Remittances and Economic Growth: Empirical Evidence from Bangladesh

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Abstract
The objective of this paper has been to investigate the causal relationship between remittances and economic growth in Bangladesh over the period 1972/73 to 2014/15. A stable, long-run relationship is found between the two variables on the basis of cointegration test. Furthermore, a one-way causation from remittances to economic growth is also observed through the Error Correction Model (ECM). The analysis indicates a positive impact of remittances on economic growth. As a policy suggestion, an appropriate environment for investing the remitted money must be created. Besides, a reliable and rapid remittances transaction system should also be developed so that the emigrants are encouraged to send money through the 'formal' channel.
Keywords: Remittance, Economic Growth, Coitegration, Error Correction Model, Bangladesh.

1. Introduction

It is commonly believed that remittances sent by the emigrants as foreign exchange to their family members are mostly spent on consumption goods as opposed to investment. Therefore remittances do not have any significant impact on economic growth and the relationship between the two is not studied frequently. However, remittances have become an important source of foreign exchange earnings from developed to developing countries which helps the recipient country in achieving a higher growth rate. In order to minimize the problem of shortages of foreign exchanges, remittance flows greatly assist the countries which suffer from such a problem.

A number of studies have been undertaken to assess the impact of remittances on economic growth. Jongwanich (2007) examined the impact of workers' remittances on growth and poverty reduction in developing Asia-Pacific countries using panel data over the period 1993-2003. The results suggests that, while remittances do have a significant impact on poverty reduction through increasing income, smoothing consumption and easing capital constraints of the poor, they only have a marginal impact on growth operating through domestic investment and human capital development. Fayissa and Nsiah (2008), explored the aggregate impact of remittances on economic growth for 37 African countries. Remittances were found to boost growth in countries with less developed financial systems by providing an alternative way to finance investment and helping overcome liquidity constraints. Using dynamic panel, Catrinescu et al. (2006) found remittances to exert positive impact on long-term macroeconomic growth in 162 countries over a period of 34 years. Similarly, using panel data from 1980-2004 in 39 developing countries, Pradhan et al.(2008) showed remittances to exert a positive impact on growth.

On the contrary, a number of studies either found limited support or no impact of remittances on economic growth. Barajs et al. (2009) found remittances to have no impact on promoting long-run economic growth in the remittance recipient countries. On the basis of two stage least squares (2sls), remittances were found to have no direct positive impact on economic growth in Sub-Saharan Africa during the period 1980-2004. However, remittances had indirect positive impact on growth through several channels such as investment and education (Balde, 2009). Ahmed and Uddin (2009) observed the causal nexus between export, import, remittance and GDP growth for Bangladesh during 1976-2005. The study found limited support in favour of the export-led growth hypothesis for Bangladesh, as exports, imports, and remittances cause GDP growth only in the short run. Feeny et al. (2014) found positive association between remittances and growth in the Small Island Developing States (SIDS) in Sub-Saharan Africa and the Pacific but not for those located in Latin America and the Caribbean. Moreover, the study also presents evidence of negative growth in the absence of remittances receipts in Pacific SIDS. Siddique et al. (2010) investigated the causal link between remittances and economic growth in Bangladesh, India, and Sri Lanka by employing the Granger Causality test under a VAR framework. Growth in remittances was found to lead to economic growth in Bangladesh whereas it had no effect on growth in India. Moreover, a two way causality between remittances and economic growth had been observed for Sri Lanka. Based on panel data regression, Zuniga (2011) investigated the impact of remittances in developing countries using panel vector auto regression. Remittances are found to have a positive impact on economic growth in Eastern Europe, the Americas, and Asia. However, it does not contribute significantly to economic growth in African economies.

In relation to remittances and economic growth, it is worth searching for if remittances cause economic growth or vice versa. The objective of this paper is to investigate the causal relationship between remittances and economic growth in Bangladesh for the period 1972/73 to 2014/15.The study proceeds as follows. Section 2 presents the data. The methodology and empirical results are provided in sections 3 and 4 respectively. Finally, conclusions and policy recommendations are drawn in the last section.

2. Data

This study is based on annual data covering the period from 1972/73 to 2014/15. Data on remittances (*R*) has been obtained from various issues of Economic Trends published by the Bangladesh Bank (BB). Economic growth (*G*) refers to real per capita GDP. Real GDP (RGDP) is obtained by dividing GDP at current market price by the Consumer Price Index (CPI). After obtaining RGDP, it has been converted to per capita terms. Data on GDP, CPI (Base: 1995-96 = 100) and Population of Bangladesh are gathered from different issues of Statistical Yearbook of Bangladesh, published by the Bangladesh Bureau of Statistics (BBS). *R* and GDP are expressed in terms of Taka (Domestic Currency of Bangladesh) in Crores[1]. Econometric estimations have been done using EViews 7.

3. Methodology

3.1 Unit Root

The econometric methodology first examines the stationarity properties of the time series. Two procedures for detecting a unit root in remittances and economic growth are used in our analysis: (i) The Dickey-Fuller (DF) test (Dickey and Fuller, 1979), and (ii) the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1981). The DF test is derived from the regression equation:

$$Z_t = \chi_0 + \chi_1 t + \sigma Z_{t-1} + \omega_t \qquad -1 \le \sigma \le 1 \tag{3.1}$$

where, Z_t is a random walk with drift around a stochastic trend and ω_t is a white noise error term. If $\sigma = 1$, then Z_t is nonstationary. Alternatively, we can estimate the model:

$$\Delta Z_t = \chi_0 + \chi_1 t + \phi Z_{t-1} + \omega_t \tag{3.2}$$

where $\phi = (\sigma - 1)$, Δ is the first difference operator and test the null hypothesis that $\phi = 0$. If $\phi = 0$, $\sigma = 1$, we have a unit root, implying that the time series under consideration is nonstationary. The ADF test is undertaken by adding lagged values of the dependent variable ΔZ_t if the error terms are correlated.

Thus, the following regression is estimated for unit root testing:

$$\Delta Z_t = \chi_0 + \chi_1 t + \phi Z_{t-1} + \beta_j \sum_{j=1}^{p} \Delta Z_{t-j} + \varepsilon_t \tag{3.3}$$

In model (3.3) Z_t is a random walk with drift around a stochastic trend, Δ is the first-difference operator, ε_t is a white noise error term and p is the number of lags in the dependent variable. The null hypothesis of a unit root implies that the coefficient of Z_{t-1} is zero i.e., $\phi = 0$. Rejection of the null hypothesis implies that the series is stationary and no differencing in the series is necessary to induce stationarity. The number of lags in the dependent variable is chosen by the Akaike Information Criterion (AIC). Unit root test identifies whether the variables are stationary or nonstationary. The test is applied on both the original series (in logarithmic form) and to the first differences. In addition, both models with and without trend are tried.

3.2 Cointegration Test

Time series should to be checked for cointegration. For two or more variables to be cointegrated, the time series must have similar statistical properties i.e., they must be integrated of the same order. The Engle-Granger two-step method (Engle and Granger, 1987) is used for this purpose. The order of integration of the variables is identified in the first step while in the second step the residuals are estimated from the Ordinary Least Squares (OLS) regression on the levels of the variables. The following cointegration equations are estimated:

$$X_t = \varsigma + \tau Y_t + e_t \tag{3.4}$$

$$Y_t = \upsilon + \xi X_t + e_t' \tag{3.5}$$

X and Y will be cointegrated if they are integrated of the same order i.e., I(*d*) and the residuals from the cointegration equations (e_t and e_t') are integrated of order less than *d*.

The presence of a long-run equilibrium relationship between two variables X and Y is also tested through Johansen (1988) maximum likelihood procedure. In Johansen's procedure X and Y is assumed to follow the first order Vector Auto Regressive (VAR) representation as follows:

$$X_t = \Pi_{11} X_{t-1} + \Pi_{12} Y_{t-1} + \varepsilon_{Xt} \tag{3.6}$$

[1] 1 Crore = 10 Million.

$$Y_t = \Pi_{21} X_{t-1} + \Pi_{22} Y_{t-1} + \varepsilon_{Yt} \qquad (3.7)$$

Subtracting lagged dependent variables from the respective equations, the system can be written in matrix notation as follows:

$$\begin{bmatrix} \Delta X_t \\ \Delta Y_t \end{bmatrix} = \begin{bmatrix} \Gamma_{11} & \Gamma_{12} \\ \Gamma_{21} & \Gamma_{22} \end{bmatrix} \begin{bmatrix} X_{t-1} \\ Y_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{Xt} \\ \varepsilon_{Yt} \end{bmatrix}$$

where $\Gamma_{11} = \Pi_{11}-1$, $\Gamma_{22} = \Pi_{22}-1$, $\Gamma_{12} = \Pi_{12}$ and $\Gamma_{21} = \Pi_{21}$ and X_t and Y_t are first difference stationary i.e., I(1). The existence of a cointegrating relationship depends on the rank of the matrix Γ which must be equal to one as there can be up to one linearly independent cointegrating vectors. The number of non-zero characteristic roots of the Γ matrix is used to test the rank condition. Johansen's procedure gives two likelihood ratio tests for the number of cointegrating vectors (r) which are found by the trace and the maximum eigen value tests as follows:

$$\lambda_{trace(r)} = -N \sum_{i=r+1}^{k} \ln(1 - \hat{\lambda}_i) \qquad (3.8)$$

$$\lambda_{\max(r,r+1)} = -N \ln(1 - \hat{\lambda}_{r+1}) \qquad (3.9)$$

where, λi's are the characteristic roots of the matrix Γ and N is the sample size. The null hypothesis of at most r cointegrating vectors is tested in both the trace test as well in the maximum eigen value test. In the trace test, the alternative hypothesis is that the number of cointegrating vectors is equal to or less than r +1, whereas it is equal to r +1 in the maximum eigen value test.

3.3 Granger Causality Test

If cointegration exists between two variables, then standard Granger causality test cannot be used as it ignores the possible long-run relationship. Vector error correction will be used to test for Granger causality direction. In spite of a long-run relationship between the variables, there may by disequilibrium in the short run. An error correction model (ECM) merges the long-run relationship with the short-run dynamics of the model in the presence of cointegrated variables. This approach consists in estimating the first difference of both the dependent and explanatory variables. According to Granger (1969), when X_t and Y_t are found to be cointegrated, the specification of ECM can be expressed as:

$$\Delta Y_t = \delta_0 + \rho_1 \mu_{t-1} + \sum_{i=1}^{n} \tau_i \Delta Y_{t-i} + \sum_{j=1}^{m} \upsilon_i \Delta X_{t-j} + w_t \qquad (3.10)$$

$$\Delta X_t = \delta_1 + \rho_2 \eta_{t-1} + \sum_{i=1}^{n} \sigma_i \Delta X_{t-i} + \sum_{j=1}^{m} \varsigma_j \Delta Y_{t-j} + \nu_t \qquad (3.11)$$

where Δ is the first difference operator, μ_{t-1} and η_{t-1} are the error correction terms which represents the lagged residuals from the cointegrating equations, n and m are the number of lag lengths chosen by the Akaike Information Criterion (AIC) and ν_t and w_t are the disturbance terms. The error correction terms μ_{t-1} and η_{t-1} measures the deviations of the series from the long-run equilibrium relations. In the above two equations, the series X_t and Y_t are cointegrated when at least one of the coefficients ρ_1 and ρ_2 is not zero. In addition, short-run dynamics between X_t and Y_t are characterized by the coefficients υ_j 's and ς_j 's. Causality may be determined by estimating equations (3.10) and (3.11) by testing the null hypothesis that $\upsilon_j = \varsigma_j = 0$ for all j's against the alternative hypothesis that $\upsilon_j \neq 0$ and $\varsigma_j \neq 0$ for at least some j's. The F-statistic is used to test the joint null hypothesis $\upsilon_j = \varsigma_j = 0$. X is said to Granger-cause Y not only if the coefficients υ_j 's are jointly significant but also if ρ_1 is significant. Similarly, Y is said to Granger-cause X not only if ς_j 's are jointly significant but also if ρ_2 is significant. If both υ_j and ς_j are significant then causality runs both way. Finally, X and Y are causally independent if υ_j and ς_j are not statistically different from zero. The t-statistic is used to test the significance of the error correction coefficients.

4. Empirical Results

The results in Table-1 indicate that in all cases, at the level remittances (*R*) and economic growth (*G*) are nonstationary. Thus to achieve stationarity the variables must be first-differenced. The DF and ADF statistics are significant only for the first-differenced series. Thus, the time series on remittances and economic growth appear to be I(1). The results reported in Table-1 provide the basis for the test of cointegration. The DF and ADF statistics for the cointegration tests are presented in Table-2. Thus, according to the Engle-Granger method, two variables, remittances (*R*) and economic growth (*G*) are considered to be cointegrated if they are integrated of the same order i.e., I(*d*) and the residuals in the regression of R_t on G_t (or vice versa) is integrated of order less than *d*. For example, R_t and G_t will be cointegrated if the residuals in the regression of R_t on G_t (and vice versa) is I(0) provided that $R_t \sim I(1)$ and $G_t \sim I(1)$. The results show that remittances and economic growth are cointegrated. The residuals of the cointegrating regressions are stationary indicating that deviations between remittances and economic growth reconcile together in the long-run.

Table-3 provides the results of the Johansen's maximum likelihood procedure for determining the number of cointegrating vectors r. The results show that the null hypothesis of no cointegration (r = 0) can be rejected . Therefore, it can be confirmed that remittances and economic growth are cointegrated. Table-4 reports the F-statistics and the t-statistics on the lagged ECM terms. The lagged changes in the independent variable represent the short-run causal impact while the error correction term gives the long-run impact. The F-statistic measures the short-run causation while the t-statistic on the lagged error correction terms indicates long-run causality. Both tests show that there exists unidirectional causality in the short as well as in the long run from remittances to economic growth.

5. Conclusions

The main aim of this paper has been to investigate the causal relationship between remittances and economic growth in Bangladesh over the period 1972/73 to 2014/15. For this investigation we use various time series econometric techniques such as unit root test, cointegration and Error Correction Model (ECM). The results imply that remittances and economic growth are both I(1) and cointegrated. The results further show a one-way causal relationship from remittances to economic growth on the basis of the Granger Causality test. In spite of low remittance spending on investment, even a small portion invested can help to alleviate the liquidity constraints and contribute to growth. This is especially undeniable for Bangladesh in the face of high unemployment pressure at home which can be alleviated through overseas employment. As a policy recommendation, there should be an appropriate environment for investment which will enable remittance recipients to utilize their funds into the productive sectors of the economy. Moreover, a reliable and rapid remittances transaction support is essential in discouraging the emigrants in remitting money through the 'informal' channel (Shams, 2012).

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Table 1
Unit Root Tests with DF and ADF for the period 1972/73 to 2014/15

	With Trend			
	DF		ADF	
Variables	Levels	First Difference	Levels	First Difference
R	-4.41	-2.91***	-3.21	-2.54***(1)
G	-5.61	-3.13***	-4.79	-3.62**(1)
	Without Trend			
	DF		ADF	
Variables	Levels	First Difference	Levels	First Difference
R	-3.71	-2.43***	-3.64(1)	-2.95***(1)
G	-3.63	-2.38***	-4.19(1)	-2.41***(1)

Notes: i) The DF and ADF tests are carried out by replacing Z_t with R_t and G_t in equations (3.2) and (3.3) respectively; (ii) Figures within parentheses indicate lag lengths chosen by the Akaike information criterion (AIC); iii) *** and ** denote rejection of the null hypothesis of unit root at the 1% and 5% levels respectively.

Table 2
Unit Root Rest for the Residuals'ω_t'

	With Trend		Without Trend	
Cointegrating Regressions	DF	ADF	DF	ADF
R_t = -12.43 + 4.29 G_{tt}	-0.61***	-0.79***(1)	1.41***	2.19***(1)
G_t = 3.24 +0.19 R_t	-4.01***	-3.20***(1)	-1.71***	-2.59***(1)

Notes: i) The Engle-Granger two-step method is undertaken by substituting X_t and Y_t by R_t and G_t in equations (3.4) and (3.5) respectively; ii) Figures within parentheses indicate lag lengths chosen by the Akaike information criterion (AIC); iii) The null hypothesis of unit root in the residuals can be rejected at the 1% level.

Table 3
Johansen's Maximum Likelihood Procedure

	Trace		λ-Max		
Null	r = 0	r ≤ 1	r = 0	r = 1	Number
Alternative	r ≤ 1	r ≤ 2	r = 1	r = 2	of lags (k)
R, *G*	23.99***	2.75	21.25***	2.75	3

Notes: i) The Johansen's maximum likelihood procedure is conducted by replacing X_t with R_t and Y_t with G_t in equations (3.6) and (3.7) respectively; ii) The lag lengths are chosen by Akaike's Final Prediction Error (FPE) criteria; iii) r denotes the number of cointegrating vectors; iv) The null hypothesis of no cointegration can be rejected at the 1% level.

Table 4
Granger Causality Test

Null Hypothesis	F- Statistic	t- Statistic
R does not Granger Cause G	6.58***	-4.68***
G does not Granger Cause R	0.438	-0.27

Notes: i) The Granger Causality test is performed by replacing X_t with R_t and, Y_t with G_t in equations (3.10) and (3.11) respectively; ii) *** denote rejection of the null hypothesis at the 1% level; iii) The optimal lag length has been considered to be 3 according to the Akaike information criterion (AIC).