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The Relationship between Exchange Rate and Trade Balance: Empirical Evidence from Sri Lanka

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Abstract

This study aims to investigate the relationship between the exchange rate and Trade Balance. Trade Balance is used as the dependent variable, and the independent variables are Exchange Rate, Gross Domestic Product, and Inflation. Augmented Dickey-Fuller unit root test was adopted to test the stationary property of time series data, Auto Regressive Distributed Lag model was employed to find the long run and short-run relationship and long-run adjustment, Bound test approach, the unrestricted Error Correction Model and Granger Causality Test are used to analyze the data from 1977 to 2019. The research findings suggest that inflation has a positive impact on the trade balance in the short run. The exchange rate and the Gross Domestic Product have adverse effects on Trade balance in the long run. The coefficient of ER in the previous year is negative, and the coefficient of TB in the previous year is positive and significant. This is consistent with the J-Curve phenomenon, which states that devaluation may not improve trade balance in the immediate period, but will significantly impact the trade balance improvement in subsequent periods. Hence Marshall Lerner Condition exists in Sri Lanka.

Keywords: Exchange Rate, Trade Balance, Gross Domestic Product, Marshall Lerner Condition, Devaluation

JEL Classification Code: C21, C24, C58, F43, G19

1. Introduction

Exchange rate refers that between two currencies, the value of one currency in terms of another value. For example, explain the US dollar in terms of Sri Lankan rupees. It is mean one US dollar can be exchanged for 180 rupees. Exchange rates have three types; fixed exchange rate, floating exchange rate, and pegged float exchange rate. A fixed exchange system is an exchange system that maintains the currency value's authority to maintain the currency

value as remain constant in terms of other country's currency. The floating exchange rate is also another type of exchange rate. The demand and supply determine the value of one county's currency in terms of another country's currency. In other words, the floating exchange rate fluctuates according to the currency market. That is why most economists suggested that the floating exchange rate is more suitable for handling the impact of the foreign exchange market and helps to economic growth.

The Pegged float exchange rate is a mixed type of exchange rate that determines exchange rate both central authority and demand, supply sides. In other words, the pegged exchange rate used a hybrid of the fixed exchange rate and floating exchange rate. There are asymmetric effects of the exchange rate on domestic corporate goods prices when the exchange rate is more volatile (Lee & Brahmanasrene, 2020).

The trade balance is a difference between value export and import. It is one of the crucial components of the Balance of Payment. It is calculated by subtracting the total value of import from the total value of export of a country in a given period of time. If the export value is greater than the value of import, the trade balance becomes positive. That is called a surplus trade balance. The second type of trade balance is a deficit trade balance occurs when the value of

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export in a particular country is less than the value of import in a given period of time. In this situation value of the trade balance becomes negative. That means the Trade balance of a country becomes not zero. Exports are less than or more than the imports that there is comparatively more supply or demand for a country's currency, which influences the price of that currency on the world market. Moreover, inflation also affects the trade balance. As the cost of inflation and inflation uncertainty on growth and welfare are significant, it is useful to determine the direction of the causality between inflation and inflation uncertainty (Mustafa & Sivarajasingham, 2019).

Compared with the Sri Lanka Exchange Rate against USD between December 2020 and January 2020 are 186.633 LKR/USD and 190.763 (LKR/USD). In Sri Lanka, a lower exchange rate was recorded in Nov 1967 at 4.762, and a higher exchange rate showed at 191.354 in April 2020. At the same time, the Country's trade balance shows a negative value often. The average value for Sri Lanka during that period of 1960 to 2019 was –7.63 percent, with a minimum of –22.58 percent in 1980 and a maximum of 3.66 percent in 1977 (Global Economy, 2021).

The relationship between exchange rate and trade balance shows through the demand and supply of foreign exchange. These currency exchange rates are influenced by the demand for currency, which is in turn influenced by trade. If a country exports more than it imports, there is a high demand for its goods, and thus, for its currency. The economics of supply and demand dictates that when demand is high, prices rise, and the currency appreciates in value. In contrast, if a country imports more than it exports, there is relatively less demand for its currency, so prices should decline.

In the case of currency, it depreciates or loses value. The relative attractiveness of exports from that country also grows as a currency depreciates. (Lioudis, 2019). Hence, there is a strong correlation between exchange rate and trade balance. In this line, As a deficit trade balance country, Sri Lanka's trade balance effect by the exchange rate. Therefore, this paper examines the correlation between exchange rate and trade balance.

2. Literature Review

Onafowora, O (2003) did the research entitled "Exchange rate and trade balance in East Asia: is there a J-Curve" examine the objective that short-run and long-run impact of real exchange rate changes on the real trade balance of three ASEAN countries, namely Thailand, Malaysia, and Indonesia and their bilateral trade to the US and Japan. The cointegration vector error correction method was used to achieve the objective by the researcher. This study indicates that the J-curve effect shows in the short run and the long run held by the Marshall−Lerner condition. There is also a

strong relationship between real trade balance, real exchange rate, real domestic income, and foreign income of each three countries in the long run.

Liew et al. (2016) examine the relationship between the exchange rate and trade balance of Asian countries, namely Indonesia, Japan, Malaysia, the Philippines, Singapore, and Thailand. This study proposed a descriptive and econometric model as a methodology. According to the result, real money affects the trade balance that the nominal money of those countries. A mathematical analysis of this research suggested that real money influences the trade balances in Malaysia, Singapore, Thailand, and the Philippines with respect to Japan. These governments should focus on the real money to solve the deficit balance trade.

The research about the relationship between trade and real exchange rate in Malaysia by Ng et al. (2008) suggests that the correlation between trade balance and exchange rate exists in the long run. Moreover, Domestic income and foreign income show a positive and negative relationship on the trade balance, respectively. Simultaneously, Malaysia's data indicate no J-curve effect, and this research suggests that currency devaluation promotes the trade balance. The above results were found using Unit Root Tests, Cointegration techniques, Engle-Granger test, Vector Error Correction Model (VECM), and impulse response analyses.

The research was done by Purwono et al. (2018) entitled "The Dynamics of Indonesia's Current Account Deficit: Analysis of the Impact of Exchange Rate Volatility" found that the current account deficit increase depreciation. The decrease in export of manufactured goods, especially gas and non-oil higher than the increase in import. Depreciation of the country's currency against the US dollar results in an increased burden of higher oil and gas imports due to import transactions for the oil and gas sector.

Narayan (2006) explores the relationship between the real exchange rate and trade balance of China, America, and vice-versa using the Autoregressive Distributed lag analysis and cointegrated method. The finding of the research that there is no evidence of a J-curve type adjustment because the real devaluation of the Chinese RMB improves the trade balance in the short-run and the long run.

Trinh (2014) analyzed the impact of fluctuations of exchange rate on the trade balance in the short run & long run. This study analyzed 2000–2010 data of Vietnam using the Auto-Regressive Distributed Lag method and Error Correction Model. This study found that impact on trade balance when real depreciated of the VND has occurred.

3. Methodology

This study Used Exchange Rate as the main independent variable to examine the relationship between the exchange rate and Trade Balance, with Gross Domestic Product and

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Inflation as control variables. Secondary data for the period of 1977–2019 from the Central Bank of Sri Lanka were used for this study. All thvariables are transformed into a natural logarithm. ADF and PP unit root test methods were adapted to test that the series is not containing $I(2)$ variables.

Akaike Information Criterion (AIC) is applied to determine the optimal lag length of each series. Following the empirical literature in determinants of ER, we develop the long-run relationship between the variable as below:

$$\text{LTB}_t = \beta_0 + \beta_1 \text{LER}_t + \beta_2 \text{LGDP}_t + \beta_3 \text{LINF}_t + U_t \quad (1)$$

Where, U_t is a white noise error term, $t = 1, 2, \ldots. T$.

Where Trade Balance (TB) is used as an endogenous variable, and the independent variables are Exchange Rate (ER), Gross Domestic Product (GDP), and Inflation (INF). Here, U is the error term, and the subscript indicates time. Augmented Dickey-Fuller (ADF) unit root tests were adopted to test the stationary property of data, and the Auto Regressive Distributed Lag (ARDL) model developed by Pesaran et al. (2001) was employed to find the long run and short-run relationship and long-run adjustment.

The Engel Granger method and Johansen method require that all of the variables in equation (1) be integrated in the same order. The error term should be integrated in order zero to form the long-run relationship. However, if variables in equation (1) have a different order, that is $I(1)$ and $I(0)$, we can use a new co-integration method which was developed by Pesaran et al. (2001). This procedure, also known as the autoregressive distributed lag (ARDL) approach to co-integration. The ARDL co-integration bound testing procedure is given by equation (2):

$$\text{LTB}_t = \rho_0 + \vartheta' \text{LZ}_{t-1} + \sum_{i=1}^{P} \eta_i \Delta \text{LTB}_{t-i}$$
$$+ \sum_{i=0}^{P} \pi_i' \Delta \text{LZ}_{t-i} + \delta' D_t + U_t \quad (2)$$

where, $\vartheta' = [\vartheta_1, \ldots \ldots \ldots \vartheta_6]$ refers to the long-run coefficients; $\text{LZ}_{t-1} = [\text{LER}_{t-1} + \text{LGDP}_{t-1} + \text{LINF}_{t-1}]$ is the vector of explanatory variables with lag one; and refers to the short-run dynamic coefficients, $\Delta \text{LZ}_{t-i} = [\text{LER}_{t-i} + \text{LGDP}_{t-i} + \text{LINF}_{t-i}]$ denotes the vector of explanatory variables with lag and is the white noise error term.

The equation (2) can be further transformed as in equation (3) to accommodate the error correction term with one period lagged (ECT_{t-1}):

$$\Delta \text{LTB}_t = \beta_0 + \sum_{i=1}^{P} \eta_i \Delta \text{LTB}_{t-i} + \sum_{i=0}^{P} \pi_i' \Delta \text{LZ}_{t-i}$$
$$+ \delta' D_t + \gamma \text{ECT}_{t-1} + U_t \quad (3)$$

where, γ speed of adjustment, which should have statistically significant and negative sign to support the co-integration between the variables, U_t: pure random error term.

To investigate the existence of long-run relationships between the variables, a bound testing procedure is used, which is based on the F-test (Wald test). The F-test is actually a test of the hypothesis of no co-integration among the variables ($H_0 : \vartheta_1 = \ldots = \vartheta_6 = 0$) against the existence of cointegration among the variables ($H_0 : \vartheta_1 \neq \ldots \neq \vartheta_6 \neq 0$) in equation (2). Finally, we used the Granger causality test to determine the direction of the causality between the variables.

4. Results and Discussion

The ADF test confirmed that all the variables are stationary at both levels and differences of the variables. Akaike Information Criteria (AIC) suggested using ARDL (1, 1, 0, 0) model for this analysis.

In Table 1, calculated F-Statistics = 10.49 is higher than the upper bound critical value at 5% level of significance (3.67). Since we confirmed the cointegrating relationship between the variables through the bound test, we estimated the long-run relationship among the variables via the ARDL model.

According to the regression results, the ER has adverse effects on TB in the long run. This proves that as the ER decreases, TB improves. A 1% devaluation of the Sri Lanka Rupee will lead to a 9.6598 unit improvement in TB. The absolute value of the coefficient of ER is higher than unity (1), which is consistent with the Marshall Lerner Condition (MLC). Hence, the MLC exists in Sri Lanka. The GDP has adverse effects on TB in the long run. A 1% increase in the GDP will lead to a 5.0270 unit decrease in TB. Sri Lanka having an import-dependent economy means that an increase in GDP will increase the patronization of imported goods by its citizens. This will lead to a trade deficit since imports will exceed exports.

The results of the diagnostic tests show that the model is correctly specified and the parameters are correctly estimated. They all exhibit probability values that are greater than the significant level of 10% (see Tables 2 and 3).

Accordingly, as expected, ECT (–1) carries a negative sign, which is highly significant, indicating that there should

Table 1: *F*-Test for the Existence of a Long-Run Relationship

F-Bound test 95% Level of Confidence		
F-Statistics	Lower Bound	Upper Bound
10.49	2.79	3.67

Table 2: Regression Result

Constant	LNER	LNGDP	LNINF	R^2
−0.6176 (0.9506)	−9.6598 (0.0006)*	−5.0270 (0.0097)*	−1.2407 (0.1755)	0.5542

Note: *P*-value is given in parenthesis. *show significance at 1% level.

Table 3: Diagnostic Test Results

Diagnostic	*P*-value	Conclusion
Serial correlation: Bruesch- Godfrey serial correlation LM test	0.5021	No Serial correlation
Normality: Jarque- Bera	0.3108	Error is normally distributed
Heteroscedasticity: White Test	0.1334	No Heteroscedasticity
Omitted Variable: Ramsey RESET Test	0.1650	No Omitted Variables

Table 4: Short-Run Coefficient Estimates and Error Correction Representation

Lag Order	ΔTB	ΔLNER	ΔLNGDP	ΔLNINF	ECT(−1)
0		19.7449 (0.0352)**	−3.9375 (0.6001)	−0.9651 (0.0836)***	−0.9074 (0.0000)
1	0.4384 (0.0026)*	−3.3789 (0.0527)***			

Note: *P*-value are given in parenthesis. *, **, *** show significance at 1%, 5% and 10% level, respectively.

Table 5: Extracted Output of Granger Causality Test

Null Hypothesis	Obs	*F*-Statistics	Prob.
LNER does not Granger CauseTB	41	5.4573	0.0085*
LNGDP does not Granger CauseTB	41	4.1014	0.0249**

Note: *,** show significance at 1% and 5% level, respectively.

be an adjustment towards the steady-state line in the long-run equilibrium at the speed of 90.7% one period after the exogenous shocks.

The coefficient of TB in the previous year (at lag 1) is positive and significant (see Table 4). This means that during that period, a 1 unit increase of TB leads to an increase 0.4384 units in TB. In the current short-run period, ER impacts positively on TB. A 1% appreciation of the Sri Lanka Rupee leads to a 19.7449 unit appreciation in TB. The coefficient of ER in the previous year (at lag 1) is negative. This means that during that period, a 1% decrease in the value of the Sri Lanka Rupee will lead to 3.3789 unit appreciation in TB. This is consistent with the J-Curve phenomenon, which states that devaluation may not make TB improve in the immediate period but will significantly impact the TB hence making TB improve in subsequent periods. The INF in the current short-run period has a positive impact on TB. A 1% increase in the INF brought about a 0.9651 unit decline in TB.

The Granger Causality test results suggest unidirectional causality that runs from ER to TB and from GDP to TB (see Table 5).

5. Conclusion

As a deficit trade balance country, Sri Lanka's trade balance effect by the exchange rate. Therefore, this paper examines the correlation between exchange rate and trade balance using Exchange Rate as the main independent variable and Gross Domestic Product and Inflation as control variables from 1977–2019. Augmented Dickey-Fuller (ADF) unit root tests were adopted to test the stationary property of data. The Auto-Regressive Distributed Lag (ARDL) model was developed to find the long-run and short-run relationship and long-run adjustment. Bound test approach was employed to investigate the existence of a long-run relationship among the variables. The unrestricted Error

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Correction Model (ECM) was employed to test the short-run dynamics of the ARDL model. Granger Causality Test was employed to check the causality relationship between the variables.

This research finds that inflation has a positive impact on the trade balance in the short run. The exchange rate has negative effects on the trade balance in the long run. The exchange rate is higher than unity (1), consistent with the Marshall Lerner Condition (MLC). Hence, the MLC exists in Sri Lanka. The GDP has adverse effects on the trade balance in the long run. Sri Lanka having an import-dependent economy means that an increase in GDP will increase the patronization of imported goods by its citizens.

This will lead to a trade deficit since imports will exceed exports. The coefficient of trade balance in the previous year (at lag 1) is positive and significant. The coefficient of the exchange rate in the previous year (at lag 1) is negative. This is consistent with the J-Curve phenomenon, which states that devaluation may not make trade balance improve in the immediate period, but will significantly impact the trade balance hence making trade balance improve in subsequent periods.

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