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The foreign aid and remittance nexus: Evidence from South Asia

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Abstract

A large body of literature has examined the determinants and impact of two external financial flows: foreign aid and remittances. Little, however, is known about the interlinking of the two flows, especially in South Asia. This study, using panel data from four South Asian countries for 1980–2015, examines the relationship between foreign aid and remittances and their links. Contrary to the traditional linear relationship reported in the literature, we find a quadratic (U-shaped) relationship between foreign aid and remittances. The results show that remittances initially fall when aid increases at the lower level of aid-dependency (aid-to-GDP); they then increase with rising aid at a higher aid-dependency level. The empirical findings also suggest that foreign aid's support of human capital increases remittances overall. Furthermore, we find that the foreign aid-led human-capital channel of migration (particularly of skilled people) reduces remittances, while the aid-led human-capital channel of economic growth increases remittance flows in South Asia. Moreover, the dynamic modelling estimation suggests that foreign aid positively affects (or complements) remittance flows in the short run but, in the long run, negatively affects remittances, indicating the substitutability of the two flows.

KEYWORDS
foreign aid, growth, human capital, migration, remittances

1 | INTRODUCTION

Foreign aid and remittances, the two primary sources of external development finance, play significant roles in stabilising fiscal balances and economic output in developing countries (see, e.g., Chami et al., 2009, 2012; Chauvet et al., 2016; Guillaumont & Le Goff, 2010). The important role these flows play in smoothing people's income and consumption contributes to improved growth and helps reduce poverty and income inequality in developing countries (see, e.g., Adams & Page, 2005; Acosta et al., 2008; Collier & Dollar, 2002; Combes & Ebeke, 2011; Gupta et al., 2009; Imai et al., 2014; Vacaflores, 2018). Foreign aid and remittances contribute to output (growth), employment opportunities, fiscal consolidation, economic stabilisation, and a reduction in poverty and income inequality. As noted earlier, significant attention has been paid to the role of aid and remittances in growth and development. However, less attention has been paid to the nexus between aid and remittances. Therefore, the question arises: are aid and remittances interlinked? There is limited research on the role of aid in promoting remittance flows, especially with particular attention to the South Asian countries. In the available limited literature, the transmission channels that link the two development finance flows, foreign aid and remittances, are unclear. This study aims to explore various transmission channels that might connect foreign aid and remittances. The focus of this study is the four major countries of South Asia, namely Bangladesh, India, Pakistan and Sri Lanka. From a significance and contribution point of view, this study differs from previous studies, including a recent study by Abbas et al. (2021), in many ways: (a) Prior studies of the aid–remittance relationship have focused on different groups of developing and least-developed countries and different transmission channels; however, this study focuses on South Asia—a small region which receives a larger volume of remittances; (b) Though we use some transmission channels as in previous studies in the literature, our study employs human–capital interactions in all transmission channels which is not the case in previous studies; (c) This study finds the polynomial relationship between the two financial flows which, to the best of our knowledge, has not been examined; (d) Moreover, this study significantly contributes to the literature by examining the dynamic relationship between foreign aid and remittances both in the short and long run which has not yet been studied in the literature.

In many developing countries and regions, remittance flows exceed foreign aid. Furthermore, remittances in some countries even surpass foreign exchange earnings from major exports. In the last four decades, US$3.1 trillion has been disbursed by both donor countries and multilateral agencies in the form of foreign aid to eradicate poverty and inequality in developing regions. During this period, US$6 trillion (almost double the volume of aid flows) has been received by low- and middle-income countries in the form of remittances (via legal channels) from emigrants living abroad—now 258 million people or 3.4% of the world's population (*Source*: World Development Indicators (WDI), 2018).

The literature on the aid–remittance relationship is mixed and uncertain. For example, Amuedo-Dorantes et al. (2007) analysed the relationship between remittances and foreign aid using panel data from 111 developing countries for the period 1990–2003 and found a negative relationship, suggesting substitutability between the two financial flows. Likewise, Bettin et al. (2015) using bilateral data from 79 developing countries receiving remittances from 103 Italian provinces also reported a negative relationship between foreign aid and remittances. However, Arvin and Lew (2012) presented a static analysis of 56 developing countries (for the year 2005) to find that foreign aid positively affects remittances. Their findings suggest a complementary relationship between the two external flows. Similarly, Driffield and Jones (2013) examined almost all developing countries for the period 1984–2007 and documented the positive impact of aid on remittance flows. Recently, Abbas et al. (2021), using data from 50 aid and remittance-receiving countries for the period 1980–2016, concluded that foreign aid negatively affects remittances in developing countries. Some of the studies also examined the impact of remittances on foreign aid. For example, Kpodar and Le Goff (2012) analysed 90 developing countries for the period 1970–2005 to report that remittances can increase or decrease aid receipts to developing countries. Furthermore, they added that if remittances are spent on human and physical capital development, then demand for aid can be reduced in developing countries. Although the above studies include some South Asian countries in their sample of developing countries, a separate analysis is required for South Asia—a small region that has not been studied earlier but is important from remittance and foreign aid perspective, receiving more than 21% of global remittances and 10% of aid disbursed worldwide. Hence, this study contributes to the literature by empirically analysing the relationship between foreign aid and remittances in a South Asian context.

The literature demands a systematic examination of the relationship between foreign aid and remittances through transmission channels that link these flows. The literature review reveals that foreign aid increases government spending and improves welfare indicators, particularly for low- and middle-income groups (see, e.g., Gomanee et al., 2005; Morrissey, 2012; Remmer, 2004). In addition, OECD statistics indicate that (bilateral) aid from Development Assistance Committee (DAC) donors has been disbursed largely to improve education and health (human capital) in developing countries. Hence, we hypothesise that the promotion of human capital using foreign aid can be instrumental in affecting remittance flows to developing countries.

The literature also reveals some linkage between migration and foreign aid (see, e.g., Berthélemy et al., 2009; Lanati & Thiele, 2018; Menard & Gary, 2018). Furthermore, Kpodar and Le Goff (2012) reported that the lobby channel of migrants is vital for determining aid to developing countries. Moreover, there are a number of studies in the literature reporting the positive influence of foreign aid on economic growth (see, e.g., Burnside & Dollar, 2000; Hansen & Tarp, 2001; Maruta et al., 2020; Mosley et al., 2004). In particular, foreign aid has been found to increase *human capital* by reducing mortality rates (Wilson, 2011). Likewise, the literature also reports the positive impact of foreign aid on education by increasing enrolment rates (see, e.g., Birchler & Michaelowa, 2016; Riddell & Nino-Zarazua, 2016). Abbas et al. (2021) notably found that the migration channel of foreign aid is important for positively influencing remittance flows only in least-developed countries (LDCs), while the aid-led human-capital channel of growth significantly increases remittances overall in developing countries and LDCs. Figure 1 explains the transmission channels of foreign aid affecting the remittance flows in developing countries.

As can be seen, foreign aid helps to improve human capital which promotes growth that then may attract remittances to the home country from the existing migrants in the host countries to invest in a

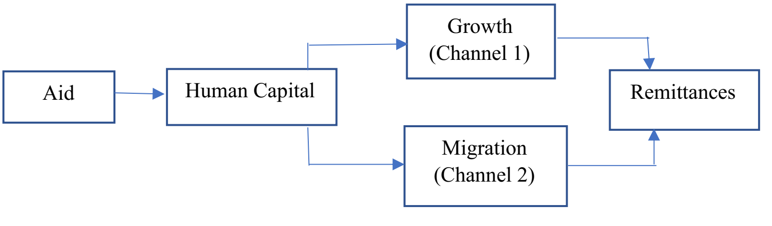

FIGURE 1 Conceptual framework of transmission channels, foreign aid and remittances.

progressive home economy (Channel 1). On the other hand, increased human capital led by foreign aid may further accelerate the number of skilled workers to migrate to other countries for opportunities, hence bringing more remittances to home countries (Channel 2). In this paper, we contribute to the literature by analysing the *aid-led human-capital channel of migration* (*lobby-network*) and the *aid-led human-capital channel of economic growth* to link foreign aid and remittances in South Asia.

The organisation of this paper is as follows. Section 2 presents a preliminary analysis of aid and remittance flows in South Asia. In addition, it shows why the South Asian analysis is important in determining the aid–remittance relationship. Section 3 discusses the potential determinants of remittances using the academic literature and data sources. Section 4 explains the methodological framework and develops models to estimate the relationship between the two external flows of foreign aid and remittances. Section 5 reports and explains the estimation results. In Section 6, we present important implications for policymakers while Section 7 presents the concluding comments of the paper.

2 | FOREIGN AID AND REMITTANCES: A PRELIMINARY ANALYSIS OF SOUTH ASIA

South Asia is a small region comprising merely eight countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka). Figure 2 plots foreign aid and remittance flows to South Asia during the 1980–2015 period. It is evident that foreign aid and remittances to the region remained at more or less the same level until the early 1990s, followed by a substantial deviation due to rapid remittance flows to the region. Importantly, it is only in the South Asian region that a phenomenal increase in remittance flows in recent times has outpaced both aid and foreign direct investment (FDI) combined. Remittances to South Asia are currently 7.5 times greater in volume than foreign aid (*source*: WDI, 2018).

Table 1 summarises statistics on various social and economic indicators for South Asia from a global perspective, averaged over the sample period 2011–2015. Columns (1) to (5) of Table 1 display, for each indicator, the share of each country (Bangladesh, India, Pakistan and Sri Lanka) and other South Asian countries as a proportion of the world total. Column (6) presents the aggregate share of

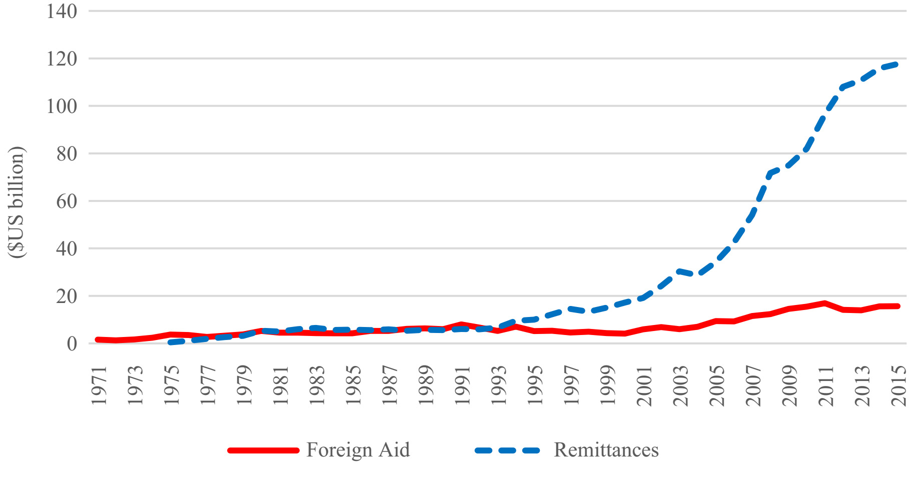

FIGURE 2 Aid and remittance flows (net), South Asia (1980–2015). *Source*: Authors' own calculations based on data from WDI, World Bank database.

TABLE 1 Share of various indicators, individual countries in South Asia and in the world, sample average: 2011–2015

Indicator	Individual countries' share in the world					Share of South Asia in the world (%)	Individual countries' share within South Asia				
	BGD	IND	PAK	SLK	Others in SA		BGD	IND	PAK	SLK	Others in SA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Population	2.2	17.8	2.5	0.3	0.8	23.6	9.3	75.2	10.7	1.2	3.6
Labour size	1.9	14.4	1.9	0.3	0.8	19.3	9.8	74.9	9.7	1.3	4.3
Remittances	2.7	13	3	1.2	1.1	21	12.8	62.1	14.1	5.8	5.2
Foreign aid	1.5	1.8	2	0.3	4.6	10.3	14.8	17.8	19.8	3.2	44.4
Economy size (GDP)	0.2	2.5	0.3	0.1	0.1	3.2	6.4	79.1	9.7	3.0	1.8
Agriculture production	0.8	10.3	1.8	0.2	0.4	13.4	5.8	76.7	13.5	1.4	2.7

Source: WDI, World Bank, various years.

Abbreviations: BGD, Bangladesh; IND, India; PAK, Pakistan; SLK, Sri Lanka.

South Asia in the world total. Columns (7) to (11) exhibit the share of each country within the South Asian regional total. As can be seen, as a single country, India is dominant in the South Asia region in all respective indicators. Pakistan has the next major share in terms of population, aid and remittance receipts, and agricultural production. As can be seen from Column (6), the South Asian region holds about 24% of the world's population and contributes nearly 20% of the global labour force. Due to its large population and labour force, the export of human capital from South Asia enabled it to receive, on average, 21% per annum of world total remittances from 2011 to 2015. However, South Asia received only 10% of total net foreign aid disbursed worldwide during this period. Nevertheless, the region, on average, contributed a mere 3.2% per annum of the world's economic output during this period.

However, favourable climatic conditions and geographical features including arable land have enabled this region to contribute more than 13% to the world's agricultural output. These four South Asian countries alone also hold a substantial share of the world population, labour, financial flow receipts, economy and agricultural production of the region. Columns (7)–(11) present information on individual countries within the South Asian region. As the third row of Column (11) shows, four countries alone hold around 95% (= 100 − 5.2) of total South Asian remittance receipts.

Remittances to the South Asian region come mainly from the Middle East/Gulf Countries, Europe and North America. From 2011 to 2015, on average, more than 60% of the remittances received by Bangladesh and Pakistan came from the Gulf region—mainly from Saudi Arabia, UAE, Qatar, Oman and Bahrain. Likewise, India and Sri Lanka received more than half of their remittances from this region alone. Remittances from the UK and the USA (major migrant destinations for Europeans and North Americans respectively) also comprise a substantial share of total remittance flows to South Asian countries, especially in India and Pakistan. (*Source*: World Bank Statistics, 2018).

Figure 3 presents a scatter diagram of remittances versus aid for the South Asia region, with both variables, expressed as a percentage of GDP. As can be seen, remittances initially decrease when aid increases up to a point when the aid-to-GDP ratio reaches around 6% and then remittances increase with increasing aid. This indicates that the two variables depend on each other and are correlated. This also means that remittances are substituted by aid flows at the lower level of aid dependency when countries require aid for budget-balancing measures or during slow growth or recessions; conversely,

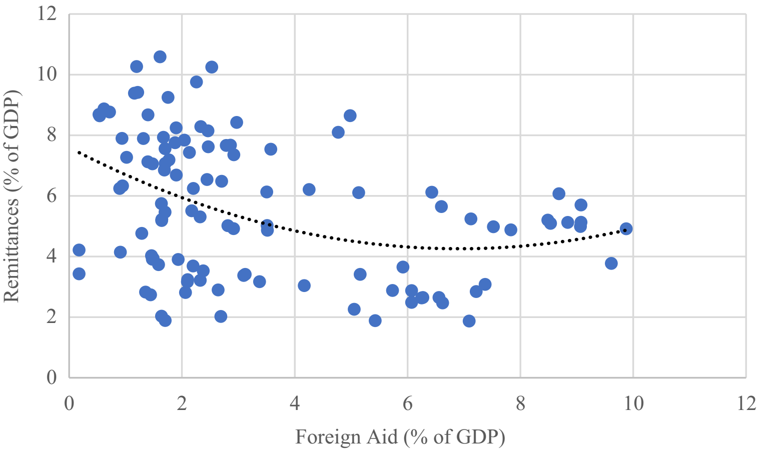

FIGURE 3 Scatterplot, remittances versus foreign aid (as percentages of GDP), South Asia.

when vulnerable countries are more dependent, remittances complement aid flows. Over the last few decades, despite fluctuations, South Asia has slightly improved its public spending on education to transform its labour force into skilled and effective human capital. This explains the slow gradual improvement in educational outcomes which have transformed the labour force into productive human-capital exports, thus resulting in greater remittance flows to the region.

3 | DETERMINANTS OF REMITTANCES AND DATA SOURCES

A review of previous studies reveals that some of the major determinants of remittances are foreign aid, economic growth, exchange rates, trade openness, political stability, human capital, FDI and migrant stock. Several studies found a significantly positive role for the home (origin) country's economic growth in influencing remittances (see, e.g., Abbas et al., 2021; Arvin & Lew, 2012; Azizi, 2018; Beine et al., 2012; El-Sakka & McNabb, 1999; Lartey, 2016; Siddique et al., 2012), while other studies have reported mixed results (see, e.g., Buch & Kuckulenz, 2004). Other macroeconomic variables, like *inflation*, are found in cross-sectional studies to have a negative influence on remittance flows (Arvin & Lew, 2012; El-Sakka & McNabb, 1999); however, some time-series and panel-estimation studies show a positive effect of inflation on remittances (Driffield & Jones, 2013). Similarly, the *exchange rate* is documented as an important determinant of remittances; however, the reported results are mixed. The literature reveals that exchange rates have a negative effect on remittance flows (Lartey, 2016), while some studies have reported a negative but insignificant effect of the exchange rate on remittances (see, e.g., Adams, 2009; Azizi, 2018). The role of *trade openness* has also been examined and found to positively affect remittances (see, e.g., Beine et al., 2012; Bettin et al., 2015). Similarly, the role of the other financial flows, *Foreign Direct Investment (FDI)*, has also been examined and found to positively influence remittance flows (Driffield & Jones, 2013). The literature also documents the important role of *political stability* on remittance flows. For example, Beine et al. (2012) and Ajide and Alimi (2019) found a significantly negative impact of political stability on remittance flows; however, Arvin and Lew (2012) reported a negative but insignificant effect. Human capital (in terms of *education levels*, *skills ratios* and/or *literacy rates*) is found to be an important factor that positively explains remittances (see, e.g., Arvin & Lew, 2012; Buch & Kuckulenz, 2004). The literature also reveals that longitudinal or macro studies may show a negative effect of human capital on remittance flows, whereas survey and micro studies may show a positive impact (Docquier et al., 2012).

TABLE 2 Descriptive statistics, pooled data, selected South Asian countries, 1980–2015

Variables	Mean	Median	Maximum	Minimum	SD	No. of obs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Aid (% of GDP)	2.617	1.705	9.878	0.092	2.478	140
FDI (% of GDP)	0.843	0.683	3.668	−0.029	0.757	140
GDP growth (%)	5.265	5.071	10.259	−1.545	1.977	140
Human capital (% of GDP)	2.529	2.465	4.347	1.011	0.759	140
Inflation (CPI, %)	8.291	7.703	22.564	1.481	3.917	140
Migration (% of population)	3.535	3.949	7.809	0.751	1.932	140
Polity	4.143	6.000	9.000	−7.000	5.109	140
Remittances (% of GDP)	4.718	4.082	10.588	0.753	2.518	140
Trade (% of GDP)	40.072	35.255	88.636	12.352	19.544	140

Migration is an essential determinant that the literature reports as directly relevant to remittance flows. The (bilateral) migrants' stock in the cross-sectional and longitudinal framework is found to positively explain remittances (see, e.g., Bettin et al., 2015; Docquier et al., 2012; Frankel, 2011).

The data for the variables of remittances, foreign aid, trade openness, exchange rate, economic growth, FDI, inflation and public spending on education are taken from WDI—the World Bank database for the period 1980–2015. Public spending on education is used in this study as a proxy for investment in *human capital* (see, e.g., Baldacci et al., 2008; Gupta et al., 2002; Lucas, 1988). Migration data are accessed from the UN migration database.[1] Political stability, measured by the *polity* variable and ranging from −10 (strong autocracy) to +10 (strong democracy), is retrieved from the *PolityIV* dataset. The polity variable not only covers governance but also includes territorial control, such as foreign invasion, internal rebellion and civil war. Since a limited amount of data is available for Afghanistan, Bhutan, Nepal and the Maldives for the required variables in this study, we have focused only on the four main countries in the region: Bangladesh, India, Pakistan and Sri Lanka.

Table 2 presents the descriptive statistics of the variables of interest to be included in the model except for exchange rate. Column (2) exhibits the mean values, column (3) shows the median, and columns (4) and (5) present the maximum and minimum values, while column (6) provides the standard deviation. The number of observations for each variable is presented in column (7) which indicates balanced data.

As can be seen in column (2), the average annual value of aid for the four selected South Asian countries combined is 2.62% of GDP, while for remittances, it is 4.72%. The average annual amount of FDI flows has remained quite low (0.84% of GDP) in the four countries compared to the other two financial flows. The net FDI flows even dropped to negative in the case of Bangladesh during the mid-1980s. The negative values of the Polity variable indicating political instability (due to autocratic regimes) are found mostly in Bangladesh and Pakistan. As can be seen from the standard deviation given in column (6), there is a great degree of variation in the trade data, while the variation in all other variables is reasonably small.

4 | METHODOLOGY

Following the extensive literature review of studies on the determinants of remittances, we selected the most commonly used significant variables, for which the data are available for South

[1]We linearise five-year UN Migration data in annual form using averages.

Asia, to include in our model (see, e.g., Abdih et al., 2012; Adams, 2009; Ajide & Alimi, 2019; Amuedo-Dorantes et al., 2007; Arvin & Lew, 2012; Azizi, 2018; Beine et al., 2012; Bettin et al., 2015; Buch & Kuckulenz, 2004; Docquier et al., 2012; Driffield & Jones, 2013; El-Sakka & McNabb, 1999; Frankel, 2011; Kpodar & Le Goff, 2012; Lartey, 2016; Siddique et al., 2012). We consider the following baseline model that expresses remittances as a function of the above-mentioned determinants:

4.1 | Model 1

$$Rem_{it} = \alpha_i + \beta_1 Aid_{it} + \delta' \boldsymbol{X}_{it} + \lambda_i + \varepsilon_{it} \quad t = 1, 2, \ldots, T \text{ and } i = 1, 2, \ldots, N \tag{1}$$

where t represents the time period, i denotes a country, *Rem* is remittance flows as a percentage of GDP, and *Aid* is foreign aid as a percentage of GDP. ***X*** represents a vector of control variables: exchange rate (measured in local currency units per US dollar), FDI (as a percentage of GDP), GDP growth, human capital (HC), inflation (consumer price index), migration (migrant stock to population ratio), political stability, and trade openness (as a percentage of GDP). λ_i measures the country effect (controlling the heterogeneity), while ε is the error term.

In Figure 2, we observed a quadratic relationship between foreign aid and remittances. Therefore, we now add a quadratic term for the aid variable in Equation (1) to empirically examine the quadratic relationship between remittances and aid. Education (a major segment of total bilateral aid) is very relevant for producing human capital. Therefore, we attempt to examine the transmission channel of foreign aid's support of social welfare expenditure, especially to raise human capital by adding an interaction term for foreign aid and HC variables—the *aid-human capital* channel. In addition, aid-led human capital can also cause the migration of skilled people to other countries in search of better economic opportunities; hence, we add a trio (an interaction between aid*HC*migration) which determines the impact of the *aid-led human-capital channel of migration* on remittances. Furthermore, skilled human capital may also positively impact economic growth by either being used domestically or by migrating to other countries. Therefore, we add another trio (an interaction between aid*H-C*growth) to measure the impact of the *aid-led human-capital channel of growth* on remittance flows. With the addition of the quadratic term of aid and transmission channels of aid, Equation (1) becomes:

4.2 | Model 2 (quadratic aid with transmission channels)

$$\begin{aligned} Rem_{it} = \alpha_i + \beta_1 Aid_{it} + \gamma_1 Aid_{it}^2 + \gamma_2 Aid_{it}{}^{*} HC_{it} + \gamma_3 Aid_{it}{}^{*} HC_{it}{}^{*} Migration_{it} \\ + \gamma_4 Aid_{it}{}^{*} HC_{it}{}^{*} Growth_{it} + \delta' \boldsymbol{X}_{it} + \lambda_i + \varepsilon_{it} \end{aligned} \tag{2}$$

We impose some restrictions in Model 2 and estimate each transmission channel separately to further strengthen the analysis. Importantly, we also examined the causality between remittances and foreign aid and found only a one-directional causality in the direction of foreign aid causing remittance flows.

The causality tests do not indicate any endogeneity; however, to avoid any further potential endogeneity, we also employ the instrumental variable-two-stage least square (IV-2SLS) method, controlling both heterogeneity and endogeneity in estimating the models.[2] Since we have added a quadratic term of AID into our model, we used appropriate U-test, Delta and Fieller methods to establish the reliability and stability of the polynomial function of aid following Lind and Mehlum (2010), Greene (*eds*.) (2008), and Hill et al. (*eds*.) (2011). Further, we also use the Fieller graphical method to investigate whether the model relationship is stable.

The panel series may also suffer from cross-sectional dependence; therefore, to examine this, we apply Pesaran's cross-sectional dependence (CD) test. The results reveal that except for the variables corresponding to GDP growth, migrant stock, polity and trade, all other panel series are found to have cross-sectional dependence.[3] Therefore, we now examine the cross-sectionally adjusted unit root tests—Fisher–augmented Dickey–Fuller (Fisher-ADF), Fisher–Phillips–Perron (Fisher-PP) and Im, Pesaran and Shin (CIPS)—for each panel series. In addition, non-stationary variables used in the estimation may result in spurious estimation results. The results indicate that foreign aid, FDI, GDP growth, inflation and human capital are stationary in levels (that is $I(0)$), while all other variables are stationary in their first differences—that is, they are $I(1)$. Since some variables are $I(0)$ while others are $I(1)$, we could consider that the dynamic ARDL method models the relationship, provided that the variables of interest are cointegrated (see, Pesaran et al., 1999, 2001).[4]

Next, we proceed to examine the null hypothesis that H_0:variables of interest are not cointegrated by applying the Kao Residual cointegration test (see Kao & McCoskey, 1998).[5] The test-statistic value examining the null hypothesis of no co-integration is −1.903 with a p-value of .028, indicating that, at the 5% level of significance, there is support for co-integration between the variables used in the models. These findings suggest the use of the auto-regressive distributed lags (ARDL) approach, which would be more suitable for modelling the relationship between remittances and foreign aid, exchange rate, FDI, human capital, inflation, migration, political stability and trade.

Set up precisely, the unrestricted specification for the dynamic ARDL system of equations for the dependent variable remittances (as a percentage of GDP) is:

[2]Following Adams (2009), we also use two variables—urban population (% of the total population) and population density (people/km^2 of land area)—to instrument foreign aid. In particular, the two instruments indicate the potential poverty or income inequality in developing countries that influences foreign aid. The literature also points out the role of urbanisation in influencing foreign aid in urban infrastructure development and reducing inequality (see, e.g., Li, 2013; Sylwester, 2008). Urbanisation has been investigated for its potential role in remittance flows, however, the literature fails to establish its role in influencing remittances (see, e.g., Abdih et al., 2012; Adams, 2009; Williams, 2017). On pages 236–237 of *Econometric Analysis of Cross-Section and Panel Data*, Woodridge (2010) recommends employing the non-linear (quadratic) form of instruments for the endogenous (polynomial) variables in the model. Therefore, we used the quadratic form of urban population and population density to instrument the polynomial form of foreign aid. Estimates of the instrumental relationship in the IV- first stage regressions are presented in Table A1 of the Appendix. The IV-first stage results indicate that both quadratic urban population and population density instruments significantly influence the polynomial form of foreign aid. Furthermore, we examine the under-identification, weak-identification, and weak-instrument robust inferences. The robustness results of the respective instruments used in the first stage of IV-2SLS regressions presented in Table A2 reveal the p-values of Anderson canonical correlation LM statistic, Anderson-Rubin Wald test, and Stock-Wright LM statistic are less than 0.05. Therefore, we can conclude that the instruments are identified, and robust and that their orthogonality conditions are valid too. Moreover, the Cragg-Donald Wald F-statistic of 9.66 indicates that the equation is not weak since the maximal relative bias falls below 10%.

[3]Pesaran CD test results are presented in Table A3 in the Appendix.

[4]The unit root test results are presented in Table A4 in the Appendix.

[5]Kao residual panel cointegration test results are presented in Table A5 in the Appendix.

4.3 | Model 3 (ARDL model)

$$Rem_{it} = \sum_{j=1}^{p} \lambda_{ij} Rem_{i,t-j} + \sum_{j=0}^{q} \beta_{ij} Aid_{i,t-j} + \sum_{j=0}^{q} \boldsymbol{\delta}'_{ij} \boldsymbol{X}_{i,t-j} + \mu_i + \varepsilon_{it} \tag{3}$$

where $t = 1, 2, \ldots, T$ and $i = 1, 2, \ldots, N$.

The long-term relationship between the variables is given as:

4.4 | Model 4 (Long-term relationship)

$$Rem_{it} = \beta_i Aid_{i,t} + \theta_i' \boldsymbol{X}_{i,t} + \upsilon_{it} \quad t = 1, 2, \ldots, T \text{ and } i = 1, 2, \ldots, N \tag{4}$$

where $\boldsymbol{X}_{i,t}$ is a $(k \times 1)$ vector of explanatory variables for country i, μ_i represents the country-specific fixed effect, and λ_{ij} and δ'_{ij} are scalars and vectors of parameters for the model respectively. This model can be reparametrised as an error correction (EC) system as under:

4.5 | Model 5 (Error-correction model)

$$\Delta Rem_{it} = \phi_i EC_{it-1} + \sum_{j=1}^{p} \lambda^*_{ij} \Delta Rem_{i,t-j} + \sum_{j=0}^{q} \beta^*_{ij} \Delta Aid_{i,t-j} + \sum_{j=0}^{q} \delta'^*_{ij} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it}, \tag{5}$$

where the error correction term $EC_{it-1} = Rem_{i,t-1} - \beta_i Aid_{i,t-1} - \theta_i' \boldsymbol{X}_{i,t-1}$;

$$\phi_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right);$$
$$\theta_i' = \sum_{j=0}^{q} \delta_{ij} \Big/ \left(1 - \sum_{k} \lambda_{ik}\right);$$
$$\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}, \quad j = 1, 2, \ldots, p-1; \text{ and}$$
$$\delta'^*_{ij} = -\sum_{m=j}^{q-1} \delta_{im}, \quad j = 0, 1, \ldots, q.$$

We expect parameter ϕ_i representing the error-correcting speed of adjustment to be negative, falling in the range between −1 and 0. The variables should return to adjust the long-term equilibrium since they are co-integrated. The coefficients β_i and θ_i' measure the long-term relationship, while λ^*_{ij}, β^*_{ij} and δ'^*_{ij} measure the short-term relationship between the variables. To model this, we apply the pooled mean group (PMG) approach that combines both pooling and averaging (see Pesaran et al., 1997, 1999). The PMG estimator restricts the long-term co-integrated coefficients to being the same across the group (countries) but allows the intercept, short-term coefficients and error variances to differ across the countries.

TABLE 3 Panel fixed-effect estimation results, models 1 and 2, South Asia, 1980–2015

	Model 1		Model 2		Restricted models			
					IV-2SLS			
	FE	IV-2SLS	FE	IV-2SLS	Excl. channels	HC	HC-migration	HC-growth
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: Remittances (% of GDP)								
Constant	−2.067	−0.102	−2.195	−0.097	9.042***	5.492**	6.335*	8.237***
	(1.598)	(1.843)	(1.516)	(2.781)	(3.127)	(2.298)	(3.384)	(2.980)
Aid	−0.193*	−0.466***	−1.186***	−3.465***	−4.575***	−3.894***	−4.318***	−5.076***
	(0.105)	(0.159)	(0.228)	(0.780)	(1.042)	(0.751)	(0.867)	(0.962)
Aid (Sq.)			0.039**	0.208**	0.331***	0.256***	0.348***	0.400***
			(0.019)	(0.087)	(0.102)	(0.081)	(0.082)	(0.086)
Exchange rate	0.022***	0.009	0.022***	0.006	−0.061***	−0.012	−0.027*	−0.029**
	(0.008)	(0.010)	(0.007)	(0.013)	(0.019)	(0.013)	(0.014)	(0.014)
FDI	−0.515**	−0.541**	−0.197	−0.598**	−0.890**	−0.643**	−0.771**	−0.718**
	(0.248)	(0.254)	(0.168)	(0.267)	(0.381)	(0.302)	(0.334)	(0.347)
Growth	0.163**	0.139*	−0.023	−0.118	0.001	0.043	0.052	−0.293*
	(0.072)	(0.075)	(0.044)	(0.111)	(0.112)	(0.086)	(0.096)	(0.150)
HC	0.295	0.256	−0.454	−1.198	0.246	−1.300	−0.407	−0.844
	(0.393)	(0.404)	(0.289)	(0.782)	(0.592)	(0.789)	(0.812)	(0.653)
Inflation	0.007	0.026	−0.015	0.008	0.068	0.011	0.008	−0.014
	(0.037)	(0.038)	(0.021)	(0.038)	(0.058)	(0.042)	(0.048)	(0.051)
Migration	0.471**	0.379*	1.099***	1.831***	0.757*	1.022***	0.889**	1.234***
	(0.216)	(0.224)	(0.245)	(0.316)	(0.392)	(0.287)	(0.366)	(0.340)
Polity	−0.069*	−0.085**	−0.091**	−0.124***	−0.117**	−0.082*	−0.065	−0.078
	(0.036)	(0.038)	(0.036)	(0.040)	(0.057)	(0.043)	(0.048)	(0.050)

TABLE 3 (Continued)

Independent variables	Model 1		Model 2		Restricted models			
					IV-2SLS			
	FE	IV-2SLS	FE	IV-2SLS	Excl. channels	HC	HC-migration	HC-growth
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trade	0.088***	0.085***	0.106***	0.132***	0.096***	(0.108***	0.103***	0.115***
	(0.016)	(0.017)	(0.010)	(0.018)	(0.025)	(0.019)	(0.022)	(0.023)
Aid*HC			0.804***	1.101***		0.448***		
			(0.135)	(0.303)		(0.167)		
Aid*HC*Migration			−0.112***	−0.142***			0.036	
			(0.021)	(0.038)			(0.028)	
Aid*HC*Growth			0.011*	0.030*				0.066***
			(0.006)	(0.015)				(0.020)
R^2	0.694	0.639	0.895	0.889	0.488	0.658	0.222	0.393
F-Stat	23.22	5.66	65.47	13.54	7.76	6.67	7.18	7.23
Prob. (*F*-Stat)	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Obs.	140	140	140	140	140	140	140	140

Note: Standard errors are given in parentheses. ***, ** and * represent the significance at 1%, 5% and 10% respectively.

5 | ESTIMATION RESULTS

Table 3 presents the estimates of Models 1 and 2. Columns (1) and (2) present the fixed effect (FE) and IV-2SLS fixed-effect estimation results of Model 1, while columns (3) and (4) show the results of Model 2. Furthermore, we impose different restrictions and present various transmission channels separately in columns (5)–(8) using the IV-2SLS fixed-effect method.

Model 1's estimation results, presented in columns (1) and (2), are consistent except for the exchange rate, which is significant only for FE estimations (presented in column (1)). As can be seen, in general across both columns (1) and (2), foreign aid, FDI, GDP growth, migration, political stability and trade openness are statistically significant, while the coefficients of human capital and inflation are insignificant. The results of Model 1 indicate that foreign aid significantly reduces remittances. The negative sign for the aid coefficient indicates *substitutability* between aid and remittance flows, as found in previous studies (see, e.g., Abbas et al., 2021; Amuedo-Dorantes et al., 2007; Bettin et al., 2015).

The estimated coefficient for exchange rates shows that per unit depreciation of a local currency against the US dollar brings more remittances, though this is significant only in Column (1). The results reveal that an increase in FDI (as a proportion of GDP) significantly reduces remittance flows, suggesting the degree of *substitution* between the two external flows. The results also show that GDP growth significantly increases remittances. This significant growth coefficient indicates a *procyclical* nature of remittances to South Asia—remittances increase when economies grow, as suggested by some recent studies (see, e.g., Lartey, 2016; Siddique et al., 2012). Similarly, there is a significant and positive relationship between migration and remittances, which agrees well with earlier studies (see, e.g., Bettin et al., 2015; Docquier et al., 2012; Frankel, 2011).

The political stability (*polity*) coefficient appears negative, suggesting that political instability would increase remittances. Politically troubled situations motivate people to move to other countries for a peaceful life, which may result in increased remittance flows. Due to the civil-military power struggle in Pakistan and Bangladesh, and the prolonged civil war in Sri Lanka over the past few decades, such negative results are expected. The risks associated with income or consumption volatility aggravate during political instability; therefore, remittance flows may increase as a result (see, e.g., Ajide & Alimi, 2019; Beine et al., 2012). Moreover, the results reveal that trade openness positively impacts remittance flows. This finding can also be found in the remittance literature (see, e.g., Beine et al., 2012; Bettin et al., 2015).

Next, we discuss Model 2's estimation results presented in Columns (3) and (4), where the foreign aid variable is considered in a polynomial form along with various transmission channels—*aid-human capital*, the *aid-led human-capital channel of migration* and *aid-led human-capital channel of growth*—using the fixed-effect and IV-2SLS estimation methods. As can be seen, the estimated aid square term is positive and statistically significant. This suggests a U-shaped quadratic relationship between aid and remittances with a negative sign for the first-order term and a positive sign for the second-order term. In other words, foreign aid initially reduces remittance flows up to a certain level at a decreasing rate, indicating a substitution relationship at lower aid-dependency (aid-to-GDP) level when countries might need little support for their fiscal imbalances. However, when aid levels increase further, remittances increase at an increasing rate, indicating that aid complements remittances when (vulnerable) developing countries depend more on foreign aid, often due to consistently poor macroeconomic management, continued economic distress and governance problems. Importantly, we used appropriate U-test, Delta and Fieller methods to establish the reliability and stability of the polynomial function of aid following Lind and Mehlum (2010), Greene (*eds.*) (2008), and Hill et al. (*eds.*) (2011). The Delta method shows a turning point of 6.47% of aid (to GDP) where remittances start increasing with aid while the appropriate U-test confirms the U-shaped relationship between aid and remittances (see Table A6 in the Appendix). Further, we graphically analyse the stability of the quadratic relationship using the Fieller method and find the relationship is stable (see Figure A1 in the Appendix).

Model 2's results are consistent with Model 1's estimates except for the GDP growth coefficient, which is negative but insignificant in Model 2, and the FDI coefficient, which is only significant in Column (4). Additionally, in Model 1 (where transmission channels are not incorporated), we found a positive but insignificant effect of human capital (HC) on remittances; however, in Model 2, the HC coefficient shows a negative sign but remains insignificant. The impact of migration, political stability and trade openness are found consistent in the Model 2 estimations.

Model 2's results suggest that a channelised effect of foreign aid translated through human capital makes a positive contribution to remittance flows. Hence, the *aid-human capital* channel significantly explains the positive influence of foreign aid on remittances by expanding the human-capital base in the (labour-abundant) South Asian countries. The *aid-led human-capital channel of migration* negatively influences the remittance flows. The bilateral aid from OECD countries may increase the possibility of permanent settlement by (skilled) migrants in developed countries, who may then lose connection with their home countries, therefore resulting in reduced remittance flows over time. Our results are thus consistent with the findings of recent studies which examine the negative impact of aid on migration (see, e.g., Adams, 2009; Lanati & Thiele, 2018; Murat, 2017). However, the *aid-led human-capital channel of growth* is found to significantly increase remittances.

Next, columns (5)–(8) present the estimates for special cases of Model 2 where certain restrictions are imposed: (a) determining quadratic aid (without transmission channels) and (b) separately presenting three respective transmission channels of foreign aid. The results show a significant polynomial relationship between foreign aid and remittances across all columns. Furthermore, migration and trade openness are found to have a significantly positive impact on remittances; however, FDI and polity are generally found to negatively affect remittances. In contrast to panel fixed-effect results, the IV-2SLS fixed-effect estimation results suggest a negative impact of the exchange rate on remittances, which is found significant in Columns (5), (7) and (8). Depreciation of the local currency increases the purchasing power of foreign currency, which may reduce remittance flows (see, e.g., Lartey, 2016; Lueth & Ruiz-Arranz, 2008). The human-capital coefficient is mostly found to be negative (though insignificant), as found in Docquier et al. (2012). The results of the restricted models presented in Columns (6)–(8) show that the *aid-human capital* and *aid-led human-capital channel of growth* are significant and positively affect remittance flows in South Asia, while the impact of the *aid-led human-capital channel of migration* is insignificant.

Table 4 presents the pooled mean group (PMG) estimation results. The findings suggest that the variables of foreign aid, exchange rate, FDI, GDP growth, human capital, inflation and migration are statistically significant in the long run while political stability and trade openness are statistically insignificant. In the short run, foreign aid, GDP growth and trade openness are statistically significant, while the variables of exchange rate, FDI, human capital, inflation, migration and political stability are insignificant. Only foreign aid and GDP growth are significant in the short run as well as in the long run, but with opposite coefficient signs. As can be seen, foreign aid negatively influences remittance flows to South Asia in the long run; however, in the short run, it positively affects remittances. In the short run, when foreign aid increases by 1%, remittances increase by 0.16%, while in the long run, remittance flows would fall by 0.28% ceteris paribus; hence, the negative long-term impact is stronger than the positive short-term effect. A unit change in the exchange rate, FDI, economic growth, inflation and migration positively influences remittances in the long run by 0.08%, 0.78%, 0.52%, 0.07% and 0.86% as a percentage of GDP, respectively, with other variables constant. In the short run, a unit change in trade openness positively affects remittance

TABLE 4 PMG estimations, South Asia, 1980–2015.

Independent variables	Long run Coefficient estimates (1)	Short run Coefficient estimates (2)
Dependent variable: Remittances (% of GDP)		
ARDL estimation method (2,2,2,2,2,2,2,2,2,2)		
Aid	−0.281 (0.109)**	0.162 (0.094)*
Exchange rate	0.075 (0.007)***	0.026 (0.038)
FDI	0.784 (0.215)***	−0.147 (0.176)
Growth	0.522 (0.081)***	−0.184 (0.080)**
HC	−2.492 (0.261)***	0.797 (0.831)
Inflation	0.074 (0.026)***	−0.061 (0.040)
Migration	0.861 (0.179)***	−6.269 (5.548)
Polity	0.004 (0.015)	0.129 (0.086)
Trade	0.005 (0.019)	0.038 (0.013)***
Error correction term (ϕ)		−0.409 (0.244)*
Remittances (lag)		0.104 (0.168)

Note: Standard errors are given in parentheses. ***, ** and * represent the significance at 1%, 5% and 10% respectively.

flows by 0.04% while economic growth reduces remittances by 0.18% as a percentage of GDP, ceteris paribus. FDI has a long-term positive impact on remittances; however, it has a negative but insignificant effect in the short run. Likewise, migration has a negative though insignificant impact on remittances in the short run, suggesting that migrants take some time to settle down abroad and remit more in the long run. Human capital has a positive but insignificant impact on remittances in the short run; however, as suggested by the literature, we found that it reduces remittances in the long run. Importantly, the results reveal that remittance flows would be reduced following (positive) growth in the short run, indicating the short-term *counter-cyclical* nature of remittances. However, remittance flows are found to be *pro-cyclical* in the long run. Remittance flows reflect insurance motives and risk sharing in the short run, while in the long run, they are investment driven. The error correction term indicates an almost 41% adjustment towards the long-term equilibrium within 1 year.

6 | POLICY IMPLICATIONS

This paper suggests important implications for policymakers in the four South Asian countries, in other regional and developing countries, as well as in donor countries and international financial institutions. The empirical findings suggest that South Asian countries (with lower aid-to-GDP) rely less on foreign assistance, substituting aid with remittance flows. Apart from development objectives, aid flows may potentially be purposed to stabilise the fiscal and current account imbalances in countries with low aid dependence. However, in countries with a higher aid to GDP ratio, aid complements remittance flows to equally support and stabilise the income and consumption of people in vulnerable (high aid-dependent) countries with continued poor macroeconomic management and governance problems.

Second, policymakers in donor countries and financial institutions are advised to structure their aid programmes to promote human development by focusing on the education and health sectors. Foreign aid helps developing countries to increase their social welfare expenditure to improve human capital. Consequently, foreign aid brings more remittances either directly or through its impact on economic growth; these remittance-receiving countries may eventually reduce their future aid dependency.

Third, foreign aid, through its potential effect on migration, may result in a reduction of remittance flows, as witnessed in the case of South Asia. Emigration (labour mobility) should generally follow labour-market dimensions like other factors such as international capital flows in a globalised world. Labour-abundant countries with productive (skilled) human capital could take more advantage of remittance flows than those with slow progress in human-capital development.

Fourth, donor countries and international financial institutions may divert aid flows to other sectors such as infrastructure, communication, trade promotion, security and climate change in developing countries that already possess abundant human capital that sufficiently contributes to remittance flows.

It is also important to note that foreign aid complements remittances in the short run, supporting fiscal balancing and welfare programmes to promote human development. This short-term positive relationship is likely to be visible in relatively small (poor) countries, while, for large economies, it may appear insignificant. In the long run, as economies grow and expand their income level, aid acts as a substitute for remittance flows.

7 | CONCLUSION

The empirical findings of this chapter suggest that, in general, foreign aid negatively affects remittances in South Asia, indicating the degree of *substitutability* between the two external financial flows. The analysis presented here contributes to the literature by examining (1) the quadratic relationship between foreign aid and remittances and (2) the mechanism through which aid influences the remittance flows. Estimation results suggest that aid initially acts as a substitute for remittances at lower levels of aid dependency (aid-to-GDP). This may be due to fiscal balancing or to provide a cushion for welfare budgets in developing countries facing macroeconomic imbalances, especially when remittances are positively influenced by economic growth—as in the case of South Asia. However, at higher aid-dependency levels, foreign aid positively affects the remittances of South Asian economies, which depend more on aid, often due to poor macroeconomic management, less domestic resource mobilisation and/or governance problems. Remittances may complement aid to smooth out the (volatile) income and consumption risks in vulnerable economies, associated with high aid-dependency levels. This study's empirical findings also suggest that the *aid-human capital* transmission channel significantly supports remittance flows to the South Asian region by increasing human capital through its considerable contribution to public welfare programmes, aimed at producing effective human capital. However, the *aid-led human-capital channel of migration* reduces remittance flows due to the permanent settlement of skilled migrants in host countries, while the *aid-led human-capital channel of growth* significantly increases remittances to the region. This means that aid, by promoting human capital, improves growth and significantly increases remittances.

The dynamic PMG estimation results reveal that aid acts as a *complement* to remittances in the short run in a positive relationship, while in the long run with a negative coefficient, there is a *substitutional* relationship between the two financial flows. Aid may support fiscal and current account balancing or welfare programmes that focus on human development and basic infrastructure, along with remittance flows in the short run. However, developing countries may not require aid if their income level increases in the long run through sustainable (reasonable) economic growth while receiving remittances, equally supporting consumption and investment.

The empirical findings also reveal that trade liberalisation has also helped South Asian countries to receive remittances. When endogeneity is controlled, the results suggest that the negative impact of exchange rate depreciation on remittance flows is due to the increased purchasing power of a foreign currency. The migrant stock from this region that stays overseas provides significant support to remittance flows, as suggested in the literature. The dynamic modelling indicates a negative though insignificant impact for migration on remittances in the short run, since migrants take time to settle down. However, after finding opportunities, they remit more in the long run. FDI also reduces remittances to the South Asian region, meaning that the two flows substitute each other. Furthermore, dynamic modelling shows the negative (though insignificant) impact of FDI on remittances. However, in the long run, FDI complements remittance flows positively.

Furthermore, these results demonstrate the important role of economic growth in influencing remittances which, in the long run, can potentially be purposed for productive investment. However, in the short run, economic growth negatively affects remittance flows. This means that economic growth (increasing the income of the home country's people) reduces demand for remittance flows for altruistic purposes. In other words, an economic slowdown brings more remittances in the short run to support income and/or consumption volatility.

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CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

DATA AVAILABILITY STATEMENT

Data openly available in a public repository that does not issue DOIs. The data can be made available on request from the authors.

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APPENDIX A

TABLE A1 IV-first-stage results, South Asia[a]

Dependent variable	Aid	Aid (Sq.)
Urban Pop.	4.068***	44.862***
Urban Pop. (Sq.)	−0.047***	−0.512***
Pop. density	−0.0383***	−0.344***
Pop. density (Sq.)	−0.00001***	−0.0001***
R^2	0.412	0.443
F-Stat	60.64	45.28
Prob. (F-Stat)	0.000	0.000

[a]Selected results (of instruments of foreign aid) are presented in this table.

***, ** and * represent the significance at 1%, 5% and 10% respectively.

TABLE A2 Summary: Robustness checks, IV-first-stage regressions, South Asia

Under-identification test		
Ho: matrix of reduced form coefficients has rank = K1-1 (under-identified)		
Ha: matrix has rank = K1 (identified)		
Anderson canon corr. LM Stat	Chi-Sq = 32.31	p-value = .000
Weak-identification test		
Ho: equation is weakly identified		
Cragg–Donald Wald F-stat	9.66	
Stock–Yogo Weak ID test critical values for K1 = 2 and L1 = 4		
5% maximal IV relative bias	11.04	
10% maximal IV relative bias	7.56	
20% maximal IV relative bias	5.57	
Weak-instrument-robust inference		
Tests of joint significance of endogenous regressors (B_1 and γ_1) in Equation (3)		
Ho: $B_1 = 0$ and $\gamma_1 = 0$, and orthogonality conditions are valid		
Anderson–Rubin Wald test	$F(4, 124) = 38.13$	p-value = .000
Anderson–Rubin Wald test	Chi-sq (4) = 167.29	p-value = .001
Stock-Wright LM S statistic	Chi-sq (4) = 75.02	p-value = .002

TABLE A3 Pesaran cross-sectional dependence (CD) test results

Variables	Test statistic	Prob.
Aid (% of GDP)	12.334	0.000
Exchange rate (LCU = US$)	14.161	0.000
FDI (% of GDP)	7.471	0.000
GDP growth (% annual)	1.532	0.126
Human capital (% of GDP)	2.933	0.003
Inflation (CPI, % annual)	3.968	0.000
Migration (% of Pop.)	0.438	0.661
Polity	0.388	0.698
Remittances (% of GDP)	5.410	0.000
Trade (% of GDP)	−1.367	0.172

TABLE A4 Unit root test results

Variables	Fisher-ADF	Fisher-PP	CIPS	Conclusion
Aid (% of GDP)				
Level (intercept and trend)	14.952 (.060)	31.832 (.000)	−1.281 (.100)	*I*(0)
First difference	68.117 (.000)	383.403 (.000)	−8.310 (.000)	
Exchange rate (LCU = US$)				
Level (intercept and trend)	8.304 (.404)	5.603 (.692)	−0.351 (.362)	*I*(1)
First difference	42.765 (.000)	65.149 (.000)	−5.572 (.000)	
FDI (% of GDP)				
Level (intercept and trend)	19.496 (.012)	15.809 (.045)	−2.376 (.008)	*I*(0)
First difference	58.287 (.000)	376.350 (.000)	−7.231 (.000)	
GDP growth (% annual)				
Level (intercept and trend)	33.983 (.000)	82.940 (.000)	−4.491 (.000)	*I*(0)
First difference	77.089 (.000)	1053.56 (.000)	−9.393 (.000)	
Human capital (% of GDP)				
Level (intercept)	16.079 (.041)	22.357 (.004)	−1.956 (.025)	*I*(0)
First difference	51.854 (.000)	74.779 (.000)	−6.230 (.000)	
Inflation (CPI, % annual)				
Level (intercept)	28.820 (.000)	41.362 (.000)	−3.575 (.000)	*I*(0)
First difference	86.164 (.000)	108.793 (.000)	−9.837 (.000)	
Migration (% of Pop.)				
Level (intercept)	6.863 (.551)	17.301 (.027)	0.243 (.596)	*I*(1)
First difference	17.643 (.024)	19.180 (.014)	−5.147 (.011)	
Polity				
Level (intercept)	14.005 (.081)	10.221 (.249)	−1.388 (.082)	*I*(1)
First difference	33.914 (.000)	46.835 (.000)	−4.721 (.000)	
Remittances (% of GDP)				
Level (intercept and trend)	7.459 (.488)	9.158 (.329)	0.358 (.640)	*I*(1)
First difference	51.430 (.000)	85.249 (.000)	−6.603 (.000)	
Trade (% of GDP)				
Level (intercept and trend)	5.273 (.728)	10.164 (.254)	0.508 (.694)	*I*(1)
First difference	32.122 (.000)	75.433 (.000)	−3.931 (.000)	

Note: *p*-values are given in parentheses.

TABLE A6 Delta method: Non-linear (quadratic) relationship of aid and remittances

Coefficient	SE	z	$P>\lvert z\rvert$	[95% confidence interval]	[90% confidence interval]
6.471	0.968	6.68	0	[4.572, 8.369]	[4.877, 8.065]

Note: Appropriate U-test (Lind & Mehlum, 2010) at 95% CI. H_0: $\beta_j f'(x_l) > 0$ and H_0: $\beta_j f'(x_h) < 0$. H_A: $\beta_j f'(x_l) \leq 0$ and/or H_A: $\beta_j f'(x_h) \geq 0$. Applying to estimated aid coefficients of Model 2 (FE): $\beta_j f'(x_l) = -5.422 < 0$ (reject H_0, negative relationship). $\beta_j f'(x_h) = 0.326 > 0$ (reject H_0, positive relationship).

TABLE A5 Kao residual panel cointegration test

Null hypothesis: No cointegration		
Newey–West automatic bandwidth selection and Bartlett kernel		
	***t*-statistic**	**Prob.**
ADF	−1.903	0.028
Residual variance	0.365	
Augmented Dickey–Fuller test equation	0.347	

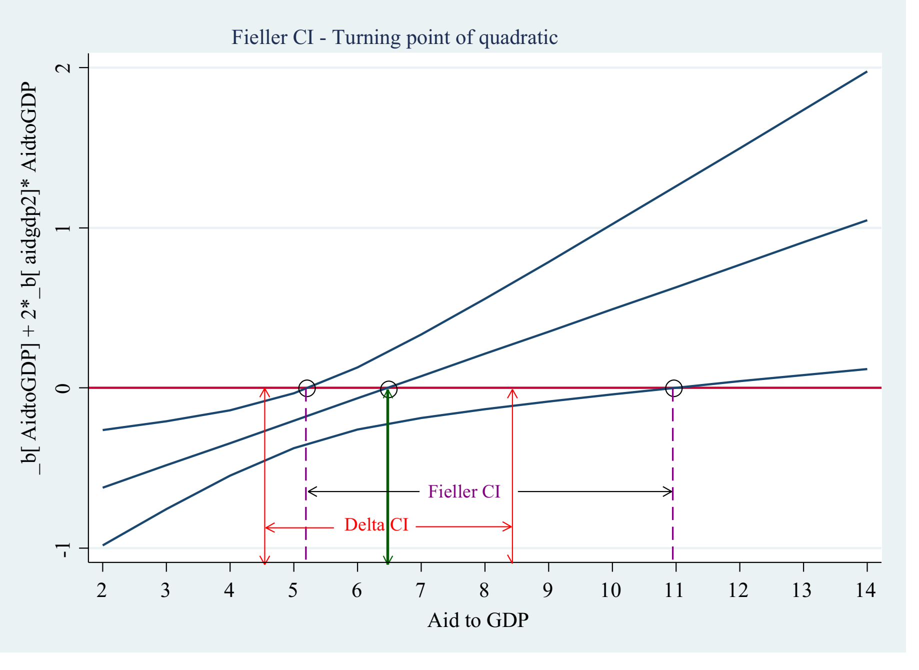

FIGURE A1 Fieller method: Non-linear (quadratic) relationship of aid and remittances.