Countries, 1981-2005 (in billions of U.S. Dollars)

2.2. Trends in Poverty

According to the World Bank's new estimate, 1.4 billion people were living below the international poverty line, less than US\$1.25 a day, in 2005. This represents over one-fourth of the developing world's population (World Bank, 2009). The United Nations' Millennium Development Goal (MDG) to eradicate extreme poverty and hunger includes cutting the proportion of people with an income that is less than US\$1 a day in half between 1990 and 2015 (UN, 2008).

In this paper, measures for poverty such as the headcount ratio, the poverty gap ratio, and the squared poverty gap ratio were used to represent the level, depth, and severity for poverty. Figure 4 presents the global trends characterizing these measures, showing a slight decrease in poverty over time. The decrease was increasingly noticeable in the headcount ratio, which dropped from 23.2% in 1981 to 18.83% in 2005. Poverty across geographical regions indicated progress in poverty reduction, but that progress has been uneven. EAP has experienced relatively rapid poverty reduction compared with that in SA and SSA. In 1981, the highest percentage of people living in extreme poverty was observed in EAP. In a two-decade span, EAP has been able to bring poverty under control, with a trend towards rapid decline (Figures 5, 6, & 7). SA has displayed a similar trend by all three poverty measures.

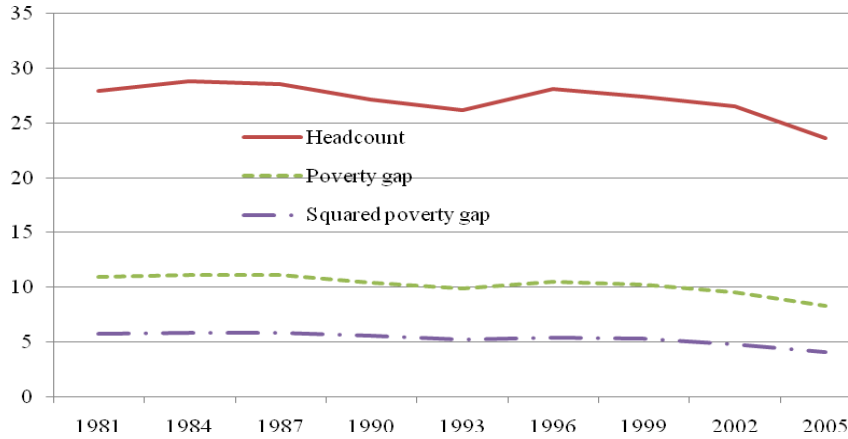


Figure 4. Measures of Poverty, 1981-2005 (in percentage)

Accelerating growth in India has put SA on the right track towards poverty reduction, while sustained growth in China has contributed to strong poverty reduction in EAP (World Bank, 2009). SSA remains trapped in poverty, since its headcount ratio, poverty gap, and squared poverty gap figures were relatively high in 2005 compared with those from other developing regions (Figures 5, 6, & 7). Although poverty rates in LAC have been lower than in SSA, poverty alleviation there seems to have stagnated, with little improvement between 1981 and 2005. The MENA and ECA were observed to have the lowest rates of poverty among developing regions.

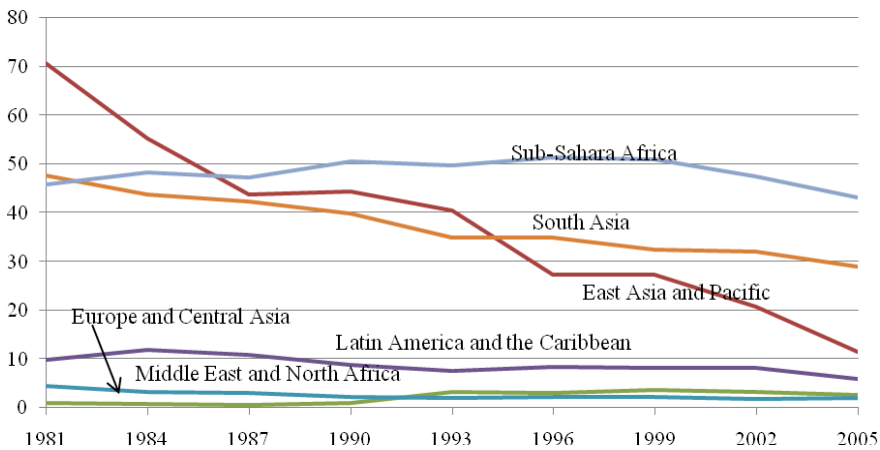


Figure 5. Headcount Ratio of Six Regional Aggregates, 1981-2005 (in percentage)

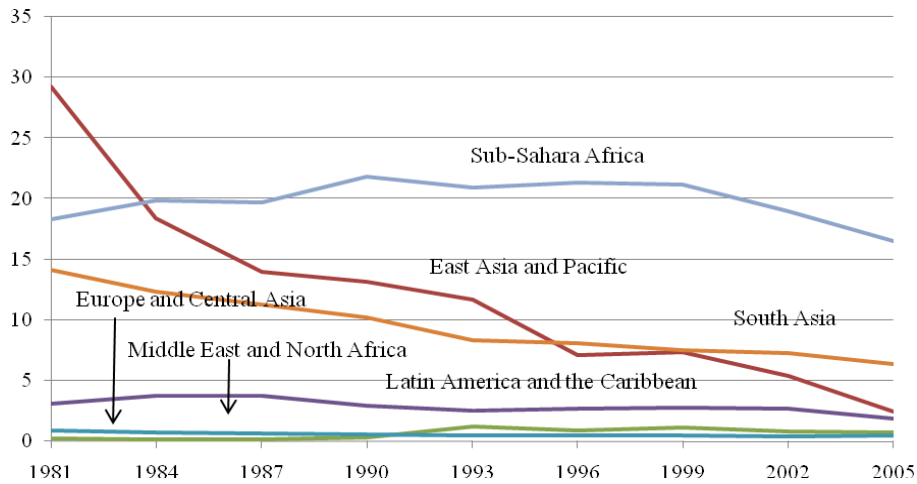


Figure 6. Poverty Gap Ratio of Six Regional Aggregates, 1981-2005 (in percentage)

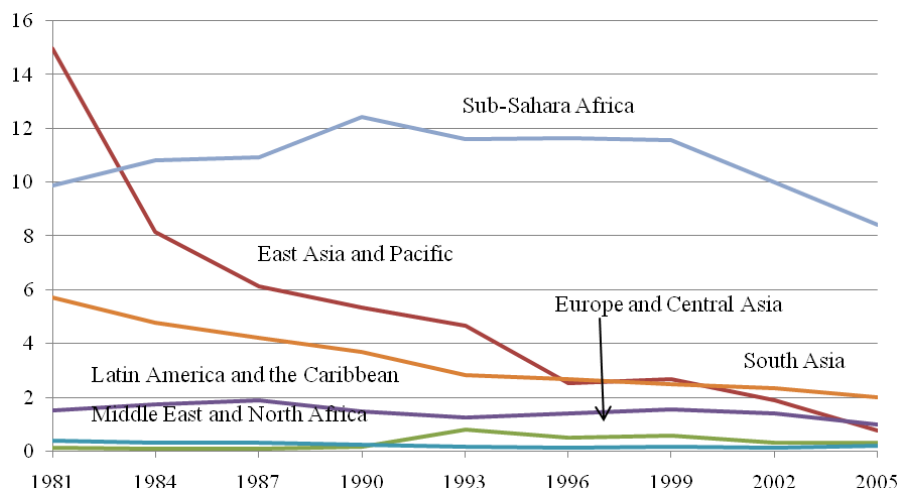


Figure 7. Poverty Gap Ratio of Six Regional Aggregates, 1981-2005 (in percentage)

The World Bank is optimistic that, if recent trends continue, it can achieve the first Millennium Development Goal (MDG) of reducing extreme poverty by 50% from its 1990 level by 2015. Even so, if the current rate of progress were sustained, one billion people will live on US\$1.25 a day or less in 2015 (World Bank, 2009). Based on this trend, SSA must be working harder to alleviate poverty.

3. RELATED LITERATURE

Previous studies evaluated the effects of remittances on poverty indicating that remittances tend to worsen income inequality and eventually raise the poverty level. Lipton (1980) argued that remittances from rural-urban migration increases interpersonal and inter-household inequality within and between villages because better-off villagers tend to be ‘pulled’ towards better jobs in urban areas and worse-off villagers are simultaneously ‘pushed’ into poverty in rural areas. Similarly, Stahl (1982) stated that migration, particularly international migration, can be an expensive venture. Better-off households will be capable of migrating and sending remittances home while poor households are unable to. Adams (1989) revealed that remittances from abroad exacerbated income inequality in rural Egypt in gross and per capita terms because they were earned primarily by upper-income villagers. This shows that households in the top income quantile benefited most from remittances. In relative terms, the rich get richer and the poor get poorer. Estudillo (2007) found, in her study of income inequality in the Philippines from 1961 to 1991, that income from remittances is among the factors responsible for increasing inequality. Rodriguez (1998) concluded that while remittances increase household income they were also associated with a rise in income inequality. He stated that continued emigration can offset gains in economic welfare by worsening income inequality. Portes (2009) investigated the effects of remittances on inequality using a panel of 46 countries that covers the period between 1970 and 2000. He found that remittances decreased inequality by increasing the income of the poor and decreasing the income of the rich. Meanwhile, Kochi and Rodriguez (2010) indicated that remittances affect the role of the government in redistributing income. They suggested that if the redistributive program is universal then an increase in remittances increases the size of the government’s transfers.

Conversely, several cross-country studies have confirmed that remittances sent by migrant workers have a significant impact on mitigating poverty. For instance, Adams and Page (2005) found that international migration and remittances significantly reduce the level, depth, and severity of poverty in the developing world. Their results showed that a 10% increase in per capita official international remittances lead to a 3.5% decline in the share of people living in poverty. Jongwanich (2007) examined the impact of workers’ remittances on growth and poverty reduction in developing countries in the Asia-Pacific region and found that remittances directly and significantly strengthen poverty reduction by increasing income, smoothing consumption patterns, and easing capital constraints on the poor. Ratha and Mohapatra (2009) argued that remittances directly augmented the income of recipient households. Remittances affected poverty and welfare through indirect multiplier and macroeconomic effects. Meanwhile, another study using a large cross-country panel dataset suggested that remittances in LAC countries reduced inequality and poverty, although the corresponding changes were generally not significant (Acosta *et al.*, 2008). Gupta *et al.* (2009) assessed the impact of the steadily growing remittance flows on poverty and inequality for Sub-Saharan

African countries. Though the region received only a small portion of all recorded remittances to developing countries, they found that remittances had a direct mitigating effect on poverty and promoted financial development.

Country-specific studies have shown an inverse relationship between remittances and poverty, suggesting that increases in remittances tended to lower the poverty level. Adams (2006) concluded that international remittances reduced the level, depth, and severity of poverty in Ghana. In a study that compared figures for Fiji and Tonga, Brown and Jimenez (2008) concluded that the estimated effects of remittances on poverty alleviation were significant. In the case of Philippines, Yang and Martinez (2005) and Pernia (2008) found that increased remittances reduced poverty due to a spillover effect.

4. METHODOLOGY

4.1. Empirical Model

To capture the effect of remittances on poverty, this study utilized an empirical model that is similar to the model employed by Ravillion (1997), Ravillion and Chen (1997), and Adams and Page (2005). The model assumed that poverty can be expressed as a function of mean income, measures of income distribution, and the variable of interest, international remittances. In such a model, the poverty equation was postulated as follows:

$$P_{it} = \alpha_{it} + \beta_1 \ln(Gini)_{it} + \beta_2 \ln(GDP)_{it} + \beta_3 \ln(Remit)_{it} + \beta_4 \ln(X_{it}) + \varepsilon_{it}, \quad (1)$$

where P_{it} represents such poverty measures as the headcount ratio, the poverty gap, and the squared poverty gap; $Gini_{it}$ is an index of income inequality; GDP_{it} refers to the per capita gross domestic product at constant 2000 prices; $Remit_{it}$ is the total amount of remittances that flow through banks, measured as a ratio to gross domestic product; X_{it} is a set of control variables for external funding such as foreign direct investment and official aid; and ε_{it} is the error term. The subscript t refers to year, while i denotes an individual country.

To analyze the impact of international remittances on poverty, the method of quantile regression was employed. This method yielded an informative regression since it evaluated the impact of remittances across quantiles rather than focusing only on the mean (Koenker, 2005). Results from this regression will offer useful insights for identifying and evaluating those poverty quantiles upon which the impact of remittances is most prominent.

Based on Equation (1), the quantile regression model is postulated as follows:

$$P_i = \ln(Z_i)' \beta_\theta + u_{\theta i} \text{ with } Quant_\theta(P_i | \ln(Z_i)) = \ln(Z_i)' \beta_\theta, \quad (2)$$

where $Quant_\theta(P_i | \ln(Z_i))$ denotes the θ 'th conditional quantile of poverty (P) given the set of independent variables (Z) expressed in logarithmic form and the subscript $i=1, 2, \dots, n$ indexes the individual country.⁴ And $u_{\theta i}$ represents the error term.

A noteworthy feature of this regression was that the coefficients of the independent variables differed over quantiles (i.e., different values of θ). It can be hypothesized that the value of β for remittance will be higher in lower quantiles and lower in higher quantiles if countries in the lower poverty quantile (i.e., the better off among poor countries) were in a relatively better position to reap the benefits of remittances compared with the worst-off quantile. In this case, we will expect β to be negative, assuming that remittances contributed to poverty alleviation. In particular, quantile regression will enable us to examine in detail how remittances were likely to affect developing countries at the extremes, in the highest and lowest quantiles of poverty distribution.⁵

Though a distribution of poverty can be dissected into any number of parts, this study focused on a five-quantile division, modeling the 10th, 25th, 50th, 75th, and 90th quantiles to cover the full range of poverty distribution. Since it is graphically evident that poverty measures differ relatively across the regions under study, with ECA, MENA, and LAC displaying relatively lower levels of poverty while ESP, SA, and SSA suffer from higher levels of poverty, there is reason to suspect that the mean will not be the appropriate measure of the main tendency.

For the estimation of the model, a bootstrapping methodology was applied to obtain robust standard errors in case the presence of heteroskedasticity is detected. Bootstrapping makes it possible to draw samples of size n with replacement from actual observed data. It typically required a resampling of between 50 and 200 to estimate standard deviations and between 500 and 2000 to establish a confidence interval (Hao and Naiman, 2007). In our case, 400 replications were used for estimating standard errors. This approach ensured that robust standard errors were obtained (Cameron and Trivedi, 2009).

In the special case of homoscedasticity, which is rarely observed in empirical studies, estimated across quantiles would be similar. Considering that estimates differed across quantiles, the F-test was employed to test for the pair-wise equality of quantile remittance estimates. The null hypothesis of equality between two quantile estimates of remittance will be tested against the alternative that the quantile estimate differs.

⁴ Note that $0 < \theta < 1$. When $\theta = 1/2$, this represents regression through the median.

⁵ Note that the higher the quantile, the higher the degree of poverty.

4.2. Data

This study used data collected from 66 developing countries covering the years 1981 through 2005. Other developing countries were not included because of missing observations pertaining to measures of poverty and remittances. Measures of poverty were available only every three years.⁶ Therefore, we included nine years' worth of data during the 1981 to 2005 period. Data were retrieved from the World Development Indicator (WDI), the World Bank's Povcal Net, and the OECD database.

Measures of poverty were taken from the World Bank's Povcal Net database. We used the headcount ratio, the poverty gap, and the squared poverty gap to measure poverty. The headcount ratio indicates the percentage of a population living below the poverty line, while the poverty gap, which captures the depth of poverty, measured in percentage terms how far the average expenditures (income) of the poor fall short of the poverty line. For instance, a poverty gap of 10% meant that the average poor person's expenditure (income) was 90% of the poverty line. The squared poverty gap indicates the severity of poverty. It measures the mean of the squared distance below the poverty line expressed as a proportion of the poverty line, and it is sensitive to the distribution of the poor. In other words, while a transfer of income from the poor to the poor will not change the headcount or the poverty gap, it will decrease the squared poverty gap since income distribution among the poor will be more equitable. (Adams and Page, 2003; Gupta *et al.*, 2009).

The Gini index, which measures income inequality, was sourced from the Povcal Net database. Per capita gross domestic product (GDP) at constant 2000 prices and foreign direct investment (FDI) data were retrieved from the World Development Indicator (WDI) while official development assistance (ODA) was taken from the OECD database. Worker's remittances (in US dollars) in the WDI were used to represent the level of remittances sent to developing countries. Table 1 shows the sample statistics for the variables used in the paper.

Table 1. Sample Statistics

Variable	Mean	Std.Dev	Min	Max
Head count ratio	28.91	25.45	0.01	89.57
$\ln Gini$	3.70	0.27	2.82	4.31
$\ln GDPPC$	7.88	0.98	4.96	10.02
$\ln(FDI/GDP)$	-5.67	1.95	-16.92	-1.43
$\ln(ODA/GDP)$	-5.39	2.78	-14.29	3.21
$\ln(remittance/GDP)$	-5.88	2.23	-15.74	-2.04

⁶ This study considered the following panel years in the analysis: 1981, 1984, 1987, 1990, 1993, 1996, 1999, 2002, and 2005.

5. RESULTS

The estimation results using the headcount ratio as dependent variable are presented in Table 2. The first column represents the results of OLS. Looking at the variables, the Gini coefficient, GDP per capita, ODA, FDI, and remittances showed the expected signs with only the FDI estimate being insignificant. Remittances showed a significant negative association with headcount ratio. This implies that a percentage increase in remittances sent by migrant workers to developing countries was associated with a reduction in the headcount ratio by 0.012, holding other factors constant.⁷ Time and regional dummy variables were used to control for time and regional effects, with 1981 as the base year and ECA as the control regional group.

Table 2. Quantile Regression using the Headcount Ratio as the Dependent Variable

Variables	OLS		Quantile Regression			
	coef	se	q10		q25	
			coef	se	coef	se
<i>lnGINI</i>	13.171**	5.988	4.678	7.697	1.138	7.345
<i>lnGDP</i> per capita	-16.872***	1.409	-15.218***	2.309	-12.764***	1.997
<i>lnFDI</i>	-0.421	0.419	-0.946*	0.565	-0.632	0.515
<i>lnODA</i>	-1.100***	0.299	-0.951***	0.352	-1.031***	0.387
<i>lnREMIT</i>	-1.185**	0.533	0.168	0.756	-0.627	0.506
<i>y84</i>	1.469	4.288	-0.033	4.697	1.194	4.049
<i>y87</i>	2.073	4.352	1.077	4.071	1.525	3.902
<i>y90</i>	-1.168	3.855	-1.690	4.142	-0.813	3.338
<i>y93</i>	-4.317	3.397	-0.869	4.177	-0.284	3.168
<i>y96</i>	-3.245	3.511	0.873	3.918	-0.094	3.222
<i>y99</i>	-3.012	3.455	0.682	3.751	0.049	3.285
<i>y02</i>	-2.739	3.500	-1.159	3.731	0.226	3.068
<i>y05</i>	-1.736	3.648	0.192	4.621	0.869	3.471
ESP	8.336***	2.603	9.702**	3.905	9.811***	3.681
LAC	3.605	2.726	3.834	3.202	4.086	2.948
MENA	-6.812***	2.081	-5.315*	2.946	-6.663***	2.465
SA	6.107*	3.268	1.174	3.215	0.322	3.556
SSA	17.754***	3.152	12.333***	4.013	16.797***	3.606
_cons	86.925***	24.507	100.326***	31.965	93.869***	31.574
N	295		295		295	
R^2 /Pseudo R^2	0.8017		0.4257		0.528	

⁷ The negative relationship between remittances and poverty reduction can also be explained by an alternative interpretation. Poor households will have more opportunities to send their family members abroad when poverty is reduced. This will increase remittances. So, our results can be driven by the causality running from poverty reduction to remittances. We would like to thank referee for the suggestion of this interpretation.

Table 2. Quantile Regression using the Headcount Ratio as the Dependent Variable (continued)

Variables	Quantile Regression					
	q50		q75		q90	
	coef	se	coef	se	coef	se
<i>lnGINI</i>	7.501	6.729	7.454	8.406	16.655*	9.587
<i>lnGDP</i> per capita	-14.379***	2.084	-17.330***	3.373	-15.229***	3.605
<i>lnFDI</i>	-0.833	0.564	-0.085	0.609	0.309	0.776
<i>lnODA</i>	-0.805**	0.402	-0.573	0.543	-0.730	0.633
<i>lnREMIT</i>	-1.281***	0.435	-1.242*	0.638	-2.150***	0.713
<i>y84</i>	4.221	5.549	4.141	8.362	-4.568	11.771
<i>y87</i>	5.171	5.227	9.466	9.971	-1.664	10.157
<i>y90</i>	3.769	4.513	-0.598	8.270	-9.470	9.633
<i>y93</i>	1.505	3.890	-3.781	7.048	-18.207**	8.981
<i>y96</i>	2.743	3.905	-3.384	7.093	-17.666*	9.094
<i>y99</i>	3.287	3.962	-2.898	7.172	-18.666**	8.862
<i>y02</i>	3.584	3.909	-2.699	7.052	-16.742*	9.107
<i>y05</i>	5.965	3.979	-1.968	7.116	-14.856	9.393
ESP	10.851***	3.457	12.176*	6.655	6.405	6.931
LAC	6.077**	2.895	6.253	4.059	2.288	5.847
MENA	-4.246*	2.274	-6.081	3.724	-8.267*	4.389
SA	10.193*	5.466	8.166	7.231	13.090*	7.910
SSA	22.721***	3.686	24.823***	7.281	25.479***	7.881
_cons	78.020**	30.820	118.583***	41.312	84.303	51.483
N	295		295		295	
R^2 /Pseudo R^2	0.6169		0.6266		0.6184	

Note: *** significant at 1%, ** significant at 5%, *significant at 10%.

The remaining columns in Table 2 present the results of the quantile regressions. The 50th quantile (q50) represents regression through the median. Advocates of quantile regression focus such analyses on the lower and upper quantiles. Considering our main variable, remittances, we observed an interesting result across the quantiles. In the lower quantile (q10), the effect of remittances was positive and insignificant. However, starting from the second quantile up to the 90th quantile, the effect was negative at varying significance levels. In absolute terms, the effect of remittances tended to increase with respect to the quantile of the headcount ratio. This implied that countries within the better-off quantile are less sensitive in terms of alleviating poverty while countries belonging to the poorest among the poor countries felt a significant impact from remittances. Contrary to the assumption that the effect of remittances tended to be more pronounced in the lower poverty distributions, the result suggested that remittances had a greater impact in alleviating poverty in countries located in the worst-off poverty distribution. The quantile regression coefficient revealed the effect of a unit change of independent variables on that specific quantile. For example, in the 90th quantile, a 1%

increase in the level of remittances for countries located in the 90th quantile was associated with a 0.0215 reduction in the headcount ratio, holding other factors constant. The time effect was prominent among those in the worst-off group when compared with the lower poverty quantile. Conversely, region dummy variables showed notable results. SSA consistently reported a higher, significant headcount ratio compared with that of the base region.

Table 3 shows the estimation results using the poverty gap as the dependent variable with robust standard errors reported. The poverty gap, as previously explained, measured the depth of poverty. With regards to regional dummy variables, only SSA posted a significant and higher level for the poverty gap compared with the control region (ECA). This is consistent with the observation that the poverty gap in SSA was improving relative to that in other regions. The remaining variables considered, bear the expected signs. Focusing on remittances, the result showed a significant effect on the poverty gap. Holding other factors constant, a 1% increase in the inflow of remittances sent to developing countries was associated with a 0.008 reduction in the poverty gap.

Table 3. Quantile Regression using the Poverty Gap as the Dependent Variable

Variables	OLS		Quantile Regression			
	coef	se	q10		q25	
			coef	se	coef	se
<i>lnGINI</i>	12.472***	3.835	4.175	2.949	3.230	2.632
<i>lnGDP</i> per capita	-7.078***	0.788	-4.313***	0.924	-4.864***	0.733
<i>lnFDI</i>	-0.188	0.239	-0.310	0.274	-0.191	0.245
<i>lnODA</i>	-0.311*	0.159	-0.173	0.135	-0.302**	0.119
<i>lnREMIT</i>	-0.759**	0.342	0.015	0.282	-0.364*	0.210
<i>y84</i>	0.973	2.280	-0.051	1.786	0.501	1.751
<i>y87</i>	1.300	2.564	0.472	1.841	0.606	1.742
<i>y90</i>	-0.713	2.009	-0.527	1.558	-0.056	1.686
<i>y93</i>	-2.322	1.842	-0.737	1.544	-0.440	1.459
<i>y96</i>	-1.797	1.978	-0.195	1.508	-0.432	1.503
<i>y99</i>	-1.545	1.903	0.381	1.543	-0.273	1.528
<i>y02</i>	-1.507	1.955	-0.738	1.406	-0.356	1.458
<i>y05</i>	-0.535	2.032	-0.269	1.700	0.213	1.552
ESP	0.170	1.329	2.420*	1.356	1.014	1.173
LAC	0.494	1.465	1.434	1.368	2.018*	1.162
MENA	-1.870	1.239	-0.628	1.004	-1.150	0.719
SA	0.061	1.702	-0.097	1.149	0.262	0.861
SSA	6.680***	1.763	4.788***	1.533	6.118***	1.408
_cons	9.708	15.225	17.654	10.883	24.309***	9.190
N	293		293		293	
R^2 /Pseudo R^2	0.6981		0.2935		0.4151	

Table 3. Quantile Regression using the Poverty Gap as the Dependent Variable
(continued)

Variables	Quantile Regression					
	q50		q75		q90	
	coef	se	coef	se	coef	se
<i>lnGINI</i>	4.707	3.173	7.599	4.641	6.900	5.635
<i>lnGDP</i> per capita	-5.391***	0.826	-6.289***	1.408	-6.921***	2.373
<i>lnFDI</i>	-0.360	0.253	-0.046	0.400	0.220	0.425
<i>lnODA</i>	-0.405***	0.146	-0.116	0.210	0.173	0.330
<i>lnREMIT</i>	-0.461**	0.211	-0.700*	0.374	-1.277**	0.509
<i>y84</i>	0.557	3.477	2.118	4.915	-4.587	5.624
<i>y87</i>	0.889	3.055	1.977	4.873	-2.435	6.468
<i>y90</i>	0.947	2.757	0.060	4.556	-6.996	4.665
<i>y93</i>	-0.018	2.658	-2.907	4.189	-11.325**	4.496
<i>y96</i>	0.604	2.626	-2.806	4.086	-11.456**	4.727
<i>y99</i>	0.891	2.615	-2.940	4.095	-11.508**	4.475
<i>y02</i>	0.383	2.601	-2.681	4.083	-10.697**	4.691
<i>y05</i>	1.950	2.621	-1.779	4.028	-9.882**	4.745
ESP	1.880	1.304	0.642	2.339	-3.969	4.009
LAC	1.774	1.232	1.993	2.215	1.338	3.142
MENA	-1.432	1.074	-0.976	2.031	-2.591	2.809
SA	-0.255	1.502	0.301	3.241	-0.087	4.924
SSA	9.530***	2.065	13.562***	3.915	12.400**	6.001
_cons	21.641*	12.282	25.459	20.450	44.693	28.500
N	293		293		293	
R^2 /Pseudo R^2	0.5073		0.5623		0.5857	

Note: *** significant at 1%, ** significant at 5%, *significant at 10%.

The results of quantile regression in evaluating the depth of poverty represented by the poverty gap are also shown in Table 3. The results were similar to what was observed in the previous quantile regressions in Table 2. In the case of remittance, the estimates showed that the lowest quantile had a positive association with the poverty gap but the effect was insignificant. From the 25th through to the 90th quantile, the coefficients on remittances showed a negative association with the poverty gap and were significant at either the 5% or the 10% level, as we observed. In terms of magnitude, the upper most quantile showed the largest estimate. This will further support the claim that remittances tended to be more effective in reducing poverty in the most disadvantaged countries. Thus, holding other factors constant at the 90th quantile, a percentage increase in remittance was associated with a 0.013 reduction in the poverty gap. However, in contrast to remittances, FDI and ODA were observed to bear an unexpected sign in the 90th quantile, although the coefficient estimates were not significant.

Table 4 reports the results for the squared poverty gap. In the case of pooled OLS, remittances showed a negative association with the squared poverty gap and were

significant at the 5% level. Holding other factors constant, a 1% increase in the bulk of remittances sent to developing countries flowing through banks was associated with a 0.005 reduction in the squared poverty gap.

To check the sensitivity of the results, we estimated additional two models. First, we estimated the fixed effect model to check if omitted country specific effects affected the results of the OLS. We find that the fixed effects produced the results that were similar to those of the OLS. So, we can infer that the inconsistency of the estimated coefficients may not be a major concern for our estimation (see appendix 1). Second, when we added the lagged remittances variable in the model to evaluate the effect of past remittances on current poverty reduction, it was statistically insignificant. This result suggests that remittances mainly reduce poverty through an increased current consumption and a long-run investment effect may not be working in the data (appendix 2).

If we look at the result of quantile estimation with the squared poverty gap as the dependent variable, the effect of remittances on poverty was quite evident from 25th up to the 90th quantile of the distribution. In absolute terms, a large reductive effect was observed in the uppermost quantile, with a 0.0077 association that was significant at 5%.

Table 4. Quantile Regression using the Squared Poverty Gap as the Dependent Variable

Variables	OLS		Quantile Regression			
	coef	se	q10		q25	
			coef	se	coef	se
<i>lnGINI</i>	9.624***	2.736	1.547	1.366	1.520	1.469
<i>lnGDP</i> per capita	-3.889***	0.530	-1.499***	0.441	-1.955***	0.397
<i>lnFDI</i>	-0.119	0.166	-0.163	0.117	-0.115	0.104
<i>lnODA</i>	-0.082	0.111	-0.047	0.060	-0.097*	0.055
<i>lnREMIT</i>	-0.529**	0.245	-0.066	0.145	-0.187	0.119
<i>y84</i>	0.659	1.460	-0.270	0.929	0.064	0.833
<i>y87</i>	1.047	1.815	0.130	0.940	0.156	0.841
<i>y90</i>	-0.374	1.278	-0.403	0.779	-0.154	0.790
<i>y93</i>	-1.445	1.197	-0.302	0.714	-0.138	0.647
<i>y96</i>	-0.992	1.317	-0.114	0.711	-0.306	0.645
<i>y99</i>	-0.926	1.238	-0.120	0.708	-0.043	0.679
<i>y02</i>	-0.974	1.272	-0.435	0.672	-0.160	0.636
<i>y05</i>	-0.198	1.328	-0.236	0.741	0.178	0.686
ESP	-1.117	0.905	0.845	0.654	0.263	0.588
LAC	-0.067	0.959	0.929	0.651	0.895	0.572
MENA	-0.670	0.872	-0.005	0.462	-0.291	0.343
SA	-0.581	1.146	0.096	0.496	-0.068	0.471
SSA	3.028***	1.172	2.555***	0.699	3.057***	0.803
_cons	-5.105	10.600	5.165	4.940	8.620*	5.112
N	293		293		293	
R^2 /Pseudo R^2	0.61		0.2082		0.3206	

Table 4. Quantile Regression using the Squared Poverty Gap as the Dependent Variable (continued)

Variables	Quantile Regression					
	q50		q75		q90	
	coef	se	coef	se	coef	se
<i>lnGINI</i>	2.869	2.096	3.590	3.395	5.189	4.664
<i>lnGDP</i> per capita	-2.763***	0.437	-2.585***	0.841	-3.840**	1.663
<i>lnFDI</i>	-0.206	0.145	-0.231	0.231	-0.098	0.264
<i>lnODA</i>	-0.104	0.071	-0.008	0.103	0.158	0.193
<i>lnREMIT</i>	-0.277**	0.130	-0.335	0.224	-0.772**	0.339
<i>y84</i>	0.201	2.168	1.562	3.063	-3.346	3.472
<i>y87</i>	0.130	2.041	1.852	2.993	-1.621	5.591
<i>y90</i>	0.583	1.818	0.197	2.990	-4.535	2.771
<i>y93</i>	-0.014	1.714	-1.290	2.704	-6.623**	2.759
<i>y96</i>	0.350	1.686	-1.128	2.715	-6.081**	2.971
<i>y99</i>	0.616	1.672	-1.240	2.722	-6.120**	2.753
<i>y02</i>	0.319	1.677	-1.141	2.697	-5.952**	2.939
<i>y05</i>	0.802	1.740	-0.317	2.764	-4.118	2.994
ESP	0.198	0.677	0.142	1.211	-3.378	2.759
LAC	0.975	0.769	1.769	1.499	1.043	2.202
MENA	-0.675	0.614	-0.182	1.239	-1.334	2.068
SA	-1.011	0.709	-0.435	1.545	-2.010	3.178
SSA	4.079***	1.416	9.732***	2.414	7.575*	4.285
_cons	9.686	7.622	7.511	13.500	18.685	22.066
N	293		293		293	
R^2 /Pseudo R^2	0.4124		0.5026		0.5536	

Note: *** significant at 1%, ** significant at 5%, *significant at 10%.

The graphical analysis of the quantile regression was presented in Figure 8. The straight broken line represents the OLS coefficient on remittances with a corresponding 95% confidence interval while the moving line represents the estimates of quantile regression for the coefficient on remittance with a 95% confidence interval enveloped. The results from quantile regression showed a declining trend from the lower to the uppermost quantile. The confidence interval of estimates from the lower quantile encloses zero value, implied that estimates for this portion were not significantly different from zero, while the upper quantiles differed from zero, and was negative. This indicated that countries in the worst-off poverty quantiles benefited more from the surging increase in remittances compared with those in the lower poverty quantile. This implied that remittances contributed to the reduction in extreme poverty in developing countries that belong to the worst-off group. Remittances tended to stabilize the level of poverty in the poorest countries since the effect was more pronounced in the worst-off quantile.

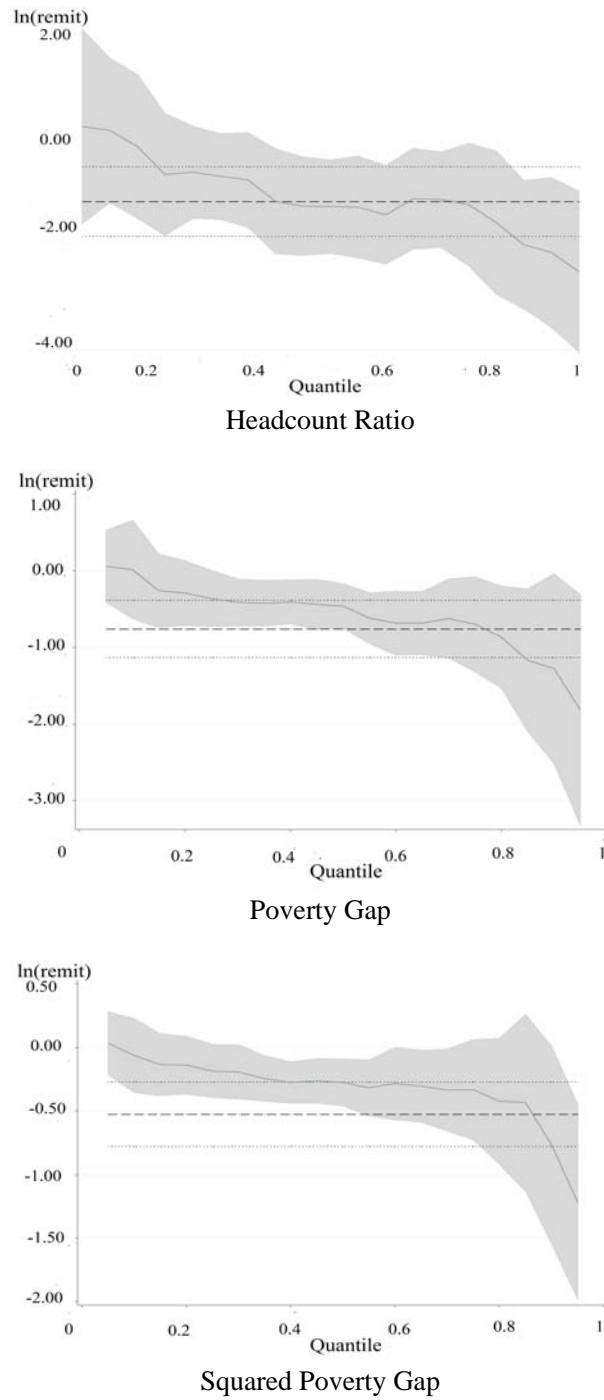


Figure 8. Quantile and OLS Coefficients and Confidence Intervals for Poverty Measures

It is imperative when conducting quantile regressions to test whether differences in quantile estimates are statistically significant. Table 5 presents the summary of the results of the pair-wise test for the equality of coefficients, using an F-test. The null hypothesis of equality is tested against the alternative that the coefficients of quantile estimates on remittance are not equal. The results showed that estimates across quantiles of the three measures of poverty exhibit some degree of difference. The 10th quantile versus the 90th quantile and the 25th quantile versus 90th quantile were consistently observed to have estimates significantly different from each other in all estimations. The results of the pair-wise test of the coefficients suggested that remittances exert an uneven impact on poverty with a significant difference in the magnitude of the impact between the lower and upper quantiles. This result further strengthened the claim that the effect of remittances was more prominent in the worst-off poverty quantile.

Table 5. Pair-wise Test for Equality of Remittance Coefficients across Quantiles

Pair-wise	Headcount Ratio			Poverty Gap			Squared Poverty Gap		
	F-value	P-value	Remark	F-value	P-value	Remark	F-value	P-value	Remark
q10=q25	2.17	0.142		2.98	0.086	*	1.41	0.236	
q10=q50	4.28	0.039	**	3.01	0.084	*	2.3	0.130	
q10=q75	2.5	0.115		2.78	0.096	*	1.45	0.230	
q10=q90	5.62	0.019	***	5.29	0.022	**	4.15	0.043	**
q25=q50	2.42	0.121		0.25	0.617		0.75	0.389	
q25=q75	0.84	0.359		0.84	0.359		0.5	0.482	
q25=q90	3.75	0.054	*	3.17	0.076	*	3.1	0.080	*
q50=q75	0.01	0.942		0.56	0.456		0.1	0.749	
q50=q90	1.51	0.221		2.99	0.085	*	2.48	0.117	
q75=q90	2.46	0.118		2.28	0.132		2.85	0.093	*
	df1=1 & df2 =276 for every pair			df1=1 & df2=274 for every pair			df1=1 & df2=274 for every pair		

Note: *** significant at 1%, ** significant at 5%, *significant at 10%.

6. CONCLUSION

This study analyzed the effects of remittances on poverty in developing countries using the quantile regression method. Measures of poverty, such as the headcount ratio, the poverty gap, and the squared poverty gap, were used to represent various dimensions of poverty such as level, depth, and severity, respectively. The poverty line utilized is the international poverty threshold set at US\$ 1 per day by the World Bank in accounting for the number people living in extreme poverty.

Based on the empirical results, the following conclusions can be drawn. Remittances contributed to reducing poverty as manifested by the negative relationship of remittances

to poverty. Effects tended to be more pronounced in the worst-off quantile. Remittances, thus, possibly helped to alleviate poverty, especially in the poorest countries. In this case, remittances may serve as an equitable force in stabilizing the poverty level since the worst-off quantile had felt the greatest impact of the surging increase in remittances.

Countries in the highest poverty quantile and the poorest among the poor countries may need remittances to increase household consumption, which in turn fuels domestic demand and eventually increases other economic activities. Given this effect, that the poorest among poor countries benefited most from remittances, SSA might consider policies that will attract a greater inflow in remittances to help ease the region out of poverty.

Since remittances are largely private household activities, governments may find it difficult to regulate how recipients use these remittances. Nevertheless, government programs that guide families of migrant workers in maximizing the benefits of remittances maybe helpful in enabling families to utilize the remittances they receive advantageously.

APPENDIX

Table A1. Fixed Effects Model

	Headcount ratio		Poverty gap		Squared poverty gap	
	coef	se	coef	se	coef	se
<i>lnGINI</i>	23.96	7.95***	19.50***	6.07	14.25***	4.22
<i>lnGDP</i> per capita	-20.80	1.83***	-8.52***	0.97	-4.55***	0.58
<i>lnFDI</i>	-0.17	0.43	-0.11	0.29	-0.07	0.22
<i>lnODA</i>	-1.16	0.50**	-0.57**	0.23	-1.08***	0.13
<i>lnREMIT</i>	-1.58	0.76**	-0.93**	0.46	-0.64**	0.23
<i>y84</i>	1.62	1.27	1.09	0.65	0.74	0.41
<i>y87</i>	0.61	2.10	0.84	1.49	0.87	1.18
<i>y90</i>	-1.91	2.04	-0.8	1.10	-0.32	0.71
<i>y93</i>	-3.74	2.96	-1.42	1.46	-0.71	0.87
<i>y96</i>	-3.99	2.83	-1.76	1.67	-0.90	1.13
<i>y99</i>	-3.78	3.25	-1.93	1.77	-1.19	1.15
<i>y02</i>	-3.43	3.00	-1.92	1.63	-1.26	1.05
<i>y05</i>	-2.59	3.46	-0.80	1.71	-0.29	1.05
<i>_cons</i>	95.48***	30.58	0.06	21.27	-15.44	14.68

Note: *** significant at 1%, ** significant at 5%, *significant at 10%.

Table A2. OLS with the Lagged Remittance Variable

	Headcount ratio		Poverty gap		Squared poverty gap	
	coef	se	coef	se	coef	se
lnGINI	14.0**	6.17	10.68***	3.85	7.70***	2.65
lnGDP per capita	-17.18***	1.50	-6.93***	0.84	-3.74***	0.57
lnFDI	-0.72*	0.42	-0.35	0.24	-0.22	0.16
lnODA	-0.94***	0.31	-0.24*	0.14	-0.07	0.089
lnREMIT	-1.42**	0.74	-0.70	0.45	-0.37	0.31
Lag[lnREMIT]	0.03	0.74	0.003	0.42	-0.045	0.29
y84	0.03	0.69	0.003	0.42	-0.045	0.29
y87	-0.73	4.30	-0.99	2.21	-0.76	1.39
y90	-0.005	3.85	-0.799	1.97	-0.71	1.27
y93	-4.05	3.55	-2.38	1.87	-1.55	1.22
y96	-3.58	3.52	-2.58	1.89	-1.79	1.24
y99	-2.76	3.61	-1.69	1.91	-1.10	1.25
y02	-2.02	3.57	-1.66	1.95	-1.24	1.28
y05	-0.85	3.84	-0.66	2.07	-0.50	1.35
_cons	7.99***	2.86	0.44	1.35	-0.80	0.87

Note: *** significant at 1%, ** significant at 5%, *significant at 10%.

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