OPENING MINDS:
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Determinants of Merchandise Export Performance in Sri Lanka

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1 INTRODUCTION

Development of a country depends on social and economic performances of that country. There are many variables that contribute to economic growth. Among them, Export is considered as one of the most important accelerator of economic growth.

There are two types of exports namely merchandise exports and service exports. Merchandise exports are tangible goods sent out of a country and service exports are selling of services from home country to a foreign country. This study concentrates on merchandise exports only.

Sri Lanka is ranked as the 83rd largest export economy in the world and known as a major exporter of tea, rubber, garment and textiles products. Despite several initiatives taken by the government to enhance the exports performance of Sri Lanka, only 8% cumulative average growth rate has been achieved for merchandise exports during the last fifteen years. Therefore analyses focusing on determinants of export are of crtical importance and will be helpful to the government to solve bottlenecks and barriers in terms of export performance.

The objectives of this study are to investigate the pattern and behaviour of merchandise exports in Sri Lanka using time series analysis and to predict future trends of merchandise exports by identifying the factors that significantly affect to the merchandise exports. Outcome of this study would help to make policy decisions and to predict short-term and long-term exports performances of the country.

2 METHODOLOGY

The annual time series data for the period 1978 to 2015 is used in this study. For the purpose of analysing the country's export performance, the export model was estimated using time series analysis techniques.

The time series data that is used in this study for Merchandise Exports in million LKR (MEX), Merchandise Imports in million LKR (MIM), Gross Domestic Product at current market price in million LKR (GDP) andSri Lanka Rupee Exchange Rates against the US Dollar (ER) were collected from "Central Bank Annual Report 2015". Data for Crude Oil Price in LKR (COP) was collected from "inflationdata.com website" and data for Foreign Direct Investment net inflow in million LKR (FDI) was collected from "The World Bank website". The statistical software, EViews 7 was used for the analysis of the data.

Multivariate time series analysis was used to identify the significantly effective factors to the merchandise exports in Sri Lanka. Time series plot and Augmented Dickey-Fuller (ADF) test were used to observe the stationary properties of the series. Johansen co-integration test was used to test the co-integration of the variables. Since variables are co-integrated and individually non-stationary Vector Error Correction Model (VECM) was used to fit a model for merchandise exports.

When time series models are used it is important to check whether the model residuals are independent, identical and normally distributed with mean zero and constant variance. In this study, Autocorrelation and Partial Autocorrelation Functions (ACF and PACF) and Box-Pierce statistic (Q-stat) were used to test whether the error terms are related to each other. Breusch-Godfrey Serial Correlation Lugrange Multiplier (LM) test was used to test the serial correlation among error terms of a model. Heteroskedasticity test was used to test the constant variance and Jarque-Bera test is used to check the normality of error series. Finally Mean Absolute Percentage Error (MAPE) is used to measure the prediction accuracy of the fitted model.

3 RESULTS AND DISCUSSION

Before carrying out the advanced analysis it is important to get a better idea about the background of merchandise exports in Sri Lanka. The sample is composed of data obtained from national level for 38 year period from 1978 to 2015.

Merchandise exports with the unit of rupees in million from 1978 to 2015 by annual basis were plotted against the year and shown in Figure 1. According to Figure 1, there is an increase in total earnings from merchandise exports from 1978 to 2015 while declines were apparent in the period 2009 and 2015. Slow increment can be identified from 1978 to 1990, and after 1990, earnings from merchandise exports increased rapidly. Therefore, in order to stabilize variance fluctuation Box-Cox transformation test is used. Suggested transformation is ln(MEX). Similarly, other explanatory variables such as MIM, GDP, FDI, GD, ER and COP are also transformed according to Box-Cox transformation test results. First difference of each transformed series is stationary

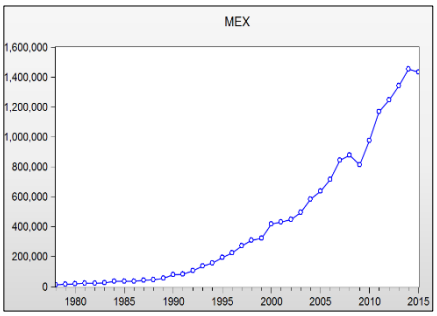

Figure 1: Time series plot of MEX

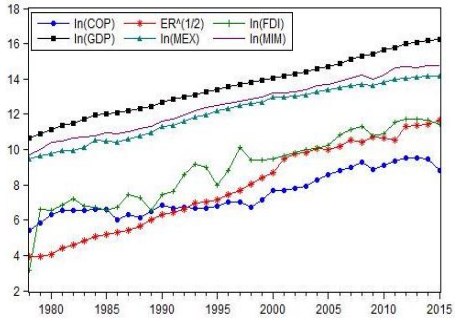

Figure 2: Graph of transformed series

Table 1: ADF test results

Series	P value		Order of integration
	Original	First difference	
ln(MEX)	0.4015	0.0000	I(1)
ln(MIM)	0.4262	0.0000	I(1)
ln(FDI)	0.7436	0.0000	I(1)
ln(GDP)	0.4454	0.0004	I(1)
ln(COP)	0.6404	0.0005	I(1)
$(ER)^{1/2}$	0.9588	0.0000	I(1)

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According to Figure 2, it can be concluded that the data are correlated and the series is non-stationary according to the ADF test. As shown in the Table 1, each series is in the same order of integration I (1). Then the Johansen co-integration test was applied to identify co-integration between them.

According to Table 2, Maximum Eigen value test shows that there is one co-integrating equation while trace statistic shows there are two co-integrating equation indicating long run relationship among variables, but lag selection criterion recommended that optimum lag is 1. Therefore VECM of lag 1 has performed.

Table 2: Johansen co-integration test result

Hypothesized No. of co-integration equations	Eigen value	Maximum Eigen value (λ_{Max})		Trace Statistics (λ_{Trace})	
		Critical Value	Prob.**	Critical Value	Prob.**
None	0.6816	40.0775	0.0372*	95.7537	0.0026*
At most 1	0.5813	33.8769	0.0974	69.8189	0.0450*
At most 2	0.4360	27.5843	0.3001	47.8561	0.2586

* Rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis p-value

Equation 1: Fitted Vector Error Correction Model

D(TMEX)=C(1)*[TMEX(-1)-0.1644*TMIM(-1)+0.6835*TCOP(-1)-0.1070*TFDI(-1)-0.6499*TGDP(-1) - 0.3169*TER(-1) - 2.9063] + C(2)*D(TMEX(-1)) + C(3)*D(TMIM(-1)) + C(4)*D(TCOP(-1)) + C(5)*D(TFDI(-1)) + C(6)*D(TGDP(-1)) + C(7)*D(TER(-1)) + C(8);

Where;TMEX=ln(MEX), TMIM=ln(MIM),TFDI=ln(FDI),TGDP=ln(GDP),
TCOP = ln(COP), TER = $(ER)^{1/2}$

Table 3: Fitted VECM results

Variable	Coefficient	Std. Error	t-Statistic	Probability
Error correction model	C(1) = -0.3948	0.1275	-3.0956	0.0044
D(TMEX(-1))	C(2) = -0.0902	0.2145	-0.4206	0.6772
D(TMIM(-1))	C(3) = -0.1030	0.2135	-0.4825	0.6362
D(TCOP(-1))	C(4) = 0.1585	0.1140	1.3907	0.1753
D(TFDI(-1))	C(5) = -0.0163	0.0253	-0.6470	0.5229
D(TGDP(-1))	C(6) =0.6020	0.4274	1.4085	0.1700
D(TER(-1))	C(7) =-0.0718	0.0989	-0.7256	0.4741
Constant	C(8) = 0.0616	0.0622	0.9902	0.3306
Model diagnostics criterion				
R-squared	0.2633	Mean dependent variance		0.1262
Adjusted R-squared	0.0791	S.D. dependent variance		0.1035
S.E. of regression	0.0994	Akaike info criterion		-1.5871
Sum squared residual	0.2764	Schwarz criterion		-1.2353
Log likelihood	36.5688	Hannan-Quinn criterion		-1.4643
F-statistic	1.4297	Durbin-Watson stat		2.0773
P value	0.233			

According to the Table 3, there is no short run causality from all explanatory variables to the MEX. But coefficient of the error correction model (C(1)) has the correct negative sign, and it is a significant indication that there is long run relationship. Since there is no short run causality from all explanatory variables to the MEX and R-square is too small VECM is not suitable for forecast MEX. So this study proposed the lag regression model.

According to Table 4, TER and TMEX lag 1 is positively significant while TCOP lag 1 value is negatively significant to the current year TMEX. Also TGDP is positively significant while TGDP lag 1 value is negatively significant to the current year TMEX.

Table 4: Fitted lag regression model with dependent variable of TMEX

Variable	Coefficient	Std. Error	t-Statistic	Probability
TER	0.0411	0.01364	3.0114	0.0050
TCOP(-1)	-0.1853	0.0369	-5.0233	0.0000
TGDP	1.2949	0.2185	5.9271	0.0000
TGDP(-1)	-1.0166	0.2117	-4.8018	0.0000
TMEX(-1)	0.7696	0.0690	11.1529	0.0000
Model diagnostics criterion				
R-squared	0.99816	Mean dependent variance		12.18772
Adjusted R-squared	0.99793	S.D. dependent variance		1.47509
S.E. of regression	0.06712	Akaike info criterion		-2.43974
Sum squared residual	0.14414	Schwarz criterion		-2.22205
Log likelihood	50.13523	Hannan-Quinn criterion		-2.36299
Durbin-Watson stat	2.37221			

Residual Analysis

Table 5: Residual Autocorrelation

lag	ACF	PACF	Q-stat	P-value	lag	ACF	PACF	Q-stat	P-value
1	-0.209	-0.209	1.7495	0.186	**6**	-0.089	-0.225	4.7498	0.576
2	-0.075	-0.124	1.9820	0.371	**7**	0.080	-0.042	5.0586	0.653
3	0.043	-0.001	2.0598	0.560	**8**	0.091	0.003	5.4746	0.706
4	-0.224	-0.237	4.2470	0.374	**9**	0.041	0.019	5.5629	0.783
5	-0.055	-0.174	4.3821	0.496	**10**	-0.025	-0.084	5.5958	0.848

According to Table 5, all Box-Peirce statistics are not significant. Therefore we can conclude that the model is adequate.

LM test statistic (2.9533 (P-value = 0.2284)) indicates no serial correlation among error terms. Jarque-Bera statistic (0.9292 (P-value = 0.6284)) and Heteroscedasticity test statistic (20.8239 (P-value = 0.1062)) for residual series indicate the normality and constant variance of error terms respectively.

After considering all the tests and criteria, it can be conclude that the following model is most suitable model for forecast the merchandise exports in Sri Lanka (MAPE = 0.305%).

$$TMEX_t = 0.0411TER_t + 1.2949TGDP_t - 1.0166TGDP_{t-1} - 0.1853TCOP_{t-1} + 0.7696TMEX_{t-1}$$

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4 CONCLUSIONS AND RECOMMENDATIONS

This study considers the performance of merchandise exports in Sri Lanka from 1978 to 2015. To determine the performance of merchandise exports in Sri Lanka, this study focused on finding significantly affected factors to the merchandise exports and also to find the suitable model for forecasting the merchandise exports.

Since all original variables are non-stationary due to trend and variance fluctuation, variables were transformed. MEX, MIM, FDI, GDP and COP were transformed in to natural logarithm of the original series and ER was transformed in to square root of the original series.

There is upward trend for merchandise exports in Sri Lanka and merchandise exports in Sri Lanka can be forecast using following time series model.

$$TMEX_t = 0.0411TER_t + 1.2949TGDP_t - 1.0166TGDP_{t-1} - 0.1853TCOP_{t-1} + 0.7696TMEX_{t-1}$$

The result suggests that an increase of current year exchange rate and gross domestic product at market price cause an increase of current year merchandise exports. Previous year gross domestic product at market price and crude oil price negatively affect the current year merchandise exports while previous year merchandise exports positively affect the current year merchandise exports. Merchandise imports and Foreign Direct Investment net inflow were found to be statistically insignificant to determine merchandise export performance.

The conclusion also reveals that the gross domestic product should continually grow in order to increase the earnings of merchandise exports for the year compared to that of the previous year. Therefore, it is recommended to formulate a policy for continuous growth of the gross domestic product of the country.

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