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Exploring the Trinity of Exports-Imports-GDP Growth: The Indian Perspective

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Structured Abstract:

Purpose: The present paper intends to analyze three crucial factors, viz. Gross Domestic Product (GDP) growth, imports and exports in an integrated framework, that are expected to exert an influence on the Indian economy. The purpose of this paper is to investigate the cointegrating relationship among the focus variables i.e. Exports, Imports and GDP Growth coupled with the examination of causality. This paper explores the role of imports and exports in India's economic growth.

Design and Methodology: Annual data ranging from 1985-2015 has been employed for this empirical study. A time series based Vector Error Correction Model (VECM) has been proposed centered on the economic theory already there in the literature.

Findings: The results support a judicious mix of export-import strategy. Strategies for exports growth need to be designed to place exports growth on a higher and sustainable growth path. On the imports side, it has become a significant instrument of accessing foreign capital and hence kicks starting further improvements in economic growth. Interestingly, this paper validates the presence of a unidirectional causality running from exports and imports to GDP growth.

Value / Originality: The uniqueness of this paper lies in carrying out a time series analysis by incorporating the three focus variables in a simultaneous equation set-up.

Keywords : Imports, Exports, GDP, Trinity, VECM Modeling.

Jel Classification Codes : C32, C51, O47.

Type: Empirical Research Paper in Macroeconomics.

Introduction

In the present context, India is 10th largest in the world on the basis of nominal GDP and the 3rd largest by purchasing power parity (PPP) measure of GDP. Also, India is the 19th largest exporter and the 10th largest importer in the world at present. The GDP growth rate at constant 2004–05 prices escalated to 8.1 per cent in 2003–04 from 4 per cent in 2002–03 and this rate of growth continued till 2010–11 except for a slowdown during 2008–09. The period

between 2005–07 witnessed some sort of an unparalleled growth recital when the growth rate went above almost 9.5 per cent. However, this matchless performance did not last long as the global recession of 2011–12 brought it down to 6.5 per cent in 2011–12 and further to 4.7 per cent during 2013–14. This resulted in exports as a percentage of imports dropping to 61.4 per cent in 2008–09. The crisis period saw India's oil import bill rising to roughly $118.7 billion, or 9.7 per cent of the GDP. Nonetheless, India has bounced back and is slowly but steadily climbing up the growth path. The three focus variables in this model, namely, GDP growth, imports and exports are inherently related. In the context of globalization, this can be explained by the fact that global markets present a greater opportunity to exploit larger global markets, indicative of an access to further capital inflows, technology, cheaper imports, and a much larger export market. This will eventually fuel up growth prospects of a country. The central idea of this paper is to focus on the trivariate causality among the focus variables so it explicitly does not incorporate other factors such as 'Managed Float'[1] exchange rate, level of FOREX reserve, etc. The speed of trade reform quickened from 1985 during the Rajiv Gandhi government. Restrictions on the import of capital goods were further relaxed to promote technological modernization. Also, during the mid-1980s, there was a renewed emphasis on export promotion. Consequently, this motivated me to explore this trivariate nexus from 1985 onwards.

The rest of the paper has been organized as follows. Section b, gives a brief review of the select literature. The objectives and limitations have been presented in section c. Section d deals with the data used in this empirical analysis, methodological issues and the estimation procedure i.e. the empirical framework. In section e, the econometric results and the discussions thereof have been presented. The paper ends with a conclusion.

Literature Review : A Brief Recapitulation

Strong economic growth coupled with robust export performance leads many people to conclude that export sector of a country has pivotal role in the economic growth of that country. Export-led growth hypothesis has not only been widely accepted by academicians (Feder 1982; Krueger 1990), but it has also shaped the development of a number of countries as well as the policies of the World Bank (Tyler 1981; Balassa 1985). This section will try to

[1] *In this hybrid exchange rate regime the exchange rate is determined through the operation of market forces in the FOREX market but during extreme fluctuations, the central bank intervenes to minimize the fluctuations in its value.*

review the literature on this subject across the world. Many evidences have failed to unequivocally support a robust export-economic growth nexus. Jung and Marshall (1985), for example, based on the standard Granger causality tests, analyzed the relationship between level of exports growth and economic growth using time series data for thirty seven developing countries and found support for the export-led growth hypothesis in only four countries. Darrat (1986, 1987) rejected the exports and economic growth causality for three out of the four countries he analyzed. In another study, out of a sample of eight recently industrialized nations, Chow (1987) got strong bidirectional causality between exports growth and the level of industrial development in seven countries.

When neo-classical economists were trying to come to a theoretical agreement on the export-led growth on account of the success of free-market and outward oriented policies of the East Asian Tigers, several researchers, such as, Bahmani-Oskooee et al. (1991) and Dodaro (1993) came up with mixed results. However, Bhat (1995) re-examined the exports-economic growth liaison for India, and found evidence in support of the bidirectional causality between the level of exports growth and economic growth. Xu (1996) obtained rejection of export-led growth hypothesis for India. Ghatak and Price (1997) concluded that exports growth is caused by the output growth in India. Similar studies by Khan et al. (1995) confirmed the presence of bidirectional causality between exports growth and economic growth for Pakistan. Also, Anwar and Sampath (2000) in their study have re-examined the export-led growth hypothesis for 97 countries (including India and Pakistan) during the period 1960-1992. They found evidence of unidirectional causality in the case of Pakistan and Sri Lanka, and their results confirm the absence of any causality for India. In their analysis, Mamun and Nath (2005) showed that industrial production and exports are cointegrated. Clarke and Ralhan (2005) and Mollik (1996) have supported this causal nexus between exports and growth for the economy of Bangladesh. Thus, it is clear that the literature unambiguously does not vocalize the existence of export-led growth.

Anoruo and Ahmad (2000), Ram (1990) note that imports have positive influence on economic growth. This is theoretically a bit contradictory. But, since their studies were mostly on ASEAN and developing economies, which depend mostly on import of foreign capital for their economic development, the results are consistent. Shifting our focus from export-led growth to the analysis of exports, imports and GDP, Hye and Boubaker (2011) carried out this type of study in Tunisia. Also, Islam, Hye and Shahbaz (2012) have carried out a study in a similar set-up using a panel of 62 countries and Hye (2012) carried out a

similar study for China using the ARDL approach. Not many studies have examined this trivariate liaison in the Indian context. Only Konya and Singh (2006) studied the relationship between GDP, exports and imports in an integrated framework with the dataset ranging from 1951-52 to 2003-04. The novelty of this paper is that it explores this liaison between the focus variables in the post-crisis period for India. As implied by the name of the paper, the aim is to probe into the export-import-GDP structure of India in the last 30 years with an exclusive emphasis on how these variables get endogenously determined from within the system. GDP growth was never incorporated in Konya and Singh (2006). This paper models GDP growth instead of GDP *per se* and redefines the trinity. The question is whether the results of Konya and Singh (2006) hold well in this set-up.

Objectives and Limitations

Studies in the Indian context which have made an attempt have never integrated the three aspects of the trinity i.e. exports, imports and GDP growth together. This paper takes a modest step in this regard. Moreover, the modeling exercise needs a special mention as most empirical studies have used the small open economy assumption and converted the simultaneous equation set-up into a single-equation model in which price variables become exogenous. Realistically, modeling the Indian scenario does not allow us to use the 'small open economy' assumption together with the fact that there is enough simultaneity among the focus variables. Thus, I have moved away from that assumption and introduced a simultaneous equation set-up for estimation by looking at the influence of exports and imports on growth. There are other factors which influence the GDP growth like inflation rate, FOREX reserves, exchange rate, exogenous policy decisions, current account deficit, etc. but these have not been taken into account. This framework will offer atleast rough information on the existing inter-relations among the most fundamental trio of economic variables, namely, Exports, Imports and GDP growth in the Indian context.

The Empirical Framework

1. Model Specifications

In this model, I have used three endogenous, viz., growth of GDP, level of exports and imports. The simultaneous equations representing the model have been mentioned below:

1. $\Delta GDPgr_{i,t} =$

$$\alpha_{1,i} + \varphi_{1,i}ECT_{i,t} + \sum_{j=1}^{k}\beta_{1,j,i}\Delta Exports_{i,t-j} + \sum_{j=1}^{k}\mu_{1,j,i}\Delta Imports_{i,t-j} + \sum_{j=1}^{k}\vartheta_{1,j,i}\Delta GDPgr_{i,t-j} + \varepsilon_{1,i,t}$$

2. $\Delta Exports_{i,t} =$

$$\alpha_{2,i} + \varphi_{2,i}ECT_{i,t} + \sum_{j=1}^{k}\beta_{2,j,i}\Delta Exports_{i,t-j} + \sum_{j=1}^{k}\mu_{2,j,i}\Delta Imports_{i,t-j} + \sum_{j=1}^{k}\vartheta_{2,j,i}\Delta GDPgr_{i,t-j} + \varepsilon_{2,i,t}$$

3. $\Delta Imports_{i,t} =$

$$\alpha_{3,i} + \varphi_{3,i}ECT_{i,t} + \sum_{j=1}^{k}\beta_{3,j,i}\Delta Exports_{i,t-j} + \sum_{j=1}^{k}\mu_{3,j,i}\Delta Imports_{i,t-j} + \sum_{j=1}^{k}\vartheta_{3,j,i}\Delta GDPgr_{i,t-j} + \varepsilon_{3,i,t}$$

2. Data description and Econometric Methodology

Annual data have been compiled from different sources such as, Handbook of Statistics on the Indian Economy, published by the Reserve Bank of India (RBI), Planning Commission database, Central Statistical Organization database and *www.indiastat.com*. The value of exports, imports, have been reported in terms of 'Rupees crores' while GDP growth rate is the growth rate of GDP at market prices and it is expressed in terms of a percentage figure. The framework used for the estimation of this model is a linear one. Before, moving onto the estimation procedure, to check for stationarity, I go for unit root test for each of the individual series by applying the Augmented Dickey Fuller test statistic, for knowing whether the series is trend or difference stationary. The intention is to reject the null hypothesis so that the data series becomes stationary. The estimable equation is given by:

$$\Delta y_t = \mu + \rho t + \tau y_{t-1} + \sum_{j=1}^{k}\varphi_j \Delta y_{t-j} + e_t \qquad \ldots\ldots (4)$$

where, μ is the constant, ρ is the coefficient on the time trend and j is the lag order of the autoregressive (AR) process and Δy_{t-j} captures the autoregressive moving average (ARMA) effect (Dickey & Fuller, 1979, 1981; Elliott et al., 1996). The test procedure is then carried out under the null hypothesis of $\tau = 0$ against the alternative hypothesis of $\tau < 0$. If the null hypothesis is rejected, it can be concluded that there is no unit root and the data is stationary.

Cointegration test proposed by Johansen (1988) is basically an uncomplicated generalization to the n variable case of the Dickey-Fuller Test based on VAR framework. The test statistics used to test for the number of characteristics roots that are significantly different from zero are given below under Johansen (1988):

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{n}\ln(1-\hat{\lambda_i}) \qquad \ldots\ldots (5)$$

$$\lambda_{Max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad \text{..... (6)}$$

[$\hat{\lambda}$ is the estimated value for the *i*-th ordered Eigen value and *r* is the number of cointegrating vectors under the null hypothesis; T = total number of observations.]

- The first test statistic is to test that the number of distinct cointegrating vector is less than or equal to *r* against a general alternative.
- The second test statistics test the null hypothesis that the number of cointegrating vector is *r* against a general alternative of (*r + 1*) cointegrating vectors. The research paper by Johansen (1988) provided the critical values of these statistics obtained using simulation studies. The distribution of these above mentioned statistics depends on the number of non-stationary components under H_0.

Coming to the issue of Granger causality (Granger, 1980), in easy terms, whenever there is some 'surprise' in the explanatory variable that leads to a later increase in the outcome variable we call this variable 'Granger causal' i.e. in technical parlance, if the lagged values of one endogenous variable is significant in explaining the other endogenous variables. Here, the null hypothesis of 'no causality' is tested against the alternative hypothesis of 'presence of granger causality'.

3. Unit Roots Checking

After conducting the ADF (Augmented Dickey Fuller) test, the results in table 1 clearly shows that GDP is stationary at its second difference so integrated of order 2 while the other variables in the model are integrated of order 1 i.e., stationary at the first difference.

[Table 1 about here]

First, a Lagrange Multiplier (LM) test has been done to check whether that lag length is optimum or not. The result reported in table 2 indicates that the optimum lag in this model is 1. The results of the study follow in the next section.

[Table 2 about here]

Results

It should be noted that these variables are considered at their stationary position i.e. at their first difference levels, *viz.* D(Exports), D(Imports). However, GDP growth is at its second

difference i.e., D(D(GDPgr)). A lag of 1 is considered to be optimum for this model given the minimum value of the Akaike information criteria (AIC), Schwarz information criteria (SIC) and Hannan-Quinn criteria (HQC). The direction of causality is going to be decisive as policy prescriptions will centre on the predictions.

For the cointegration analysis, the null hypothesis is the absence of cointegration.

[Table 3 about here]

From Table 3, we see that the p value at *none* is 0.00 < 0.05. Hence, the null hypothesis of 'no cointegration' is rejected. Also, the p value at *at most* 1, *at most* 2 co integrating equation is 0.00 < 0.05. So, the null hypotheses of *at most* 1 and *at most* 2 cointegrating relation are also rejected. But, the null hypothesis of *at mos*t 3 cointegrating equations get accepted as 0.46 > 0.05. Hence, it can be concluded that in this model there exists at most 3 cointegrating relationships. From the above results obtained from the Johansen cointegration test, we found that:

a. Trace test indicates 3 cointegrating equations at the 0.05 level.

b. Max-eigen value test indicates 3 cointegrating equations at the 0.05 level.

Any particular lagged value of one of the variables is retained in the regression if it is significant according to a *t*-test along with the fact that if the other lagged values of the variable jointly add explanatory power to the model according to an *F*-test Then, the null hypothesis of no Granger causality is not rejected if and only if none of the lagged values of the explanatory variables have been retained in the regression.

[Table 4 about here]

There are 3 cointegrating relations in this model. This validates the claim that the focus variables are in fact endogenously related. The results in table 4 show that there is a bidirectional causality running between *Exports and Imports*; *Exports and GDPgr*; *Imports and GDPgr*. Since the focus variables are cointegrated, Fully Modified Ordinary Least Square (FMOLS) estimates proposed by Phillips and Hansen (1990) has been used for estimation purpose. In carrying out this FMOLS regression, *GDPgr* is the dependent variable. However, *Exports* or *Imports* can also become the dependent variable in view of the fact that these three variables are cointegrated.

[Table 5 about here]

Imports significantly affect GDP growth in the positive direction. The results are consistent with Ram (1990) and Anoruo and Ahmad (2000). This confirms the fact that India's growth trajectory is indeed dependent on the import of foreign capital. Moreover, productivity-enhancing impact of imports may be attributed to the recent technological transfers embodied in imports of capital goods from developed countries. Exports and lagged values of exports have a positive impact on GDP growth. This result is quite expected. Thus, this study confirms that trade promotion policy reforms have indeed been useful in accelerating India's overall economic growth.

Conclusion

There is absolutely no denying the fact that the twin processes of globalization and liberalization are determining a novel system of international economic situation, where the changing patterns of investment and trade, the global velocity of financial reforms and the role of technology have become dominant. A robust growth in exports remains one to the most critical factors in the long term viability of India's external sector. So strategies for exports growth need to be designed to place exports growth on a higher and sustainable growth path. On the imports side, it has become an important vehicle of accessing foreign capital initiating further improvements in economic growth. Interestingly, this paper validates the presence of bidirectional causality between exports and imports. Centering the arguments on this proposition, it is clear that not only a judicial mix of export-import policies is required but also fiscal and monetary policies in tune with exchange rate management will go a long way in determining India's growth prospects. The literature has talked about export-led growth but, in an integrated framework as shown here, an economy can also experience import-led growth. Hence, putting unnecessary restrictions on imports and living in a protective cocoon is hardly an optimal solution. The simultaneity among these variables is a hint for the policymakers to judiciously encourage the promotion of both imports and exports. This model also reflects the recent developments on the macroeconomic facade together with deciphering the direction of movement of the focus variables. As already mentioned, there is also a scope of including other variables to give a broader dimension to this subject in the future and the exercise is worth exploring.

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Annexure

Table 1: Unit Root Results

Variables	Level of Stationarity	ADF test statisitc	Probability value	Order of Integration
Imports	First difference	- 4.09*	0.00	I(1)
Exports	First difference	- 4.41*	0.00	I(1)
GDPgr	Second difference	- 6.03*	0.00	I(2)

Source: Compiled by the author

Notes: * indicates significant at 5 per cent level of significance; Results as obtained in Stata 12.

Table 2: LM Test for checking lag length

Lag	AIC	SC	HQ
0	78.27	78.56	78.35
1	73.27*	73.99*	73.48*

Source: Compiled by the author

Notes: * indicates the lag order selected by the criterion

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 3: Cointegration Results

Hypotheses	Trace Test Statistic	p-value	Hypotheses	Eigen value Statistic	p-value
R = 0*	846.20	0.00	R = 0*	46.23	0.00
R = 1*	281.37	0.00	R = 1*	40.07	0.00
R = 2*	154.20	0.00	R = 2*	33.87	0.00

Hypotheses	Trace Test Statistic	p-value	Hypotheses	Eigen value Statistic	p-value
R = 3	15.75	0.46	R = 3	3.84	0.09

Notes: McKinnon-Haug-Michelis (1999) p-values have been considered. R stands for the number of cointegrating vectors. Trace Test indicates 3 cointegrating equations at the 0.05 level;

Compiled by the author; * denotes rejection of the hypothesis at the 0.05 level. Max-eigen value test also indicates 3 cointegrating equations at the 0.05 level.

Table 4: Granger Causality Results

Pair wise Granger Causality Test Results (between Exports and GDP growth)

Null Hypothesis	F-Statistic	Probability
Exports does not Granger Cause *GDPgr*	4.44	0.00*
GDPgr does not Granger Cause *Exports*	7.01	0.00*

Pair wise Granger Causality Test Results (between Imports and GDP growth)

Null Hypothesis	F-Statistic	Probability
*Import*s does not Granger Cause *GDPgr*	5.67	0.00*
GDPgr does not Granger Cause *Imports*	7.48	0.00*

Pair wise Granger Causality Test Results (between Exports and Imports)

Null Hypothesis	F-Statistic	Probability
Exports does not Granger Cause *Imports*	6.07	0.00*
Imports does not Granger Cause *Exports*	5.90	0.00*

Source: Compiled by the author

Notes: * indicates significant at 5 per cent level of significance; Results as obtained in Stata 12

Table 5: FMOLS Results (Linear Trend)

Dependent variable : GDP				
Variable	**Coefficient**	**Standard error**	**t-statistic**	**Probability value**
Imports	0.46	0.16	4.81	0.00*
Exports	1.16	4.13	5.92	0.00*
$Import_{t-1}$	0.02	4.67	3.33	0.00*

Dependent variable : GDP				
Variable	**Coefficient**	**Standard error**	**t-statistic**	**Probability value**
$Export_{t-1}$	0.67	8.91	-4.46	0.00*
Constant	35.7	81.81	0.09	0.99
R^2 Value : 0.94 ; Adjusted R^2 value : 0.93				

Source: Compiled by the author

Notes: * indicates significant at 5 per cent level of significance; Results as obtained in Stata 12;