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The effect of real exchange rate volatility on agricultural exports in Sri Lanka

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Abstract
In the study of measuring the Effect of Real Exchange Rate Volatility (RERV) on Agricultural Exports (AGX) in Sri Lanka, secondary data from Central Bank Reports of Sri Lanka (CBRSL) and statistics from International Monetary Fund were employed. The main objective of the study is focused on identifying effect of RERV on AGX and thereby, a core objective has been set up. That is, identification of AGXs effect to Trade Balance (TB) as AGX is also included in the TB. The secondary data of CBRSL were used from year 1996 to 2018. Therefore, to analyze these data both descriptive statistic tools and econometric tools were used. Ordinary Least Square (OLS) method was used to test the variables by using Statistical Package for Social Sciences (SPSS). The results of OLS depicted that, a strong relationship can be seen between Real Exchange Rate (RER) and AGX. This strong relationship was positive in nature. Therefore, when RER appreciates AGX appreciated. When RER depreciates AGX depreciated. As well as, for TB, AGX showed a positive relationship. When AGX goes up TB deficit narrowed and vice versa. Furthermore, e-views has been used to run the Unit Root Test (URT) and Granger Causality Test (GCT). From the URT it was identified that, all the variables considered in this study were not stationary and has a unit root. GCT showed a unidirectional causality between RER vs AGX and AGX vs TB. The overall results brought into consideration that, government should design proper strategies to brighter the AGX and should ensure the security of Agricultural Exporters against short run and long run risks.

Keywords: real exchange rate volatility, agricultural exports, trade balance, ordinary least square

1. Introduction

Over the years, human wants and needs have become more complicated. As a result of that, human beings started to exchange their goods and services with others to maximize their level of satisfaction. The uttermost result of these exchanges were the origin of international trade. Different countries in the world started to exchange their production with the rest of the world, in order to enhance the utility gain from consuming goods and services. In that case, exports and imports plays a vital role in every country's economy, as todays economies of most countries are not self-sufficient. A small island like Sri Lanka is also facing the same challenge due to the scarcity of resources in the country. Currently, Sri Lanka is the 79th largest exporter economy of the world (International Trade Council, 2020). The country's level of exports during the year 2019 were US$ 11.9 billion and total imports were recoded as US$ 19.9 billion (CBRSL, 2019).

Export sector of Sri Lanka contributes to the majority of national income of the country over the years. Thereby, industrial sector's contribution to the export income was 78.9% and AGX of the country is only 20.6% (CBRSL, 2019). In the Sri Lankan context, agricultural sector has a rich history which is dating back over 2500 years and this island was well known as the "Granary of the East" in early eras. Engage in agricultural activities were not just an economic activity and it directed the lives of people and shaped the society in many ways in Sri Lanka even though share of exports from the sector is relatively low. The main agricultural crops grown in Sri Lanka are Tea, Rubber and Coconut. Among these tea is the main currency earner to the country from agricultural exports. Therefore, with the rich history of the sector, it marks an important area to pay further attention, to accelerate the country's AGX to a higher level. Further, AGX enables to reduce the country's poverty level by providing more income to the people who engage in agricultural activities.

For a country like Sri Lanka, exports provides a gateway to solve the severe issues of TB. Because import payments can be covered through export receipts in developing countries. Therefore, widening of the export share of Sri Lanka's AGX same as the industrial exports is a fact that should be emphasized. In this regard, exchange rate is another component that taken into consideration with exports and imports. Because the volatile nature of the exchange rates make a great impact to the level of export income of the nation. Therefore, the main focus of the study centered on AGX and exchange rate volatility.

There are number of studies have been conducted on the effect of exchange rate volatility on trade of Sri Lanka. Kandearchchi (2018) studied the impact of exchange rate volatility on industrial exports of Sri Lanka. But none of the studies have been conducted to address the effect of exchange range volatility into agricultural exports. Therefore, this study is mainly addressing to the problem of how exchange rate volatility extended the diminishing pattern of the agricultural exports of Sri Lanka while identifying its impact to TB by filling the research gap.

As well as, a tropical country like Sri Lanka has a good climatic condition which is needed for the agricultural production. Therefore, this study also aims to identify strategies which can be implemented to enhance the export level of the agricultural crops in situations with volatile exchange rates.

2. Material and methods

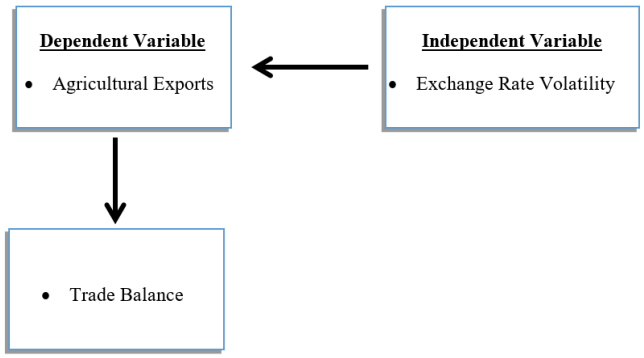


Fig 1: Conceptual Framework

AGX being used as the dependent variable and the fluctuations in the AGX performance were measured from exchange rate volatility in this study. Because exchange rate is the most important variable that influence on the volume of AGX. Appreciation of exchange rate indicates the depreciation of exporters' receipts in terms of domestic currency and at the same time depreciation of exchange rate referred to the increment in exporters' gains in terms of domestic currency. Therefore, if Sri Lankan rupee depreciates it encourages exporters to expand their production as a result of increase in the value of the agricultural products in the domestic currency.

The independent variable for the study is exchange rate volatility. The changes of the country's competitiveness against a foreign nation can be easily expressed though RER. For this study, exchange rate volatility is measured over US$ against the Sri Lankan rupee. That is because of US$ are considering as a vehicle currency. As well as, AGX is also a part of the TB. Therefore, it is including to this study to identify its impact to the TB from AGX.

Secondary data were employed in this study from the period of 1996 to 2018 from the available data. The data on AGX and TB were collected from the CBRSL. The data related to RER were sourced from the International Monetary Fund. In order to identify the effect of exchange rate volatility over AGX, the Ordinary Least Square method has applied. As well as, the Bivariate Granger Causality Test was used to determine the causality between exchange rate volatility and the AGX. The unit root tests has been employed to identify the stationarity of the time series. Additionally, effect to the TB from the AGX were also determined by the Ordinary Least Square method.

AGX = f (RER)

Where;
AGX = Agricultural Exports
RER = Real Exchange Rate
Model Estimation:

$$AGX = \beta 0 + \beta 1 RER + \mu$$

Where;

$\beta 0 -$ Constant
$\beta 1 -$ Coefficient of explanatory variable
$\mu -$ Stochastic variable

Hypothesis;
H_0: Real Exchange Rate Volatility does not affect the Agricultural Exports
H_1: Real Exchange Rate Volatility affect the Agricultural Exports
TB = f (AGX)

Where;
TB=Trade Balance
Model Estimation:

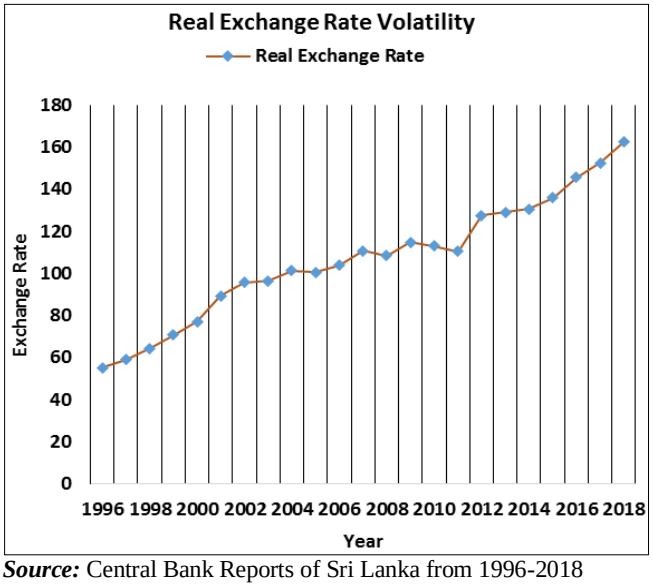
$$TB = \beta 0 + \beta 1 AGX + \mu$$

Where;

$\beta 0 -$ Constant
$\beta 1 -$ Coefficient of explanatory variable
$\mu -$ Stochastic variable

The results of the study have been represented by using descriptive statistical methods and by using econometric tools.

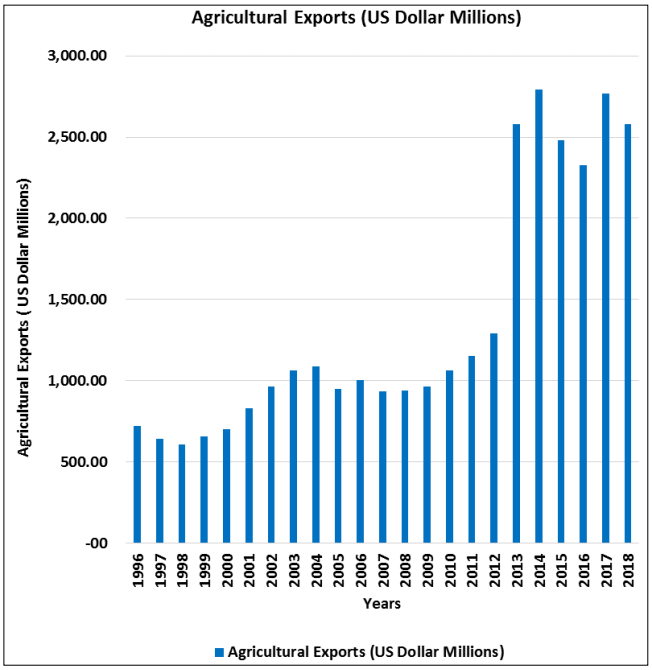
3. Results and Discussion



Source: Central Bank Reports of Sri Lanka from 1996-2018

Fig 2: Real Exchange Rate Volatility from 1996-2018

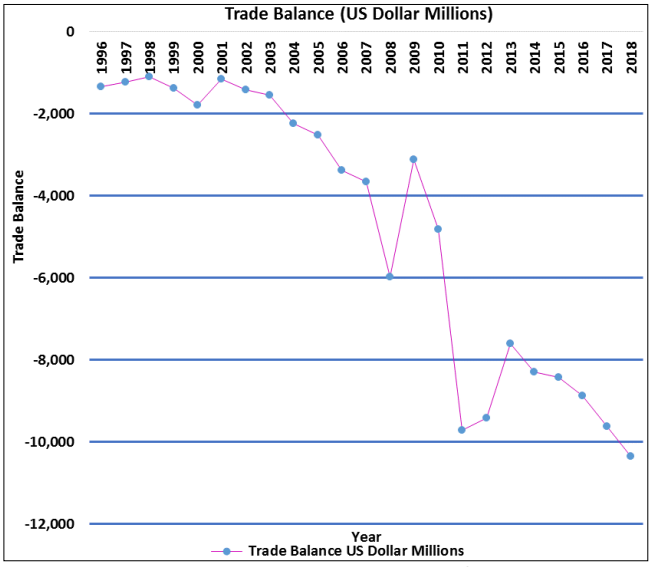
Source: Central Bank Reports of Sri Lanka from 1996-2018
Figure 2: Real Exchange Rate Volatility from 1996-2018
The Figure 2 represents the RERV from the period of 1996 to 2018. From the data, it has shown that, the RERV has increased over the period from Rs. 55.27 to Rs. 162.465 against the US$. This is 194% as a percentage over the period of 1996-2018.



***Source*:** Central Bank Reports of Sri Lanka from 1996-2018

Fig 3: Agricultural Exports from 1996-2018

As per the Figure 3, AGX have been fluctuated from time to time. The highest level of AGX were recorded in year 2014 and it was US$ Millions 2793.87. But during year 2015 and 2016 it was decreased gradually up to the level of US$ Millions 2326.09. Again in 2017, agricultural exports have been increased, but in year 2018 it has reduced to the level of US$ Millions 2579.29.



Source: International Monetary Fund Statistics from 1996-2018

Fig 4: Trade Balance from 1996 to 2018

The Trade Balance of Sri Lanka from the period of 1996 to 2018 has always showed a trade deficit. In 1996 trade deficit was only US$ Million -1,344. But in 2018, the Trade deficit US$ Million -10,343. There is a significant drop in Trade Deficit during year 2009

Even though from 1996 to 2008, the country's Trade Deficit has accelerated. But after that, Trade Deficit has grown up till year 2012. Again in year 2013, Trade Deficit has reduced US$ Million -7609. And up to 2018 from year 2013 Trade Deficit has increased. The highest Trade Deficit over the period is recorded in 2018. That is US$ Million 10,343 as a value.

Table 1: Model Summary

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.846[a]	.716	.703	422.064816	.662
a. Predictors: (Constant), Real Exchange Rate Volatility					
b. Dependent Variable: Agricultural Exports					

***Source*:** Author's computation based on CBRSL data from 1996 to 2018

According to Table 1, there is a strong positive correlation between RERV and AGX. It is 0.846 as a value. Further, based on R^2 value 71.6% (approximately 72%) of AGX are explained by the RERV. The Durbin Watson value depicts that, a positive autocorrelation can be seen in the data set.

Table 2: Model Summary

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9437974.439	1	9437974.439	52.981	.000[b]
	Residual	3740912.885	21	178138.709		
	Total	13178887.325	22			
a. Dependent Variable: Agricultural Exports						
b. Predictors: (Constant), Real Exchange Rate Volatility						

Source: Author's computation based on CBRSL data from 1996 to 2018

The Table 2 depicts, statistically significance of the variables. Therefore, P<0.05 (P = 0.0001) and it concludes that, RERV affect the AGX by rejecting null hypothesis which describes that RER has no effect on AGX.

Table 3: Coefficients Table-AGX and RER

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1045.538	340.917		-3.067	.006
	Real Exchange Rate Volatility	22.463	3.086	.846	7.279	.000

Source: Author's computation based on CBRSL data from 1996 to 2018

As per the coefficients table, regression equation can be expressed as follows,

$$\mathbf{AGX} = -1045.538 + 22.463\mathbf{RER} + \mu$$

Therefore, AGX were US$ Million -1045.538 at zero level of Exchange Rate volatility. When RER appreciates by 1, AGX also increase by US$ Million 22.463.

Table 4: Coefficients Table-AGX and TB

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-469.503	1024.719		-3.458	.003
	Agricultural Exports	2.914	.661	.693	4.405	.000
a. Dependent Variable: Trade Balance						

Source: Author's computation based on CBRSL data from 1996 to 2018

One of the aims of this study is identifying effect of RER volatility on the AGX and thereby, identifying the AGX's impact on the TB. Therefore, Table 4 has shown that,

$$\mathbf{TB} = -469.503 + 2.914\mathbf{AGX} + \mu$$

If AGX is zero TB is -469.503 US$ Millions and with the increase of AGX from 1US$ Million TB will go up by 2.914 US$ Millions. Therefore, it showed that as a part of TB, AGX has a direct impact over minimizing the Trade Deficit.

Table 5: Unit Root Test Results for Exchange Rate Volatility

Null Hypothesis: RER has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=6)				
			t-Statistic	Prob.*
			-0.068714	0.9410
Augmented Dickey-Fuller test statistic				
Test critical values:	1% level		-3.788030	
	5% level		-3.012363	
	10% level		-2.646119	

Source: Author's computation using e-views based on CBRSL data from 1996 to 2018

Table 5, represents the unit root test of RER. ADF Test statistics on RER records a value of -0.0687 and P value is 0.9410. Therefore, it has identified that, series are non-stationary and has a unit root with 1st difference while accepting null hypothesis.

Table 6: Unit Root Test Results for Agricultural Exports

Null Hypothesis: AGX has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)				
			t-Statistic	Prob.*
			-0.400805	0.8928
Augmented Dickey-Fuller test statistic				
Test critical values:	1% level		-3.769597	
	5% level		-3.004861	
	10% level		-2.642242	

Source: Author's computation using e-views based on CBRSL data from 1996 to 2018

Table 6, shows the unit root test ran for AGX. For AGX, ADF Test statistics is at a value of -0.400805 and P value is 0.8928. Therefore, on the side of AGX, it has identified that, series are non-stationary and has a unit root with 1st difference. Therefore, this enables to accept the null hypothesis, which says AGX has a unit root.

Table 7: Unit Root Test Results for Trade Balance

Null Hypothesis: TB has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)				
			t-Statistic	Prob.*
			-0.517049	0.8700
Augmented Dickey-Fuller test statistic				
Test critical values:	1% level		-3.769597	
	5% level		-3.004861	
	10% level		-2.642242	

Source: Author's computation using e-views based on CBRSL data from 1996 to 2018

When concerned about the AGX final impact to the TB, it is important to identify whether it is stationary or not stationary. Therefore, as per the data of Table 8, it represents that, ADF Test Statistics is -0.517049 and P value of ADF >P by giving a value of 0.8700. This conclude that, TB has a unit root by accepting the null hypothesis at 1st difference and shows that series are non-stationary.

Table 8: Granger Causality Tests

Pairwise Granger Causality Tests			
Sample: 1996 2018			
Lags: 2			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
RER does not Granger Cause AGX	21	8.68446	0.0028
AGX does not Granger Cause RER		1.47266	0.2588
TB does not Granger Cause AGX	21	0.36694	0.6985
AGX does not Granger Cause TB		13.3030	0.0004

Source: Authors computation using e-views based on CBRSL data from 1996 to 2018

The Granger Causality results of Table 8, shows a unidirectional causality and was equally observed between Exchange Rate Volatility and the AGX and between AGX and TB. As well as, Null hypothesis of no Granger Causality cannot be rejected in the cases of TB and AGX and between AGX and RER.

Conclusion

The main objectives of this study is to identify the effect of Exchange Rate Volatility on AGX and thereby identifying AGXs impact to TB. From the descriptive statistics, it depicted that there's an increasing trend in the RER volatility of Sri Lanka. As well as, there were gradual fluctuations in AGX and TB and still the share of AGX to national income is relatively low. A positive relationship exerts between RER and AGX in Sri Lanka. When RER

Appreciates AGX increases. When RER depreciates AGX also decline. Moreover, these two variables represented a strong correlation. The OLS results of TB and AGX also shows a positive relationship and widening of AGX helps to reduce the Trade Deficit in Sri Lanka. The URT was conducted to identify the stationary and the non-stationary behaviour of the variables of the study. Based on the results, all the variables were non-stationary and had a unit root at 1st difference. Further, from the GCT, unidirectional causality observed between RER and AGX and between AGX and TB. Based on these results, government should possess the responsibility of enhancing the level of AGX and narrowing of the TB. If government can implement proper strategies, there will be a bright prospect for AGX. Therefore, it's the proper time to increase the AGX earnings of the country. Additionally, the study recommends measures that will be promoting the Exchange Rate Stability and design proper trade conditions in the country. Also insuring themselves against long- and short-term risks effectively helpful for the Agricultural Exporters.

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