

# Dynamic Relationship between Workers' Remittances and Human Capital Formation in Sri Lanka

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## ABSTRACT

This study explored the effect of workers' remittances on human capital formation in Sri Lanka for the period of 1975-2017. To our knowledge, there were very scarce in-depth studies on this issue in Asian countries, Sri Lanka in particular. This study tried to fill this gap. The annual time series data for the following variables: education expenditure, health expenditure, gross domestic product and workers' remittances were collected from the World Bank database. The human development index (HDI) was collected from various issues of human development reports of the World Bank. The human development index was used as a proxy for human capital formation in Sri Lanka. The standard unit root tests (Augmented Dickey-Fuller and Philips Perron) indicated that the HDI was non-stationary,  $I(1)$  and other variables were stationary at level,  $I(0)$ . The Autoregressive Distributed Lag (ARDL) bounds test showed that there was a long-run equilibrium relationship between workers' remittances and human capital formation in Sri Lanka. The results from the error correction model also showed that 37% of disequilibrium error was corrected each year and the response variable of human capital formation moved towards the long-run equilibrium time path. In addition, findings from Pairwise Granger's causality and VAR Granger Causality tests indicated that the workers' remittances Granger cause the human capital formation. Furthermore, the findings of long-run causality from error correction term confirmed that there was a long-run causality between workers' remittances and human capital formation in Sri Lanka. Our results implied that workers remittances had a significant role in human capital formation, in particular, Sri Lanka. Workers' remittances Granger cause human capital formation, in short term and in long term, hence the higher human capital formation can stimulate skilled workers to migrate and get more workers' remittances so that economy could benefit sustainable economic growth and economic development in Sri Lanka.

**Key Words :** ARDL bounds test, Workers' remittances, Human capital formation, Sri Lanka

## INTRODUCTION

In recent years, the workers' remittance inflow is getting more attention among policymakers, economists and development experts. In developing countries, they are increasing continuously, and are more stable (World Bank, 2015). International labour migration, and accompanying workers' remittance flows have internationally become a key development driver (UNDP, 2009). The total amount of officially recorded workers' remittances to the developing countries are three times of the amount to the net official development assistance

and aid received by them (World Bank, 2012) and are the second largest source of foreign exchange next to the foreign direct investment (Azizi, 2017). Since the latter part of the 1970s, the workers' remittances have become a kind of essential inflows of external finance to the developing countries (Gupta *et al.*, 2009; Batu, 2015).

Workers' remittance come to an economy through formal and informal channels (Lucas and Strak, 1985). Amount of workers' remittances come through the informal channel is also important in economic development. The actual amount of workers' remittances come through the informal channel might even be more

than the formal channel. More than half of the total workers' remittances are moving globally through informal channels (World Bank, 2015). It is reported by a number of literature that the workers' remittances affect various sectors such as financial development, economic growth, human capital formation, consumption expenditure and gross domestic saving in an economy (Beine *et al.*, 2008; Özden and Schiff, 2007). However, the impact of workers' remittances on human capital formation has not been studied in-depth. The studies on this issue are very scarce in Asia, particular in Sri Lanka.

Human capital formation is an important concept around the world after getting attention on globalization (Denison, 1962). Well educated people are considered as the most critical asset to a knowledge economy whereas the knowledge economists believe that the most talented and informative people can have more opportunities to preside over the entire economy (Becker, 2007). Therefore, physical or financial capital of an economy cannot be a noticeable source of competitive advantage in the long - run to an emerging economy, while, people know their abilities, experiences, competencies, and skills, as well as, access to human capital, can be powerful drivers to build the economy more competitive (Garcia-Fuentes and Kennedy, 2009; Ziesemer, 2009). Unfortunately, the developing countries did not have enough investment in human capital formation due to the lack of resources. In this circumstance, the workers' remittances can help to increase the investment in human capital formation through education and health expenditures (Yang, 2006). According to Becker (2007), investment in training, education, and medical care may promote human capital formation but not financial or physical capital. The society education, training, medical care, etc. are the different ways for generating human capital formation (Husz, 1998; Kohil, 2013). In which, education is more considered as the most significant mechanism for human capital formation (Becker, 2007). Human capital formation and education are therefore interrelated factors for getting sustainable economic development in a country (Hassan *et al.*, 2013).

Sri Lanka is a small open economy and follows labour migration regime since the latter part of the 1970s. Workers' remittances in Sri Lanka are the largest component of inflows of foreign exchange compared to foreign direct investment (FDI) and other external financial sources. Further, they contribute a big portion

in reducing the country's balance of payment deficit. In contrast, migrant households in Sri Lanka determine their essential needs based on the volume of their receiving workers' remittances from migrant labour. Literature focusing on the impact of workers' remittances has concluded that the consumption, saving, and human capital formation are the basic needs of migrants' households. In 1975, 8.3% of education expenditure in Sri Lanka was substituted by workers' remittances which extended as 288% in 2017. These figures, therefore, seem that the workers' remittances are providing a large proportion in education expenditure in Sri Lanka. As stated earlier, education is an important factor to increase the human capital formation which upsurges the human development index of a country. The human development index consists of life expectancy, education and per-capita income as indicators. Thus, it is identified that education expenditure is an essential factor to upgrade human capital formation. In Sri Lanka, there are no studies regarding the relationship between workers' remittances and human capital formation using time series data. As a result, this situation arises an issue regarding the relationship between workers' remittances and human capital formation in Sri Lanka. As of the above argument, this study attempts to answer the research question of whether the workers' remittances promote the human capital formation in Sri Lanka? To answer this research question, this study forms the following objective. The objective of this study is to investigate the relationship between workers' remittances and human capital formation in Sri Lanka.

Rest of the paper is organized as follows: Section 2 briefly describes the review of literature, section 3 explains the methodology, section 4 discuss the results and section 5 delivers the conclusion and recommendation.

## REVIEW OF LITERATURE

Empirically, there are a number of studies concerning the relationship between workers' remittances and human capital formation made in different countries using different econometric techniques. This section reviews past studies related to the relationship between workers' remittances and human capital formation in a single and cross country manner.

### Single country approach:

Most of the literature conducted the impact of workers' remittances on human capital formation in a single country environment by using the regression

technique. Accordingly, Edwards and Ureta (2003) studied the relationship between workers' remittances and human capital development in El Salvador, based on household survey data in 1997. In this study, it was found that the workers' remittances accelerate human capital formation. Salas (2014) investigated the effect of workers' remittances on human capital formation in Peru. This study also concluded that the workers' remittances positively effect on human capital formation. While, Ponce *et al.*, (2008) analyzed the impact of workers' remittances on the outcome of human development in Ecuador using cross-sectional data collected from 55666 households in 2006. This study also concluded that the workers' remittances positively effect on the human capital outcome. Moreover, Acharya and Gonzalez (2014) found that the workers' remittances positively stimulate human capital formation in Nepal. This study also used cross-sectional data collected from 992 households in 2013. Another study was conducted by Bansak and Chezum (2009) in Nepal using the cross section data collected from 4629 school students and found that the workers' remittances stimulate with the education. Bredl (2011) examined how workers' remittances effect on the education outcome in Haiti. This study also used the cross-sectional data, collected from the 270 samples during the period of 2000Q1 to 2003Q4. This study found that workers' remittances play an important role in poor households in alleviating budget constraints and encouraging children's education. Meanwhile, Koska *et al.* (2013) studied the relationship between workers' remittances and human capital formation in Egypt using primary data collected from 4816 households in various years. This study found that the workers' remittances positively effect on children education. Kroeger and Anderson (2014) in Kyrgyzstan found the workers' remittances positively effect on the children education. This finding was confirmed by cross-sectional data, collected from 9468 samples during the period of 2005–2009. Meanwhile, In Sri Lanka, De and Ratha (2012) examined the relationship between workers' remittances and human capital formation based on the cross-sectional data collected from 7500 households during the period 1999 to 2000. This study also concluded that the workers' remittances positively effect on human capital formation. On the other hand, Hanson and Woodruff (2003) in Mexico *et al.* (2011) in Indonesia found that the workers' remittances negatively influence on human capital formation.

### **Cross - country approach:**

In cross - country approach, Azam and Raza (2016) investigated the impact of workers' remittances on human capital formation in 17 different developing countries over the period of 1996 to 2013. In this study, the cointegration and OLS fixed – effect regression techniques were employed and this study concluded that the workers' remittances positively effect on human capital formation in such countries. Acosta *et al.* (2007) explored that the workers' remittances have a positive relationship with the education and health expenditures in 11 Latin American countries using the household survey data. This study was conducted based on OLS regression technique. While Adenutsi (2009) found the workers' remittances have a positive relationship with human capital formation over the period of 1987 to 2007 in 18 Sub-Saharan African countries. In this study, the fixed effect regression technique was employed to examine the relationship. Ngoma and Ismail (2013) studied the impact of migrant remittances on human capital formation in 89 developing countries over the period 1970 to 2010. This study used the generalized method of moments (GMM) and found that the workers' remittances have an important factor for human capital formation in sample countries. Instead, Akanbi (2017) examined the impact of workers' remittances on economic growth and human capital formation in selected 19 Sub-Saharan African (SSA) countries from 1990 to 2013. This study used the two-stage least squares estimation technique and found the workers' remittances negatively effect on human capital formation in such countries. Huay and Bani (2018) studied the relationship between workers' remittances and the human capital formation in 51 developing countries using the Generalized Moment Method (GMM). This study found the workers' remittances have a negative relationship with human capital formation.

Based on the review of the literature, the findings of the relationship between workers' remittances and human capital formation got mixed results. Most of them declared that the workers' remittances have a positive relationship with human capital formation. Few of them stated the workers' remittances had a negative relationship on the human capital formation. Therefore, there is no common conclusion in the relationship between workers' remittances and human capital formation

In the case of Sri Lanka, De and Ratha (2012) studied the relationship between workers' remittances

and human capital formation using cross-sectional data. It was the first study in Sri Lanka using the cross-sectional data series, regarding the relationship between workers' remittances and human capital formation. However, none of the researchers in Sri Lanka focussed on the relationship between workers' remittances and human capital formation based on time series or using macro data. Furthermore, the volume of workers' remittances to Sri Lanka sending from the migrant labourers shows increasing trend since the latter part of the 1970s. At the same time, the absolute owners of workers' remittances are migrant households, they have portioned a part of the workers' remittances to their children education and health expenditures. There are no time series studies on the relationship between workers' remittances and human capital formation in Sri Lanka, this study attempts to fill this gap.

### METHODOLOGY

This section presents the empirical model, variables description, Data and analytical methods.

#### The empirical model:

The human capital theory is closely associated with the study of human resource development (HRD). As a kind of capital, this theory tries to explain the gain of education, health, and training as a form of investment in human resource (Aliaga, 2001). It was found that increasing investment in human capital formation uplifts the skill of human which gains the macroeconomic factors positively. Human Capital theory is a measure of the skills, education, capacity, and attributes of labour which influence productive capacity and earning the potential of people. The empirical model of this study was formulated based on the human capital model developed by Becker (1962) and Schultz (1962), who considered education as an investment in human capital motivated by the expected rates of returns. From the theoretical model, the empirical model for the relationship between workers' remittances and human capital formation can be written as:

$$HDI_t = f(EDUGDP_t, HEXGDP_t, WRE_t), \dots (1)$$

Where:  $HDI_t$  represents the human capital index which is proxy variable for human capital formation,  $EDUGDP_t$  is the education expenditure GDP ratio,  $HEXGDP_t$  represents the health expenditure GDP ratio, and  $WRE_t$  denotes the workers' remittances.

#### Data and variables:

Variables used in this study were human development index (HDI), education expenditure GDP ratio (EDUGDP), Health expenditure GDP ratio (HEXGDP), and Workers' remittances (WRE). Data for the variables used in the study were annual time series data for the period of 1975 to 2017. HDI and WRE data series were transformed into natural logarithms to reduce the Skewness of the distribution, to make data normality and linearity. All data except Human Development Index were collected from the World Bank database. Further, Human Development Index was collected from various human capital development reports of the World Bank.

**Table 1: Description of variables**

| Variable   | Description  |
|------------|--|
| $HDI_t$    | HDI indicates human development index which consists of life expectancy index, education index, and GNI index. HDI measures national achievements in human development based on three essential components of human life. The index is composed of "average achievement in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living". |
| $EDUGDP_t$ | EDUGDP is defined as Education expenditure /GDP. Education expenditure consists of current and capital expenditures on education.  |
| $HEXGDP_t$ | HEXGDP is defined as health expenditure /GDP. Health expenditure consists of current and capital expenditures on health.   |
| $WRE_t$    | Workers' remittances mean the transfer of money which send by a foreign worker to an individual in their home country.   |

#### Analytical method:

This section explains the methods that are used to analyze the data of the variables. Unit root test, ARDL bounds test, Diagnostic tests, Ganger's causality test, and VAR Granger Causality were employed as the method of data analysis of this study.

#### Unit root test:

Since the time series data were used in this study, it was necessary to confirm whether the variables were stationary or not. In general, econometricians believe that non – stationary variables can cause a spurious problem. The Augmented Dickey-Fuller (ADF) test under Schwartz information criterion and Philips Perron (PP) test under Newey – West Bandwidth criterion were conducted to test the stationarity of the series. Based on the ADF and

PP test, if the series was stationarity at the level, it is denoted as  $I(0)$  series and if the series were stationary in first difference, it is denoted as  $I(1)$  series.

**Cointegration technique:**

To test the long – run relationship between variables, there are a number of conventional cointegration techniques applied in empirical studies. Such techniques require all series using in the empirical equation should be in the same order and have a large sample size ( $N>50$ ). Alternatively, the Autoregressive Distributed Lag (ARDL) bounds testing approach introduced by Pesaran *et al.* (2001) was employed in the study to find out the long run equilibrium relationships between variables. The ARDL bounds technique has some advantages compared to conventional cointegration techniques. The first, it allows mixed order variables for testing the long – run relationship but doesn't allow  $I(2)$  or higher order of variables. The second, this method applicable for small and finite samples. The third, the ARDL bounds technique has the ability to accommodate different time lags for different variables in the model, while other conventional techniques require all variables were to be kept in the same lag order. The fourth, this method takes care of omitted variables and serial correlation problem and address any endogeneity problem, since it provides unbiased estimates in the long – run model. Finally, the ARDL model estimates both short- run and long – run dynamics simultaneously in a single reduced form of equation (Harris and Sollis, 2003).

The ARDL model specification of the study is given in equation (2)

$$\Delta LHDI_t = \beta_0 + \sum_{i=1}^{p_1} \beta_{1i} \Delta LHDI_{t-i} + \sum_{i=0}^{p_2} \beta_{2i} \Delta EDUGDP_{t-i} + \sum_{i=0}^{p_3} \beta_{3i} \Delta HEXGDP_{t-i} + \sum_{i=0}^{p_4} \beta_{4i} \Delta LWER_{t-i} + \delta_5 LHDI_{t-1} + \delta_6 EDUGDP_{t-1} + \delta_7 \quad (2)$$

where  $\Delta$  indicates the first difference operator,  $p_1, p_2$  and  $p_3$  are the optimal lag length.  $e_t$  is random error term,  $\beta_0$  is constant,  $\beta_{1i} - \beta_{4i}$  are the short –run coefficients, and  $\delta_5 - \delta_8$  are the long – run coefficient.

In terms of unrestricted error correction model (ECM) given by equation (2) , the joint null hypothesis to be tested, which implies the absence of a long term relationship between LHDI and the explanatory variables, is Null hypothesis  $H_0 : \delta_5 = \delta_6 = \delta_7 = \delta_8 = 0$  vs Alternative hypothesis  $H_1 : \delta_5 \neq \delta_6 \neq \delta_7 \neq \delta_8 \neq 0$ . The  $F$  test is done by comparing the  $F$  – test statistic with the critical values

proposed by Pesaran *et al.* (2001).

Pesaran *et al.* (2001) formulated two sets of alternative critical values at each level of significance. One set that represented the lower bound critical value assuming that all regressors were  $I(0)$  and other sets that represented the upper bound critical value assuming that they were  $I(1)$ . If the calculated  $F$ - statistic of the ARDL model was greater than the upper bound critical value (UBC), ( $F > F_{UBC}$ ), the null hypothesis was rejected, it can be concluded that the variables were cointegrated or had a long – run long-run relationship among the variables. On the other hand, if the calculated  $F$ - statistic of ARDL model was less than the lower bound critical value (LBC), ( $F < F_{LBC}$ ), the null hypothesis cannot be rejected. It can be noted that the variables were not cointegrated or had no long-run relationship among the variables. As well, if the calculated  $F$ - statistic of the ARDL model was situated between the upper and lower bounds critical values, ( $F_{LBC} < F < F_{UBC}$ ) it cannot come to conclusion (inconclusive) of the cointegration.

If the cointegration would be confirmed among the variables, next, the error correction model can be estimated. The error correction model of the study can be written as in equation (3):

$$\Delta LHDI_t = \beta_0 + \sum_{i=1}^{p_1} \beta_{1i} \Delta LHDI_{t-i} + \sum_{i=0}^{p_2} \beta_{2i} \Delta EDUGDP_{t-i} + \sum_{i=0}^{p_3} \beta_{3i} \Delta HEXGDP_{t-i} + \sum_{i=0}^{p_4} \beta_{4i} \Delta LWER_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad (3)$$

where,  $\lambda$  represents the coefficient of error correction term,  $ECT_{t-1}$  is the error correction term. In the error correction model, it was expected that the coefficient of error correction term should be negative, less than one and significant in order to have long run equilibrium.

**Diagnostic test:**

The robustness of the results were examined by using the following diagnostic tests: serial correlation LM test, Heteroskedasticity ARCH test, and stability test of CUSUM and CUSUMSQ plots.

**Granger's causality test:**

Granger causality from one variable to another variable means that the conditional forecast for the latter can be significantly improved by adding lagged variables of the former to the information set. Causality is defined as  $X_t$  is said not to Granger cause  $Y_t$  if

$$E(Y_{t+h}|I_t, X_t) = E(Y_{t+h}|I_t) \dots (4)$$

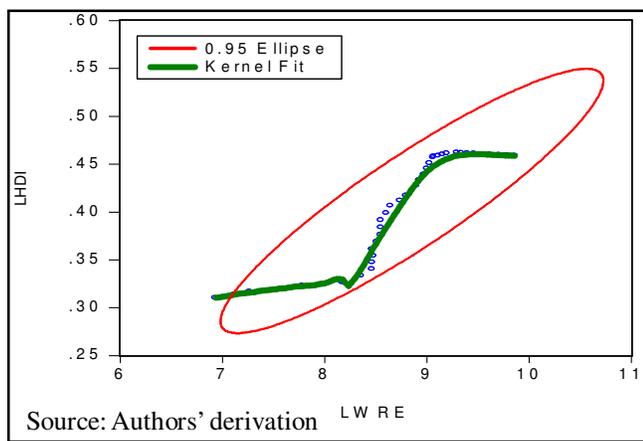
Pairwise Granger causality test (F- test) and Granger causality under VAR framework were performed to investigate the causal relationship. Granger (1988) proposed a test for long-run causality within the context of the error correction representation of a cointegrated system of variables. The presence and the direction of Granger causality, in the long run, can be assessed by testing the null hypothesis that the error correction coefficients is zero. Long – term Granger causality result was given by the coefficient of ECT.

### RESULTS AND DISCUSSION

This study uses various econometric techniques such as exploratory data analysis, unit root test, cointegration analysis and Granger causality to achieve the objective of this study.

#### Exploratory data analysis:

EDA and non-parametric techniques (graphical displays; line graphs, kernel density estimate, confidence ellipse,) are used to find novel and useful information that might otherwise remain unknown. These techniques may uncover the underlying relationship between the variables. Fig. 1 confirms that there is a positive relationship between workers’ remittances and human capital index in Sri Lanka at 95% of confidence level.



**Fig. 1 : Association between workers’ remittances and HCI**

#### Unit root test:

Unit root test results (Table 2) show that human capital index (LHDI) in level is non – stationary and stationary at 1<sup>st</sup> difference *I*(1). Other variables,

EDUGDP, HEXGDP and LWRE are stationary at level, *I*(1). Therefore, the results of unit root tests show that the variables in the study are in mixed order, *I*(0) and *I*(1).

| Variable            | Augmented Dickey – Fuller Test |                            | Phillips – Perron Test |                            | Order        |
|---------------------|--------------------------------|----------------------------|------------------------|----------------------------|--------------|
|                     | Level                          | 1 <sup>st</sup> Difference | Level                  | 1 <sup>st</sup> Difference |              |
|                     | LHDI <sub>t</sub>              | -0.311<br>(0.914)          | -5.355<br>(0.000)      | -0.415<br>(0.897)          |              |
| EDUGDP <sub>t</sub> | -4.199<br>(0.002)              | -18.916<br>(0.000)         | -4.934<br>(0.000)      | -19.558<br>(0.000)         | <i>I</i> (0) |
| HEXGDP <sub>t</sub> | -3.044<br>(0.041)              | -2.657<br>(0.0093)         | -2.914<br>(0.052)      | -5.546<br>(0.000)          | <i>I</i> (0) |
| LWRE <sub>t</sub>   | -5.262<br>(0.000)              | -8.936<br>(0.000)          | -3.936<br>(0.000)      | -3.937<br>(0.004)          | <i>I</i> (0) |

Note: P – value are in parenthesis  
Source: Authors’ estimation

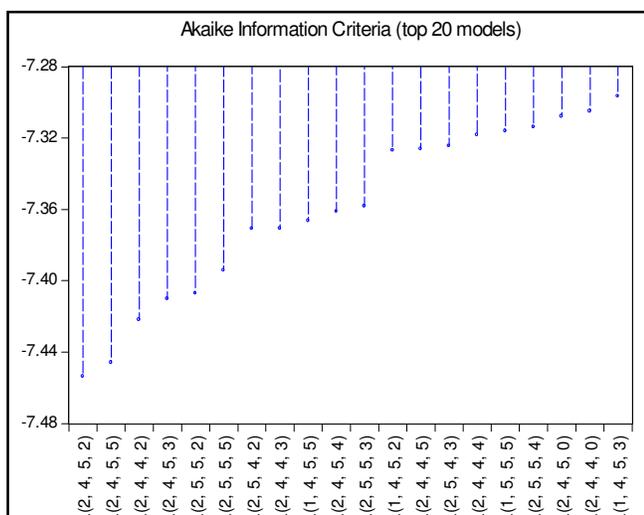
In addition to the unit root test, sample observations are (43) which are less than 50 observations. Therefore, the conventional cointegration techniques are no suitable to test the long – run relationship between the variables. Thus, this study employs the Autoregressive Distributed Lag (ARDL) bounds technique to examine the long – run relationship between workers’ remittances and human capital formation in Sri Lanka.

#### Optimal Lag Selection and ARDL Model:

This study uses the Akaike Information Criterion (AIC) to select a suitable optimum lag model to investigate the relationship between workers’ remittances and human capital formation in Sri Lanka. Fig. 2 shows the AIC model selection criterion from Eviews in graph. According to Fig. 2, ARDL (2, 4, 5, 2) model has an optimum lag value compared to other models (Fig. 2). Therefore, the ARDL (2, 4, 5, 2) is selected to achieve the objective of the study.

#### Cointegration test-ARDL Bounds test:

Table 3 indicates the results of the long-run relationship between workers’ remittances and human development index. According to Table 3, the estimated *F*- statistic is 5.45 which is greater than the upper bound critical value (4.35) at 5% significance level. Therefore,



**Fig. 2 : Model selection criteria, Eviews**

the null hypothesis of no long-run relationship between variables is rejected. It indicates that there is a long – run relationship between workers’ remittances and human development index in Sri Lanka.

| Test statistic | Value      |            |
|----------------|------------|------------|
| F- Statistic   | 5.45       |            |
| K              | 3          |            |
| Significance   | I(0) Bound | I(1) Bound |
| 10%            | 2.72       | 3.77       |
| 5%             | 3.23       | 4.35       |
| 2.5%           | 3.69       | 4.89       |
| 1%             | 4.29       | 5.61       |

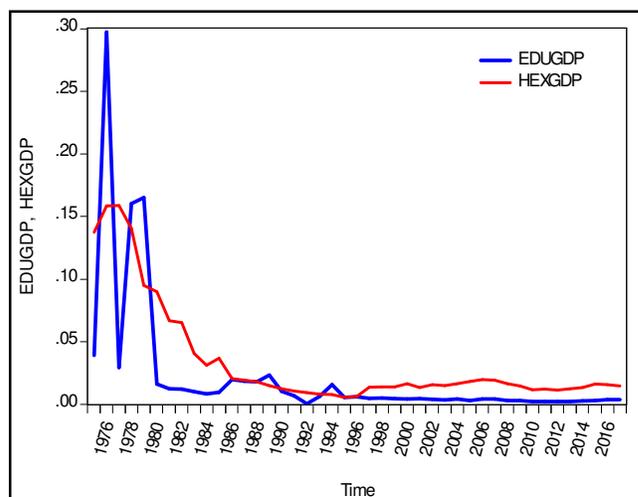
Source: Authors’ calculation

Table 4 illustrates the coefficients of the estimated long-run model. Based on these results indicating in Table 4, health expenditure GDP ratio and workers’ remittances have a positive relationship with the human capital formation at 1% significance level. On the other hand, education expenditure GDP ratio is insignificant with the human capital formation in Sri Lanka. It may be due to that its share is not adequate enough to influence human capital formation. The education expenditure GDP ratio is not at the optimum level. During the last five years, government expenditure on education was around 9.5% of total expenditures which was less than 2.5% of total GDP on average. This is why university academics in Sri Lanka are demanding education expenditure to GDP should be to be 6 per cent. Our empirical findings also indicate that the education expenditure in Sri Lank should

be increased to uplift the human capital formation. Our findings are consistent with the findings of Irdam (2012); Nnenna and Stanley (2017) and Zahari (2017).

Health expenditure is one of the factors framing the human capital formation of a country. Our findings show that health expenditure GDP ratio affects human capital positively and significantly. The estimated coefficient of health expenditure GDP ratio is 1.58. As the p-value is less than 0.05, this variable is statistically significant. If the health expenditure GDP ratio is increased by 1 unit, the human capital formation in Sri Lanka will be increased by 158%. Therefore, our findings confirm that the health expenditure GDP ratio in Sri Lanka has a significant role in human capital formation. It can be justified as our health expenditure GDP ratio is high compared to education GDP ratio (Fig. 3). Sri Lankan government spends a huge amount of money on health sector development compared to other South Asian countries. During the last five years, the health expenditure was around 11.7% of total government expenditure which is 3% of GDP on average. It seems that health expenditure promotes human capital formation. Therefore, our findings strongly confirmed that the health expenditure in Sri Lanka is a very important factor for uplift human capital formation in the long - term. This finding of the study is consistent with the findings of Razmi *et al.* (2012.) and Fadilah *et al.* (2018).

In general, even though both education expenditure and health expenditure are important determinant factors to the human capital formation in worldwide, health



Source: Authors’ derivation from Eviews

**Fig. 3 : Expenditures on Health and Education sectors % of GDP**

expenditure in Sri Lanka is identified as a significant factor to increase the human capital formation compared to the education sector (Table 4). The percentage of education expenditure to the GDP has been less than the health expenditure to the GDP in recent decades, since 1996. It can be easily compared by using Fig. 3.

Workers’ remittances are considered as a key independent variable in this study. This variable has a positive relationship with the human capital formation at 1% significance level (Table 4). If the workers’ remittances are increased by 1%, human capital formation is to be increased by 4.2%. This finding is consistent with the study of Edwards and Ureta (2003); Salas (2014); Ponce *et al.* (2008); Hanson and Woodruff (2003); Bansak and Chezum (2009); Bredl, (2011); Koska *et al.* (2013); Kroeger and Anderson, (2014); De and Ratha (2012).

**Table 4 : Long – run relationship between workers’ remittances and HDI**

| Dependent Variables: LHDI <sub>t</sub> |             |              |                     |
|--|-------------|--------------|---------------------|
| Variable                               | Coefficient | t- statistic | P value             |
| EDUGDP                                 | 0.498       | 0.468        | 0.644 <sup>ns</sup> |
| HEXGDP                                 | 1.584       | 2.200        | 0.039**             |
| LWRE                                   | 0.042       | 12.448       | 0.000*              |
| C                                      | -1.454      | -16.457      | 0.000*              |

Note: \* p<0.01, \*\* p<0.05, and <sup>ns</sup> not significant  
Source: Authors’ calculation

The estimated coefficient of the error correction term (ECT<sub>t-1</sub>) carries the negative sign and statistically significant at 1% level. The negative sign indicates that the response variable (LHDI) moves towards long-run equilibrium time path and it also indicates the stability of the corresponding model. The estimates of adjustment coefficient (ECT<sub>t-1</sub>) is -0.377. It implies that 38 percent of the disequilibrium error is corrected every year (Table 5).

**Table 5 : Speed of error correction adjustment**

| Dependent Variables: ΔLHDI <sub>t</sub> |             |              |         |
|---|-------------|--------------|---------|
| Variable                                | Coefficient | t- statistic | P value |
| ECT <sub>t-1</sub>                      | -0.377      | -3.988       | 0.000*  |

Note: \* p<0.01  
Source: Authors’ calculation

**Diagnostic test for estimated long – run and short run models:**

To make sure the validity and stability of the selected long – run and short - run models, the following

statistical tests: serial correlation LM test, Heteroskedasticity ARCH test, and CUSUM and CUSUMSQ plots were employed. Accordingly, Table 6 shows the validity of estimated long – run and short – run models which confirms by both Breusch-Godfrey Serial Correlation LM Test and Heteroskedasticity ARCH test. Both long – run and short – run models are not suffering from the serial correlation and Heteroskedasticity issues, the probability values of both tests are greater than 5% significance level. As the probability values are greater than 5% significance level, the null hypothesis of no serial correlation and no heteroskedasticity are not rejected (Table 6).

**Table 6 : Diagnostic Tests results of estimated models**

| Model       | Test statistic                             |               |                               |              |
|-------------|--|---------------|-------------------------------|--------------|
|             | Breusch-Godfrey Serial Correlation LM Test |               | Heteroskedasticity Test: ARCH |              |
|             | F-statistic                                | Prob.F(2, 29) | F-statistic                   | Prob.F(7,21) |
| Long – run  | 1.138                                      | 0.3411        | 0.065                         | 0.799        |
|             | F-statistic                                | Prob.F(1, 14) | F-statistic                   | Prob.F(1,34) |
| Short - run | 0.033                                      | 0.857         | 0.033                         | 0.857        |

Source: Authors’ calculation

Table 7 explains the testing of the normality assumption of residual for the long – run and short – run models. As the p - values of Jarque – Bera test of long – run and short – run models are greater than at 5% significance level, the null hypothesis of normality distribution is not rejected (Table 7).

**Table 7 : Normality Tests results of estimated models**

|             | J-B test statistic<br>Chi-square | p-value |
|-------------|----------------------------------|---------|
| Long - run  | 1.328                            | 0.514   |
| Short – run | 1.380                            | 0.566   |

Source: Authors’ calculation

The plot of Cumulative Sum of Recursive Residuals from the estimated model for long – run and short – run shows that the recursive residual behaviour within the critical bounds at 5% significance level (Fig. from 4 to 7). It indicates that the null hypothesis of parameter coefficient constancy is not rejected. Our findings show that human capital formation function is stable and the estimated parameters are stable over the study period.

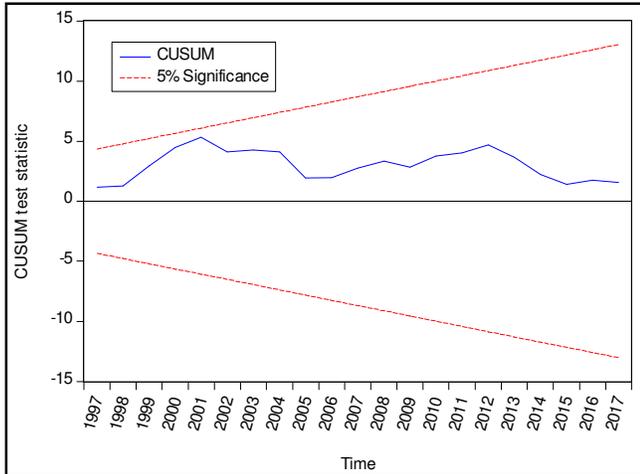


Fig. 4 : CUSUM plot for long – run model

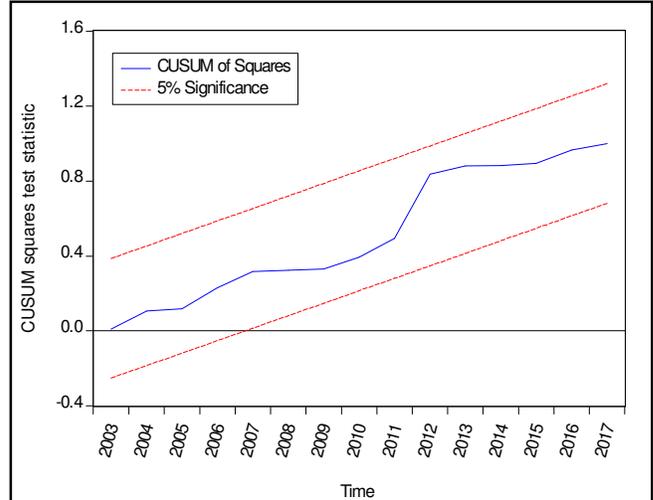


Fig. 7 : CSUMSQ plot for short – run model

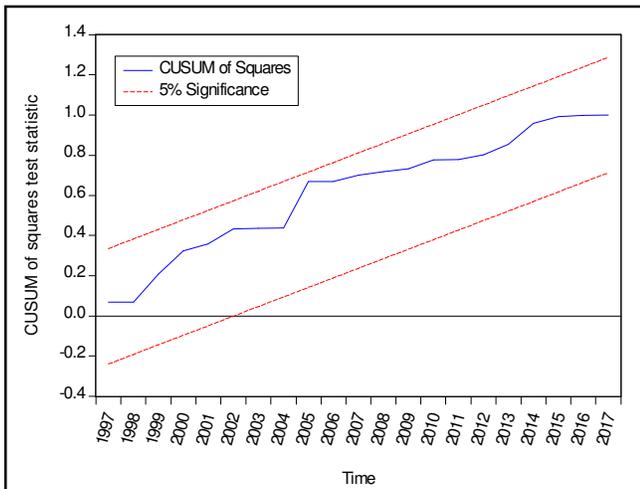


Fig. 5 : CSUMSQ plot for long – run model

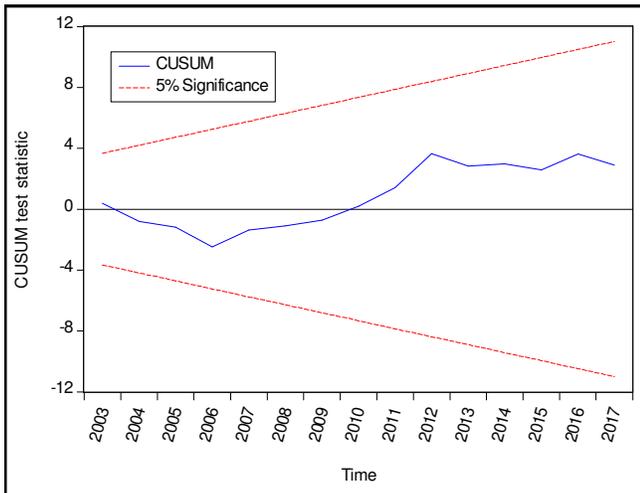


Fig. 6 : CUSUM plot for short – run model

**Granger causality analysis:**

The results from Pairwise Granger causality (*F*-test) from single equation is given in Table 8 and Granger causality under VAR framework (Block Exogeneity Wald Tests) is given in Table 9. The result from Pairwise Granger causality (*F*-test) indicates that the null hypothesis of workers’ remittances does not Granger Cause human capital formation is rejected at 5 percent significance level. It indicates that there is evidence of one-way causality running from workers’ remittances to human capital formation. As Sri Lanka is a developing country, the one-way direction WRE →HDI is consistent with economic theory.

**Table 8 : Pairwise Granger causality test Results**

| Null Hypothesis                   | Obs | F – Statistic | Prob.   |
|-----------------------------------|-----|---------------|---------|
| LWRE does not Granger Cause DLHDI | 40  | 6.76075       | 0.0033* |
| DLHDI does not Granger Cause LWRE | 40  | 1.41011       | 0.2576  |

\*p<0.05

Source: Authors’ calculation

Results from VAR Granger causality/Block Exogeneity Wald Test in Table 9 shows that LWRE Granger cause LHDI significantly. The p-value given in the Table 9 indicates that the null hypothesis of no causality (workers’ remittance does not cause human capital formation) is rejected at 5% significance level. Thus, workers’ remittances help to predict the human capital formation series.

| Table 9 : VAR Granger Causality /Block Exogeneity Wald Test |          |    |         |
|---|----------|----|---------|
| Dependent Variable: DLHDI                                   |          |    |         |
| Excluded  | Chi-sq.  | df | Prob.   |
| EDUGDP  | 74.05242 | 2  | 0.0000  |
| HEXGDP  | 0.502827 | 2  | 0.7777  |
| LWRE  | 11.78223 | 2  | 0.0028* |
| All   | 252.0520 | 6  | 0.0000  |

\* $p < 0.01$ 

Source: Authors' calculation

**Long run causality test:**

Long – run causality results are exhibited by error correction term coefficient estimate in Table 5 shows the workers' remittances granger cause human capital formation in Sri Lanka in long – run. Therefore, we can conclude that workers' remittances Granger cause human capital formation in the short- run as well as in the long – run.

### CONCLUSION AND POLICY RECOMMENDATION

The study has examined the relationship between workers' remittances and human capital formation in Sri Lanka using annual time series data for the period of 1975 to 2017. The unit root test (ADF and PP) indicate that HDI is a non – stationary,  $I(1)$  and EDUGDP, HEXGDP and WRE are stationary at the level  $I(0)$ . The ARDL bounds test shows that workers' remittances and human capital formation have a long-run equilibrium relationship between them and the workers' remittances are positively promoting the human capital formation in Sri Lanka. The coefficient of  $ECT_{t-1}$  is significant and has a negative sign. This implies that the response variable of human capital formation moves towards long-run equilibrium. The diagnostic tests show that the results are robust. Further, the Granger causality test analysis also showed that the workers' remittances Granger cause to human capital formation in Sri Lanka.

This study finds one-way causality from workers' remittances to human capital formation in Sri Lanka both short – run and long – run period. This implies that the policymakers should promote workers' remittances, as well as human capital formation, so that both two way Granger causality can occur. Our study shows that education is not a significant variable to determine the human capital formation in Sri Lanka. Thus, the Government needs to allocate more money on education sector show that human capital formation can be

improved. Health expenditure significantly influences on human capital formation. However, the government should allocate their expenditure in optimum way for education sector as well as health sector.

To our knowledge, this study is one of the first paper to discuss the impact of workers' remittances on human capital formation in Sri Lanka. Our study is limited to 43 sample observations. Future studies could collect more sample observation and study the impact of workers' remittances on human capital formation in Sri Lanka in depth.

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