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A Causality Analysis on the Empirical Nexus between Export and Economic Growth: Evidence from India

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Abstract

The paper tries to assess empirically the relationship between export and economic growth in India using annual data over the period 1972-73 to 2010-11. Time-series econometric techniques (Granger causality and cointegration) are applied to test the hypothesis of economic growth strategy led by exports. The paper is based on the following hypotheses for testing the causality and co-integration between GDP and export in India as to whether there is bi-directional causality between GDP growth and export, or whether there is unidirectional causality between the two variables or whether there is no causality between GDP and export in India or whether there exists a long run relationship between GDP and Export India. The cointegration test confirmed that economic growth and exports are co integrated, indicating an existence of long run equilibrium relationship between the two as confirmed by the Johansen cointegration test results. The Granger causality test finally confirmed the presence of bi-directional causality which runs from economic growth to export and vice-versa. The error correction estimates gave evidence that in short run also, export and GDP are mutually causal.

Keywords: Exports, economic growth, India, causality, cointegration, error correction model.

1. Introduction:

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 are the most significant source of foreign exchange, which can be used to ease pressure on the balance of payments and generate much-needed job opportunities. 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. The major momentum for most studies on this relationship is the export-led growth hypothesis which fascinatingly represents a leading explanation in this context. The issue of how a country can achieve economic growth is one of the fundamental economic questions. An export-led growth hypothesis (Balassa 1978, Bahagwati 1978, Edwards 1998) states that exports are means to promoting economic growth. The export development and free entry and exit are considered as the key causes of economic growth. Firms can take advantage of more efficient allocation of resources, scale economies and encouraging creativity and innovation caused by foreign competition (Helpman and Krugman, 1985). Moreover, export can cause more import of intermediate goods which leads to increase of capital accumulation and output growth. Therefore, the export-led growth hypothesis states that the growth of exports has a favorable impact on economic growth. However, the empirical evidence on the causal relationship between exports and growth is diverse. There is a substantial literature that investigates the relationship and causation between exports and economic growth, but the conclusions still remain a subject of debate. In particular, available time series studies fail to provide consistent support for the export-led growth hypothesis while most cross-sectional studies provide empirical evidence in support of the hypothesis.

It is generally customary that countries which display glaring picture in their export performance also replicate healthy sign in their GDP performance and vice versa. This moves up a vital question as to the nature of the association between the two. It also raises an interesting issue on whether there is a causal nexus between export and economic growth via GDP growth.

In view of the above analysis, the paper attempts to evaluate the direction of causality between export and economic growth in India during 1972-73 to 2010-11 covering a period of 39 years.

The paper is organised as follows: Section 2 briefly presents the review of existing literature, section 3 discusses the methodology and data base; section 4 analyses the empirical results, while section 5 presents summary and conclusion.

2.Literature Review:

Darrat (1986) studied on four Asian (Hong Kong, South Korea, Singapore, and Taiwan) countries and observed no evidence of uni-directional causality from exports to economic growth in all the four economies. In the case of Taiwan, however, the study identified unidirectional causality from economic growth to export growth.

Sinha (1999) examined the relationship between export instability, investment and economic growth in Asian countries using time series data and the cointegration methodology framework. The study found that most of the variables are non-stationary in their levels and not cointegrated. For Japan, Malaysia, Philippines and Sri Lanka, the study found a negative relationship between export instability and economic growth but for (South) Korea, Myanmar, Pakistan and Thailand, the study founds a positive relationship between the two variables. For India, it was found to be mixed results. In most cases, economic growth was found to be positively associated with domestic investment.

Erfani (1999) examined the causal relationship between economic performance and exports over the period of 1965 to 1995 for several developing countries in Asia and Latin America. The result showed the significant positive relationship between export and economic growth. This study also provides the evidence about the hypothesis that exports lead to higher output.

Vohra (2001) tested the relationship between the export and growth in India, Pakistan, the Philippines, Malaysia, and Thailand for 1973 to 1993. The empirical results indicated that when a country has achieved some level of economic development than the exports have a positive and significant impact on economic growth. The study also showed the importance of liberal market policies by pursuing export expansion strategies and by attracting foreign investments.

Balaguer (2002) examined the hypothesis of export-led growth from the Spanish trade liberalization process initiated four decades ago, for 1961 to 2000. Both the export expansion and the progression from “traditional” exports to manufactured and semi-manufactured export is considered for this purpose. It is proved that the structural transformation in export composition has become a key factor for Spain’s economic development along with the relationship between export and real output.

Subasat (2002) investigated the empirical nexus between exports and economic growth which suggested that the more export oriented countries like middle-income countries grow faster then the relatively less export oriented countries .The study also showed that export promotion does not have any significant impact on economic growth for low and high income countries.

Amavilah (2003) determined the role of exports in economic growth by analyzing Namibia’s data from 1968 to 1992. Results explained the general importance of exports, but find no discernible sign of accelerated growth because of exports.

Lin (2003) stated that ten percent increase in exports cause one percent increase in GDP in the 1990s in China on the basis of new proposed estimation method, when both direct and indirect contributions are considered.

Shirazi (2004) studied the short run and long run relationship among real export, real import and economic growth on the basis of co-integration and multivariate Granger causality developed by Toda and Yamamoto (1995) for the period 1960 to 2003.This study showed a long-run relationship among import, export and economic growth and found unidirectional causality from export to output while did not find any significant causality between import and export.

Mah (2005) studied the long-run causality between export and growth with the help of significance of error correction term, ECt-1. This study also indicated that export expansion is insufficient to explain the patterns of real economic growth.

Tang (2006) stated that there is no long run relationship among export, real Gross Domestic product and imports. This study further shows no long-run and short-run causality between export expansion and economic growth in China on the basis of Granger causality while economic growth does Granger-cause imports in the short run.

Jordaan (2007) analyzed the causality between exports and GDP of Namibia for the period 1970 to 2005. The hypothesis of growth led by export is test through Granger causality and cointegration. It tests whether there is uni-directional or bi-direction causality between export and GDP. The results revealed that exports Granger cause GDP and GDP per capita and suggested that the export-led growth strategy through various incentives has a positive influence on growth.

Pazim (2009) tested the validity of export-led growth hypothesis in three countries by using panel data analysis. It is concluded that there is no significant relationship between the size on national income and amount of export for these countries on the basis of one-way random effect model. The panel unit root test shows that the process for both GDP and Export at first difference is not stationary while the panel co-integration test indicates that there is no co-integration relationship between the export and economic growth for these countries.

Ullah et al (2009) investigated Export-led-growth by time series econometric techniques (Unit root test,Co-integration and Granger causality through Vector Error Correction Model) over the period of 1970 to 2008 for Pakistan. In this paper, the results reveal that export expansion leads to economic growth. They also checked whether there is uni-directional or bidirectional causality between economic growth, real exports, real imports, real gross fixed capital formation and real per capita income. The traditional Granger causality test suggests that there is uni-directional causality between economic growth, exports and imports. On the other hand Granger causality through vector error correction was checked with the help of F-value of the model and t-value of the error correction term, which partially reconciles the traditional Granger causality test.

3. Methodology:

3.1. Data and Variables

The objective of this paper is to investigate the dynamics of the relationship between export and economic growth in India using the annual data for the period, 1972-73 to 2010-11 which includes the 39 annual observations. The two main variables of this study are economic growth and export. The real Gross Domestic Product (GDP) is used as the proxy for economic growth in India and we represent the economic growth rate by using the constant value of Gross Domestic Product (GDP) measured in Indian rupee. All necessary data for the sample period are obtained from the Handbook of Statistics on Indian Economy, 2010-11 published by Reserve Bank of India. All the variables are taken in their natural logarithms to avoid the problems of heteroscedasticity.

Using the time period, 1972-73 to 2010-11 for India, this study aims to examine the long-term and causal dynamic relationships between the level of export and economic growth. The estimation methodology employed in this study is the cointegration and error correction modeling technique.

The entire estimation procedure consists of three steps: first, unit root test; second, cointegration test; third, the error correction model estimation.

3.2. Econometric specification:

3.2.1Hypothesis:

The paper is based on the following hypotheses for testing the causality and co-integration between GDP and export in India (i) whether there is bi-directional causality between GDP growth and export, (ii) whether there is unidirectional causality between the two variables, (iii) whether there is no causality between GDP and export in India (iv) whether there exists a long run relationship between GDP and EX in India.

3.2.2.Model Specification

The choice of the existing model is based on the fact that it allows for generation and estimation of all the parameters without resulting into unnecessary data mining.

The growth model for the study takes the form: GDP=f (EX) -------------------(1)

Where GDP and EX are the gross domestic product and export respectively.

Equation (1) is treated as a Cobb-Douglas function with export from India, (EX), as the only explanatory variable.

The link between Economic growth (measured in terms of GDP growth) and export in India can be described using the following model in linear form:

$LnGDPt= \alpha + \beta_{Ln} EX_t + \varepsilon_t$ -------------- (1.1)

α and $\beta>0$

The variables remain as previously defined with the exception of being in their natural log form. εt is the error term assumed to be normally, identically and independently distributed.

Here, GDP_t and EX_t show the Gross Domestic Product annual growth rate and export growth at a particular time respectively while ε_t represents the "noise" or error term; α and β represent the slope and coefficient of regression. The coefficient of regression, β indicates how a unit change in the independent variable (export) affects the dependent variable (gross domestic product). The error, ε_t, is incorporated in the equation to cater for other factors that may influence GDP. The validity or strength of the Ordinary Least Squares method depends on the accuracy of assumptions. In this study, the Gauss-Markov assumptions are used and they include; that the dependent and independent variables (GDP and EX) are linearly co-related, the estimators (α, β) are unbiased with an expected value of zero i.e., $E(\varepsilon_t) = 0$, which implies that on average the errors cancel out each other. The procedure involves specifying the dependent and independent variables; in this case, GDP is the dependent variable while EX the independent variable.

But it depends on the assumptions that the results of the methods can be adversely affected by outliers. In addition, whereas the Ordinary Least squares regression analysis can establish the dependence of either GDP on EX or vice versa; this does not necessarily imply direction of causation. Stuart Kendal noted that "a statistical relationship, however, strong and however suggestive, can never establish causal connection." Thus, in this study, another method, the Granger causality test, is used to further test for the direction of causality.

Step –I: Ordinary least square method:

Here we will assume the hypothesis that there is no relationship between export (EX) and Economic Growth in terms of GDP. To confirm about our hypothesis, primarily, we have studied the effect of foreign trade on economic growth and vice versa by two simple regression equations:

$EX_i=a+ b*GDP_i$ ……………………………………………………………………………………………………..(2)

$GDP_i=a_1+ b_1*EX_i$ ……………………………………………………………………………………………………(3)

GDP = Gross domestic product.

EX = Export from India.

t= time subscript.

This study aimed to examine the long-term relationship between export and GDP growth in India between 1972-72 and 2010-11. Using co-integration and Vector Error Correction Model (VECM) procedures, we investigated the relationship between these two variables. The likely short-term properties of the relationship among economic growth and export were obtained from the VECM application. Next, unit root, VAR, cointegration and Vector Error Correction Model (VECM) procedures were utilized in turn. The first step for an appropriate analysis is to determine if the data series are stationary or not. Time series data generally tend to be non-stationary, and thus they suffer from unit roots. Due to the non-stationarity, regressions with time series data are very likely to result in spurious results. The problems stemming from spurious regression have been described by Granger and Newbold (1974). In order to ensure the condition of stationarity, a series ought to be integrated to the order of 0 [I(0)]. In this study, tests of stationarity, commonly known as unit root tests, were adopted from Dickey and Fuller (1979, 1981) and Phillips-Perron test. As the data were analyzed, we discovered that error terms had been correlated in the time series data used in this study.

*Step –II**:** The Stationarity Test (Unit Root Test)*

It is suggested that when dealing with time series data, a number of econometric issues can influence the estimation of parameters using OLS. Regressing a time series variable on another time series variable using the Ordinary Least Squares (OLS) estimation can obtain a very high R^2, although there is no meaningful relationship between the variables. This situation reflects the problem of spurious regression between totally unrelated variables generated by a non-stationary process. Therefore, prior to testing Cointegration and implementing the Granger Causality test, econometric methodology needs to examine the stationarity; for each individual time series, most macro economic data are non stationary, i.e. they tend to exhibit a deterministic and/or stochastic trend. Therefore, it is recommended that a stationarity (unit root) test be carried out to test for the order of integration. A series is said to be stationary if the mean and variance are time-invariant. A non-stationary time series will have a time dependent mean or make sure that the variables are stationary, because if they are not, the standard assumptions for asymptotic analysis in the Granger test will not be valid. Therefore, a stochastic process that is said to be stationary simply implies that the mean [(E(Yt)] and the variance [Var(Yt)] of Y remain constant over time for all t, and the covariance [covar(Yt, Ys)] and hence the correlation between any two values of Y taken from different time periods depends on the difference apart in time between the two values for all t≠s. Since standard regression analysis requires that data series be stationary, it is obviously important that we first test for this requirement to determine whether the series used in the regression process is a difference stationary or a trend stationary. The Augmented Dickey-Fuller (ADF) test is used. To test the stationary of variables, we use the Augmented Dickey Fuller (ADF) test which is mostly used to test for unit root. Following equation checks the stationarity of time series data used in the study:

$$\Delta y_t = \beta_1 + \beta_1 t + \alpha\, y_{t-1} + \gamma \sum_{t=1}^{n} \Delta y_{t-1} + \varepsilon_t$$

Where ε_t is white nose error term in the model of unit root test, with a null hypothesis that variable has unit root. The ADF regression test for the existence of unit root of y_t that represents all variables (in the natural logarithmic form) at time t. The test for a unit root is conducted on the coefficient of yt-1 in the regression. If the coefficient is significantly different from zero (less than zero) then the hypothesis that y contains a unit root is rejected. The null and alternative hypothesis for the existence of unit root in variable y_t is H0; $\alpha = 0$ versus H1: $\alpha < 0$. Rejection of the null hypothesis denotes stationarity in the series.

If the ADF test-statistic (t-statistic) is less (in the absolute value) than the Mackinnon critical t-values, the null hypothesis of a unit root can not be rejected for the time series and hence, one can conclude that the series is non-stationary at their levels. The unit root test tests for the existence of a unit root in two cases: with intercept only and with intercept and trend to take into the account the impact of the trend on the series.

The PP tests are non-parametric unit root tests that are modified so that serial correlation does not affect their asymptotic distribution. PP tests reveal that all variables are integrated of order one with and without linear trends, and with or without intercept terms.

Phillips–Perron test (named after Peter C. B. Phillips and Pierre Perron) is a unit root test. That is, it is used in time series analysis to test the null hypothesis that a time series is integrated of order 1. It builds on the Dickey–Fuller test of the null hypothesis δ = 0 in $\Delta y_t = \delta y_{t-1} + u_t$, here Δ is the first difference operator. Like the augmented Dickey–Fuller test, the Phillips–Perron test addresses the issue that the process generating data for y_t might have a higher order of autocorrelation than is admitted in the test equation - making y_{t-1} endogenous and thus invalidating the Dickey–Fuller t-test. Whilst the augmented Dickey–Fuller test addresses this issue by introducing lags of Δy_t as regressors in the test equation, the Phillips–Perron test makes a non-parametric correction to the t-test statistic. The test is robust with respect to unspecified autocorrelation and heteroscedasticity in the disturbance process of the test equation.

Once the number of unit roots in the series was decided, the next step before applying Johansen's (1988) co-integration test was to determine an appropriate number of lags to be used in estimation. Second, Eagle-Granger residual based test tests the existence of co integration among the variables-FT and GDP at constant prices for the economy. Third, if a co integration relationship does not exist, VAR analysis in the first difference is applied, however, if the variables are co integrated, the analysis continues in a cointegration framework.

Step-III: Testing for Cointegration Test(Johansen Approach)

Cointegration, an econometric property of time series variable, is a precondition for the existence of a long run or equilibrium economic relationship between two or more variables having unit roots (i.e. Integrated of order one). The Johansen approach can determine the number of co-integrated vectors for any given number of non-stationary variables of the same order. Two or more random variables are said to be cointegrated if each of the series are themselves non – stationary. This test may be regarded as a long run equilibrium relationship among the variables. The purpose of the Cointegration tests is to determine whether a group of non – stationary series is cointegrated or not.

Having concluded from the ADF results that each time series is non-stationary, i.e it is integrated of order one I(1), we proceed to the second step, which requires that the two time series be co-integrated. In other words, we have to examine whether or not there exists a long run relationship between variables (stable and non-spurious co-integrated relationship) . In our case, the mission is to determine whether or not export(EX) and economic growth(GDP) variables have a long-run relationship in a bivariate framework. Engle and Granger (1987) introduced the concept of cointegration, where economic variables might reach a long-run equilibrium that reflects a stable relationship among them. For the variables to be co-integrated, they must be integrated of order one (non-stationary) and the linear combination of them is stationary I(0).

The crucial approach which is used in this study to test r cointegration is called the Johansen cointegration approach. The Johanson approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order.

Step-IV: 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 Yt add no information to explanation of movements of Xt beyond that provided by lagged values of Xt itself (Green, 2003). We should take note of the fact that the Granger causality technique measures the information given by one variable in explaining the latest value of another variable. In addition, it also says that variable Y is Granger caused by variable X if variable X assists in predicting the value of variable Y. If this is the case, it means that the lagged values of variable X are statistically significant in explaining variable Y. The null hypothesis (H0) that we test in this case is that the X variable does not Granger cause variable Y and variable Y does not Granger cause variable X.In summary, one variable (Xt) is said to granger cause another variable (Yt) if the lagged values of Xt can predict Yt and vice-versa.

EX and GDP are, in fact, interlinked and co-related through various channel. There is no theoretical or empirical evidence that could conclusively indicate sequencing from either direction. For this reason, the Granger Causality test was carried out on EX and GDP.

The spirit of Engle and Granger (1987) lies in the idea that if the two variables are integrated as order one, I(1), and both residuals are I(0), this indicates that the two variables are cointegrated. The Granger theorem states that if this is the case, the two variables could be generated by a dynamic relationship from GDP to EX and, vise versa.

Therefore,a time series X is said to Granger-cause Y if it can be shown through a series of F-tests on lagged values of X (and with lagged values of Y also known) that those X values predict statistically significant information about future values of Y. In the context of this analysis, the Granger method involves the estimation of the following equations:

If causality (or causation) runs from EX to GDP, we have:

$$dLnGDP_{it} = \eta_i + \Sigma\alpha_{11} dLnGDP_{i,\ t-1} + \Sigma\beta_{11} dLnEX_{i,\ t-1} + \varepsilon_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

If causality (or causation) runs from GDP to EX, it takes the form:

$$dLnEX_{it} = \eta_i + \Sigma\alpha_{12} dLn\ EX_{i,\ t-1} + \Sigma\beta_{12} dLnGDP_{i,t-1} + \lambda ECM_{it} + \varepsilon_{2t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

where, GDP $_t$ and EX$_t$ represent gross domestic product and export respectively, ε_{it} is uncorrelated stationary random process, and subscript *t* denotes the time period. In equation 4,failing to reject: H_0: $\alpha_{11} = \beta_{11} = 0$ implies that educational expenditure does not Granger cause economic growth. On the other hand, in equation5,failing to reject H_0: $\alpha_{12} = \beta_{12} = 0$ implies that economic growth via GDP growth does not Granger cause educational expenditure.

The decision rule:

From equation (4), $dLnEX_{i\ t-1}$Granger causes $dLnGDP_{it}$ if the coefficient of the lagged values of EX as a group (β_{11}) is significantly different from zero based on F-test (i.e., statistically significant). Similarly, from equation (5), $dLnGDP_{i,t-1}$ Granger causes $dLnEX_{it}$ if $\beta_{12}$is statistically significant.

Step V: Error Correcting Model (ECM) and Short Term Causality Test :

Error correction mechanism was first used by Sargan (1984), later adopted, modified and popularized by Engle and Granger (1987). By definition, error correction mechanism is a means of reconciling the short-run behaviour (or value) of an economic variable with its long-run behaviour (or value). An important theorem in this regard is the Granger Representation Theorem which demonstrates that any set of cointegrated time series has an error correction representation, which reflects the short-run adjustment mechanism.

Co- integration relationships just reflect the long term balanced relations between relevant variables. In order to cover the shortage, correcting mechanism of short term deviation from long term balance could be cited. At the same time, as the limited number of years, the above test result may cause disputes (Christpoulos and Tsionas, 2004). Therefore, under the circumstance of long term causalities, short term causalities should be further tested as well. Empirical works based on time series data assume that the underlying time series is stationary. However, many studies have shown that majority of time series variables are nonstationary or integrated of order 1 (Engle and Granger, 1987). The time series properties of the data at hand are therefore studied in the outset. Formal tests will be carried out to find the time series properties of the variables. If the variables are *I* (1), Engle and Granger (1987) assert that causality must exist in, at least, one direction. The Granger causality test is then augmented with an error correction term (ECT) and the error correcting models could be built as below:

$$dLnGDP_{it} = \eta_i + \Sigma\alpha_{11} dLnGDP_{i,\ t-1} + \Sigma\beta_{11} dLnEX_{i,\ t-1} + \lambda ECM_{it} + \varepsilon_{it} \quad \text{...(6)}$$

$$dLnEX_{it} = \eta_i + \Sigma\alpha_{12} dLn\ EX_{i,\ t-1} + \Sigma\beta_{12} dLnGDP_{i,t-1} + \lambda ECM_{i\ t} + \varepsilon_{it} \quad \text{...............................(7)}$$

Where t represents year, d rerepresents first order difference calculation, ECMit represents the errors of long term balance which is obtained from the long run co-integrating relationship between economic growth and educational expenditure. If $\lambda = 0$ is rejected, error correcting mechanism happens, and the tested long term causality is reliable, otherwise, it could be unreliable. If $\beta 1=0$ is rejected, and then the short term causality is proved, otherwise the short term causality doesn't exist.

4. Analysis of the Result:

4.1.Ordinary Least Square Technique:

This section presents the nexus between export and economic growth in terms of OLS Technique.

[Insert Table-1 here]

In ordinary least square Method, we reject the hypothesis that there is no relationship between the variable and the results of the Ordinary Least Squares Regression are summarized in the Table 1. The empirical analysis on basis of ordinary Least Square Method suggests that there is positive relationship between export and GDP and vice versa.

4.2.Unit Root Test:

Table 2&3 present the results of the unit root test. The results show that both variables of our interest, namely LnGDP and Ln EX attained stationarity after first differencing, I(1), using PP test. The augmented Dickey Fuller Test fails to provide result of stationary at first difference at all lag differences.

[Insert Table-2 here]

Table (2) presents the results of the unit root test for the two variables for their levels. The results indicate that the null hypothesis of a unit root can not be rejected for the given variable and, hence, one can conclude that the variables are not stationary at their levels.

To determine the stationarity property of the variable, the same test above was applied to the first differences. Results from table (3) revealed that the ADF value is not greater than the critical t-value at 1% ,5% and 10%level of significance for all variables. Based on these results, the null hypothesis that the series have unit roots in their differences can not be rejected.

An inspection of the figures reveals in table-5 that each series is first difference stationary at 1%,5% and 10% level using the PP test. However, the ADF test result is not as impressive, as all the variables did not pass the differenced stationarity test at the one, five and ten percent levels. We therefore rely on the PP test result as a basis for a cointegration test among all stationary series of the same order meaning that the two series are stationary at their first differences [they are integrated of the order one i.e I(1)].

[Insert Table-3 here]

[Insert Table-4 here]

[Insert Table-5 here]

4.3.Cointegration Test:

Having established the time series properties of the data, the test for presence of long-run relationship between the variables using the Johansen and Juselius (1992) LR statistic for cointegration was conducted. The crucial approach which is used in this study to test cointegration is called the Johansen cointegration approach. The Johanson approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order. The results reported in table (6) suggest that the null hypothesis of no cointegrating vectors can be rejected at the 1% level of significance. It can be seen from the Likelihood Ratio (L.R.) that we have a single co-integration equations. In other words, there exists one linear combination of the variables.

[Insert Table-6 here]

The normalized cointegrating equation is

LnGDP = -9.825+ 0.9791 LnEX -----------------------(7)

((17.50)

The standard error is in the parentheses the behavioural parameter (EX) is statistically significant at 1%.

Estimating the long-run relationship, the results are contained in equation (7) which shows positive relationship between education and economic growth. Precisely, 1% increase in export raises the level of GDP by 97.91%.Therefore,the normalized cointegration equation reveals that there is a positive relationship between export(EX) and GDP(Economic growth).Looking at the results, the normalized cointegrating equation (7) reveals that in the long-run, export affects economic growth positively in India. Interestingly, this result is impressive because 1% change in export volume leads to about 98 percent change in economic growth via GDP growth in the same direction, over the long-run horizon. This of course is highly significant judging from the t-statistic.

4.4.Granger Causality Test :

The results of Pairwise Granger Causality between economic growth (GDP) and export (EX) are contained in Table 7. The results reveal the existence of a bi-directional causality which runs from economic growth (GDP) to investment in education (EX) and vice versa.

[Insert Table-7 here]

The null hypotheses of the Granger-Causality test are:

H0: $X \neq Y$ (X does not granger-cause Y)

H1: $X \neq Y$ (X does Granger-cause Y)

We have found that both for the Ho of "LNEX does not Granger Cause LNGDP" and Ho of "LNGDP does not Granger Cause LNEX" , we cannot reject the Ho since the F-statistics are rather small and most of the probability values are close to or even greater than 0.1 at the lag length of 1 to 4. Therefore, we accept the Ho and conclude that LNEX does not Granger Cause LNGDP and LNGDP does not Granger Cause LNEX.

The above results generally show that causality is bidirectional and therefore we find that the direction of causality between export indicators and economic growth in India is generally bidirectional (causality runs in both directions).

4.5.Error Correction Mechanism(VECM):

The result (Table 8) indicates that the ECM in model-1 tested by equation (6) is positive and passes the significance test by 0.05, which means error correction happens, and the pulling function of export on GDP is proved. The ECM in model-2 tested by equation (7) is positive and passes the test, which means that there exists mutual causality between export(EX) and GDP. According to the co-integration equations, we can see they are positively related. That is to say, exports have positively pulling function on GDP; on the other hand, the GDP growth will also promote the export volume of the country. So it can be concluded that exports and GDP are mutually causal.

[Insert Table-8 here]

5. Conclusion:

The paper tries to assess empirically, the relationship between export and economic growth in India using annual data over the period 1972-73 to 2010-11. The unit root properties of the data were examined using the Augmented Dickey Fuller test(ADF) after which the cointegration and causality tests were conducted. The error correction models were also estimated in order to examine the short –run dynamics. The major findings include the following:

The unit root test clarified that both economic growth and export are non-stationary at the level data but found stationary at the first differences.Therefore,the series of both variables of our consideration-EX and GDP, namely, export and economic growth were found to be integrated of order one using the Phillips-Perron tests for unit root.

The cointegration test confirmed that economic growth and export are cointegrated, indicating an existence of long run equilibrium relationship between the two as confirmed by the Johansen cointegration test results.

The Granger causality test finally confirmed the presence of bi-directional causality which runs from economic growth to export and vice-versa.

The error correction estimates gave evidence that in short run also, export and GDP are mutually causal.

The results recommend that an export-led growth strategy through contributing various incentives should be adopted and continued to have greater access over international market and a long-term relationship between exports and economic growth via GDP growth has been emerged. Export promotion has a positive influence on growth in GDP. The results confirm further the advantages of an export-led growth strategy for India. India can expand its market by exporting products to the international markets. Policies focusing on export promotion should be used effectively to fabricate export capacity in order to enhance economic growth.

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Table: 1:Result of OLS Technique

Variable	Dependent variable is LnGDP				
	Coefficient	SE	t ratio	R^2	F Statistic
Ln EX	0.359008	0.010424	34.44	0.97	1186.20
	Dependent variable is LnEX				
LnGDP	2.703410	0.078493	34.44	0.97	1186.20

Ho: There is no relationship between the variables; H1: There is relationship between the variables

Table 2: Unit Root Test: The Results of the Augmented Dickey Fuller (ADF) Test for Levels with an Intercept and Linear Trend

	Intercept only			Intercept&Trend		
Variable	ADF(0)	ADF(1)	ADF(2)	ADF(0)	ADF(1)	ADF(2)
LnGDP	2.214	2.097	2.108	-0.7376	-0.4758	-0.7265
AIC	-3.028	-2.964	-2.906	-3.013	-2.933	-2.894
SBC	-2.941	-2.831	-2.728	-2.883	-2.757	-2.672
	1% Critical Value* -3.62 5% Critical Value -2.94 10% Critical Value -2.61			1% Critical Value* -4.22 5% Critical Value -3.53 10% Critical Value -3.20		
Ln EX	0.381	0.6001	0.7499	-1.479	-4.134	-2.906
AIC	-1.860	-1.802	-1.917	-1.872	-10.129	-2.117
SBC	-1.774	-1.672	-1.741	-1.743	-9.954	-1.896
	1% Critical Value* -3.62 5% Critical Value -2.94 10% Critical Value -2.61			1% Critical Value* -4.23 5% Critical Value -3.53 10% Critical Value -3.20		

Ho: series has unit root; H1: series is trend stationary

*MacKinnon critical values for rejection of hypothesis of a unit root.

AIC stands for Akaike info criterion

SBC stands for Schwarz Bayesian criterion

Table 3: Unit Root Test: The Results of the Augmented Dickey Fuller (ADF) Test for the First Differences with an Intercept and Linear Trend

	Intercept only			Intercept&Trend		
Variable	ADF(0)	ADF(1)	ADF(2)	ADF(0)	ADF(1)	ADF(2)

LnGDP AIC SBC	-5.677 -2.894 -2.806	-3.429 -2.830 -2.696	-2.517 -2.782 -2.602	-6.411 -2.981 -2.849	-4.333 -2.934 -2.756	-3.240 -2.841 -2.616
	1% Critical Value* -3.62 5% Critical Value -2.94 10% Critical Value -2.61			1% Critical Value* -4.23 5% Critical Value -3.54 10% Critical Value -3.20		
LnEX AIC SBC	-5.512 -1.846 -1.759	-2.884 -1.955 -1.823	-2.824 -1.884 -1.706	-5.491 -1.809 -1.678	-2.980 -1.931 -1.755	-2.973 -1.863 -1.641
	1% Critical Value* -3.62 5% Critical Value -2.94 10% Critical Value -2.61			1% Critical Value* -4.23 5% Critical Value -3.54 10% Critical Value -3.20		

Ho: series has unit root; H1: series is trend stationary.

*MacKinnon critical values for rejection of hypothesis of a unit root.

AIC stands for Akaike info criterion

SBC stands for Schwarz Bayesian criterion

Table 4: Unit Root Test: The Results of the Phillips-Perron Test for First Differences with an Intercept and Linear Trend

	Intercept only			**Intercept&Trend**		
Variable	**ADF(0)**	**ADF(1)**	**ADF(2)**	**ADF(0)**	**ADF(1)**	**ADF(2)**
LnGDP AIC SBC	2.214 -3.028 -2.941	2.389 -3.028 -2.941	2.490 -3.028 -2.941	-0.7376 -3.013 -2.883	-0.6763 -3.013 -2.883	-0.6617 -3.013 -2.883
	1% Critical Value* -3.62 5% Critical Value -2.94 10% Critical Value -2.61			1% Critical Value* -4.22 5% Critical Value -3.53 10% Critical Value -3.20		
Ln EX AIC SBC	0.3808 -1.860 -1.774	0.3680 -1.860 -1.774	0.3019 -1.860 -1.774	-1.479 -1.872 -1.743	-1.548 -1.872 -1.743	-1.737 -1.872 -1.742
	1% Critical Value* -3.62 5% Critical Value -2.94 10% Critical Value -2.61			1% Critical Value* -4.23 5% Critical Value -3.53 10% Critical Value -3.20		

Ho: series has unit root; H1: series is trend stationary

*MacKinnon critical values for rejection of hypothesis of a unit root.

AIC stands for Akaike info criterion

SBC stands for Schwarz Bayesian criterion

Table 5: Unit Root Test: The Results of the Phillips-Perron Test for First Differences with an Intercept and Linear Trend

	Intercept only			Intercept&Trend		
Variable	ADF(0)	ADF(1)	ADF(2)	ADF(0)	ADF(1)	ADF(2)
LnGDP AIC SBC	-5.676 -2.894 -2.806	-5.678 -2.894 -2.806	-5.690 -2.894 -2.806	-6.411 -2.981 -2.849	-6.409 -2.981 -2.849	-6.415 -2.981 -2.849
	1% Critical Value* -3.62 5% Critical Value -2.94 10% Critical Value -2.61			1% Critical Value* -4.23 5% Critical Value -3.5 10% Critical Value -3.20		
Ln EX AIC SBC	-5.512 -1.846 -1.759	-5.498 -1.846 -1.759	-5.585 -1.846 -1.759	-5.491 -1.809 -1.678	-5.473 -1.809 -1.678	-5.545 -1.809 -1.678
	1% Critical Value* -3.62 5% Critical Value -2.94 10% Critical Value -2.6			1% Critical Value* -4.22 5% Critical Value -3.53 10% Critical Value -3.20		

Ho: series has unit root; H1: series is trend stationary

*MacKinnon critical values for rejection of hypothesis of a unit root.

AIC stands for Akaike info criterion

SBC stands for Schwarz Bayesian criterion

Table 6. Johansen Cointegration Tests:

Hypothesized NO. Of CE (s)	Eigen value	Likelihood Ratio	5% critical value	1% critical value
None **	0.391276	21.18541	19.96	24.60
At most 1	0.087980	3.315365	9.24	12.97

Ho: has no co-integration; H1: has co-integration

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

L.R. test indicates one cointegrating equation(s) at 5% significance level

Table: 7: Granger Casuality test

Null Hypothesis	Lag	Observations.	F-statistics	Probability	Decision

LNEX does not Granger Cause LNGDP	1	37*	1.37426	0.24923	Accept
	2	36	0.93287	0.40419	Accept
	3	35	0.50957	0.67892	Accept
	4	34	0.53263	0.71292	Accept
LNGDP does not Granger Cause LNEX	1	37	0.73917	0.39595	Accept
	2	36	0.60438	0.55273	Accept
	3	35	0.93755	0.43567	Accept
	4	34	0.53712	0.70977	Accept

*Observations. after lag.

Table:8: Short term causality test for time series data(VECM)

Variables	Model-1 D(LNGDP)	Model-2 D(LNEX)
ECM	-0.004384* (0.00168) (-2.61752)	-0.006725 (0.00277) (-2.43097)
D(LNGDP(-1))	-0.093354 (0.18076) (-0.51646)	0.168664 (0.29854) (0.56495)
D(LNGDP(-2))	-0.042965 (0.18030) (-0.23829)	-0.412777 (0.29779) (-1.38612)
D(LNEX(-1))	0.071269 (0.10234) (0.69637)	0.015474 (0.16903) (0.09154)
D(LNEX(-2))	-0.039312 (0.10419) (-0.37731)	0.405279 (0.17208) (2.35511)
R-squared	0.168063	0.196713
F-statistic	3.236361	3.390904

*indicates panel data pass the significance test by 95% level.