

Impact of Exchange Rate Volatility on Sri Lankan Bilateral Demand of Imports

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Abstract

Purpose - The value and importance of imports of the Sri Lankan economy has been increasing according to statistical patterns of Sri Lanka. The exchange rate volatility is one major factor that has an impact on the demand for imports in a country. This research has been carried out to identify the impact of exchange rate volatility (long-run influence) on Sri Lankan bilateral demand of imports.

Design/Methodology/Approach- Monthly data has been used for the study for the period of 2013 to 2019. GARCH and standard deviation techniques were used to measure the exchange rate volatility of USD/LKR exchange rate and exporter currency exchange rates. The autoregression distributions lag (ARDL) bound test approach was the model that has been used to estimate the long-run effect of the volatility clustering.

Findings - According to the findings of China, Indian, Japan, the UK, Singapore, Hong Kong, and the USA country models, the error terms are highly significant at 5% and 10% levels. Thus, it indicates that there is a long-run impact from exchange rate volatility on-demand on Sri Lankan bilateral imports.

Contribution - The study fulfils the existing research gap in exchange rate volatility and Bilateral demand of imports of Sri Lanka. The findings of this study will help the country to plan their bilateral demand of imports when exchange rate volatility exists and enables future researchers to conduct studies related to this area.

Keywords: *ARDL approach, Bilateral imports, Exchange rate, GARCH effect, Volatility clustering*

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1. Introduction

The historical evidence provided where Sri Lanka has been used as a trading hub in world trade since ancient times. Not only Sri Lanka's geographical location which is situated in between the sea and silk road, but the richness of natural resources also led to attracting the attention of traders towards Sri Lanka. The importance of exports and imports of the Sri Lankan economy is increasing based on recent exports and imports statistical patterns. According to Central Bank of Sri Lanka (CBSL) statistics in 2019, Sri Lanka's exports and imports values were recorded, USD million 10,939 and 18,153 respectively. While discussing imports and exports the one most predominant factor which cannot be forgotten is the exchange rate, as the exchange rate of a currency has a direct impact in determining the prices of exports and imports of a country. Even though the exchange rate volatility will lead to a change in the prices of exports and imports, Sri Lankan imports have the highest statistical value and the highest number of products when compared to exports. Hence throughout the study, consideration was given to the impact of exchange rate volatility on bilateral imports demand in Sri Lanka. As per the CBSL, the total volume and the total value of imports from 2009 to 2019 have increased drastically by evidencing that the Sri Lankan bilateral imports are playing a significant role in the Sri Lankan economy. However, more than 50% of the Sri Lankan imports had imported majorly from, India, China, Singapore, Japan, Hong Kong, the USA, and the UK and those imports are highly diversified than the other countries.

In recent past years, the role of imports in the Sri Lankan economy has improved and is expected to increase further. Therefore, identification of exchange rate volatility impact on Sri Lankan demand of imports will provide benefits for different parties including policymakers, financial institutions, and other imports organizations. Majorly, this study will help to design effective international trade agreements and to make effective decisions regarding the balance of payment, government budgets, and exchange rate policies. Further, in terms of the financial institution and import organizations, this study will assist them to identify the Sri Lankan consumers' sensitivity to exchange rate risk.

1.1. Evolution of Sri Lankan exchange rate regimes

Sri Lankan exchange rate regime has evolved from time to time from a fixed exchange rate regime to an independent floating exchange rate regime and at present, the CBSL is practicing an independent floating exchange rate regime system to control the Sri Lankan exchange rates. The exchange rates in independent floating exchange rate regimes are sensitive to changes in the foreign exchange rate markets' supply and demand and it defines as the exchange rate volatility or exchange rate risk. Therefore, exchange rate volatility directly impacts the Sri Lankan trade and the importers and exporters, i.e., the parties who are engaging in international trade.

1.2. Exchange rate volatility and trade

Initially, theoretical papers explained that if any mechanism is absent to reduce the risk of exchange rate volatility, it will lead to reducing the volume of international trade. Ethier (1973) specified that the traders' uncertainty about

the impact of firms' revenue from exchange rate volatility will course to reduce trade. Baron (1976) explained the same by specifying that the risk-averse firms will reduce trade and reduce the risk exposure of the firm due to exchange rate volatility. Thus, it can conclude that the exchange rate volatility will negatively affect trade, and exchange rate volatility will lead to reducing the trade. However, in contrast to that, Sercu and Vahulle (1992) and Grauwe (1988) stated, that there is a positive relationship between the exchange rate volatility and risk-loving trades. Moreover, Willett (1986) specified that exchange rate volatility does not have a significant effect on trade due to not much of a difference between the behaviors of international risk and domestic risk by indicating that the exchange volatility does not have a significant impact on trade. Regarding the above facts, it can be noticed that many researchers have illustrated a mixed relationship between the exchange rate volatility and international trade. Therefore, this study has been carried out to identify whether there is an impact from exchange rate volatility on Sri Lankan bilateral demand of imports.

2. Literature Review

As discussed earlier, the relationship between exchange rate volatility and international trade can be categorized mainly into three forms as negative, positive, and insignificant relationships. Concerning the negative relationship between international trade and exchange rate volatility theories, Clark (1973) explained exchange rate volatility and risk-averse exporter behavior. He elaborated that the exchange rate volatility will reduce the trade due to the uncertainty about the future exchange rate translated into future export receipts in domestic currency. Further, he

specified that the risk-averse exporter maximized expected utility by reducing the exchange rate risk exposure through reducing the sales. By following the same findings, Baron (1976) has illustrated the same impact of exchange rate volatility on trade by using two situations including the exporter invoiced in foreign currency and the exporter invoiced in domestic currency. In 1978 Hooper and Kohlhagen (1978) have explained the relationship from the perspective of exporter and importer. As of that, an increase in exchange rate volatility will lead to an increase in the variance of profits of both importer and exporter. Therefore, the importer's demand curve will shift downward and the exporter's supply curve will shift leftward. That will lead to a reduction in the quantity demanded of imports and prices conversely, which will lead to a reduction in the quantity exported and ultimately lead to increase export prices. However according to this model, if the importer bears the risk of exchange rate volatility, it will lead to a reduction in the price and reduce the demand of an importer. Further, if an exporter bears the risk of exchange rate volatility, it will lead to an increase in price due to the premium price charged by the exporter.

Moving to the positive relationship between international trade and exchange rate volatility theories, Grauwe (1988) has highlighted the relationship by using income and substitution effects which are working in opposite directions. According to his findings, a sufficient risk-averse exporter will increase exports when increasing the exchange rate volatility risk due to increases of expected marginal utility of exporter revenue (substitution effect). Also, a very risk-averse exporter will increase exports when increasing the exchange rate volatility due to worry

about the worse possible outcome and avoid the decline of the firm's revenue (income effect). Additionally, Viaene and de Vries (1992) explained that the forward spot exchange rate volatility can affect the volume of trade through the effect of the forward exchange rate. Therefore, changes in prices partly or fully will be offset by the changes in forwarding exchange rates. This will make an opportunity to earn profits for both importers and exporters. Therefore, exchange rate volatility will lead to increase trade. Not only the positive and negative relationship Willett (1986) has demonstrated an insignificant relationship between international trade and exchange rate volatility due to the lack of differential increase in international risk relative to the domestic risk.

When considering the type of exchange rate, bilateral and effective exchange rates can be used either as nominal or real terms. If the impact of exchange rate uncertainty on the demand of imports is to be measured for the economy, effective exchange rates should be used either in nominal or real terms. If the impact of exchange rate uncertainty on the demand of imports is to be measured for individual traders, bilateral exchange rates should be used either in nominal or real terms. Bahmani-Oskooee and Hegerty (2007) have carried out the impact on demand of imports by categorizing into three ways an aggregate data used studies, bilateral data used studies and sectorial data used studies. According to that, in bilateral data used studies; bilateral exchange rates have been used either in nominal or real terms, in sectorial data used studies, bilateral data has further been disaggregated into sectorial wise due to different levels of risk faced by different types of sectors and bilateral exchange rates either in nominal or real terms has been used in sectorial data used studies as well as in bilateral data used studies. Exchange rate volatility

measuring techniques have evolved reflecting the new advances in econometric techniques. Discussing the exchange rate volatility measurement techniques, in early empirical studies, the most famous and mostly used volatility measurement technique is the standard deviation measurement (Akhtar & Hilton, 1984) (Gotur, 1985) (Lastrapes & Koray, 1990) (Koray & Lastrapes, 1989). However, the validity of the standard deviation technique has been criticized due to many reasons. Therefore, as a substitution the ARCH and GRACH base volatility measuring techniques have been introduced. The ARCH and GRACH model is the most used modern time series techniques in modern empirical studies to measure the exchange rate volatility (McKenzie & Brooks, 1997) (Caporale & Doroodian, 1994) (Jiranyakul, 2013) (Hakan, Hidayet, & Murat, 2012) and (Aftab, Syed, & Katpe, 2017).

As this study is focused on identifying the impact of exchange rate volatility on the demand for imports, it was brought to the attention that there is empirical evidence for negative, positive, and insignificant relationships. Akhtar and Hilton (1984) have identified a significant negative impact of exchange rate volatility on both USA and Germany import demand. They have used a polynomial distributed lag method in their ordinary least square (OLS) to estimate the effect of exchange rate volatility and used standard deviation measurement to capture the exchange volatility. Following the findings, Lastrapes and Koray (1990) also have explained the same negative relationship by using time series vector error correction (VAR) model. The study has used aggregate monthly data of import, export, money supply, T-bills rates, income, and consumer price index of the USA from 1973 to 1987. Caporale and Doroodian (1994) have used the OLS method to estimate bilateral exchange rate volatility between USA and Canada.

They used GRACH measurement to capture the exchange rate volatility. They set import volume as a function of income and real exchange rate and results showed a significant negative relationship between bilateral exchange rate volatility and USA demand for Canadian import. Alhayky and Senanayake (2010) have used the time series model to estimate the impact of bilateral exchange rate volatility on China and Sri Lanka aggregate trade flows (exports and imports). In this study, they used another panel data model to estimate the impact of bilateral exchange rate volatility on China and Sri Lanka 23 sectors trade flows. They set import volume as a function of income, relative prices, and exchange rate volatility. The results showed a significant negative relationship between the bilateral exchange rate volatility and import demand in both aggregate and sectoral data models. Further, Hakan, Hidyet, and Murat (2012) and Jiranyakul (2013) have used ARDL bound test approach to estimate the impact of exchange rate volatility on Turkey's demand of imports and Thailand demand of imports respectively. They used the GARCH technique to capture the exchange rate volatility and set the real imports as a function of relative price and real GDP. The results showed a significant negative relationship between the exchange rate volatility demand of imports in both the short-run and long-run.

Moving to the empirical evidence for the positive relationship between exchange rate volatility and demand of imports, McKenzie and Brooks (1997) has used ARCH at the rate of change measurement to capture the exchange rate volatility and set import volume as a function of Income, prices, nominal exchange rate, and real exchange rate. They used monthly data of two countries throughout 1973- 1992 and tested their model separately using real

exchange rates and nominal exchange rates. In both situations, results showed a significantly positive relationship between exchange rate volatility and demand for imports. Apart from the empirical evidence for positive and negative, it can also be noticed that there is an insignificant relationship between exchange rate volatility and demand of imports. While Lastrapes and Koray (1990) have used the VAR model, Bahmani-Oskooee and Hegerty (2007) have used the Granger method of co-integration to estimate the effect of exchange rate volatility. Even though Lastrapes and Koray (1990) set import volume as a function of money supply, Bond yield, Prices, income, and nominal exchange rate as variables of the UK, France, Germany, Japan and Canada Bahmani-Oskooee and Hegerty (2007) has set import volume as a function of income, relative prices, and exchange rate volatility of Greece, Korea, Pakistan, Philippine, Singapore, and South Africa. At the end of the study both the results showed a weak relationship between bilateral exchange rate volatility and import volume between countries.

3. Methodology

The arguments of Anderton and Skudelny (2001) and Cushman (1986) have been used to create the initial model to identify the impact of exchange rate volatility on Sri Lanka's bilateral demand of imports.

3.1. Conceptual Framework

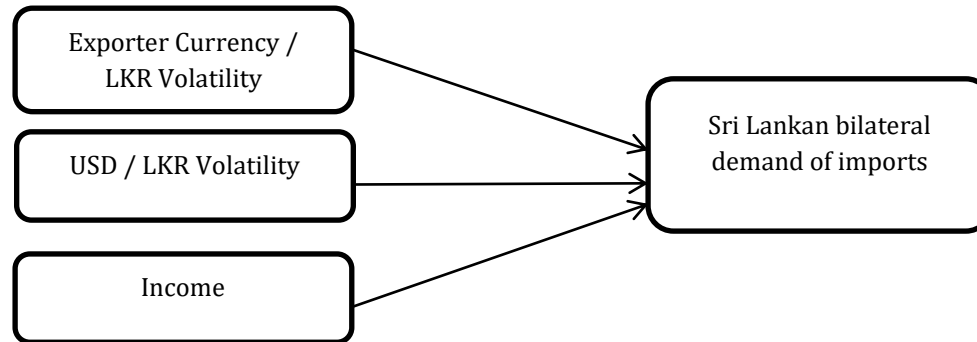


Figure 1: Conceptual Framework

Source: Author Compiled

3.2. Model Development

The model was developed under the assumption that Sri Lankan imports are invoiced in either USD or exporter currency. Therefore, the exchange rate volatilities of USD/LKR and exporter currency/LKR can have an impact on Sri Lankan bilateral demand of imports. Further, to improve the significance of the statistical model, income has been introduced as a control variable. This study is expecting to identify the impact of exchange rate volatility on the bilateral demand of imports for the countries of India, China, Japan, the UK, Singapore, Hong Kong, and the USA.

1. SL demand on: Income & INR/LKR volatility & USD/LKR volatility Indian imports

- 2 SL demand on: Income & RMB/LKR volatility & USD/LKR volatility Chinese imports
- 3 SL demand on: Income & YEN/LKR volatility & USD/LKR volatility Japanese imports
- 4 SL demand on: Income & GBP/LKR volatility & USD/LKR volatility UK Imports
- 5 SL demand on: Income & SGD/LKR volatility & USD/LKR volatility Singapore imports
- 6 SL demand on: Income & HKD/LKR volatility & USD/LKR volatility Hong Kong imports
- 7 SL demand on: Income & USD/LKR volatility & USD/ LKR volatility USA imports

According to the model developed in the theoretical framework, import value is set as a function of income, exporter currency/LKR volatility, and USD/LKR volatility.

$$M_x = a_0 + a_1 Y + a_2 X / \text{LKR volatility} + a_3 \text{USD/LKR volatility} \quad (1)$$

Where “ M_x ” is representing imports from country “ X ”, “ Y ” is income as a proxy of the index of industrial production. “ $X/\text{LKR volatility}$ ” is used as a measure of uncertainty in bilateral NER (Nominal exchange rate) between exporter currency and LKR, and “ $\text{USD/LKR volatility}$ ” is used as a measure of uncertainty in bilateral NER between USD and LKR. The impact of income should be positive because income increases will lead to an increase in the ability of spending on imports and vice-versa. According to the results of previous studies, currency exchange rates volatilities may have a negative, positive, or insignificant effect on the demand for imports.

When developing the hypotheses, theoretical arguments regarding exchange rate volatility and international trade have been used. As of that, there could be positive, negative, and insignificant relationships between exchange rate volatility and demand of Sri Lankan imports.

H1 = Exporter currency/LKR exchange rate volatility does have an impact on Sri Lankan bilateral demand of imports.

H2 = USD/LKR exchange rate volatility does have an impact on Sri Lankan bilateral demand of imports.

3.3. Model Design

Even though Sri Lanka is trading with many countries, 54% of imports out of total imports from 2014 to 2019 period were imported from seven countries including India, China, USA, UK, Japan, Singapore, and Hong Kong. Therefore, monthly data of NER, monthly industrial production index of Sri Lanka in LKR has been used for the analysis. Thus, a sample size of 84 data sets has been collected from 2013 to 2019. All the required secondary data was gathered from numerous sources such as the Central Bank of Sri Lanka, World Bank, World Integrated Trade Solution, and International Trade Center. In order to estimate the overall model, the Auto Regression Distribution Lag (ARDL) bound test approach will be used as it would identify the long-run and short-run relationships between variables. Also, Generalized Autoregressive Conditional Heteroskedasticity (GARCH) technique has been used to measure the

volatility of the exchange rate. But then again, Standard Deviation (SD) will be used for the variables that did not have a GARCH effect.

4. Findings and Discussion

Before running the model, the Augmented Dickey-Fuller (ADF) test has been carried out and identified all the variables including imports, USD/LKR exchange rate, Export Currency/LKR exchange rate, and Industrial Production Index (IPI) is stationary “at level” and “1st difference” forms. Further, the Cumulative Sum of Recursive Residuals (CUSUM) test, Breusch-Pagan- Godfrey Test, Correlogram Q statistic tests also have been performed to identify the stability of the parameters, heteroskedasticity, and serial correlation of all the models respectively.

As per table 1, there is a GARCH effect in the USD/LKR exchange rate as the p-value is 0.037 which is significant at the 5% level. When discussing the exchange rate volatility impact on Sri Lankan demand on imports, the Chinese imports, RMB/LKR exchange rate’s GARCH term is highly significant as the p-value is 0.001. Therefore, it can conclude that there is a GARCH effect in the Chinese exchange rate. Also, as there is a GARCH effect both in the RMB/LKR exchange rate and USD/LKR exchange rate researcher created exchange rate volatility with respect to GARCH models.

Table 01: GARCH Model and ARDL Model Results of Imports

Country Import	GARCH Model – P-value		ARDL Model	
	Export Currency/LKR	USD/LKR	Error Correction	Beta Value
Model 1- China	0.0001	0.037	0.002	-0.93
Model 2 - India	0.2898	0.037	0.014	-0.73
Model 3 - Japan	0.5102	0.037	0.0746	-0.59
Model 4 - UK	0.6384	0.037	0.0000	-1.10
Model 5 - Singapore	0.2139	0.037	0.0000	-1.00
Model 6- Hong Kong	0.5510	0.037	0.0002	-1.007
Model 7-USA	0.0378	0.037	0.0004	-0.719

Source: Author Compiled

Thus, the long-run effect of volatility clustering can be tested using the ARDL model. According to the ARDL model probability of error correction term is 0.002 with a negative beta value of -0.93. As the result is significant with a negative beta value there is a long-run effect from RMB/LKR exchange rate volatility clustering and USD/LKR exchange rate volatility clustering to Chinese imports. Moving to Indian imports, IND/LKR exchange rate volatility variable is created by using the standard deviation technique since there is no GARCH effect in the IND/LKR exchange rate as the GARCH term is highly insignificant (0.2898). However, since there is a GARCH effect in the

USD/LKR exchange rate researcher created USD/LKR exchange rate volatility with respect to the GARCH model. Hence, the long-run effect of volatility clustering has been tested using the ARDL model. According to the ARDL model, there is a long-run effect from IND/LKR exchange rate volatility clustering and USD/LKR exchange rate volatility clustering to Indian imports as the error correction term and beta value is 0.014 and -0.73 respectively.

According to the Japanese imports, the YEN/LKR exchange rate volatility variable is created by using the standard deviation technique as there is no GARCH effect in the YEN/LKR exchange rate ($0.5102 < 0.005$). Also, as per the ARDL model, there is a moderately long-run effect from YEN/LKR exchange rate volatility clustering and USD/LKR exchange rate volatility clustering to Japan imports as the p-value is significant at 10%. When explaining the exchange rate volatility impact on Sri Lankan demand on UK imports, the GARCH model probability of the GBP/LKR, the GARCH term is highly insignificant as the P-value is 0.6384. This indicates that there is no GARCH effect in GBP/LKR exchange rate. As the volatility clustering of USD/LKR is identified earlier, only the GBP/LKR exchange rate volatility variable is created by using the standard deviation technique since there is no GARCH effect in GBP/LKR exchange rate. According to the ARDL model, the probability of error correction term is 0.0000 with a negative beta value of -1.10. The significant P-value with a negative beta value is indicating that there is a long-run effect from GBP/LKR exchange rate volatility clustering and USD/LKR exchange rate volatility clustering to UK imports.

As per the Singapore imports and Hong Kong imports, the export currency rates of SGD/LKR and HKD/LKR's GARCH term are insignificant as the p-value is 0.2139 and 0.5510 respectively. Hence both the exchange rates the volatility variable are created by using the standard deviation technique. Also, as per the ARDL model, it was brought to the attention that there is a long-term effect from SGD/LKR and HKD/LKR exchange rates volatility clustering and USD/LKR volatility clustering to Singapore imports and Hong Kong Imports. Lastly, according to the exchange rate volatility impact on Sri Lankan demand on USA imports, it was discovered that there is a GARCH effect in the USD/LKR exchange rate. Thus, it could create the exchange rate volatility with respect to the GARCH model. Correspondingly, the long-run effect of the volatility clustering has been tested using ARDL Model. As the error correction term is 0.0004 and the beta value is -0.719 there is a long-run effect from USD/LKR exchange volatility clustering to the USA imports.

5. Conclusion

The Importance of imports in the Sri Lankan economy has been gradually increasing according to the recent import statistics. However, more than 50% of Sri Lankan imports are coming from the countries such as China, India, Japan, UK, Singapore, Hong Kong, and the USA. One of the most predominant issues that all the importers, financial institutions, and policymakers are facing is exchange rate volatility. According to the available literature, exchange rate volatility has a significant (positive or negative) or insignificant impact on the demand for imports. Therefore,

the main objective of this study was to identify the impact of exchange rate volatility on Sri Lankan bilateral demand of imports.

The imports invoices are assumed to be invoiced either in USD or exporter currency. According to the literature, it was found that Cushman's (1986) theory, exchange rate volatility of more than two currencies can affect to offset the trade patterns of bilateral trade flows. Hence, the exchange rate volatility of USD/LKR and the exchange rate volatility of exporter currency /LKR both were used to develop the model. Also, the Income was introduced as a control variable for the final model and the industrial production index has been used to measure the proxy income. Further, GARCH and standard deviation techniques have been applied to identify the exchange rate volatility whereas, the ARDL technique was applied to test the overall model. According to the analysis, the volatility clustering was presented in all the exchange rate variables including RMB/LKR, IND/LKR, YEN/LKR, GBP/LKR, SGD/LKR, and HKD/LKR. However, the GARCH effect has only appeared in USD/LKR and RMB/LKR exchange rate variables. In those variables, the exchange rate volatility variables are created with respect to the GARCH model. The export exchange rates of IND/LKR, GBP/LKR, YEN/LKR, HKD/LKR, and SGD/LKR, the exchange rate volatility variables are created with respect to the standard deviation. Further, according to the ARDL model results, all the countries' error terms are highly significant at 5% and 10% levels. Therefore, the study can reject the hypotheses of which the exporter currency/LKR exchange rate volatility does have an impact on Sri Lankan bilateral demand of imports, and USD/LKR exchange rate volatility does have an impact on Sri Lankan bilateral demand of imports.

Thus, this indicates that there is a long-run impact from exchange rate volatility on-demand on Sri Lankan bilateral imports.

Even though the objective of the study has been satisfied, this research has given it's focused only on a specific set of countries. Also, this study has not considered, the differences of countries' trade agreements and tax policies as the trade agreements and tax policies may offset the actual impact of the exchange rate volatility on the demand of imports. By considering all the limitations, the same study could be examined further by analyzing the impact of exchange rate volatility on the demand of sectorial imports.

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