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The Impact of Exchange Rate and Exchange Rate Volatility on Foreign Direct Investment: An Econometric Investigation in Sri Lanka

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Abstract **- This paper aims to explore the impact of exchange rate volatility on the ability to attract foreign direct investment (FDI) in the emerging economy of Sri Lanka. This investigation covers the period between 1978 and 2018. Exchange rate volatility is captured from the variance of the residuals by employing the testing procedure of ARCH (Engle, 1982) and GARCH (Bollerslev, 1986) models and its impact upon FDI is estimated by an Autoregressive Distributed Lag (ARDL) approach which is developed byPesaren *et al.*, (2001). The estimated results indicated that exchange rate volatility exerted significant positive impact on FDI during the period between 1978 and 2018 and the results show that exchange rate, exchange rate volatility, inflation, infrastructure, local and foreign interest rate, real GDP,political stability, and trade openness are the crucial determinants of FDI inflow in Sri Lanka. These findings are supported with Goldberg and Kolstad (1994) and it helps to the policy makers toconcentrate exchange rate volatility, other macro-economic stability and political stability are key to boom FDI inflow in Sri Lanka.**

Keywords: **Exchange Rate, Exchange Rate Volatility, Econometric Investigation**

I. INTRODUCTION

Sri Lanka is one of the emerging Asian countries moving towards to achieve the per capita income USD 5000 per year by employing the substantial tasks of creating millions of employment opportunities, raising FDI to USD 5 billion per year to become as an upper middle income country. However, the accumulation of capital and internal investment capacity is limited due to the lower serving ratio of the country. Accordingly, external financial source is needed to accumulate the capital to achieve the expected higher economic growth from Sri Lanka. Hence, the foreign direct investment (FDI) as a form of external financial source to accelerate the investment into the country. Though, Sri Lanka failed to attract more FDI inflows up to 2009 due to the civil war inside the country but policy makers presumed that FDI would accelerate after the war ended but it is not happened. Even FDI inflows could not pass beyond the level of their initial stage of fluctuation. Average FDI inflow is recorded 1.19 percent of GDP between 2009 and 2017.

FDI is a risk free for a country and it contributes for employment creation, increase income and enhances the financial stability and boosting economic growth. Foreign direct investment is a significant source of both faster economic growth and rising inequality (United Nations conference on Trade and Development Report, 2017). According to the Colen *et al.*, (2008) FDI is an engine for economic growth and human development. Hence lack of investment is a main reason for unemployment and poverty problem for all over the world especially in under developing countries. Thus, investment is a crucial instrument to eradicate such kind of unfavorable issues from the under developing country and it accelerate the economic growth and development. Basically developing countries are barrier to keep enough savings to achieve a higher economic growth. Therefore a large amount of inward FDI is an irrefutable factor to fill the savings and investment gap and the extent of global integration is also measured by the shares of trade and foreign direct investment in gross domestic product (United Nations conference on Trade and Development Report, 2017). International trade and integration is the crucial way for driving more foreign direct investment throughout the world.

FDI not only impulse more benefits for host country but also which urge more gains for home country especially diversification of investment which reduces overall risks and accumulate more return for foreign investors. However foreign investors they always concern about the risks when they carry out their investment, for instance political risk and legal risk which are common for all. But nowadays foreign investors face another risk of exchange rate volatility therefore, they should aware about the exchange rate fluctuation before they accomplish their investment. If the countries are following fixed exchange rate is not supposed to change and it is fixed for a permanent period of time therefore investors do not worry about it while, the floating exchange rate they float up and down - down and up from year to year, week to week and minute by minute which volatile create risks. Therefore floating exchange rate will be a year from now or even a week from now is often very difficult to predict. Secure investment opportunities try to avoid the exchange rate volatility and uncertainty (Morsink and Molle, 1992).

Basically, exchange rate volatiles indicate the degree of changes the exchange rate over time. Exchange rate volatility would differ from one country to another. Therefore, the sense of volatility also differs through the world. Effects of volatility are concentrated in a short time

frame and can have much larger economic impacts (Goldberg and Kolstad, 1994). Larger magnitude of changes or the quicker change over time is meant as a higher volatility. The fixed exchange rates have no volatility since they are not supposed to change. But fixed exchange rate is quite frequently devalued or revalued which means they can change indeed while floating exchange rates are generally expected to be more volatile since they are free to change. Currency instabilities have an impact on trade flows, foreign direct investment, currency crises, debt servicing costs, portfolio composition and commodity prices (Esquivel and Larrain, 2002). Exchange rate volatility is the main source for economic instability in developed as well as the developing countries. Taking a consideration about inflow of foreign direct investment is much difficult under floating exchange rate system and it creates exchange rate risks for international investors.

Moreover, Sri Lanka exposes number of positive signs to attract more inflow of FDI such as it is an open economy, heavily invested to develop its infrastructure facilities (efficient and modern sea ports and airports, network of well-maintained roads and highways, high quality telecommunication network, reliable utility services at competitive rates, export processing zones and industrial parks with plug and play facilities), geostrategic location, pro-business government policies, higher percentage of young population in labor force and Sri Lanka is one of the safest county in the world to invest in and it has signed bilateral protection arguments with 28 countries (Investment Guide, 2017). Though, Sri Lanka failed to record more inflow of FDI in while it gives favorable signal. Why? Is there any influence made by exchange rate volatiles? There is an ambiguous answer for this question in the empirical studies. Therefore, this study attempts to explore the impact of exchange rate volatility on FDI under Sri Lankan context.

II. THEORETICAL AND EMPIRICAL REVIEW

Since the collapse of Bretton woods system in 1973 majority of developed world economies switch to follow floating exchange rate regime (Jayasekara, 2013). This exchange rate reforms allows the fluctuation of the exchange rate, and it is settled by market mechanism through the demand and supply adjustments. From that period to up to now, there are numbers of study investigating the association between the exchange rate uncertainty and FDI as a result; most of the studies detected the existence of a relationship between exchange rate uncertainty and FDI.

There are three theoretical basements which are highly related with the behavior of exchange rate and FDI. First, the dominant theory of capital inflow is international monetary approach (IMA) widely published by Emerson who believed that stability in exchange rate that accompany monetary union should improve trade and investment in the economy even as they noted that exchange rate volatility could be detrimental to FDI (Ajayi, *et al.,* 2016). Further international monetary approach indicates stability of exchange rate enhance FDI. Exchange rate volatility and uncertainty that goes along with inhibits FDI (Giorgioni, 1999). By using the international monetary approach, Morsink & Molle discovered the exchange rate volatility as a restricting factor to FDI flows between two countries (Ajayi, *et al.,* 2016).

Second theoretical argument is the multiplier accelerator model which indicates the changes in capital stock or investment are determined mainly by income and interstate (Udoh and Egwaikhide, 2008). However, there are other factors also influence to determine the investment of a country. Portfolio allocation theory which is introduced by the Fedderke (2002) states the FDI inflows are determined by two main factors such as rates of return and risk (Vinayagathasan and Priyatharsiny, 2017). While FDI is positively affected by rate of return and adversely affected by risk factors. Though, returns of foreign investment are functions of exogenous factors such as foreign interest rates, macroeconomic policies, and health of foreign economies (Schadler, *et al.,* 1993) and foreign investors face political, legal and exchange rate volatile risk therefore, they should be aware about the exchange rate fluctuation before they carry out their investment.

Third theoretical aspect is production flexibility argument and risk aversion arguments which are important but have merit under different circumstances. Production flexibility argument says producers engage in international investment diversification to achieve a post-production flexibility and higher profits in response of shocks (Goldberg and Kolstad, 1994). This argument is relevant to the extent that post-production flexibility is possible within the window of time before the realization of the shocks. Exchange rate volatility does tend to increase the share of productive capacity located abroad (Goldberg and Kolstad, 1994). Therefore, higher the exchange rate volatility creates higher FDI in ex-ante phase (Wang, 2013). Next aspect is risk aversion; foreign investors they would like to maximize their return and avert their risks. Higher exchange rate volatility spurs higher risk and creates lower return for investors; therefore, in a higher volatile time they discourage to invest more FDI in order to eliminate the risk.

Based on the theoretical background, now thus study considers the empirical literatures. First, Wang (2013) analyzed the impact of exchange rate volatility on FDI in selected BRIC countries namely, Brazil, Russia, India, and China by using data over the period of 1994-2012. The standard deviation of monthly is applied to examine the exchange rate volatility and its influence upon FDI tested used Auto Regressive Distributed Lag (ARDL) approach and the Co-integration and Error Correction Model (ECM). Eventually he found there is a negative long run relationship between exchange rate volatility and FDI for India and Russia and the existence of a short run association was found in China, India, and Russia. However, Brazil no connection between the two variables was observed.

A study of exchange rate volatility on foreign direct investment in Sub-Saharan Africa the case of Ghana is demonstrated by Coleman and Tettey (2008). To find out the real exchange ratevolatility they used ARCH and GARCH models and they adopted co-integration and ECM to detect short and long run relationship by employing the time series data covering the period of 1970-2002. Finally, the study revealed the result that exchange rate volatility has a negative influence on FDI and liberalization process has not a greater inflow of FDI in Ghana.

Udoh and Egwaikhide (2008) examine the exchange rate volatility, inflation uncertainty and foreign direct investment in Nigeria covering the period between 1970 and 2005. They used GARCH model to estimate the exchange rate volatility and inflation uncertainty and detected both exchange rate volatility and inflation uncertainty exerted significant negative impact on foreign direct investment during the period. In addition, the result exposes the infrastructural development, appropriate size of the government sector and international competiveness are crucial determinants for FDI of the country.

Renani and Mirfatah (2012) evaluated the study of the impact of exchange rate volatility on foreign direct investment in Iran by using the Johansen and Juselius's co-integration approach covering the period of 1980Q2-2006Q3. They detected exchange rate volatility have a negative impact on FDI. Hence this study suggested implementing the policies which promote the stability of the exchange rate volatility to attract more FDI.

Goldberg and Kolstad (1994) analyzed foreign direct investment, exchange rate variability and demand uncertainty by testing United States bilateral quarterly data of FDI inflows of Canada, Japan, and United Kingdom for the period of between 1978 and 1991 based on the two highly influential theoretical arguments of the production flexibility and risk aversion. They concluded that exchange rate volatility can spur an increase in international capital flows that can substitute for international trade in goods without depressing overall economic activity; therefore, it is incorrect to assume that the selection of a flexible exchange rate system will lead to depressed economic activity.

Above empirical findings are consistent with the theoretical aspects. Most of the studies revealed exchange rate volatility is a constraint to attract more FDI inflow (Wang, 2013; Coleman and Tettey, 2008; Udoh and Egwaikhide, 2008 and Renani and Mirfatah, 2012) and they strongly advised exchange rate stability should enhance FDI which means that there is a negative relationship relies between exchange rate volatility and FDI. While Goldberg and Kolstad (1994) detected exchange rate volatility can spur an increase in international capital flows.

III. OBJECTIVES OF THE STUDY

There are two objectives of this study precede as follows,

1. Identify the factors affecting the foreign direct investment net inflow.
2. Evaluate the impact of exchange rate volatility on foreign direct investment net inflow during the period between1978 and 2018 (After the implementation of floating exchange rate regime) in Sri Lanka.

IV. DATA AND METHODOLOGY

To examine the impact of exchange rate volatility on FDI, this study adopts variables which are highly concentrated with both theoretical and empirical literatures. Data of all variables considered into this study is gathered from World Development Indicator over the period of 1978 - 2018 while daily data of exchange rate is gathered from Federal Reserve Economic Data source. Volatility of exchange rate is estimated by using Auto Regressive Conditional Heteroskedasticity (ARCH) and Generalized Auto Regressive Conditional Heteroskedasticity (GARCH) models introduced by Robert Engle (1982) and Bollerslev (1986) respectively and impact of exchange ratevolatility upon FDI is measured by using an Auto Regressive Distributed Lag (ARDL) bound test approach developed by Pesaran, Shin and Smith (2001).

Volatility is tested by using ARCH and GARCH models. Before running the ARCH family model, one first needs to calculate the return series for our time series data plot and check the stationary property for that data. Then, identify the volatility clustering and ARCH effects for the data.

Volatility is statistically measuring as follows (Gujarati, 2003);

$$Y_t = \text{LKR/US dollar}$$

$$Y_t^* = \log \text{ of } Y_t$$

$$dY_t^* = Y_t^* - Y_{t-1}^* = \text{relative change in the exchange rate}$$

$$\bar{d}Y_t^* = \text{mean of } dY_t^*$$

$$V_t = dY_t^* - \bar{d}Y_t^*$$

Thus, Vt is the mean adjusted relative change in the exchange rate. Now we can use $V2$ as a measure of volatility.

$$V_t^2 = \delta_0 + \delta_1 V_{t-1}^2 + e_t \qquad (1)$$

$$e_t \approx N(0, h_t)$$

This model postulates that volatility in the current period is related with its value in the previous period plus a white noise error term (Gujarati, 2003). Where, $\delta 0$ and $\delta 1$ are constants; $\delta 0$, intercept; δ,ARCH (1) lagged coefficient, et, residual series; $et \approx (0, ht)$; where, $ht = \sigma 2$, conditional variance indicating variance of the errors is not constant over time it indicates the presents of heteroskedasticity. Conditional heteroskedastic series are non-stationary since its variance is not constant over time. We are mainly interested in variance of the return series.

$$ht = \omega + \alpha e2 + \beta ht-1 \qquad (2)$$

$\omega > 0$, $\alpha > 0$, $\beta > 0$; and $\alpha + \beta < 1$ (unconditional variance)

This is a GARCH (1, 1) model which is like ARMA (1, 1) model for the variance equation. Coleman and Tettey (2008) indicated that the conditional variance ($\sigma 2$) is a function of three terms: where, ω is intercept; α, ARCH term means lag of the squared return; and β, GARCH term means lag of the conditional variance. Equation (2) says that the conditional variance of e at time t depends not only on the squared error term in the previous time but also on its conditional variance in the previous time period.

According to the Engle (2001) "the ARCH model allowed the data to determine the best weights to use in forecasting the variance. A useful generalization of this model is the GARCH parameterization introduced by Bollerslev (1986). This model weighted average of past squared residuals, but it has declining weights that never go completely to zero. It gives parsimonious models that are easy to estimate and, even in its simplest form, has proven surprisingly successful in predicting conditional variances". Above complicated estimation procedure is explained the volatility of exchange rate of LKR per US dollar by using ARCH and GARCH models. Next, the impact of exchange rate volatility upon FDI is measured by using an Auto Regressive Distributed Lag (ARDL) bound testing approach developed by Pesaran, Shin and Smith (2001) to find the long run relationship, long run equilibrium and short run relationship.

This study developed the analytical procedure based on the portfolio allocation theory introduced by Fedderke (2002) to detect the impact of exchange rate volatility on FDI. He pointed out the foreign direct investment net inflow (FDINI) is determined by two main factors such as rate of return and risk (Vinayagathasan and Priyatharsiny, 2017).

Rate of return of FDINI is a function of exogenous factors such as exchange rate (ER), inflation (INF), infrastructure (INFRA) as a proxy for fixed telephone subscriptions per 100 people, local real interest rate (IR), foreign interest rtes (INRUS) as a proxy for deposit interest rate of United States, real gross domestic product (RGDP) and trade openness (TO) and risk factor associates with political stability (PS) and exchange rate volatility (ERV). The result of theoretical model is described as follows.

$$FDINI = f(ER, ERV, INF, INFRA, INR, INRUS, PS, RGDP, TO) \qquad (3)$$

The above functional form of this study can be specified in the following general model.

$$FDINIt = \mathrm{P0} + \mathrm{P1}ERt + \mathrm{P2}ERVt + \mathrm{P3}INFt + \mathrm{P4}INFRAt + \mathrm{P5}INRt + \mathrm{P6}INRUSt + \mathrm{P7}PSt + \mathrm{P8}RGDPt + \mathrm{P9}TOt) \qquad (4)$$

The above variables are selected based on the empirical and theoretical studies of Fedderke (2002), Coleman and Tettey (2008), Udoh and Egwikhide (2008), Renani and Mirfatah (2012) and Ullah, Haider and Azim (2012). Foreign direct investment net inflows as a percentage of GDP is a dependent variable and others are the independent variables of this study. Data of FDINI, OPEN, RGDP, INF, LIR, and INFRA is gathered from World Bank Indicators (WDI) and daily data of exchange rate is extracted from Economic Research: Federal Reserve Bank of ST. Louis during the period of 1986 to 2018.

ARDL bound testing approach is adopted to examine the equation (4). The procedure of ARDL as follows (Vinayagathasan and Priyatharsiny, 2017).

$$\Delta FDINI = \mathrm{P}_0 + \gamma' \mathrm{X}_{t-1} \sum_{i=1}^{p} \pi_i \Delta FDINI_{t-i} + \sum_{i=0}^{P} \theta_i' \Delta \mathrm{X}_{t-i} + u_t \qquad (5)$$

Where, $\gamma' = [\gamma_1, \ldots, \gamma_{10}]$ indicates long run coefficients;

$\mathrm{X}_{t-1} = [FDINI_{t-1}, ER_{t-1}, ERV_{t-1}, INF_{t-1}, INFRA_{t-1}, INR_{t-1}, INRUS_{t-1}, PS_{t-1}, RGDP_{t-1}, TO_{t-1}]$ is the vector of explanatory variables with lagged one;

π_i and $\theta' = [\theta_{1i}, \ldots \ldots, \theta_{9i}]$ indicates short run coefficients,

$$\Delta \mathrm{X}_{t-i} = [\Delta ER_{t-i}, \Delta ERV_{t-i}, \Delta INF_{t-i}, \Delta INFRA_{t-i}, \Delta INR_{t-i}, \Delta INRUS_{t-i}, \Delta PS_{t-i}, \Delta RGDP_{t-i}, \Delta RGDP_{t-i}, \Delta TO_{t-i}]$$

Once this study confirmed the co-integrating relationship among the variables by the bound testing procedure from equation (5), then this study employs error correction representation of ARDL model to identify the short run relationship between the variables and long run adjustment of the model, which is specified below.

$$\begin{aligned} \Delta FDINI_t = {} & \mathrm{P}_0 + \sum_{i=1}^{q1} \mathrm{P}_{1i} FDINI_{t-i} + \sum_{i=0}^{q2} \mathrm{P}_{2i} ER_{t-i} + \sum_{i=0}^{q3} \mathrm{P}_{3i} ER_{t-i} + \sum_{i=0}^{q4} \mathrm{P}_{4i} INF_{t-i} \\ & + \sum_{i=0}^{q5} \mathrm{P}_{5i} INFRA_{t-i} + \sum_{i=0}^{q6} \mathrm{P}_{6i} INR_{t-i} + \sum_{i=0}^{q7} \mathrm{P}_{7i} INRUS_{t-i} + \sum_{i=0}^{q8} \mathrm{P}_{8i} PS_{t-i} \\ & + \sum_{i=0}^{q9} \mathrm{P}_{9i} RGDP_{t-i} + \sum_{i=0}^{q10} \mathrm{P}_{10i} TO_{t-i} + \varphi ECT_{t-1} + u_t \end{aligned} \qquad (6)$$

Where, P1i, ….. P10i are short run coefficients; φ is the coefficient of speed of adjustment, ECT denotes the error correction term and ut is the white noise process.

V. RESULTS AND DISCUSSION

First, this study obtained the results from ARCH and GARCH model are presenting as follows; Augmented Dickey Fuller (ADF) test is confirmed exchange rate return series has unit root at their level. Hence this study used return series to calculate the volatility.

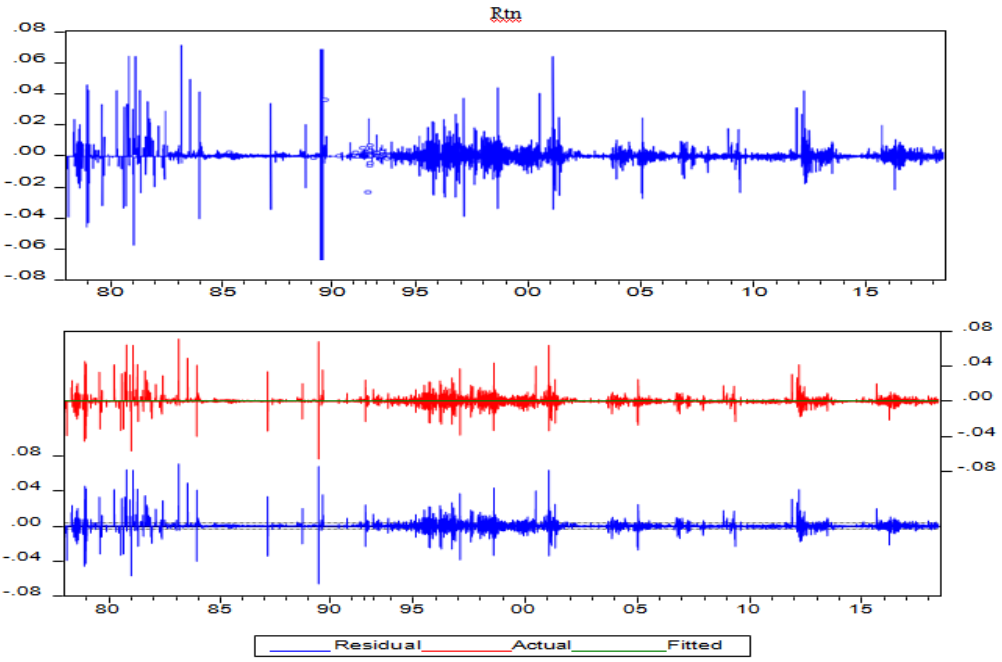

Fig.1 Fluctuation of exchange rate return and its residuals

The above graph has obviously shown there is a volatility clustering in the data plot, meaning that serial correlation exists in the squared return that is the variance of the return. Moreover, the graph has represented periods of high volatility is followed by periods of high volatility for a prolonged period as well as periods of low volatility tends to be followed by periods of low volatility for a prolonged period.

TABLE I RESULTS OF ARCH MODEL

Heteroskedasticity Test: ARCH				
F-statistic	260.8605	Prob. F(1,9681)		0.0000
Obs*R-squared	254.0683	Prob. Chi-Square(1)		0.0000
Test Equation:				
Dependent Variable: RESID^2				
Method: Least Squares				
Date: 07/29/18 Time: 08:57				
Sample (adjusted): 1/06/1978 12/29/2017				
Included observations: 9683 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1.25E-05	1.43E-06	8.727161	0.0000
RESID^2(-1)	0.161983	0.010029	16.15118	0.0000
R-squared	0.026239	Mean dependent var		1.49E-05
Adjusted R-squared	0.026138	S.D. dependent var		0.000142
S.E. of regression	0.000140	Akaike info criterion		-14.91327
Sum squared resid	0.000189	Schwarz criterion		-14.91178
Log likelihood	72204.58	Hannan-Quinn criter.		-14.91276
F-statistic	260.8605	Durbin-Watson stat		2.000578
Prob(F-statistic)	0.000000			

Then the ARCH effect was estimated. The above result obtained from the ARCH test is confirmed there is a heteroscedasticity stochastic process, indicating ARCH effects is there since we reject the null hypothesis (Prob. Chi - Square (1) is 0.00000). Further, the correlogram result also indicates there is an ARCH effect since the probability value is 0.0000, meaning that there is a serial correlation.

Results obtained from the ARCH (1) model, coefficient of lagged term ($\delta 1$) is positive (0.161983) and statistically highly significant (probability value is 0.0000); it suggests, if volatility was high in the previous period, it would continue to be high in the current period. It is representing volatility clustering is present in the present instance. If $\delta 1$ is zero, then there is no volatility clustering (Gujarati, 2003).

Finally, the return series has volatility clustering and ARCH effect. When it is happens for residuals, we have all the justification to run the ARCH family model. The following result is a GARCH (1, 1) model which is like ARMA (1, 1) model for the variance equation.

TABLE II RESULTS OF GARCH (1,1) MODEL

Dependent Variable: RTN				
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)				
Date: 07/29/18 Time: 08:58				
Sample (adjusted): 1/05/1978 12/29/2017				
Included observations: 9684 after adjustments				
Convergence achieved after 31 iterations				
Coefficient covariance computed using outer product of gradients				
Presample variance: backcast (parameter = 0.7)				
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
C	0.000148	1.87E-05	7.894957	0.0000
RTN(-1)	-0.182589	0.010381	-17.58934	0.0000
Variance Equation				
C	4.24E-07	3.17E-09	133.5689	0.0000
RESID(-1)^2	0.075835	0.001063	71.33317	0.0000
GARCH(-1)	0.913356	0.000626	1458.689	0.0000
R-squared	0.018770	Mean dependent var		0.000233
Adjusted R-squared	0.018669	S.D. dependent var		0.003898
S.E. of regression	0.003861	Akaike info criterion		-8.650622
Sum squared resid	0.144353	Schwarz criterion		-8.646915
Log likelihood	41891.31	Hannan-Quinn criter.		-8.649365
Durbin-Watson stat	1.941981			

Conditional variance equation is obtained from the above result of GARCH (1, 1) as follows.

$$ht = 0.0000424 + 0.075835e2 + 0.913356ht-1 \quad (7)$$

There are three coefficients in the conditional variance equation (7) are listed as c, the intercept; RESID(-1)^2, the first lag of the squared return; and GARCH(-1), the first lag of the conditional variance. The coefficient of RESID(-1)^2, 0.075835; and GARCH(-1), 0.9133566; are positive and statistically significant at the 1 percent significance level.

Notice that the sum up coefficients of both ARCH (1) and GARCH (1) is 0.075835 + 0.9133566 = 0.989191, is very closer to one (less than unity), which means that the volatility shocks are persistent and require to has a mean reverting variance process. Since the sum is very close to one this process only mean reverts slowly (Engle, 2001).If the sum of coefficients is very closer to one and positive, it creates sensitive effect and stationary in variance which means conditional variance forecasts will converge on their unconditional value as horizon increases.

The most widely used GARCH specification asserts that the best predictor of the variance in the next period is a weighted average of the long run average variance, the variance predicted for this period, and the new information in this period that is captured by the most recent squared residual (Engle,2001). Long run average variance is

$$\sqrt{\omega / 1 - \alpha - \beta} = \sqrt{0.0000424 / (1 - 0.989191)}$$
$$= 0.0626311185$$

since this only works if $\alpha + \beta < 1$ (this is just unconditional variance) and it only really makes sense if the weights are positive, requiring $\omega > 0$, $\alpha > 0$ and $\beta \geq 0$. Thus, the GARCH models are mean reverting and conditionally heteroskedastic, but have a constant variance (Engle, 2001). Therefore, the variance of the next period is approximately 0.0626311185 which is a very useful predictor of volatility for the next period.

Second, this study obtained the results from ARDL bound testing approach. The ADF unit root test approaches confirmed that none of the variables are I(2) meaning that all variables are stationary at their level I(0) and first difference I(1). Akaike information criterion suggested that to use ARDL (2, 1, 1, 1, 0, 2, 0, 1, 0, 0) model for this analysis. This best model is selected among top 20 model based on AIC criteria.

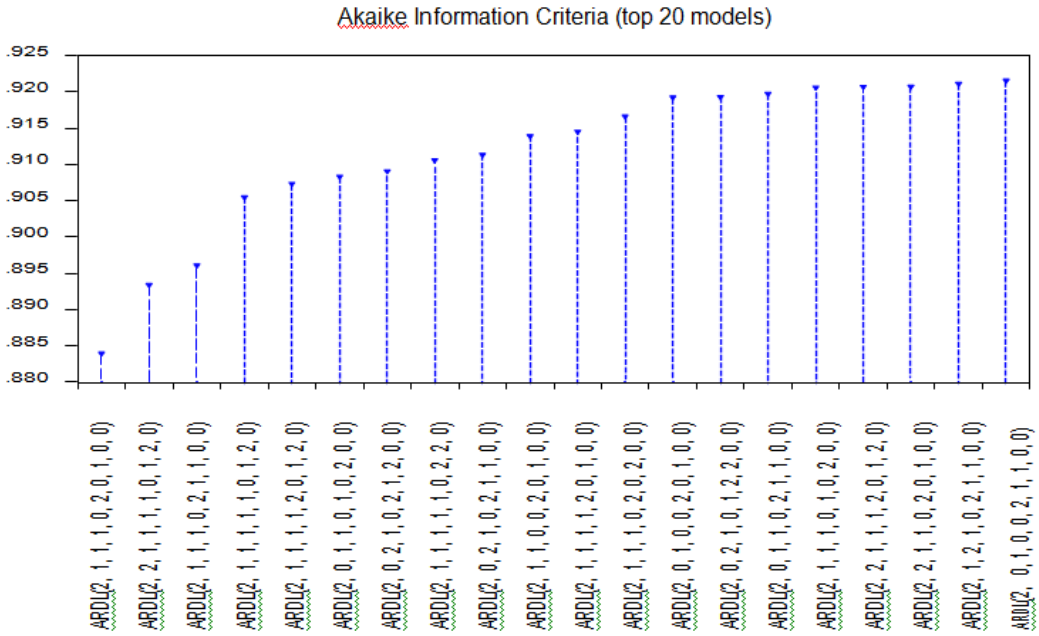

Fig. 2 Akaike Information Criteria (top 20 models)

The results of Breush-Godfrey serial correlation LM test reveals that there is a serial correlation in the above model since reject the null hypothesis (probability value is 0.0033). Stability diagnostic test of CUSUM test and recursive residual detect that the model is stable since the residual line lies between the 95 percent confident bands also the recursive residual line lies between $\pm 2S.E.$

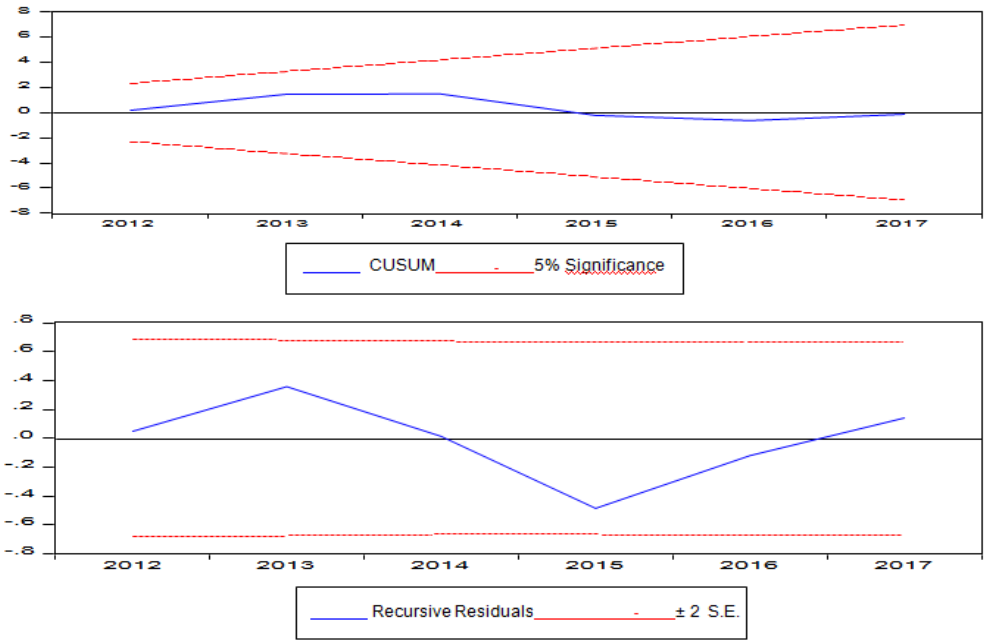

Fig. 3 Stability diagnostic test of CUSUM test and recursive residual

Ramsey RESET test for omitted variable suggests there are no omitted variables in this study sine the probability value is 0.0408). The results of Breush-pagan-Godfrey heteroskedasticity test reveal the residuals are homoscedasticity meaning that variance of the residual is constant.

The results of Wald test or Bound test suggests that the existence of co-integrating relationships between the variables under considered in this study since the F-statistic is 7.475190 which is above the lower bound I(0) and upper bound I(1) range at 1 percent significance level.

TABLE III RESULTS OF BOUND TEST/ WALD TEST

F-Bounds Test		**Null Hypothesis: No levels relationship**		
Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	7.475190	10%	1.8	2.8
k	9	5%	2.04	2.08
		2.5%	2.24	3.35
		1%	2.5	3.68

If the study confirmed the co-integrating relationship among the variables then his study should employ the error correction representation of ARDL model.

TABLE IV RESULTSOFLONGRUNRELATIONSHIP

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ER	-0.048774	0.013795	-3.535603	0.0021*
ERV	120.6682	36.40803	3.314329	0.0035*
INF	-0.006650	0.016516	-0.402648	0.6915
INFRA	0.042756	0.018219	2.346759	0.0293**
INR	0.011306	0.026222	0.431163	0.6710
INRUS	-0.137671	0.048791	-2.821619	0.0105**
PS	1.225600	0.415476	2.949872	0.0079*
RGDP	8.97E-11	2.39E-11	3.762646	0.0012*
TO	8.986453	2.194447	4.095088	0.0006*
C	-2.821453	0.904261	-3.120176	0.0054*

*,** represents the variables are statistically significant at 1% and 5% level of significance respectively

The results reveal that ER and INRUS have a negative significant impact on FDINI while ERV, INFRA, PS, RGDP and TO have a positive significant impact on FDI in long run. Which are the major factors determines the inflows of FDI in Sri Lanka within the long run time period.

ER has a significant negative impact on FDINI in long run. This means that the exchange rate depreciation improves the FDINI on contrast exchange rate appreciation leads to shrink the FDINI in long run. While, the exchange rate volatility has a positive impact on FDINI in long run. Volatility is a risk for foreign investors when this risk increases, investors motivates to invest more because to urge more return. If the risk increases return should increases. This finding rejects the portfolio theory of investment since it mentioned risk and inflows of FDI have a negative impact.

Infrastructure, political stability, real GDP, trade openness has a positive impact on FDI inflows which means that better infrastructure facilitates to attract more FDI inside the country. Also political stabilization favorable government policies have positive signals to attract more FDI. Emerging economic activity and boosting gross domestic product also give a positive signal for FDI while the domestic interest rate of United State has a negative impact. If the domestic interest rate is high in foreign countries, then foreign investors encourage saving more in their own country. Therefore they disappoint to carry out their investment. Other variable such as inflation and local real interest rate do not have an impact on FDINI.

The error correction representation of ARDL model explains the short run relationship and long run adjustment of the model. First, we take consideration on short run relationship. Two year lagged value of FDINI, current value and near lagged value of exchange rate, near lagged value of exchange rate volatility, current value of inflation, one year lagged value of inflation, current value of infrastructure, one year lagged value of local real interest rate, one year lagged value of interest rate United States, current value of political stability, one year lagged value of political stability, current

value of real GDP and current value of trade openness have a significant impact on the current value of FDINI in short run. Which are the major factors determining the inflows of FDI in Sri Lanka within the short run time.

TABLE V RESULTS OF ECM- ARDL (2, 1, 1, 1, 0, 2, 0, 1, 0, 0) MODEL

Dependent Variable: D(FDINI)				
Method: Least Squares				
Date: 07/21/18 Time: 14:47				
Sample (adjusted): 1981 2017				
Included observations: 37 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-0.007432	0.106133	-0.070029	0.9449
D(FDINI(-1))	0.075879	0.089321	0.849509	0.4068
D(FDINI(-2))	-0.409664	0.083570	-4.902015	0.0001*
D(ER)	-0.058704	0.015869	-3.699377	0.0016*
D(ER(-1))	-0.034020	0.016868	-2.016883	0.0589***
D(ERV)	38.09152	26.42713	1.441379	0.1666
D(ERV(-1))	193.6541	30.50090	6.349128	0.0000*
D(INF)	-0.029386	0.011486	-2.558419	0.0197**
D(INF(-1))	0.020768	0.009783	2.122953	0.0479**
D(INFRA)	0.075332	0.039899	1.888064	0.0752***
D(INR)	0.030614	0.029765	1.028519	0.3173
D(INR(-1))	0.086557	0.025432	3.403461	0.0032*
D(INR(-2))	-0.039119	0.028631	-1.366317	0.1887
D(INRUS)	-0.304503	0.050241	-6.060898	0.0000*
D(PS)	-1.252848	0.383553	-3.266426	0.0043*
D(PS(-1))	-1.183967	0.374721	-3.159592	0.0054*
D(RGDP)	1.84E-10	4.30E-11	4.281139	0.0004*
D(TO)	16.91692	2.614595	6.470186	0.0000*
ECT(-1)	-1.708767	0.216858	-7.879656	0.0000*
R-squared	0.907034	Mean dependent var		0.013743
Adjusted R-squared	0.814068	S.D. dependent var		0.571639
S.E. of regression	0.246490	Akaike info criterion		0.343489
Sum squared resid	1.093630	Schwarz criterion		1.170717
Log likelihood	12.64546	Hannan-Quinn criter.		0.635125
F-statistic	9.756608	Durbin-Watson stat		2.040033
Prob(F-statistic)	0.000006			

*, **, *** represents the variables are statistically significant at 1%, 5% and 10% level of significance respectively

Two year lagged value of FDINI has positive and strong significant impact on the current value of FDINI in short run. Current value and near lagged value of exchange rate have a negative significant impact on current value of FDINI. However, near lagged value of exchange rate volatility has a positive and strong significant impact on current value of FDINI. If the volatility changes happen under flexible exchange rate regime in the short run it is not hurts the inflows of FDI since it has positive and strong significant impact on the current value of FDINI in short run.

Finally, coefficient of error correction term (ECT) is strongly significant and negative implies that the whole system can get back to long run steady state equilibrium at the speed of 1.71*100% in each year one period after the exogenous stock.

VI. CONCLUSION

In this study identify the factors affecting the foreign direct investment net inflow and it evaluates the impact of exchange rate volatility on foreign direct investment net

inflow during the period between1978 and 2018 in Sri Lanka. To that aim, ARCH and GARCH models and ARDL bound testing approaches are used. ARCH and GARCH models suggested there is a volatility clustering, and the sum of coefficients is very closer to one and positive, it creates sensitive effect meaning that volatility shocks are persistent and require having a mean reverting variance process. The test further found the variance of the volatility for the next period is approximately 0.0626. Akaike information criterion suggested that to use ARDL (2, 1, 1, 1, 0, 2, 0, 1, 0, 0) model for this analysis. Breush- Godfrey serial correlation LM test reveals that there is a serial correlation in the above model. Stability diagnostic test of CUSUM test and recursive residual detect that the model is stable. Ramsey RESET test for omitted variable suggests there are no omitted variables in this study. Breush-pagan-Godfrey heteroskedasticity test reveals the residuals are homocedasticity. The results of Wald test or Bound test suggests that the existence of co-integrating relationships between the variables under considered in this study. If it confirmed the co-integrating relationship among the variables, then employed the error correction representation of ARDL model.

The results of error correction representation of ARDL reveal that ER and INRUS have a negative and statistically significant impact on FDINI in long run period while ERV, INFRA, PS, RGDP and TO have a positive and statistically significant impact on FDINI in long run. Which are the major factors determining the inflows of FDI in Sri Lanka within the long run time. The error correction representation of ARDL model explains the short run relationship and long run adjustment of the model. First, we take consideration on short run relationship. Two year lagged value of FDINI, current value and near lagged value of exchange rate, near lagged value of exchange rate volatility, current value of inflation, one year lagged value of inflation, current value of infrastructure, one year lagged value of local real interest rate, one year lagged value of interest rate United States, current value of political stability, one year lagged value of political stability, current value of real GDP and current value of trade openness have a significant impact on the current value of FDINI in short run. Which are the major factors determining the inflows of FDI in Sri Lanka within the short run time. Next, the Error Correction representation of ARDL model reveals that the coefficient of Error Correction Term (ECT) is strongly significant and negative implies that the whole system can get back to long run steady state equilibrium at the speed of 1.71*100% in each year one period after the exogenous stock.

In sum, the exchange rate volatility creates risk for foreign investors since it is having a negative impact on FDINI. However, the study has found the exchange rate volatility has positive and statistically significant impact on inflows of FDI since it rejects the theoretical results. Liberalization brought flexible exchange rate regime in Sri Lanka since 1977 and this flexible exchange rate regime and its volatility movements improve the FDINI in Sri Lanka. However, the central bank of Sri Lanka control and manage the fluctuation of flexible exchange rate in some level. If central bank allows floating fully freely, FDINI would be further increase in some extent since flexible exchange rate has a positive impact on FDINI. Therefore, exchange rate volatility is not a barrier to attract more FDI in Sri Lanka. But, other macro-economic variables, political instability infrastructure and government policies have some barrier to attract more FDI.

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