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The Nexus between Stock Price and Exchange Rates: Empirical Evidence from Sri Lanka

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Abstract

The purpose of this study is to examine the relationship between stock price and exchange rate in Sri Lanka. Monthly, All Share Price Index (ASPI) and exchange rate of US dollar and Euro from January 2005 to December 2016 were retrieved from Colombo Stock Exchange (CSE) website and Central Bank of Sri Lanka?s monthly publication of Selected Economic Indicators. Unit root test, co-integration test and causality test were applied to test the relationship between stock price and exchange rates. The unit root test proves that in the first differences, there is no unit root. Cointegration test shows that there was no long-run stable equilibrium relationship and causality test revealed. There was no direction of causality stock price to exchange rate and exchange rate to stock price.

Index terms—

1 Introduction

tock market gets an important role in an economy because its contribution to Gross Domestic Product (GDP) is high. The stock price is an indicator of the stock market's well-being and reflects the listed companies future corporate performance also. Macroeconomic variables and companies internal factors are the two major branches which determine stock price. Therefore, the decisions regarding macroeconomic policies have a casual relationship with stock prices (Wickremasinghe, 2011; Kalainathan and Kaliaperumal, 2013).

After the introduction of floating exchange rate system, the foreign exchange market gets attention by the financial economists. This exchange rate is one of the important factors that has tremendous influences in both the short term and long term period on an economy. On the other hand, foreign exchange market and stock market activities are closely observed by the economists as a result of adoption of the floating rate system and open economic policy. The foreign direct investment was increased. This is the reason behind two effects; both the stock market and exchange rate are inter-related and may cause economic growth or economic crisis. So, the link between these two markets is by a reference to portfolio approach to exchange rate determination (Bahmani-Oskooee & Sohrabian, 1992). In this approach, wealth is one of the determinant factors of exchange rate. At the same time, increases of stock price cause to increase the public wealth and create the demand for money and therefore, interest rates **??**Bahmani-Oskooee&Saha, 2015).

Further, to get more foreign investment, domestic currencies are appreciated.Conversely, the depreciation of domestic currency increases exports and increases the profits of the exporting organizations' stock prices. In addition to that, the depreciation of domestic currency leads to increase the production cost because of the imported raw materials and lead to low profits. Therefore, the exchange rate and stock prices may move in either direction.

The empirical studies regarding the relationship between stock prices and exchange rates show contradictory results. In Sri Lankan context also, the relationship between stock price and exchange rate shows contradictory results. Wickremasinghe (2011) proved that there is both short and long term relationship between stock price and exchange rate and Amarasinghe and Dharmaratne (2014) argue that stock return is not a significant factor for exchange rate changes. Wickremasinghe (2012) also proved that most of the variance of stock price explained by Indian rupees with other currencies with a little variation. Therefore, this study focuses on the relationship between stock price and exchange rate in Sri Lanka.

2 II.

3 Literature Review

The financial economist started to examine stock market activities and exchange rates and its relationship from late 1970s because of the introduction of floating exchange rate system. From that period, many previous studies focused on the relationship between stock prices and exchange rate in both developed and developing countries. However, the relationship between these two variables is still debatable because the interaction between stock market and exchange market creates profit for their investors and the previous studies show contradictory results for decision making.

Further, the relationship between stock price and exchange rates were explained by the classical economic theory with flow-oriented and portfolio balance model. While exchange rates determine the stock price, the discount rate is also being affected. This discount rate determines the corporate value, exchange rate and future cash flows **??**Dornbusch & Fisher, 1980). In addition, the exchange rate variation determines capital flows and in this situation, capital structure, profitability, corporate value, stock prices, and cash flows are being affected (Branson et, al., 1977). Further, the exchange rate fluctuations impact on the corporate cost of capital also (Phylaktis & Ravazzolo, 2000). Aggarwal (1981) used the monthly data of aggregated index of stock price and effective exchange rate of the US dollar from 1974-1978 and proved a negative relationship between stock price and exchange rate. But, a contradictory result was showed by Soenen and Hennigar (1988). After the Asian financial crisis of 1997, Granger, Huang and Yang (2000) studied the interaction between stock price and exchange rates of nine East Asian counties of Hong Kong, Japan, Malaysia, Indonesia, South Korea, Singapore, Thailand, Philippines and Taiwan by using Gregory Hansen cointegration test and Granger causality test and proved a mixed result. In Japan and Thailand exchange rate influences on stock price positively and in Taiwan it is negatively influenced. Feedback effect shows in Indonesia, Malaysia, Philippines and Korea and there is no any pattern in Singapore.

Nieh and Lee (2001) investigated the same variables in G-7 countries by using daily data from 1993-1996 and proved a short-term relationship between stock price and exchange rates and thus last one day for certain G-7 countries. But, the same relationship was investigated in Bangladesh, India, Pakistan and Sri Lanka by using Engle-Granger and Johansen's cointegration techniques. The result of the study revealed that there is no any long-run equilibrium relationship between stock price and exchange rate (Smyth &Nandha, 2003). In New Zealand, the relationship between five exchange rates and performance of stock market was analyzed. Cointegrating VAR approach used to prove the weekly data from 1999-2005 and the results revealed that there was a bi-directional causality between the selected five exchange rates and a couple of share market indices **??**Obben, Pech&Shankur, 2006). The bi-directional relationship was also proved in Bangladesh, Sri Lanka, Taiwan and Japan also (Muhammad & Rasheed, 2003; **??**au&Nieh, 2006).

Tudor and Popescu-Dutaa (2012) comparatively investigated Granger causality between stock prices and exchange rates movement in 13 developed and emerging markets from 1997 to 2012. The results of the Granger causality test prove that Korean stock market Granger causes the USD exchange rate. But, the Brazil exchange rate has an impact on next month stock market index returns. During the Asian financial crisis, seven Asian countries were included for Granger causality and Johansen cointegration test to find out the relationship between stock price and exchange rates using daily data from 1988-1998 and it was concluded that there is no long-run equilibrium relationship between stock price and exchange rate (Pan et al., 2007). The same result that there is no long-run relationship between stock price and exchange rate, was also proved by Ismail and Isa (2009) **??**013) analyzed and proved that there is a long-run relationship and variables that are cointegrated. When considering the prior studies, there are some contradictory results observed in Sri Lanka and other developed and emerging markets. These results revealed that the relationship between stock price and exchange rate yields mixed results.

4 III.

5 Methodology a) Data

The monthly data of exchange rate of US dollar and Euro were retrieved from the Central Bank of Sri Lanka's monthly publication of Selected Economic Indicators and the stock price of Colombo Stock Exchange (CSE) from the CSE web site (cse.lk) from January 2005 to December 2016. The stock price used in this study covers the All Share Price Index (ASPI) of the listed Companies in Sri Lanka.

6 b) ADF Test for Unit Root

Dickey and Fuller extended their initial unit root test in 1981 to eliminate the problem of autocorrelation by allowing extra lagged terms of the dependent variables as an explanatory variable. The three possible types of models of ADF test are given bellow.??? ?? = ???? ???1 + ? ?? ?? ??? ????? ?? ??=1 + ?? ??**(1)**??? ?? = ?? 0 + ???? ???1 + ? ?? ?? ??? ????? ?? ??=1 + ?? ??**(2)**??? ?? = ?? 0 + ?? 1 ?? + ???? ???1 + ? ?? ?? ??? ????? ?? ??=1 + ?? ??**(3)**

For the purpose of estimating co-integration model, among these three models, the study allows model (3) where constant and deterministic trend are included. The model (2) and model (3) can be written as Equation

(4) which is the general case for both the models.??? ?? = ? ?? ?? ?? ?? ?? ??=0 + ???? ???1 + ? ?? ?? ??? ????? ?? ??=1 + ?? ??**(4)**

In generalized model (4), p allows to take only 0 and 1. If p is equal to zero (p=0), the model (4) allows only constant term in the above model (4) and if p is equal to one (p=1), the model (4) allows only constant and deterministic trend in the above model.

7 Ng-Perron Test for Unit Root

Before coming to Ng-Perron Test, consider the following model;??? ? ?? = ? ?? ?? ?? ?? ?? ??=0 + ???? ? ???1 + ? ?? ?? ??? ? ????? ?? ??=1 + ?? ??**(5)**

Where ?? ? ?? denotes the de-trended data of ?? ?? . This model (5) is the modified version of ADF test which is known as ADF-GLS test (ADF-Generalized Least Square) also known as ERS test (Elliot, Eothenberg& Stock, 1996). This ERS test achieves local asymptotic power that is approximately the same as the feasible point-optimal test. **??**erron (1995, 2001) built on de-trended data?? ? ?? obtained from the ADF-GLS test and modified the Phillips-Perron test (1988). Ng-Perron (2001) considered two modified feasible point optimal tests and derived their limiting distributions.MP T GLS = ?c ? 2 T ?2 ? y ? t?1 2 T t=1 ? c ? T ?1 y ? T 2 ? s AR 2 ? if p = 0 (6) MP T GLS = ?c ? 2 T ?2 ? y ? t?1 2 T t=1 ? (1 ? c ?)T ?1 y ? T 2 ? s AR 2 ? if p = 1 (**7**)

Wheres AR 2 = ? e ? tk 2 T t=k+1 (T ? k) ?1 ? ? ? ? i k i=0 ? ?**(8)**

And??? = ? ?7 if p = 0 ?13.5 if p = 1

As study mentioned earlier in ADF test part, this study is concerned with constant with linear trend given in test statistics model (7) since the study objective is to identify the stable equilibrium between stock market price and exchange rate in Sri Lanka from January 2005 to December 2016. Other three test statistics of Ne-Perron are given as follows: ?????? are greater than their asymptotic critical values given above table at a particular significance level, then the study fails to reject the null hypothesis that the series has a unit root. ?? = white-noise error term.MZ ? GLS = (T ?1 y ? T 2 ? s AR 2) ?2T ?2 ? y ? t?1 2 T t=1 ?**(9)**MSB GLS = ?2T ?2 ? y ? t?1 2 T t=1 s AR 2 ? ? 1 2 ?**(10)**

8 c) Co-integration

The co-integration technique is used to test the existence of an equilibrium relationship between the exchange rate and stock price. The study investigates co-integration by using both Engel and Granger (1987) method and Johansen and Juselius (1990).

9 ? Engel and Granger Co-integration

If two or more series are integrated of order one I (1) but a linear combination of them is integrated order zero I(0) and thus stationary, then the series is said to be cointegrated. When a series is cointegrated, then there exists a long-run stable equilibrium relationship among the variables.

Let us consider the following relationship,?? ?? = ?? 0 + ?? 1 ?? ?? + ?? ??

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Where, the series of ?? ?? and ?? ?? non-stationary is at level. For the co-integration, the residual of above model should be a stationary series.

10 ?? ? ?? = ?? ?? ? ?? ?0 ? ?? ?1?? ??

If ?? ? ?? ~??(0) there does exist co-integration and if?? ? ?? ~??(1) does not exist co-integration among the variables ?? ?? and ?? ?? .

11 ? Johansen and Juselius Co-integration

The Johansen and Juselius (1990) maximum likelihood approach was applied to examine the cointegration between variables. The approach is suitable for identifying the number of cointegrating relations between selected variables. Most of the previous literatures suggested that the variables are integrated of the same order, so the results state that the test may be sensitive to the lag length. Therefore, the Johansen method suggest as a common procedure to determine cointegration vectors in non-stationary time series of a traditional vector autoregressive (VAR). This model can be shown as an error corrective form as follows:??? ?? = ?? + ? Î?”?? ?? ??? ???1 + ???1 ??=?? ??? ???1 + ?? ?? Where: ?? ?? = ?????????? ???? ?????? ? ???????????????????? ???????????????? Î?” ?????? ? = ?????????????????????? ???????????????? ?? = ???????????????? ???????? d) Causality Test

If co-integration exists between stock prices and exchange rate, the Error Correction Model (ECM) was checked to affirm the short-run disequilibrium by using the following formula:????????? ?? = ? 0 + ? ?? 1?? ????????? ???1 + ?? ??=1 ? ?? 2?? ????? ???1 + ?? ??=1 ?? 1 ?? ???1 + ?? 1?? ????? ?? = Q 0 + ? ???? 1?? ????? ???1 + ?? ??=1 ? ?? 2?? ????????? ???1 ?? ??=1 + ?? 1 ?? ???1 + ?? 2??

If co-integration does not exist between these two variables, the following equations are used to test the Granger Causality.????????? ?? = ? 0 + ? ?? 1?? ????????? ???1 + ?? ??=1 ? ?? 2?? ????? ???1 ?? ??=1 + ?? 1?? ????? ?? = Q 0 + ? ???? 1?? ????? ???1 + ?? ??=1 ? ?? 2?? ????????? ???1 ?? ??=1 + ?? 2??

Where: ASPI = All Share Price Index EX= Exchange Rate Z t-1 = error correction term obtains from the cointegrating equation ?? 1 ?????? ?? 1 = expected to capture the adjustment of ASPI t and EX t towards long-run equilibrium IV. .2 conclude that the level of series of all three variables has a unit root but there is no unit at first differencing level of series. This means that all these three variables are non-stationary at level of series but it turns to be a stationary series at first differencing level of series.

12 Results and Discussion

For applying Engel & Grange Co-integration model, the series of variables should be integrated with the order one I (1). For applying Johanson & Jelious Cointegration model, all series of variables should follow the same order of integration. Since it satisfies both the conditions the study applies in both Engel and Granger Co-integration and Johanson & Jelious Co-integration to validate the results more. In Table 3, the results of Engel and Granger Cointegration test are given for the four cases. According to the p-values, the study fails to reject the null hypothesis that there is no cointegration between both the variables. This means that there was no longrun stable equilibrium between the stock market price and exchange rate for the period from 2005 and 2016 in Sri Lanka. The results of Johansen &Juselius cointegration are given in Table 5 for the variable ASPI and USD, and in Table 5 for the variable ASPI and EURO. The Trace statistics and Max-Eigen statistics revealed that there was no co-integration relation between ASPI and USD as well as between ASPI and EURO. These finding is the same as to the finding of Engel Granger cointegration. Since there was no cointegration relationship between these variables, the study avoids the Error Correction Model analysis. Further, this study simply uses the Granger Causality test which results are given in Table 6. Table 6 shows the results of pairwise Granger Causality Test at lag order one where the study fails to add more lag in terms of AIC criteria. These results explain that there was no causality direction any of the variables given in table. This means that there is no causality relationship between the stock market and exchange rate in Sri Lanka during 2005 and 2016.

V.

13 Conclusion

This paper examined the relationship between the stock price and exchange rates in Sri Lanka. Fist unit root test was applied to identify the unit root of the time series data. The results prove that all data were unit root in level of series and there was no unit root at first differencing level. Then, both the Engel & Granger cointegration and Johansen & Jeselius Cointegration test was applied to test the long-run equilibrium relationship and both Engel & Granger cointegration and Johansen & Jeselius Cointegration conclude that there was no long-run stable equilibrium relationship between the stock market price and exchange rate in Sri Lanka. The Granger Causality test results revealed that there was no direction of causality from the stock market price to exchange rate and exchange rate to stock market price.

Most of the investors believe that the exchange rate changes reflect in the stock prices. But, the empirical results in Sri Lanka reveal that there is no relationship between the stock prices and exchange rate. Sri Lanka is a developing country and the stock market is also an emerging market. Compared to the developed countries' capital, its market capitalization is very low. Therefore, the results may differ from welldeveloped capital markets.

1

$$\text{MZ t GLS} \\ \text{GLS} = \text{MZ ? * MSB GLS} \tag{11}$$

Figure 1: Table 1 :

[1] [2]

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1 shows the asymptotic critical values for the Ng-Perron unit root test statistics in case of allowing constant with the trend of the model. If the absolute calculated critical values of MZ ? GLS and MZ t GLS for a series of a variable are less than their absolute asymptotic critical values given in above table and if the calculated values of ?????? ?????? and ???? ??

Figure 2: Table .

2

Variable	???? ?? ??????	???? ?? ??????	?????? ??????	???? ð ?"ð ?" ??????	Decision
ASPI	-5.65209	-1.57614	0.27886	15.9139	Unit root
EURO	-8.86568	-2.03195	0.22919	10.5610	Unit root
USD	-9.83070	-2.12475	0.21613	9.68769	Unit root
?ASPI	-68.8978 *	-5.86921 *	0.08519 *	1.32311 *	No Unit root
?USD	-68.1874 *	-5.83864 *	0.08563 *	1.33790 *	No unit root
?EURO	-70.9267 *	-5.95297 *	0.08393 *	1.29423 *	No unit root

Notes: ASPI, EURO and USD stand for all share price index, number of Sri Lankan rupees per EURO, and rupees per US dollar respectively; ? indicates the first difference of these variables. Both a constant and line deterministic components in this unit root test.

Figure 3: Table 2 :

Figure 4:

3

Variables Dependent	Independent	tau-statistic	p-values
ASPI	USD	-1.3173	0.8262
ASPI	EURO	-1.2320	0.8720
USD	ASPI	-1.0384	0.8946
EURO	ASPI	-2.2026	0.4259
Note: MacKinnon (1996) p-values			

Figure 5: Table 3 :

4

Null Hypothesis	Trace Statistic	Prob	Max-Eigen Statistic	Prob
r = 0	7.2871	0.5445	7.1343	0.4734
r ? 1	0.1527	0.6959	0.1527	0.6959
Note: MacKinnon-Haug-Michelis (1999) p-values				

Figure 6: Table 4 :

5

NullHypothesis	Trace Statistic	Prob	Max-EigenStatistic	Prob
r = 0	11.4176	0.1871	8.5701	0.3237
r ? 1	2.8475	0.0915	2.8475	0.0915
MacKinnon-Haug-Michelis (1999) p-values				

Figure 7: Table 5 :

6

Causality From	To	F-Statistic	p-values	Nature of Causality
ASPI EURO USD ASPI	EURO ASPI ASPI USD	0.0707 0.0853 0.0806 2.1653	0.7706 0.7907 0.7768 0.1434	No causality

Figure 8: Table 6 :

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