

Original Article

## Macroeconomic Performance and its Impact to Container Throughput at Port of Colombo

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### Abstract

Services for freight transport have become an increasingly important aspect of global trade. The transport of freight cargo as a result of the shipping industry has very unique characteristics. The creation of container throughput volumes for this research is described in the sense of macro-economic effect variables. This research will lead to the understanding of how the economic variables of Sri Lanka affect the volume rate of container throughput at Port of Colombo. The study question answered using hypothesis testing using data obtained from the Department of Census and Estimates, Central Bank Reports and Port Annual Reports, and the data is evaluated using a multiple linear regression model of E-Views. There is a linear relation with the defined economic variables for container throughput capacity, except for the inflation rate. There is also a clear correlation, except for the rate of inflation, between the economic variables and all the response variables. At Colombo Port, the Number of Imports & Exports of Sri Lanka were the most explanatory variables for container throughput ratios, where it is seen that Number of exports has a greater effect compared to the other macro-economic variables. In a more macroeconomic context, this analysis adds to the

interpretation of container throughput volume trends. Further studies should concentrate on the evolution of broader datasets.

**Keywords:** *Colombo Port, Container Throughput Volume, Macro-economic Variables, Economic Impact, Multiple Linear Regression Model (E-Views)*

### Introduction

Efficient logistics management and the full use of available services to increase container throughput performance are the key objectives of any port. Growing the port throughput capacity, which is mentioned, is also contributing to sustaining the economy of the country positively. At the centre of commercial activity, ports have always been. It is primarily dependent on the quantity of port throughput over a given span of time. Port throughput is known as the average amount of cargo containers that may move through a port on a regular basis when a ship is loaded into the port or discharged from the ship for clearance. Throughput is commonly expressed in tons of measurements.

Sri Lankan macro-economic factors mostly affecting to the container throughput

volumes at Colombo Port. In this research mainly focusing on analysing the most affective macro-economic factor which are identified by literatures (Jung (2011) Hao & Xiaohong (2008) , Inland Navigation Market, (2017)) the to the container throughput volume and the relationship between all the macro economic variables and container throughputs at Colombo Port. After analysing the macroeconomic factors, the ports throughput, it can provide information to both private sector and government officers for planning & managing their future development. The results can be providing as a support for port business investment, decision making and risk control, and also can provide assistance for port enterprises or other researchers.

- Research Problem

There has no particular study on calculating container throughput at Colombo port. Therefore, this study can be refer to the future researches with the relevant information.

- Objectives

- ✓ Primary - Identifying the factors and measures which impact economically on Colombo Port throughput
- ✓ Secondary - Determine the relationship between macro-economic variables and Colombo Port throughput levels and identifying which variable has the greatest impact on Container Throughput Level at Colombo Port.

## Methodology

Augmented dickey fuller test and Phillips Perron test will be applied in order to check the stationarity of the variables. Stationarity of the data is important for forecasting. Also checking for stationarity, unit root testing

has been carried out prior to modeling. In order to make accurate predictions, unit root testing will provide guide to build the models (Mudunkotuwa, 2015)

$$\Delta Y_t = \alpha + \beta T + \gamma Y_{t-1} + \sum_{i=0}^p \varphi_i \Delta Y_{t-1} + \varepsilon_t$$

$Y_t$  is level and  $\Delta Y_t$  is first difference time series.  $T$  is time in year.  $\alpha$  is the intercept constant.  $\beta$  is the coefficient on the time period.  $\gamma$  is the coefficient presenting root.  $p$  is the lag order of first difference autoregressive process.  $\alpha, \beta, \gamma$  are parameters which are estimated.

The hypothesis of stationary test is as followed;

H0: variable has a unit root (non-stationary)

H1: variable has no unit root (stationary)

Co-integration is a statistical property generally applies for set of stationary series. When the observed series are stationary at the first difference, it is said to be that the series are integrated of order one. That is series are in  $I(1)$ . Once a unit root has been confirmed for all data series as stationary, it is required to test whether there is any possibility for the existence of a long run equilibrium relationship among a given set of variables. In this aspect it is required to find the lag period Johansen's cointegration test is very sensitive to the choice of optimal lag length. Thereafter, the sequential modified likelihood ratio test statistics is used to select the number of lags required in the cointegration test (Mudunkotuwa & Karunaratne, 2017). Hathurusingha & Mudunkotuwa (2015) have cited that Granger Causality is a technique based on

predictions rather than causation and was developed by Prof. Clive Granger (1969) to determining the causal relationship between two variables. This concept is used to determine whether one variable can be used to predict the other and if so, what the direction of that relationship is. Ordinarily regressions mirror “mere” co-relations. According to Poof.Clive Granger’s definition (1969), “a variable Y is Causal for another Variable X if knowledge of the past history of Y is useful for predicting the future state of X over above knowledge of the past history of X itself. So if the prediction of X is improved by including Y as a predictor, then Y is said to be Granger causal for X.”.

newspapers, blogs, conference papers, thesis papers, academic papers and literature books have been collected for this research. I was collected statistical data from Mr.Upul Jayatissa, who is a Managing Director at Sri Lanka Ports Authority. And refer the SLPA annual reports. For the research to be carried out, 20 years of data are gathered in order to establish the relationship between variables. Using a sample size of 20 years. The 10-year timeframe for this analysis is the period from 2000 to 2019, the most recent data available.

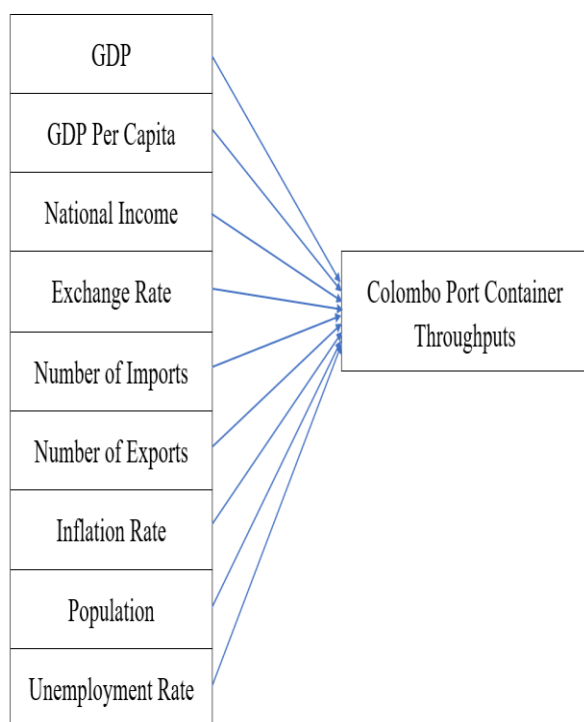


Figure 1: Conceptual Framework

Collecting data using secondary data collection method. Data from sources such as the Department of Census and Statistics, Sri Lanka Central Bank Study Publications, Port Annual Accounts, related articles,

**Data Analysis**

*Vector Error Correction Model*

R-squared	0.584305	Mean dependent var	245373.1
Adjusted R-squared	0.435843	S.D. dependent var	323108.5
S.E. of regression	242688.0	Akaike info criterion	27.86394
Sum squared resid	3.30E+12	Schwarz criterion	28.50316
Log likelihood	-1051.762	Hannan-Quinn criter.	28.11962
F-statistic	3.935714	Durbin-Watson stat	2.124783
Prob(F-statistic)	0.000027		

According to the VECM statistic, P value is significant as the probability is 0.00027. This indicates that Vector Error Correction Model is highly valid.

*Granger Causality*

Null Hypothesis:	Obs	F-Statistic	Prob.
DEXCHANGE_RATE does not Granger Cause DCONTAINER_THROUGHPUTS	17	0.54897	0.5914
DGDP does not Granger Cause DCONTAINER_THROUGHPUTS	16	0.95284	0.4153
DGDP_PER_CAPITA does not Granger Cause DCONTAINER_THROUGHPUTS	16	0.49878	0.6204
DNATIONAL_INCOME does not Granger Cause DCONTAINER_THROUGHPUTS	16	1.24385	0.3258
DNUMBER_OF_EXPORTS does not Granger Cause DCONTAINER_THROUGHPUTS	17	8.63368	0.0048
DNUMBER_OF_IMPORTS does not Granger Cause DCONTAINER_THROUGHPUTS	17	15.8245	0.0004
DPOPULATION does not Granger Cause DCONTAINER_THROUGHPUTS	17	1.02841	0.3870
DUNEMPLOYMENT_RATE does not Granger Cause DCONTAINER_THROUGHPUTS	16	0.73481	0.5017
INFLATION_RATE does not Granger Cause DCONTAINER_THROUGHPUTS	17	1.50649	0.2608

According to the Granger Causality results, there are only two independent variables highly impact to the dependent variable in short run. Number of imports and exports are does not granger cause with Container Throughputs at

Colombo Port. And having 0.0048 and 0.0004 significant P-Values. Therefore, it may consider those variables contribute to the container throughput volume changes.

*OLS Model*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.013190	0.019306	-0.683218	0.5138
DEXCHANGE_RATE	-0.000226	0.001461	-0.154610	0.8810
DGDP	-0.000379	0.002911	-0.130220	0.8996
DGDP_PER_CAPITA	-1.82E-05	6.10E-05	-0.297875	0.7734
DNATIONAL_INCOME	0.002444	0.003548	0.688866	0.5104
DNUMBER_OF_EXPORTS	0.123716	0.019923	6.209734	0.0003
DNUMBER_OF_IMPORTS	-0.006114	0.006991	-0.874669	0.4072
DPOPULATION	0.038270	0.053545	0.714718	0.4951
DUNEMPLOYMENT_RATE	-0.016656	0.010626	-1.567446	0.1556
INFLATION_RATE	0.001816	0.001415	1.283111	0.2354
R-squared	0.968554	Mean dependent var		0.050511
Adjusted R-squared	0.933177	S.D. dependent var		0.088755
S.E. of regression	0.022943	Akaike info criterion		-4.411397
Sum squared resid	0.004211	Schwarz criterion		-3.916746
Log likelihood	49.70257	Hannan-Quinn criter.		-4.343191
F-statistic	27.37796	Durbin-Watson stat		1.417606
Prob(F-statistic)	0.000045			

When considering about the OLS Model Results, there is only number of exports has a significant P-value. According to that number of exports which is greatly affect to the Container Throughput of Colombo Port in short run.

### Discussion of Findings

Augmented root analysis of the Dickey Fuller (ADF) unit was used in the report. As more variables at the first discrepancy are stationary, they can be cointegrated to have a long-term relationship. All the I (1) variables have also been added to assess their long-term relationship. As there are several factors, through applying the temporal disaggregation process, researchers interpolated the low frequency of annual data to the high frequency of quarterly data. The Cointegration Equation

(CE) number was calculated by the Johansen Cointegration test. In the analysis, researchers established VECM by choosing four cointegration equations based on trace statistics. Therefore, overall container output has a long-term relationship with other macro-economic influences.

After evaluating long run association using VECM, used Granger Causality Test and LS Model to evaluate effect from the independent variables in short run. In Granger Causality test, can be identified two variables with the significance of P-value. Number of imports and exports have more relationship with the Container Throughput in short run association. Then run the OLS Model as well. To identify which variable has the greatest influenced to the dependent variable than granger causality

test. After analysing have identified only number of exports has a greater influenced to the Container Throughput.

### Conclusion

This research explores the effect on container throughput levels at Colombo Port of the macro-economic variables of Sri Lanka. The goal is to broaden scientific awareness and add to current studies on the effect of economic factors on the level of port throughput. Research objectives are fulfilled with the VEC Model, Granger Causality Test, and OLS Model. Number of imports and exports have more relationship with the Container Throughput in short run association with granger causality while it has identified that only number of exports has a greater influenced to the Container Throughput from the OLS Model.

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