Impacts of Increasing Demand for Vehicles and Crude Oil on Exchange Rate in Sri Lanka

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ABSTRACT

Economic development and transport are solely linked since the transport activity is a key component of economic development and human welfare. The main objectives of this study is to identify, whether or not the expansion of transport sector and the resultant ballooning of imports bill due to this incidence had a significant impact on the exchange rate in Sri Lanka. For this purpose, data were collected from the Ceylon Petroleum Cooperation, annual reports of CBSL, the Department of Motor Traffic and the World Bank database. Augmented Dicky-Fuller, Johansson cointegration test and Vector Error Correction Model were employed as major econometrics procedures to identify the impacts of vehicles and crude oil imports on exchange rate in Sri Lanka. This study revealed that, vehicle imports and crude oil imports are positively affected to depreciate the Sri Lankan rupee in the long run as well as in the short run. A one per cent increase in vehicle and crude oil imports affect the depreciation of Sri Lankan rupee by 4.6% and, 14.98% respectively, in the long run. Interest rate was found as an insignificant factor affect the changes of exchange rate. Increasing export, promoting public transport system, encouraging fuel efficient vehicles could be suggested to mitigate associated problem with currency depreciation of Sri Lanka.

Keywords: Currency Depreciation, Exchange Rate, Transport, Vehicle Imports, Crude Oil Imports

1. INTRODUCTION

Individual desire on purchasing luxurious vehicle boosting by increase in income, self-interest and social imitation, have been inevitably increased the demand for vehicles and crude oil in recent years in Sri Lanka. The transportation sector generates about 5% of direct employment from the total employment opportunities in the country, 12% of the country's GDP (exceed the total contribution by agricultural sector to the GDP 10.1%), and 22.8% of the total private expenditure (CB Annual Report, 2014). Unprecedented demand boosting by social prestige on vehicle and crude oil imports have been drastically affected the currency depreciation with ongoing socio-economic and environmental issues in Sri Lanka by 2016. The main objectives of this study is to identify, whether or not the expansion of transport sector and the resultant ballooning of imports bill due to this incidence had a significant impact on the exchange rate in Sri Lanka ?

India has dominated the Sri Lankan vehicle import market with a share of over 50% of the total imports while the second place has been taken by Japan at 22 percent. China has become the third leading supplier of vehicles to Sri Lanka with a market share of 7% in 2012. Since the general belief on owning a motor vehicle with a higher value and brand gives a higher status to the owner, the demand for luxury vehicles has drastically increased irrespective of any effect of the exchange rate volatile and even effecting their income level. Concessionary vehicle permits brought about a massive increase in imports of diesel passenger vehicles between 1500 cc & 2500 cc by 227% in 2012 (The Island, 2013).

Amid strong economic growth and cutting taxes on vehicles imports resulted in the increase of all types of vehicles by 75.9%. Of the 20 million population, approximately one among five people owns a motor cycle or a three wheeler. Sri Lanka imports nearly 40,000 auto trishaws each year, but in 2010 this rate grown up to 194 percent with the import of petrol auto trishaws exceeding over 80,000 while 427 percent was import diesel auto trishaws (Department of Motor-Traffic 2014).

The impact come up with these incidences resulted to inevitably depreciation of Rupee in Sri Lanka. Severity of currency depreciation in the foreign exchange market is explained by (Cabral, 2008) through his speech at the Ceylon Chamber of Commerce annual session on 2nd July 2008. According to his speech,

"As at end of the March 2008, Sri Lanka's external public debt was Rs.1,295 billion. By them 48% or nearly US$ 6 billion or simply Rs. 620 billion of external debt has to be repaid just due to the depreciation of the Sri Lankan rupee. This was adequate to construct 15 Hambantota Ports, or provide the ability to construct 30 Southern Highways, or can pay the entire government salary and pension bill for 2 years, or pay the salaries of the entire armed services for 10 years" (Cabral, 2008).

Therefore, the major scope of this study is to find the answer for, has the expansion of transport sector through increase in demand for vehicles and crude oil affected the changes of exchange rate of Sri Lanka?

2. LITERATURE REVIEWS

Exchange rate is simply defined as the price of one currency in terms of foriegn currency and which is persisted either in fixed or floating. Fixed exchange rates are decided by central bank of a country whereas floating exchange rates are determined by the mechanism of demand and supply forces in competitive exchange rate market. (The Economic Time, 2016). In a theoretical aspect, foreign exchange inflows affects the appreciation of the currency while foreign exchange outflows affect the depreciation of currency. Since this study is paying special attention on currency depreciation, imports were identified as a crucial factor affect the changes of exchange rate whereas empirical evidences show that vehicle imports and crude oil imports have been playing the major role in currency depreciation in Sri Lanka.

Demand for vehicles and crude oil is ballooning with the effect of increasing per-capiata income of the individuals which has been increased by 25% per annum from 2003 to 2015 (World Bank, 2016). According to the Ileperuma (2001), The Sri Lankan economy is being industrialized and its per-capita has been doubled within a decade from 1985 to 1995. Liberalization, together with these urbanization have affected an increase in the energy consumption and the fleets of motor vehicles by three times within the last decades. According to the Mwega (1993), the demand for machinery and transport equipment is significantly influenced by real income. Kidane (2000) found that machinery, transport and equipment imports are positively and significantly affected by real income in the short run. Once individual purchase a vehicle, the artificial demand is raised for demanding crude oil. Since the crude oil is included under the imports, which has also being affected on the changes of exchange rate in Sri Lanka.

Delsalle (2002) identified the relationship between the changes in oil prices and demand for vehicles based on fuel efficiency. He shows that when there is a decrease in fuel prices people are willing to switch towards less fuel efficient vehicles while when prices was higher the result was reduction in the demand for gasoline cars and heavy trucks significantly. Finally he concludes that, as an increase in apparent fuel efficiency, as the reduction of road transport demand is happened rarely. Meanwhile, Wei (2009) shows that demand for vehicles and changing gasoline prices largely depends on conventional wisdom. The obvious impacts (positive correlation between the export and import) were revealed by the Huchet-Bourdon and Korinek (2011). According to them, import expenditure tends to be automatically boosting with any excess demand on export. Therefore, the existing multicolinearity is the inevitable problem with these two factors.

With the expectation of currency depreciation cause to reduce the demand for imports (vehicles and crude oil) and encourage the exports income in a country, Central Bank of Sri Lanka intervened to the foreign exchange market by depreciating currency in several time. This has als0 been practiced in several countries. By using quarterly data from 1978 to 1997, Weliwita and Tisujii (2000) examined how the Sri Lanka's trade deficit has responded to the currency devaluation. His findings through the estimated VAR model, revealed that expected results by currency devaluation in Sri Lanka could not be achieved. Since the Central Bank policies on depreciation was not adequate to overcome the trade deficits, CBSL further devaluated the rupee by 3.7% against US dollar in 2012, compared to the depreciation of 11.3 % in 2001 (CBSL, 2013). Post impacts of this currency devaluation and increasing in ongoing demand of crude oil and vehicles imports were drastically affected to raise many socio-economic problems in Sri Lanka.

The rupee depreciation had severely affected on key debt indicators, such as budget deficit/GDP ratio and government revenue and duration of the debt portfolio in 2012. As a percentage of GDP, foreign debt increased to 36.50% in 2012 from 35.59% in 2011 resulting this unprecedented depreciate in exchange rate (CBSL, 2013).

3. PROBLEM STATEMENT

Whether or not the expansion of transport sector and the resultant ballooning of imports bill due to increase in demand for vehicles and crude oil had a significant impact on the exchange rate in Sri Lanka?

4. OBJECTIVES

- To identify the expansion of transport sector has an affect the exchange rate in Sri Lanka.
- To investigate the short run and long run effects of the major determinants on the changes of exchange rate in Sri Lanka.

5. ECONOMETRIC METHODOLOGIES

Monthly time series data from 2003 to 2015 were collected from the Department of Motto-traffic, Ceylon Petroleum Cooperation (CEPETCO) and special statistics appendix of the Central Bank annual reports published in 2015. For ensuring the real impacts of vehicle imports on exchange rate depreciation, we assume that there are only 65% vehicles are averagely moving on the roads in Sri Lanka (Based on the tax revenue collection by annual vehicle registrations, the Central Bank.

5.1 Description of the Variables in the Model

Based on the empirical literature, the variances of the exchange rate were measured by four explanatory variables, namely total import expenditure except vehicles and crude oil imports (EXM), vehicle imports (VM), Crude oil imports (CM), Exports (X) and Interest rate(R). To formalize the systematic and rationale model explanatory variable are constructed under the following methodologies,

5.1.1 *Real effective exchange rate (*REER)

Since, individuals import vehicles from several countries than a single country, Japan, India and South Korea so on, we used Real Effective Exchange Rate (REER) as a depended variable than any other forms of exchange rate. REER, can be defined as the weighted average of the domestic currency relative to the basket of other major currencies adjusted for the inflation effects. REER is frequently used for a variety of purposes, such as assessing the equilibrium value of a currency, identifying the competitiveness and the drivers of trade etc. The following formula is used to calculate REER.

$$REER_t = NEER_t \left(\frac{P_f}{P_d} \right)$$

Where,
$REER_t$ is the real effective exchange rate, $NEER_t$ is the Nominal Effective exchange rate, P_d is the Consumer price index of the domestic country, P_f is the consumer price index of the foreign country.

5.1.2 Total import expenditure excluding crude oil and vehicles import (EXM)

The import is one of the crucial variable to determine the changes of exchange rate in a country. Here we used the US Dollar value of total import expenditure in Sri Lanka. In a floating exchange rate system, there is a positive relationship between the exchange rate and imports, which means that when the imports expenditure is increased currency is expected to depreciate due to higher capital out flows (citizen increasing their demand on foreign goods and services than purchasing domestic goods and services). We constructed this variable as follow.

$$EXM_t = M_t - \left(VM_t + CM_t \right)$$

Where,
EXM_t is US dollar million (US$ mn) value of total import expenditure excluding vehicles and crude oil imports, M_t is Total imports expenditure (US$ mn), $VM_{t\,is}$ the US$ mn value of vehicle imports and CM_t is the US$ mn value of crude oil imports.

5.1.3 Vehicle imports (VMt)

VM has been identified as the most influential factor on the changes of exchange rate in Sri Lanka. By 2015, 20.8mn people are using 4.3mn vehicles means that there is a vehicle per each 4 persons. Within a decade (from 2003-2013), vehicle population has been increased by 109 per cent unpresidently. By the passing of time, increasing per capita income and other social factors induce individual's preference to purchase the luxurious car (prestige goods). Since the vehicle imports is consisted in total import expenditure of a country, here we used the vehicle imports as an explanatory variable to identify the impacts on

exchange rate. This Variable (VM_t) is constructed as follows,

$$VM_t = \frac{VM_t}{\left(VM_t + CM_t\right)}$$

Where, the denominator ($VM_t + CM_t$) of the above equation is stated that the total expansion of transport sector trough vehicle and crude imports while vehicle imports by the term of US dollar value presents in the above equation as the numerator. Thus, this variable implies the impacts of vehicle imports as a rate of total transport sector expansion. Since the vehicle imports is consisted under the imports, here we assume that the positive relationship between the REER and Vehicle imports because of any increasement of vehicle import is affected to depreciate the currency.

5.1.4 Crude-oil imports (CMt)

Based on the views of Sadarathne (2011) and CEPETCO calculations, we assume that transport sector is consuming 60 per cent from the total imported crude oil in Sri Lanka. Therefore, here we constructed the variable absorbing only a 60 percent from the total imports expenditure as a crude oil consumption by the transport sector. Crude oil is also belongs to the as a significant components of imports, increasing demand for crude oil is resulted to depreciate the rupee due to higher capital outflows. This variable is constructed as following,

$$CM_t = \frac{CM_t}{\left(VM_t + CM_t\right)}$$

Where CM_t is the 60 percent (US$ value) value of crude oil imports and denominator ($VM_t + CM_t$) is stated as same as in the previous explanation for the total expansion of transport sector.

After formalizing the process of contracting explanatory variable as above, we posit the following function where ε_t represents variables outside the model.

$$REER_t = f\left(EXM_t, VM_t, CM_t, X_t\right) \pm \varepsilon_t \tag{1}$$

To linearize equation (1), as the previous model, here we also assumed a Cobb-Douglas log-linear model of the following form which is multiplicative in nature;

$$REER_t = \alpha_0 (EXM_t)^{\alpha_1} (VM_t)^{\alpha_2} (CM_t)^{\alpha_3} (X_t)^{\alpha_4} \varepsilon_t^{U_t} \tag{2}$$

To reduce multicollinearity and to make our equation linear, we take the natural log of equation (6) which gives;

$$\ln REER_t = \alpha_0 \pm \alpha_1 \ln EXM_t \pm \alpha_2 \ln VM_t \pm \alpha_3 \ln CM_t \pm \alpha_4 \ln X_t \pm U_t \tag{3}$$

Where U_t is the stochastic error term. Since all the variables in equation (3) are in log form, their coefficients could be interpreted as their long-run elasticities. Therefore, α_1 which is the coefficient of EXM, is the elasticity of REER with respect to EXM. It measures the degree of responsiveness of REER to changes in the level of imports EXM ceteris paribus. α_2 and α_4 also represent their respective coefficients and elasticities and thus postulate similar behaviour as α1. From the above theoretical and empirical literature, we hypothesize the following signs for our coefficients; α_1, α_2, $\alpha_3 > 0$ and $\alpha_4 < 0$.

5.2 The Model, Unit Root and Cointegration

It is necessary in determining the order of integration of each series as well determine the number of times a series must be differenced to attain stationarity. Here we used the Augmented Dickey-Fuller test to check the satioanrity conditions of the selected time series data.

After establishing the unit root or stationarity of our series, we employed the Johansen (1988,1991) cointegration test and the Vector Error Correction Model (VECM). The Johansen cointegration test is a maximum livelihood approach for testing cointegration in multivariate vector autoregressive (VAR) models with the sole motive of finding a linear combination which

is most stationary by relying on the relationship between the rank of a matrix and its eigenvalues. After identifying the cointegration relationship is existed, this study proceeds to estimate the following VECM which captures both the long-run dynamics as well as the short-run error correction model (ECM).

$$\ln REER_t = \alpha_0 \pm \sum_{i=1}^{n} \Omega \ln REER_{t-1} \pm \sum_{i=1}^{n} \Phi \ln EXM_{t-1} \pm \sum_{i=1}^{n} \partial \ln VM_{t-1} \pm \sum_{i=1}^{n} \Psi \ln CM_{t-1} \pm \sum_{i=1}^{n} \varpi \ln X_{t-1} \pm \varepsilon_t \quad (4)$$

$$\Delta \ln REER_t = \alpha_0 \pm \sum_{i=1}^{n} \Omega \Delta \ln REER_{t-1} \pm \sum_{i=1}^{n} \Phi \Delta \ln EXM_{t-1} \pm \sum_{i=1}^{n} \partial \Delta \ln VM_{t-1} \pm \sum_{i=1}^{n} \Psi \Delta \ln CM_{t-1} \pm \sum_{i=1}^{n} \varpi \Delta \ln X_{t-1} \pm \alpha ECT_{t-1} + \varepsilon_t \quad (5)$$

Where δ is the coefficient of the error correction term (ECT_{t-1}) which is obtained from the cointegration vector and measures the feedback effect or the speed of adjustment to long-run equilibrium resulting from a shock to the exchange rate market, ε_t is the error term while the other variables still maintain their usual definitions.

6. RESULTS AND DISCUSSION

6.1 Descriptive Statistics

The descriptive statistics for all the five variables are presented in Table 1, shows that all variables are exhibited a positive range, and positive mean.

A distribution is said to be normal if the value of the skewness and kurtosis are respectively 0 and 3. It can be seen that the distributions of all the variables except vehicle imports (LVM) are far from being normal. The values of the standard deviation presents the normal condition of the selected variables.

6.2 Results of Unit Root Test

Summary results revealed by the ADF test is presented in the following Table 2.

Table 2, shows that, after taking first order differential, there are no unit roots further in all variables. All variables become stationary is meant that, cointegration relationships may exist in this data. In practice, the first step in the estimation of any VAR model once the variables that will enter the VAR have been established, will be to determine the appropriate lag length. Table 3, below presents VAR lag order selection criteria to be used in both the Johansen cointegration test and VECM. To minimize the value of the information criteria, we used a lag length of 2 in the general VAR model as suggested by Akaike information criterion (AIC). Results of the Lag order selection criteria is shown on the following Table 3.

Table 1: Descriptive statistics

	LREER	LEXM	LVM	LCM
Mean	4.502210	11.41140	3.357089	4.235091
Median	4.566637	11.37053	3.374360	4.259780
Maximum	4.643814	12.03002	4.240576	4.475698
Minimum	4.259153	10.71686	2.496842	3.419436
Standard deviation	0.129708	0.352237	0.323989	0.152507
Skewness	–0.642588	0.077957	–0.282365	–1.689076
Kurtosis	1.738622	1.768473	3.086574	9.215968
Jarque-Bera	14.59239	6.934356	1.468871	225.2258
Probability	0.000678	0.031205	0.479776	0.000000
Sum	486.2387	1232.431	362.5656	457.3899
Sum square deviation	1.800184	13.27558	11.23169	2.488634
Observations	108	108	108	108

Source: Author calculation (2015)

At this lag length two (2), the AIC criterion rejects the null hypothesis of the presence of serial correlation in the model. It confirms that the chosen lag level is optimum and the model is not mis-specified.

6.3 Cointegration Test

The following Table 4 presents the results of Johansen Cointegration Test under the lag selection criterion at level 2. Results are presented based on both Eigen value and Trace statistics in following Table 4.

The null hypothesis (H_o) that the variables are not cointegrated is rejected at 5% significance level and thus from Table 4 above, both test statistics indicate that there is a 01 cointegrating relationships between the exchange rate and selected explanatory variables.

6.4 Vector Error Correction Model (VECM)

The VECM is employed to identify long run impacts on exchange rate and results are presented in the following Table 5.

Table 2: The results of ADF test

Variables	At level				At first (1st) difference			
	T-statistics	Critical value	P-value	Decision	T- statistics	Critical value	P-value	Decision
LREER	–1.627	–3.445	0.776	N. S.	–8.962	–3.445	0.000	S.
LEXM	–3.080	–3.445	0.115	N. S.	–13.74	–3.445	0.000	S.
LX	–5.511	–3.445	0.0001	S.	–8.253	–3.448	0.000	S.
LVM	–9.572	–3.444	0.000	S.	–10.29	–3.445	0.000	S.
LCM	–10.046	–3.444	0.000	S.	–8.596	–3.445	0.000	S.
LR	–1.085	–3.445	0.926	N. S.	–8.427	–3.445	0.000	S.

Critical value at 0.05 significance level, N.S.: Non-stationary, S.: Stationary, Source: Author calculation (2015)

Table 3: VAR Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	435.9305	NA	1.14e-10	–8.705666	–8.574600	–8.652636
1	509.2855	137.8186	4.29e-11	–9.682536	–8.896136*	–9.364357
2	549.2661	71.07657	3.19e-11*	–9.985174*	–8.543441	–9.401846*
3	562.4156	22.04860	4.09e-11	–9.745769	–7.648703	–8.897293
4	583.1113	32.61149	4.54e-11	–9.658815	–6.906415	–8.545189
5	613.7201	45.14016*	4.18e-11	–9.772123	–6.364389	–8.393348
6	636.1355	30.79298	4.61e-11	–9.719910	–5.656844	–8.075987
7	661.4791	32.25543	4.89e-11	–9.726850	–5.008451	–7.817778
8	685.5987	28.26134	5.44e-11	–9.709064	–4.335331	–7.534843

*Indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

Table 4: The results derived in Johansen cointegration test

No	Hypothesized No. of CE (s)	Eigenvalue	Trace statistic	0.05 critical value	Prob.**	Max-Eigen statistic	0.05 critical value	Prob.**
1	None *	0.29396	78.4364	69.8188	0.008	36.5496	33.8768	0.0234
2	At most 1	0.20253	41.8868	47.8561	0.161	23.7631	27.5843	0.1432
3	At most 2	0.12905	18.1237	29.7970	0.556	14.5080	21.1316	0.3248
4	At most 3	0.02769	3.61565	15.4947	0.932	2.94933	14.2646	0.9501
5	At most 4	0.00632	0.66631	3.84146	0.4143	0.66631	3.84146	0.4143

*Denotes rejection of the hypothesis at the 0.05 level

Trace test indicates 1 cointegrating eqn (s) at the 0.05 level

Max-eigenvalue test indicates 1 cointegrating eqn (s) at the 0.05 level

Source: Author calculation (2015)

The VECM allows the long run behavior of the endogenous variables to converge to their long run equilibrium relationship. As the theory predicts, the Error Correction Term (ECT) is negative (-0.0197) and statistically significant at 1 per cent (P-value: 0.0006), suggested that a 1.97 per cent of the deviation from the equilibrium is corrected within a month, taking around 6 months to reach the long run equilibrium.

Based on the t-statistics and p-value, we show that, LVM and LCM are significant at 0.01 level of significant and signs are also consisted with our expectation while LX and LEXM are not significant to explain the changes of exchange rate at any significant level. The estimated equation which presents the long run impacts from vehicles, crude oil, imports and exports on exchange rate is illustrated as follow;

LREER = - 0.6722 - 0.0156 LEXM + 0.0464LVM +0.1498LCM + 0.0132LX

The positive sign of long-run relationship between REER and vehicle imports (LVM) is expected and which means that a 1% increase in LVM, affects to depreciate exchange rate in Sri Lanka by 4.6 per cent while an increase in crude oil imports by 1 percent, would depreciate the exchange rate by 14.98 per cent. Signs of export (LX) and other imports (LEXM) are inconsisted with our expectation and which are statistically insignificant to explain the changes of exchange rate.

Thus we identified that vehicle and crude oil imports (which is consider as the expansion of transport sector) are significantly affected the changes of exchange rate in the long run rather than any other influences in the Sri Lanka. Given the existence of long-run relationship/equilibrium between exchange rate and macroeconomic variables, we estimate the VECM which shows short-run dynamics and an error correction term (ECT) where in the short-run, disequilibrium from long-run path resulting from a shock to the exchange rate is corrected according to the speed of adjustment.

6.5 Wald Test Analysis

Wald Test Analysis is employed to identify the combined short run impacts of explanatory variables on REER in our study. Results are shown in the following Table 6.

Since the null hypothesis were rejected under 0.05 percent significant level we show that In the short run there are only two variables (LVM and LCM) are significantly and jointly affected the changes of exchange rate in Sri Lanka while we show that, as same as in the long run Export (LX), interest rate (R) and other imports are not influenced on the changes of exchange rate in Sri Lanka.

7. FINDINGS

The R-squared is at 31.65 per cent, and the p-value for the F-stat. (0.000114) suggests that the EC model as a whole is statistically significant at the 1 percent level. Estimated model is fitted under the 31.6% means that explanatory variables in our

Table 5: Normalized cointegration coefficients

	LREER	LEXM	LVM	LCM	LX
ß coefficient	1.000000	0.789585	–2.349120	–7.585303	–0.669832
Standard error		(0.51719)	(0.74151)	(1.55937)	(0.73690)
T-Statistics		[1.52668]	[–3.16802**]	[–4.86433**]	[–0.90898]
P-value		0.12684	0.00154	0.00006	0.36336

Standard error ( ), T-statistics [], ** denotes rejection of the hypothesis at the 0.01 level

Table 6: Summary of the wald test analysis

Variables	Null hypothesis	P value	Decision
LEXM	C(4)=C(5)=0	0.1064	LEXM having 2 lags, does not jointly influenced on the changes of REER in the short run
LVM	C(6)=C(7)=0	0.0457	LVM having 2 lags, is jointly influenced on the changes of REER in the short run
LCM	C(8)=C(9)=0	0.0443	LCM having 2 lags, does not jointly influence on the changes of REER in the short run
LX	C(10)=C(11)=0	0.1581	LX having 2 lags, does not jointly influence on the changes of REER in the short run

Source: Author calculation (2015)

model including crude oil imports, vehicles imports exports and interest rate are explained the changes of exchange rate only by 31.6%. It is consisted with the real world condition, because exchange rate is determined by many other factors than the selected factors in our model. The Durbin Watson statistics is 2.11 which suggests that there is no first-order autocorrelation in the model. To ensure that the model does not suffer from higher order serial correlation, an AR(4) specification was fitted and a Breusch-Godfrey test was performed. Again, the results indicate that there is no serial correlation in the model. Thus Diagnostic test on the residuals is also shows that our fitted model is free from the problems of heteroskedasticity, and auto correlation in the series while it shows that errors of the residuals are normally distributed.

The VAR approach of the analysis revealed that vehicles and crude oil imports are significantly influence on the changes of exchange rate both in the short run and long run in Sri Lanka. Results reveled by the long run statistics show that LVM and LCM are positively correlated with REER which means that a 1 per cent increase in LVM and LCM are affected to depreciate the rupee by 4.6%, and 14.98% per cent respectively. LX and LEXM shows the unexpected sign with the REER however which is not statistically significant at any level even in the short run and long run. Interest rate is also shows that very poor correlation with the REER. Results pertains to the Error Correction Term (ECT) suggests that a 1.97 per cent of the deviation from the equilibrium is corrected within a month then taking around 6 months to reach the long run equilibrium. Therefore, result revealed by our analysis shows that, Vehicle (TVM) and crude oil (LCM) imports are crucial factors and which make a significant impact on the changes of the exchange rate both in the short run and long run in Sri Lanka.

8. CONCLUSION

The main aim of this study is to identify the impacts of the expansion of transport sector on exchange rate with its major determinants in Sri Lanka. Results revealed by the study shows that, vehicles imports (4.6%) and crude oil imports (14.98%) are positively affected (to depreciate) the changes of exchange rate in Sri Lanka in the long run. Wald test analysis implies that vehicles and crude oil imports are the only factors affect the changes of depreciate the exchange rate in the short run in Sri Lanka while other three variables, exports, imports (excluding the vehicles and crude oil imports) and interest rate do not significantly affect exchange rate in Sri Lanka. Since our findings shows that interest rate does not influence on the changes of exchange rate either in long run or short run, which implies that interest rate sensitivity with the changes of other macroeconomic variables are very poor in Sri Lanka.

Results revealed by the error correction model and cointegration theory, suggest that the REER and its determinants have long-run relationship where short-run disequilibrium is corrected. The coefficient of the Error Correction Term (ETC) shows the speed of adjustment towards long-run equilibrium. As expected, the negative and significant (at 1% level) ECT suggests that following a shock to the REER in the short-run, deviation from long-run equilibrium is corrected by 1.98% per every month and takes approximately 8 months for all disequilibrium to be corrected and the series eventually returned fully to its long-run equilibrium.

Thus, along the literature survey we show that, Central bank policies on currency depreciation are not effectively affected to minimize the demand for either vehicle or crude oil imports in Sri Lanka. Individual willingness, social imitation and other socio economic influences have been more powerful to ballooning the imports and hence depreciation of the currency. As an example, individual preference on purchasing luxurious vehicle does not change significantly with the changes of exchange rate or interest rate, even imposing tariff on vehicles imports. Somehow they try to materialize their dreams. Therefore, initializing the efficient public transport system, leading to a modal shift from private to public modes of transportation may able to minimize the problems (Socio-economic and environmental) associated with the increasing vehicle population and huge imports bill in Sri Lanka.

9. RECOMMENDATIONS

- Initializing the efficient public transport system (such as BRT, LRT and MRT systems) leading to a modal shift from private to public modes of transportation in which we will be able to mitigate the problem (such as environmental problems, increasing accidents due to the inefficiencies and inadequate road networks) with large vehicle population in Sri Lanka.
- Alternative Vehicles Increased adoption of electric and hybrid vehicles running on alternative fuels such as electricity, biofuels, is essentials to minimize the artificial demand for crude oil.
- Increasing exports and establishing interest sensitive infrastructure development should be initialized to mitigate the adverse impacts triggering from the vehicles and crude oil imports.

REFERENCES

Huchet-Bourdon, M., & Korinek, J. (2011). To what extent do exchange rates and their volatility affect trade?.

Cabral, A.N. (2008) Managing inflation, interest rate and exchange rate, The Balancing act, Presented at the Ceylon Chamber of Commerce Annual Sessions on 2 July 2008, Slide no. 16

Central Bank annual Report (2014). Special Statistical Appendix, Central Bank of Sri Lanka

Delsalle, J. (2002). *The effects of fuel price changes on the transport sector and its emissions-simulations with TREMOVE* (No. 172). Directorate General Economic and Monetary Affairs (DG ECFIN), European Commission.

Ileperuma, O. A. (2000). Environmental pollution in Sri Lanka: a review. *Journal of the National Science Foundation of Sri Lanka*, *28*(4), 301-325.

Kidane, A. (1997). *Exchange rate policy and economic reform in Ethiopia* (Vol. 54). African Economic Research Consortium.

Mwega, F. M. (1993). Import demand elasticities and stability during trade liberalization: A case study of Kenya. *Journal of African Economies*, *2*(3), 381-416.

Wei, C. (2009). A Dynamic General Equilibrium Model of Driving, Gasoline Use and Vehicle Fuel Efficiency. *George Washington University manuscript*.

Weliwita and Tisujii (2000), "The Exchange rate and Sri Lanka's Trade Balance", Journal of Economic Development, vol. 25, No. 2, pp.131-157.

World Bank Data (2016). Country Profile: Sri Lanka, The online version available at: http://data.worldbank. org/country/sri-lanka

The Economic Time. (2016). The online version available at: http://economictimes.india times.com/definition/exchange-rate

The Island. (2013, February 12). The online version available at: http://www.island.lk/index.php?page_cat=home

APPENDIX

Vector Error Correction Model

Dependent Variable: D (LREER)

Method: Least squares

Date: 11/25/16 Time: 19:08

Sample (adjusted): 4 108

Included observations: 105 after adjustments

D (LREER) = C (1)*(LREER(-1) + 0.789585325035*LEXM(-1) - 2.34911996275*LVM(-1) - 7.58530276903*LCM(-1) - 0.669832192567 *LX(-1) + 34.0281675409) + C(2)*D(LREER(-1)) + C(3)*D(LREER(-2)) + C(4)*D(LEXM(-1)) + C(5)*D(LEXM(-2)) + C(6)*D(LVM(-1)) + C(7) *D(LVM(-2)) + C(8)*D(LCM(-1)) + C(9)*D(LCM(-2)) + C(10)*D (LX(-1)) + C(11)*D (LX(-2)) + C(12)

	Coefficient	Standard error	t-statistic	Prob.
C(1)	–0.019755	0.005545	–3.562761	0.0006
C(2)	0.282007	0.094809	2.974463	0.0037
C(3)	–0.187774	0.096585	–1.944135	0.0549
C(4)	0.030010	0.016481	1.820857	0.0718
C(5)	0.029453	0.016208	1.817231	0.0724
C(6)	–0.040183	0.016778	–2.394946	0.0186
C(7)	–0.026053	0.014172	–1.838372	0.0692
C(8)	–0.103514	0.041945	–2.467858	0.0154
C(9)	–0.060723	0.031608	–1.921130	0.0578
C(10)	–0.027546	0.014524	–1.896635	0.0610
C(11)	–0.018137	0.014216	–1.275793	0.2052
C(12)	0.002803	0.001726	1.624385	0.1077
R-squared	0.316424	Mean dependent var		0.003321
Adjusted R-squared	0.235571	S.D. dependent var		0.019501
S.E. of regression	0.017050	Akaike info criterion		–5.198097
Sum squared resid	0.027036	Schwarz criterion		–4.894787
Log likelihood	284.9001	Hannan-Quinn criter.		–5.075190
F-statistic	3.913571	Durbin-Watson stat		2.116849
Prob (F-statistic)	0.000114			

Estimated Vector Error Correction Equation

D(LREER) = -0.019755LREER(-1) - 0.0156LEXM(-1) + 0.0464LVM(-1) +0.1498LCM(-1) + 0.0132*LX(-1) -0.6722) + 0.2820D(LREER(-1)) - 0.1878D(LREER(-2)) + 0.030010D(LEXM(-1))+ 0.029453D(LEXM(-2)) - 0.040183D(LVM(-1)) - 0.0260D(LVM(-2)) -0.1035D(LCM(-1))-0.0607D(LCM(-2)) -0.02755D(LX(-1)) -0.0181D(LX(-2)) + 0.002803

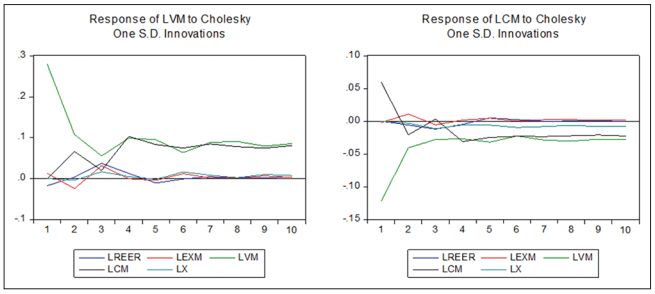

Figure 1: Response to the unit shocks on LVM and LCM
Source: Author calculation (2016)