Do Remittances Have Asymmetric Impacts on Human Development? Panel Evidence from South Asia

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ABSTRACT

Globally, the remittances have increased significantly recently, most of which have gone to developing countries. In light of recent evidence of the role of remittances in economic development, it is pertinent to investigate how human development responds to remittances. Based on human capital and investment decision theory, the present study investigates the short and long-run asymmetric impacts on human development for six South Asian countries from 1990 to 2021 using the panel asymmetric autoregressive distributive lag model (PNARDL). A robustness check has been done using the dynamic common correlated effect pooled mean group effect model (CCEPMG). The direction of causality is examined using a panel dynamic heterogenous model. The result of this study indicates that remittances have a significant short and long-run asymmetric impact supporting the human capital and investment decision theory. Results suggest positive shocks promote human development while negative shocks have the opposite effect. Causality results suggest a two-way relationship supporting remittance-led human capital development in South Asia. In line with the above findings, the study recommends encouraging higher remittances and integrating development policies with migration policies to promote education, health, and human development.

JEL Classification: F22, F24, O15

Keywords: Human Development; Remittances; NARDL; South Asia

INTRODUCTION

Remittance inflows to developing countries have increased significantly since the early 1990s, and it has become the largest source of foreign capital in many developing countries, exceeding traditional external finances such as FDI or FPI (World Bank, 2021). Compared to FDI and FPI, remittances are stable and counter-cyclical and contribute significantly to the forex exchange reserve in small developing countries. According to the World Bank (2023), remittances to developing countries reached $648 billion in 2022. Further, remittances represent the engine of economic growth in many small countries and socio-economic transformation in rural areas, as 50% of remittances are sent to rural areas (UNDP, 2022).

Globally, 200 million people send money home, constituting 60 % of households' total income in many countries. Remittances directly impact the households' welfare and are vital for achieving Sustainable Development Goals (SDGs). Remittances have a direct link with SDG-1(reduction of poverty), SDG-2 (no hunger), SDG-3(better health), SDG-4 (quality education), SDG-5 (women empowerment), SDG-6 (clean water and sanitation), SDG-7 (clean energy), SDG-10 (reduction in inequality) and SDG-12 (climate action plan).

Theoretically, remittances can promote human development in multiple ways: first, remittances are expected to encourage growth by increasing the level of consumption, investment, and financial development (Aggarwal et al., 2011; Arora, 2012; Ratha, 2013; Tsaurai, 2018; Aregbeshola, 2022). Further, remittances lead to reduced poverty, increased spending on health and education, and improved access to critical infrastructure, including financial infrastructure (Aggarwal et al., 2011; Ratha, 2013; Salas, 2014). Based on the factors mentioned above, it is suggested that remittances have direct and indirect impacts on human development in the recipient country.

Despite the optimistic prediction of theoretical models, the empirical results are mixed, and most literature is based on studies using microdata (Skeldon, 2008; Adenutsi, 2010; Hassan et al., 2013; Salas, 2014; Bredtmann et al., 2018; Azizi et al., 2018). Further, the existing studies apply traditional economic methods, assuming a symmetric link between remittance and human development. However, a sufficient theoretical background indicates that remittances may have an asymmetric or non-linear impact on human development (Qamruzzaman and Jianguo, 2020; Mensah and Abdul-Mumni, 2022; Xia et al., 2022; Akinlo, 2022). Nevertheless, the increase in remittances (positive shocks) would increase household income, leading to higher expenditure on consumption, education, health, small business, insurance, housing, and the purchase of assets. The opposite effect may happen if there is a negative shock in remittances. Further, the asymmetric relationship may arise due to the pattern and purpose of remittance use and the presence of facilitating institutions (Hassan and Shakur, 2017). Considering the potential asymmetric link between remittances and human development, there is a necessity for asymmetric tests, which is missing in past studies. More importantly, the policy implications may differ if the relationship is asymmetric rather than symmetric.

In recent years, remittances have emerged as significant external capital flows to South Asia. According to the World Bank (2023), South Asia received $157 billion in remittances, or 21 percent of total inward remittances in 2022. Between 1990 and 2021, remittances increased more than 32 times from a meager $5.6 billion to $176. Among South Asian countries, India received the highest amount of remittances ($111 billion) in the world, and Pakistan and Bangladesh received $30 billion and $22 billion, respectively, with 7th and 8th positions. Small countries like Nepal ($8 billion) and Sri Lanka ($5.5 billion) also received significant amounts. However, despite its significance and relevance for South Asian countries, very little attention has been given to the importance of remittances in promoting human development in South Asia. Our research adds to the existing literature by utilizing macroeconomic data and new evidence from different regions.

Against this backdrop, this study examines the asymmetric effects of remittances on human development in South Asia, covering six countries: Bangladesh, India, Nepal, the Maldives, Pakistan, and Sri Lanka. The motivation for this study is manifold: first, the study contributes methodologically to the existing literature by examining the asymmetric impact of remittances on human development in South Asia. For this purpose, the study uses an asymmetric ARDL model proposed by Shin et al. (2014), which is more appropriate as it captures both long and short-run asymmetric effects. In addition, the study uses the common correlated effect pooled mean group (CCEPMG) model proposed by Chudik and Pesaran (2015) in the non-linear ARDL framework to account for the cross-section effect, country-specific heterogeneity, and endogeneity. Second, this study includes small countries like Nepal and the Maldives, which have been

ignored in past studies focused on South Asia. Third, the causal relationship between remittances and human development is examined, which has relevant policy implications.

The remaining parts of the study are arranged as follows: Section 2 deals with the theoretical and empirical literature, and Section 3 provides the trends and importance of remittances. Section 4 discusses sources of data, model specifications, and methodology employed. Section 5 discusses the empirical results. In conclusion, the suggestions for the policy-makers are presented in Section 6.

LITERATURE REVIEW

Theoretical Underpinnings

There are two hypotheses on the impact of remittances on human development: the pessimistic and the optimistic. The optimistic view uses the 'family approach' and the 'portfolio approach' to explain the developmental impact of remittances. According to the family approach, altruistic factors are major reasons behind the remittance inflows. The emigrants send remittances to back their families from poverty and consumption shocks (Chami et al., 2009; Barajas et al., 2009). Contrarily, the portfolio approach emphasizes investment motives that drive remittance inflow (Lucas and Strack, 1985; Giuliano and Ruiz-Arranz, 2005). Whatever the reasons, both cases have economic impacts on the recipient country by increasing domestic consumption, investment, savings, financial development, and economic growth (Fajnzylber and Lopez, 2008; Ratha, 2013; Kpodar et al., 2021). An increase in economic growth promotes human development as there is a direct relationship between the two (Ranis, 2004).

Theoretically, it is argued that remittances to developing countries positively impact the financial sector, mainly the banking sector, as most remittances are channeled through banks (Aggarwal et al., 2011; Brown et al., 2013). Remittance inflows increase the depth and breadth of the financial sector and increase financial inclusion by covering poor households (Brown et al., 2013). Access to formal finance increases economic opportunities for needy families and their physical and human capital investment (Fajnzylber and Lopez, 2008; UNDP, 2010; Azizi, 2018).

Further, it is argued that remittances increase the demand for basic physical and services infrastructure like water, healthcare, education, insurance, and housing, significantly impacting human development (Fajnzylber and Lopez, 2008). In addition, increased demand for basic services promotes economic growth through a multiplier effect (Dridi et al., 2019). Theoretical models based on human capital theory indicate that remittances' spillover impact on human development is realized with a time lag. Further, the economic theory of family suggests that a larger portion of remittances initially goes to consumption and less to education and health. However, the amount allocated to investment activities, including education and health, increases proportionately (Chami et al., 2003; Salas, 2014). This suggests the possibility of an asymmetric effect of remittance on economic development (Hassan and Shakur, 2017).

On the other hand, pessimists put forward a counter-argument suggesting that remittances are a curse for the recipient country as they increase unproductive expenditure and imports by appreciating domestic currency (Nimmi et al., 2008; Mallick, 2012; Ferdaous, 2016). Others (Rubenstein, 1992; Bredtmann et al., 2018) argue that migration leads to brain drain and skilled labour shortage, adversely affecting economic growth and human development. However, this argument may not be valid for labour-surplus countries like South Asian countries where there are not enough opportunities for educated youth, and migration reduces pressure on the labour market.

Previous Empirical Studies

The role of remittances in economic development has been investigated using micro and macro approaches. Studies using microdata found that remittances positively impact household welfare like consumption, poverty, business, investment, social security, financial inclusion, education, and health (Yang, 2008; Adam, 2011; Borja, 2014; Mohammad, 2022). On the other hand, the macroeconomic studies investigated remittances' impact on macro variables like economic growth (Adams and Page, 2005; Yoshino et al., 2017; Imai et al., 2014), investment, savings (Petrou and Connell, 2014; Inoue and Hamori, 2016; Dash, 2022), financial development (Aggarwal et al., 2011), an exchange rate (Kim., 2019), inflation (Narayan et al., 2011) and human development (Adenutsi, 2010; Ustubici and Irdam, 2012; Sahoo et al., 2020). Results based on

micro studies find a strong positive impact on household welfare; the findings of macro studies are inconclusive (Chami et al., 2008; Nimmi et al., 2008; Mallick, 2012; Ferdaous, 2016). Few other studies find that the positive spillover of remittances depends on conditional factors like the level of economic and financial development and the quality of institutions (Betti and Zazzaro, 2012; Kim, 2021; Odugbesan, 2021). Further, most micro studies focused on growth impact and only a few on human capital development (Adenutsi, 2010; Ustubici and Irdam, 2012; Huay et al., 2019; Sahoo et al., 2020; Mohammed, 2021).

Adenutsi (2010) investigated the role of personnel remittances in promoting human development for 15 developing countries in Sub-Saharan Africa from 1987 to 2007 using the panel fixed effect model. The study finds a positive effect of remittances for sub-Saharan countries. Ustubici and Irdam (2012) examine the interconnection between migration and human development for 32 countries covering developed, developing, and underdeveloped countries from 1990-2005. Using the panel OLS method, the study finds that remittances positively impact human development, and the impact is much higher than FDI and aid. Using a large panel set of 122 developing countries, Azizi (2018) investigated the effect of remittances on social development, such as health expenditure, female labour participation, enrollment, and child mortality, from 1990 to 2015. The result of the study suggests that remittances accelerate school enrollment, completion rate, and health expenditure but depress female labour participation and child mortality rate. Huay et al. (2019), using the system GMM methodology, examine the effect of remittances on human development for a group of developing countries. Results of this study indicate that a 10% increase in remittances improves human development by 0.016%. Sahoo et al. (2020) reached a similar conclusion in a study of South Asian countries. Sahoo and Sethi (2020) investigated the macroeconomic effects on remittances for 31 Sub-Saharan countries using multiple panel methods such as DOLS and FMOLS. Results suggest a positive impact on economic growth and human development. Bare et al. (2022) studied the financial sector's role in facilitating remittance's developmental effect for Sub-Saharan countries. The study finds that financial development is vital for the positive impact of remittances. Mohammed (2021), using the GMM system, finds that institutions play an important role in assessing the symmetric effect of remittances in Sub-Saharan countries. The study finds a positive and more significant impact of remittances on human development in those countries where the institutions are less developed. The effect of remittances on human development is abridged if the institutions are well-developed.

Only some studies in recent times, like Qamruzzaman and Jianguo (2020) and Biyase and Naidoo (2023), focused on the asymmetric relationship between remittances and other variables like household consumption, financial development, and economic growth. The results of these studies support the asymmetric relationship between remittances and other variables. Xia et al. (2022) have used asymmetric methods (PNARDL) to study the impact of remittances, FDI, and investment on human development for the top ten remittances-receiving countries (Germany, Philippines, Mexico, Egypt, Pakistan, India, Bangladesh). The findings suggest an asymmetric relationship exists between remittances and human development.

From the above literature, it is clear that most studies have investigated the symmetric effect of remittances on human development and a few asymmetric impacts. More importantly, these studies suffer from methodological drawbacks as they do not account for endogeneity and cross-section effect. The robustness of these results is highly questionable. Using an improved method panel asymmetric method (PNARDL), we hope to provide new insights into the impact of remittances and human development in South Asia.

TRENDS AND IMPORTANCE OF REMITTANCES OF SOUTH ASIA

Remittance inflows to developing countries have enlarged from $ 27.9 billion in 1990 to $ 596 billion in 2021 (see Table 1). The rise in remittances has been significant for lower-middle-income countries as remittances increased from $16.5 billion in 1990 to $324 billion in 2021. South Asia has also experienced a substantial rise in remittance since the 1990s. While other regions experienced a mild fall in remittances due to COVID-19 in 2019, there was a negligible increase in the remittances to South Asia between 2020 and 2021. India accounts for more than 60 % of total inflows to South Asia.

Table 1 Trends in Remittances: Selected Regions and Countries (in $billion)

Region/Country	1990	1995	2000	2005	2010	2015	2017	2018	2019	2020	2021
Developing countries	27.2	45.6	70.5	191	339	446	477	523	546	541	596
Low income	2.2	2.1	2.7	4.2	8.6	11.7	8	12	11.6	11	2.4
Lower Middle Income	16.5	28.6	41.7	102	197	276	296	324	341	340	324
South Asia	5.6	10	17.2	34	82	117	117	131	139	147	152
East Asia & Pacific	8.6	14.8	18.7	37.6	69	111	114	115	113	111	95
Sun-Saharan	2.4	3	4.8	20	32	36	42	49	49	42	28
India	2.3	6.2	12.9	22.2	53.5	70	68.9	78.7	83.3	83.3	89.4
Pakistan	2	1.7	1	4.2	9.6	19.3	19.7	21.2	22.25	26	31.1
Bangladesh	0.77	1.2	1.97	4.3	10.8	15.3	13.5	15.5	18.3	21.7	22.2
Nepal	0.02	0.05	0.1	1.2	3.4	6.7	6.9	8.2	8.2	8.1	8.2
Sri Lanka	0.4	0.8	1.1	2.0	4.1	7	7.2	7.2	7	6.7	5.5
Maldives	0.002	0.002	0.002	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.005
China	0.1	0.35	0.75	23.6	52.4	63.9	64	67	68	59	53
Mexico	3	4.3	7.5	22.7	22	26	32	36	39	42	54

Source: Compiled from the UNCTAD database

Importance of Remittances

The importance of remittances is measured in terms of GDP, gross fixed capital formation, and trade. Figure 1 shows remittances as a proportion of GDP for six South Asian countries: India, Pakistan, Bangladesh, Nepal, Maldives, and Sri Lanka. Nepal, Bangladesh, and Sri Lanka rely on remittances (See Figure 1). Nepal has seen a rise in remittances and its share of GDP since 2002. The remittances were 11% of GDP in 2002, but they increased to above 28% in 2015 and declined to 22 % in 2021. Bangladesh has seen an increase in remittances as a ratio to GDP till 2012. Since then, remittances as a ratio of GDP deteriorated and now stand at 6.6% in 2021. India is the largest receiver of remittances. Nonetheless, remittances as a the proportion of GDP remained below 4% from 1990 to 2021. For the Maldives, the ratio remained below 1% from 1990 to 2021, suggesting that remittances are less vital than in other South Asian countries.
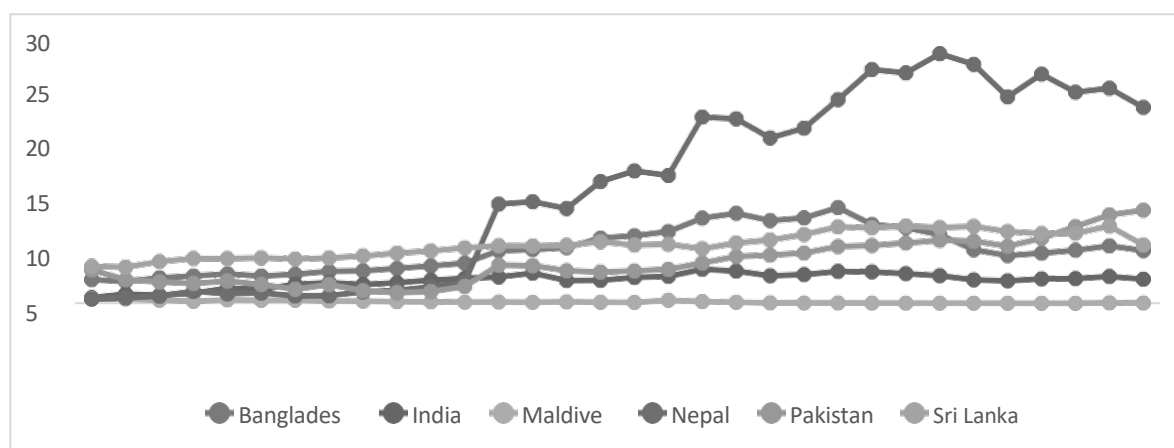
Source: Authors' calculation using data from World Development Indicators

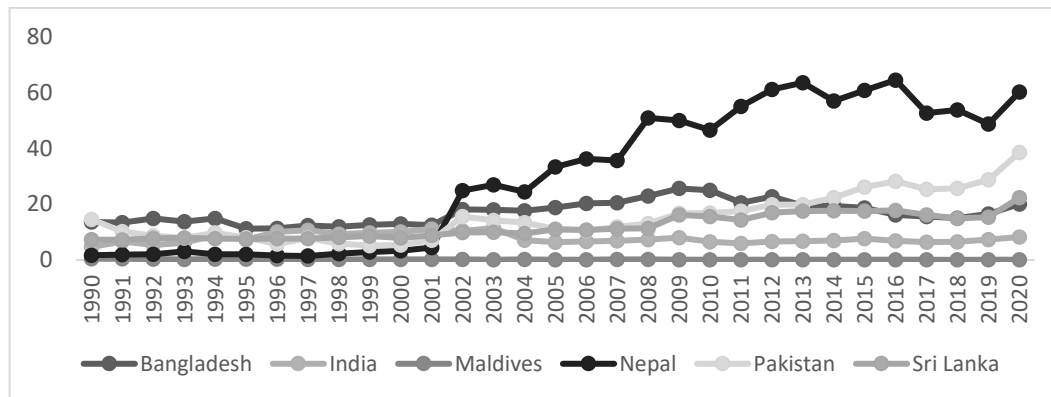Figure 1 Remittances as a ratio of GDP

Figure 2 shows remittance inflows as a proportion of domestic investment. The trend suggests that remittances as a source of capital are vital for South Asian countries except for the Maldives. Nepal is heavily dependent on remittance inflows for capital requirements, as remittances to GFC were more than 50 % from 2002 to 2021. Pakistan and Bangladesh are also heavily reliant on remittances for capital formation. For Sri Lanka, remittance contribution to GFC is also significant (more than 30 %). For India, remittances to GFC enlarged from 5% in the 1990s to above 10% in the 2000s and have remained stable since 2008.
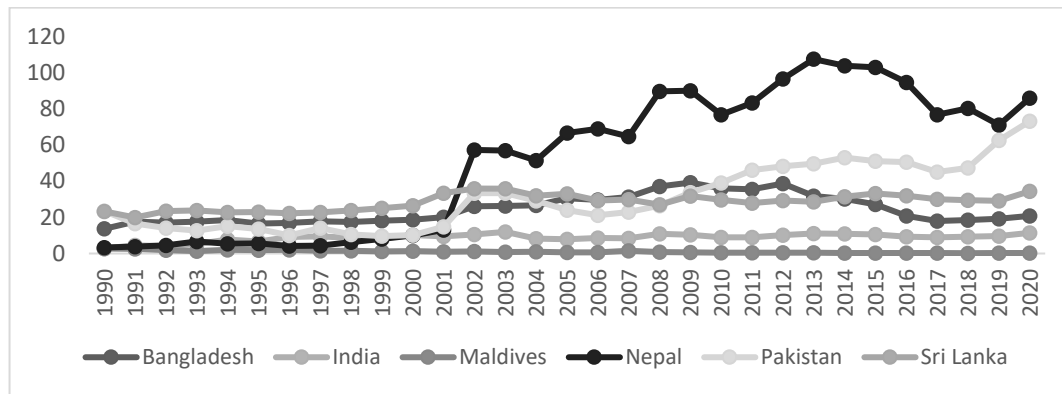
Source: Authors' calculation using data from World Development Indicators

Figure 2 Remittances as a proportion of Gross Fixed Capital

Figure 3 shows remittances as a proportion of trade. The heavy dependence on remittances can be observed in Nepal, Bangladesh, Pakistan, and Sri Lanka. For India, remittances to trade have improved from 5% in the early 1990s to above 10% in the late 1990s. Since then, it has declined to below 10%. Still, remittances remain very important for India.

Source: Authors' calculation using data from World Development Indicators

Figure 3 Remittances as a ratio of trade

DATA, MODEL SPECIFICATIONS AND METHODOLOGY

Sources of Data

Annual data on remittance inflows, FDI, gross fixed capital, telecom density, and GDP growth rate is obtained from the World Development Indicators (WDI) of the World Bank for six South Asian countries. The Human Development Index (HDI) data is collected from the UNDP database. The period of analysis is from 1990 to 2021. The starting and ending years of the dataset are chosen based on the data availability. Detailed information about data, definition, sources, and the study period is given in Table 2.

Table 2 Data Sources of South Asia

Variables	Definition	Sample period	Sources
REM	Personnel remittances as a ratio of GDP	1991-2021	WDI
FDI	Net FDI inflows to GDP	1991-2021	WDI
GFC	Gross Fixed Capital to GDP	1991-2021	WDI
Trade	Trade to GDP	1991-2021	WDI
FD	Domestic sector credit by Banks to GDP	1991-2021	WDI
HDI	Human Development Index	1990-2021	UNDP
GR	GDP growth rate	1990-2021	WDI

Source: Authors' compilation

Model specification

Based on the previous literature, we build the following model to examine the impact of remittances on human development:

$$HDIit = \beta_0 + \beta_1 REM_{it} + \beta_2 GFC_{it} + \beta_3 GR_{it} + \beta_4 Trade_{it} + \beta_5 FDI_{it} + \beta_6 FDI_{it} + \sigma_i + \pi_t + \varepsilon_{it} \qquad (1)$$

Where HDI is the human development index, REM is remittance inflows to GDP, GFC is the gross fixed capital formation (% of GDP), GR is the real GDP growth rate, trade is the total trade to GDP, FDI is the net foreign direct investment to GDP, FD refers to financial development proxied by Bank credit to GDP, σ_i is the fixed effect, π_t is the time effect and ε_{it} is the error term.

Besides remittances, we include other control variables such as gross fixed capital, financial development, trade, FDI, and economic growth. The justification for including these variables is as follows: Gross fixed capital formation is expected to positively impact human development as higher investment boosts economic growth and creates better education and health facilities for citizens (Eggoh et al., 2015). Trade also promotes human development by augmenting growth through its positive spillover effect on the domestic economy (Davies and Ouinlivan, 2006; UNDP, 2014). Financial development is also expected to have a positive sign as financial development boosts economic growth and improves access to better education and health facilities (Demirgüç-Kunt and Levine, 2008). Economic growth is also expected to promote human development as it increases income, which in turn increases capabilities, choices, and freedom (Ranis et al., 2000). Further, the coefficient of FDI is also expected to be positive since FDI stimulates economic growth by enhancing capital formation and technological development (OECD, 2002). Finally, remittances are expected to have a positive impact on human development as they promote growth and increase household expenditure on basic needs, including education, health, and housing, etc. which reduces poverty and improves the standard of life (Ratha, 2013; Salas, 2014; Xia et al., 2022).

Methodology

The study follows a multi-step procedure and applies several panel methods to examine asymmetric long and short-run effects of remittances. First, the study uses a cross-sectionally adjusted ADF panel unit test (CADF) to investigate the order of the integration of the variables. Second, long- and short-run symmetric and asymmetric relationships between remittances and human development are examined using the panel mean group (PMG) and the common correlated effect panel mean group (CCEPMG) model. Third, the direction of causality is further explored by using a dynamic heterogeneous panel model proposed by Juodis et al. (2021). A brief description of the above methodology is provided below.

<u>Panel Unit Root</u>

In the first step, the study uses the following augmented ADF test (adjusted for cross-section effect), as proposed by Pesaran (2007), to check the stationarity properties of the variables:

$$DX_{i,t} = \alpha_i + \beta_i X_{i,t-1} + \sum_{j=0}^{p} \delta_{i,j} \bar{X}_{t-1} + \sum_{j=1}^{p} \mu_{i,j} D\bar{X}_t + e_{it} \qquad (2)$$

Where D is the difference operator, p is the lag order, and $\bar{X}$ is the cross-section average. The presence of unit root is tested by setting the null $\beta = 0$ against the null $\beta_i < 0$ for some *i*. The average CADF t-ratio is calculated by using the following:

$$CADF = \sum_{t=1}^{N} \frac{t_i(N,T)}{N} \qquad (3)$$

Panel Non-Linear ARDL Model

The short-run and long-run asymmetric impact of remittances is examined using a non-linear ARDL model.[1] Proposed by Shin et al. (2014). For this purpose, remittances are decomposed into negative and positive partial sums. To analyze the asymmetric impact, two estimation techniques (PMG and CCEPMG) are applied to estimate the short- and long-run symmetric and asymmetric effects in the ARDL framework. PMG and CCEPMG assume long-run coefficients to be the same, but short-tun coefficients vary across countries. Alternatively, the mean group (MG) and common correlated effect mean group (CCEMG) assume long- and short-run coefficients to differ across countries. The choice between PMG and MG and CCEMG and CCEPMG is decided using the Hausman test, setting the null (H_0) slope homogeneity against alternative (H_1) slope heterogeneity. The CCEPMG model has advantages over PMG since it accounts for the cross-section effect. The non-linear representation of Equation 1 is written as:

$$HDI_{it} = \beta_0 + \beta_1 REM_{it}^+ + \beta_2 REM_{it}^- + \beta_3 GFC_{it} + \beta_4 GR_{it} + \beta_5 Trade_{it} + \beta_6 FDI_{it} + \beta_7 FDI_{it} + \sigma_i + \pi_t + \varepsilon_{it} \tag{4}$$

Where REM^+ and REM^- are asymmetric shocks (the positive and negative) of remittances. In equation (4), remittances are decomposed with increased and decreased partial sum, $REM = REM^+ + REM^-$. Thus, remittances have two components, which are the partial sum of the variables:

$$REM^+ = \sum_{j=1}^{t} DREM^+_j = \sum_{j=1}^{t} Max^+_j (DREM_j, 0) \tag{5}$$

$$REM^- = \sum_{j=1}^{t} DREM^-_j = \sum_{j=1}^{t} Min^-_j (DREM_j, 0) \tag{6}$$

The asymmetrical cointegration model of the equation of (4) can be written as:

$$\begin{aligned} DHDI_{it} = \beta_0 &+ \beta_1 HDI_{it-1} + \beta^+_2 REM^+_{it-1} + \beta^-_2 REM^-_{it-1} + \beta_3 GFC_{it-1} + \beta_4 GR_{it-1} + \beta_5 Trade_{it-1} \\ &+ \beta_6 FDI_{it-1} + \beta_7 FD_{it-1} + \sum_{j=1}^{m-1} \mu_{ij} DHDI_{i,t-j} + \sum_{j=0}^{n-1} (\rho^+_{ij} DREM^+_{ij} + \rho^-_{ij} DREM^-_{ij}) \\ &+ \sum_{i=1}^{n} \mu_1 DFDI_{t-i} + \sum_{i=1}^{n} \mu_2 DGFC_{t-i} + \sum_{i=1}^{n} \mu_3 DGR_{t-i} + \sum_{i=1}^{n} \mu_4 DTrade_{t-i} \\ &+ \sum_{i=1}^{n} \mu_5 DFD_{t-i} + \sigma_i + u_{it} \end{aligned} \tag{7}$$

The asymmetric long-run effect is tested using the Wald test (W_{LR}) by setting the null as (H_0): $\beta_2^+ = \beta_2^-$ against the alternative of (H_1): $\beta_2^+ \neq \beta_2^-$. The short-run asymmetric effect is checked using the Wald test (W_{SR}) by setting the null as (H_0): $\rho^+ = \rho^-$ against the alternative of (H_1): $\rho^+ \neq \rho^-$.

Panel causality

The panel Granger non-causality test (Juodis et al., 2021) is carried out using the following model:

$$DHDI_{I,t} = \alpha_{0,i} + \sum_{k=1}^{k} \gamma_{k,i} DHDI_{i,t-k} + \sum_{k=1}^{k} \rho_{i,k} DREM_{i,t-k} + e_{i,t} \tag{8}$$

Where the parameter $\alpha_{0,i}$ represents the individual fixed effect, $\gamma_{k,i}$ are the heterogeneous autoregressive parameters, k is the lag length and ρ_{ik} are heterogeneous feedback coefficients. Assuming homogenous lags for both $HDI_{i,t}$, $REM_{i,t}$, granger causality from $REM_{i,t}$ to $HDI_{i,t}$ is tested using the null hypothesis:

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[1] The panel non-linear model is appropraie givem that we have mix of I (0) amd I (1) variables and short-panel (N) with larger timer effect (T).

H_0: ρ_{ki} = 0 for all i and k.
H_a: $\rho_{ki} \neq 0$ for some i and k.

The pooled estimator $\{\rho_{ki}\}_{i=1}^{N}$ are subject to Nickel Bias corrections and form the basis of a Wald test for Granger causality. As N and T $\rightarrow \infty$ with N/T $\rightarrow$ u^2 ϵ [0, ∞], the standard Wald statistics computed as:

$$\widehat{W}_{HPJ} = NT\tilde{\rho}'\left(\hat{J}^{-1}\,\hat{V}\hat{J}^{-1}\right)^{-1}\rho \rightarrow \chi^2(K) \tag{9}$$

Where $\hat{J} = (NT)^{-1}\sum_{i}^{1}REM_i'\,M_{z_i}REM_i$, $Z_{i,t} = (1,\ HDI_{i,t-1},\ ...,\ HDI_{i,t-p})$ and $M_{z_i} = I_T - Z_i(Z'_i Z_i)^{-1}\,Z'_i$.

ANALYSIS OF RESULTS

Unit Root Test

We start with checking the stationarity of the variables or the integration order of the variables by using the CADF unit root test proposed by Pesaran (2007) and present the results (See Table 3). We find a blend of I (0) and I (1) variables. Variables such as HDI, REM, GFC, Trade, and FD are found to be I (1) as the null of the unit root is not rejected at a 1% significance level. On the other hand, variables such as FDI and GR are found I (0) process or stationary at the Level. Panel ARDL model is appropriate as we have a mix of (0) and I (1) variables.

Table 3 Results of Unit Root with Cross-sectional Dependency

Series	levels		Fist diff.	Results
	Intercept only	Intercept & time trend	Intercept only	
HDI	-2.02	-2.23	-3.07**	Non-Stationary
REM	-1.98	-2.14	-3.30**	Non-Stationary
GFC	-1.58	-2.11	-3.54**	Non-Stationary
FDI	-2.98**			Stationary
GR	-3.42**			Stationary
Trade	-1.38	-1.74	-2.99**	Non-Stationary
FD	-1.76	-1.39	-3.12**	Non-Stationary

Note: ** denotes the rejection of unit root at 1 % level. The BIC criteria are used to determine the lag length.

Symmetric and Asymmetric Evidence of Remittances

The results of both symmetric and asymmetric impact using both MG and PMG methods are presented in Table 4. Since this study estimates asymmetric impact, the coefficients are estimated using the maximum likelihood method. The Hausman test for slope homogeneity is carried out to test the slope heterogeneity and is presented in the last column. Under the null, the PMG estimator is efficient, while the MG estimator is the efficient estimator under the alternative hypothesis. First, the study analyses the symmetric impact of remittances.

Long and Short-run Symmetric Impact (PMG and CCEPMG)

The study first presents symmetric impact (long-run and short-run). The results are provided in the 2nd column of Table 4. Panel A presents long-run coefficients, and panel B provides short-run coefficients[2]. The Hausman test suggests that PMG and CCEPMG estimators are efficient, so the study only presents PMG and CCEPMG results. The long-run coefficients show that remittances have a significant positive impact on human development in South Asia. The coefficient of remittances is 0.034 in PMG and 0.039 in CCEPMG, meaning that a 10% rise in remittances as a ratio to GDP results in a 0.34% and 0.39% increase in the HDI score, respectively. The results of this study support the hypothesis of remittance-led human development in South Asia, although the coefficient is lower compared to other regions (Koska et al., 2013; Sahoo and Sethi, 2020; Xia et al., 2022).

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[2] The stability of the parameter of the linear and non-linear model is examined by using cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ). Both tests confirm the parameter stability.

Table 4 Results of the Symmetric and Asymmetric Evidence of Remittances

Variables	With Symmetry		With Asymmetry	
	Panel A: Long-run Coefficients			
	PMG	CCEPMG	PMG	CCEPMG
REM	0.034**(3.46)	0.039**(3.46)	-	
REM$^+$	-	-	0.025** (2.99)	0.036*(2.64)
REM$^-$	-	-	0.018 * (2.57)	0.025*(2.43)
FDI	0.02*(2.37)	0.03*(2.37)	0.034** (3.20)	0.028* (2.51)
GFC	-0.01* (2.26)	0.02 (1.26)	-0.016* (-2.56)	-0.011* (-2.14)
TRADE	0.005** (3.98)	0.007** (3.56)	0.004* (2.34)	0.005* (2.55)
GR	0.05*(4.22)	0.06*(6.48)	0.04** (3.41)	0.07** (3.51)
FD	0.005* (2.56)	0.003* (2.48)	0.004* (2.46)	0.005* (2.68)
	Panel B. Short-run coefficients			
ECT$_{t-1}$	-0.04* (-2.87)	-0.13** (-3.68)	-0.03** (-3.34)	-0.17** (-4.21)
DREM	0.005 (1.24)	0.007* (2.13)	-	-
DREM+	-	-	0.01* (2.04)	0.014* (2.42)
DREM-	-	-	0.007 (1.54)	0.009* (2.03)
DFDI	-0.002 (-0.57)	-0.003 (-0.88)	-0.003 (-0.87)	0.004* (2.12)
DGFC	0.005* (2.34)	0.02** (3.08)	0.004* (2.12)	-0.005* (-2.32)
DTRADE	-0.003** (-3.45)	-0.003* (-2.62)	-0.003* (-2.45)	-0.002* (-2.31)
DGR	0.005 (0.67)	-0.005 (-0.98)	0.005 (1.23)	-0.006 (-1.18)
DFD	0.004* (2.65)	0.004 (1.45)	0.004* (2.65)	0.006* (2.82)
Constant	0.011** (3.45)	0.17** (4.31)	0.03* (2.38)	0.11* (2.58)
	Panel C: Diagnostic statistics			
Hausman test	0.53	0.57	0.34	0.43
F. Stat.	0.00	0.00	0.00	0.00
Adj. R^2	0.81	0.88	0.77	0.73
W$_{LR}$	-		0.04*	0.02*
W$_{SR}$	-	-	0.14	0.04*
No. of Countries	6	6	6	6
Observation	186	186	186	186

Note: ** and * denote 1 and 5 % levels of significance. Figures in () are t-ratio.

All the control variables have expected signs and are statistically significant except gross fixed capital. The coefficient of FDI is 0.02, indicating a 10 percent increase in FDI as the ratio of GDP leads to a 0.2 percent increase in the HDI score. Like remittances, FDI inflows also play a major and significant role in improving the level of human capital in South Asia. The positive impact is not surprising, as FDI inflows are expected to improve economic growth, skill development, and production efficiency through technology transfer (Sharma and Gani, 2004; Adenutsi, 2010; Yildirim and Tosuner, 2014). Furthermore, it is found that openness to trade positively affects human development through its spillover impact on the domestic sector. The effect of financial development on HDI has also been found to be positive, as it promotes economic growth and provides more access to education, health, and modern infrastructure (Demirgüç-Kunt and Levine, 2008). More importantly, economic growth positively impacts HDI as a rise in economic growth increases the range of choices and economic freedom enjoyed by households and the government, leading to higher human development (Ranis, 2004). Compared to theoretical expectations, gross fixed capital negatively impacts human development, indicating that investment in physical capital may not translate into higher human development in South Asia.

The short-run coefficients indicate that only variables like GFC and financial development positively impact human development, and trade negatively impacts. Other variables have no significant short-run impact on human development. The coefficient of error correction term (ECT) is negative and significant, confirming the presence of a long-run stable relationship between human development and its determinants.

Long and short-run asymmetric impact (PMG AND CCEPMG)

The results of the asymmetric relationship between HDI and remittances (long-run and short-run coefficients) are presented in Table 4. Using the Hausman test, the study only presents the results from the preferred (PMG) estimators. As shown in Table 4, the Hausman test suggests the PMG estimators are efficient since the null hypothesis is accepted as the p-value is more than 5%. More importantly, the coefficient of error correction term (ECT) is negative and significant as expected, indicating that disequilibrium in the previous period is corrected in the next period. It suggests the presence of cointegration between HDI and remittances. The Wald test is used to test the asymmetric effects of remittances (short and long-run). Results indicate that the Wald test rejects the symmetric link between remittances and human development in the long run but not in the short run, indicating a significant long-run asymmetric effect.

Panel Granger Non-Causality Results

The existence of cointegration as shown by the ARDL and NARDL model indicates the presence of causality in at least one direction between HDI and remittances. The results of panel granger non-causality with and without cross-section heterogeneity between human development and remittances are presented in Table 5.

Table 5: Results of Juodis et al. (2021) Granger non-causality test

Direction of Causality	Test statistics	Test Value
DREM → DHDI	$\widehat{W}_{HPJ}$	3.77*
DREM → DHDI (with cross-section heterogeneity)	$\widehat{W}_{HPJ}$	5.46*
DHDI → DREM	$\widehat{W}_{HPJ}$	4.78*
DHDI → DREM (with cross-section heterogeneity)	$\widehat{W}_{HPJ}$	6.21**

Note: * indicates $p < 0.05$. The BIC criteria are used to select the lag length.

The result suggests evidence of a bi-directional or mutual feedback relationship, as we reject the null of no causation at the 5% level. The positive impact on human development and mutual feedback between the two support the hypothesis of remittance-led human development in South Asia.

CONCLUSION AND POLICY IMPLICATION

The contribution of remittance inflows to economic development has been an important topic of debate among researchers and policymakers as remittance inflows to developing countries have increased significantly. Previous studies are restricted to linear effects. This assumption may not hold in reality, as suggested by human capital theory. In line with this view, the remittance data have been decomposed into positive and negative components. This allowed us to examine the asymmetric effect of remittances on human development for South Asian countries spanning from 1990 to 2021 using the panel asymmetric ARDL model. The results suggest that positive and negative shocks positively impact human development, indicating that remittances have asymmetric effects on economic development. The findings suggest that a rise in remittances (positive shocks) boosts human development, and a fall in remittances (negative shocks) reduces human development in the short and long run. The study supports the brain-gain hypothesis as remittances have an asymmetric positive impact on human development. The brain-gain hypothesis is further supported by causality evidence as there is a bi-directional causality or mutual feedback relationship between the two.

Based on the above findings, the study has a few policy implications to encourage higher remittances and accelerate human development. First, favorable policies (tax cuts, building capacities, and promoting greater competition) should be implemented to encourage remittances through formal channels. Second, an appropriate policy and incentive structure should be in place for the productive use of remittances to promote further human development. Third, social development policies should be interlinked with remittance policies to promote education and health. Fourth, South Asian countries must recognize the positive spillover of remittances and align training and skill development schemes with migration policy. Fifth, well-tailored safety nets must be created to reduce the adverse shocks of remittances on economic development. The recommendations apply equally to other developing countries or regions reliant on remittances. The present study can be further extended by exploring the asymmetric relationship between remittances and sectors like education, health, investment, and financial development. The asymmetric link can further be examined using alternative methods and covering many developing countries.

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