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Export-Led Growth in India: Cointegration and Causality Analysis

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Abstract

The extensive research testing export led growth hypothesis in India have been mixed and inconclusive. Difference in time periods, variable definitions and techniques are three possible reasons for this. This paper explores the causal relationship between exports and economic growth by employing Johansen co-integration and Granger causality approach. Annual time series data on India for the variables exports and GDP per capita stemming from 1980 to 2012 have been used in analysis. The tests on the long run and short run relationship between exports and economic growth are conducted. Based on the findings of cointegration approach this paper concludes that there does not exist long run equilibrium relationship between exports and GDP per capita. Granger causality test exhibits bidirectional causality running from exports to GDP per capita and GDP per capita to exports.

Keywords: Export, Economic Growth, Johansen co-integration, Granger causality

JEL classification: F43, C22

1. Introduction

The link between exports and economic growth has been closely studied by economists, largely because of the results achieved by export-led growth in some countries.

The theoretical basis for achieving growth through the development of export industries is that competition on international scale requires efficiency, innovation and investment, all of which may encourage economic growth within a country.

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The development of export markets can lead to economies of scale as industries expand and develop their markets overseas in response to foreign demand. Industries may promote world-class skills in product design, research and development and marketing, which increase their export capacity and promote economic development in their own country. The promotion of international trade leads to free trade policies that promote exports from the country and attract direct foreign investment into local industries (Hann, 2014).

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. An export-led growth strategy aims to provide producers with incentives to export their goods through various economic and governmental policies. It also aims to increase the capability of producing goods and services that are able to compete in world market, to use advanced technology, and to provide foreign exchange needed to finance imports. Exports can increase intra industry trade, help the country to integrate in the world economy and reduce the impact of external shocks on the domestic economy. Experiences of Asian and Latin American economies provide good examples of the importance of the export sector to economic growth and development, which led economists to stress the dynamic role of exports as the engine of economic growth (Abou-Stait, 2005).

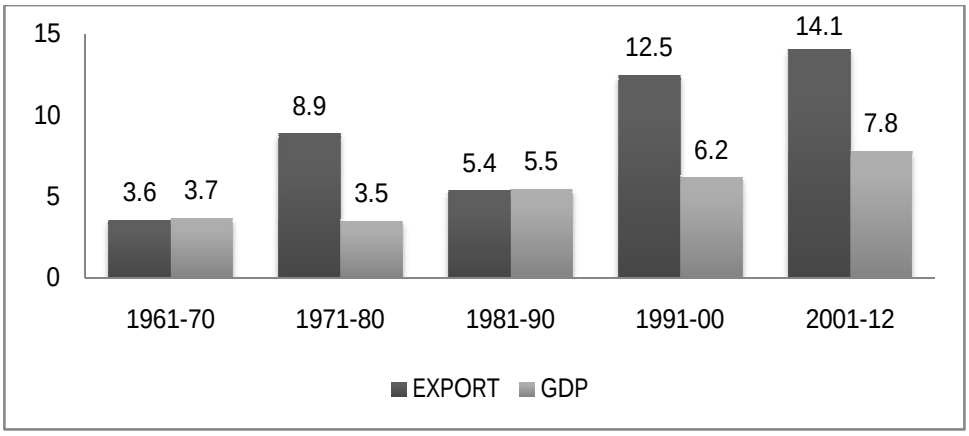
The role of exports in economic performance of developing countries like India has become one of the more popularly researched topics during post liberalization period. Exports can help the country to integrate in the world economy and help to reduce the impact of external shocks on the domestic economy. Exports allow domestic production to achieve a high level of economies of scale (Ray, 2011). Exports growth also stimulate competition, acquisition of new knowledge and ideas, dissemination of technical knowledge and increased specialization leading to more efficient methods of production. By the end of 1970's India had acquired a reputation as one of the most protected and heavily regulated economies in the world. Starting in the mid-1970s and then later on in the 1980s, a few tentative steps were taken to liberalize the regulatory regime. More extensive reforms followed in 1991. Since then, there has been further policy changes in diverse sectors all aimed at opening up the economy to greater private sector entrepreneurship as well as to foreign trade and investment (Kotwal, Ramaswami and Wadhwa, 2011).

In 1991, the government introduced major changes in its policy on trade, foreign investment, tariffs and taxes under the name of 'New Economic Reforms'.

The main focus of these reforms has been on liberalization, openness and export promotion activity (Kaur,2012). Focusing on trade liberalization in particular, a considerable increase in exports took place with tariff reduction and removal of other barriers. Prior to the reforms all imports were either submitted to licensing or prohibited altogether (Khan, 2005). It was realized that the import substituting inward looking development policy was no longer suitable in the modern globalizing world. Before the reforms, trade policy was characterized by high tariffs and extensive import restrictions. Imports of manufactured consumer goods were completely banned. For capital goods, raw materials and intermediates, certain lists of goods were freely importable, but for most items where domestic substitutes were produced, imports were only possible with import licenses. The criterion for issue of licenses was non-transparent, delays were endemic and corruption was unavoidable. The economic reforms sought to phase out import licensing and also to reduce import duties (www.indianbusiness.nic.in).

Since 1991 India transformed itself from one of the most closed large economies of world to relatively more open one Figure 1.1 represents the performance of export and GDP growth during different periods at constant prices with the base year 2005. In the1961-70 period, the compound growth rate of export was 3.6 percent and increased to 12.5 in the 1991-2000, period of economic reforms. During 2001-12, the compound growth of exports was 14.1 percent. The compound annual growth rate of GDP increased from 3.7 to 7.8 percent over the period 1961-70 to 2001-12. Thus liberalization policies gave boost to GDP growth as well as exports growth.

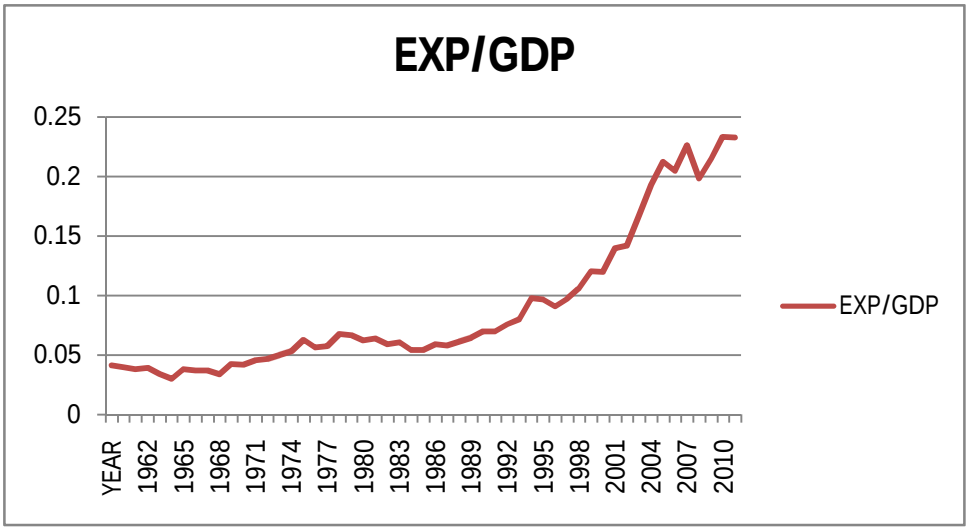
Figure:1.1 Compound Annual Growth Rate of Exports and GDP in India



Sources: Calculations based on data from World Development Indicators, World Bank.

The Export- GDP ratio during 1960-2012 has been presented in Figure 1.2. It shows that after 1991 economic reforms, trade openness has increased significantly.

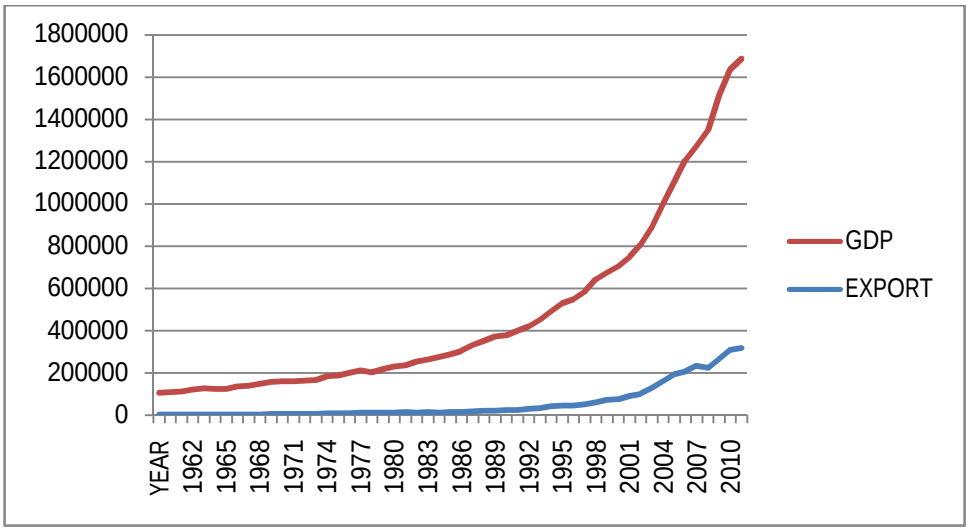
Figure: 1.2 Export-GDP Ratios during 1960-2012



Sources: Calculations based on data from World Development Indicators, World Bank

The volume of exports and GDP has been shown in Figure 1.3. It is clearly visible that new economic policies have positively contributed to the growth of exports as well as GDP.

Figure: 1.3 Volume of Export & GDP during 1960-2012 (Constant US Million dollars)



Sources: World Development Indicators, World Bank.

Objectives of the Study

The main objective of the study is to examine causal relationship between exports and GDP for Indian economy. Johansen cointegration technique along with Granger Causality is used to test the long run and short run relationship.

The present paper has been discussed in 4 sections. In section 2 review of literature has been presented. Section 3 deals with database and research methodology. Major findings emerging from the study are presented in section 4.

2. Review of Literature

A number of studies including Bhat (1995), Ghatak and Price (1997), Dhawan and Biswal (1999), Nataraj.Sahoo and Kamaiah (2001), Chandra (2003), Sharma and Panagiotidis (2004), Padhan (2004), Pandey (2006), Pradhan (2010), Mishra (2011), Ray (2011), Kaur and Sidhu (2012) and Devi (2013) had adopted time series analysis for exploring the causal relationship between exports growth and output growth. The first group of studies concluded in the support of the export-led growth (ELG) hypothesis. The studies used the Engle-Granger (1987) approach to cointegration and error correction modeling for the study of causality. Bhat (1995) and Chandra (2003) employed cointegration technique to find the relationship between exports growth and output growth. Both studies found positive relationship. On the other hand, Padhan (2004), Pandey (2006), Ray (2011) and Devi (2013) used bivariate framework to investigate the relationship between export growth and economic growth. These studies also supported ELG hypothesis. However, Pradhan (2010); Kaur and Sidhu (2012) used multivariate framework to examine relationship and supported ELG hypothesis.

The second group of studies which does not support ELG hypothesis includes Ghatak and Price (1997), Dhawan and Biswal (1999), Nataraj, Sahoo and Kamaiah (2001), Sharma and Panagiotidies (2003) and Mishra (2011). Difference in time periods, variable definitions and technique are three possible reasons for this. Except Mishra (2011) all the other studies in this group used multivariate framework to examine the relationship between exports growth and output growth but failed to find that exports growth causes GDP growth. A brief review of economic literature on ELG in India is given in Table 2.1

Table:2.1 A Brief Framework of the Related Economic Literature on ELG in India

Author	Period of st	Variables	Econometric techniqu	Conclusions
Bhat(1995)	1950-51 to 1	Export &GDP	Cointegration	ELG
Ghatak& Price (1997)	1960-92	Export, import,GDP, human & capital	Cointegration&ECM	Reject ELG
Dhawan&Biswal (1999)	1961-93	Real GDP, real export &TOT	Johansen's procedure & VAR	Reject ELG
Nataraj, Sahoo& Kamaiah (2001)	1965-66 to 1	Export, import, GDP& capital formation	VAR & FEVD	Reject ELG
Chandra(2003)	1950-96	Real export, real income &TOT	Cointegration	ELG
Sharma &Panagiotidi	1971-2001	GDP, GDP net of exports, real exports, real imports, investment, population, employment	Cointegration, causality, VAR, IRF	Reject ELG
Padhan (2004)	1950-51 to 2000-01	Export &GDP	Cointegration&ECM	ELG
Pandey (2006)	1950-51 to 2001-02	GDP& export	Causality &ECM	ELG
Pradhan (2010)	1970-71 to 2009-10	Export, real GDP, world GDP, REER, capital formation	Granger causality &VAR	ELG
Mishra (2011)	1970-2009	Export &GDP	Johansen's procedure & VECM	Reject ELG
Ray (2011)	1972-73 to 2010-11	Export &GDP	Cointegration, granger causality &ECM	ELG
Kaur & Sidhu (2011-12)	1996-97 to 2008-09	Real GDP, real export, trade openness	Cointegration, vecm	ELG
Devi (2013)	1990-91 to 2011-12	Real GDP, total exports	Cointegration, granger causality	ELG

3. Database and Research Methodology

Database

The present study is based on secondary data. The data for exports of goods & services and GDP per capita in US dollars at the constant prices for the base year 2005 have been taken from World Development Indicators for the period 1980-2012. Furthermore, all of the series are transformed into log form.

Log transformation can reduce the problem of heteroscedasticity because it compresses the scale in which the variables are measured, thereby reducing a tenfold difference between two values to a twofold difference (Gujarati 1995). The following time series are analyzed in this study:

1. LNEXP = Log of Exports of Goods and Services
2. LNGDPPC = Log of Gross Domestic Product Per Capita

The prefix 'LN' stands for the natural logarithm of the concerned time series and 'D' denotes differencing of the relevant time series. All econometric estimations in this paper have been carried out using E views.

Methodology

3.1 Unit Root Test

Before testing for Johansen cointegration and Granger causality, econometric methodology needs to examine the stationarity for each individual time series. The present study uses Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests to examine the stationarity of the data series. Augmented Dickey-Fuller test consists of running a regression of the first difference of the series against the series lagged once, lagged difference terms and optionally, a constant and a time trend. The additional lagged terms are included to ensure that the errors are uncorrelated. This can be expressed as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \alpha_2 Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \varepsilon_t \qquad (1)$$

Where ε_t is a pure white noise error term and ΔY_{t-1}= (Y_{t-1}- Y_{t-2}), ΔY_{t-2}=(Y_{t-2}- Y_{t-3}) etc. The ADF test adjusts the DF test to take care of possible serial correlation in the error terms of adding the lagged difference terms of the regressand. Phillips and Perron use nonparametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms. Since the asymptotic distribution of the PP test is the same as the ADF test statistic (Gujarati and Sangeetha, 2010).

Table: 3.1 (a) Results of Augmented Dickey-Fuller test for Variables

LNEXP	Test Statistics	1% critical	5% critical	10% critical	p-value	Result
At level	-2.832663	-4.273277	-3.557759	-3.212361	0.1967	Do not Reject
At first difference	-5.273641*	-4.284580	-3.562882	-3.215267	0.0009	Reject Null Hypothesis
LNGDPPC	Test Statistics	1% critical	5% critical	10% critical	p-value	Result
At level	-0.697593	-4.273277	-3.557759	-3.212361	0.9647	Do not Reject
At first difference	-5.318608*	-4.284580	-3.562882	-3.215267	0.0008	Reject Null Hypothesis

Note: * and ** denote statistical significance at 1 per cent and 5 per cent levels of significance respectively.

Table: 3.1(b)Results of Phillips-Perron test for Variables

LNEXP	Test Statistics	1% critical	5% critical	10% critical	p-value	Result
At level	-2.832663	-4.273277	-3.557759	-3.212361	0.1967	Do not Reject
At first difference	-5.273641*	-4.284580	-3.562882	-3.215267	0.0009	Reject Null Hypothesis
LNGDPPC	Test Statistics	1% critical	5% critical	10% critical	p-value	Result
At level	-0.697593	-4.273277	-3.557759	-3.212361	0.9647	Do not Reject
At first difference	-5.318608*	-4.284580	-3.562882	-3.215267	0.0008	Reject Null Hypothesis

Note: * and ** denote statistical significance at 1 per cent and 5 per cent levels of significance respectively.

Having concluded from the ADF and PP results, each time series is non-stationary at level, but the series have been found to be stationary at first difference i.e. integrated of order one I(1). So, we proceed to the second step, which requires that the two time series be co-integrated.

3.2 Cointegration Test

Cointegration means that despite being individually non stationary, a linear combination of two or more time series can be stationary. Cointegration of two or more time series suggests that there is a long run or equilibrium relationship between them (Gujarati & Sangeetha, 2010).

The Johansen approach to cointegration test is based on two test statistics, viz., the trace test statistic, and the maximum eigen value test statistic.

3.2.1 Trace Test Statistic

The trace test statistic can be specified as: $\tau_{trace} = -T\sum_{i=r+1}^{k} \log(1-\lambda_i)$, where λ_i is the i^{th} largest eigen value of matrix Π and T is the number of observations. In the trace test, the null hypothesis is that the number of distinct cointegrating vector(s) is less than or equal to the number of cointegration relations (*r*).

3.2.2 Maximum Eigenvalue Test

The maximum eigenvalue test examines the null hypothesis of exactly *r* cointegrating relations against the alternative of *r* + 1 cointegrating relations with the test statistic:

$\tau_{max} = -T\log(1-\lambda_{r+1})$, where λ_{r+1} is the $(r+1)^{th}$ largest squared eigen value. In the trace test, the null hypothesis of *r*=0 is tested against the alternative of *r*+1 cointegrating vectors (Mishra, 2011).

The trace test and maximum eigen value tests were employed to establish the number of cointegrating vectors, and the results are presented in table 3.2 for the series LNGDPPC (log of GDP per capita) and LNEXP (log of exports).

Table:3.2 Johansen Co-integration Test Statistics

Series: LNGDPPC LNEXP
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.392506	23.12148	25.87211	0.1059
At most 1	0.219204	7.670673	12.51798	0.2798

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No.of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.392506	15.45080	19.38704	0.1704
At most 1	0.219204	7.670673	12.51798	0.2798

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.392506	15.4508	19.38704	0.1704
At most 1	0.219204	7.670673	12.51798	0.2798

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The results show that Trace statistic value is below than 5% critical value, hence it does not reject null hypothesis of no cointegration. Similarly, Max-Eigen statistic value is also below than 5% critical value, which does not reject null hypothesis of no cointegration. The results thus suggest that there does not exist long-run stable relationship between GDPPC and exports.

3.3 The Granger Causality test

Causality is a kind of statistical feedback concept which is widely used in the building of forecasting models. Historically, Granger (1969) and Sim (1972) were the ones who formalized the application of causality in economics. Granger causality test is a technique for determining whether one time series is significant in forecasting another (Granger, 1969). The standard Granger causality test (Granger, 1988) seeks to determine whether past values of a variable helps to predict changes in another variable. The definition states that in the conditional distribution, lagged values of Y_t add no information to explanation of movements of X_t beyond that provided by lagged values of X_t itself (Green, 2003).

The basic idea is that variable *X* Granger causes *Y* if past values of *X* can help in explaining *Y*. Of course, if Granger causality holds this does not guarantee that *X* causes *Y*.

This is why we say "Granger causality" rather than just "causality". Nevertheless, if past values of *X* have explanatory power for current values of *Y*, it at least suggests that *X* might be causing *Y*. Granger causality is only relevant with time series variables. Suppose the variables *X* and *Y* are stationary then the model holds:

$$Y_{t=} \alpha + \varphi Y_{t-1} + \beta_1 + X_{t-1} + e_t$$

This model implies that last period's value of *X* has explanatory power for the current value of *Y*. The coefficient β_1 is a measure of the influence of X_{t-1}on Y_t. If β_1 = 0, then past values of *X* have no effect on *Y* and there is no way that *X* could Granger cause *Y*. In other words, if β_1= 0 then *X* does not Granger cause *Y*. An alternative way of expressing this concept is to say that "if β_1 = 0 then past values of *X* have no explanatory power for *Y* beyond that provided by past values of *Y*". OLS estimation of the above regression can be conducted and the P-value for the coefficient on X_{t-1} can be examined for significance. If β_1 is statistically significant (e.g. P-value <0.05) then we conclude that *X* Granger causes *Y* (Koop, 2006). The null hypotheses of the Granger-Causality test are:

H_0: X ≠ Y (X does not granger cause Y)
H_1: X ≠Y (X does Granger-cause Y)

Table:3.3 Result for Pair-wise Granger Causality Test

Pair wise Granger Causality Tests
Date: 05/14/14 Time: 10:47
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D(LNEXP) does not Granger Cause D(LNGDPPC)	31	4.58705	0.0411
D(LNGDPPC) does not Granger Cause D(LNEXP)		5.99817	0.0208

Results of Pair-wise Granger Causality Test are presented in table 3.3. The results imply that Exports Granger cause GDP per capita while GDP per capita also Granger cause Exports. Hence, results show that causality is bidirectional (causality runs in both directions).

4. Conclusions

There is still a debate among economists regarding the validity of the export-led growth strategy in case of India. The present paper examines the relationship between exports and GDPPC in India using time series data stemming from 1980 to 2012. Various econometric methodologies have been applied in order to investigate the short and long run causality relationship between export and growth.

For India, the study finds no evidence of export-led growth hypothesis, particularly for the long run. The cointegration test does not confirm the existence of long run equilibrium relationship between exports and GDP per capita. The Granger Causality test gives evidence that there exists bidirectional causality running from exports to GDP per capita and GDP per capita to exports. Thus the results of Granger Causality test support ELG hypothesis in case of India and policy reforms adopted seem to have affected the GDP and exports growth positively.

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