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Relationship between Remittance and Economic Growth in Sri Lanka an Autoregressive Distributed lag Model (ARDL)

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Abstract

This present research study investigates the long-run relationship between remittances and the economic growth in Sri Lanka. Remittances make a vital contribution to Sri Lankan economy for many years. In 2018, the country received over USD 7 billion of remittances, accounting for 7.9% of the GDP and often attributed to temporary migrant workers. The main objective of this study is to examines the impact of the remittance on economic growth (GDP) in Sri Lanka based on the annual time series data from over the period 1980–2017. This analysis is employed Autoregressive Distributed Lag (ARDL) models to examining the unit root properties of the variables and Consequently, this study used the diagnostic tests such as the residual normality test, heteroskedasticity and serial autocorrelation tests for misspecification in order to validate the parameter estimation outcomes achieved by the estimated model. The stability of the model is checked by CUSUM test.

The findings of the bound test confirm that the variables are cointegrated. Further the results reveal that there is a statistically significant long run positive relationship between remittance and GDP growth rate in Sri Lanka. The empirical finding reveals that one percent increase in remittance and gross fixed capital formation increase the GDP by 5.7 percent and 7.5 percent in the long run respectively. Similarly, household consumption and the foreign direct investment and GDP growth rate have not significant relationship in the long run.

Keywords: remittance, gross domestic product (GDP), autoregressive distributed lag (ARDL), CUSUM test, error correction model (ECM).

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Introduction

Remittances can play a vital role in countries' economy as well as it fights to poverty, stimulate the consumption and investment also decrease the labour force. International migration considered as one of the most substantial factors affecting economic and sociopolitical development not only in developing countries but also in developed countries in the 21st century Shapan and Zhang (2016). Remittance is gradually growing external financial source for developing countries. It can generate substantial welfare gains for migrants and thereby could play an important role in reducing poverty to them. Migration generates a relatively stable source of income that contributes to the support of migrant workers' family members back home, enabling them to invest in education, health and housing. Thus, it can improve the household living conditions of the migrants and reducing vulnerability of family members, especially women and children. Remittances therefore generate a stable source of poverty reduction among them (IOM, 2009). Further, study of World Bank (2008) finds that migrant remittances impact positively on the balance of payments in many developing countries.

Sri Lanka has been the most liberalized economy in South Asia, recording greater trade dependency with an export and import share in gross domestic product (GDP) that is higher than 55 percent (often referred to as the trade dependency ratio). The country insistently depends on worker remittances as a gorgeous source of financing the widening trade deficit in its balance of payments. Also, these are the major contributing source of external financing. They help to offset over 70 percent of the trade deficit and to reduce the current account balance to a manageable level.

As of 2018, remittance inflows account for almost 8.1 percent of Sri Lankan GDP and remittances are more likely to be spent on investments whether these are physical or human capital investments such as education.

Remittances have great potential to generate a positive impact on development and poverty reduction in Sri Lanka. Also, it can reduce the probability of food-based and capability-based poverty among needy entities at the receipt end. It is fit to both rural and conflict affected areas of the country.

Therefore, the volume of remittances has positive correlation with wage levels of migrant workers and the economic needs of their families. Significantly, a massive share of the total remittances received by Sri Lanka meets day-to-day consumption needs rather than long-term productive purposes Siddique, at el (2010). The same source indicates that the remittance-recipient households set aside little or no savings for their future.

Literature Review

Dietmar and Adela (2017) did a research on the impact of remittances on economic growth: An econometric model using panel data in six high remittances receiving countries, Albania, Bulgaria, Macedonia, Moldova, Romania and Bosnia Herzegovina during the period 1999–2013. They used a fixed effect model (FE) to analyze the Panel data considers explanatory variables as non-random. They found that remittances have a positive impact on growth and this impact increases at higher levels of remittances relative to GDP.

Nsiah and Fayissa () had investigated the relationship between economic growth and remittances through panel data of 64 different countries of African, Asian, and Latin American-Caribbean from 1987–2007. They had employed panel unit root and panel co-integration tests to investigate the exact relationship between remittances and economic growth. Their finding suggests that there is a positive relationship between remittances and economic growth throughout the whole group.

Huseyin and Yilmaz (2015) examined the relationship between economic growth, remittances, foreign direct investment inflows and gross domestic savings in Turkey during the period 1974-2013 by using Autoregressive Distributed Lag approach. They found that remittances, foreign direct investment and gross domestic savings had positive impact on economic growth.

Bayar (2015), in his study shows that the causal relationship among the real GDP per capita growth, personal remittances and net foreign direct inflows in the transition economies of the European countries during the period 1996-2013 by using causality test. He found that there is unidirectional causality from remittances and foreign direct investment inflows to the economic growth.

Siddique, et al. (2010), studied the causal link between remittances and economic growth in three countries, Bangladesh, India and Sri Lanka, by using the Granger causality test. They found that growth in remittances leads to economic growth in Bangladesh, no causal relationship between growth in remittances and economic growth in India and a two-way directional causality such as economic growth influences growth in remittances and vice-versa in Sri Lanka.

Gyan, at et al. (2008) examined the effect of workers' remittances on economic growth in a sample of 39 developing countries using panel data from 1980–2004 resulting in 195 observations. They applied a standard growth model using both fixed-effects and random-effects approaches. They found a significant overall fit based on the fixed-effects method as the random-effects model is rejected in statistical tests. Remittances have a positive impact on growth. Since official estimates of remittances used in our analysis tend to understate actual numbers considerably, more accurate data on remittances is likely to reveal an even more pronounced effect of remittances on growth.

Mesbah (2014) in his study examined the long-run causal link between remittances and output in Egypt for the period 1977–2012 using the autoregressive distributed lag (ARDL) bounds test for cointegration, also a vector error correction model to estimate the short- and long-run equilibrium dynamics. His result revealed that remittances and GDP are cointegrated, with a statistically significant, positive causality running from remittances to output, while output is found not to be a long-run forcing factor of remittances in Egypt.

On the other hand, Rahman et al. (2006) and Rahman (2009) reveled that remittance have insignificant and ambiguous effects on Bangladesh's GDP. Ahmed (2010) found in his study that

flow of remittances to Bangladesh have been statistically significant but have a negative impact on growth.

Model and Methodology

The general objective of this paper is to examine the impact of remittance and other related control variables such Gross Domestic Product growth rate (gdpr), household consumption (hhc), Foreign Direct Investment (fdi) and Gross Fixed Capital Formation (GFCF) as on economic growth in Sri Lankan economy. The following model is identified for the empirical analysis.

$gdpr_t = b_0 + b_1 lnhhc_t + b_2 lnrem_t + b_3 lnfdi_t + b_4 lngfcf_t + \varepsilon_t$…… (1)

where lnhhc is GDP growth rate
lnrem is remittance
lnfdi is Foreign direct investment
lngfcf is gross fixed capital formation as percent of GDP
εt is error term

Where, b_0, b_1, b_2, b_3 and b_4 are the parameters to be estimated.

b

Cointegration analysis (ARDL)

$lngdpr_t = b_0 + b_1(lnhhc)_{t-1} + b_2(lnrem)_{t-1} + b_3(lnfdi)_{t-1} + b_4(lngfcf)_{t-1} + \Sigma_{t=1}^{n} b_5 \Delta lnhhc_{t-1} + \Sigma_{t=1}^{n} b_6 \Delta lnrem_{t-1} + \Sigma_{t=1}^{n} b_7 \Delta lnfdi_{t-1} + \Sigma_{t=1}^{n} b8 \Delta lngfcf_{t-1} + \varepsilon t$……..(2)

Error Correction model specification

The following equation (3) develop for an error correction model to examine the short-run dynamics and to check the stability of the parameters of the long-run.

$lngdpr_t = b_0 + \Sigma_{t=1}^{n} b_1 \Delta lnhhc_{t-1} + \Sigma_{t=1}^{n} b_2 \Delta lnrem_{t-1} + \Sigma_{t=1}^{n} b_3 \Delta lnfdi_{t-1} + \Sigma_{t=1}^{n} {}_{t-1} b4 \Delta lngfcf + \lambda ECT_{t-1} + \varepsilon t$…… (3)

Data and Variables

This study combines five variables, GDP growth rate (percent) a proxy of economic growth denoted by (gdpr), household consumption as percent of GDP denoted by hhc remittance inflows as percent of GDP (rem), Foreign direct investment, net inflows percent of GDP, denoted by

(fdi) and gross fixed capital formation as percent of GDP denoted by (gfcf). The data (series) of variables (gdpr, gfcf, hhc, rem and fdi) under consideration are expressed in logarithm.

In this study, time series data have been used for the period of 37 years (1980 to 2017). All data has been gathered from the official database of World Bank (available at http://data.worldbank.org/indicator).

3. PRESENTATION OF RESULTS AND INTERPRETATION

In order to investigate the impact of remittance on GDP growth, this study specified econometric model. The independent variables are household consumption, foreign direct investment, remittance, and gross fixed capital formation while the dependent variable is economic growth of GDP.

3. Descriptive statistics and Correlations of the variables

Table 3.1 explains the summary of the variables used in this study. 37 of sample is covering the period of 1980 to 2017. The means value of remittance (rem) is 0.1041868 with the standard deviation of 0.0871414. It shows that the mean value is scattered by 0.0871414. Likewise, the mean value is 1.559725, 0.0791825, 0.0781182, -0.0027299 with the standard deviation of 0.4293503, 0.0822825, 0.4812214 and 0.0748298 of household consumption (hhc), foreign direct investment (fdi) and gross fixed capital formation (gfcf) respectively.

Table 3.1 Descriptive Statistics for Variables

Table 3.1 represents the summary of the characteristics of variables. The sample size is 37 covering the period 1980-2017

Variable	gdpr	lnhhc	lnfdi	lngfcf	lnremi
Max	2.21266	.3592906	1.276294	.1219881	.4142594
Min	.5481214	-.0492995	-1.041454	-.2425895	-.0313897
Mean	1.559725	.0791825	.0781182	-.0027299	.1041868
Std. Dev	.4293503	.0822825	.4812214	.0748298	.0871414
Skewness	-1.605457	1.125898	-.0868507	-.8516651	1.22609
Kurtosis	6.481665	5.427179	3.543439	4.285106	5.589441
Variance	.1843417	.0067704	.231574	.0055995	.0075936

Source: WD indicators & Author calculations

Figure 2 and Figure 3 illustrate the stationary level of the variables. Figure 2 shows the data series of all variables household consumption (hhc), foreign direct investment (fdi) and gross fixed capital formation (gfcf)except GDP growth rate are non-stationary at level. In this situation it is essential to convert the data into stationary. Figure 3 presents the view of stationary of the variables at first difference.

Figure 1 Graphical Illustration of data with level (I)0

Figure 2 Graphical Illustration of data on First difference

3.1. Unit Root Test

The unit root test is performed using the Augmented Dickey Fuller (ADF) unit root test. This test is performed to ensure that none of the variables are I (2) too. The results are shown in Table 1. Table shows all the variables are none stationary at levels and become stationary at first difference except for gross domestic product growth rate. Gross domestic product growth rate is stationary at level which means it is integrated of order zero, I (0). This implies that the unit root results validated a combination of I (0) and I (1).

Table 3.1. Unit Root Test

variables	Level I (0)		1st Difference I (1)	
	Test Statistic	5% Critical Value	Test Statistic	5% Critical Value
lngdpr	-4.755	-2.966		
lngfcf	-2.593	-2.966	-4.921	-2.969
lnrem	-0.732	-2.966	-4.894	-2.969
lnhhc	0.052	-2.966	-6.175	-2.969
lnfdi	-1.219	-2.966	-6.252	-2.969

Table 3.2 reports the optimal lag length of four (4) out of a maximum of 4 lag lengths as selected by four different criteria: Final Prediction Error (FPE), Akaike information criteria (AIC), Schwarz Information Criterion and Hannan-Quinn Information Criterion.

Table-3.2 Lag Length Selection

lag	LL	LR	FPE	AIC	HQIC	SBIC
0	59.035		4.2e-07	-3.33546	-3.27442*	-3.15406*
1	68.8526	19.635	6.1e-07	-2.96077	-2.6556	-2.05379
2	89.6381	41.571	4.8e-07	-3.25079	-2.70149	-1.61824
3	115.904	52.533	2.9e-07	-3.87299	-3.07955	-1.51486
4	136.614	41.418*	2.8e-07*	-4.1584*	-3.12082	-1.07468

*indicates lag order selected by the criterion

3.2 ARDL Bounds Test for Cointegration

Following the unit root test and establishing that none of the variables are I(2), the study examine the long run relationship among the variables. Starting with gross domestic product growth rate as the dependent variable, the calculated F-statistics is 28.866. The critical values ranges are I(0) = 4.914 and I(1)= 7.299 at 1% level of significance. Therefore, comparing the F-statistics with the critical values, it indicates that F-statistics is greater than the upper critical value at 1% level of significance. This suggests that the null hypothesis of no cointegration will be rejected

indicating the existence of long-run relationship between the variables. Nevertheless, since four of co-integration equations validate the existence of a long run relationship between the variables, here the study conclude that there is a long run relationship between gross fixed capital formation, remittance, household consumption and foreign direct investment in Sri Lanka.

Table 3.3 ARDL bound test for Cointegration

ARDL Co-integration test			
Lag length			F-statistic
ARDL (1,3,4,3,2)			28.866***
Significance level	Critical values *		
	Lower bounds I (0)		Upper bounds I (1)
1 percent	4.914		7.299
5 percent	3.286		5.042
10 percent	2.644		4.144
	Diagnostic tests		
NORMAL	SERIAL	Heteroskedasticity	WHITE
0.3989 (0.1200)	1.984674 (0.9949)	16.09 (0.3079)	11.17 (0.6728)

The long-run coefficients are reported in the output section LR. They represent the equilibrium effects of the independent variables on the dependent variable. In the presence of cointegration, they correspond to the negative cointegration coefficients after normalizing the coefficient of the dependent variable to unity. The latter is not explicitly displayed.

Table 3.4: Long Run coefficients estimated through ARDL approach

Variable	Coefficients	Standard Error	T-statistics	Probability
dlngfcf	7.514862	1.189843	6.32	0.000
dlnrem	5.736542	1.555356	3.69	0.002
dlnhhc	-2.217659	1.393849	-1.59	0.132
dlnfdi	-.2866454	.1500486	-1.91	0.075

The study next involves estimating the long run coefficients and the results are demonstrated in Table 3.4. According the above table, the gross fixed capital formation and remitences are

statistically significant and positively correlated with gross domestin production growth rate in the long run. Specifically, the coefficient of gross fixed capital formation is 7.514862, which implies that a 1% increase in gross fixed capital formation leads to 7.514862% increase in gross domestic production growth. The results are consistent to studies conducted by Bayar (2015) and Ahmed (2010). The coefficient of remittance is 5.736542, which means that a 1% increase in remittance results in an increase of about 5.736542% in gross domestin production growth. The results are consistent to studies conducted by Huseyin and Bayar (2015) Dietmar and Adela (2017) and Siddique et al (2010). Household consumption and foreign direct investment are not statistically significant and have a negative effect on gross domestic production growth in long run.

The negative speed-of-adjustment coefficient is reported in the output section ADJ. It measures how strongly the dependent variable reacts to a deviation from the equilibrium relationship in one period or how quickly such an equilibrium distortion is corrected. The short-run coefficients are reported in the output section SR. They account for short-run fluctuations not due to deviations from the long-run equilibrium.

Table 3.5 Short run analysis

Dependent Variable = lngdpr (gross domestic production growth rate)				
Short Term Results				
Variable	Coefficients	Standard Error	T-statistics	Probability
gross fixed capital formation dlngfcf				
D1.	-2.728804	1.050135	-2.60	0.020
LD.	-2.094895	.7924327	-2.64	0.018
L2D.	-2.411175	.5944936	-4.06	0.001
remittance dlnrem				
D1.	-4.407966	1.415599	-3.11	0.007
LD.	-3.280226	1.099722	-2.98	0.009
L2D.	-3.314654	.815624	-4.06	0.001
L3D.	-1.604046	.6087015	-2.64	0.019
Household consumption dlnhhc				
D1.	3.242746	1.250392	2.59	0.020
LD.	2.08482	.8153963	2.56	0.022
L2D.	1.843952	.423426	4.35	0.001
foreign direct investment dlnfdi				
D1.	3.242746	1.250392	2.59	0.020
LD.	2.08482	.8153963	2.56	0.022
ADJ lngdpr L1.	-1.157316	.1244126	-9.30	0.000
R^2	0.9710			
Adj R-squared	0.9381			

Table 3.5 illustrates the short run results and the speed of adjustment coefficient (ADJ). It is established that the coefficient of the adjustment (-1.157316) is negative and statistically significant at the 1% level of significance. This indicates that approximately 115% of the disequilibrium of gross domestic production growth rate shock of the previous year will result in the adjustment back to the long run rate equilibrium of gross domestic production growth rate and should be corrected in the current year. The specified variables are found to have a positive

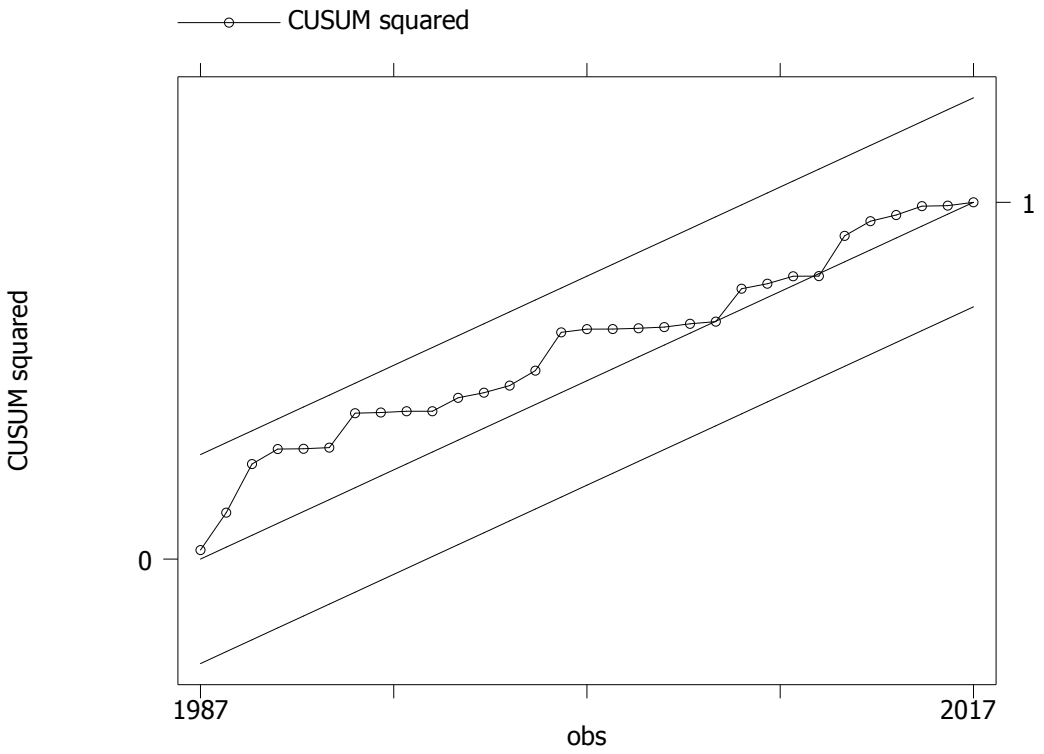
and a statistically significant effect on gross domestic production growth rate except for gross fixed capital formation and remittance in the short run. Gross fixed capital formation and remittance have a negative effect on domestic production growth rate but they are statistically significant.

Results of the diagnostic tests show that the estimated ARDL model and the error-correction models do not have serial correlation, heteroscedasticity, specification error, and nonnormality at the 5% significance level. As is evident from Table 3.3, all the *P* values of the diagnostic tests are greater than 5%, implying that the null hypotheses of no serial correlation, homoscedasticity, normality, and specification error cannot be rejected at the 5% significance level.

Stability Tests

Finally, this study explored the stability of the long-run trends together with the short-run movements of the variables. Cumulative sum squares (CUSUMSQ) tests was applied to explore the stability of the long run which proposed by Borensztein et al. (1998). This same process has been applied by Pesaran and Pesaran (1997), Mohsen et al. (2002) and Suleiman (2005) to test the stability of the long-run parameters.

Figure - 1 Cumulative sum squares (CUSUMSQ) tests



Figures 1 plot the CUSUM of squares statistics and CUSUMSQ stays within the critical 5% bounds that confirms the long-run relationships among variables and thus shows the stability of coefficient.

CONCLUSION

This study investigated the relationship between gross domestic growth rate, remittance, gross fixed capital formation, household consumption and foreign direct investment of Sri Lanka during the period of 1980 to 2017 by employing the ARDL bound test approach. Bound test suggested that the remittances have the long run negative relationship with economic growth of Sri Lanka. The model having lag 2 is the best model, because it has no serial correlation, no heteroskedasticity and residuals are normally distributed. The model is also stable. The model has getting towards long run equilibrium at the speed of 1.157316. The model has short run causality from independent variables to dependent variable. Also, it has long run association among the variables and they move together. The error correction term of this models is highly

significant and correctly singed. This shows adjustment to long term equilibrium in the dynamic model. The coefficients of error correction are (-1.157316). This indicates that deviations from the remittance to economic growth adjust quickly. Dang Tung (2015), Shapan and Zhang (2016) findings are supported the coefficient on the error correction term, ECM (–1), is significant and negative at the 1 percent level, which permits the existence of the long-run relationship among the variables in this model found by the F-test.

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