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Do international remittances promote poverty alleviation? Evidence from low- and middle-income countries

Abstract

Unlike previous empirical studies, this paper investigates the contemporaneous and lagged impacts of international remittances on poverty alleviation using data for 65 low- and-middle-income countries from 2002 to 2016. By using two-stage least square (2SLS) regression analysis, this study establishes that, in general, international remittances per gross domestic product (GDP) significantly mitigate poverty. On average, a 10-percentage-point increase in remittances will lead to a similar decrease in the poverty headcount ratio at USD 1.90 a day, a 4.8-percentage-point decline in poverty gap ratio at USD 1.90 a day, and a 6.7-percentage-point reduction in the poverty gap ratio at USD 3.20 a day. This result remains robust with the inclusion of political factors in the model. Moreover, the system-generalized method of moments (SGMM) estimations found that the contemporaneous effects of international remittances are much more substantial than their lagged effects. This indicates that most of the poverty alleviation role of remittances is contributed by its direct effect on increasing the wealth index of recipient households rather than the spillover effect on other members of the community. Therefore, we strongly suggest that efforts be made to improve the remittance infrastructures, especially in recipient countries, and the development of cooperatives in the enclaves of migrant workers to spread the beneficial effects of remittances to all members of society.

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1 Introduction

The resilience of remittance flows during or after economic downturns or recessions has been recognized by previous studies (Ratha et al., 2008; Jha et al., 2009; World Bank, 2021a). Remittances have also been found to increase when recipient countries experienced disruptive shocks, such as macroeconomic vulnerability, natural disasters, and armed conflict (Fagen and Bump, 2006; Singh et al., 2011; Naudé and Bezuidenhout, 2014). Those findings disclose that remittances have countercyclical behavior, as migrant workers sent more money in response to times of hardship in their respective home countries.[1] To put it differently, the welfare of household members should be a central component of the migrants' utility function (Faini, 2007; Niimi et al., 2010).

The advantages of remittances, as mentioned earlier, have spurred many researchers to investigate further the extent of the remittances' role in promoting development in recipient countries. One of the aspects that caught their attention was with respect to its impact on poverty alleviation, considering that most migrant workers originate from poor households living in rural areas. The prominent view emerging from the literature on this issue is that increased remittance flows significantly mitigate poverty rates in the home country (Hatemi-J and Uddin, 2013; Satti et al., 2015; Pradhan and Mahesh, 2016; Mehedintu et al., 2019; Musakwa and Odhiambo, 2020). It can be said that these findings, which researchers generally agree upon, are in line with the "migration optimism" concept, which holds that migration is one of the main instruments in promoting economic development in the home countries (de Haas, 2007). However, there are also some study results that are consistent with de Haas' (2007) "migration pessimism", as they reveal contradictory evidence (Tsaurai, 2018; Kousar et al., 2019).

Some studies that evaluated the impact of remittances on poverty have ignored the potential bidirectional causality between the two variables (Yoshino et al., 2017; Abduvaliev and Bustillo, 2019). Other scholars who investigated the impact of remittance on poverty recognize that the endogeneity issue in remittances will cause bias in the estimates (Gupta et al., 2009). Therefore, they include several instruments for remittances (Adams and Page, 2005; Combes et al., 2014; Akobeng, 2016; Vacaflores, 2018; Azizi, 2019).

This study has identified several potential instruments related to remittance-receiving countries that garner little attention in the literature. For instance, migrant workers consider the exchange rate appreciation in their home country as a cost of sending remittances because it will reduce the amount of money they can send to their relatives (Abdih et al., 2012). In addition, the nature of the trade policies adopted in their home country may also be associated with quotas for sending migrants abroad, which, in turn, affects the inflow of remittances. Thus, this paper will apply exchange rate and trade openness to instrument remittance (Gupta et al., 2009). Econometrically, we will use two-stage least square (2SLS hereafter) equipped by Driscoll and Kraay's (1998) covariance matrix estimator to analyze the causal impact of remittances on poverty. With the aid of this approach, our estimation model is expected to produce unbiased parameters and consistent standard errors (SEs) for all forms of autocorrelation, heteroskedasticity, as well as cross-sectional and temporal dependencies (Hoechle, 2007).

In addition, the existing studies are still focused on the contemporaneous effect of remittances on poverty. However, its lagged effect on the outcome of interest has not yet been

1 What we mean by times of hardship is a decline in GDP regardless of what causes it.

explored. This paper fills this void by estimating the dynamic relationship between remittance and poverty. To conduct such analysis, we will use the system-generalized method of moments (SGMM hereafter) estimator and introduce the lagged levels of remittance on the right-hand side of the estimation model. Using this dynamic model allows us to test different causal mechanisms.

As identified by the existing literature, financial support from migrant workers can facilitate poverty alleviation through two causal channels: an increase in the income of recipient households and nonrecipients in the local community. Some of these effects are observed immediately after remittances are disbursed, while others may be delayed. For example, the recipient household's income automatically increases after the remittance is disbursed. Thus, the financial access of this household is more open, enabling the house members to improve their standard of living and move above the poverty line (Du et al., 2005; Paris et al., 2010; Housen et al., 2013; Arouri and Nguyen, 2017). On the other hand, families that do not receive remittances can also indirectly benefit from such transfers and, thus, promote local development and poverty alleviation (Nyberg-Sorensen et al., 2002; Ravanilla and Robleza, 2005; Ghosh, 2006). A spillover mechanism is operating here, and there is likely some temporal lag before the remittance stimulates local economic activity. Previous cross-country studies on this topic did not recognize these two causal mechanisms when they documented the importance of international remittance on poverty alleviation.

The remainder of the paper is arranged as follows. Section 2 provides an overview of the literature dealing with remittance and poverty alleviation. Section 3 discusses the data used and the econometric model applied in this paper. Section 4 delivers the empirical results of this study. Finally, we provide conclusions of this study along with policy recommendations.

2 Related Literature

Since 2001, remittance has become a popular subject among scholars when discussing the roles that migration plays in an economy, especially in remittance-receiving countries, such as food security (Generoso, 2015), agricultural productivity (Huy and Nonneman, 2016), economic growth (Sobiech, 2019), and financial development (Kakhkharov and Rohde, 2020). This study, however, only focuses on the impact of remittances on poverty. Empirical studies on the issue are abundant and appear to have quite varied results (Kousar et al., 2019; Musakwa and Odhiambo, 2020). Nonetheless, a general consensus is that remittances may decrease the possibility of households remaining poor (Hashmi et al., 2008; Ciupureanu and Roman, 2016; Pradhan and Mahesh, 2016; Imran et al., 2018; Ali et al., 2019; Mehedintu et al., 2019; Arapi-Gjini et al., 2020).

More specifically, this paper is in line with a small group of studies in the remittances and poverty literature, which pay close attention to the potential issue of endogeneity of remittances. Most of the studies in this area use data involving multiple units across place and time (Adams and Page, 2005; Acosta et al., 2008; Gupta et al., 2009; Anyanwu and Erhijakpor, 2010; Combes et al., 2014; Imai et al., 2014; Akobeng, 2016; Inoue, 2018; Vacaflores, 2018; Azizi, 2019). However, other studies have used household-level data, e.g., the empirical investigation conducted by Acharya and Leon-Gonzalez (2012) in Nepal over two different survey periods (1996 and 2004). Such studies agree that endogeneity in remittances arises because most migrants

who leave their hometown or country originate from low-income families. They are looking for much better opportunities to improve their standard of living. Once they successfully achieve this dream, they set aside a portion of their income to be distributed to the relatives they have left behind. It indicates that the relationship between remittances and poverty is not necessarily one-way but can be two-way as well. Thus, the authors incorporated several instruments for remittances in the analysis to solve the endogeneity problem.

The rapidly growing literature examines only the contemporary impact of remittances on poverty. However, little is known about the lagged effects of remittances on poverty. We contribute to this topic by quantifying the lagged effects of international remittances on poverty alleviation. As highlighted earlier, two plausible channels of effects underpin such an analysis: an increase in the income of recipient households and other households in the local communities owing to remittances.

First, the importance of remittances for beneficiary families is clear cut. A portion of migrants' money deposited for their families directly increases the family's income. These remittances become part of the households' fungible budget such that this has a positive impact on the livelihoods of recipient households — namely, increasing household investment in housing and education and reducing the depth of household poverty (Du et al., 2005; Housen et al., 2013). In short, international remittances help migrant households to increase their wealth index (Adams and Cuecuecha, 2013; Arouri and Nguyen, 2017).

Second, at the local community level, the benefits of remittances can be enjoyed widely by the existence of a spillover mechanism. Thus, households that do not receive remittances can still benefit indirectly. For example, increased consumption of recipient households will benefit other community members through increased demand, which stimulates local production, promoting job creation and local development (Nyberg-Sorensen et al., 2002; Ravanilla and Robleza, 2005; Ghosh, 2006). In addition, local people in the area of origin of migrants usually form a small community to manage the money that migrants send (e.g., migrant cooperatives). This can improve community credit services or construct physical infrastructures in the community, such as schools, health centers, roads, and other community projects. With these mechanisms, poverty alleviation applies not only to beneficiary households but also to nonbeneficiaries. The difference is that the latter effect may involve some temporal lag.

3 Research Methodology

3.1 Variables

This study uses annual macro-level data for 65 low- and middle-income countries (LMICs) worldwide between 2002 and 2016 to estimate the impacts of international remittances on poverty (see Table A1 in Appendix for the country list understudy).[2] We fully utilize data provided by reputable and credible international institutions, such as the World Development Indicators (WDI) provided by the World Bank and International Monetary Fund (IMF). The data set includes 345 observations from 15 low-income countries, 21 middle-income countries,

2 For the current 2021 fiscal year, low- and middle-income countries consist of low-income countries (≤1.045 USD in 2020), upper-middle-income countries (1.046 – 4.095 USD), and middle-income countries and above (4,096 – 12,695 USD). This classification is based on the 2020 gross national income (GNI) per capita calculated using the World Bank Atlas Method (World Bank, 2021b).

and 29 upper-middle-income countries. These income classifications follow the conventions of the World Bank. Countries for which no data are available are excluded from the sample.

As proposed by Foster et al. (1984), poverty headcount (P_0) and poverty gap (P_1) can be decomposed by a single equation as follows:

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{n_p}\left(\frac{G_i}{z}\right)^\alpha \quad (1)$$

where P stands for poverty and α represents the level of sensitivity of the index in measuring poverty. G_i is the income shortfall of household i in relation to the poverty line (z). Finally, n and n_p are the total number of households and the number of the poor, respectively. Eq. (1) measures the percentage of people living under the poverty line when $\alpha = 0$.[3] Eq. (1) represents the mean shortfall in income or consumption from the poverty line for $\alpha = 1$.[4] We adapted the three indicators used by Banga and Sahu (2013) to measure poverty but using the latest international poverty line (IPL) as proposed by Jolliffe and Prydz (2016), namely, poverty headcount ratio at USD 1.90 per day ($P_{0-1.9}$, % of the population), poverty gap at USD 1.90 per day ($P_{1-1.9}$, %), and poverty gap ratio at USD 3.20 per day ($P_{1-3.2}$, %).

For the remittance, we follow Gupta et al. (2009) and Akpan et al. (2014) to use the proportion that international remittances contribute to gross domestic product (GDP) (R, %). This variable of interest consists of two components that are respectively recorded as primary and secondary income in the balance of payment, namely, personal transfers (workers' remittance) and compensation of employees (IMF, 2009). Chami et al. (2009) commented on such aggregation. They argued that measuring international remittances by totaling those two components is inappropriate because each type of transfer has different characteristics and responds differently to economic turmoil. According to the IMF (2009), the difference between the two types of transfer lies in how long migrants who send money to households/relatives stay in their respective host countries. However, Martin (2015) argued that most nations do not know precisely how long migrants who remit money have been abroad, and thus most researchers use that aggregation when studying remittances. We prefer this second argument as a precaution against obtaining invalid remittance measurements.

The controlled causal hypothesis is crucial to ensure our analysis leads to the proper conclusion. All variables except those investigated (in this case, it is remittances) must remain constant (or "controlled") in all experimental conditions (Schwichow et al., 2016). Hence, we include in the analysis several exogenous regressors that may affect poverty, as suggested by Anyanwu and Erhijakpor (2010): per capita GDP (IC), Gini ratio (GN), and inflation (INF). Per capita income is used to measure the level of a country's economy. The Gini index is used to portray a country's income gap. Inflation is included to account for the purchasing power of the individual country's currency. Table A2 in Appendix provides the definitions of proxies, alongside each one's unit of measurement, expected sign, data source, and summary statistics of all variables.

3 $P_0 = n_p/n$ (poverty headcount).

4 $P_1 = P_0 \cdot \left(\sum_{i=1}^{n_p} G_i / z\right)$ (poverty gap).

3.2 **Baseline model**

To achieve the objective of this study, we regress all poverty indicators mentioned earlier against international remittance and all selected control variables. Under the assumption that the unobservable individual country effects are correlated with the explanatory variable of interest R_{it}, $\text{cov}(\alpha_i, R_{it}) \neq 0$, we posit that the fixed-effects (FE hereafter) model can yield more consistent coefficient estimates than the ordinary least squares (OLS hereafter). The first model of this study can be written as follows:

$$P_{\alpha it} = d_i + \boldsymbol{\phi R_{it}} + \beta \mathbf{X}_{it} + \varepsilon_{it} = \boldsymbol{\delta Z_{it}} + d_i + \varepsilon_{it} \quad (2)$$
$$\left(i = 1, \ldots, N; t = 1, \ldots, T_i\right)$$

where $P_{\alpha it}$ is a vector of all poverty measurements for country i at year t, $\boldsymbol{R_{it}}$ is the remittance received by the country as a share of the GDP, X_{it} is a vector of the control variables, d_i is the country FE, which considers unobserved time-invariant (country-specific) characteristics in a flexible manner.[5] Z_{it} is the set of regressors, $\mathrm{Z}_{it} = [\boldsymbol{R_{it}} \mathrm{X}_{it}]$. Finally, ε_{it} is an error term. We assume that α_i and ε_{it} are not independently and identically distributed (i.i.d.) as heteroskedasticity, another form of cross-sectional dependency, is often encountered in a panel data set (Hoechle, 2007). The Driscoll and Kraay (1998) SEs are robust to disturbances being a heteroskedastic, autocorrelated, and very general form of cross-sectional dependence used in the baseline model.

With respect to the empirical point of view revealed by previous studies, we expect that international remittances mitigate poverty in remittance-receiving countries. Following the results of previous studies, such as by Michálek and Výbošťok (2018) and Sehrawat and Giri (2018), we expect that per capita GDP has a negative effect on poverty, while the Gini index has a positive effect. We argue that increases in the revenue of the community imply narrowing shortfall from the poverty line, and it is associated with alleviating poverty. On the other hand, the income gap exacerbates poverty because only a few people enjoy economic growth. At the same time, the lowest layer of society remains poor or even becomes worse. By adapting mixed empirical results from de Hoyos and Medvedev (2009) and Fujii (2013), inflation is estimated to have a positive or negative effect on poverty. We believe that if price increases can stimulate people's income, inflation can improve poverty alleviation. However, inflation can exacerbate poverty if price increases only worsen people's purchasing power rather than increase income.

3.3 **Endogeneity problem and instrumental variables**

It should be noted that Eq. (2) assumes that the impact of remittances as a share of GDP against all poverty measurements is a causal relationship. However, the relationship between remittances and poverty may be bidirectional, which causes remittance variables to be endogenous. According to Azizi (2019), the endogeneity of remittances in relation to poverty can be explained via micro and macro perspectives and also measurement error terms as follows:

- In the micro perspective, the household members who live in poverty may decide to migrate and remit their money to help their relatives cope with financial constraints.

5 Specifically, the country and time fixed effects can be defined as $a_i = f(U_i)$, where U_i represents this country-specific unobserved confounder, a common cause of the outcome and treatment variables (Imai and Kim, 2019).

- In the macro perspective, the poorer countries tend to have more migrant workers than rich countries, and more migrant workers correspond to more remittances received in a country.
- The endogeneity problem also arises because of unobservable variables in the error terms that may drive migrant workers to remit their money.

These three situations lead to the biasness of the parameters in Eq. (2). To address these issues, we apply the 2SLS method. As the first stage, we perform regression of the auxiliary regression of remittances against the exogenous regressors in Eq. (2) and the instrumental variables (IVs). We use trade openness and exchange rate of remittance-receiving countries as instruments for the remittance variables (see Table A2 in Appendix for detailed description).

As with Gupta et al. (2009), trade openness is measured as a share of total trade (exports and imports) to GDP. We argue that economic liberalization describes the freedom of economic activity in the output and input markets, which involves exchanging labor between countries. Thus, we expect that trade openness has a positive effect on remittances. In contrast to Azizi (2019), we use remittance-receiving countries' currency against US dollars to express the exchange rate variable. An appreciation of the domestic currency can reduce the remittance ratio because it represents a cost for the remitter (Abdih et al., 2012). Thus, this variable is expected to have a positive effect on remittance.

On the other hand, this study argues that these instruments do not affect poverty in ways other than through the remittance variable. For example, the exchange rate will not affect the income of the poor unless one of their income sources relates to the exchange rate volatility. This income must come from abroad, such as from remittances. This argument is reasonable considering that poverty used in this study is measured by income level rather than consumption level. Therefore, concerns about the influence of the exchange rate on poverty through the consumption of imported goods can be ignored. On the other hand, trade openness will not affect the income of the poor unless it is associated with the easing of immigration policies, corresponding to the migrants' remittances sent to the needy in society. To ensure that the instruments are strong and valid, this study undertakes several tests such as under- and overidentification.

3.4 **SGMM model**

The second set of models explores the dynamic relationship between remittances and poverty. Given that the level of poverty tends to be highly persistent over time, it is reasonable to assume that current poverty depends on past poverty levels and remittances. Therefore, we estimate the variance of the poverty level with a dynamic panel model by introducing the lagged levels of poverty and remittance on the right side of the equation. The following equation captures that dynamic:

$$P_{\alpha it} = d_i + \boldsymbol{\gamma} \boldsymbol{P}_{\alpha it-1} + \boldsymbol{\phi} \boldsymbol{R}_{it} + \boldsymbol{\theta} \boldsymbol{R}_{it-1} + \beta \mathrm{X}_{it} + \varepsilon_{it} \quad (3)$$

$$\left(i = 1, \ldots, N; t = 1, \ldots, T_i\right)$$

The main difference between Eqs. (2) and (3) is that the latter captures both the contemporary effect and the lagged effect of remittances on poverty. As mentioned earlier, estimating

this dynamic model allows us to perform tests of different causal mechanisms: an increase in the income of recipient households and nonrecipients in the local community. However, it should be noted that, Eq. (3) can still produce biased and inconsistent parameters because heteroskedasticity in residuals and autocorrelation within panels (countries) always appear in data involving many units across places. In addition, the bias parameter is also attributed to the potential endogeneity of the lagged poverty level ($\boldsymbol{P}_{\alpha it-1}$) in a dynamic panel model – when this variable correlates with the random error term of the equation. That there is potential for this problem to arise is very reasonable, considering that we cannot fully capture the determinants of poverty.

To address these potential issues, we explore Model (3) using the dynamic SGMM estimators proposed by Arellano and Bover (1995) and Blundell and Bond (1998). In contrast to the Difference-GMM (DGMM hereafter) proposed by Arellano and Bond (1991), the SGMM estimation corrects the endogeneity problem by introducing more instruments, thereby dramatically increasing the estimator's efficiency. Another advantage of using this model is that it allows us to minimize data loss better than the DGMM. This is because, instead of subtracting the previous observation from a contemporaneous one, the SGMM subtracts the average of all future available observations of a variable. It implies that no matter how many gaps we have in our unbalanced panel data set, such a model is computable for all observations except the last for each individual (country). In addition, the Monte Carlo simulation also suggests that when the time span is short and the dependent variable (DV) is persistent, there are gains in precision and the small-sample bias is reduced when the SGMM is applied (Blundell and Bond, 1998).

To test the validity of the instrument, we run the Hansen test and the difference-in-Hansen test. The null hypothesis for the first test states that all instruments used are exogenous (orthogonal to DVs). The null hypothesis for the second test confirms the exogeneity of external instruments (consists of key explanatories and control variables) in the SGMM estimation. However, Roodman (2009) stated that the *p*-value of those tests might be bloated, primarily when the instruments used to overcome the endogeneity problems outnumber the country panels. Due to the relatively large number of periods under study (t = 15), the SGMM model that we have built is likely to face the instrument proliferation problem, especially when all lags are exploited as instruments. Therefore, the GMM-style instrument lag needs to be restricted to two to prevent overuse of the instruments in the model, as Roodman (2009) suggested. We treat $P_{\alpha it-1}$, R_{it}, and R_{it-1} as endogenous and generate the GMM-style instruments for the corresponding endogenous variables.

4 Results and Discussion

4.1 Initial results

Table 1 displays the initial results of this study. Generally, we find that "international remittances per GDP" negatively affects all three poverty indicators. Models 1–3 use the pooled OLS regression, while Models 4–6 include country FEs. The Hausman test results suggest that the null thesis of no FE is rejected even at the 1% significance level. It indicates that the pooled OLS models likely produce inconsistent coefficient estimates for our baseline equation. Hence, Eq. (2) should be estimated by FE (within) models. Therefore, in further discussions

Table 1 The effect of international remittances on poverty

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
	OLS	**OLS**	**OLS**	**FE**	**FE**	**FE**	**IV + FE**	**IV + FE**	**IV + FE**
DV	$P_{0-1.9}$	$P_{1-1.9}$	$P_{1-3.2}$	$P_{0-1.9}$	$P_{1-1.9}$	$P_{1-3.2}$	$P_{0-1.9}$	$P_{1-1.9}$	$P_{1-3.2}$
R	−0.950***	−0.362***	−0.673***	−0.575***	−0.139***	−0.430***	−1.012***	−0.475***	−0.665***
	(0.052)	(0.020)	(0.039)	(0.156)	(0.037)	(0.118)	(0.196)	(0.100)	(0.144)
log_IC	−19.677***	−7.485***	−14.974***	−12.789***	−3.558***	−10.919***	−11.245***	−2.372**	−10.090***
	(0.773)	(0.406)	(0.507)	(1.334)	(0.559)	(0.950)	(1.578)	(0.896)	(1.031)
GN	0.297***	0.177***	0.213***	0.503***	0.355***	0.407***	0.497***	0.350***	0.404***
	(0.049)	(0.033)	(0.030)	(0.084)	(0.056)	(0.067)	(0.111)	(0.080)	(0.084)
INF	0.009	0.029**	0.009	0.012	−0.004	0.008	0.052	0.026	0.029
	(0.027)	(0.012)	(0.023)	(0.026)	(0.015)	(0.022)	(0.032)	(0.019)	(0.024)
Observations	345	345	345	345	345	345	336	336	336
Adjusted R^2	0.814	0.729	0.835	0.535	0.400	0.609	0.362	0.056	0.490
Hausman (γ)				6.43	15.32	6.70			
				(0.000)***	(0.000)***	(0.000)***			
F-test of excluded instruments							30.850 (0.000)***	30.850 (0.000)***	30.850 (0.000)***
Kleibergen–Paap LM Test							11.820 (0.003)***	11.820 (0.003)***	11.820 (0.003)***
Hansen *J* test							2.176 (0.140)	0.075 (0.785)	1.625 (0.202)
Endogeneity test							4.347 (0.037)**	9.311 (0.002)***	2.779 (0.096)*

Notes: Driscoll–Kraay SEs are in parentheses under coefficient estimates. *p*-values are in square brackets. Per capita income (*IC*) is transformed into a logarithm because it is measured by units of money (USD). Hausman shows robust Hausman test results. Kleibergen–Paap LM statistics show robust underidentification test results. Hansen *J* statistics show robust overidentification test results. Robust endogeneity test results are shown by chi^2-statistics. Some observations in Models 7–9 are dropped because singleton groups were detected by Stata. $P_{0-1.9}$, poverty headcount ratio at USD 1.90 per day; $P_{1-1.9}$, poverty gap at USD 1.90 per day; $P_{1-3.2}$, poverty gap ratio at USD 3.20 per day.

*Significance at the 10% level.

**Significance at the 5% level.

***Significance at the 1% level.

DV, dependent variable; FE, fixed effect; IV, instrumental variable; LM, lagrange multiplier; OLS, ordinary least squares; SE, standard error.

of our regression analysis, we only dwell on the FE estimation results. In Models 7–9, we use trade openness and exchange rate in remittance-receiving countries to instrument international remittances. We find that on average, a 10-percentage-point increase in international remittances per GDP will lead to a similar decrease in poverty headcount at USD 1.90 a day, a 4.8-percentage-point decline in the poverty gap at USD 1.90 a day, and a 6.7-percentage-point decrease in the poverty gap at USD 3.20 a day. In addition, all control variables appear with the expected sign across all models.

In Models 7–9, the *F*-statistics of excluded instruments (*TOP* and log_*EX*) emerge with the *p*-values lower than the 1% significance level, indicating that they jointly have substantial impacts on international remittances in LMICs. Trade openness and exchange rate are particularly strong predictors of international remittances (see Table A3 in Appendix). In addition, the results of the underidentification test also reject the null hypothesis of the weak joint instruments (*p*-value of Kleibergen–Paap lagrange multiplier (LM) statistics < 0.01). Statistically, the test results provide strong evidence that the two variables are relevant instruments for international remittances. The overidentification fails to reject the null hypothesis of the joint exogeneity of the instruments (*p*-value of Hansen *J* statistics >0.1). It implies that our instruments are valid because they are orthogonal to the outcome of interest ($P_{\alpha it}$). It also complements the underidentification test results; thus, the two attributes of "good instruments" (relevant and valid) are met. Finally, the endogeneity test rejects the null hypothesis of the exogeneity of international remittances (*p*-value of chi^2-statistics <0.05). It indicates that the troublesome regressor of this study (*R*) should be treated as endogenous; hence, incorporating instruments for this variable is essential.

4.2 **Robustness check**

To check the robustness of the regression results shown in Models 7–9 in Table 1, we add one political variable as an exogenous regressor for poverty, obtained from the World Governance Indicators (WGI) provided by the World Bank, namely, political stability and absence of violence/terrorism (*POL*) (see Table 2). This variable measures perceptions related to the possibility of political instability and politically motivated violence, including terrorism (Kaufmann et al., 2010). This political factor has a negative influence on all poverty measurements in this study. Qualitatively, the presence of political variables in the FE- IV model does not change the significance and sign of the coefficient of remittances to poverty. However, quantitatively, the magnitude of the parameter estimate is slightly smaller; they are 1.005, 0.471, and 0.661, respectively. Compare this with remittances in FE-IV that do not involve political factors, where the sizes of the effects are 1.012, 0.475, and 0.665, respectively (see Models 7–9 in Table 1). To put it differently, our FE-IV models remain robust with the inclusion of political factors into the analysis.

4.3 **The contemporaneous and lagged effects of remittances on poverty**

Table 3 summarizes the results from the SGMM estimations, which now estimate the contemporaneous and lagged effects of international remittances on the poverty level in a dynamic setting. The Hansen *J* statistics fail to reject the null of the joint exogeneity of all instruments

Table 2 The effect of international remittances on poverty by controlling for political variable for Models 7–9 in Table 1

Model	**(7)**	**(8)**	**(9)**
	IV + FE	**IV + FE**	**IV + FE**
DV	$P_{0-1.9}$	$P_{1-1.9}$	$P_{1-3.2}$
R	−1.005***	−0.471***	−0.661***
	(0.206)	(0.104)	(0.153)
log_IC	−10.864***	−2.244**	−9.844***
	(1.543)	(0.908)	(1.012)
GN	0.499***	0.350***	0.405***
	(0.116)	(0.082)	(0.087)
INF	0.040	0.022	0.022
	(0.033)	(0.020)	(0.025)
POL	−1.489**	−0.490	−0.954**
	(0.589)	(0.351)	(0.359)
Observations	333	333	333
Adjusted R^2	0.377	0.064	0.500
F-test of excluded instruments	29.79 (0.000)***	29.79 (0.000)***	29.79 (0.000)***
Kleibergen–Paap LM test	11.330 (0.004)***	11.330 (0.004)***	11.330 (0.004)***
Hansen *J* test	0.757 (0.384)	0.004 (0.949)	0.689 (0.406)
Endogeneity test	5.735 (0.017)**	9.351 (0.002)***	3.361 (0.067)*

Notes: Driscoll–Kraay SEs are in parentheses under coefficient estimates. *p*-values are in square brackets. Per capita income (*IC*) is transformed into a logarithm because it is measured in units of money (USD). Kleibergen–Paap LM statistics show robust underidentification test results. Hansen *J* statistics show robust overidentification test results. Robust endogeneity test results are shown by chi^2-statistics. Some observations are dropped because singleton groups are detected by Stata and lacked data for the political variable. Table only reports FE-IV estimation results. $P_{0-1.9}$, poverty headcount ratio at USD 1.90 per day; $P_{1-1.9}$, poverty gap at USD 1.90 per day; $P_{1-3.2}$, poverty gap ratio at USD 3.20 per day; *R,* total remittance c as a share of GDP (current USD).

*Significance at the 10% level.

**Significance at the 5% level.

***Significance at the 1% level.

DV, dependent variable; FE, fixed effect; GDP, gross domestic product; GN, Gini ratio; INF, inflation; IV, instrumental variable; LM, lagrange multiplier; POL, political stability; SE, standard error.

across specifications 1–6 (*p*-value > 0.1), which brings some confidence that our instruments are jointly valid (*p*-value >0.1). The difference-in-Hansen test also indicates that the GMM-type internal instruments are also valid (*p*-value > 0.1). Moreover, the Arellano–Bond test for autoregressive (AR) (2) across all models failed to reject the null hypothesis of no second-order serial correlation (*p*-value > 0.1). This implies that original disturbances are serially uncorrelated, and the moment conditions are correctly specified, making our estimations safe from bias.

Table 3 Results from one-step SGMM estimation

Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	One-step SGMM	**One-step SGMM**	**One-step SGMM**	**One-step SGMM**	**One-step SGMM**	**One-step SGMM**
DV	$P_{0-1.9}$	$P_{1-1.9}$	$P_{1-3.2}$	$P_{1-1.9}$	$P_{1-1.9}$	$P_{1-3.2}$
$L1.P_{0-1.9}$	0.699***			0.697***		
	(0.161)			(0.171)		
$L1.P_{1-1.9}$		0.567***			0.589***	
		(0.100)			(0.112)	
$L1.P_{1-3.2}$			0.707***			0.707***
			(0.150)			(0.164)
R	−0.374*	−0.064	−0.308*	−0.386**	−0.080	−0.324**
	(0.191)	(0.066)	(0.150)	(0.180)	(0.057)	(0.147)
*L*1.*R*	−0.123	−0.015	−0.064	−0.124	−0.018	−0.062
	(0.129)	(0.041)	(0.099)	(0.130)	(0.043)	(0.102)
log_IC	−4.068*	−1.122**	−4.028*	−4.196**	−1.245**	−4.250**
	(2.025)	(0.537)	(2.084)	(1.772)	(0.551)	(1.972)
GN	0.049	0.046**	0.027	0.048	0.042**	0.026
	(0.051)	(0.022)	(0.043)	(0.057)	(0.020)	(0.048)
INF	0.014	0.005	0.004	0.015	0.007	0.005
	(0.023)	(0.005)	(0.024)	(0.025)	(0.006)	(0.026)
POL				−0.076	−0.046	0.015
				(0.606)	(0.179)	(0.596)
AR (2)	0.61	0.60	0.27	0.64	0.60	0.31
	(0.545)	(0.546)	(0.789)	(0.523)	(0.546)	(0.757)
Hansen *J* test	4.91	4.09	5.02	3.15	2.32	3.99
	(0.672)	(0.770)	(0.658)	(0.871)	(0.940)	(0.781)
Difference-in-Hansen test	1.36	4.27	1.79	2.99	4.98	4.28
	(0.851)	(0.370)	(0.775)	(0.560)	(0.290)	(0.370)
Instruments	27	27	27	28	28	28
Observations	209	209	209	209	209	209

Notes: Robust SEs are in parentheses. *p*-values are in square brackets. Per capita income (*IC*) is transformed into a logarithm because it is measured in units of money (USD). Hansen *J* statistics show the validity test of external instruments. Difference-in-Hansen statistics show the validity test of GMM-type instruments. Some observations are dropped because singleton groups are detected and lacked data for the political variable.

$P_{0-1.9}$, poverty headcount ratio at USD 1.90 per day; $P_{1-1.9}$, poverty gap at USD 1.90 per day; $P_{1-3.2}$, poverty gap ratio at USD 3.20 per day; *R,* total remittance c as a share of GDP (current USD).

*Significance at the 10% level.

**Significance at the 5% level.

***Significance at the 1% level.

AR, autoregressive; DV, dependent variable; GDP, gross domestic product; GN, Gini ratio; INF, inflation; POL, political stability; SE, standard errors; SGMM, system-generalized method of moments; L1, first lag.

Other key findings of this study emerge in Table 3. The contemporaneous impact of international remittances is still consistent in promoting poverty alleviation (see Models 1–3). It is indicated by the negative and significant effects of remittance on poverty headcount ratio at USD 1.90 a day (p-value < 0.1) and poverty gap ratio at USD 3.20 a day (p-value < 0.1), but with insignificant effect on poverty gap ratio at USD 1.90 a day (p-value > 0.1). In addition, the effect sizes of remittances became larger and significant (p-value < 0.05) when political variables were included in the estimation models (see Models 4–6), but the effect remained insignificant on the poverty gap ratio at USD 1.90 a day (p-value > 0.1). These contemporaneous effects of international remittances are much larger than their lagged effects, which were found to be insignificant across poverty measures and specifications (p-value > 0.1).

As discussed earlier, the contemporaneous effects of remittances mainly capture their direct and immediate impact on increasing migrant families' income, which is then configured to reduce poverty among migrant families. By contrast, the lagged effects of remittances capture the indirect effects of remittances on the income of other members of the community of origin through local market linkages (spillover mechanism). After some temporal lag, remittances may promote local development and alleviate poverty. Our findings seem to provide some support that a greater proportion of poverty reduction could be explained by the direct effect of international remittances on increasing the wealth index among recipient households.

In addition, the insignificant impact of the first lag of remittance variable on poverty is confusing. This indirect effect should be substantially greater than the direct effects on which researchers and policymakers usually focus (Taylor and Dyer, 2009). However, these results can still be justified at the practical level. As Barham and Boucher (1998) and Brown and Jimenez (2008) note, the impact of migration on household poverty is seen in the net effect of a reduced labor supply in local communities and the incentive effect of receiving remittances. For example, Adaku (2013) has found in northern Ghana that labor loss due to migration tends to keep households poor. In addition, a net detrimental effect has been found by Tuladhar et al. (2014) in Nepal, where migration causes labor shortages while agricultural households receiving remittances do not invest in increasing agricultural productivity. On the other hand, the Food and Agriculture Organization (FAO) (2018) asserts that the main channel through which the effects of migration can spread to other members of the community of origin are the dynamic effects resulting from investment and the response in terms of labor supply and demand.

An insignificant spillover effect of remittance was found in this study probably because those main channels do not work optimally. Many local community workers are lost, and recipient families have no incentive to invest. This argument is reinforced by the results of the Migrating out of Poverty (MOOP) Consortium survey, which revealed that investment spending in agriculture by migrant households in most developing countries only represents a small part of the total remittance use, while the largest share of remittances (30%–40%) is dedicated to daily consumption (Poggi, 2018). However, the negative effect of outmigration on labor availability can be offset by reinvestment of remittances (Huy and Nonneman, 2016). Perhaps this is one of the reasons why the effect of the lagged remittance variable coefficient is left negative even though the impact is not significant.

5 Conclusion

This study uses an unbalanced panel data set on 65 LMICs through the years 2002–2016 to examine the impact of international remittances as a share of GDP on three poverty measurements: poverty headcount ratio at USD 1.90 a day, poverty gap ratio at USD 1.90 a day, and poverty gap ratio at USD 3.20 a day. After coping with the endogeneity problems of international remittances, we found that these remittances, statistically per GDP, have a substantial impact on mitigating poverty in LMICs. More substantively, a 10-percentage-point rise in remittances will lead to a 10.12-percentage-point decrease in the population living under USD 1.90 per day. A similar increase in remittances led to a 4.75- and 6.65-percentage-point decrease in the poverty gap ratio at USD 1.90 and USD 3.20 per day, respectively. Qualitatively, our findings remain robust with the inclusion of political factors in the analysis. In addition, the SGMM regression results show that the contemporaneous effect is much more substantial than the lagged effect, both in terms of effect magnitude and significance level across all poverty measures. This result seems to provide some support to the proposition that a greater proportion of poverty reduction could be explained by the direct effect of international remittances on increasing the wealth index among recipient households.

Our findings also conclude that managing remittances is becoming more critical in the international development community. Therefore, policies need to be implemented to improve global remittance infrastructures. The authorities in receiving countries may be able to offer subsidies/incentives to money transfer service providers. For example, a remittance service provider can claim a tax credit to waive remittance fees paid by migrants as senders. In addition, governments should identify, remove, or reduce factors that can prevent or hinder migrant workers from using digital payments to send money. Governments and international institutions should work side by side to monitor the flow of remittances through various channels. Until now, they have only paid significant attention to the global movement of goods, services, and finance but have paid little attention to the international movement of people. In addition, they should pay attention to the implementation of safe and regular migration programs, reducing the cost of recruiting migrant workers, and establishing cooperatives/microfinance institutions in the enclaves of migrant workers to activate the spillover mechanism. Thus, the beneficial effects of remittances can spread to other members of the community and the broader economy.

Declarations

Availability of data and material

The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interest

The authors state that there is no conflict of interest.

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Authors' contributions

Prianto Budi Saptono: Introduction, Literature Review, Conclusions. Gustofan Mahmud: Introduction, Literature Review, Dataset Collection, Variable Description, Methodology, Estimations, Findings, Conclusions. Li-Fen Lei: Introduction, Estimations, Findings, Conclusions.

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Appendix

Table A1 List of countries

Countries	Years	Countries	Years	Countries	Years
Albania	2008, 2012	Gambia	2010, 2015	Nepal	2003, 2010
Armenia	2002–2016	Georgia	2003–2016	Nicaragua	2005, 2009, 2014
Azerbaijan	2005	Ghana	2012, 2016	Niger	2005, 2007, 2011, 2014
Bangladesh	2005, 2010, 2016	Guatemala	2006, 2014	Nigeria	2003, 2009
Belarus	2002–2016	Honduras	2010–2016	Pakistan	2004–2005, 2007, 2010–2011, 2013, 2015
Benin	2003, 2011, 2015	India	2004, 2009, 2011	Peru	2008–2015
Bhutan	2012	Indonesia	2002–2014	Philippines	2003, 2006, 2009, 2012
Bolivia	2002, 2004–2009, 2011 2016	Iran	2005, 2006, 2009, 2013–2016	Russian Federation	2010–2015
Bosnia and Herzegovina	2007, 2011	Iraq	2012	Rwanda	2005, 2010, 2013, 2016
Botswana	2009, 2015	Jamaica	2002, 2004	Senegal	2005, 2011
Brazil	2012–2016	Jordan	2002, 2006, 2008, 2010	Serbia	2012–2015
Bulgaria	2006–2014	Kazakhstan	2009–2016	Sri Lanka	2002, 2006, 2009, 2012, 2016
Burkina Faso	2003, 2009, 2014	Kenya	2005, 2015	St. Lucia	2016
Burundi	2013	Kyrgyz Republic	2002–2016	Tajikistan	2009, 2015
Congo, Dem. Rep	2012	Malawi	2004, 2010, 2016	Tanzania	2007, 2011
Costa Rica	2002–2016	Malaysia	2004, 2007–2008, 2011, 2013, 2015	Togo	2006, 2011
Cote d'Ivoire	2002, 2008, 2015	Maldives	2009	Tunisia	2005, 2010, 2015
Dominican Republic	2002–2016	Mali	2006	Turkey	2005–2016
Ecuador	2008–2014	Mexico	2004–2005, 2006, 2008, 2010, 2012, 2014, 2016	Uganda	2002, 2005, 2009, 2012, 2016
El Salvador	2002–2016	Moldova	2002–2015	Ukraine	2002–2008, 2011–2015
Ethiopia	2015	Morocco	2006, 2013	Zambia	2006, 2010, 2015
Gabon	2005	Namibia	2009, 2015		

Table A2 Descriptions of the variables

Variables	Definitions	Source	Expected Sign	Mean	Std. Dev.
Dependent variables					
$P_{0-1.9}$	The percentage of the population that is living under 1.90 USD per day (constant 2011 USD adjusted for PPP)	WDI		11.80	17.45
$P_{1-1.9}$	The percentage of mean shortfall in income from 1.90 USD per day (constant 2011 USD adjusted for PPP)	WDI		4.06	7.18
$P_{1-3.2}$	The percentage of mean shortfall in income from 3.20 USD per day (constant 2011 USD adjusted for PPP)	WDI		10.15	13.01
Explanatory variables					
R	Total remittance consisting of personal transfers and compensation of employees as a share of GDP (current USD)	IMF	Negative (−)	7.22	7.97
Control variables					
IC	Income (GDP) per capita (constant 2011 USD adjusted for PPP)	WDI	Negative (−)	9,029.94	6,055.61
GN	Gini Index varies between 0 (equality) and 1 (inequality)	WDI	Positive (+)	39.32	8.27
INF	Percentage change of consumer price index in annual average	WDI	Positive (+)/ Negative (−)	7.23	7.27
Instrumental variables					
TOP	Total import and export as a share of GDP	WDI	Positive (+)	77.79	31.39
EX	LCU per USD	WDI	Positive (+)	896.54	3,430.19

Notes: Std. Dev, Standard deviation. Number of observations is 345 for all variables.

GDP, gross domestic product; IMF, International Monetary Fund; LCU, local currency unit; WDI, world development indicators.

Table A3 First-stage regression results for Models 7–9

Models	**(1)**	**(2)**	**(3)**	**(4)**
DV			*R*	
Excluded instruments				
TOP	0.102***	0.107***	0.107***	0.100***
	(0.018)	(0.018)	(0.018)	(0.016)
log_EX	0.126	0.245	0.226	0.893
	(0.483)	(0.497)	(0.470)	(0.214)
Included exogenous variables				
log_IC	4.182**	4.021**	4.173**	
	(1.985)	(1.979)	(1.752)	
GN	−0.021	−0.022		
	(0.049)	(0.049)		
INF	0.025			
	(0.027)			
Observations	336	336	336	336

Notes: Driscoll–Kraay SE are in parentheses. *p*-values are in square brackets. Per capita income (IC) and exchange rate (EX) transformed into logarithm because they are measured in units of money (USD) and local currency unit/USD, respectively). Some observations are dropped because singleton groups were detected.

*Significance at the 10% level.

**Significance at the 5% level.

***Significance at the 1% level.DV, dependent variable; GN, Gini ratio; INF, inflation; TOP, total imports and exports; SE, standard error.