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The impact of remittances on human development in developing countries: an empirical evidence from cross-sectionally dependent heterogeneous panel data with structural breaks

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Abstract

This paper applies second generation panel unit root, panel cointegration and panel vector error-correction Granger causality tests that allow for country specific heterogeneity, cross-country dependence and multiple structural breaks in a panel of 100 developing countries and shows that in the short-run, there is evidence of (i) a bidirectional causal relationship between economic growth and human development; (ii) a unidirectional causal relationship from remittances to human development and (iii) a bidirectional causal relationship between economic growth and remittances. Our results further suggest that in the long-run, both economic growth and remittances jointly Granger-cause human development and that it takes more than fourteen years for human development to converge to its long-run equilibrium in response to changes in economic growth and remittances.

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1 Introduction

"Migration is the oldest action against poverty. It selects those who most want help. It is good for the country to which they go; it helps to break the equilibrium of poverty in the country from which they come. What is the perversity in the human soul that "causes" people to resist so obvious a good?"

John Kenneth Galbraith, The nature of mass poverty, 1979.

In recent years, remittances inflows – money sent by people living and working abroad to their home countries - have been increasing substantially. Today, they represent the largest source of external finance for many developing countries, ahead of Official Development Assistance (ODA) and Foreign Direct Investment (FDI). According to the World Bank, official remittances[1] grew by 9.6 per cent in 2018 (up from the 8.8 per cent rise in 2017), to reach a record $529 billion [11]. Remittances are particularly important in developing countries where they can represent over a third of Gross Domestic Product (gdp).[2] They are also an important contributor to resilience in the face of crises such as the covid-19 pandemic.[3]

Not surprisingly therefore, the past few years have witnessed a remarkable revival of interest in the impact of remittances on growth [16, 7, 55, 31]; on poverty reduction [3, 2, 35, 1, 8]; on development [41, 19, 47, 25, 4, 39]; on environment [30]; on labor productivity [5] and on political institutions [54]. Yet most of the studies investigating the impact of remittances at country level have systematically used panel data, the advantages of which are to provide more data and increase the power and accuracy of conventional time series [13]. However, previous works may lead to misleading results for at least three reasons. First of all, most of them assume homogeneity of the countries in the panel. Yet remittance recipient countries are very different in terms of their levels of human development, economic development and the amount of remittances received. Moreover, past work relies on the assumption of cross-sectional independence among the countries. However, owing to non-random selection of the countries in the panel, unobserved common shocks, due to socioeconomic, cultural, political ties, countries are likely to be cross-sectionally dependent. Finally, past work systematically ignores the possibility of structural breaks in the data, which cannot be overlooked when dealing with international remittances because they are countercyclical in nature relative to the economic cycle of the recipient country [21].[4]

With this in mind and using a panel of 100 developing countries[5] over a period of three decades, this study contributes to the existing literature by simultaneously considering heterogeneity, cross-sectional dependence and structural breaks to examine the short and the long-run impacts of remittances on overall development proxied by the Human Development Index (hdi).

Developing countries are chosen mainly because over the past two decades, they have experienced growing remittance inflows, on the one hand, and low levels of human development on the other hand [42]. Better understanding the nexus between remittances and human development could help policy makers and financial institutions to design appropriate policy instruments to maximize the human developmental impacts of remittance flows.

The rest of the paper proceeds as follows: the second section describes the empirical model and the data. Section three follows up with the econometric techniques and discusses the empirical results while a final section concludes and provide some policy recommendations.

[1] Freund & Spatafora [17] estimate that the amount of informal remittances sent through informal channels, e.g. self-carry, hand-carry by friends or family members or in-kind remittances of clothes and other consumer goods may equal about 35 to 75 per cent of official flows.

[2] Examples include Lesotho (25.09 per cent), Tajikistan (26.69 per cent), Kyrgyzstan (31.32 per cent), Somalia (34.78 per cent), and Tonga (38.98 per cent).

[3] During the covid-19 pandemic, remittances did not decline as much as FDI flows to LMICs. As a result, remittance flows to LMICs (excluding China) surpassed the sum of FDI and overseas development assistance in 2020 [44].

[4] Remittances have been shown to rise when the recipient economy suffers a downturn in activity or macroeconomic shocks due to financial crisis, natural disaster, or political conflict, because migrants may send more funds during hard times to help their families and friends [43].

[5] The countries included in this study account for more than 80 per cent of the global remittance received [42].

2 Empirical model and data

This section presents an empirical model that captures the relationship between remittances, economic growth and human development, and describes the data.

2.1 Empirical model

The increasing remittance inflows of the last 20 years have assisted many countries and improved their deprivation levels in dimensions such as education, health and standard of living. As a consequence, remittances improved the human development level in many countries [28, 18, 41]. To investigate the causal relationship between remittances, growth and human development, we use the extended version of the model suggested by Ravallion and Chen [45], in which a measure of poverty or development can be modeled as a function of mean income, some measure of income distribution, and a variable of interest. In doing so, we follow Adams and Page [3], Gupta et al. [22]. The relationship that we want to estimate can therefore be expressed as follows:

$$ln(hdi)_{it} = \alpha_i + \beta_1 ln(gdp)_{it} + \beta_2 ln(rem)_{it} + \epsilon_{it} \quad (1)$$

Where $i = 1, 2, ...N$ and $t = 1, 2, ...T$ are country and time notations, $(hdi)_{it}$ is the measure of human development in country i at year t, ranging from 0 to 1, economic growth is represented by $(gdp)_{it}$ and $(rem)_{it}$ is the international remittance flows as a percentage of gdp. The β coefficients in (1) capture the long-run effects between the variables, while α_i are country specific fixed effects that help to control any omitted factors that are stable over time. All time-varying variables are expressed in natural logarithms.

2.2 Data and descriptive statistics

Our empirical analysis is based on a balanced and heterogeneous panel for 100 developing countries, covering the period 1990-2018. Using such a heterogeneous panel is always a challenging exercise because countries differ good deal from each other in terms of economic performances and human development levels. However, what these countries share in common is that most of them are among the poorest and least developed countries in the world. They have also experienced a major increase in remittance inflows over the past decades. The data used in this paper was mainly collected from the World Bank's World Development Indicators (WDI). Our target variable, the *hdi* is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living.[6] Remittances[7] are expressed as a ratio of *gdp* of recipient countries. The economic growth variable is the per capita *gdp* in constant 2010 United States dollars.

All the variables in Table 1 are transformed into their natural logarithm. For all variables, we observe a significant difference between the maximum annual value and the mean value over the three decades. This can be explained by the fact that our variables constantly increased. Indeed, the increasing poverty and deprivation levels in source countries as well as the widening income inequalities between source and destination countries over the past decades led more people to choose to migrate. At the same time, migration costs as well as remittances transfer costs have been lowered over the years, so that more people could migrate and send more remittances. Increased remittances then raised standard of living of the poor and led to an increase of their *hdi*. We also notice that all the variables used exhibit a high degree of dispersion measured by the standard deviation, which is line with the fact that our panel is heterogeneous. Further, skewness and kurtosis suggest that none of the

[6]The *hdi* is the geometric mean of normalized indices for each of the three dimensions. The health dimension is assessed by life expectancy at birth, the education dimension is measured by mean of years of schooling for adults aged 25 years and more and expected years of schooling for children of school entering age. The standard of living dimension is measured by gross national income per capita.

[7]In this work as in most studies on the topic, remittances are aggregate worker remittances, compensation to employees, and migrant transfers series from the IMF Balance of Payments database, supplemented by the data from World Bank.

series follows a normal distribution. Therefore, because our variables share common characteristics, we can model them together in a cointegration analysis.

3 Cointegration analysis

Before undertaking any cointegration analysis, it is crucial to test for cross-sectional dependence and heterogeneity because countries in our panel are different in terms of their levels of human development, their economic performances and in terms of the remittances received. Furthermore, they exhibit socioeconomic, cultural and political ties. In this context, overlooking the issues of cross-sectional dependence and heterogeneity may produce inconsistent estimates and misleading information [12]. After that, we examine stationarity of our variables using the Pesaran [9] second-generation cross-sectional augmented IPS (CIPS) unit root test, which accounts for both heterogeneity and cross-sectional dependence. This is followed by the second-generation bootstrap panel cointegration tests developed by Westerlund [52] and Westerlund and Egerton [53] which account for heterogeneity and cross-sectional dependence in the panel, to obtain the long-term relationship between all variables. We then estimate the cointegration coefficients through Panel Dynamic Ordinary Least Squares (DOLS), Panel Fully Modified Ordinary Least Squares (FMOLS) and Canonical Correlation Regression (CCR) estimators. Finally, Panel Vector Error Correction Model (VECM) is estimated to evaluate the short- and long-run impacts.

3.1 Cross-sectional independence and heterogeneity

3.1.1 Cross-sectional independence

To check whether the data for remittances, *hdi* and real *gdp* per capita are cross-sectionally independent, we apply second-generation cross-sectional dependence (CD) test which uses the approach developed by Pesaran [10]. This test builds on the Breusch-Pagan LM test and employs the correlation coefficients between the time series for each panel country to test the null of cross-sectional independence. The outcomes reported in Table 2 reject the null of cross-sectional independence at 1 per cent significance level for all variables.

3.1.2 Heterogeneity

We check for heterogeneity, using the Pesaran and Yamagata [38] second-generation test that builds on the modified version of Swamy test [50] to estimate the delta ($\tilde{\Delta}$) and the adjusted delta ($\tilde{\Delta}_{adj}$) to test the null hypothesis of slope homogeneity, $H_0 : \beta_i = \beta$ for all i against the alternative hypothesis of slope heterogeneity $H_1 : \beta_i \neq \beta_j$ for a non-zero fraction of pairwise slopes for $i \neq j$. The test statistics in Table 3 are significant at 1 per cent level, thus confirming the existence of slope heterogeneity in our panel data.

3.2 Panel unit root test without structural break

In the presence of cross-sectional dependence and heterogeneity across the countries in the panel, first-generation unit root tests are not appropriate [9].[8] Rather, we employ the Pesaran [9] second-generation cross-sectional augmented IPS (CIPS) unit root test, which accounts for both heterogeneity and cross-sectional dependence. The CIPS test in table 4 indicates that in level form, the test cannot reject the null hypothesis of unit roots, except for *rem* and *gdp*. However, after applying the first difference, the null hypothesis is rejected at the 1% level, meaning that all the considered variables are integrated of order one, or I (1).

[8] Levin-Lin Chu (LLC), ImPesaran-Shin (IPS), augmented Dickey-Fuller (ADF) and PhillipsPerron (PP)

3.3 Panel unit root test with structural break

To test for stationarity in the presence of structural breaks, we use the Clemente-Montanes-Reyes structural unit root test [14]. This unit root test which is an extension of the Perron and Vogelsang's [37] statistics accounts for the possibility of two structural breaks within two types of events: either additive outlier (AO), which captures a sudden change in a series or innovational outliers (IO), allowing for a gradual shift in the mean of the series. The country-specific findings, with the null of stationarity allowing for two structural breaks[9], are reported in Table 5. The findings reveal that at level, our variables are stationary for some countries, confirming the heterogeneity of countries in the panel.

Table 5 further reveals that there is a preponderance of breaks located around the middle of the sample, which makes sense from an historical point of view with events such as the recession in Japan, the September 9/11 attack, the stock market crash and in particular the global economic crisis that followed the subprime crisis. Specifically, while the breaks found in the late 1990's are in line with the emerging market crisis of 1997 to 1999 that preceded the severe recession in Japan and a slow-down of the world economic growth, the breaks in the early and middle 2000's agree with the stock market crash that followed the 9/11 attack and the corporate fraud scandals, such as Enron. The breaks in the late 2000's can be the consequence of the subprime and mortgage crisis following the bankruptcy of Lehman Brothers.

3.4 Panel cointegration tests

Having found that our variables are integrated of order one, the next step is to conduct cointegration analysis. In the presence of cross-sectional dependence and heterogeneity however, the first-generation panel cointegration tests such as the Pedroni [36] and the Kao [29] tests fail to accurately identify the cointegration relationship among panel data. Therefore, this study uses the second-generation bootstrap panel cointegration tests developed by Westerlund [52] and Westerlund and Egerton [53] which account for heterogeneity and cross-sectional dependence in the panel.

The findings, reported in table 6 indicate that the null hypothesis of no-cointegration between the *hdi*, remittances and real *gdp* per capita can be strongly rejected, since the asymptotic $p-value$ is zero for all variables. However, these $p-values$ are computed under the assumption of cross-section independence, which is not the case in our context. Therefore, in order to account for this dependence, we use the bootstrapped $p-values$. As can be seen, the conclusions are not altered by taking the cross-sectional correlation into account. Overall, our results indicate that the *hdi* and remittances have a long-run equilibrium relationship. In other words, while unit root tests provided support for the presence of stochastic trend in the data, cointegration tests suggest that these trends have cancelled each other, leading to stationary residuals. In practice, this means that these variables have a significant long-run relationship.

However, these results should be interpreted with caution because the Westerlund cointegration test based on cros-sectional dependence does not account for structural breaks. Therefore, to account for cross-sectional dependence, heterogeneity and structural breaks, we apply Westerlund and Egerton [53] panel cointegration test with cross-sectional dependence and structural breaks. The results reported in table 7 don't alter those obtained without breaks. In other words, if we account for structural breaks as well as cross-country dependence, the null hypothesis of no-cointegration is safely rejected at 1% level. What this means is that the variables are in fact cointegrated around a broken trend, which is in support of the counter cyclical nature of remittances.

3.5 Panel Granger causality test

Based on the panel cointegration test results, we know that there is the presence of a long-run relationship between variables. However, the cointegration test results don't give information about

[9] A test statistic exceeding the critical value is significant.

the direction of this relationship. The short-run causality tests are performed through the second-generation pairwise (Dumistrescu and Hurlin 2012) [15] panel causality test which accounts for both issues of heterogeneity and cross-sectional dependence in panels, while long-run causality is inferred from the coefficients of ECT and corresponding t-statistics.

In the short-run, there is evidence of (i) a bidirectional causal relationship between economic growth and human development ($gdp \Leftrightarrow hdi$) and between economic growth to remittances ($gdp \Leftrightarrow rem$), (ii) a unidirectional causal relationship from remittances to human development ($rem \Rightarrow hdi$). Our short-run results can be contrasted with Sahoo and Sethy[46] and Adenutsi[4] who found that there is a unidirectional causality between remittance and human development in Sub-Sahara African countries. Our outcomes can further be contrasted with Jawaid and Raza [27] who found that worker's remittances cause economic growth in the case of China and Korea. Likewise, Olubiyi [34] established that remittances cause economic growth in Nigeria. The causality from remittances to economic growth is also consistent with findings of the UN [41], who found that remittances in developing countries promote economic growth. Finally, the short-run causality from growth to remittances is also consistent with findings of the IMF[10], who found that a one per cent decrease in real *gdp* is associated with a four per cent increase in the net remittances inflows to the West African countries (about 0.1 per cent of *gdp*). This means that migrants tend to send more money home when economic activity in a recipient country slows down, and vice versa, which confirms the countercyclical character of remittances.

For the long-run causality results, the coefficient of the ECT when *hdi* is the dependent variable, is negative and statistically significant. This implies that (i) *hdi* tends to converge to its long-run equilibrium in response to changes in *gdp* per capita and remittances, and (ii) *gdp* per capita and remittances jointly Granger cause an improvement in *hdi* in the long-run (gdp & $rem \Rightarrow hdi$). It should also be noted that the ECT coefficient of 0.07 means that it takes more than fourteen years (1/0.07) for *hdi* to return to equilibrium after a shock. The ECT coefficient also means that about seven percent of this disequilibrium is corrected in 1 year.

Both the short- and long-run Granger causality confirm that causality runs from economic growth and remittances to human development. The short-run causality from remittances to human development suggests that remittances are a short-run strategy for migrants originating from developing countries to help their family left behind to improve their living conditions. The long-run joint causality for remittances and economic growth to human development suggests that developing countries that receive remittances generally face high levels of deprivation and low levels of economic development.

3.6 Long-run relationship coefficients estimation

Having established cointegration as well as the direction of causality in the short and in the long-run, we examine the long-run elasticities of the impact of remittances and economic growth on human development. The three long-run estimators that we use for this purpose are the FMOLS, DOLS and CCR. All estimators display similar results, in terms of the sign and statistical significance - remittances and growth have a positive effect on human development - , whereas the magnitudes of the estimated coefficients are slightly different. Because the variables are expressed in natural logs, the coefficients on the remittances and growth variables can be interpreted as elasticities. All the coefficients are statistically significant at the 1% level of significance. More specifically, the results suggest that a one percent increase in remittances leads to an increase of the *hdi* by 0.03-0.04 percent. These conclusions are consistent with Sahoo and al. [46], Huay et al. [23], Naeem and Arzu [32], Adenutsi [4], Irdam [25], Ponce et al. [39], Imran et al. [24] who concluded that an increase in remittances inflow is effective way to enhance human development in the recipient countries. The reason for this improvement is that the increasing remittance inflows of the last 20 years have assisted many countries and ameliorated their deprivation levels in dimensions such as education, health and standard of living [28, 18, 41].

There is a positive correlation between human development and economic growth, suggesting that a one percent increase in *gdp* per capita improves the *hdi* by 0.01 percent . This outcome is in line

[10]International Monetary Fund (2013), Country Report 13/92. West African Economic and Monetary Union (WAEMU): Staff Report on Common Policies for Member Countries.

with Ranis & Stewart [40], Shome [49], Islam [26], Gorica & Gumeni [20] who conclude that economic growth positively impacts human development.

Table 9 also gives the estimations of our model when poverty headcount is the dependent variable. It is important to contrast elasticities obtained with the *hdi* with those obtained when poverty headcount is dependent variable because in previous works poverty headcount has been used as an alternative measure of human development. The reason is that income has always been thought to bring material prosperity and therefore lead to the improvement of the quality of life. Thanks to Sen and his *Capability Approach* however, we know that income-based approaches are ill-suited to capture all the aspects of human development [6].

Results in table 9 first indicate that there is a negative correlation between the remittance variable and the poverty headcount ratio, thereby indicating that remittances are associated a reduction of poverty levels in the countries of our sample. Accordingly, a one percent increase in remittances leads to a reduction of the poverty headcount by 2.40 - 2.49 per cent while the same increase in *gdp* per capita reduces poverty headcount by 2.34 - 2.37 per cent. Interestingly, although increased remittances have a positive impact on the *hdi* and poverty headcount, the elasticities differ significantly according to the indicator used. More precisely, international remittances will have a much larger impact on poverty headcount compared to the *hdi*. What this seems to mean is that receiving remittances is associated with a higher share of expenditure allocated to pure consumption and in contrast, a much lower share allocated to education, health and standard of living. This result suggests that people who are income - poor are not always the same as those who lack access to education, health care and standard of living [51, 48].

3.7 Robustness check

In order to ensure the robustness of our results, we re-estimate our model considering two sub-samples. After the unit root test with structural break, we highlighted the fact that most of the structural breaks in our variables were located around 2008. That year, due to the global crisis, remittances have declined for the first time since the 1980s, by 6.1 percent[42]. To capture the potential effects of this global crisis on the $hdi - remittances$ nexus, we divide our sample into the pre-2008 crisis (1980-2008) and the post-2008 crisis (2009-2017).

The results which are reported in Table 10 are similar in terms of the sign and statistical significance with those obtained with the full sample, whereas the magnitudes of the estimated coefficients are slightly different. We find that the impact of remittances on *hdi* was higher after 2008. More specifically, a one percent increase in remittances in the pre and post-2008 period reduces the *hdi* by 0.002 and 0.03 per cent respectively. This result seems to corroborate the counter-cyclical nature of remittances which seem to increase in times of hardship. Our FMOLS results are confirmed by the DOLS and the CCR estimates in both sub-periods.

4 Conclusion

This paper has empirically examined the causal relationship between international remittances and human development in a panel of 100 developing countries during the period 1990-2018, by applying second-generation cointegration procedures. This paper contributes to the existing literature by investigating the effects of remittances on a broad measure of development, covering a longer span of available time series data and employing recently developed and robust unit root and cointegration tests that allow for country specific heterogeneity, cross-country dependence as well as multiple structural breaks.

Our main findings suggest that international remittances are associated with an improvement of human development. This result is robust to the use of alternative estimators as well as poverty headcount ratio. Our findings further reveal that in the short-run, there is evidence of (i) a bidirectional causal relationship between economic growth and human development and between economic growth to remittances, (ii) a unidirectional causal relationship from remittances to human development. Finally, we find that in the long-run, (i) it takes more than fourteen years to human development to converge to

its long-run equilibrium in response to changes in remittances and economic growth and (ii) remittances and economic growth jointly Granger-cause improvements in human development.

The findings on the short-run causality can be contrasted with those of the IMF [11]which found that remittances play an important role in developing countries, as a shock-absorbing device when economies slow down. Our long-run causality results suggest that developing countries partly rely on remittances to improve their living conditions, reduce their levels of poverty and foster their economic growth.

Overall, our findings are in line with the United Nations 2030 Agenda for Sustainable Development where they recognize that migration and remittances could contribute to the long-run development of the receiving countries [33]. However, to take full advantage of the human and economic development potential of remittances, governments of the recipient countries have to take some measures including: (a) reduction of barriers to legal migration and costs incurred so that more people will be able to migrate legally and send remittances home; (b) increase transparency and competition in the transfer market with the aim of reducing the cost of sending money home. This measure will not only make more money to flow directly into the pocket of the recipients, it will also lower the amount of remittances that go unrecorded because of high transaction fees; (c) increase banking penetration in the developing countries which remains low. Higher access to financial institutions would channel more transfer into the formal sector. Furthermore, mobile banking, which has been a significant source of domestic transfer in developed countries remains little developed. The development of mobile banking in developing countries could facilitate substantially remittances flows, as there would be no exchange rate cost associated with money transfers; (d) take measures to ensure that remittances recipients have access to targeted financial services to help them save and/or invest their funds and access credit. However, all these measures will be effective if and only if the institutions are strong. Future research in this area could assess the role of institution in the impact of remittance on human development. More specifically, future research could consist in assessing the relation between quality institutions, international remittances and human development and determine whether there is a threshold for quality institutions beyond and above which remittances will impact human development differently.

Tables

Table 1
Descriptive statistics of variables (in natural logarithm).

Variables	*hdi*	*rem*	*gdp*
Mean	-0.57	4.75	8.84
Median	-0.50	4.73	8.7
Maximum	0	5.63	11
Minimum	-1.66	0	0
Std. dev.	0.27	1.13	1.66
Skewness	-0.84	-16.79	-0.88
Kurtosis	3.56	533.44	42.19
Observations	2900	2900	2900

[11]International Monetary Fund (2013), Country Report 13/92. West African Economic and Monetary Union (WAEMU): Staff Report on Common Policies for Member Countries.

Table 2
Test for cross-sectional independence.

	Level		First difference	
Variables	Test-value	Correlation	Test-value	Correlation
hdi	321.85***	0.852	48.17***	0.223
rem	49.26***	0.519	49.26***	0.519
gdp	228.89***	0.718	228.89***	0.718

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 3
Test for homogeneity.

Test	*rem*	*gdp*
$\tilde{\Delta}$	82.794***	77.519***
$\tilde{\Delta}_{adj}$	87.440***	81.869***

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 4
CIPS panel unit root test.

	Level	First difference
Variables		
hdi	−1.826	−3.952***
rem	−2.482***	−4.691***
gdp	−2.539***	−3.644***

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 5

Country-specific Clemente-Montanes-Reyes structural break unit root test (additive outlier - AO).

	hdi			*rem*			*gdp*		
Country	T-Statistic	TB1	TB2	T-Statistic	TB1	TB2	T-Statistic	TB1	TB2
Argentina	-3.574	1998	2007	-5.370	2003	2011	-4.146	2000	2007
Armenia	-1.869	2000	2008	-4.388	1994	2001	-3.651	1991	2009
Bangladesh	-2.792	2000	2011	-3.075	2004	2015	-2.562	2004	2012
Belarus	-1.438	2002	2009	-3.496	1997	2012	-3.310	2001	2007
Belize	-3.334	2001	2009	-4.111	2002	2007	-5.277	2000	2004
Benin	-2.884	2002	2010	−6.301*	1992	1998	-3.563	2003	2015
Bolivia	-2.922	1999	2010	-3.095	2004	2011	-2.761	2007	2014
Bosnia	-2.835	2002	2013	-1.476	1996	2001	-4.034	1998	2007
Botswana	-4.091	2005	2011	-3.050	1996	2009	−10.279*	1998	2009
Brazil	-3.317	1998	2010	-5.252	2001	2006	-3.592	2003	2009
Bulgaria	-2.545	2002	2009	-2.755	2000	2006	-2.715	2003	2009
Burkina Faso	-2.771	2001	2009	-2.764	2000	2012	-2.148	2000	2009
Burundi	-4.160	2003	2008	3.040	2010	2012	-3.169	1994	1997
Cabo Verde	1.732	2003	2009	−8.049*	1992	2003	-3.771	1996	2004
China	-2.883	1999	2008	-3.313	1995	2002	-2.779	2003	2010
Colombia	-2.729	1999	2008	-3.430	2000	2008	-3.440	2005	2011
Comoros	-3.202	1999	2008	-3.823	2000	2005	-4.256	1997	2010
Congo, D.R.	-2.827	2005	2011	-1.835	2008	2011	−10.268*	1994	2011
Congo, R.	-2.915	2009	2016	-4.364	2010	2014	-4.388	1995	2007
Costa Rica	-3.054	1999	2008	-2.665	2002	2010	-2.755	1999	2008
Ivory Coast	-3.017	2006	2013	-1.990	1991	2006	-3.711	2001	2014
Djibouti	-3.094	2004	2011	-1.906	1991	1999	1.935	1995	2003
Dominican R.	-2.695	2001	2011	-2.419	2000	2004	-2.439	2001	2011
Ecuador	-4.530	2005	2012	-4.117	1997	2005	-4.530	2005	2012
Egypt, A.R.	-2.742	2000	2009	-5.417	1995	2009	0.813	2001	2009
El Salvador	-3.263	1997	2005	-3.316	1991	2001	-2.998	1996	2007
Eswatini	-0.088	1999	2017	-5.019	1994	2001	-3.276	2003	2010
Ethiopia	-3.032	1998	2007	-3.365	2001	2012	-1.836	2006	2012
Fiji	-3.099	2001	2012	-5.435	2001	2007	-3.017	2000	2013
Gambia	-2.979	2000	2009	-3.386	2000	2013	-5.105	1999	2008
Georgia	1.634	2002	2012	-3.237	1994	2008	-4.179	2004	2012
Ghana	-2.952	2001	2009	-0.798	2008	2012	-1.100	2007	2013
Guatemala	-2.964	2000	2011	−5.825*	1999	2003	-2.641	1999	2008
Guinea	-2.911	2001	2009	1.578	2000	2003	-2.453	1998	2013
Guinea-Bissau	-2.958	1999	2008	-4.509	1999	2010	−5.705*	1999	2008
Guyana	-3.014	1996	2008	-3.239	2001	2014	-2.712	1998	2010
Haiti	-2.473	2000	2010	5.011	1999	2016	-2.749	1991	2002
Honduras	-3.245	1999	2008	-4.602	2001	2006	-3.676	2004	2013
India	-2.801	2000	2011	-3.306	1997	2004	−5.920*	2000	2011
Indonesia	-2.786	1998	2010	-3.801	2002	2009	-3.084	2005	2012
Iran, I. R.	-3.082	1997	2007	-2.880	1994	2005	-3.631	1999	2004
Jamaica	-4.173	1998	2005	-5.328	1991	2001	-4.200	2004	2010
Jordan	-3.848	1995	2002	−6.544*	1994	2007	-2.660	1991	2010
Kazakhstan	-3.486	2002	2012	−7.242*	1994	2000	-3.203	2002	2008
Kenya	-3.200	2005	2011	-1.785	1997	2001	-3.065	2007	2012
Korea, R.	-2.994	1998	2007	-0.690	1995	2004	-3.270	1996	2007
Kosovo	−6.664*	1994	2008	-3.217	1996	2001	0.904	1994	1999
Kyrgyz, R.	-2.709	2002	2013	-1.635	2003	2007	-3.787	2003	2010
Lebanon	-4.745	2008	2013	-3.842	1994	1999	-2.436	1997	2010
Lesotho	-2.070	2000	2013	-3.602	1997	2007	-3.196	2002	2009
Liberia	−7.085*	1995	1999	-3.245	1999	2007	-2.308	2000	2010

Critical value for Clemente–Montanes–Reyes two breaks test at 5% = -5.49

Table 5 continued

Country-specific Clemente-Montanes-Reyes structural break unit root test (additive outlier - AO).

	hdi			*rem*			*gdp*		
Country	T-Statistic	TB1	TB2	T-Statistic	TB1	TB2	T-Statistic	TB1	TB2
Madagascar	-3.285	1997	2005	-0.623	2004	2008	-3.04	1999	2006
Malaysia	-2.887	1998	2009	-3.958	2000	2009	-2.900	2003	2012
Mali	-3.447	1998	2005	-5.229	1996	2008	-3.068	2000	2011
Mauritania	-4.637	1999	2010	-4.841	2005	2011	-4.409	2004	2012
Mauritius	-3.069	2000	2009	0.873	2002	2013	-4.488	1999	2009
Mexico	-2.741	1999	2007	-2.262	2000	2004	-4.712	1997	2012
Moldova	-3.476	2002	2010	-3.475	1997	2004	-2.413	2007	2015
Mongolia	-3.347	2001	2008	-1.643	2000	2002	-3.304	2005	2012
Montenegro	-3.108	1999	2007	-3.391	1998	2007	-3.616	1999	2009
Morocco	-2.938	2000	2010	-2.673	2000	2010	-3.215	2002	2010
Mozambique	-2.558	2000	2009	-5.322	1996	2014	-2.557	2000	2009
Myanmar	-2.964	2001	2010	-3.558	1996	2014	-2.846	2003	2011
Namibia	-2.104	1998	2012	-1.413	1998	2006	-3.887	2003	2011
Nepal	-3.093	2001	2011	-3.678	2003	2009	-2.744	2001	2011
Nicaragua	-2.695	1998	2009	-4.856	1996	2002	-2.904	2001	2013
Niger	-2.688	2002	2011	-4.547	2000	2007	-4.218	2009	2013
Nigeria	-2.989	1999	2008	-4.314	2002	2011	-3.541	2003	2010
Pakistan	-3.022	2001	2010	-3.707	2003	2010	-3.039	1991	2008
Panama	-2.799	1999	2008	-3.750	1996	2003	-3.295	2005	2012
Paraguay	-2.902	1998	2009	-5.480	1991	2004	-3.658	2009	2015
Peru	-2.623	2000	2010	-4.008	2000	2011	-3.504	1996	2009
Philippines	-2.744	2001	2011	-3.739	1998	2009	-2.883	2005	2013
Romania	-3.568	1999	2005	-5.567^{*}	2002	2014	-3.754	2003	2009
Russia	-2.994	2003	2012	-0.066	1991	1996	-1.677	1991	2009
Rwanda	-2.966	1998	2007	-2.817	2004	2008	-3.358	2003	2011
Samoa	-3.358	2000	2008	-2.220	1991	2002	-3.264	1997	2003
Sao Rome	-2.706	2002	2012	-5.587^{*}	1998	2010	1.733	2007	2015
Senegal	-3.499	2002	2010	-4.875	2002	2009	-3.046	2000	2011
Serbia	-2.577	2002	2010	-3.845	1997	2003	-3.600	1999	2007
Seychelles	-0.500	2004	2011	-3.582	2002	2009	-3.801	1998	2008
Sierra Leone	-3.146	2001	2009	-2.572	1992	1996	-3.579	1999	2009
South Africa	-3.433	1999	2011	-6.360^{*}	1999	2004	-4.422	2001	2007
Sri Lanka	-3.017	2000	2009	-4.163	1999	2011	-3.470	2001	2011
Sudan	0.215	2000	2009	-2.818	1996	2006	-2.810	2004	2013
Syrian, R.	-4.637	2002	2014	20864	1992	2002	-3.070	1995	1999
Tajikistan	-2.833	2003	2009	-3.526	1996	2003	-4.909	1994	2007
Tanzania	-3.622	2002	2009	-2.238	1993	2007	-2.792	2004	2012
Thailand	-2.825	2000	2008	-3.547	2003	2010	-1.620	2003	2011
Timor-Leste	-4.435	1998	2007	-3.452	1998	2006	-3.066	2001	2006
Togo	-2.483	2005	2012	-4.241	1998	2002	-3.432	1995	2012
Tonga	-0.938	2004	2012	-3.200	1996	2016	-3.505	1999	2011
Tunisia	-2.957	1999	2007	-5.443	2001	2009	-3.060	2000	2008
Turkey	-2.904	2001	2011	-1.090	2000	2003	-3.237	2004	2012
Uganda	-2.945	1999	2007	-2.835	2000	2004	-2.909	2002	2008
Ukraine	-2.940	2002	2007	-3.179	2001	2012	-4.768	1995	2003
Uzbekistan	-2.809	2000	2009	-3.432	1996	2003	-3.159	2005	2012
Vanuatu	-3.273	1998	2005	-2.456	1994	1999	-4.524	1998	2007
Vietnam	-3.014	1999	2008	-4.110	1996	2004	-2.514	2002	2011
Yemen, Rep.	-5.778^{*}	1998	2004	-3.993	2001	2013	-3.517	1999	2012
Zimbabwe	-2.988	1999	2011	-2.048	2001	2009	-4.710	2004	2011

Table 6
Bootstrap panel cointegration test based on cross-sectional dependence: Westerlund (2007) .

	hdi		
Test	$Value$	$p-Value^a$	$p-Value^b$
G_τ	-2.275	0.000	0.000
G_a	-7.399	0.745	0.000
P_τ	-65.917	0.000	0.000
P_a	-29.759	0.000	0.000

Note: P_τ and G_a are the groups mean statistics. P_τ and P_a are panel mean statistics. The Westerlund (2007) test takes the null hypothesis of no cointegration. ^{a} The $p-values$ are for a one-sided test based on the normal distribution. ^{b} The $p-values$ are for a one-sided test based on 300 bootstrap replications.

Table 7
Panel cointegration tests with cross-sectional dependence and structural breaks: Westerlund and Egerton (2008) .

	hdi			
Model	$Z_\tau(N)$	$p-Value$	$Z_\phi(N)$	$p-Value$
No break	-10.978	0.000	-21.008	0.000
Level break	2.098	0.982	2.010	0.978
Regine shift	-5.761	0.000	-9.387	0.000

Note: The test is implemented using the Campbell and Perron (1991) automatic procedure to select the lag length.

Table 8
Dumistrescu and Hurlin 2012 Granger causality test.

Dependent Variables			Short-Term Causality	Long-Term Causality
	Δhdi	Δrem	Δgdp	ECT(-1)
Δhdi		1.7912*	7.006**	−0.0759**
		(0.0733)	(0.000)	(0.0302)
Δrem	−0.068		3.429***	−0.3514***
	(0.9459)		(0.000)	(0.057)
Δgdp	2.243**	1.673***		−0.4902***
	(0.015)	(0.094)		(0.1281)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 9
Long-run estimates by alternative estimators for the full sample.

	DOLS		FMOLS		CCR	
Variables	*hdi*	*pov*	*hdi*	*pov*	*hdi*	*pov*
rem	0.003***	−2.459***	0.003*	−2.401***	0.004*	−2.493***
	(0.002)	(0.630)	(0.002)	(0.526)	(0.002)	(0.565)
gdp	0.010***	−2.373***	0.010***	−2.345***	0.010***	−2.349***
	(0.001)	(0.108)	(0.001)	(0.102)	(0.001)	(0.104)
Constant	2.871***	34.291***	2.872***	33.343***	2.871***	33.933***
	(0.013)	(3.633)	(0.011)	(3.042)	(0.011)	(3.256)
Observations	2900	2900	2900	2900	2900	2900

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 10
Long-run estimates by sub-periods (1990-2008 and 2008-2018).

	1990-2008			2008-2018		
Variables	FMOLS	DOLS	CCR	ARDL	DOLS	CCR
rem	0.002***	0.005***	0.002**	0.003***	0.012***	0.026***
	(0.000)	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)
gdp	0.001***	0.010***	0.010***	0.010***	0.011***	0.011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.890***	2.854***	2.893***	2.691***	2.804***	2.756***
	(0.004)	(0.010)	(0.007)	(0.041)	(0.015)	(0.010)
Observations	2085	2085	2087	1276	1273	1275

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

References

[1] Acosta, P., Calderón, C., Fajnzylber, P., and López, H. Remittances and development in latin america. *World Economy 29*, 7 (2006), 957–987.

[2] Adams Jr, R. H., and Cuecuecha, A. The impact of remittances on investment and poverty in ghana. *World Development 50* (2013), 24–40.

[3] Adams Jr, R. H., and Page, J. Do international migration and remittances reduce poverty in developing countries? *World development 33*, 10 (2005), 1645–1669.

[4] Adenutsi, D. E. Do international remittances promote human development in poor countries? empirical evidence from sub-saharan africa.

[5] Al Mamun, M., Sohag, K., Uddin, G. S., and Shahbaz, M. Remittance and domestic labor productivity: Evidence from remittance recipient countries. *Economic Modelling 47* (2015), 207–218.

[6] Anand, S., and Sen, A. Human development and economic sustainability. *World development 28*, 12 (2000), 2029–2049.

[7] Ang, A. Workers. *Asia-Pacific Social Science Review 9*, 2 (2010), 63–77.

[8] Anyanwu, J. C., and Erhijakpor, A. E. Do international remittances affect poverty in africa? *African Development Review 22*, 1 (2010), 51–91.

[9] Baltagi, B. *Econometric analysis of panel data*. John Wiley & Sons, 2008.

[10] Baltagi, B. H., and Hashem Pesaran, M. Heterogeneity and cross section dependence in panel data models: theory and applications introduction, 2007.

[11] Bank, W. Migration and remittances: Recent development and outlook, special topic on global compact on migration. *KNOMAD 11463* (2017), 3–11.

[12] Breitung, J. *The local power of some unit root tests for panel data*. Humboldt-Universität zu Berlin, Wirtschaftswissenschaftliche Fakultät, 2005.

[13] Breitung, J., and Pesaran, M. H. Unit roots and cointegration in panels. In *The econometrics of panel data*. Springer, 2008, pp. 279–322.

[14] Clemente, J., Montañés, A., and Reyes, M. Testing for a unit root in variables with a double change in the mean. *Economics letters 59*, 2 (1998), 175–182.

[15] Dumitrescu, E.-I., and Hurlin, C. Testing for granger non-causality in heterogeneous panels. *Economic modelling 29*, 4 (2012), 1450–1460.

[16] Faini, R. Migration, remittances and growth. In *Conference on Poverty, International Migration and Asylum, Helsinki, September* (2002), pp. 27–28.

[17] Freund, C., and Spatafora, N. *Remittances: transaction costs, determinants, and informal flows*. The World Bank, 2005.

[18] Gapen, M. T., Chami, M. R., Montiel, M. P., Barajas, M. A., and Fullenkamp, C. *Do Workers' Remittances Promote Economic Growth?* No. 9-153. International Monetary Fund, 2009.

[19] Giuliano, P., and Ruiz-Arranz, M. Remittances, financial development, and growth. *Journal of Development Economics 90*, 1 (2009), 144–152.

[20] Gorica, K., and Gumeni, A. Towards sustainable development: Relationship between hdi and gdp per capita in albania. *International Journal of Scientific and Engineering Research 4*, 12 (2013), 3–5.

[21] Grabel, I. Remittances: Political economy and developmental implications. *International Journal of Political Economy 38*, 4 (2009), 86–106.

[22] Gupta, S., Pattillo, C. A., and Wagh, S. Effect of remittances on poverty and financial development in sub-saharan africa. *World development 37*, 1 (2009), 104–115.

[23] Huay, C. S., Winterton, J., Bani, Y., and Matemilola, B. T. Do remittances promote human development? empirical evidence from developing countries. *International Journal of Social Economics* (2019).

[24] Imran, K., Devadason, E. S., and Cheong, K.-C. Do migrant remittances reduce poverty? micro-level evidence from punjab, pakistan. *Malaysian Journal of Economic Studies 55*, 1 (2018), 19–47.

[25] Irdam, D. The impact of remittances on human development: A quantitative analysis and policy implications. *Sociology 5*, 1 (2012), 74–95.

[26] Islam, S. The human development index and per capita gdp. *Applied Economics Letters 2*, 5 (1995), 166–167.

[27] Jawaid, S. T., and Raza, S. A. Workers' remittances and economic growth in china and korea: an empirical analysis. *Journal of Chinese Economic and Foreign Trade Studies* (2012).

[28] Jongwanich, J. *Workers' remittances, economic growth and poverty in developing Asia and the Pacific countries*, vol. 7. United Nations Publications, 2007.

[29] Kao, C., and Chiang, M.-H. On the estimation and inference of a cointegrated regression in panel data. *Available at SSRN 1807931* (1999).

[30] Li, X., and Zhou, J. Environmental effects of remittance of rural–urban migrant. *Economic Modelling 47* (2015), 174–179.

[31] Mundaca, B. G. Remittances, financial market development, and economic growth: the case of latin america and the caribbean. *Review of development economics 13*, 2 (2009), 288–303.

[32] Naeem, M. Z., Arzu, S., et al. The role of remittances on human development: Evidence from developing countries. *Bulletin of Business and Economics (BBE) 6*, 2 (2017), 74–91.

[33] Nations., U. *Sustainable Development Goals Report 2016*. UN, 2016.

[34] Olubiyi, E. A. Trade, remittances and economic growth in nigeria: Any causal relationship? *African Development Review 26*, 2 (2014), 274–285.

[35] Page, J., and Plaza, S. Migration remittances and development: A review of global evidence. *Journal of African Economies 15*, suppl_2 (2006), 245–336.

[36] Pedroni, P. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and statistics 61*, S1 (1999), 653–670.

[37] Perron, P., and Vogelsang, T. J. Testing for a unit root in a time series with a changing mean: corrections and extensions. *Journal of Business & Economic Statistics 10*, 4 (1992), 467–470.

[38] Pesaran, M. H., and Yamagata, T. Testing slope homogeneity in large panels. *Journal of econometrics 142*, 1 (2008), 50–93.

[39] Ponce, J., Olivié Aldasoro, L., and Onofa, M. Remittances for development?: A case study of the impact of remittances on human development in ecuador. *Elcano Newsletter*, 48 (2008), 33.

[40] Ranis, G., Stewart, F., and Ramirez, A. Economic growth and human development. *World development 28*, 2 (2000), 197–219.

[41] Ratha, D. Leveraging migration and remittances for development. *UN Chronicle 50*, 3 (2013), 26–29.

[42] Ratha, D. *Migration and remittances Factbook 2016*. The World Bank, 2016.

[43] Ratha, D., et al. Workers' remittances: an important and stable source of external development finance. *Remittances: development impact and future prospects* (2005), 19–51.

[44] Ratha, D. K., De, S., Kim, E. J., Plaza, S., Seshan, G. K., and Yameogo, N. D. Covid-19 crisis through a migration lens. *Migration and Development Brief 32* (2020).

[45] Ravallion, M. Can high-inequality developing countries escape absolute poverty? *Economics letters 56*, 1 (1997), 51–57.

[46] Sahoo, M., Sucharita, S., and Sethi, N. Does remittance inflow influence human development in south asian countries? an empirical insight. *Business Strategy & Development 3*, 4 (2020), 578–589.

[47] Schiantarelli, F. *Global economic prospects 2006: economic implications of remittances and migration*. The World Bank, 2005.

[48] Siani, J., et al. A multidimensional analysis of poverty using the fuzzy set approach. evidence from cameroonian data. *Economics Bulletin 35*, 3 (2015), 2012–2025.

[49] Swaha, S., and Sarika, T. Balancing uman development with economic rowth: A studi of asean. *Annals of the University of Petrosani, Economics 10*, 1 (2010), 335.

[50] Swamy, P. A. Efficient inference in a random coefficient regression model. *Econometrica: Journal of the Econometric Society* (1970), 311–323.

[51] Tchouametieu, J. S., et al. Has poverty decreased in cameroon between 2001 and 2007? an analysis based on multidimensional poverty measures. Tech. rep., 2013.

[52] Westerlund, J. Testing for error correction in panel data. *Oxford Bulletin of Economics and statistics 69*, 6 (2007), 709–748.

[53] Westerlund, J., and Edgerton, D. L. A simple test for cointegration in dependent panels with structural breaks. *Oxford Bulletin of Economics and Statistics 70*, 5 (2008), 665–704.

[54] Williams, K. Do remittances improve political institutions? evidence from sub-saharan africa. *Economic Modelling 61* (2017), 65–75.

[55] Ziesemer, T. H. Worker remittances, migration, accumulation and growth in poor developing countries: Survey and analysis of direct and indirect effects. *Economic Modelling 29*, 2 (2012), 103–118.