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A STUDY ON EFFECTS OF EXCHANGE RATE FLUCTUATION ON STOCK RETURNS; EVIDENCE FROM COLOMBO STOCK EXCHANGE

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ABSTRACT

The objective of this study is to empirically investigate the effects of exchange rate volatility on stock market return volatility from listed companies in Sri Lanka. This study utilizes daily time series data for the All Share Price Index (ASPI) returns of the Colombo Stock Exchange (CSE) and exchange rates over a period of seven years from January 2011 to December 2017. Further, the study utilizes the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) estimation model in order to identify the impact of exchange rate volatility on stock market return. The empirical results of the study reveal that the volatility of Euro, Japan Yen, and US Dollars exchange rates has a positive and significant impact on ASPI return. Overall, the finding of the study highlight that exchange rate volatility is a determinant of stock market return volatility. The findings from this research could provide relevant insights into Sri Lankan listed companies.

KEYWORDS: ***Exchange rate, Stock return, GARCH***

INTRODUCTION

Countries are interconnected to each other as result of several reasons including international diversification, cross-market return, and adoption of the flexible exchange rate, removal of barriers to capital flow in both emerging and changing economies. These changes have increased the opportunities for cross-border investment along with the volatility of exchange rates and the risk of portfolio diversification. The expectation of relative currency value plays a considerable role in their price movement particularly in foreign transactions so the stock price movement may or may not be affected by the exchange rate volatility (Ajayi, 1996).

Stock market performance is generally evaluated by the financial and economic condition of the country. Market fluctuation directs the degree of price variation between the share prices during a particular period (Aggarwal, 1981). A certain degree of market volatility is unavoidable, even desirable, as the stock price fluctuation indicates changing values across economic activities and it facilitates better resource allocation. But regular and wide stock market variations cause insecurity about the value of an asset and affect the confidence of the investor (Ma and Kao, 1990). The risk-averse and the risk-neutral investors may remove from a market at sharp price movements. Extreme volatility disrupts the smooth functioning of the stock market.

Therefore, both domestic and international investors need to understand the relationship between exchange rates and stock prices in order to make careful investment decisions to secure stable returns (Abdullah, 2012).

Additionally, firms without foreign transactions, costs, or operations might be indirectly affected by exchange rate changes through its their act on foreign competition or broader macroeconomic conditions (Parsley and Popper, 2002). Due to the unstable market condition, foreign exchange risk has become a key challenge for the treasury and financial sector of the country. Hence, it leads the firms to make foreign exchange exposure management a key to corporate strategy (Laurence Booth, 1990).

Volatility in stock return is always considered a measure of risk and it is mostly focused in the area of asset pricing, hedging, risk management, and portfolio selection (Jegajeevan2012). Furthermore, the exchange rate started to fluctuate due to current changes in the global financial market which has created to result in positive and adverse effects on global countries (Perera, 2016).

The exchange rate system of Sri Lanka has changed from a regime of fixed exchange rates to a managed float and finally to an independent float. Sri Lanka restructured the exchange rate system in 1977 and introduced the managed floating exchange rate system. The rupee came under increasing pressure in mid-2000 when there was a serious decline in Sri Lanka's external reserves (Gunaratna, 2010). As a result of these problems, the Central Bank stopped announcing buying and selling rates in advance and a free float exchange rate regime was introduced in 2001(Kanchana, 2010). According to BOI in Sri Lanka, Despite an increase of 12% in 2019 to USD 1 426

billion, global FDI flows remained below levels recorded between 2010 and 2017. Compared to 2017, FDI flows decreased by 15%, continuing the downward trend observed since 2015. This is a bad indication that the foreign investors' risk-taking appetite for Sri Lanka has decreased. Higher equity investment suggests an increase in new ventures/businesses and ala so possible change in the nature of businesses and industries backed by foreign investors. Further, in this paper the study attempt to investigate the Effects of Exchange Rate Fluctuation on Stock Returns. Evidence from Colombo Stock Exchange by using standard Ordinary Least Squares (OLS) and Generalize Autoregressive Conditional Heteroscedasticity (GARCH) models. The data is based on a daily basis so that it delivers strong evidence on results.

OBJECTIVES

The main research objective of the study is,
To test the level of impact of the exchange rate fluctuation on stock return.
Sub research objectives of the study are,

1) To test the level of impact of EUR/ LKR on stock return
2) To test the level of impact of JY/ LKR on stock return
3) To test the level of impact of USD/ LKR on stock return

LITERATURE REVIEW

The fluctuation of exchange rate changes has increased significantly as a result of the floating rate regime in the early 1970s. As a result, international equity markets experienced a major level of uncertainty nature. This risk may influence the volume of international t, therefore, overall portfolio decisions became increasingly important in the selection of international investment and choice of currency (Ma and Kao, 1990).

The exchange rate regime defines as how a country manages its currency with respect to foreign currency and the foreign exchange market. Many firms dedicate a considerable amount of resources to the management of foreign exchange risk, which is often perceived as a source of risk to be actively hedged away (Jorion, 1991). Modern portfolio theory, however, emphasizes that investors are not willing to pay a premium for firms with active hedging policies if foreign exchange risk can be diversified away. As a result, more stable earnings should not change the cost of capital and it does not add value to the firm. (Mathur, 1982).

Many academics have studied the relationship between the foreign currency market and the stock market, and many empirical investigations have produced complex and even contradicting results. Most scholars still employ static approaches for research and analysis, such as the Granger causality test, cointegration analysis, and the GARCH model, in prior research. The results of Liu and Wan (2012), for example, reveal that there is a cross-correlation between the Chinese Shanghai Composite Index (SCI) and the renminbi (RMB) exchange rate versus the US dollar, but no cointegration link. Furthermore, prior to the financial crisis, there was no causation between the two variables, whereas there was unidirectional causality from the foreign currency market to the stock market.

Sekmen (2011), using ARIMA models on stock returns study discovered that exchange rate volatility negatively affects stock returns. He further concluded that the availability of hedging instruments could not lessen the negative impact of exchange rate volatility on the volume of trade. At the same time study (Altin,2014) used the Johansen model Vector Autoregressive Model (VAR) model According to application results, there is a significant relationship between exchange rates and BIST 100. This result is consistent with Turkey's foreign currency composition. However, the direction of the effect of foreign currencies on BIST 100 expressed mixed results. Another recent study (Bernardus, 2016) adopted Fama and French Three Factor Asset Pricing Model because it can capture the sensitivity of stock returns to variable market equity. The study illustrated that analysis of the relationship between exchange rates shows that there is no significant relationship between the exchange rate exposures on stock returns. Based on the literature reviewed it is confusing that every study used a different model of analysis and there are different results from each author.

Baharumshah et al. (2002) examined the relationship between exchange rates and stock prices in Malaysia by applying an augmented monetary model to the ringgit/US dollar exchange rate and ringgit/yen exchange rate. They found that the augmented monetary model was cointegrated. The restricted vector autoregression model which imposes exogeneity restrictions on variables, such as stock prices, among others, exhibits both cointegration and parameter stability. They showed that the exchange rate adjusted to clear any disequilibrium in the long-run relationship. The findings of this study suggest that the equity market is significant in affecting the exchange rate and in explaining at least in part the parameter instability evidenced in the cointegrating system.

Michael, (2009) disclosed the movement of different exchange rates in determining stock returns. The finding (Tulin, 2012) was that different exchange rates have a mixed effect on stock returns in the same context. The finding of (Gaurav et al, 2010) suggested that, a negative correlation between stock price and exchange rate of Nifty returns and Indian Rupee, US Dollar Exchange Rates. (Ratnik, 1993) has also found a similar result.

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In China, the study carried out by (Carlos, et. al, 2017) in the area of exchange rate exposure of stock returns in selected industries, and the sample ranges from November 1996 to February 2015. The finding suggested that unanticipated exchange rate changes will affect firm returns. The study further evidenced that non-exporting industries are subject to exchange rate exposures, which could be due to the higher proportion of their net imports.

Rahman and Uddin (2009), could not find any relationship between stock prices and exchange rates in the long term in their research of Banglades, Indıa, and Pakistan.

Adjasi and Biekpe (2005), reported that as per the stock-oriented model, relative currency movements have a significant impact on financially held assets so this conjecture implies that currency movements may influence stock price volatility. Moreover, (Branson, and Handerson 1988), and (Frankel 1983) through the portfolio balanced model, demonstrated that the connection between the movements of the exchange rate and stock the market has a negative relationship. Despite the theoretical appeal of the association between exchange rates and stock market volatilities, early empirical studies in this discipline (Jorion, 1991) failed to construct valid evidence to support the relationship between exchange rate and stock market movements.

In Sri Lanka, Gunasekarage et al. (2004) studied the exchange rate between the US dollar and the Sri Lankan rupee the study found that there is a long-term equilibrium relationship between share price and exchange rate. Moreover, Gunasehara, (2012) surveyed the relationship between stock prices and exchange rates in Sri Lanka. The author uses monthly data on four foreign exchange rates and the All Share Price Index (ASPI) of the Colombo Stock Exchange in the empirical analysis results showed that Johansen's cointegration test finds no long-run relationships between stock prices (ASPI) and any of the four exchange rates during the sample period.

Menike (2006) results from that inverse relationship between share price and exchange rate. A study by Perera (2016) suggests that in overall there is a weak impact of exchange rate volatility on stock market return volatility. However, the results further demonstrate that the volatility of the Euro exchange rate has a positive and significant effect on the volatility of ASPI returns whilst volatilities of USD and GBP are found to be negative and insignificant. In addition to that, the overall finding of the study seems to be more robust for an emerging financial market such as Sri Lanka, which does not have a well-developed derivative market to provide more opportunities in order to mitigate the exposure to foreign exchange risks.

THE CONCEPTUAL FRAMEWORK

The following conceptual framework is derived based on the literature survey.

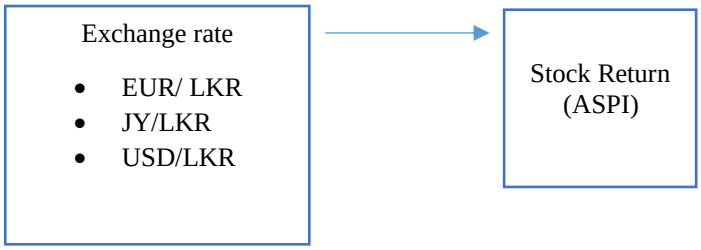

Figure 01. Conceptual Framework

Source (Author developed)

RESEARCH METHODOLOGY

The sample of the study consists of daily market values of the All Share Price Index (ASPI) of the Colombo Stock Exchange (CSE) and the daily exchange rate values of the US Dollar, Euro, and Japan Yen for a period of seven years from January 2011 to 31 December 2017.

Bolleslev (1986) generalized the ARCH (GARCH (p, q)) process by allowing the conditional variance to be a function of the prior period's squared errors as well as its past conditional variances. Following the introduction of ARCH and GARCH models, there have been numerous refinements of the approach to modeling conditional volatility to better capture the stylized characteristics of the data (Bahadur, 2008).

The data was then tested for stationarity by using Augmented Dickey-Fuller (ADF) test in order to avoid constructing spurious regressions which can be occurred due to the problem of unit root that is present when working with non-stationary time series data.

In order to analyze the impact of exchange rate volatility on stock market volatility this study first employs the OLS method where equation (1) specifies the model that is estimated with OLS.

$$rt = \beta 0 + \beta \text{EUR}t + \beta 2\text{JY}t + \beta 3\text{USD}t + \mu t \quad (1)$$

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where rt is the daily stock returns of ASPI calculated by taking the natural logarithm of the daily closing price relative,
$\beta 0$ is the intercept;

EURt is the natural logarithm of the daily exchange rate i.e. EURt= ln(EURO/ EUROt-1);

JYt is the natural logarithm of the daily exchange rate i.e. *JYt= ln(YEN/YENt-1);*

USDt is the natural logarithm of daily exchange rate i.e. *USDt= ln(Dollart/ Dollart-1);*

$\beta 1\ to\ \beta 3$specify the coefficients of the parameters; and μt is the white noise error term.

The suitability of this estimated OLS model is then tested with the Autoregressive Conditional Heteroscedasticity (ARCH) test. Then the GARCH process, which was firstly introduced by Bollerslev (1986), employs to estimate the parameters where the GARCH (1,1) process is specified as follows;

$rt = \gamma 0 + \gamma 1\text{EUR}t + \gamma 2\text{JY}t + \gamma 3\text{USD}t + \varepsilon t$ (2) $\sigma t2 = \omega 0 + \alpha 1\varepsilon t2 + \alpha 2\sigma t2$ (3)

Equation (2) is the mean equation and equation (3) is the variance equation where the parameters are defined the same as in the previous model;
$\gamma 0$ is the intercept; $\gamma 1\ to\ \gamma 3$ are the coefficients of the estimated parameters of the mean equation. $\sigma t2$ is the conditional variance where $\omega 0$ is the mean; $\alpha 1\varepsilon t2$ is the news about volatility from the previous period, measured as the lag of the squared residual from the mean equation which is defined as the ARCH term; and $\alpha 2\sigma t2$ is the last period's forecast variance which is defined as the GARCH term. The GARCH specification requires that in the conditional variance equation, parameters $\omega 0.\ \alpha 1,\ and\ \alpha 2$ to be non-negative and the sum of $\alpha 1\ and\ \alpha 2$ to be less than one to secure the covariance stationarity of the conditional variance.

Table 1: Descriptive analysis of exchange rate fluctuation and stock return

	N	Minimum	Maximum	Mean	Std. Deviation	Jarku-Bera	Probability
EUR/LKR	1676	137.94	180.54	160.36	10.25	79.72	0.0000
JY/LKR	1676	1.05	1.66	1.361	0.14	13.21	0.0010
USD/LKR	1676	108.69	151.79	132.69	11.58	20.57	0.0000
Return of the share (ASPI)	1676	4737.75	7811.80	6391.5	646.24	33.74	0.0000

(Source: Study data)

The descriptive statistic of the study illustrated in Table 1. The data were tested for normality through the Jarque-Bera (JB) test (Gujarati, 2003). Normal distribution requires a skewness value between -2 and +2, and for kurtosis, the value has to be in the region of -3 and +3. Based on the results obtained in the Table shows that the variables are near the required value so the data is normally distributed. The results further describe the negative value for return. EUR, JY closer to 0 meantime USD shows a negative skewness value of 0.16, the kurtosis values of all variables are less than or approximately 3 indicating the normal distribution.

Unit Root Test

The first step in estimating the model is to analyze the stationary characteristics of variables after compiling the statistics. For this purpose, the Augmented Dickey-Fuller test is used (Gujrati 2003). Unit root test has run to check the stationary of the variables. The purpose of the test is to confirm that the time series data is non-stationary

Table 2: ADF Test

		T statics	Probability
EUR/LKR	ADF Test	-43.35	0.0001
JPY/LKR	ADF Test	-40.82	0.0000
USD/LKR	ADF Test	-40.59	0.0000
Return of the share (ASPI)	ADF Test	-32.66	0.0000

(Source: Study data)

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Table 2 explains the result of the unit root test. According to the p-value reject the null hypothesis. If the series is stationary there may be a long-term relationship exist.
In this table, all variables have been stationary after one difference Unit root tests are based on the null hypothesis that the time series under consideration has a unit root; that is, it is non-stationary. The alternative hypothesis is that the time series is stationary

OLS
The estimation regression method is ordinary least squares (OLS) in this section. The checking points are whether the stock market dynamics are affected by the following prices. Respecting, all the multiple regression assumptions, Eviews is used to estimate the model

$$rt = \beta 0 + \beta \text{EUR}t + \beta 2\text{JY}t + \beta 3\text{USD}t + \mu t$$

Table 3: Ordinary Least Square test
Dependent variable: return

Variable	Coefficient	Std. Error	T-statistic	Prob.
C	12134.97	217.6356	55.75818	0.0000
EU	-3.559213	1.159000	-3.070934	0.0022
JY	-3298.600	83.90521	-39.31341	0.0000
USD	-6.257293	1.022783	-6.117912	0.0000

R-squared	0.50	Adjusted R-squared	0.50
Prob(F-statistic)	0.0000	Durbin-Watson	0.013

(Source: Study data)

Table 3 demonstrates the results of OLS estimation. As per the results, it depicts that EUR, JY, and USD have a significant positive impact on the ASPI return However, the suitability of the regression OLS estimates is tested with the ARCH test.

Table 4: Heteroskedasticity Test: ARCH

F-statistic	33943.03	Prob. F(1,1673)	0.00000
Obs*R-squared	1596.32	Prob. Chi-Square(1)	0.00000

(Source: Study data)

The results of the ARCH test are presented in Table 4 where if the squared residuals of the equation contain autocorrelation or heteroscedasticity, the null hypothesis would be rejected. Hence, the results demonstrate that the null hypothesis would be rejected at a 1% significant level representing that classical OLS estimated coefficients are not effectively estimated so inferences based on such coefficients are unreliable and unaccepted.
Estimation of return with GARCH (1,1) model

Before analyzing the relationship between exchange rate and stock market return, it is first necessary to determine the volatilities of variables. Therefore, the study uses the GARCH model which allows us to identify the dynamics of each variable in long term. Since its development by Nesrine Mechri, Salah Ben Hamad, (2019). the GARCH specification (1.1) has proved to be an adequate representation for most financial time series.
By definition, the GARCH model (1.1) is presented below

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Table: 5 GARCH 1,1

GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)				
Dependent variable: Return				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10401.60	44.00831	236.3553	0.0000
EU	-1.092382	0.358403	-3.047917	0.0023
JY	-2966.612	19.95506	-148.6647	0.0000
USD	1.835665	0.249216	7.365746	0.0000
Variance Equation				
C	1166.468	185.1024	6.301743	0.0000
RESID(-1)^2	0.914782	0.112922	8.100981	0.0000
GARCH(-1)	0.088807	0.035970	2.468907	0.0136

(Source: Study data)

Both the Arch and GARCH parameters are highly significant with p-values of 0.0000.
The sum of the coefficient of the Arch and GARCH parameters (0.91+0.088) is close to 1 which means that shocks to conditional variance will be highly persistent.

Since the GARCH parameter is significant, a large excess return value either positive or negative will lead future forecasts of the variance to be high for a prolonged period of time. This means the GARCH model will be a better forecasting model than the Arch model in periods of high volatility. The results of the analysis contradicted the study of Perera (2016).

Diagnostics tests

As Gujarati (2004) argued diagnostic tests should be performed in order to determine the suitability and the reliability of the selected model where this study employs a correlogram of the squared residual test and the heteroscedasticity test as diagnostic tests. The estimated results of the correlogram of the squared residual test are presented in Table 7 which demonstrates that all Q statistics at all lags under the normal GARCH model are signs indicating that there is a significant serial correlation among the residuals

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Correlogram of squared residual test

Table: 6 Correlogram of squared residual test

	AC	PAC	Q-STAT	Prob
1	0.976	0.976	1599.7	0.000
2	0.951	-0.044	3118.1	0.000
3	0.926	0.006	4560.0	0.000
4	0.903	0.023	5932.4	0.000
5	0.879	-0.037	7234.0	0.000
6	0.855	-0.011	8466.3	0.000
7	0.831	-0.021	9630.3	0.000
8	0.809	0.031	10734.	0.000
9	0.784	-0.074	11770.	0.000
10	0.759	-0.009	12743.	0.000
11	0.740	0.107	13667.	0.000
12	0.717	-0.091	14536.	0.000
13	0.693	-0.050	15347.	0.000
14	0.668	-0.006	16102.	0.000
15	0.645	0.010	16806.	0.000
16	0.621	-0.038	17459.	0.000
17	0.599	0.031	18066.	0.000
18	0.578	0.038	18634.	0.000
19	0.562	0.046	19170.	0.000
20	0.547	0.011	19678.	0.000
21	0.531	0.015	20158.	0.000
22	0.518	0.029	20615.	0.000
23	0.507	0.002	21052.	0.000
24	0.493	-0.054	21465.	0.000
25	0.478	0.007	21855.	0.000
26	0.467	0.035	22227.	0.000
27	0.457	0.019	22583.	0.000
28	0.446	-0.033	22921.	0.000

(Source: Study data)

The finding of the study explains that the fluctuation of the exchange rate has a significant impact on stock return. Aggarwal, (1981) also found the same result between stock price movements and exchange rate movements in the US. The results support the results of (Maysumi and Koh, 2000, Najan and Seifert 1992). Further, (Ajayi and Mougoue 1996) also found prices would have a positive long-run effect on the domestic currency.

Sekmen, (2011), stock returns for the US discovered that exchange rate volatility negatively affects the stock return. (Olugbenga, 2012) also depicted a significant negative association between stock market return and exchange rate in the long run.

Heteroskedasticity Test: ARCH effect

F-statistic	20.81	Prob. F(1,1673)	0.0000
Obs*R-squared	21.05	Prob. Chi-Square(1)	0.0000

(Source: Study data)

CONCLUSIONS AND RECOMMENDATIONS

The study of the impact of exchange rate volatility on the stock market return volatility has become very important as a consequence of various changes occurred in the global business and financial arena in recent years. Thus, this study examines the effects of exchange rate volatilities on stock market return volatilities by using both OLS and GARCH estimation models over the period of January 2011 to 31 December 2017.

At the beginning of the study test the stationarity of the time series, as the result of the augmented dickey –fuller (ADF) test is reported in table 2 according to the p values, the unit root null hypothesis has rejected the level of 1% for all the sequence which suggests that all the series are stable.

The GARCH (1.1) is used to measure the volatility of our time series and the study have applied multiple regression to analyze the impact of the exchange rate and relative prices volatilities on the stock market fluctuations.

However, the GARCH model provides more effective and reliable coefficient estimates for the parameters of exchange rates and stock return volatilities as the presence of residual autocorrelation in the OLS model. (Perera, 2016).

The empirical findings of the study suggest that in overall there is a weak impact of exchange rate volatility on stock market return volatility. However, the results further demonstrate that the volatility of Euro JY, and USD exchange rates have a positive and significant effect on the volatility of ASPI returns. Multiple regression shows a significant impact between the dependent and independent variables. EU, JY, and USD have a positive impact on stock return. Even emerging financial markets such as Sri Lanka, which does not have a well-developed derivative market provide more opportunities in order to mitigate exposure to foreign exchange risks. The limitation of this paper is that the study only considers three main currencies in the process of the exchange rate affecting the stock market. Hence, data is limited. In future research, it could be possible to consider interest rate inflation rate but this will also increase the complexity of the model. Maybe the study will need to introduce other analysis methods like the structural equation model.

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