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Relationship between Exports, Economic Growth and Other Economic Activities in India: Evidence from VAR Model

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Abstract

In recent years, a significant number of empirical studies have examined the relationship between export and economic growth in India. However, this study analyses the relationship between exports and economic growth through the time series model. The main aim of this study is to investigate the causal relationship between exports and economic growth in India. The VAR model was used for the period 1961 to 2015 after verifying the stationarity of the variables through using Augmented Dickey-Fuller and Phillip-Perron tests. The Indian export sector has been found to have a significant and positive impact on economic growth and other long-term economic activities. The study also employed the Granger causality test to check the direction of causality and found that RXGS, RGDP, RPFC, and RGFC had a unidirectional relationship and RXGS and RMGS had a bidirectional relationship in long run. Also, the findings of this study suggest that a steady-state between exports and economic growth can be achieved in India over a long period. The overall outcome of this study provides a testimony of the fact that the export sector plays a vital role in economic growth in India and also leads to the long-term growth of other economic activities.

Keywords: Export, Economic Growth, GDP, VAR Model, India

JEL Classification Code: F1, F4, F63

1. Introduction

One of the most important topics in international growth history has been the significance of exports in economic growth. Many economists believe that rapid export growth will lead to increased economic growth. Balassa (1978) calls it the export-led growth hypothesis (ELGH). There are various reasons why the ELGH should be supported: (1) Exporters should sell their products in competitive global markets so that they can compete and adopt new technology; (2) Domestic competition motivates non-exporters to become more efficient, implement new technologies, or innovate, resulting in higher market productivity gains and rapid economic development; (3) better allocate scarce resources across the economy to trade liberalization or export promotion policies; (4) successful exporters will increase output and employment exponentially as a result of their exposure to much larger world markets; (5) growing exports encourage better access for domestic businesses to international capital and intermediate products, contributing to productivity gains and output frontier expansion; and (6) successful exporters will increase output and employment exponentially as a result of their exposure to much larger world markets.

Higher exports, thereby contribute to a more productive, more technically advanced, more efficient, and speedily growing economy. Based on ‘endogenous’ growth models (in an environment defined by increasing returns to scale),

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Romer (1986, 1920) emphasized the benefits of a competitive export industry and predicted that developments in more flexible market technologies would lead to increased returns to scale (Barro & Sala-i-Martin, 1995; Edwards, 1998).

Many developing countries have implemented import substitution industrialization (ISI) policies, but India did so after gaining independence for several economic and political reasons. India was concerned about regaining foreign dominance and wanted to promote domestic industries while ignoring importing disturbances in the economy. India was also concerned that the commodity's exports would be harmed as a result of the trading conditions (Singer-Prebisch hypothesis). Nonetheless, the small domestic market has resulted in restricted industrial expansion as a result of ISI policies, which include diseconomies of scale and long-term protection of domestic industries with high tariffs, resulting in inefficient and uncompetitive firms that are unable to export (resulting in overvalued exchange rates). Exports have been restricted to a bare minimum as a result of ISI policies and have certainly not been able to stimulate growth in the rest of the economy.

Following that, India's new economic policy ushered in a wave of trade reforms, gradually moving the country closer to an open economic system. Exports are critical for the promotion of economic growth in emerging countries. As a result, export-oriented economic growth has been promoted as a superior option to the domestic growth trend. External orientation contributes to improved productivity growth, which supports capital material investment, including FDI (Bhagwati, 1978). If it is competent, the rest of the world can increase product and service quality while simultaneously reducing domestic producer inefficiencies. For example, foreign exchange liberalization is a critical component of an export-based strategy since it reduces the inefficiencies of exchange control for domestic producers. Importing final and intermediate items will force native producers to be more innovative and effective to compete with imports.

2. Literature Review

There is a large body of literature dedicated to the causal relationship between export and economic growth. This literature emphasizes the benefits of an export-oriented trade policy that promotes exports over the shortcomings of an import substitution domestic policy. Dhawan and Biswal (1999), using the VAR model, examined the relationships between export and economic growth in India from 1961 to 1993. They discovered the macroeconomic variables' long-term cointegration. In their research, they used real exports, real GDP, and trade conditions.

Mallick (1996), during the 1950s and 1990s in India, observed a strong link between wealth and export development. The direction of the ranges of causation from income and export growth was revealed using the vector error correlation and Granger cointegration model. Mishra (2011) examined the long-term relationship between two variables using the Granger cointegration and vector error correlation models. He evaluated time series data on export and GDP from 1970 to 2009. His paper established a long-term association between two variables, rejecting the premise that exports caused growth and favoring growth-driven exports instead.

In Malaysia, Ghatak and Price (1999) examined the relationship between export and growth in the Malaysian economy and reported that GDP growth is due to exports. Subsequently, Keong et al. (2005) built a VAR model that includes GDP, import, export, labor, and exchange rate variables to analyze the relationship between economic growth and exports in the Malaysian economy during 1960-2001. They observed that exports and labor stimulated economic development and imports and that the exchange rate had a negative effect on growth. They also found cointegration between exports and economic growth. Shah and Yuosf (1990) also stated exports cause economic growth. While other studies indicated the opposite, some other studies have claimed that there is a mutual relationship between economic growth and exports. The path of causality and existence of the long-term relationship seems to differ among countries, depending on the role played by exports in manufacturing products in that economy.

The growth of world GDP is controlled by the economic growth of countries; nevertheless, some economists think that increased world GDP will result in decreased exports. For example, during the years 1967–1980 and 1985–1988, this theory did not apply in the United States since global GDP growth caused a decline in terms of trade between countries (Krugman & Obstfed, 1994). Financial expansion, according to Kumar and Parmanik (2020), has a long-term favorable impact on economic growth. Furthermore, both the positive and negative components of financial expansion have a proportionate impact on the Indian economy, while the effects of control variables like exchange rates, trade openness, and other economic activities are compatible with shared economic insights. Solanki et al. (2020) and Alam & Alam (2021) investigated the path of economic development and sectoral economy linkage. The study emphasized the dynamic relationship between the contributions of the industrial and agricultural sectors to economic growth. The findings revealed that both the short- and long-term contributions of the industrial and agricultural sectors to economic growth proved to be positive and significant.

Since India is an agriculture dominant country, the growth of the world GDP variable was included in this study to examine how agricultural exports will lead to increased world GDP growth. Because there is a strong demand for agricultural products at the moment, which in turn, reduces the current deficit and improves the country's GDP.

2.1. Research Question and Objectives

Many studies have been conducted to analyze the relationship between exports and economic growth, which used only two variables, exports and GDP. However, the current study used macroeconomic variables such as RGDP, RXGS, RMGS, RPFC, and RGFC.

1. Which types of relationships exist among the variables?
2. Which kind of impact do exports have on economic growth?
3. Which types of causal relationship among the variables?

And while previous research merely looked at the link between factors, this study looks at the impact of exports on economic activity. For the examination of time series macroeconomic data in India from 1961–1962 to 2015–16, the VAR model was utilized. The study was also used to analyze the causation between macroeconomic variables using Granger's causality test. The primary goal of this research was to look at the long-term relationship between exports and economic growth, causality among macroeconomic variables in India, and the impact of exports on economic activity using econometric models.

3. Data and Research Methodology

3.1. Data Collection

The data of macroeconomic variables (RGDP, RPFC, RGFCE, RXGS, and RMGS) in India was obtained from the annual data of the Reserve Bank of India during 1961–2015 and GWGDP data had been received by the World Bank (2015). Macroeconomic variables were calculated in real terms by using the GDP deflator 2011–12 (=100). The data analyses and evaluation of the data applied these econometric parameters; Stationarity tests, Vector Auto-Regression (VAR) tests, Impulse Response Function (IRF) tests, and Grange-Causality tests.

3.2. Econometric Model

VAR model was applied to analyze the impact of unexpected disturbance on variables. Variables used in the VAR model are Real Gross Domestic Product (RGDP), Real Private Final Consumption (RPFC), Real Government Final Consumption (RGFC), Real Exports Goods and Services (RXGS), Real Imports Goods and Services (RMGS), and Growth of World Gross Domestic Product (GWGDP).

3.3. Unit Root Test

Unit root test is one of the most important steps to verify the stationary of macroeconomic variables and the growth of world GDP data. It was developed by Dickey-Fuller (DF) in 1979. If the variables are not stationary (shows the stochastic tendency), the conventional hypothesis test and confidence intervals will not be reliable. If there is a non-stationary presence in the variables, this situation is known as spurious regression. The condition of spurious regression states that when the value of R^2, and t-stochastic are very high, it means that there is no economic significance (Granger & Newbold, 1974).

The Augmented Dickey-Fuller (ADF) test, as well as the Philip-Perron test, have been applied to the stationary test for unit roots in macroeconomic variables.

3.4. Augmented Dickey-Fuller (ADF) Test

The following regression model describes the ADF test for a unit root:

$$\Delta Y_t = \beta_0 + \delta Y_{t-1} + \gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + \dots\dots\dots\dots\dots\dots + \gamma_p \Delta Y_{t-p} + \mu_t \quad (1)$$

Where:
Y = (RGDP, RPFC, RGFC, RXGS, RMGS, GWGDP) = macroeconomics variables under this study.
Δ = operator of differencing.
$\beta_0, \Delta, \gamma_1, \gamma_2, \gamma_p$ = parameters of estimated.
μ_t = White noise

In this situation, the null hypothesis can be expressed as follows:

H_0: $\delta = 0$ (Y_t is non-stationary)

A time trend (t) may be introduced to Eq. 1 if Y_t is stationary around a deterministic linear procedure. If so, Eq. 1 is written as follows:

$$\Delta Y_t = \beta_0 + \alpha t + \delta Y_{t-1} + \gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + \dots\dots\dots\dots\dots\dots + \gamma_p \Delta Y_{t-p} + \mu_t \quad (2)$$

Were:
t = time of trend.
α = parameter of estimated for the time trend.

3.5. Phillip-Perron (PP) Test

One of the ADF test's key assumptions is that the ut error terms are distributed independently and uniformly. By including the lags difference terms in the regression equation, the ADF test can manage the likelihood of serial correlation in error terms. Phillip-Perron (PP) test is an alternative test of stationarity, to analyze the unit root process. The PP test primarily uses the non-augmented Dickey-Fuller test in Eqn 1 and 2 and modifies the coefficient's *t*-ratio; this means that serial correlation has no effect on the test statistic's asymptotic distribution.

3.6. Testing Vector Auto-Regression (VAR) Model

The Vector autoregressive model is used to analyze the macroeconomic variables in the long-term co-integration relationship, which assumes that the macroeconomic variables have stationary behavior. This model incorporates a specific set of macroeconomic factors in the linear forms of the vector process, which are integrated at a scale lower than the mechanism itself. If one non-stationary variable relates to another non-stationary variable, a linear combination between them exists that becomes stationary. Co-integrated relationships should also be viewed as stable-state relationships throughout macroeconomic variables.

All these endogenous variables have been considered as a function of the lagged values in the equations. The VAR model constructed in this study, the structure B model is as follows:

$$\Delta Z_t = \sum_{i-1}^{p} \beta_i \Delta Z_{t-1} + \varepsilon_t \tag{3}$$

Where:
Z_t = Time-series variables in vector form (RGDP, RPFC, RGFC, RXGS, RMGS, GWGDP).
Δ = 1st difference operator.
μ = Constant term.
β_i = VAR parameters with lags *i*.
ε_t = Vector terms.

Eq. 1 shows all macroeconomic variables in the stationary process and the number of lags.

The lag length (*p*) of *Z* is calculated by two test techniques, the first of which is the Akaike Information Criterion (AIC), and the second of which is the Schwarz Statistics Criterion (SIC). Both tests are entirely based on the maximum value of the likelihood function, with the number of estimated parameters serving as an additional penalizing factor. According to both criteria, increasing model parameters leads to the inclusion of additional lags in the model. The null hypothesis of the VAR model is that the estimated coefficients are zero.

H_0: $\beta_i = 0$ (variables are not co-integrated).

According to the alternative hypothesis, at least one coefficient is not zero. Due to the unrestricted VAR model used in this study, the null hypothesis includes coefficients in all of those equations. The coefficients of the model were estimated using the Ordinary Least Square method.

3.7. Testing Impulse Response Function (IRF)

The impulse response function measures the shocks of endogenous variables and the impact of a unit or a standard deviation shock in the error term relating to the variable *j* in the variable *k*, in *n* periods.

Let $\Delta U_{j,\,t} = 1$, therefore, the impulse response function is:

$$\text{IRF}(n,k,j) = E\begin{bmatrix} \left[Y_{k,t+n} \mid U_{j,t} = 1\right] \\ -E\left[Y_{k,t+n} \mid U_{j,t} = 0\right] \end{bmatrix} \tag{4}$$

Where Y_k is a variable, and U_k is the corresponding error term.

3.8. Testing the Granger Causality Test

Extended version of the Granger causality test used in this study. The Granger test in bivariate regression is expressed as follows:

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \phi_i Y_{t-i} + \sum_{i+1}^{q} \delta_j X_{t-i} + \varepsilon_t \tag{5}$$

$$X_t = \beta_0 + \sum_{i=1}^{p} \pi_i X_{t-i} + \sum_{i+1}^{q} \lambda_i Y_{t-i} + \mu_t \tag{6}$$

Where:
α and β = Constant term;
φ, δ, λ, and π = Estimated coefficients of lagged variables in the bivariate regression form.
p and *q* = The optimal log of the series *Y* and *X*.

The null hypothesis is that the coefficients of lagged X_s in Eq. 5 is jointly equal to zero ($\delta_1 = \delta_2 = \ldots\ldots = \delta_i = 0$) and that the coefficient of lagged Ys in Eq. 6 is jointly equal to zero ($\lambda_1 = \lambda_2 = \ldots\ldots\ldots = \lambda_i$).

If the null hypothesis is rejected through the *F* test, this would represent proof that *X* Granger causes *Y* in Eq. 4, and *Y* Granger causes *X* in Eq. 5. This technique was applied to test Granger's causality between exports and other macroeconomic variables in the study.

4. Results and Discussion

Macroeconomic trends in the Indian economy from 1961 to 2015 are shown in Figure 1. From 1961 to 2015,

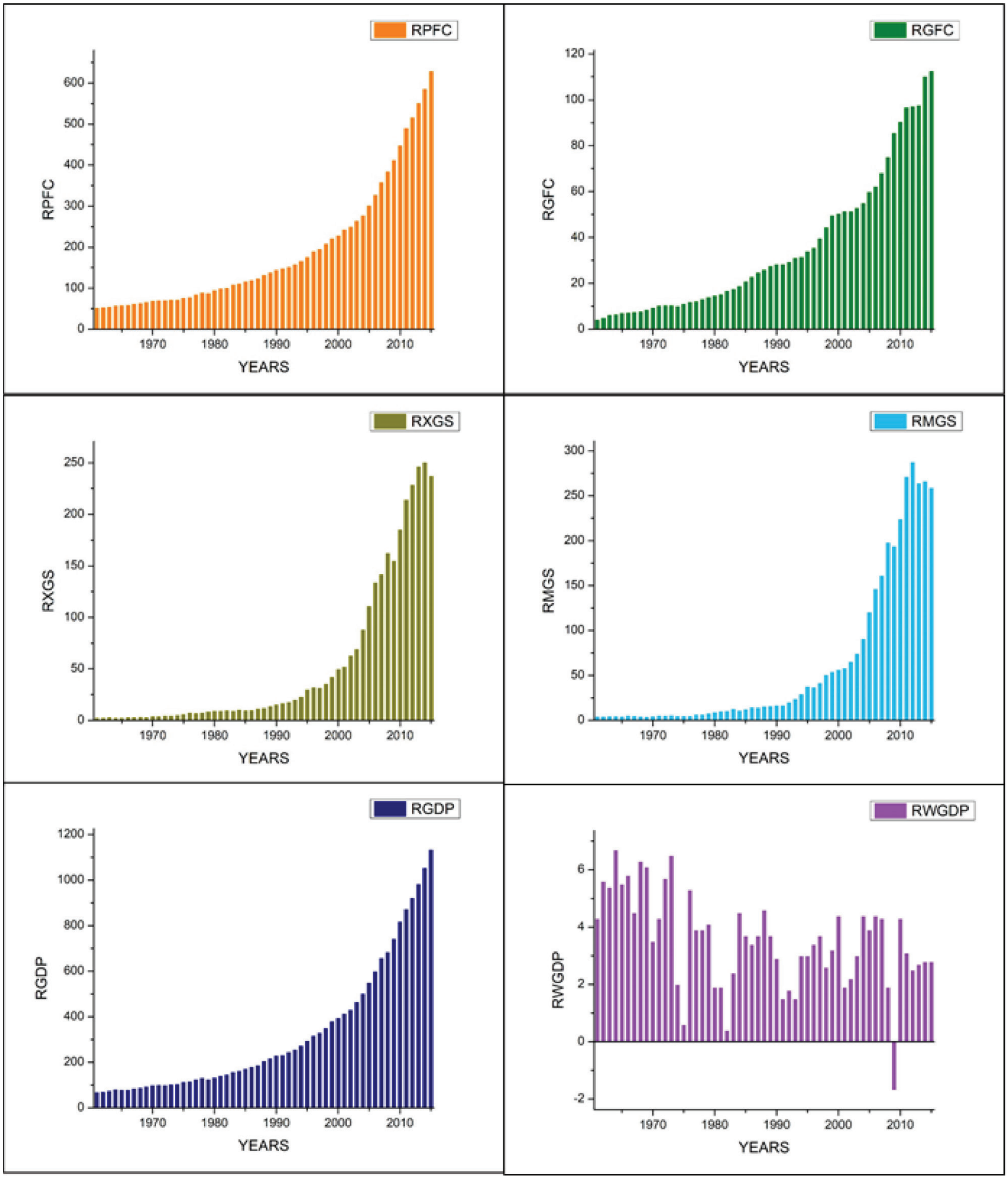

Figure 1: Trends in Macroeconomic Variables in India During the Period 1961–62 to 2015–16 (Billion Rupees in Constant Prices).

Sources (RBI). The real level calculated to using the GDP deflator (2011–12 = 100) RGDP = Real Gross Domestic Product, RPFCE = Real Private Final Consumption Expenditure, RGFCE = Real Government Final Consumption Expenditure, RXGS = Real Exports of Goods and Services, RMGS = Real Imports of Goods and Services and RWGDP = Real World Gross Domestic Product in % Annual.

time-series data for RGDP, RPFCE, RGFCE, RXGS, and RMGS show trends. Although other macroeconomic variables, except for GWGDP, have shown a consistent upward trend, RXGS fell between 2013 and 2015 as the worldwide price of crude and petroleum products fell sharply, and the value of the Indian currency depreciated as well.

The trends identified for the major macroeconomic variables in Fig 1 illustrate that any useful analysis of the complicated relationship between exports and economic growth in the Indian setting requires the application of advanced econometric methods. To determine the relationship between exports and economic growth, many studies used classic econometric techniques such as the ordinary least square method, cointegration, and the Granger causality test (Balassa, 1978; Jin & Yu, 1996). Nevertheless, these econometric techniques generated misleading results that can be ignored. Most of the current study used the VAR model to investigate the cointegration of macroeconomic variables.

4.1. Stationary Tests

The stationarity test seems to be essential to avoid spurious and bias results, which may lead to wrong conclusions. To avoid this situation, the study employed the unit root tests for all variables. RGDP, RPFC, RGFC, RXGS, and RMGS are non-stationary at *I*(0), but GWGDP is stationary at *I*(0) (Table 1). GWGDP is stationary at *I*(0) because it is distinct from other variables, hence, the null hypothesis could not be rejected at *I*(0). Therefore, this test was done again at *I*(1), resulting in non-stationarity except for RMGS. However, at the appropriate significant level, the null hypothesis of the unit root test is rejected at *I*(2). As a result, all variables included in this study follow the second-order of integration, *I*(2), because none of the variables are stationary at *I*(0) and *I*(1). That is, after the second difference, all of the study's variables achieved stationarity.

The results of various statistical tests used to test the stationarity of macroeconomic variables in time series

Table 1: ADF Unit Root Test for Variables

	***I*(0)**	**RGDP**	**RPFC**	**RGFC**	**RXGS**	**RMGS**	**GWGDP**
With Constant	*t*-Statistic	20.0146	21.5224	6.8734	0.3792	4.1659	−4.4446
	Prob.	**1.0000#**	**1.0000#**	**1.0000#**	**0.9800#**	**1.0000#**	**0.0007*** **
With Constant & Trend	*t*-Statistic	8.9035	10.1519	5.9885	−0.1274	3.3300	−5.3577
	Prob.	**1.0000#**	**1.0000#**	**1.0000#**	**0.9929#**	**1.0000#**	**0.0003*** **
Without Constant & Trend	*t*-Statistic	26.1587	2.8422	6.9124	0.7724	3.8535	−1.2420
	Prob.	**1.0000#**	**0.9986#**	**1.0000#**	**0.8770#**	**0.9999#**	**0.1942#**
	***I*(1)**	***d*(RGDP)**	***d*(RPFC)**	***d*(RGFC)**	***d*(RXGS)**	***d*(RMGS)**	***d*(GWGDP)**
With Constant	*t*-Statistic	4.8844	0.9392	3.7384	−0.2324	−4.4630	−8.4707
	Prob.	**1.0000#**	**0.9953#**	**1.0000#**	**0.9268#**	**0.0007**	**0.0000*** **
With Constant & Trend	*t*-Statistic	−2.9909	−1.0767	0.8830	−1.6752	−5.0095	−8.3932
	Prob.	**0.1444#**	**0.9231#**	**0.9997#**	**0.7466#**	**0.0008*** **	0.0000***
Without Constant & Trend	*t*-Statistic	5.3795	1.9557	4.7915	0.3632	−4.0399	−8.5370
	Prob.	**1.0000#**	**0.9869#**	**1.0000#**	**0.7855#**	**0.0001*** **	**0.0000*** **
	***I*(2)**	***d*(RGDP)2**	***d*(RPFC)2**	***d*(RGFC)2**	***d*(RXGS)2**	***d*(RMGS)2**	***d*(GWGDP)2**
With Constant	*t*-Statistic	−8.548890	−12.08171	−6.093635	−2.753252	−8.713392	−6.064613
	Prob.	0.0000***	**0.0000*** **	0.0000***	**0.0729*** **	0.0000***	0.0000
With Constant & Trend	*t*-Statistic	−7.335884	−12.47755	−8.021563	−2.885311	−8.719057	−5.992573
	Prob.	**0.0000*** **	**0.0000*** **	**0.0000*** **	0.0445***	0.0000***	0.0000***
Without Constant & Trend	*t*-Statistic	−8.109691	−11.66809	−0.795980	−2.460234	−8.796668	−6.143879
	Prob.	**0.0000*** **	**0.0000*** **	**0.0000*** **	0.0149***	0.0000***	0.0000***

The lag length is based on SIC (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%; and (#) Not Significant.

1961–2015 are described in Table 2. The Phillips-Perron test statistic in *I*(0) reveals the presence of unit root in all variables except GWGDP, hence the null hypothesis cannot be rejected (Table 2). RGDP and RPFC were not stationary again in *I*(1), therefore, unit root tests were done again in *I*(2), resulting in stationarity for all variables in the study at the second difference.

4.2. VAR Tests

After establishing stationarity in all macroeconomic variables at the second difference (Excluded GWGDP and RMGS, those show stationarity at the level and first difference, respectively. The stationarity in all macroeconomic variables was applied to the VAR model to perform a cointegration test for long-term equilibrium (Table 3).

The estimated regression was primarily explained by independent variables in the equations, depending on the length of the lag and the AIC and SIC criteria. The effects goodness of fit showed that the estimated regression was mostly explained by independent variables in the equations. Furthermore, the *F* test results reveal that the null hypothesis should be rejected at a significant level, implying that all macroeconomic variables are in long-term equilibrium. It signifies that in the long run, all macroeconomic variables have reached steady-state equilibrium. Also shown at the bottom of Table 3 is further information on specification testing.

LM test checks the serial correlation in the VAR model. The null hypothesis should be rejected because the LM test *p*-value is less than the critical value of the test, which means that the VAR model was robust. Normality tests, such as Skewness, Kurtosis, and Jarque-Bera, examine the model's normality distribution error (J–B). Normality tests were unable to reject the null hypothesis, implying that outliers in the VAR model may have generated normality distribution errors in the model.

The table above provides the estimated coefficients in the VAR model system. The length of the lag in the VAR model is based on the AIC and SIC criteria (lag is 2).

Table 2: PP Unit Root Test for Variables

	***I*(0)**	**RGDP**	**RPFC**	**RGFC**	**RXGS**	**RMGS**	**GWGDP**
With Constant	*t*-Statistic	27.9811	19.4208	5.3009	2.9654	1.6873	−4.4446
	Prob.	**1.0000#**	**1.0000#**	**1.0000#**	**1.0000#**	**0.9995#**	**0.0007*** **
With Constant & Trend	*t*-Statistic	12.4727	9.2259	1.3070	0.2502	−0.5256	−5.2839
	Prob.	**1.0000#**	**1.0000#**	**1.0000#**	**0.9979#**	**0.9793#**	**0.0003*** **
Without Constant & Trend	*t*-Statistic	24.7164	15.3454	8.8252	4.3752	2.8052	−1.4470
	Prob.	**1.0000#**	**1.0000#**	**1.0000#**	**1.0000#**	**0.9985#**	**0.1365#**
	***I*(1)**	***d*(RGDP)**	***d*(RPFC)**	***d*(RGFC)**	***d*(RXGS)**	***d*(RMGS)**	***d*(GWGDP)**
With Constant	*t*-Statistic	0.2446	0.8308	−4.6078	−3.9853	−4.4677	−22.6873
	Prob.	**0.9730#**	**0.9937#**	**0.0004*** **	**0.0030*** **	**0.0007*** **	**0.0001*** **
With Constant & Trend	*t*-Statistic	−2.7860	−1.8895	−6.3253	−4.8197	−5.0199	−24.1527
	Prob.	**0.2087#**	**0.6460#**	**0.0000*** **	**0.0014*** **	**0.0008*** **	**0.0001*** **
Without Constant & Trend	*t*-Statistic	1.2989	2.4192	−3.1801	−3.4604	−4.0016	−19.5648
	Prob.	**0.9492#**	**0.9958#**	**0.0020*** **	**0.0009*** **	**0.0001*** **	**0.0000*** **
	***I*(2)**	***d*(RGDP)2**	***d*(RPFC)2**	***d*(RGFC)2**	***d*(RXGS)2**	***d*(RMGS)2**	***d*(GWGDP)2**
With Constant	*t*-Statistic	−11.25852	−13.17214	−18.31146	−11.56492	−14.57690	−37.44296
	Prob.	0.0000***	**0.0000*** **	0.0000***	**0.0000*** **	0.0000***	0.0001***
With Constant & Trend	*t*-Statistic	−22.50218	−20.36078	−19.89214	−11.52690	−14.87014	−36.97614
	Prob.	**0.0001*** **	**0.0001*** **	0.0001***	0.0000***	0.0000***	0.0001***
Without Constant & Trend	*t*-Statistic	−10.31512	−11.82313	−17.37092	−11.68818	−14.88401	−37.95182
	Prob.	**0.0000*** **	**0.0000*** **	**0.0000*** **	0.0000***	0.0000***	0.0000***

The lag length is based on SIC (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%; and (#) Not Significant.

Table 3: Results of the Estimated Vector Auto-Regression (VAR) Model

Variables	RGDP	RPFC	RGFC	RXGS	RMGS	GWGDP
RGDP(−1)	1.398580 (0.23466) [5.96008]	0.379449 (0.09054) [4.19076]	−0.001053 (0.05352) [−0.01967]	0.882832 (0.14233) [6.20285]	0.794129 (0.21737) [3.65330]	0.096081 (0.04466) [2.15150]
RGDP(−2)	−0.197844 (0.29670) [−0.66682]	−0.232108 (0.11448) [−2.02744]	0.214589 (0.06767) [3.17110]	−0.563062 (0.17996) [−3.12887]	−0.266773 (0.27484) [−0.97063]	−0.073875 (0.05646) [−1.30834]
RPFC(−1)	−1.427945 (0.52047) [−2.74356]	0.075356 (0.20083) [0.37523]	0.136462 (0.11871) [1.14957]	−1.069538 (0.31568) [−3.38803]	−0.400291 (0.48213) [−0.83025]	−0.111565 (0.09905) [−1.12635]
RPFC(−2)	1.090897 (0.55919) [1.95087]	0.682402 (0.21577) [3.16271]	−0.306041 (0.12754) [−2.39962]	0.219622 (0.33916) [0.64754]	−0.886462 (0.51800) [−1.71133]	0.036825 (0.10642) [0.34604]
RGFC(−1)	1.659555 (0.93205) [1.78055]	0.781397 (0.35964) [2.17275]	0.955474 (0.21258) [4.49469]	−0.657952 (0.56531) [−1.16387]	1.064904 (0.86339) [1.23340]	0.126262 (0.17738) [0.71183]
RGFC(−2)	−1.467177 (0.92196) [−1.59136]	−0.820053 (0.35574) [−2.30517]	−0.690478 (0.21028) [−3.28364]	1.705762 (0.55920) [3.05038]	0.054583 (0.85405) [0.06391]	−0.071516 (0.17546) [−0.40760]
RXGS(−1)	0.749664 (0.41189) [1.82006]	0.276555 (0.15893) [1.74010]	0.082739 (0.09394) [0.88074]	0.542622 (0.24982) [2.17202]	0.314451 (0.38155) [0.82414]	0.000119 (0.07839) [0.00151]
RXGS(−2)	−0.494523 (0.44722) [−1.10577]	−0.219302 (0.17256) [−1.27085]	−0.388269 (0.10200) [−3.80652]	0.137183 (0.27125) [0.50574]	−0.209747 (0.41428) [−0.50629]	−0.021969 (0.08511) [−0.25812]
RMGS(−1)	−0.184955 (0.22857) [−0.80920]	0.029322 (0.08819) [0.33247]	−0.118109 (0.05213) [−2.26563]	0.314826 (0.13863) [2.27095]	0.773212 (0.21173) [3.65188]	−0.028420 (0.04350) [−0.65335]
RMGS(−2)	0.110512 (0.25295) [0.43689]	0.012253 (0.09760) [0.12554]	0.238189 (0.05769) [4.12861]	0.020874 (0.15342) [0.13606]	0.118795 (0.23432) [0.50698]	0.070061 (0.04814) [1.45540]
GWGDP(−1)	−1.762895 (0.83465) [−2.11214]	−0.323439 (0.32205) [−1.00430]	−0.203516 (0.19036) [−1.06909]	−0.836183 (0.50624) [−1.65176]	−0.471047 (0.77317) [−0.60924]	0.319116 (0.15884) [2.00903]
GWGDP(−2)	0.284748 (0.85034) [0.33486]	−0.393498 (0.32811) [−1.19929]	−0.167466 (0.19394) [−0.86348]	−0.003423 (0.51576) [−0.00664]	−1.255896 (0.78771) [−1.59437]	−0.073975 (0.16183) [−0.45712]
C	12.77798 (11.0670) [1.15460]	8.480760 (4.27028) [1.98600]	0.763761 (2.52413) [0.30258]	21.52472 (6.71247) [3.20667]	33.23979 (10.2518) [3.24233]	5.441964 (2.10615) [2.58384]
R-squared	0.999497	0.999738	0.997674	0.997289	0.995255	0.441348
Adj. R^2	0.999346	0.999660	0.996976	0.996476	0.993832	0.273752
F-statistic	6624.309	12728.19	1429.704	1226.386	699.1755	2.633405

Specification Test for residua autocorrelation: LM(2) = 6.13[0.0466]; Test for the Test for Normality; VAR model Skewness (2) = −1.1158, Chi-sq = 9.2894[0.1579]; Kurtosis(2) = 22.8796, Chi-sq = 10.66547[0.0993]; Jarque−Bera (2) = 19.95497[0.0679].

Standard errors in ( ), *t*-statistics in [ ] and *p*-values in **[ ]**. The LM test is the number of lags, the number of components in the parentheses for the normality test is the number of components.

Johnsen's cointegration test examined the relationship between exports and GDP growth in India; this test used variables of RXGS, RMGS, and RGDP. The null hypothesis proposed no cointegration in these variables; it was verified this hypothesis by checking the Trace, Eigen, and Max-Eigen statistics (Table 4).

Table 4 clearly shows that the p-value of Eigen and Max-Eigen is less than the critical value of probability. So, the null hypothesis should be rejected at a significant level. Hence, there is the existence of cointegration among the variables. This result clearly indicates that there is a long-term relationship between exports and GDP in India. In other words, the cointegration test was confirmed that exports lead to GDP growth in India.

4.3. IRF Tests

The IRF test determines whether a variable's reaction to another variable is at least one standard deviation; it is also known as variable shocks. The following are the results of the IRF analysis as shown in Fig. 2:

- Shock to RGDP educed a positive response from RXGS because the response graph does not go below the zero line.
- Shock to RPFC educed a positive response from RGFC because of the response graph above the zero line.
- Shock to RXGS educed a positive response from RGDP because of the response graph above the zero line.
- Shock to RMGS educed a positive response from RGFC because of the response graph above the zero line.
- Shock to GWGDP educed a positive response from RGDP because of the response graph above the zero line.
- Shock to GWGDP educed a negative response from RGFC at start level and end level but middle level positive.

Figure 2 specifically indicates that the positive responses expired after 2–4 years. This study indicates that changes in all variables are positive. As a result, this finding shows the vital relationship between exports and economic growth in India.

4.4. Granger Causality Tests

Granger Causality test results in Table 5 presented the causal relationship among the macroeconomic variables. GWGDP variable was excluded from the granger causality test because GWGDP was calculated in a percentage unit and other variables calculated in another unit. So, GWGDP has a different order from other variables.

The granger causality test structured these null hypotheses as follows:

1. RXGS does not Granger-Cause RGDP and vice versa.
2. RXGS does not Granger-Cause RPFC and vice versa.
3. RXGS does not Granger-Cause RGFC and vice versa.
4. RXGS does not Granger-Cause RMGS and vice versa.

Table 5 indicates that the first null hypothesis (RXGS non-Granger-Cause RGDP) cannot be rejected; however, the opposite of the null hypothesis (RGDP non-Granger-Cause RXGS) should be rejected with a significance level. The second null hypothesis (RXGS non-Granger-Cause RPFC) cannot be rejected with a significance level; however, the inverse of the null hypothesis (RPFC non-Granger-Cause RXGS) must be rejected. The third null hypothesis (RXGS non-Granger-Cause RGFC) cannot be rejected at the significance level; similarly, the inverse of the null hypothesis (RGFC non-Granger-Cause) should be rejected with a significance level. Finally, the fourth null hypothesis (RXGS non-Granger-Cause) cannot be rejected with a significance level, in the same way; the inverse of

Table 4: Johannsen Co-Integration Test for RGDP, RXGS an RMGS

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.	Max-Eigen Statistic	0.05 Critical Value	Prob.
None*	0.633790	81.27650	29.79707	0.0000	53.24107	21.13162	0.0000
At most 1*	0.372601	28.03544	15.49471	0.0004	24.70719	14.26460	0.0008
At most 2	0.060866	3.328250	3.841466	0.0681	3.328250	3.841466	0.0681

Trace test shows (2) the 0.05 level of co-integration equations. The Max-Eigen value test shows (2) the 0.05 level of co-integration equations.
*Rejection of the null hypothesis of no co-integration at level 0.05.

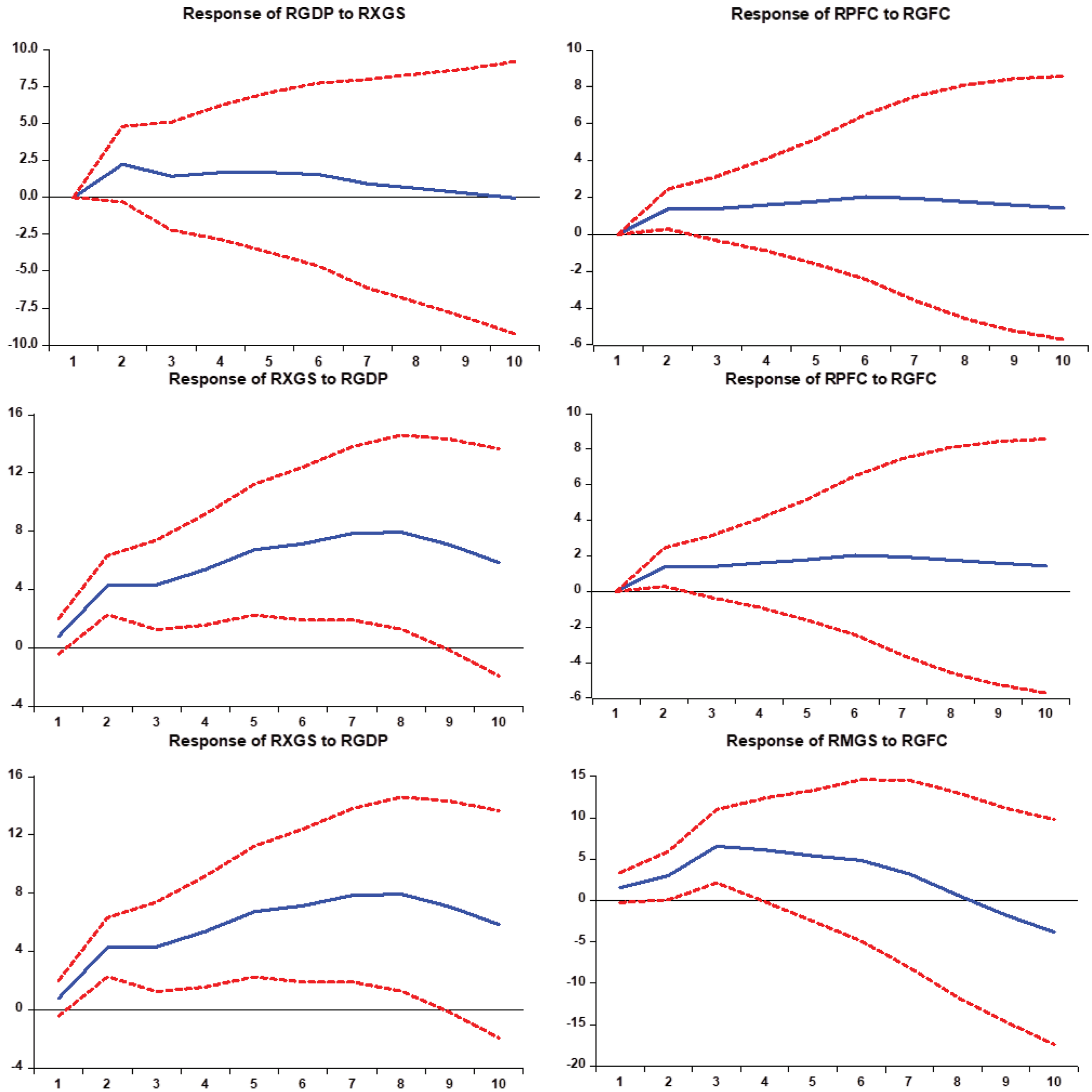

Figure 2: Results of Impulses Response Function to Cholestry 1SD Innovations ±2 SE

the null hypothesis (RMGS non-Granger-Cause) cannot be rejected at the level of significance. It means that the RXGS, RGDP, RPFC, and RGFC have a unidirectional, and RXGS and RMGS have a bidirectional relationship in the long run.

Table 5 shows the findings of the Granger causality test, which reveals that exports are highly related to India's economic growth. This test provides sufficient evidence that exports are vital to India's economic growth. The causality test revealed that exports have a positive impact on India's economic activities. The export sector is also a significant factor in India's economic growth, according to this study (Figure 3).

Table 5: Results of Granger-Causality Tests

Lags: 2				
Null Hypothesis:	**Obs.**	***F*-statistic**	**Prob.**	**Inference**
RXGS does not Granger Cause RGDP	53	0.04370	0.9573	Accepted
RGDP does not Granger Cause RXGS		12.2623	0.0340*	Rejected
RXGS does not Granger Cause RPFC	53	2.31920	0.1093	Accepted
RPFC does not Granger Cause RXGS		4.14064	0.0219*	Rejected
RXGS does not Granger Cause RGFC	53	1.14992	0.3252	Accepted
RGFC does not Granger Cause RXGS		3.46011	0.0395*	Rejected
RXGS does not Granger Cause RMGS	53	1.43609	0.2479*	Accepted
RMGS does not Granger Cause RXGS		2.43802	0.0981	Accepted

Granger causality between real exports (RXGS) and the following economic variables are used in the above tests: RGDP, RPFC, RGFC, and RMGS. * At 5% significance level.

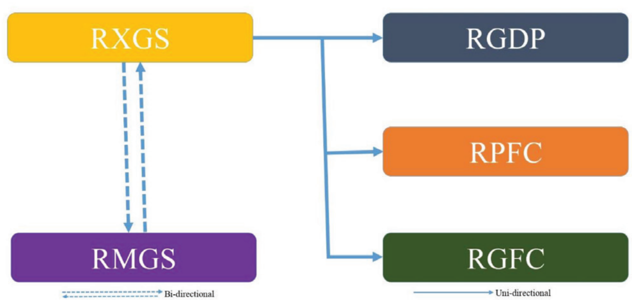

Figure 3: Granger-Causality Between RXGS and the Following Economic Variables: RGDP, RPFC, RGFC, and RMGS

5. Conclusion

The role of exports in economic growth has always remained a contentious topic among economists. This study has tried to clarify controversial issues involved in these studies and investigates the relationship between exports and economic growth in India. In this study, applying modern econometric tools, the present study investigated the long-term relationship between macroeconomic variables from 1961 to 2015. The VAR model involved six equations that provided export support to drive economic growth in India. Co-integration (Table 4) clearly shows that the existence of a long-term stable equilibrium relationship between exports and economic growth. Fig-2 represents IRF shocks generate responses to macroeconomic variables in India; as a result, exports significantly responded to other macroeconomic variables in India. Finally, real exports do not granger cause real GDP, real private final consumption, real government final consumption, or real imports, whereas real GDP, real private final consumption, and real government final consumption granger cause real exports. There is a unidirectional relationship between the variables; it means that the exports are strongly related to economic growth in India.

The overall outcome of this study provides a testimony of the fact that the export sector plays a vital role in economic growth in India and also leads to the long-term growth of other economic activities.

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