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Does remittance drive economic growth in emerging economies: Evidence from FMOLS and Panel VECM

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Abstract. *The study investigates the dynamic relationship among remittances, export, exchange rate and economic growth in emerging (Brazil, Russian Federation, India, China and South Africa) economies using balanced panel data ranging from 1994-2013. Data for all variables have been extracted from World Bank Indicators in terms of US$. The Multivariate Panel Cointegration technique results demonstrate the existence of long run equilibrium relationships among observed variables. Employing the Fully Modified OLS Model (FMOLS), the study finds that remittances have significant negative impact on economic growth in Brazil, Russian Federation and India. However, remittances have significantly positive impact on economic growth in China. As a group FMOLS extends negative impact of remittances on economic growth across the selected emerging economies. Panel Vector Error Correction Model (PVCEM) has been adopted to show the long run and short run causality among the variables across the countries. The PVECM result reveals that there is a long-run causal relationship running from export and remittances to economic growth.*

Keywords: Remittance, economic growth, FMOLS, co-integration, panel VECM.

JEL Classification: E3, F24, F43.

1. Introduction

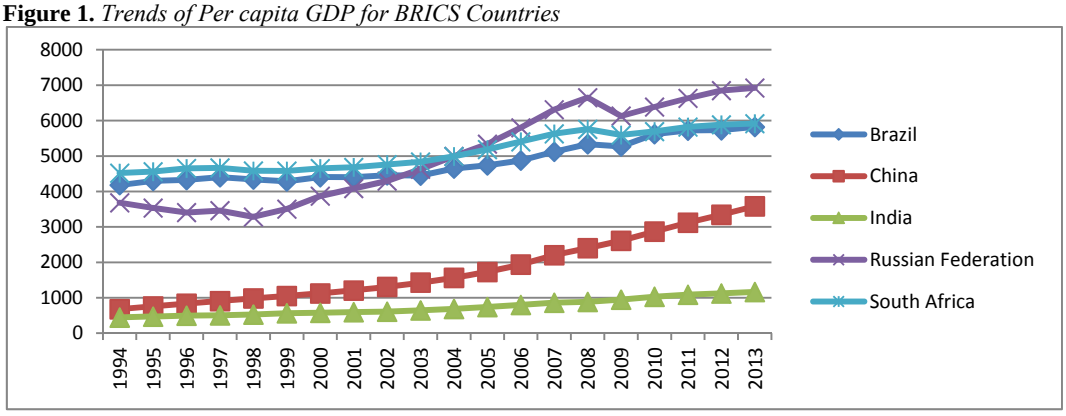
A long before there have been emerging debates on sources of economic growth of developing economies. Remittance is one of the major sources of economic growth that attracts academics, policy makers and researchers indicating their possible impacts on economic growth and development of developing countries. Many studies have made an attempt to show various sources of economic growth including the use of surplus labor, export rate, FDI and other external sources (Lewis, 1954; Myrdal, 1968; Harris-Todaro, 1970; Romer, 1986; Barro, 1991). Among all sources remittances have been considered as a major and consistent source of external income in developing countries. Primarily the role of remittances in the developing countries is to bridge the balance of payment (BOP) gap; and persistence of the better economic condition. Workers remittances have increased rapidly, growing more than FDI flows and Official Development Assistance in developing countries. Workers remittances in developing countries was US$280.8billion in 2009 and reached around US$400 billion in 2012 (World Bank, 2012). This paper tries to examine the short run and long run causality between remittances and economic growth in emerging (Brazil, Russian Federation, China and South Africa) countries. BRICS countries are major suppliers of migrant workers who are spread all over the world and contribute significantly their economic growth.

The study will be organized as follows the subsequent section provides the trends of remittances received, export rate, exchange rate and per capita GDP across the BRICS countries ranging from 1994 to 2013. In section 3, study discussed literature review on remittances and economic growth, section 4 reveals data sources sand variable description. Model specification, econometrics methodology and result are presented in section 5. Finally, conclusion and policy implication are presented in last section.

2. Trends of remittances, export rate, exchange rate and per capita GDP across BRICS

This section reports the trends of per capita GDP, export as percentage of GDP in US$, remittance received as percentage of GDP in US$ and exchange rate against US$ across the BRICS countries ranging from 1994 to 2013.

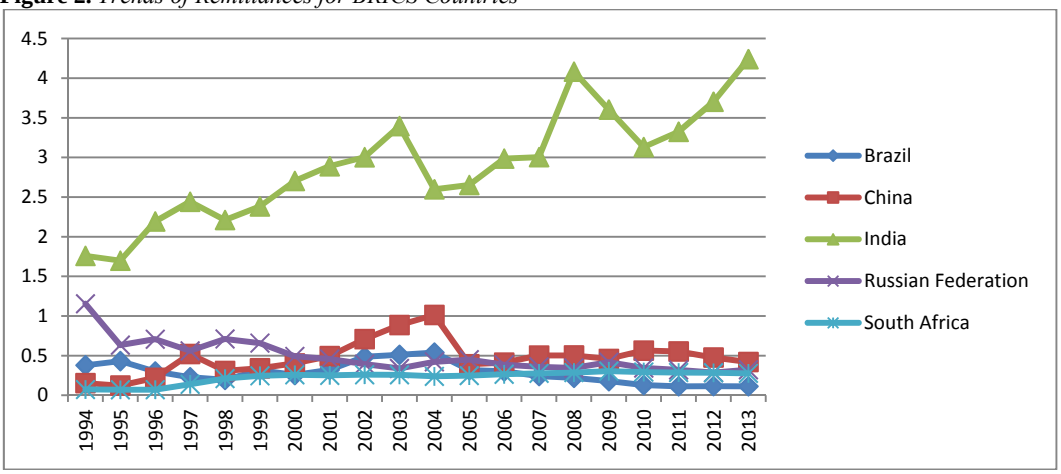
Figure 1. *Trends of Per capita GDP for BRICS Countries*



Source: Author's compilation using World Bank Data.

Figure 1 shows the per capita real GDP (US$) for BRICS countries year ranging from 1994 to 2013. The following figure depicts that, the trends of the growth rates are negatively affected from the economic global crisis in 2008 and the Asian crisis 1997. Except India and China; Brazil, Russian Federation and South Africa are the most affected countries from global financial crisis in 2008. The trends reveal that the growth rate was -1.21%, -2.88% and -7.79% for Brazil, South Africa and Russian Federation respectively during the period of 2008-2009.

Figure 2. *Trends of Remittances for BRICS Countries*(1)

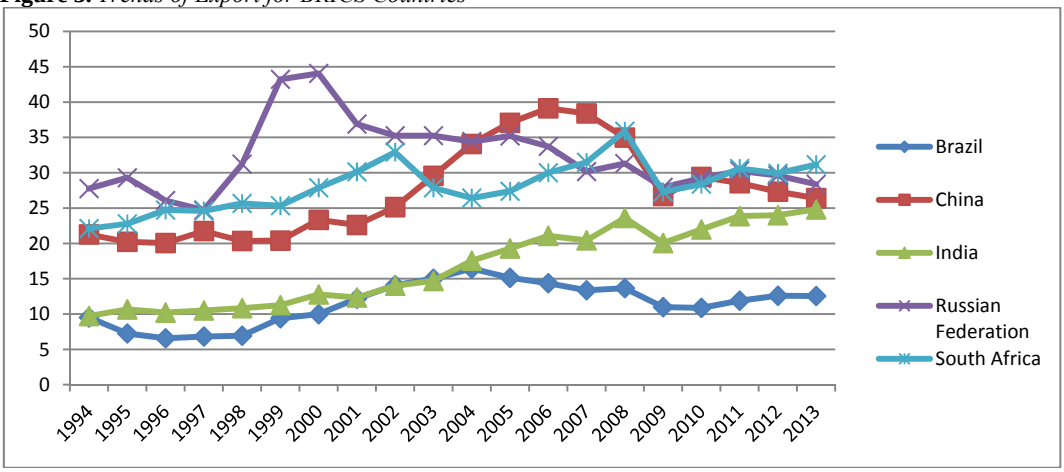


Source: Author's compilation using World Bank Data.

Figure 2 presents the trends of remittances received as percentage of real GDP for BRICS countries. As per as World Bank data it is evident that there was significance contribution of remittance to the real GDP in India compared to her panel countries. The trend of remittances to the real GDP from 1994 to 2013 has increased from 1.175% to 4.25 % for India. However, contribution of remittances to the real GDP was less than 0.75% for Brazil, Russian Federation and South Africa. During the period from 2003 to 2004, contribution of remittances was 0.80% to 1.2% to the real GDP in China. It indicates that during these two years some deviation has been occurred in Chinese economy due to crunch of remittances towards economic growth

Figure 3 implies the contribution of export towards the real GDP across the BRICS countries. Having export as a sole indicator of economic growth as we observed from the Figure 3, each country's export rate has increased along the period from 1994 to 2013. The contribution of export towards real GDP for Russian Federation was very high comparatively its panel countries during the first 10 years and is followed by South Africa. The contribution of export to the real GDP was 27.75% and 35.20% in 1994 and 2005 respectively for Russian Federation, and then it declined to 28.36% in 2013.

Figure 3. *Trends of Export for BRICS Countries*[2]

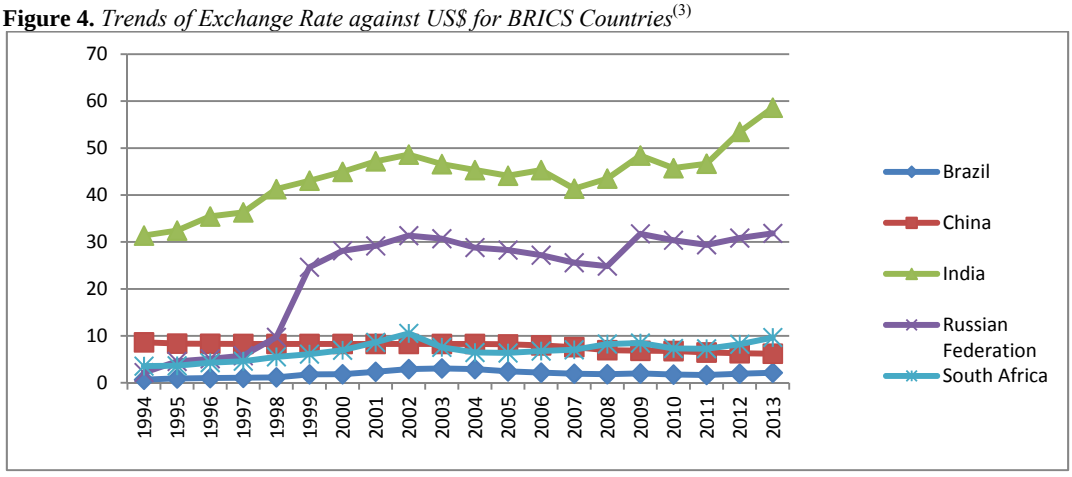


Source: Author's compilation using World Bank Data.

However, during the period of 2007, it was 38.39% which was highest share towards the GDP for China compared to its panel countries. During the period of 2008 contribution of export to real GDP growth rate fell down due to global economic crisis for all countries instead of India. This trend reports that there was no influential impact of global economic crisis on the Indian economy.

As we follow from Figure 4, it is shows the exchange rate of BRICS countries against US$ across BRICS countries. The trends show that the exchange rate against US$ is very high for India. It was 31 units and 58 units of Indian currency against US$ in 1994 and 2013 respectively. There is no deviation of Brazilian and Chinese currencies in terms of US$. However, there was huge deviation in currency of Russian Federation. It was 9.70 and 31.83 units of Russian currencies against US$ in 1994 and 2013 respectively. Expansion and contraction of currencies in terms of US$ have influential impacts on trade practices and BOP of the country's leading to economic fluctuation in home countries and vice-versa.

Figure 4. *Trends of Exchange Rate against US$ for BRICS Countries*[3]



Source: Author's compilation using World Bank Data.

3. Review of literature

3.1. Theoretical background

In recent global economy, workers' remittances have been growing rapidly as one of the major source of external financing. Workers' remittances is the second largest source of external fiancé to many developing countries (World Bank, 2006), which tends to accelerate the pace of economic growth and development through enhancing domestic saving and investment in recipient countries. In this contrast another side of story confirms that workers' remittances are highly used for consumption purposes instead of investment and saving in recipient countries. We review both contrasting studies on the impact of remittances and economic growth as well.

Research on impacts of remittances on economic growth has been attempted by many researchers in recent era. Few empirical studies have investigated the role of remittances in consumption and poverty reduction (Lucas and Stark, 1985; Adams, 1991; Rapoport and Docquier, 2003; Sander, 2004; Azam and Gubert, 2005; Adam, 2006), where, these studies are based on household survey data from different countries. Primarily macroeconomic impacts of remittances may be segregated in two ways. From the theoretical stand point, workers' remittances are mainly used for consumption purposes; and it has negligible impact on saving and investment. The opposite case is that of migration is the leading to brain drain which creates more inequality in the sphere of human capital; globalization makes human capital scarcer where it is already scarce and more abundant where it is already abundant. (Docquire and Rapoport, 2006). For an instance, labor migration from Asian countries to European countries; it is evidence that former having less human capital abundance than latter. Stahl and Arnold (1986) report the use of remittances for consumption purposes which may have positive effect on economic growth. It happens due to possible multiplier effect. Moreover, many migrants invest their savings in small business, real estate or other related assets in their own countries because they have enough information about their local market than in their host countries in the picture of future market prospective. It is clearly observed (Owens, 1987; Kaufman and Mastruzzi, 2007) that impact of worker' remittance depends on many factors such as political freedom, political instability, political voice and accountability in terms of economic growth and development.

3.2. Empirical background

It is very fascinating idea that every economy tries to grow at faster rate than earlier. Henceforth researchers have been interested in the rate at which the nation grows. To determine responsiveness of growth rate (per capita GDP has been taken as proxy for economic growth) to remittances and other sources of economic growth, such as percentage of export towards GDP, and variation in exchange rate, we first specify a simple double log-linear Cobb-Douglass production function as:

$$LnPGDP_{it} = \beta_0 + \beta_1 Ln\,\mathrm{Re}m_{it} + \beta_2 LnExp_{it} + \beta_3 LnExc_{it} + \varepsilon_{it}$$

Where, $LnPGDP_{it}$ is the natural log of Per capita GDP in US$ and $Ln\,\mathrm{Re}m_{it}$ is natural log of percentage of remittances as real GDP. This variable is measured as investment in

human capital expected to have smoothly spurred on the economic growth of developing countries (Schultz, 1980; Romer, 1986; Lucas, 1988; Barro, 1990).

Where, $LnExc_{it}$ indicates the natural log of exchange rate against US$, expected result of impact of fluctuation in exchange rate on economic growth may be mixed (Berg et al., 2002; Edwards and Savastono, 2000; Kandi et al., 2007). It may be expansionary or contractionary that is depending on economic condition of the countries.

Where, $LnExp_{it}$ indicates the natural log of percentage of export towards the real GDP, expected result of the impact of export revenue on economic growth would be positive (Giuliano and Ruiz-Arranz, 2005; Rajan, 2006).

There are several empirical studies that addresses the impact of remittances on economic growth in many countries to find out whether remittances promote economic growth or not. First we review the positive impact of remittances on economic growth. Workers' remittances have dual role in recipient countries, both enhancing economic growth and generating huge demand. It has been evident that workers' remittances have a positive impact on domestic saving, economic growth, productive investments and reducing poverty (Adams, 1992, 1998; Adams and Page, 2003; Giuilano and Arranz, 2005; Jongwanich, 2007; Taylor, 1992; Faini, 2001; Fayissa and Nsiah, 2010). A study finds that remittances have positive impact on economic growth in a 36 cross-sectional studies using a linear regression model (Pradhan et al., 2008). Aggarwal et al. (2006) find that remittances have positive effect on bank deposits and credit to GDP conducting a study of 99 countries ranging the period from 1975 to 2003. A study made an attempt to comprise the relation between remittances and GNP in Mexico; it has been found that every Mexican migrant send back the dollar to home country with them increasing Mexico's GNP (Taylor, 1999).

In this contrast some group of studies believe that remittances don't contribute to the economic growth instead it aggravates the economy as possible. The flows of remittances are used for expenditure on conspicuous consumption (Rahman et al. 2006; Stahl and Arnold, 1986; Chami et al., 2003) rather than minimal impact on saving and investment in productive assets. Although developing countries benefit from workers' remittances but countries suffers from the loss of skilled, educated workers, high labor force, which may have impact on output and revenue to the government. Reichat (1981) used a very technical term that 'Migrant Syndrome' to explain the negative impacts of remittance on the economic growth. It indicates that the loss of human capital against the compensatory transfers which called as 'Dutch Disease' that affects the production of goods and services in the home countries. There is no direct link between per capita GDP and remittances in developing countries (Spatafora, 2005). In this prospect one of the larger cross country survey conclude that remittances have negative effect on economic growth across a sample of 113 countries (Chami et al., 2003). Similarly various studies have concluded that the remittances have focused on the alleviation of poverty rather than overall economic growth (see, Stahl and Arnold, 1986; Chami et al., 2003; Adams and Page, 2003).

Some studies found the mixed result of the impact of remittances on economic growth, these are as follows. The impact of workers' remittances on economic growth is mixed in South and South East Asian countries (Habib and Nourin, 2006). The study posits that there

is negative relationship between migrant remittances and per capita GDP growth in Thailand, Sri Lanka, India and Indonesia. However, in case of Bangladesh, Pakistan and Philippines there is positive relationship between migrant remittances and per capita GDP.

4. Data Source and Variable Description

The data used for this study to explore the long run relationship exists among the observed variables across BRICS Countries. Annual data on per capita real GDP in US$, personal remittance received as percentage of real GDP, export of goods and services as percentage of real GDP and exchange rate against US$ for BRICS countries have been extracted from the World Bank data base ranging from period 1994 to 2013. The data on per capita Gross Domestic Product has been taken at 2005 constant base price in US$. Natural Logarithmic transformation has been made to normalise the data and further analysis been proceeded on the logarithmic transformed series. Per capita GDP at factor cost has been considered as proxy for economic growth across the BRICS countries in this present study. The variable remittances consists of all current transfers in cash or in kind made or received by resident households to or from non-resident households, However remittances includes income of border, seasonal and short term workers who are engaged in an economy where they are not residing and employed by non-residents (World Bank Classification). The variables description and their specification for empirical analysis are as follows:

- PGDP: Per capita Gross Domestic product (US$).
- Rem: Remittances received as percentage of GDP.
- Exp: Export of goods and services as percentage of GDP.
- Exc: Exchange Rate against US$ across BRICS.

5. Model Specification and Econometric Applications

It is very interesting to see that every economy tries to grow at faster rate than earlier. Henceforth, researchers have been interested in the rate at which the nation grows. To determine responsiveness of growth rate (per capita GDP has been taken as proxy for economic growth) to remittances and other sources of economic growth, such as percentage of export of GDP, and variation in exchange rate, we first specify a Cobb-Douglas production function as follows:

$Y_{it} = \alpha_i X_{it}^{\beta} u_{it}$ Where, I = 1, 2, 3,…, N and t = 1, 2, …, T.

Applying log transformation we can get the equation as follows:

$y_{it} = \alpha_i + \beta' X_{it} + u_{it,}$ Where, X is vector of explanatory variables and β is vector of parameters.

Now, we can apply such techniques for this present study taking double log linear model as follows:

$$\ln PGDP_{it} = \alpha_0 + \beta_1 \ln REMT_{it} + \beta_2 \ln EXPT_{it} + \beta_3 \ln EXRT_{it} + u_{it} \qquad (1)$$

Where $ln\ PGDP$ is the natural log of Per capita GDP in US$ and $lnREMT$ is natural log of percentage of remittances as real GDP. This variable is measured as investment in human capital expected to have smoothly spurred on the economic growth of developing countries (Schultz, 1980; Romer 1986; Lucas, 1988; Barro, 1990). Where $lnEXRT$ indicates the natural log of exchange rate against US$, expected result of impact of fluctuation in exchange rate on economic growth may be mixed (Berg et al., 2002; Edwards and Savastono, 2000; Kandi et al., 2007). It may be expansionary and compression phase in the circumstances that is depending on economic condition of the countries. Where $lnEXPT$ indicates the natural log of percentage of export towards the real GDP, expected result of the impact of export revenue on economic growth would be positive (Giuliano and Ruiz-Arranz, 2005; Rajan, 2006).

5.1. Descriptive statistics

The descriptive statistics for all variables under the study named at PGDP Rem Exp Exc are presented in Table 1. The value of skewness and kurtosis indicate the symmetric nature in the distribution. In general if the value of skewness and kurtosis are 0 and 3 respectively, the observed distribution is said to be normally distributed. Moreover, if the skewness coefficient is more than unity it is considered fairly extreme and the low (high) kurtosis value indicates extreme platykurtic (extreme leptokurtic). From the table the result shows that the frequency distributions of observed variables are not normally distributed. The value of standard deviation indicates that deviation in the distribution.

Table 1. *Descriptive Statistics Cross Sectional Units*

Variables	Mean	SD	Min	Max	Skewness	Kurtosis	J-Bera
Brazil							
PGDP	4821.882	566.967	4181.670	5823.044	0.629	1.838	2.443
Rem	0.284	0.132	0.112	0.538	0.442	2.239	1.135
Exp	11.478	3.008	6.566	16.425	-0.265	1.973	1.113
Exc	1.883	0.677	0.664	3.077	-0.007	2.337	0.365
Russia							
PGDP	4988.318	1355.030	3282.790	6923.447	0.135	1.393	2.213
Rem	0.487	0.205	0.286	1.154	1.830	6.459	21.141
Exp	32.197	5.123	24.730	44.060	0.906	3.297	2.812
Exc	23.010	10.667	2.190	31.837	-1.074	2.389	4.162
India							
PGDP	738.458	233.901	444.483	1164.996	0.507	1.904	1.859
Rem	2.899	0.697	1.697	4.240	0.151	2.422	0.353
Exp	16.681	5.491	9.717	24.815	0.124	1.419	2.134
Exc	43.979	6.551	31.373	58.597	-0.081	3.207	0.057
China							
PGDP	1782.675	923.428	679.298	3583.376	0.599	2.039	1.967
Rem	0.472	0.216	0.122	1.013	0.770	3.760	2.460
Exp	27.334	6.423	20.053	39.126	0.548	2.018	1.806
Exc	7.7406	0.812	6.195	8.618	-0.847	2.045	3.155
South Africa							
PGDP	5118.642	529.858	4519.510	5916.463	0.316	1.395	2.480
Rem	0.229	0.076	0.069	0.303	-1.331	3.260	5.969
Exp	28.125	3.461	22.102	35.880	0.234	2.689	0.263
Exc	6.859	1.884	3.550	10.540	-0.114	2.499	0.252

Source: Calculated by authors taking data from World Bank Indicators.

5.2. Panel Unit Root Test

In order to test the panel cointegration among variables, the first step is to examine the unit roots properties of the data, because the variables must be integrated of the same order. In the present study we have used four unit roots methods viz. Levin-Lin-Chu (LLC et al., 2002), Im-Pesaran-Shin (Im et al., 2003), Fisher ADF and Fisher PP tests respectively. The null hypothesis of all these Panel unit roots tests have always consider non-stationary of the data in its null hypothesis. IPS combines information from the time series dimension with that from the cross section dimension, such that fewer time observations are required for the test to have power. Most of the researches have opined that IPS test have superior test power to analyze the long-run relationships in panel data and therefore, the present study have employed this procedure. IPS begins by specifying a separate ADF regression for each cross-section with individual effects and no time trend.

$$\Delta y_{it} = \alpha_i + \rho i\, y_{i,t,1} + + \sum_{j=1}^{pi} \beta_{ij} \Delta Y_{i,t,j} + \varepsilon_{it} \quad (2)$$

Where i = 1, . . ., N and t = 1,. . ., T.

IPS use separate unit root tests for the N cross-section units. Their test is based on the Augmented Dickey-fuller (ADF) statistics averaged across groups. After estimating the separate ADF regressions, the average of the t-statistics for P_1 from the individual ADF regressions t_{iTi} (P_i).

$$\bar{t}_{NT} = \frac{1}{N} \sum_{i=1}^{N} t_{iT}(P_i \beta_i) \quad (3)$$

Then the t-bar has been standardized and it converges to the standard normal distribution as N and T approaches towards infinity. IPS (1997) proposed that when N and T are small in the panel model the t-bar test performers better than other tests. In panel unit root estimation they proposed a cross-sectionally demeaned version of both test to be used in the case of errors of different regressions which contains a common time specific component.

The results of Table 2 presents both the Levin et al. (2002; LLC) and Im et al. (2003) confirm that all the series are non-stationary at their level instead of only LnRem. That indicates that we cannot reject the null hypothesis of non-stationarity, or the series contains a unit root. Hence, after the first order differentiation the test statistics show that we can reject the null hypothesis of non-stationarity for all the series at 1% level of significance.

Table 2. *Panel Unit Root Test Result*

Variables	Test Eqn.	At Level				At Difference				Order. Int.
		LCC	IPS	ADF	PP	LCC	IPS	ADF	PP	
LnPGDP	C	0.8	4.09	0.44	0.45	-4.6***	-3.71***	31.41***	31.2***	I(1)
LnPGDP	CT	-1.01	-0.45	11.21	4.33	-3.99***	-2.35***	21.73**	21.57***	
LnRem	C	-3.85	-1.81	20.05	17.47	-7.63***	-6.98***	58.31***	103.72***	I(1)
LnRem	CT	-2.98	-1.61	18.73	14.00	-3.22***	-3.87***	31.48***	56.27***	
LnExp	C	-0.5	0.11	9.12	7.86	-7.55***	-6.73***	56.32***	56.05***	I(1)
LnExp	CT	-0.94	-0.04	11.66	6.00	-5.37***	-5.11***	40.94***	45.79***	
LnExc	C	-1.48	-0.65	18.86	19.92*	-5.25***	-3.74***	31.05***	31.11***	I(1)
LnExc	CT	-0.43	1.13	5.29	4.95	-4.18***	-1.31*	17.6*	21.79**	

Note: Figures in parentheses are P-values. C refers to the specification with intercept; CT refers to the specification with intercept and trend. ***, ** and * indicate 1%, 5% and 10% level of significance.

In conclusion, all series are stationary at their first order differences, or they are I (I) variables. All variables for the case of BRICS countries are integrated of order one. Since the variables are integrated of order of one for series, the Peronei's (1999, 2004) cointegration test will be applied to understanding the long-run equilibrium relationship among the variables. The Pedroni (1999, 2000) test of cointegration has been explained in below.

5.3. Panel cointegration tests

Pedroni (1997, 1999) has proposed a heterogeneous panel cointegration test, which has been used to estimate the cointegration among the variables in this present study. This test allows various cross sectional interdependence along with other different individual effects in order to establish the cointegration. He defines two kinds of test statistics where the first one is based on pooling residuals within the dimension of the panel. The tests are as follows:

Panel v Statistic:

$$T^2 N^{3/2} Z \hat{v}_{N,T} \equiv T^2 N^{3/2} \left[\sum_{i=1}^{N} \sum_{t=1}^{T} L\hat{}^{-2}_{11i} \hat{e}_{i,t-1}^{2}\right]^{-1} \quad (4)$$

Panel e statistic:

$$T\sqrt{NZ}\hat{p}_{N,T} \equiv T\sqrt{N} \left[\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{2}\right]^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} (\hat{e}_{I,t-1} \Delta\hat{e}_{i.t} - \hat{\lambda}_i) \quad (5)$$

Panel t statistic (Non-parametric):

$$Z_{tN,T} \equiv [\tilde{\sigma}^2_{N,T} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \hat{e}^2_{i,t-1}]^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} (\hat{e}_{I,t-1} \Delta\hat{e}_{I,t} - \hat{\lambda}_i) \quad (6)$$

Panel t statistic (Parametric):

$$Z^* tN_{,T} \equiv [\hat{S}^{*2}_{N,T} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{*2}_{i,t-1})^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} (\hat{e}^*_{I,t-1} \Delta\hat{e}^*_{i,t}) \quad (7)$$

Group e statistic:

$$TN^{-1/2} \hat{Z}\hat{p}_{N,T-1} \equiv TN^{-1/2} \sum_{i=0}^{N} [\sum_{t=1}^{T} \hat{e}^2_{i,t-1})^{-1} \sum_{t=1}^{T} [\hat{e}_{i,t-1} \Delta\hat{e}_{I,t} - \hat{\lambda}_i] \quad (8)$$

Group t statistic (non-parametric):

$$N^{-1/2} \hat{Z}_{tN,t-1} \equiv N^{-1/2} \sum_{i=1}^{N} [\hat{\sigma}^2_i \sum_{t=1}^{T} \hat{e}^2_{i,t-1}]^{-1/2} \sum_{t=1}^{T} [\hat{e}_{i,t-1} \Delta\hat{e}_{I,t} - \hat{\lambda}_i] \quad (9)$$

Group t statistic (parametric):

$$N^{-1/2} \hat{Z}^*_{tN,T} \equiv N^{-1/2} \sum_{i=1}^{N} [\sum_{t=1}^{T} \hat{S}^{*2}_i \hat{e}^{*2}_{i,t-1}]^{-1/2} \sum_{t=1}^{T} [\hat{e}^*_{i,t-1} \Delta\hat{e}^*_{i,t}] \quad (10)$$

Table 3, Table 4 and Table 5 present the Pedroni's cointegration test; Kao test and Combined Fisher ADF test. Since all the variables are *I (1),* Pedroni's cointegration test, Kao test and Fisher ADF test are employed to investigate the null hypothesis of no cointegrating relationship against the alternative hypothesis of the existence of cointegrating relationship.

The maximum test of statistics indicate that null hypothesis of no cointegrating relationship can be rejected at 1% , 5% or 10% level of significance for all BRICS countries. Hence all the six test statistics supports a panel cointegration relationship

among LnRem, LnExp, LnExc and LnPGDP at 1%, 5% or 10% level of significance. Panel V statistics shows cointegration at 1% and 10% level of significance. In case of Kao test the cointegration is significance at 5% level of significance.

Table 3. *Panel Cointegration Result*

Statistics	**C**	**CT**	**NCT**
Within Dimension			
Panel V-Statistics	1.42* (0.07)	6.00*** (0.00)	0.94 (0.17)
Panel rho-Statistics	-0.45 (0.32)	0.28 (0.61)	-1.21 (0.11)
Panel pp-Statistics	-5.55*** (0.00)	-2.26** (0.01)	-3.38*** (0.00)
Panel ADF-Statistics	-3.25*** (0.00)	-0.26 (0.39)	-1.45* (0.07)
Between Dimension			
Statistics	C	CT	NCT
Group pp-Statistics	0.81 (0.79)	1.22 (0.88)	0.64 (0.73)
Group rho-Statistics	-3.63*** (0.00)	-3.58*** (0.00)	-1.92** (0.02)
Group ADF-Statistics	-1.38* (0.08)	-0.78 (0.21)	-0.04 (0.48)

Note: Figures in Parentheses are p-values. C refers to the specification with intercept; CT refers to the specification with intercept and trend and NCT refers to the specification of without trend and intercept. ***, ** and * indicate 1%, 5% and 10% level of significance.

Table 4. *Kao Test*

ADF	-1.98** (0.02)
Residual Variance	0.025
HAC Variance	0.027

Note: Figures in parentheses indicate the P value and ** indicates statistical significant at 5%.

Table 5. *Combined Fisher ADF Test*

No. of CE(s)	Trace Test	Prob.	Max-Eigen Value	Prob.
r=0	112.60	0.00	78.84	0.00
r>1	48.60	0.00	27.06	0.00
r>2	32.80	0.00	28.23	0.00
r>3	21.08	0.02	21.08	0.02

Note: Probabilities are computed using asymmetric Chi-square distribution.

Table 6. *Panel cointegration result across variables*

	Model-I	**Model-II**	**Model-III**
Within Distribution			
Panel V-Statistics	-1.68 (0.95)	-1.68 (0.95)	-1.45 (0.92)
Panel rho-Statistics	-0.86 (0.19)	-0.87 (0.19)	-0.45 (0.32)
Panel pp-Statistics	-1.88** (0.02)	-4.04*** (0.00)	-0.67 (0.25)
Panel ADF-Statistics	-1.66** (0.04)	-2.16** (0.01)	-1.52* (0.06)
Between Distribution			
Group pp-Statistics	0.98 (0.83)	1.24 (0.89)	0.98 (0.83)
Group rho-Statistics	-1.87** (0.03)	-2.50*** (0.00)	-0.43 (0.33)
Group ADF-Statistics	-1.96** (0.02)	-0.95 (0.17)	-1.01 (0.15)

Note: Model I indicate the cointegration between LnPDGP and LnRem, Model-II indicates the cointegration between LnPGDP and LnExc; and Model-III indicates the cointegration between LnPGDP and LnExp. Figures in parentheses indicate the P values and ***, ** and * implies statistically significant at 1%, 5% and 10% respectively.

For the testing of long-run equilibrium in the panels Pedroni (1999) has proposed two types of residual-based tests that are i.e. without dimension tests (panel V static, panel e static, panel t statistic (non-parametric) and panel t statistic (parametric) and within dimension. Kao and combined Fisher ADF tests are also applied for the panel cointegration.

The combine Fisher-ADF test shows the existence of cointegrating relationship among variables such as remittances received (LnRem), export of goods and services to the real GDP(LnExp), exchange rate against US$(LnExc) and per capita Gross Domestic Product(LnPGDP) as the trace statistics is greater than the maximum Eigen value which rejects null hypothesis of no cointegration. All the statics are statistically significant at 1% level, confirming overwhelming support in favor of panel cointegration. The cointegrating relationship does not speak about the long and short-run dynamics of the variables. For the sake of knowing the long run and short elasticities we have employed the Fully Modified Least Square. In case of fully modified least square the study estimates the long run elasticities of the variables.

5.4. Fully modified least square

The fully modified least square estimation has been adopted form Christopoulos and Tsionas (2004) for estimating the asymptotically efficient consistent in panel series where the method takes in to consideration of non-exogeneity, serial correlation and heterogeneity (Pedroni, 1996). As all the explanatory variables are cointegrated with time trend , henceforth there is a existence of long-run equilibrium relationship among the variables through the panel unit root test (LLC, IPS, Fisher ADF and PP) and panel cointegration test (Pedroni, 1990). The study proceeds to estimate the Equation (1) by the method of fully modified OLS (FMOLS). The FMOLS allows consistent and efficient estimation of cointegratioin vector and at same time it addresses the problem of nonstationary regressors, as well as the problem of simultaneity biases in the heterogenous cointegrated panels. The OLS estimation is not as powerful as FMOLS and it yields biased results in regressors that are endogenously determined in the *I(1)* cases. The model can be written as:

$$Y_{it} = \alpha_{it} + x'_{it}\beta + \varepsilon_{it} \qquad (11)$$

$$X_{it} = x_{i,t\ 1} + \varepsilon_{it}$$

Where $\xi_{it} = [e_{it}, \varepsilon'_{it}]$ is the stationary with covariance matrix Ω_i .The estimators will be consistent with the error process $\omega_{it} + [e_{it}, \varepsilon'_{it}]'$ statistics the assumption of cointegration between y_{it} and x_{it}. The limiting distribution of OLS estimator depends upon nuisance parameters. Following Phillips, and Hansen (1990), a semi-parametric correction can be made to the OLS estimators that elements the second order biases caused by the fact regressors are endogenous. Pedroni (1990 and 2000) follows the same principle in the panel data context, and allows for the heterogeneity in the short run dynamic and fixed effects. FMOLS Pedroni's estimator is constructed as follows

$$\hat{\beta}_{FM} \quad \beta = \sum_{i=1}^{N} \hat{\Omega}_{22}{}^{2}{}_{i} \ \sum_{t=1}^{T}(x_{it}\,\hat{x}_t)^2 \sum_{i=1}^{N} \hat{\Omega}_{11} i^{1}\, \hat{\Omega}_{22i}{}^{1} \sum_{t=1}^{T}(x_{it}\,\overline{x}_t)\, e_{it}\, T\, \hat{\gamma}_i \qquad (12)$$

$$\hat{e}_{it} = e_{it}\ \hat{\Omega}_{22}{}^{1} \quad \hat{\Omega}_{21i,} \quad \hat{\gamma}_i = \hat{\Gamma}_{22i} + \hat{\Omega}_{22i}{}^{0}\ \hat{\Omega}_{21i}\,(\hat{\Gamma}_{22i} + \hat{\Omega}_{22i}{}^{0}) \qquad (13)$$

Where the covariance matrix can be decomposed as $\hat{\Omega}_1 = \hat{\Omega}_1 + \hat{\Gamma}_i + \hat{\Gamma}_i$ where Ω_i^0 is the contemporaneous covariance matrix and $\hat{\Gamma}_i$ is a weighted sum of autocovariance. The $\hat{\Omega}_i{}^0$ represents an appropriate estimator of $\hat{\Omega}_i{}^0$.

This study has used panel group FMOLS test from Pedroni (1996, 2000). This test allows for greater flexibility in the presence of heterogeneity of the cointegrating vectors. The null hypothesis constructed for the test statistics of the panel group estimators is that H_o: $\beta_i = \beta$ for all i against the alternative hypothesis H_A: $\beta_i \neq \beta$, so that the values for β_i are not constrained to be the same under the alternative hypothesis. This is clearly an advantage. Another advantage lies with the interpretation of the point estimates in the event that the true cointegrating vectors are heterogeneous. It can be interpreted as the mean value for the cointegrating vectors (Pedroni, 2001).

Table 7 shows the long run elasticities estimated by adopting FMOLS. The study estimates long run elasticities for all the individual BRICS countries along with panel group. Table 7 reports the results of individual and panel cointegrated cases for Eq. (1). Apart from South Africa all four countries have statistical significant impact of remittances on economic growth. The individual FMOLS results show that remittances inflow of China has positive impact on economic growth. The result shows that one percent increase in inflow of remittances in China has positive and statistical significance which increase 0.19percentage change in growth. However, Brazil, Russia and India show a negative relation between remittances received and economic growth where 1% changes in remittances received leads to 0.19%, 2.48% and 0.67% decline in economic growth respectively in long run. Panel FMOLS result reveals that there is 0.40% decline in economic growth due to 1%change in remittances inflow to the home country overall in long run. All countries have positive and statistical significant impacts of export rate on the economic growth. Individual FMOLS result shows that due to 1% change in rate of export there are 0.26%, 2.60%, 0.96%, 0.68% and 0.55% changes occur in economic growth in Brazil, Russia, India and South Africa, respectively.

Table 7. *Long-run Elasticity coefficient of FMOLS*

Country	LnRem	LnExp	Ln Exc
Brazil	-0.19(-14.23) ***	0.26(4.32)***	-0.03(-3.65)***
Russia	-2.48(-5.03)***	2.60(19.10)***	-0.84(-3.65)***
India	-0.67(-3.94)***	0.96 (7.70)***	1.22(17.85)***
China	0.19(4.87)***	0.68(8.27)***	-3.65(-24.50)
South Africa	0.08(1.13)	0.55(1.86)*	-0.12(-0.76)
Panel	-0.40(-4.71)***	0.59(4.07)***	-0.23(-2.93)***

Note: Figures in Parentheses indicate t statistics; and *, **and*** indicate statistically significant at 10%, 5% and 1% respectively.

There is 1% change in export towards real GDP increases growth by 0.55% in overall panel in the long run. Individual FMOLS result show that there are positive significant impact of exchange rate on economic growth. However, there are negative impacts of exchange rate on economic growth in Brazil and Russia. It is estimated that 1% chnage in exchange rate leads to 0.03% and 0.85% decline in growth rate in Brazil and Russia respectively in long run where 1%chnage in exchange rate it leads to 1.22%chnages occur in growth rate in India. Overall panel result revels that there is significant negative impact of exchange rate on economic growth. It shows that due to 1% change in exchange rate, 0.23% changes occur in economic growth in long run.

5.5. Panel Vector Error Correction Model (PVECM)

The study has applied Engle and Granger (1987) suggests two-step procedure in order to examine the short-run and long-run dynamic relationships between expenditure on education and economic growth. In the first step the long-run model specified in Eq. (1) is to be estimated and in the next step we have to define the lagged residual obtained as the error correction term (ECT). The estimation of dynamic vector error correction (VECM) model is as follow:

$$\Delta LnRem_{it} = \theta_{1i} + \sum_{j=1}^{q} \theta_{1,1ij} \Delta LnRem_{it-j} + \sum_{j=1}^{q} \theta_{1,2ij} \Delta LnPGDP_{it-j} + + \sum_{j=1}^{q} \theta_{1,3ij} \Delta LnEXC_{it-j} + \sum_{j=1}^{q} \theta_{1,4ij} \Delta LneXP_{it-j} + \lambda_{1i} ECT_{it-1} + \mu_{1it} \quad (14)$$

$$\Delta LnPGDP_{it} = \theta_{2i} + \sum_{j=1}^{q} \theta_{2,1ij} \Delta LnRem_{it-j} + \sum_{j=1}^{q} \theta_{2,2ij} \Delta LnPGDP_{it-j} + + \sum_{j=1}^{q} \theta_{2,3ij} \Delta LnEXC_{it-j} + \sum_{j=1}^{q} \theta_{2,4ij} \Delta LneXP_{it-j} + \lambda_{2i} ECT_{it-1} + \mu_{2it} \quad (15)$$

$$\Delta LnExp_{it} = \theta_{3i} + \sum_{j=1}^{q} \theta_{3,1ij} \Delta LnRem_{it-j} + \sum_{j=1}^{q} \theta_{3,2ij} \Delta LnPGDP_{it-j} + + \sum_{j=1}^{q} \theta_{3,3ij} \Delta LnEXC_{it-j} + \sum_{j=1}^{q} \theta_{3,4ij} \Delta LneXP_{it-j} + \lambda_{3i} ECT_{it-1} + \mu_{3it} \quad (16)$$

$$\Delta LnExc_{it} = \theta_{4i} + \sum_{j=1}^{q} \theta_{4,1ij} \Delta LnRem_{it-j} + \sum_{j=1}^{q} \theta_{4,2ij} \Delta LnPGDP_{it-j} + + \sum_{j=1}^{q} \theta_{4,3ij} \Delta LnEXC_{it-j} + \sum_{j=1}^{q} \theta_{4,4ij} \Delta LneXP_{it-j} + \lambda_{4i} ECT_{it-1} + \mu_{4it} \quad (17)$$

Where the ECT (Error correction term) is derived from the long-run FMOLS results from Eq. (1)

Table 8 shows the dynamics of remittances, export, and exchange rate on economic growth in BRICS countries both in short-run and long-run.

Table 8. *Result of PVECM*

Dependent Variables	Short-run				Long-run	
	ΔLnPGDP	ΔLnRem	ΔLnExp	ΔLnExc	ECT	JST
ΔLnPGDP	-	-0.004 (0.76)	-0.38 (0.30)	0.06 (0.01)**	-0.00 (0.02)**	1.13 (0.34)
ΔLnRem	-0.24 (0.90)	-	0.20 (0.41)	-0.02 (0.88)	-0.24 (0.00)***	0.17 (0.98)
ΔLnExp	-0.74 (0.08.)*	0.07 (0.48)	-	-0.09 (0.25)	0.03 (0.37)	0.83 (0.54)
ΔLnExc	-5.64 (0.00)***	-0.05 (0.41)	0.30 (0.08)*	-	-0.02 (0.36)	2.02 (0.07)*

Note: Figures in Parentheses are P value and ***, ** and * indicate significant level at 1%, 5% and 10% respectively. ECT indicates Error Correction Term and JST indicate Joint Significance Test.

From the panel vector error correction model the results are in favor of long-run causality among the variables; remittances, export rate, exchange rate and economic growth in all the countries where as there is no short run casual effect detected from remittances and export to economic growth. However, only short run causality detected from exchange rate to economic growth. It is evident that in long-run there only remittances and export rate have significant impact on economic growth generating infrastructure development, employment opportunities and capital formation in the countries. From the vector error correction long run causality detected from economic growth, export rate and exchange rate to remittances whereas no casualty has been fitted in short run and there is also no joint statistical significant among the variables. Another pair of panel VECM result reveals that there is short run causality detected from export to GDP while no joint statistical significant or long run causality detected among the observed variables in the BRICS countries.

Panel VECM result depicts that there is short run causality running from exchange rate and export to the economic growth. However, there is joint statistical significant satisfies among the variables. It implies casualty detected from export rate, exchange rate and economic growth; and vice versa.

From the above Panel Vector Error Correction Model, the result revels that there is no short run causality depicted from remittances to economic growth, as we know amount of remittances received spends on conspicuous purposes, poverty reduction and luxury investment instead of saving and investment in productive assets (Lucas and Stark, 1985; Adams, 1991; Rapoport and Docquier, 2003; Sander, 2004; Azam and Gubert, 2005; Adam, 2006). Henceforth the result depicts that there is no short run causality between remittances and economic growth). It many have causal impacts in long run transferring remittances in to productive investments after full filling basic requirement and getting optimum luxuries consumption.

6. Policy implication and conclusion

In this paper, study empirically investigates the effects of remittances as percentage of real GDP, export of goods and services as percentage of real GDP (US$); and exchange rate on economic growth in BRICS (Brazil, Russian Federation, India, China and South Africa) countries period ranging from 1994 to 2013. In this panel data analysis technique, the study finds that there is a long-run equilibrium existence between remittances and growth rate in all BRICS countries. It is found that there is a negative long run impact of remittances on economic growth as PVECM result shows that 1% change in remittances that leads to 0.24% decline in GDP per capita income in the long run. To understand the short-run and long-run dynamics of the variables we have adopted the panel cointegration and panel vector error correction models with joint Significance test Statistics. Result finds that all the countries have long-run relationship with economic growth due to impact of remittances and exchange rate on per capita GDP across the BRICS countries. Joint significant test result reveals that causality depicted from exchange rate to other variables jointly across the countries sin the long run.

From the empirical result, it is found that remittances have negative impacts on economic growth across the countries in the long run. It could be interpreted that due to migration, countries experience loss of human capita which leads to low productivity in the home countries and it has negative impact on economic growth (Spatafora, 2005; Chami et al., 2003). However, it is technically called as Migrant Syndrome and Dutch disease effects of production of goods and services in sending and receiving countries (Reichart, 1981). The policy makers should put more emphasis on the emigration policies and its relevant application and dynamic use in modern economic growth by contributing high human capital in the countries.

Notes

(1) Remittances as % of Real GDP for BRICS Countries.
(2) Export as percentage of Real GDP for BRICS Countries.
(3) Currencies against US$ for BRICS Countries.

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