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Causality between Oil Exports and GDP in India

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ABSTRACT

This study empirically estimates the critical parameters of oil export impact on economic growth in India for the study period. The PP unit root test, Johansen co-integration test, Granger causality tests were used in this study. The Johansen co-integration test showed all the variables are co-integrated. The results showed the presence of co-integration between Oil Exports and GDP implying the presence of the even short-run and long-run relationship between them. And suggest a one-way causation from GDP to Oil Exports in India. It does not support the notion of bi-directional causation.

Key Words : Oil exports, Imports, Trade, Gross domestic product, Foreign exchange

INTRODUCTION

Economic growth is one of the most important determinants of economic welfare. The relationship between exports and economic growth is a frequent topic of discussion, when economists try to explain the different levels of economic growth between countries. Exports of goods and services represent one of the most important sources of foreign exchange income that ease the pressure on the balance of payments and create employment opportunities. The argument concerning the role of exports as one of the main deterministic factors of economic growth is not new. It goes back to the classical economic theories by Adam Smith and David Ricardo, who argued that international trade plays an important role in economic growth. The neoclassical approach emphasizes the importance of competitive advantages in international trade. Each country maximizes its welfare through the activities which are the most efficient regarding resource and production factors scarcity in of economy. In this case, the benefits of the trade are static and trade liberation and openness can't lead to increase in long run growth rate, but it influences income level. Over the past years, an increasingly larger role granted to exports in rising domestic demand, the growth of exports increases technological innovation covers the domestic and foreign demand and also increases the inflows of foreign exchange, which could lead to greater capacity utilization and economic growth.

Earlier Studies:

Ruba Abu Shihab, Thikraiat Soufan and Shatha Abdul-Khaliq, this study aims to examine the causal relationship between economic growth and exports in Jordan using the Granger methodology in order to determine the direction of the relationship between the two variables during the period 2000-2012. The study found that there is a causal relationship going from the economic growth to Export, and not *vice versa*. Based on the outcome of causality tests, the changes in the economic growth help explain the changes that occur in the Export.

Kolawole Olayiwola and Henry Okodua, The study examines the contribution of Foreign Direct Investment to the performance of non-oil exports in Nigeria within the framework of the export-led growth hypothesis. The

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results obtained from the causality analysis revealed that a unidirectional causality runs from FDI to non-oil exports. Each of the three variables exhibited on the average and at the early stages of the out-of-sample forecast period, a dormant response to one standard deviation shock or innovation. However, they all demonstrated significant responses after some 7 years into the out-of-sample forecast period. The results also show that an encouragement of non-oil exports is a necessity for an effective FDI in Nigeria. Therefore, in designing policies towards this direction, policy response lag need to be taken into consideration.

Aremu Idowu Raheem, this study investigated the role of oil and non-oil exports on the Nigerian economy over the period of 1981 to 2015. The ADF and PP unit root test, Johansen co-integration test, Granger causality test, impulse response functions and variance decomposition were used in the analysis of the study. The co-integration test indicates that GDP, Oil and Non-oil exports were co-integrated. The Granger causality test indicates short run unidirectional causality running from oil export to GDP. There are also bidirectional long run causality relationship between oil export and GDP, and unidirectional long run causality running from non-oil export to GDP. The study result indicates that oil exports have inverse relationship with economic growth while non-oil exports have positive relationship with economic growth.

METHODOLOGY

The study is based on secondary data only. The secondary data have been collected from Hand Book of Statistics on Indian Economy and Published by RBI.

Tools for analysis:

The secondary data is expressively analyzed by using econometrical tools such as Granger Causality Test. Three methods are Unit Root Test, Johansen's Co-integration Test and Pairwise Granger Causality Test. Analysis has been done by using E-views software.

Period of the study:

The period of the study taken up for the analysis was a period of 41 years, from the year 1977-78 to that of the year 2017-18.

Hypotheses:

1. H_0: There is no bidirectional causality between Oil exports and GDP in India.

2. H_o: There is no unidirectional causality between Oil exports and GDP in India.

Mathematical Background :

Test for Stationarity:

Unit Root Test:

Time series analysis is about the identification, estimation and diagnostic checking of stationary time series.

Definition: The sequence y_t is said to be covariance stationary if for all t and t - s

$E(y_t) = E(y_s) = \mu$

$E(y_t - \mu)^2 = E(y_{t-s} - \mu)^2 = \sigma$

$E(y_t - \mu)(y_{t-s} - \mu) = E(y_{t-j} - \mu)(y_{t-j-s} - \mu) = \Upsilon^2$

The Augmented Dickey-Fuller Test and Phillips-Perron Test for Unit Roots:

Dickey and Fuller (1979, 1981) devised a procedure to formally test for the presence of a unit root. The Augmented Dickey-Fuller test and PP test simply includes AR (p) terms of the Xt term in the three alternative models.

Therefore we have:

$$\Delta X_t = \gamma Y_{t-1} + \sum_{I=1}^{P} \beta_1 \Delta X_{t-1} + \varepsilon_t$$

Co-integration Tests:

Johansen Test:

This test permits more than one co-integrating relationship so is more generally applicable than the Engle Granger test which is based on the Dickey Fuller (or the augmented) test for unit roots in the residuals from a single co-integrating relationship. In fact, Johansens procedure is nothing more than a multivariate generalisation of the Dickey-Fuller test. Consequently, he proposes two different likelihood ratio tests namely

- The trace test
- Maximum eigenvalue test

Johansen's method takes as a starting point the vector auto regression (VAR) of order p given by

$X_t = \Pi_1 X_{t-1} + \Pi_2 X_{t-1} + u_t$

where Xt is an n * 1 vector of variables that are integrated of order one. u_t is an n * 1 vector of innovations while Π_1 through Πp are m*n coefficient matrices.

Trace test:

The trace test tests the null hypothesis of r co-

integrating vectors against the alternative hypothesis of n co-integrating vectors. The test statistic is given by

$$\tau_{trace} = -T\sum_{i=r+1}^{k}\ln(1-\lambda_i)$$

Maximum eigenvalue test:

The maximum eigenvalue test, on the other hand, tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of (r + 1) co-integrating vectors. Its test statistic is given by

$$\tau_{trace} = -T(1-\lambda r)+1$$

where T is the sample size, and λ_i is the i^{th} largest canonical correlation.

Granger Causality Test:

Granger pointed out that if a pair of time series is co-integrated, and then there must be causation in at least one direction. According to the Granger causality (Granger, 1969) approach a variable Y is caused by X, if Y can be predicted better from past values of Y and X, than from past values of Y alone. Moreover X 'Granger causes' Y if past values of X can help explain Y. If Granger causality holds this does not guarantee that X causes Y. But, it suggests that X might be causing Y. Four patterns of causality can be distinguished:

- unidirectional causality from X to Y;
- unidirectional causality from Y to X;
- feedback or bi-directional causality; and
- no causality.

For a simple bivariate model, the pattern of causality can be identified by estimating regression of Y and X on all the relevant variables including the current and past values of X and Y respectively and by testing the appropriate hypothesis. The causal relations between stationary series xt and yt can be established based on the following equations:

$$\Delta X_t = \alpha_0 + \lambda_1 EC^{1}_{t-1} + \sum_{i-1}^{m}\alpha_i \Delta X_{t-i} + \sum_{j=1}^{n}\alpha_j \Delta Y_{t-j} + \varepsilon_{1t}$$

$$\Delta Y_t = \beta_0 + \lambda_2 EC^{2}_{t-1} + \sum_{i-1}^{m}\beta_i \Delta Y_{t-i} + \sum_{j=1}^{n}\beta_j \Delta X_{t-j} + \varepsilon_{2t}$$

where Δ is the first difference operator; EC_{t-1} is the error correction term lagged one period; l is the short-run coefficient of the error correction term ($-1 < \lambda < 0$); and is the white noise. The error correction coefficient (λ) is very vital in this error correction estimation as the greater coefficient indicates higher speed of adjustment of the model from the short-run to the long-run. Sometimes we check for Granger causality simply (albeit imperfectly) using only t-tests. The P-values for the t-states on individual coefficients can be used to determine whether Granger causality is present.

RESULTS AND DISCUSSION

The results are presented in Table 1, to empirically analyse the Oil Exports and GDP in India, the present study primarily tested the stationarity of the selected time series data for which univariate Dickey-Fuller Generalized Least Squares (DF-GLS), Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests have been conducted. The unit root tests results reveals that the oil exports and Economic Growth series are found to be stationary at first order level and integrated at the order of I(1).

Table 2 and 3, this paper considers trace statistics as to interpret the co-integration results for further

Table 1 : Unit Root Test

Oil Exports	t-Statistic	Prob.*	GDP	t-Statistic	Prob.*
PP test statistic	-15.2717	0.000	PP test statistic	-7.5807	0.000
Critical values: 1% level	-3.6155		Critical values: 1% level	-3.6155	
5% level	-2.9411		5% level	-2.9411	
10% level	-2.6090		10% level	-2.6090	

Source: Author's own calculation.

Table 2 : Unrestricted Co-integration Rank Test (Trace)

Co-integration Equation	Eigen value	Trace statistics	5% CV	Prob.**
None*	0.3952	22.9373	15.4947	0.0032
At Most 1	0.0817	3.3240	3.8414	0.0683

Trace test indicates one co-integrating equations at the 0.05 level.
*Denotes rejection of the hypothesis at the 0.05 level.
**Mackinnon – Haug – Michelis (1999) p – values.

Table 3 : Unrestricted Co-integration Rank Test (Maximum Eigen)

Co-integration Equation	Eigen value	Max-Eigen statistics	5% CV	Prob. **
None*	0.3952	19.6132	14.2646	0.0065
At Most 1	0.0817	3.3240	3.8414	0.0683

Source: Author's own calculation.
Max-Eigen value test indicates one co-integrating equations at the 0.05 level.
*denotes rejection of the hypothesis at the 0.05 level.
**Mackinnon – Haug – Michelis (1999) p – values.

Table 4 : Granger Causality Test

Null Hypothesis	F Statistic	Probability	Decision
GDP does not Granger Cause of OIL EXPORTS	7.9560	0.0015	Rejected
OIL EXPORTS does not Granger Cause of GDP	0.1981	0.8212	Accepted

Source: Author's own calculation.

granger causality tests. Based on the Johansen co-integration results, we cannot reject the null of a single co-integrating vector using both Trace and Maximum Eigen value tests at the 5 per cent level of significance.

Table 4 indicate that the GDP does not granger cause of Oil Exports is rejected Null Hypothesis at 5 per cent level. Based on this causality test, changes GDP cause changes in Oil Exports in short-run and long-run.

Conclusion:

This study empirically estimates the critical parameters of oil export impact on economic growth in India for the study period. The PP unit root test, Johansen co-integration test, Granger causality tests were used in this study. The Johansen co-integration test showed all the variables are co-integrated. The results showed the presence of co-integration between Oil Exports and GDP implying the presence of the even short-run and long-run relationship between them. And suggest a one-way causation from GDP to Oil Exports in India. It does not support the notion of bi-directional causation.

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