



Economic Growth and Container Port Development in India: - An Empirical Assessment

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Abstract

The development of ports infrastructure in India is very crucial and indispensable for the increase of export volume through maritime trade. Export is an important and key component of Gross Domestic Products (GDP), which is a base indicator for economic growth in India. Presently exports contribute 25% of the country's GDP (gross domestic products) and are expected to reach a level of 500 billion USD by 2020. The port infrastructure has to be developed accordingly as 90 % of export cargo by volume travels by sea. Cargo traffic in India has significantly increased. Total cargo handled by the major Indian ports was 581.34 million tons in 2014-15, which is 28 times more than in 1950-1951. The study measures the growth of cargo traffic during the selected time period 1994-95 to 2014-15 and also finds out the impact of Economic Growth Indicators on Cargo Traffic handled by selected ports in India. For measuring the growth of cargo traffic, the study incorporates the time trend analysis of cargo traffic handled by selected twelve ports during the specified time period. Similarly, to measure the impact of economic growth on cargo traffic handled by selected ports in India, multiple regression analysis is considered for the study. The study considered three variables named 'Agricultural GDP Growth' (AGDPG), 'Industrial GDP Growth' (IGDPG) and 'Services GDP Growth' (SGDPG) as economic growth indicators.

Keywords: Sea Ports Infrastructure, Cargo Traffic, Agricultural GDP Growth, Industrial GDP Growth, Services GDP Growth, Time Trend Analysis, Multiple Regression Analysis

JEL Classification: F43, O19

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Introduction

Growth of India's economy and international trade depends heavily upon its ports. Seaports are vital for India's International trade as over 90% of trade by volume and 70% by value takes place through its ports. India has a long coastline of 7517 km that harbors 12 major ports and 200 minor ports. It is essential to ensure that both capacity and efficiency of these ports is increased to meet the growing demands of India's International trade. Also needed is the development of entirely new ports at strategic locations which are favoured by deeper draft of water and at locations favourable to handling the hinterland cargo. In the year of 1970-71, India's total amounts

of exports were 2031.3 million USD and imports were 2162.3 million USD. But, the scenario has changed after new economic policy of July, 1991. The export volume for the year 1993-94 was 22238.3 million USD and imports were 23306.2 million USD. For the year 2012-13¹, the volume of export was 300570.6 million USD, which was 148 times more than the year of 1970-71. Similarly, the import volume for the year 2012-13 was 491487.2 million USD, a whopping 227 times more than the year of 1970-71. India's exports of goods and services were 13 % of GDP in the year of 2000 and the same has increased to 24 % for the year 2012. Similarly, the imports of goods and services were 14 % of GDP for the year 2000 and it has increased to 32 % for the year 2012. Therefore, exports and imports have played a crucial role for the development of Indian economy. The rapid economic development of India requires a well functioning seaport system. Detailed plans have been made for the development of the major Indian Ports to International standards so as to meet the growing demands of the Indian economy.

Literature Review

There are many studies in the areas of economic growth and sea-port performance, but the selected relevant literatures are explored for the study. Jung (2011) studied the effect of ports on the major port cities in Korea and noted negative correlation between ports and port cities economy. Ducruet, Itoh & Merk (2014) have concluded that investments and technological improvement in Chinese ports have increased their efficiency which has led to socio-economic development. De Langen (2004) pointed out the ports provide value adding logistic services and therefore act as hubs of economic activity. Clark, Dollar & Micco, (2004) stated that port efficiency has been found to be of key importance in determining transport costs and hence, international trade among countries. De (2003), De & Ghosh (2002), Ghosh & De (2000) stated that the production activities in a country, the operations of the individual ports and sea transportation providing an effective link, are an important aspect of international trade. Fujita & Mori (1996) proposed a model based on new economic geography assumptions and argue that the construction of a port in a relatively backward region may deteriorate local economic conditions. Martin & Rogers (1995) argued that local industries may be crowded out by international competition, so that economic development may be enhanced by temporarily worsening transport costs. Michaely (1977) found a strong positive correlation between economic growth and international trade. Balassa (1978) pointed out the positive relation between the countries exports and its economic growth. Feder (1983) and Ram (1985) concluded that exports facilitate the earnings of foreign exchange which helps in importing of new technology and production methods. Grossman & Helpman (1991) stated that openness to trade supports good investment climate, technology externalities, and learning effects that lead to economic development of a country. Ahmad & Harnhirun (1996) examined the relationship between cause and effect between exports and economic growth for five countries of the Association of Southeast Asian Nations (ASEAN). Dutt & Ghosh (1996) studied cause and effect relationship between exports and economic growth for a relatively large sample of countries using the Error Correction Model (ECM), in which they found Co-integration. According to Love & Chandra (2004), a feedback relationship exists between trade and economic growth of a country. Acciaro & McKinnon (2013) pointed out that increased hinterland connectivity is possible through better management of road-rail networks, dry ports and empty container management. However benefits of increased connectivity have to be balanced with sustainability consideration.

¹According to Indian Port Associations, the given data was available when last referred the website on November 23, 2015.

Research Gap

It is observed that the relationship between the economic growth and volume of trade is always an important issue for research, since the new economic policies of the import and export liberalization era. Many of the studies conducted in this area so far do not discuss the issue of cause and effect relationship between the selected three explanatory variables (Agricultural GDP Growth, Industrial GDP Growth, Services GDP Growth) and the dependent variable (Cargo Traffic) in the Indian economic context.

Contribution of the Study

The study measures the growth of cargo traffic during the selected time period 1994-95 to 2014-15 and also finds out the impact of Economic Growth Indicators on Cargo Traffic handled by selected ports in India. For measuring the growth of cargo traffic, the study incorporates the time trend analysis of cargo traffic handled by selected twelve port's during the specified time period. Similarly, to measure the impact of economic growth on cargo traffic handled by selected ports in India, multiple regression analysis is considered for the study. The study considered three variables named 'Agricultural GDP Growth' (AGDPG), 'Industrial GDP Growth' (IGDPG) and 'Services GDP Growth' (SGDPG) as economic growth indicators.

Objectives of the Study

The study has very specific two objectives.

1. To find out the linear trend of economic growth indicators and cargo traffic handled by 12 selected major Indian sea ports during the selected time period.
2. To analyze the impact of economic growth on throughput (cargo traffic) of selected 12 major sea ports in India.

Research Methodology for the Study

Type of Study

The study is empirical in nature and the basic purpose is to examine the flow pattern of Agricultural GDP Growth, Industrial GDP Growth, Services GDP Growth and Cargo Traffic handled by selected 12 major ports in India. The unit of cargo traffic handled by selected ports is thousand metric tonnes ('000 Tonnes) and it includes both exports and imports.

Sample

The selected 12 major ports in India are Kolkata, Haldia, Paradip, Vishakapatnam (Vizac), Chennai, Tuticorin, Cochin, New Mangalore, Marmugaon, Mumbai, Jawaharlal Nehru Port Trust (JNPT) and Kandla. The unit of cargo traffic handled by selected ports is thousand metric tonnes (000 Tonnes) and it includes both exports and imports.

Period of Study

The selected time period for the study is from 1994-95 to 2014-15. The data have been collected from 'Major Ports of India - A Profile: 2013-2014', published by Indian Port Association, Operational Detail published by 'Indian Ports Association', 24th Anniversary special publication named 'Surging Ahead Towards Greater Heights' by Jawaharlal Nehru Port Trust;

'Administration report and annual accounts 2011-12, 2012-13, 2013-14, 2014-15', by Cochin Port Trust, 'Emerging Hub port of the Indian Sub Continent', by Port of Chennai, websites of Kolkata, Haldia, Paradip, Vishakapatnam (Vizac), Chennai, Tuticorin, Cochin, New Mangalore, Marmugaon, Mumbai, Jawaharlal Nehru Port Trust (JNPT) and Kandla Port, website of Shipping Corporation of India; and website of the World Bank.

Variables of study and their definitions

Variables for trend equation. The study has selected 'Agricultural GDP Growth' (AGDPG), 'Industrial GDP Growth' (IGDPG) and 'Services GDP Growth' (SGDPG) as economic growth indicators. The other variables are the cargo handled by each of the 12 ports, given by $CARGO_{(portname)}$.

Variable for multiple regression equation. $CARGO_{(Traffic12Ports)}$ The cargo traffic handled by all selected ports in thousands metric tonnes unit are the dependent variables. Agricultural GDP Growth, Industrial GDP Growth and Services GDP Growth are the explanatory variables.

Hypothesis

The impact of economic growth indicators on volume of cargo traffic handled by selected 12 major sea ports in India is positive and significant.

Research Models

Linear Trend Analysis. For measuring the flow pattern of economic indicators and cargo traffic handled by selected 12 major ports in India during the selected time period from 1994-95 to 2014-15, the study incorporates the Linear Time Trend Analysis as follows.

$$AGDPG = \gamma_1 + \delta_1 T \dots\dots\dots(1)$$

$$IGDPG = \gamma_2 + \delta_2 T \dots\dots\dots(2)$$

$$SGDPS = \gamma_3 + \delta_3 T \dots\dots\dots(3)$$

$$CARGO_{Kolkata} = \alpha_1 + \beta_1 T \dots\dots\dots(4)$$

$$CARGO_{Haldia} = \alpha_2 + \beta_2 T \dots\dots\dots(5)$$

$$CARGO_{Paradip} = \alpha_3 + \beta_3 T \dots\dots\dots(6)$$

$$CARGO_{Vizac} = \alpha_4 + \beta_4 T \dots\dots\dots(7)$$

$$CARGO_{Chennai} = \alpha_5 + \beta_5 T \dots\dots\dots(8)$$

$$CARGO_{Tuticorin} = \alpha_6 + \beta_6 T \dots\dots\dots(9)$$

$$CARGO_{Cochin} = \alpha_7 + \beta_7 T \dots\dots\dots(10)$$

$$CARGO_{Mangalore} = \alpha_8 + \beta_8 T \dots\dots\dots(11)$$

$$\text{CARGO}_{\text{Marmugaon}} = \alpha_9 + \beta_9 T \dots\dots\dots(12)$$

$$\text{CARGO}_{\text{Mumbai}} = \alpha_{10} + \beta_{10} T \dots\dots\dots(13)$$

$$\text{CARGO}_{\text{JNPT}} = \alpha_{11} + \beta_{11} T \dots\dots\dots(14)$$

$$\text{CARGO}_{\text{Kandla}} = \alpha_{12} + \beta_{12} T \dots\dots\dots(15)$$

Where,

AGDPG is the growth rate of agricultural gross domestic product in India and γ_1 & δ_1 represent the intercept and slope coefficients of the trend equation respectively. Here, T_1 is the time variable in years.

$\text{CARGO}_{\text{Kolkata}}$ represents the cargo traffic handled by Kolkata port in thousand metric tonnage volume, α_1 represents the intercept value of the trend equation, which means the initial volume of cargo traffic handled by the Kolkata port, β_1 represents the slope coefficient of the trend equation, which indicates the magnitude of growth of cargo traffic over the selected time period and T is the time variable in years.

Similarly, the other equations are defined and considered for the study.

Multiple Regression Analysis:

$$\text{CARGO}_{\text{Traffic12Ports}} = \alpha + \beta_1 \text{AGDPG} + \beta_2 \text{IGDPG} + \beta_3 \text{SGDPG} \dots\dots\dots(16)$$

Here, $\text{CARGO}_{\text{Traffic12Ports}}$ is the cargo traffic handled by all selected ports in thousands metric tonnes unit is the dependent variables. Agricultural GDP Growth, Industrial GDP Growth and Services GDP Growth are the explanatory variables.

Where,

α , β_1 , β_2 and β_3 are the intercept and slope coefficients of the regression equation respectively.

Statistical Tools Used

Linear Time Trend Analysis and Multiple Regression Analysis were carried out using the statistical package SPSS and EVIEWS.

Data Analysis and Results Discussions

Results of Time-trend Analysis

The trend means a sustained upward or downward movement of the dependent variables. If the slope coefficient of the trend equation is positive then there is an upward trend in the dependent variable and in case of negative slope coefficient, there is a downward trend of the dependent variable. The time (T) is an independent variable. Agricultural GDP Growth, Industrial GDP Growth, and Services GDP Growth and Cargo Traffic handled by each selected port in thousand metric tonnage volumes ($\text{CARGO}_{\text{portname}}$) during the specified time period (1994-95 to

2014-15) are explanatory variables.

- AGDPG = 0.62 + 0.53 T(1)
(SE = 0.301; t statistic = 1.76; p value = 0.07; level of significance 5 %)
- IGDPG = 0.81 + 0.64 T(2)
(SE = 0.242; t statistic = 2.65; p value = 0.00; level of significance 1 %)
- SGDPG = 0.55 + 0.78 T(3)
(SE = 0.432; t statistic = 1.81; p value = 0.060; level of significance 10 %)
- CARGO_{Kolkata} = 0.49 + 0.48 T(4)
(SE = 0.084; t statistic = 5.71; p value = 0.000; level of significance 1 %)
- CARGO_{Haldia} = 0.62 + 0.53 T(5)
(SE = 0.095; t statistic = 5.58; p value = 0.000; level of significance 1 %)
- CARGO_{Paradip} = 0.82 + 0.59 T(6)
(SE = 0.152; t statistic = 3.88; p value = 0.000; level of significance 1 %)
- CARGO_{Vizac} = 0.93 + 0.74 T(7)
(SE = 0.123; t statistic = 6.02; p value = 0.000; level of significance 1 %)
- CARGO_{Chennai} = 1.03 + 0.98 T(8)
(SE = 0.235; t statistic = 4.17; p value = 0.000; level of significance 1 %)
- CARGO_{Tuticorin} = 0.54 + 0.89 T(9)
(SE = 0.494; t statistic = 1.80; p value = 0.060; level of significance 10 %)
- CARGO_{Cochin} = 0.71 + 0.83 T(10)
(SE = 0.407; t statistic = 2.04; p value = 0.001; level of significance 5 %)
- CARGO_{Mangalore} = 0.42 + 0.71 T(11)
(SE = 0.455; t statistic = 1.56; p value = 0.099; level of significance 10 %)
- CARGO_{Marmugaon} = 0.34 + 0.49 T(12)
(SE = 0.254; t statistic = 1.93; p value = 0.034; level of significance 5 %)
- CARGO_{Mumbai} = 0.82 + 0.51 T(13)
(SE = 0.327; t statistic = 1.56; p value = 0.097; level of significance 10 %)
- CARGO_{JNPT} = 1.26 + 0.98 T(14)
(SE = 0.045; t statistic = 21.78; p value = 0.000; level of significance 1 %)
- CARGO_{Kandla} = 0.62 + 0.54 T(15)
(SE = 0.287; t statistic = 1.88; p value = 0.036; level of significance 5 %)

According to the estimated values of slope coefficients (all are positive), it is found that Agricultural GDP Growth, Industrial GDP Growth, Services GDP Growth and Cargo Traffic handled by each selected port in thousand metric tonnage volume ($CARGO_{portname}$) have increased over time. Most of the estimated coefficients are significant at 1 % level (two tailed test), but coefficients of Marmugaon, Kandla and Cochin ports are significant at 5 % level (two tailed test), and for Agricultural GDP Growth, Services GDP Growth, Tuticorin, Mangalore and Mumbai ports coefficients are significant at 10 % level (two tailed test). The result shows the resemblance with the study carried out by De Langen (2004).

Results of Multiple Regression Analysis

The estimated multiple regression equation is as follows.

$$CARGO_{Traffic12Ports} = 1.26 + 0.45 AGDPG + 0.42 IGDPG + 0.51 SGDPG.....(16)$$

Table 1: Multiple Regression Analysis

Dependent Variable: $CARGO_{Traffic12Ports}$				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.2612	0.2320	5.4362	0.0000
AGDPG	0.4521	0.2873	1.5736	0.0765
IGDPG	0.4268	0.1546	2.7606	0.0021
SGDPG	0.5125	0.2314	2.2148	0.0012
R-squared	0.5303	Mean dependent var		5.1233
Adjusted R-squared	0.5123	S.D. dependent var		2.2763
S.E. of regression	24.2431	Sum squared resid		0.0025
Log likelihood	244.4662	F-statistic		6.9951
Durbin-Watson stat	2.0212	Prob(F-statistic)		0.000000

Table 1 shows the estimated coefficients of explanatory variables of Services GDP Growth (SGDPG) and Industrial GDP Growth (IGDPG) are individually highly significant, as its t-statistics is very high and corresponding p value is very small [significant at 5 % level (two tail test)]. The sign of the coefficient is positive, which indicates the supporting and constructive role of ‘Services GDP Growth’ to the growth of Cargo Traffic handled by the selected 12 ports in thousand metric tonnage volumes ($CARGO_{portname}$). The coefficient of explanatory variable Agricultural GDP Growth (AGDPG) is also positive, but significant at 10 % level (two tail test). The value of R-squared is 0.53, which means that the explanatory variables are able to explain the dependent variable by about 53 %. The Durbin-Watson Statistic is 2.02, which indicates that there is no autocorrelation in the data set. The result shows the concurrence with many of the studies conducted worldwide in this area which show strong positive correlation between economic growth and international trade.

Conclusion

The study is conducted for investigating the impact of economic growth on throughput of selected 12 major sea ports in India. The volume of cargo traffic handled by the selected 12 major sea ports in India is considered as infrastructural development indicator. Agricultural

GDP Growth, Industrial GDP Growth, and Services GDP Growth are considered as economic indicators. The analysis is based on multiple regression technique to measure the impact of economic growth on infrastructural development in India. The value of R-squared reveals that 53 % of the dependent variable i.e., Cargo Traffic handled by the selected 12 ports in thousand metric tonnage volume (CARGO_{portname}) is explained by the explanatory variables i.e., Agricultural GDP Growth, Industrial GDP Growth, and Services GDP Growth in India. It has been found from the results of linear time-trend analysis that all the variables incorporated in this study have increased over time. Therefore, the empirical result of the study rejects the null hypothesis i.e., there is no significant relation between economic growth indicators and volume cargo traffic handled by selected 12 major sea ports and accepts the alternative hypothesis i.e., there is significant relation between economic growth indicators and volume cargo traffic handled by selected 12 major sea ports.

Limitations of the Study

The study incorporated only uni-directional relationship between selected variables.

Scope for Further Research

As a future scope of research, it can be tested for bi-directional relationships also. The scope for further research also remains on the investigation of the specific strategy followed, if any, by the Government of India for developing infrastructure of India's major ports as a means of boosting India's economic growth.

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