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Remittances inflow and private investment: a case study of South Asian economies via panel data analysis

Zeeshan Khan\textsuperscript{a}, Fazli Rabbi\textsuperscript{b}, Manzoor Ahmad\textsuperscript{c,d} and Yang Siqun\textsuperscript{a}

\textsuperscript{a}School of Economics and Management (SEM), Tsinghua University, Beijing, China; \textsuperscript{b}Department of Economics and Development Studies, University of Swat, Mingora, Pakistan; \textsuperscript{c}Department of Industrial Economics, School of Economics, Nanjing University Business School, Nanjing, China; \textsuperscript{d}Department of Economics, Abdul Wali Khan University Mardan, Pakistan

ABSTRACT

This study examines the association between remittances inflow and investment. The data of five major South Asian countries that receive a significant portion of remittances including India, Sri Lanka, Pakistan, Nepal, and Bangladesh are considered from 1990 to 2016. Pooled ordinary least square (OLS), the fixed effect within group estimator (FEWGE), fixed effect (FE) and random effect (RE) are used for the analysis of the data. Unit root tests were employed and then followed by a pooled mean group (PMG) analysis to analyse the long-run relationship between private investment and remittances while controlling for several other variables, such as real-interest rate, economic growth, and the interaction between remittances inflow and business freedom. We use the error correction mechanism (ECM) to find the short-run relationship among variables. Our findings reveal that private investment is positively affected by remittances inflow. Moreover, remittances flow with low business freedom opposes the positive association in the case of these sampled countries. We recommend channelising remittances and lower barriers to business freedom, which may pave the way for a conducive investment-friendly environment.

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KEYWORDS

Pooled mean group (PMG); FEWGE; positive; channelise; business freedom; ECM

1. Introduction

The global migration of nearly 250 million people is a key factor affecting the economies of developing countries via different channels. A recent report by The Global Knowledge Partnership on Migration and Development (KNOMAD) (2017) found that remittances are a critical macroeconomic variable that contributes 596 billion dollars to the global economy, of which 450 billion flows to developing or under-developing economies.

Developing countries take the major share of total remittances inflow, as indicated in Figure 1. The flow of remittances is larger than private capital inflow and official

CONTACT Zeeshan Khan \textsuperscript{a} zeeshan.17@sem.tsinghua.edu.cn

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development assistance to these economies. For some of the developing countries, the contribution of remittances inflow is more than foreign direct investment and contributes a large amount to the gross domestic product (GDP) (Adenutsi, 2011; Bjuggren, Dzansi, & Shukur, 2010; Connell & Brown, 2004; De Haas, 2006; Giuliano & Ruiz-Arranz, 2009; Heilmann, 2006; Rao & Hassan, 2011). However, South Asia countries such as India, Pakistan, Sri Lanka, Nepal, Bhutan, the Maldives, Afghanistan, and Bangladesh are the primary recipients of remittances inflow in the world, and among these countries, India takes considerable portion (World Bank, World Development Indicators, 2016; The Global Knowledge Partnership on Migration and Development (KNOMAD)).

The economic power of remittances inflow is considered a vital source of support. As a capital, it affects the lives of millions of people across the globe. In the literature, the role of remittance has two different theoretical aspects: one theory is based on self-interest, and the other is based on altruistic drive. Money sent by migrants is either used for basic daily necessities or invested in some profitable ventures. Both of these motives are affected by the economic condition of the recipient, which affects both the level of investment and consumption of the receiver. Altruistic drive focuses on the utility of recipient, which is more concerned with the consumption of the recipient’s basic necessities, as most migrants remit funds from abroad due to consumption motives of their families (Barajas, Gapen, Chami, Montiel, & Fullenkamp, 2009). Remittances inflow significantly affects the standard of living of the recipient family, as some amount is also spent on health, capital formation, and education. In most cases, the recipient spends his or her money on physical capital or real estate for profit motives, which confirms the self-interest motive of remittances. (Mallick, 2008)

Empirical work suggests that remittances inflow mostly affects the consumption level of households through the multiplier effect (Stahl & Arnold, 1986; Rahman, 2009). However, the role of remittances cannot be limited only to consumption or economic growth; it is also used for foreign exchange (Maimbo & Ratha, 2005; Ratha, 2005; Ratha & Shaw, 2007) and allows debt constraints to be curbed due to the low number of microfinancing opportunities available in developing countries (Giuliano & Ruiz-Arranz, 2009).

The role of remittances is multidimensional, and it has a positive effect not only on poverty, economic growth, consumption, and real-exchange rates but also on private investment in developing countries. As mentioned earlier, remittances play a vital

![Figure 1. Comparison of FDI, remittances inflow and other capital inflow to developing countries. Source: The Global Knowledge Partnership on Migration and Development (KNOMAD) (2017).](image-url)
role in Bangladesh, Sri Lanka, Pakistan, Nepal, and India; these countries collectively received 220,976 million U.S. dollars in the year 2016–2017. However, the contribution to the economy of each of these countries is different, as shown in Figures 2 and 3, in terms of remittances as a percentage of GDP as well as in terms of millions of U.S. dollars to these countries (World Bank, World Development Indicators, 2016; The Global Knowledge Partnership on Migration and Development (KNOMAD)).

In the case of South Asian economies, in addition to the economic growth, poverty and real-exchange rate are crucial to the role of remittances in promoting private investment. In the case of Nepal (Bank, 2012), findings found that remittances help farmers in acquiring lands for agricultural activities. Similarly, Pakistan is also getting a major portion of its GDP from migrant remittances. The role of remittances is essential, and it positively affects private investment, which further leads to higher economic growth (Yasmeen, Anjum, Yasmeen, & Twakal, 2011). However, it has been argued that remittances have a minimal effect on private investment, but as a
whole are a crucial factor affecting countrywide economic growth (Ullah, Rahman, & Jebran, 2015, p. 178).

Following the previous literature, the role of remittances cannot be denied among major South Asian countries such as India, Pakistan, Sri Lanka, Nepal, and Bangladesh. However, most of the previous studies have analysed the effect of remittances only on economic growth, poverty, and real-exchange rates. The effect of remittances on investment in these countries has not been analysed, especially by applying more advanced econometric techniques such as pooled mean group (PMG) analysis. No cross-country analysis exists in this area of research. Therefore, this study is the only contribution to the existing literature that takes into account five cross sections (Pakistan, India, Sri Lanka, Nepal, and Bangladesh) and uses the most updated data from 1990 to 2016.

2. Previous empirical findings

On the role of remittances, numerous studies have been conducted to trace their effect on education, poverty, the health care system, economic growth, the standard of living, the balance of trade and real-exchange rates. Different studies have found remittances to have a positive effect on education, health care, economic growth, poverty, balance of trade and real-exchange rate in the recipient countries (Lopez, Fajnzylber, & Acosta, 2007; Alberola & Lopez, 2001; Barajas, Chami, Fullenkamp, & Garg, 2010; Burki, 1991; Chishti, 2007; Faridi & Mehmoord, 2014; Heilmann, 2006; Khan, Ali, & Khalid, 2016; Khan, Sajid, Gondal, & Ahmad, 2009; Lopez, Bussolo, & Molina, 2007; Mughal & Anwar, 2012; Neyapti, 2004; Ratha & Shaw, 2007). In the case of Pakistan, the findings of Faridi and Mehmood (2014), obtained by simple regression analysis, suggest that remittances help to alleviate poverty. Another study, by Lopez et al. (2007) and using a Heckman two-step approach to study the effect of remittances in controlling poverty in Latin American economies, suggests that remittances help alleviate poverty but that the effect is different in different countries. It also helps to promote sustainable development and improves the skills, standard of living, and welfare of the society (Heilmann, 2006; Khan et al., 2009; Ratha & Shaw, 2007). However, the issue of remittances and private investment has been overlooked, despite it being an important macroeconomic variable for gauging the overall economic performance of a country. Tables 1 and 2 provide detailed findings of each mentioned study.

Many single-country analyses have been done by researchers, institutions, and academia on the relationship between remittances and private investment with both supporting and conflicting findings.

It has been found that, similarly to the positive effect of remittances on other macroeconomic variables, private investment is also affected positively by remittances (Akter, 2016; Cherono, 2013; Das, 2009; Griffith, Boucher, McCaskie, & Craigwell, 2008; Le, 2011; Malik, 2013; Mehra & Singh, 2014; Okodua & Olayiwola, 2013; Thagunna & Acharya, 2013; Ullah et al., 2015; Yasmeen et al., 2011) the role of remittances has been considered to be positive in promoting private investment when linked with a sound and well-organised financial sector that can channelise migrant
money into private investment (Ojapinwa & Odekunle, 2013). In other studies, it has been found that only a minor portion of money sent by migrants is devoted to investment for promoting small-scale industries (Jahjah, Chami, & Fullenkamp, 2003; Khan et al., 2007).

It has further been found that migrant remittances are invested more often in housing or non-tradable goods than capital investment (Osili, 2004; Woodruff & Zenteno, 2007). On the other hand, studies have reported the positive effect of remittances on education and have linked spending on education with human capital by generating more skills and knowledge (Adams & Cuecuecha, 2010; Edwards & Ureta, 2003; Yang, 2005). The extensive literature mentioned above that focuses on the role of remittances in promoting investment is difficult to refute, as only one of the studies had contradictory results and did not find a positive role of remittances on promoting private investment (Mallick, 2012).

### Table 1. Summary of literature review.

| Author             | Title of article                                      | Area/Time                     | Methods            | Findings                                                                 |
|--------------------|-------------------------------------------------------|-------------------------------|--------------------|--------------------------------------------------------------------------|
| (Faridi & Mehmood, 2014) | Workers’ Remittances and poverty in Pakistan | Pakistan, (1972–2010) | OLS                | Remittances alleviate poverty                                             |
| (Lopez et al., 2007)   | The impact of remittances on poverty and human capital | Latin American Countries, (1980–2005) | Heckman two-step, OLS | Decrease poverty but heterogeneous in terms of significance in different countries |
| (Khan et al., 2009)    | Impacts of remittances on living standards of emigrants families | Gujarat, Pakistan (2007–2008) | Statistical tests | Positive effect on the living standard of families                       |
| (Lopez et al., 2007)   | Remittances and the real-exchange rate                  | Latin American Countries (2005) | FE                 | Remittances appreciate the real-exchange rate                            |
| (Ratha & Shaw, 2007)   | South-South migration and remittances                  | Survey                        | Statistical test   | Migration improves welfare and increases the efficiency of skills of labour. |
| (Mughal & Anwar, 2012) | Remittances, inequality, and poverty                   | Pakistan (1979–2008)         | IVGMM              | Remittances decrease poverty and inequality and have a much stronger effect than internal remittances. |
| (Chishti, 2007)        | The rise in remittances to India: A closer look         | India (2007)                  | Statistical tests  | Remittances turned people from savers into investors                     |
| (Neyapti, 2004)        | Trends in Workers’ Remittances: A Worldwide Overview   | Developed, Less Developed Countries (1980–1999) | Statistical tests | Remittances have a significant advantage for less developed countries    |
| (Heilmann, 2006)       | Remittances and the migration-development nexus—Challenges for the sustainable governance of migration | Global Perspective | Statistical tools | Remittances promote sustainable development                               |
| (Khan et al., 2016)    | Remittances inflow and Real-Exchange Rate              | Pakistan (1980–2014)         | ARDL               | Remittances appreciate the real-exchange rate.                           |
| (Barajas et al., 2010) | The global financial crisis and workers’ remittances to Africa: what’s the damage | African Countries, (2009–2010) | OLS                | Remittances drop cause GDP to fall in selected countries                |
Table 2. Remittances and Private Investment.

| Author                        | Title of Article                                                                 | Area/Time                  | Methods          | Findings                                                                                                                                 |
|-------------------------------|----------------------------------------------------------------------------------|----------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| (Mehra & Singh, 2014)         | Migration: a propitious compromise                                               | India                      | Survey           | Remittances improved the condition of the recipient household                                                                          |
| (Das, 2009)                   | The Effect of Transfers on Investment and Economic Growth: Do Remittances and Grants Behave Similarly? | Bangladesh, Pakistan, Egypt, Syria (1975–2006) | GMM              | Remittances affect remittances positively and negatively in different countries. It is helpful for capital formation and growth.       |
| (Cherono, 2013)               | The effect of remittances and financial development on private investment         | Kenya (1980–2011)         | Co-integration, ECM | Remittances positively affect investment                                                                                                |
| (Thagunna & Acharya, 2013)    | Empirical analysis of remittance inflow                                           | Nepal (2001–2009)          | Granger Causality, OLS | Remittances increase consumption more compared to investment                                                                             |
| (Yasmeen et al., 2011)        | The Impact of Workers’ Remittances on Private Investment and Total Consumption    | Pakistan (1984–2009)      | OLS              | Remittances increase private investment and consumption                                                                               |
| (Okodua & Olayiwola, 2013)    | Migrant workers’ remittances and external trade balance                           | Sub-Saharan African Countries (2002–2011) | Pooled OLS, GMM | Appreciate local currency                                                                                                                |
| (Akter, 2016)                 | Remittance Inflows and Its Contribution to the Economic Growth                   | Bangladesh (1990–2013)    | OLS              | Remittances increase private capital and generate economic growth                                                                      |
| (Ullah et al., 2015)          | Terrorism and Worker’s Remittances                                               | Pakistan (1995–2013)      | Johansen Co-integration | Remittances affect economic growth in the long and short run                                                                            |
| (Le, 2011)                   | Remittances for economic development: The investment perspective                 | General Model              | Theoretical Approach | Transfers increase income’s compensatory effect and business encouragement.                                                            |
| (Griffith et al., 2008)       | Remittances and Their Effect on the Level of Investment                           | Barbados (1996–2007)      | Dynamic OLS      | Remittances increase remittances both in the short and long run                                                                        |
| (Malik, 2013)                 | Role of Foreign Private Investment and Remittance in Stock Market Development     | Pakistan, India, Bangladesh (1988–2011) | Co-integration   | The stock market is positively related with remittances inflow                                                                         |
| (Ojapinwa & Odekunle, 2013)   | Workers’ remittance and their effect on the level of investment                   | Nigeria (1977–2010)       | Dynamic OLD, 2IVLS | Remittances increase the stock of physical investment                                                                                 |
| (Jahjah et al., 2003)         | Are immigrant remittance flows a source of capital for development               | Worldwide View             | Theoretical Model | Remittances negatively affect economic growth                                                                                           |
| (Khan et al., 2007)           | Remittances as a determinant of import function                                  | Pakistan (2007)            | OLS              | Imports have positive while the real-exchange rate has negative marginal propensity                                                  |
| (Woodruff & Zenteno, 2007)    | Migration networks and microenterprises                                          | Mexico                     | OLS, IV           | Migration leads to higher investment and profit                                                                                         |
| (Anwar & Mughal, 2012)        | Motives to remit: some microeconomic                                             | Pakistan (2005–2008)      | OLS              | Remittances are used for necessities and loan repayment                                                                               |
| (Adams & Cuecuecha, 2010)     | Remittances, household expenditure and investment in Guatemala                  | Guatemala                  | Dubin and McFadden method | Human and physical investment is increased through remittances                                                                        |

(continued)
2.1. Theoretical views on migration and remittances

The role of remittances has been in discussion for a long time among the different schools of thought on migration. There are diverse opinions on the role of remittances opinions; some migration theories support the positive role of remittances, and some of them argue against it. This has been discussed by the classical and pessimistic schools of thought in the 1950–1960s and 1970–1980, respectively. However, both theories provide reasons for the role of remittances on recipient economies regarding poverty, economic development, and growth. The pessimistic theory (1970–1980s) viewed remittances as harmful for the economy and believed that they could cause investment in nonproductive ventures such as real estate (De Haas, 1998, 2005; Haan et al., 2000), which does not generate any real effect on the economy or job creation.

In the same way (Binford, 2003; De Mas, 1978), consider migration as a syndrome, stating that more migration causes more underdevelopment and the circle goes on by causing damage to the economy. Following the same concept, dependency and structuralists view migration as a source of dependency (Almeida, 1973). Neo-Marxists viewed migration and remittances as a source of inequality, reinforcing the capitalist system and the deficit in the trade balance for the receiving country (Papademetriou, 1991; Taylor & Wyatt, 1996). In contrast, the optimist theory (1950–1960s) of migration takes remittances as a positive stimulus to the economy that bridges the gap between external deficits, increasing industrialisation, education, economic development, knowledge and other structural changes in the recipient economy (Heinemeijer, Van Amersfoort, & den Haan, 1977).

3. Methods and techniques for analysis

The aim of this study was to explore the effects of remittances flow on private investment for five major recipient economies of South Asia that includes Pakistan, Sri Lanka, India, Nepal, and Bangladesh. This study uses remittances as our main exogenous variables while controlling for other variables such as economic growth,
interest rate and the multiplicative effect of business freedom with remittances inflow. Panel data for the years of 1990–2016 for five cross-sections is taken from The Global Knowledge Partnership on Migration and Development (KNOMAD, 2017) and the World Bank (2016).

### 3.1. Econometrics model

\[
PI_{it} = \gamma_0 + \gamma_1 RI_{it} + \gamma_2 RIR_{it} + \gamma_3 EG_{it} + \gamma_4 RI/\text{BF}_{it} + \mu_{it}
\]

Where PI is private investment (PI), remittances inflow is denoted by (RI), the real-interest rate by (RIR), EG is the economic growth, the multiplicative variable of business freedom is (BF), and remittance inflow is given by RI/\text{BF}. Further, the term ‘i’ is for the cross section, ‘t’ is for the time period starting from 1990 to 2016, \(\gamma_0\) is for constant term and \(\gamma_1, \gamma_2, \gamma_3\) and \(\gamma_4\) are the coefficients, and \(\mu_{it}\) is the error term. Further, business freedom to initiate business is measured through ten other different indicators by the Word Bank (‘World Bank, World Development Indicators,’ 2016), and it contains the minimum level of capital required for starting a business, the timing, the procedure for obtaining business licenses, the time to close a business, recovery rate and cost of starting a business. The business freedom minimum point or low level of freedom is 40, and the maximum range or high level of business freedom value is 100 (Theglobaleconomy.com, 2016).

### 3.2. Panel data models

In panel data analysis, the simple form of the method is pooled OLS; it assumes a common intercept/constant for each country and the error term is not correlated with the independent variables such as remittances inflow, real-interest rate, economic growth, and an interactive term. The function for pooled OLS is as follows:

\[
PI_{it} = \gamma_0 + \gamma_1 RI_{it} + \gamma_2 RIR_{it} + \gamma_3 EG_{it} + \gamma_4 RI/\text{BF}_{it} + \mu_{it}
\]

The pooled OLS model considers all the cross sections as homogeneous and does not consider the heterogeneity problem in the model. However, the problem of heterogeneity and correlation between the error term and independent variable may produce inconsistent as well as biased results. To address the problem of endogeneity and heterogeneity, the fixed-effect model is more appropriate compared to pooled OLS and addresses the issues that remain in the pooled OLS (Asteriou et al., 2015). The functional for the fixed-effect model is given below:

\[
PI_{it} = \gamma_i + \gamma_1 RI_{it} + \gamma_2 RIR_{it} + \gamma_3 EG_{it} + \gamma_4 RI/\text{BF}_{it} + \mu_{it}
\]

### 3.3. Fixed effect within group estimator (FEWGE)

Another method in panel data, used for a robustness check and to help remove the problem of unobserved factors such as \(\gamma_i\) is the fixed effect within group estimator. It eliminates the unobserved factors effect by first taking the average and then putting
it in the original equation for the estimation. Moreover, the value of the constant term also drops-out to zero (Greene, 2003). The method is given below:

$$\sum_{t=1}^{T} PI_{it} = \frac{1}{T} \left[ \sum_{t=1}^{T} (\gamma + \gamma_1 RI_{it} + \gamma_2 RIR_{it} + \gamma_3 EG_{it} + \gamma_4 RI * BF_{it} + \theta_{it}) \right]$$  (4)

The term 'T' denotes total time period, writing this equation as (5), the Bar denotes the average value:

$$PI_i = \gamma_i + \gamma_1 RI_i + \gamma_2 RIR_i + \gamma_3 EG_i + \gamma_4 RI * BF_i + \bar{\theta}_i$$  (5)

$$PI_{it} - \bar{PI}_{it} = \gamma_1 (RI_{it} - RI_{it}) + \gamma_2 (RIR_{it} - RIR_{i}) + \gamma_3 (EG_{it} - EG_i)$$
$$+ \gamma_4 (RI * BF_{it} - RI * BF_{i}) + (\theta_{it} - \bar{\theta}_i)$$  (6)

### 3.4. Fixed effect (FE) vs. random effect (RE)

The random effect model considers $\gamma_i$ as a random variable, while $\gamma$ is the average value and is specified as follows:

$$\gamma_i = \gamma + \delta_i$$  (7)

All the variations or heterogeneity come from $\delta_i$ while $\gamma$ is the average value common for all. Following Equation (7), the random effect is written as:

$$PI_{it} = \gamma_i + \gamma_1 RI_{it} + \gamma_2 RIR_{it} + \gamma_3 EG_{it} + \gamma_4 RI * BF_{it} + \theta_{it}$$  (8)

where the error component $\theta_{it}$ has both components come from $\delta_i$ and $\theta_{it}$ and can be written as $\theta_{it} = \delta_i + \theta_{it}$; it is also called the idiosyncratic error term. Moreover, $\theta_{it}$ is not correlated with independent variables. Further, to choose between fixed effect and random effect, a Hausman Test is employed. The null hypothesis supports the RE while the alternative prefers the FE Model for the analysis (Gujarati, 2009).

$$HT = (\hat{\gamma}^{FE} - \hat{\gamma}^{RE})' \left[ Var(\hat{\gamma}^{FE}) - Var(\hat{\gamma}^{RE}) \right]^{-1} (\hat{\gamma}^{FE} - \hat{\gamma}^{RE}) \sim \chi^2(k)$$  (9)

These methods are applicable if there is no problem with stationarity in the data. In the next section, the stationarity of each variable is tested through unit root tests; if any issue of stationarity is found, then another appropriate method will be applied.

### 3.2. Panel autoregressive distributive lags model (PARDL)

The methodology of the pooled mean group proposed by (Pesaran & Smith, 1995) addresses the problem of heterogeneous slopes, especially in dynamic panels, causing bias in the results. Moreover, the mean group (MG) estimator long-run parameters...
are provided for the panel by taking an average of the long-run parameters through the autoregressive distributive lags model (ARDL) for each country. The given model is as follows:

\[ Y_{it} = \alpha_i + \pi_i y_{i,t-1} + \theta_i Z_{it} + \mu_{it} \]

In this model, ‘i’ denotes the number of countries/cross sections such as \( i = 1, 2, 3, 4, 5 \) and ‘t’ means time period.

The long-run parameter for the model follows as:

\[ \gamma_i = \frac{\theta_i}{1 - \pi_i} \]

Moreover, for the mean group (MG) estimator for the complete Panel we have,

\[ \hat{\gamma} = \frac{1}{N} \sum_{i=1}^{N} \gamma_i \]
\[ \hat{\alpha} = \frac{1}{N} \sum_{i=1}^{N} \alpha_i \]

The above-written equations show how regression for each cross-section can be estimated by the model and the unweighted averages of the coefficients without any restrictions as it follows the heterogeneity of coefficients both in the short-run and long-run. Moreover, the model requires data with a large time series dimension to have validity and consistency. In contrast, the method of PMG has been employed to find the short and long-run relationship between remittances and private investment for five different cross sections by taking into account the issue of dynamic heterogeneity; to address this issue, a panel ARDL model in ECM form is employed and estimated on the basis of the MG model developed by Pesaran, Shin, and Smith (1999) and Fromentin (2017). An ARDL specification follows:

\[ PI_{it} = \sum_{j=1}^{p-1} \pi^j_{PI}(PI_{i,t-j}) + \sum_{j=0}^{q-1} \varphi^j_{PI}(Z_i)_{t-j} + \varphi^j[PI_{i,t-1} + \omega_i + \mu_{it} \]

The \((Z_i)_{t-j}\) is \(K\) by \(1\) vector containing all the explanatory variables for each ‘i’; the term \(\omega_i\) shows the fixed effect. If the panel is unbalanced, then there is a possibility that \(p\) and \(q\) differ across cross sections. Now extending the model to Vector Error Correction (VECM) form:

\[ \Delta PI_{it} = \gamma_i(PI_{i,t-j} - \theta_i Z_{i,t-j}) + \sum_{j=1}^{p-1} \Delta \pi^j_{PI}(PI_{i,t-j}) \]
\[ + \sum_{j=0}^{q-1} \varphi^j_{PI} \Delta(Z_i)_{t-j} + \varphi^j[PI_{i,t-1} + \omega_i + \mu_{it} \]

In the above-given model, \(\theta_i\) refers to long-run parameters while \(\gamma_i\) shows the error correction mechanism (ECM) towards equilibrium. Moreover, PMG considers
the $\theta$ element the same across each cross section (countries):

$$ \Delta PI_{it} = \gamma_1 (PI_{i,t-j} - \theta_1 Z_{i,t-j}) + \sum_{j=1}^{p-1} \Delta \pi_j (PI_{i,t-j}) + \sum_{j=0}^{q-1} \phi_j \Delta (Z_{i,t-j}) + \phi_0 (PI_{i,t-1}) + \omega_i + \mu_{it} $$

The term $PI$ shows private investment, $Z$ contains all the explanatory variables such as remittances inflow (RI), and real-interest rate by (RIR); EG is the economic growth, the multiplicative variable jointly of business freedom is (BF) and the remittance inflow is given by RI*BF. Moreover, $\pi$ and $\phi$ show the short-run coefficient and $\theta$ is the long-run coefficient for independent and dependent variables. The term ‘$\gamma$’ is the speed of adjustment towards long-run equilibrium. The bracket terms are for the long-run growth regression.

The decision to use MG or PMG is made on the basis of the Hausman test. The null hypothesis supports the PMG while the alternative hypothesis supports the MG model. Moreover, if the alternative hypothesis is accepted, then the dynamic fixed model (DFE) may also be applied and should be compared in the same way, through the Hausman test with MG.

More formally, the PARL methodology can be as follows:

$$ \Delta PI_{it} = a + \beta_1 \sum_{i=1}^{p} \Delta PI_{i,t-i} + \beta_2 \sum_{i=1}^{p} \Delta RI_{i,t-i} + \beta_3 \sum_{i=1}^{p} \Delta RIR_{i,t-i} + \beta_4 \sum_{i=1}^{p} \Delta EG_{i,t-i} + \beta_5 \sum_{i=1}^{p} \Delta RF_{i,t-i} + \lambda_1 \Delta PI_{i,t-i} + \lambda_2 \Delta RI_{i,t-i} + \lambda_3 \Delta RIR_{i,t-i} + \lambda_4 \Delta EG_{i,t-i} + \lambda_5 \Delta RF_{i,t-i} + \mu_{it} $$

(10)

‘$\beta_0$’ shows the drift, while ‘$\mu$’ specifies a white noise error term. Furthermore, the term with summation sign implies the error correction dynamics. First, the equation shows the short run while the second part is for long-run association. To get panel ARDL results, optimum lags should be selected using BIC, AIC and HQ criteria, and then after optimum lags, long-run relations are computed by using Equation (10):

$$ PI_{it} = a + \beta_0 \sum_{i=1}^{p} PI_{i,t-i} + \beta_1 \sum_{i=1}^{p} RI_{i,t-i} + \beta_2 \sum_{i=1}^{p} RIR_{i,t-i} + \beta_3 \sum_{i=1}^{p} EG_{i,t-i} + \beta_4 \sum_{i=1}^{p} RF_{i,t-i} + \beta_5 \sum_{i=1}^{p} RI*BF_{i,t-i} + \mu_{it} $$

(11)

If the long-run relationship is reported, then error correction mechanism should be used for the short-run relationship through Equation (11):
\[ \Delta PI_{it} = \alpha_0 + \beta_1 \sum_{i=1}^{p} \Delta PI_{i, t-i} + \beta_2 \sum_{i=1}^{p} \Delta RI_{i, t-i} + \beta_3 \sum_{i=1}^{p} \Delta RIR_{i, t-i} + \beta_4 \sum_{i=1}^{p} \Delta EG_{i, t-i} + \beta_5 \sum_{i=1}^{p} \Delta R * BF_{i, t-i} + \lambda ECM_{it-1} + \mu_{it} \]

The term ‘\( \lambda \)’ means adjustment speed or convergence towards equilibrium.

4. Interpretations and discussion

This section of the study addresses and discusses the interpretations of significant findings. It contains results obtained from pooled OLS, the fixed effect within group estimator (FEWGE), fixed effect (FE), random effect (RE), the Hausman test (HT), unit root tests, optimum lag criteria, cross-sectional dependency, long-run, and short-run coefficients, and mean group and pool mean group. Preceding with panel ARDL requires us to test the stationarity of all the variables of interest to avoid any misleading results using wrong techniques. To achieve this goal, a unit root test was applied to report the order of integration of each variable and to design methodology accordingly. To test stationarity of the data, two unit root tests such as Im, Pesaran, and Shin (2003) and Levin, Lin, and Chu (2002) were used, both with their specific characteristics and dealing with heterogeneity in the panel data.

Table 3 reports hypothesis testing results. Hypothesis testing is useful in specifying the model and also helps to find the relevant variables, which affects the dependent variable. The results show that remittances inflow and Economic Growth positively and statistically significantly affect private investment in the case of the five sampled countries. On the other hand, real-interest rate and multiplicative term of remittances inflow and business freedom negatively and statistically significantly affect private investment in the case of India, Pakistan, Nepal, Bangladesh, and Sri Lanka. In the next section, based on Hypothesis testing, pooled OLS, FEWGE, FE, RE, and the Hausman test are employed.

Table 4 reports result obtained from pooled OLS, FEWGE, FE and RE. The results show that both remittances inflow and economic growth in case of pooled OLS, FEWGE, FE and RE positively and statistically significantly affect private investment for Pakistan, Sri Lanka, Nepal, India, and Bangladesh. A one percent increase in remittances inflow causes private investment to increase by 0.036%, 0.030%, 0.11%, and 0.035%, respectively, with a 1% and 5% significance level; coefficients for RI are positive and statistically significant in all methods. The results support (Akter, 2016; Cherono, 2013; Das, 2009; Griffith et al., 2008; Le, 2011; Malik, 2013; Mehra & Singh, 2014; Okodua & Olayiwola, 2013; Thagunna & Acharya, 2013; Yasmeen et al., 2011) findings, who reported that remittances inflow and economic growth promote private investment in the recipient countries. Remittances played an essential role in the financial development of a country. These findings suggest that remittances inflow help to expand and provide the required level of capital for investment.
The utilisation of remittances inflow is vital, as if it is utilised and appropriately channelised, then it will have a positive effect on small and medium enterprises (Woodruff & Zenteno, 2007).

The effect of remittances inflow on business freedom has a negative and statistically insignificant effect at 1%, 5%, and 10%, which is similar to Muhammad, Lakhan, Zafar, and Noman (2013) and Wuhan and Khurshid (2015) who reported that business freedom is an essential factor for promoting private investment in these sampled remittances recipient countries. The findings further revealed that a business-friendly environment is crucial for attracting private investment through remittances inflow. The more there is freedom to invest, the higher the positive effect on the economy. The real-interest rate, as expected, negatively affects private investment in the cases of India, Pakistan, Sri Lanka, Bangladesh, and Nepal. Moreover, to select between the fixed effect and random effect models, the Hausman test is employed; the test value prefers the fixed effect over the random effect model as its value is significant at 5% supporting the alternative hypothesis. In the next section, unit root tests are employed to trace the stationarity of the data, if a stationarity problem is found then the panel ARDL model should be used.

Table 3. Hypothesis Testing for each variable.

| Variable               | Hypothesis | T-test (p-value) | F-test (p-value) | Accepted Hypothesis/Sgn |
|------------------------|------------|-----------------|-----------------|-------------------------|
| Remittances Inflow     | $H_0: \gamma_1 = 0$ $H_1: \gamma_1 \neq 0$ | 3.0232 [0.0031] | 9.1401 [0.0031] | $H_1: \gamma_1 > 0$    |
| Economic Growth        | $H_0: \gamma_2 = 0$ $H_1: \gamma_2 \neq 0$ | 3.82 [0.0002]  | 14.66 [0.0002]  | $H_1: \gamma_2 > 0$    |
| Real-Interest Rate     | $H_0: \gamma_3 = 0$ $H_1: \gamma_3 \neq 0$ | -1.772 [0.0793] | 3.14 [0.0793]   | $H_1: \gamma_3 < 0$    |
| Remittances*Business Freedom | $H_0: \gamma_4 = 0$ $H_1: \gamma_4 \neq 0$ | -0.991 [0.3204] | 0.991 [0.3204]  | $H_1: \gamma_4 < 0$    |

Note: values contain in [ ] indicate p-values, ***, **, * shows level of significance at 1%, 5% and 10%.

Table 4. Panel data analysis.

| Variables               | Pooled OLS | FEWGE | FE | RE |
|-------------------------|------------|-------|----|----|
| Remittances Inflow      | 0.03615    | 0.03072 | 0.11248 | 0.035028 |
|                         | (0.011960) | (0.01210) | (0.01079) | (0.012620) |
| Economic Growth         | 0.04091    | 0.0440  | 0.02805 | 0.04120  |
|                         | (0.04091)  | (0.01051) | (0.00590) | (0.011279) |
| Real-Interest Rate      | -0.00802   | -0.00831 | -0.00132 | -0.000755 |
|                         | (0.00453)  | (0.004584) | (0.00296) | (0.00481) |
| Remittances*Business Freedom | -0.000070  | -0.008636 | -0.005964 | -0.0060347 |
|                         | (0.000007) | (0.09371) | (0.07826) | (0.09944) |
| Constant                | 2.3492     | -      | 1.05556 | 2.7020   |
|                         | (0.24692)  | (0.48266) | (0.48266) | (0.69786) |
| Hausman test            | -          | -      | 10.750 | 0.0295   |

() contain standard error, [ ] contain p-values, FEWGE (Fixed Effect within Group Estimation), FE (Fixed Effect), RE (Random Effect), OLS (Ordinary Least Square).

utilisation of remittances inflow is vital, as if it is utilised and appropriately channelised, then it will have a positive effect on small and medium enterprises (Woodruff & Zenteno, 2007).

The effect of remittances inflow on business freedom on private investment is negative, however, and statistically insignificant at 1%, 5% and 10%, which is similar to Muhammad, Lakhan, Zafar, and Noman (2013) and Wuhan and Khurshid (2015) who reported that business freedom is an essential factor for promoting private investment in these sampled remittances recipient countries. The findings further revealed that a business-friendly environment is crucial for attracting private investment through remittances inflow. The more there is freedom to invest, the higher the positive effect on the economy. The real-interest rate, as expected, negatively affects private investment in the cases of India, Pakistan, Sri Lanka, Bangladesh, and Nepal. Moreover, to select between the fixed effect and random effect models, the Hausman test is employed; the test value prefers the fixed effect over the random effect model as its value is significant at 5% supporting the alternative hypothesis. In the next section, unit root tests are employed to trace the stationarity of the data, if a stationarity problem is found then the panel ARDL model should be used.

Table 5 Before applying mean group or alternatively, PMG, as panel ARDL, unit root tests are used to check the order of integration of the variables. Further, it is tested that none of the variables is of order I(2) as then F-statistics values are not valid anymore (Pesaran, Shin, & Smith, 2001). Im et al. (2003) and Levin et al. (2002)
Table 5. Unit root results.

| Variables                  | Test Name       | Coefficient (p-Value) | Coefficient (p-Value) | I(0) | I(1) |
|----------------------------|-----------------|-----------------------|-----------------------|------|------|
| Private Investment (PI)    | Levin, Lin & Chu| −3.13768 [0.0009]    | −7.94693 [0.0000]    | I(0) | I(1) |
|                            | Im, Pesaran and Shin| −0.64124 [0.2607]    | −8.46732 [0.0000]    | −    | I(1) |
| Remittances Inflow (RI)    | Levin, Lin & Chu| −1.22001 [0.1112]    | −5.17395 [0.0000]    | −    | I(1) |
|                            | Im, Pesaran and Shin| 1.89929 [0.9712]     | −4.94508 [0.0000]    | −    | I(1) |
| Real-Interest Rate (RIR)   | Levin, Lin & Chu| −1.50684 [0.0659]    | −6.69218 [0.0000]    | I(0) | I(1) |
|                            | Im, Pesaran and Shin| −1.67374 [0.0471]    | −6.55298 [0.0000]    | I(0) | I(1) |
| RI*Business Freedom        | Levin, Lin & Chu| 0.92127 [0.8215]     | −8.57943 [0.0000]    | −    | I(1) |
|                            | Im, Pesaran and Shin| 0.73163 [0.7678]     | −7.83519 [0.0000]    | −    | I(1) |
| Economic Growth (EG)       | Levin, Lin & Chu| −7.25263 [0.0000]    | −                    | I(0) | −    |
|                            | Im, Pesaran and Shin| −6.27314 [0.0000]    | −                    | I(0) | −    |

Note: values contain in [ ] indicate p-values.

Table 6. Lags selection procedure.

| Model | AIC          | BIC          | HQ            | Lags         |
|-------|--------------|--------------|---------------|--------------|
| 1     | −3.349287    | −2.658567    | −2.839591     | ARDL(1, 1, 1, 1) |
| 2     | −3.328015    | −2.331663    | −2.930558     | ARDL(2, 1, 1, 1) |

reported in Table 5 verifying that variables in the model are mixed in order of integration i.e., I (1), I (0), I (1), I (1), I (1) and hence permit the possibility of employing a panel autoregressive distributive lag model (PARDL) to find the long-run coefficients and using an error correction mechanism (ECM) to get the short-run coefficients of the model.

The cross-sectional dependency test; the results support an alternative hypothesis of cross-sectional dependency. The next step is to select the optimum lags order of integration to specify the model accordingly and to ensure accurate results; without selecting the optimum lag order, it is difficult to get efficient results. There are different tests for the selection of optimum lags, which include Bayesian information criterion (BIC), Akaike information criterion (AIC), and Hannan-quinn criterion (HQ). Each of these tests has its specific characteristics that differentiate one from the other (Gujarati & Porter, 1999). However, this study uses all three criteria to reach a solid consensus and to get more efficient results. The model selected by AIC, BIC and HQ have the same optimum lags in our analysis.

Results reported in Table 6 show that we have to follow the model with one lag for each variable in our analysis, i.e., PARDL (1, 1, 1, 1); lags order has been selected by taking the minimum value of AIC, BIC, and HQ. As in this case, minimum values are reported as −3.349, −2.658 and −2.839, respectively. In the next section, long-run results are presented, followed by short-run results, and then the Hausman test is employed to select between MG and PMG.

The long-run results given in Table 7 correspond to the previous reported results of Okodua and Olayiwola (2013), Griffith et al. (2008), Malik (2013), Le (2011), Das (2009), Thagunna and Acharya (2013), Yasmeen et al. (2011), Mehra and Singh (2014), Akter (2016), and Cherono (2013) who stated that remittances inflow positively affects private investment as well as education, health care, and other spendings; recipient households also devote remittances to investment. Similarly, Table 7 shows that the results confirm that a one percent increase in remittances inflow increases private investment by 0.088% in the cases of selected South Asian
In the long run, the results revealed that remittances inflow played an important role in increasing private and this is because the capital requirement to the businesses is covered through remittances inflow. In the case of selected South Asian economies, remittances inflow is helpful in formation of capital and job creation for the migrant’s families back home. The current findings are also in line with the view of optimistic theory (1950–1960) of migration which advocates that remittances play a constructive role by encouraging private investment.

Further, our analysis suggests that economic growth supports private investment and has a positive relationship with private investment, verifying that a one percent increase in economic growth causes a 0.16 increase in private investment. On the other hand, interactive variables, business freedom, and remittances influx have a negative relationship with private investment in the case of Nepal, Bangladesh, Pakistan, India, and Sri Lanka; these findings support (Muhammad et al., 2013; Wuhan & Khurshid, 2015) who found that business freedom is necessary for promoting private investment. However, the analysis found a negative relationship between real-interest rate and investment in the private sector in these economies (Muhammad et al., 2013; Wuhan & Khurshid, 2015).

Table 8 reports the short run findings; it is found that remittances do not have a statistically significant relationship with private investment in the short run, though it affects remittances positively. One possible reason for the lack of a statistically significant relationship in these countries is that in the initial stages of migration, migrants are trying to stabilise their level of consumption. In the initial stages, recipients spend more on necessities, such as shelter, food, and water, before they settle down and proceed towards financial stabilisation. In the stabilised stage, the recipients start saving and then convert those savings to investment in the long run, which is supported in our findings in Table 7. In the short run, the other variables respond in the same manner as in the long run except for the interaction between business freedom and remittances inflow. The error

Table 7. Long-run PMG/PARDL Coefficients.

| Variables | Coefficient | Std. Error | t-Statistic | p-values |
|-----------|-------------|------------|-------------|----------|
| RM        | 0.088397**  | 0.028694   | 3.080649    | 0.0030   |
| EG        | 0.168276**  | 0.013923   | 2.246703    | 0.0281   |
| RM*BF     | –0.345502***| 0.099321   | –3.47863    | 0.0010   |
| RIR       | –0.032945***| 0.007628   | –4.31895    | 0.0001   |

Note: ***, **, and * shows level of significance at 1%, 5% and 10% correspondingly.

Table 8. ECM short-run coefficients.

| Variable  | Coefficient | Std. Error | t-Statistic | p-values |
|-----------|-------------|------------|-------------|----------|
| C         | 0.671517**  | 0.226218   | 2.968451    | 0.0042   |
| D(RM)     | 0.000198    | 0.073060   | 0.002704    | 0.9979   |
| D(EG)     | 0.006937    | 0.019918   | 0.348283    | 0.7288   |
| D(RMTBFLN)| 0.063582    | 0.127682   | 0.497971    | 0.5631   |
| D(RIR)    | –0.007562*  | 0.004261   | –1.77470    | 0.0689   |
| λ         | –0.266190***| 0.086886   | –3.063653   | 0.0032   |

Note: ***, **, and * shows level of significance at 1%, 5% and 10% correspondingly.
correction mechanism (ECM) term ‘λ’ reports the speed of adjustment towards long-run equilibrium or the convergence towards long-run equilibrium. At every year, 26% adjustment takes place.

The Hausman test has been used to select between the mean group and pooled mean group. Before the Hausman test, both MG and PMG models were used, and the Hausman test decides which one to use. Similarly, Table 9 reports that the findings of the Hausman test suggest using PMG over MG, which allows testing the short-run and the long-run relationship inflow of remittances and investment. Pooled mean group analysis is superior to mean group analysis as it allows heterogeneous short-run coefficients, intercept and cointegrating coefficients to vary for each cross section (country) (Pesaran et al., 1999).

5. Conclusion

This study analysed how remittances inflow affects private investment for South Asian economies from data collected from 1990 to 2016. This study employed different econometric tests, including pooled OLS, the fixed effect within group estimator (FEWGE), fixed effect (FE) and random effect (RE) to report the relationship between Remittances Inflow and Private Investment.

Further, to check the long-run and the short-run relationship between private investment and remittances inflow pooled mean group (PMG) analysis was employed. Prior to PMG, Im et al. (2003) and Levin et al. (2002) were used for testing the unit root problem in the data and was followed by Bayesian information criterion (BIC) Hannan-Quin criterion (HQ) and Akaike information criterion (AIC) tests for selecting the optimum lag structure of the model. Similar to earlier studies, the current study also found a positive effect of remittances inflows on private investment in the context of India, Sri Lanka, Bangladesh, Pakistan, and Nepal.

The results reported in this study are also consistent with the findings of earlier work on the current issue for different countries, regions and time periods by Mehra and Singh (2014), Das (2009), Cherono (2013), Thagunna and Acharya (2013), Yasmeen et al. (2011), Okodua and Olayiwola (2013), Ullah et al. (2015), Akter (2016), Le (2011), Griffith et al. (2008), and Malik (2013). Moreover, the long-run relationships for other variables such as economic growth, remittances inflow, and business freedom interaction and real-interest rate were also reported. An error correction mechanism (ECM) confirmed the short-run relationship between other variables and private investment. The negative relationship between the interactive variable (remittances inflow and business freedom) is due to that fact that these five

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**Table 9. Hausman test results.**

| Variables (A) | MG   | PMG  | (A – B) Difference | Sqrt(diag(V_A–V_B)) S.E. |
|--------------|------|------|--------------------|--------------------------|
| RI           | 0.677687 | 0.088397 | 0.58929            | 0.7054                   |
| EG           | −0.0076892 | 0.168276 | −0.17596           | 0.1076                   |
| RIR          | −0.0198792 | −0.345502 | 0.32562            | 0.0286                   |
| RM*BF        | −0.1978921 | −0.032945 | −0.16494           | 23.872                   |

Chi – Square = 0.21 Prob > chi – Square = 0.8346
sampled countries are underdeveloped countries and not very business friendly due to complex bureaucracy. Barriers, such as obtaining a license, cost of starting a business and the minimum level of capital required, are the key constraints to business freedom; this is why there was an inverse relationship between both. Studies by Imtiaz and Bashir (2017) and Amponsem (2017) also reported the need for a business-friendly environment for gaining investors’ interest in the case of South Asian countries. The findings of this study also support the optimistic theory (1950–1960) of migration, advocating that remittances play a supportive role in encouraging investors and promoting investment. Pakistan, India, Bangladesh, Sri Lanka, and Nepal need to channelise remittances inflow and should develop strong financial systems to seize the benefit of remittances inflow fully. In addition, they should make business licenses easily available, lower restrictions on new businesses, reduce the cost for starting a new business and keep the interest rate at a minimum level to compensate investors in these five major South Asian remittances recipient countries.

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ORCID

Zeeshan Khan http://orcid.org/0000-0003-1374-0836
Manzoor Ahmad http://orcid.org/0000-0002-1152-2096
Yang Siqun http://orcid.org/0000-0001-6539-7289

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