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Determinants of Exports in India

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Abstract: ***This paper examines the responsiveness of exports to FDI taking into account responsiveness to other determinants. Using 46 year annual data of the variables and applying various time series techniques such as unit root, cointegration, ARDL and ECM; the results show cointegration relationships among the variables as a whole. The results also show the existence of long run and short run causality from the determinants to exports.***

Keyword: ARDL and ECM; the results show cointegration relationships among the variables as a whole.

I. INTRODUCTION

Although the primary objective of the study is to investigate the exports-FDI relationship in India (Das, 2018), the study has been extended by including other determinants of exports besides FDI. This will provide us more insights about the exports behaviour in India. There are several demand-side, supply-side factors and policy issues which can affect export behaviour of a country. We expect, inclusion of other determinants will provide us a more realistic picture about the exports-FDI relationship. Using multi-variate time series analysis and collecting data from UNCTAD and from RBI for the period between 1970 and 2015, the objective of the study is to empirically examine the major determinants of exports in India.

The theoretical foundation of the determinants of exports lies in the conventional trade theories. The absolute cost advantage of Adam Smith and the comparative cost advantage of Ricardo advocate countries to exports the commodity which have absolute advantage and comparative advantage respectively in the production of the commodity. On the other hand, the Heckscher-Ohlin theory explains the causes of the comparative advantage and suggests a country to export the commodity whose production requires the intensive use of the country's relatively abundant factor (Salvator, 2012). Besides these conventional theories of international trade, the modern theories such as new growth theory and endogenous growth theory suggests removal of trade barriers, research and development, economies of scale, reduction of price distortions, FDI, innovation, specialization and efficiency of production *etc.* are the some of the determinants of exports (Salvator, 2012).

Based on these theories, various studies explain numerous determinants of exports while examining the exports-FDI relationships. For example, Xuan and Xing (2008) in their investigation of whether FDI in transitional economies promote their exports or not took other determinants like GDP, real bilateral exchange rate and free trade agreements along FDI in their gravity model.

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Zhang and Song (2000) in their study on the effects of FDI on exports in China took growth of GDP,
lag exports, domestic investment share of manufacturing output and exchange rate in their panel data approach. Likewise Njong and Raymond (2011) in their study on effects of FDI inflows on export growth in Cameroon took real effective exchange rate, real GDP, trade liberalization index, external market access indicator and lag exports as the determinants of exports. Moreover, Sharma (2000) in his study on whether or not FDI had made any significant contribution to India's export growth took real effective exchange rate, relative prices of exports, world income, lagged export demand for demand equation and Indian export prices relative to domestic prices, domestic demand pressure, FDI, infrastructure facilities, lagged export supply *etc.* for supply equation in his simultaneous equation approach. Furthermore, Athukorala (2002) mentioned the real depreciation of exchange rate, liberalization in investment policy and the provision of export subsidies as some of the determinants that contributed India's exports development.

The paper proceeds as follows: second section deals with the determinants used in the study and data source and methodology of the study are presented in the third section. The results and discussion are presented in fourth section and the Chapter ends with the conclusion in the fifth section.

II. DETERMINANTS OF EXPORTS USED FOR THE STUDY

Although the literature suggests a lot of determinants of exports, we cannot include all the determinants for our study due to unavailability of data and for analytical complexities. We tried to include maximum variables. Since we have only 46 observations, we selected two demand side determinants *viz.*, World GDP and real effective exchange rate; two supply side determinants, *viz.*, FDI inflows and India's own GDP; and one variable representing the policy issues, *i.e.* trade liberalization index. We find applying these determinants help us to include maximum variables. However, inclusion of external market access determinants and lag exports permits only two or three variables to work with the model whereas, trade liberalisation index, a proxy of export policy issue, enables us to work with five variables. Moreover, inclusion of lag exports and external market access indicators increases the chance of violation of serially independence assumption of the residuals.

Foreign Direct Investment:

The impact of FDI on exports is not clearly established and ambiguous in the international trade literature (Liu and Shu, 2003; Sharma, 2000). Moreover, the role of FDI in export promotion in developing countries is depends on the motive behind such investment (Sharma, 2000).

If the motive is to bypass the trade barriers and capture the domestic market in the host country, then there is no possibility of export promotion; on the other hand, if the motive is to take advantage of the host country's comparative advantage, then FDI will contribute to export promotion (Sharma, 2000). We suppose FDI has been contributing to India's export promotion and expect the coefficient has a positive sign.

***India's GDP**:*

The GDP of India is used as a proxy for the supply capacity of the country (Njong and Raymond, 2011). The coefficient of GDP is expected to have a positive sign as it is expected to capture the effects of increased supply capacity due to FDI inflows (Njong and Raymond, 2011).

***World GDP**:*

From demand side we take World income as a determinant of exports. World income seems to have a positive impact on exports (Sharma, 2000) because as the world income increases the demand for exports also increases. The coefficient is expected to have a positive sign.

***Real Effective Exchange Rate**:*

Another determinant from the demand side is real effective exchange rate[1]. This determinant is taken as it is a good measure that captures competitiveness (Njong and Raymond, 2011) of an economy. The appreciation of real effective exchange rate reduces the export demand (Joshi and Little, 1994 and Srinivasan, 1998 as cited by Sharma, 2000; Njong and Raymond, 2011) and thus the coefficient is expected to have a negative sign. Because appreciation of exchange rate leads to reduction of the value of the foreign currency and they have to pay more than earlier hence the demand for exports reduce.

***Trade Liberalization Index**:*

The trade liberalization index is included as a proxy of policy issues. It is expected to capture the liberalization measures undertaken by the country. The index is calculated as the import ratio on total international trade volume (Bamoul *et al*., 2006 as cited by Njong and Raymond, 2011). The coefficient is expected to have a positive sign.

III. III. DATA SOURCE AND METHODOLOGY

Data used for this paper is purely secondary in nature and these data have been collected from various secondary sources such as UNCTAD and RBI. The current prices values are converted into constant prices so that we can avoid the potential effects of prices and to avoid biases. Moreover, the real effective exchange rate (REER) data are available in different base periods. To combine these various index numbers covering different base periods, we applied splicing method to make the series in to one single series, taking 2005 as the base year. The data are transformed into the logarithmic (natural logarithm) values so that changes in the variables represent the relative changes or percentage changes after multiplication by 100 (Gujarati, 2011). For analysis, various time series techniques such as unit root, cointegration, FM-OLS, ARDL *etc.* have been applied.

From export-FDI theories and existing literature, we find various factors that influence a country's exports. Some of these are shown through the following export function:

$$X = f(F, G, WG, RE, TL, U) \quad (1)$$

Where X is exports, F= foreign direct investment inflows, G= the country's own Gross Domestic Product, WG= world GDP, RE= real effective exchange rate, TL= trade liberalization index and U covers the other variables that influence a country's exports.

The use of time series technique depends on stationarity of the variables. Since we want to include some other variables along with FDI to investigate their impact on exports, therefore, their stationarity will help us to determine which time series technique to be used. To check the stationarity, we have applied two most popular unit root tests *viz.* ADF and PP test. The equation for ADF test is:

$$\Delta Y_t = \alpha_t + \beta T + \delta Y_{t-1} + \Theta i \sum \Delta Y_{t-i} + \epsilon_t \quad (2)$$

Where Y stands for concerned variable, 'T' is the time trend and ϵ is the error term. If $\delta=0$ then the series is stationary if not then the series is non-stationary. For Phillips-Perron test, the equation to be estimated is:

$$\Delta Y_t = \alpha + \beta T + \pi Y_{t-1} + u_t \quad (3)$$

Where Y is the series concerned, 'T' the time trend and u_t is the error term. For stationarity, $\pi = 0$. If $\pi \neq 0$, then the series is non-stationary.

From the unit root test (Table 1), we find that all the variables are non-stationary at level but stationary at first difference, *i.e.*, they are integrated of order one I(1). Therefore, we used Johansen cointegration test (1991) to see the long run relationship between exports and its determinants. The equation for cointegration analysis is:

$$X_t = \beta_0 + \beta_1 F_t + \beta_2 G_t + \beta_3 WG_t + \beta_4 RE_t + \beta_5 TL_t + u_t \quad (4)$$

The Johansen procedure is a system estimation and it applies maximum likelihood to the VAR model with the assumption that the errors are normally distributed (Maddala and Kim, 1998). But the procedure is very sensitive when the errors are not normal (Huang and Yang, 1996 as cited by Maddala and Kim, 1998). Moreover, the Johansen procedure produces more outliers than other procedure (Phillips, 1994 as cited by Maddala and Kim, 1998). Furthermore, the study of Gonzalo and Lee (Maddala and Kim, 1998) shows that this procedure tend to find spurious cointegration in some situations.

Although the Johansen procedure suggest cointegration relationship between exports and its determinants, there are some problems which can affect the validity of the model. *First*, India experienced a major liberalization process during early 1990s. This liberalization process led to India's increased participation in world trade and increased inflows of foreign investment. Moreover, the liberalization process continued and the inflows of foreign capital during the first decade of 20th century show a steep increased.

But the effects of these events are not estimated in the Johansen method. Furthermore, these events may affect the results of unit root test (Perron (1989) as cited by Rad (2009). *Second*, with 46 observations, the Johansen test can be subject to size and power biased (Rad, 2009). In such a short span of time, the structural break may not give us fruitful results.

1. [1]EER data are available in different base periods. To combine these various index numbers covering different base periods, we applied splicing method to make the series in to one single series, taking 2005 as the base year

Third, it will not be possible to investigate short run relationship and causality under Johansen procedure with 46 observations and six variables. Because, Johansen procedure is a system analysis, it will estimate six equations for six variables. With lag, the number of coefficients may exceed the number of observations.

Besides these problems of Johansen procedure, the observations are also low and we have more than two variables. In that case, instead of using Johansen Contegration procedure or Engle-Granger approach, here we used Autoregressive Distributed Lag (ARDL) model of Pesaran and Shin (1995). The ARDL procedure is appropriate because it estimates the long run effects and short run effects jointly (Rad, 2009). Unlike Johansen procedure, it is not a system equation, but single equation model. Moreover, the ARDL approach of cointegration is the most appropriate approach for small sample. Furthermore, the ARDL approach allows both I(0) and I(1) variables (Maddala and Kim, 1998), thus, unit root may not be a problem. Moreover, another interesting property of ARDL model is that it can be calculated its long run or static equilibrium solutions (Brooks, 2008). The basic form of equation to be estimated through ARDL is:

$$X_t = C_t + \alpha_i\sum X_{t-i} + \beta_j\sum F_{t-j} + \gamma_k\sum G_{t-k} + \theta_m\sum WG_{t-m} + \varphi_n\sum RE_{t-n} + \zeta_p\sum TL_{t-p} + \varepsilon_t \quad (5)$$

Where ε_t is the random disturbance term and X_{t-i} represents the autoregressive term. To check the short run causality under ARDL model, the following conditional ECM is used:

$$\Delta X_t = C_t + \alpha_i\sum X_{t-i} + \beta_j\sum \Delta F_{t-j} + \gamma_k\sum \Delta G_{t-k} + \theta_m\sum \Delta WG_{t-m} + \varphi_n\sum \Delta RE_{t-n} + \zeta_p\sum \Delta TL_{t-p} + X_{t-1} + G_{t-1} + F_{t-1} + WG_{t-1} + RE_{t-1} + TL_{t-1} + \varepsilon_t \quad (6)$$

Where, C_t is the constant, $\varepsilon_t$is the error term and $X_{t-1} + G_{t-1} + F_{t-1} + WG_{t-1} + RE_{t-1} + TL_{t-1}$represents the long run cointegrating regression.

IV. RESULTS AND DISCUSSION

Since the first step of time series analysis is to check whether the series are stationary or not, we used the two most popular unit root tests *viz.*, ADF and PP test. After that we examine the cointegration relationships among the variables and then apply ARDL and ECM to get a more realistic picture of their relationship.

4.1. Unit Root Test:

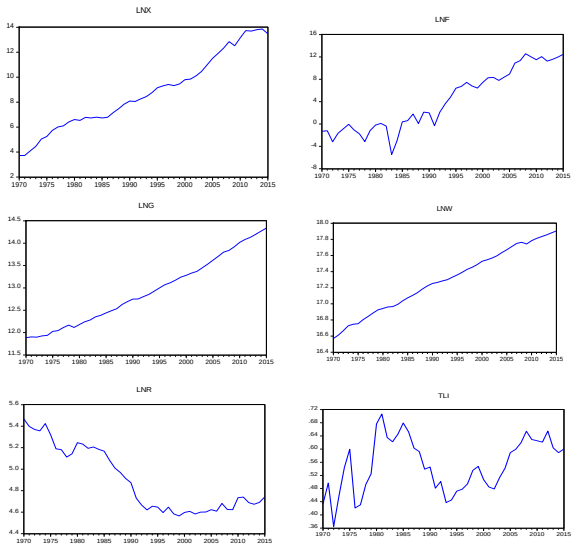
Table 1: Unit Root Test Results

	ADF		Phillips Perron		Decision
Variable	Level	1st Diff.	Level	1st Diff.	
*ln*X	-2.87 (0.18)	-5.14 (0.00*)	-2.00 (0.58)	-5.33 (0.00*)	I(1)
*ln*F	-3.29 (0.08)	-5.62 (0.00*)	-3.13 (0.11)	-11.99 (0.00*)	I(1)
*ln*G	3.44 (1.00)	-5.77 (0.00*)	3.91 (1.00)	-5.78 (0.00*)	I(1)
*ln*WG	-3.45 (0.06)	-5.28 (0.00*)	-2.78 (0.21)	-5.66 (0.00*)	I(1)
*ln*RE	-2.10 (0.25)	-5.47 (0.00*)	-2.05 (0.26)	-5.44 (0.00*)	I(1)
TLI	-2.59 (0.10)	-6.91 (0.00*)	-2.55 (0.11)	-9.35 (0.00*)	I(1)

Note:
1. Figures in the brackets ( ) indicates (in ADF Test) the Mackinnon one sided 'p'-values for rejection of null hypothesis.
2. Figures in the brackets ( ) indicate (in PP Test) MacKinnon (1996) one-sided 'p'-values for rejection of null hypothesis.
3. * represents rejection of null hypothesis at 0.05 per cent or less level of significance.

Table 1 shows the results of unit root tests. It is observed from Table 1 that all the variables are non-stationary at level but stationary at first difference at 5 per cent level of significance. The results are consistent with both the ADF and PP tests. Although we present a line chart of the variables in Chart 1, we followed a systematic procedure to include trend and intercept or intercept or no trend and no intercept. First we include trend and intercept and check their significance level. If they are not significant we include only intercept and if intercept is also insignificant then we include none in both the ADF and PP unit root tests.

Chart 1: Line Chart for *ln*X, *ln*F, *ln*G, *ln*WG, *ln*RE and TL



Source: Authors's own derivation

The graphical representations of the six time series *viz.*, exports, FDI, India's GDP, World GDP, real effective exchange rate in their natural log forms and trade liberalization index are presented in Chart 1. Exports, FDI, India's GDP and World GDP show both intercept and an upward trend, while real effective exchange rate shows intercept and downward trend. The trade liberalization index[2] has intercept but its trend is indistinct. The graphs also helps us in deciding whether to include trend and intercept in unit root testing besides checking the significance of trend and intercept in unit root test results.

4.2. Cointegration:

[2]The TL variable is not converted to logarithmic values since the variable is already in percentage form.

Table 2: Johansen Cointegration Test results

		Linear Deterministic Trend		No deterministic trend		Quadratic Deterministic Trend
Test Stats.	Null Hypothesis	Intercept, no trend	Intercept, and trend	No intercept, no trend	Intercept, no trend	Intercept and Trend
Trace Statistics	None	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	At most 1	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	At most 2	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	At most 3	0.0013*	0.0001*	0.0005*	0.0000*	0.0013*
	At most 4	0.0149*	0.0325*	0.0123*	0.0106*	0.0177*
	At most 5	0.0671	0.6771	0.0651	0.1039	0.6132
Maximum Eigen Value	None	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	At most 1	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	At most 2	0.0000*	0.0000*	0.0003*	0.0000*	0.0000*
	At most 3	0.0278*	0.0006*	0.0089*	0.0002*	0.0267*
	At most 4	0.0316*	0.0147*	0.0341*	0.0038*	0.0119*
	At most 5	0.0671	0.6771	0.0651	0.1039	0.6132

Note:
1. *denotes rejection of null hypothesis that there is no cointegration at 0.05 per cent or less level of significance.
2. Figure shows the 'p' values for the null hypothesis that there is at most one cointegration
3. Lag length has been chosen on the basis of AIC's automatic lag selection procedure taking maximum lags equal to the cube root of the number of observations.

The cointegration results are presented in Table 2. To carry out the cointegration relationship among the variables, Johansen cointegration test have been applied. Since some variables have trend and intercept, some variables have only intercept and some variable have no trend and intercept; therefore it is difficult for us to decide which cointegration test specification to include. Therefore, we examine the cointegration test by applying all the cointegration test specifications under Johansen procedure. Moreover, to select the optimum lag, the lag length criteria under VAR have been checked. And the trace statistics of all the test specifications rejects the null hypothesis that there is no cointegration among the variable. Same is the case with maximum Eigen value statistics. All the test specifications under Johansen procedure show that there are 5 cointegrating relationships among the variables. Therefore, Johansen procedure suggests presence of cointegration among the variables. The summary of the Johansen Cointegration results are presented in Table 3.

Table 3: Number of Cointegrating Relations by Model

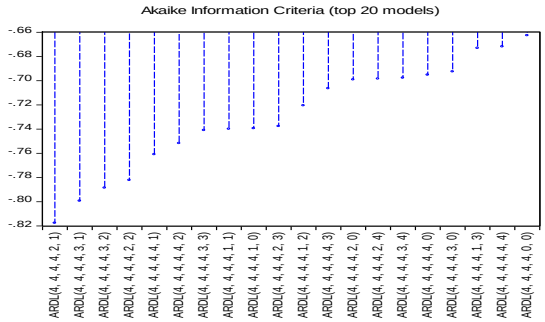
Data Trend	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	5	5	5	5	5
Max-Eig	5	5	5	5	5

Note: Critical Values based on MacKinnon-Haug-Michellis

4.3. Autoregressive Distributed Lag (ARDL) Model:

We start with maximum lag 4. With maximum lag 4, we estimated ARDL (4,4,4,4,2,1)model as suggested by AIC and which is the optimal model as suggested by criteria graph (Chart 2). The recursive estimate CUSUM test under stability diagnostics shows the model is stable. Furthermore, the residual diagnostics also shows that the residuals are normally distributed and no heteroskedasticity among the residuals but it fails in serial correlation test. The presence of serial correlation is predictable because the model takes the 4 lag values of the dependent variable. The results are presented in Table 5.

Chart 2.: Criteria Graph



Sorce: Derived from ARDL System

To justify the selection of ARDL (4,4,4,4,2,1) model over other models, Chart 2 provides the answer. The ARDL approach evaluated 12500 models. Out of these we select the ARDL (4,4,4,4,2,1) model because the criteria graph in Chart 2 shows that the ARDL (4,4,4,4,2,1) models appears strong over other models.

Table 4: ARDL Results [*ln*X is the Dependent Variable] Selected Model: ARDL(4,4,4,4,2,1) , Selected on the basis of AIC

Sl No	Coefficient	Coefficient Values	Prob.
1	*ln*X(-1)	0.71	0.0032***
2	*ln*X(-2)	-0.04	0.8653
3	*ln*X(-3)	0.22	0.4008
4	*ln*X(-4)	-0.95	0.0015***
5	*ln*F	-0.03	0.4118
6	*ln*F(-1)	0.00	0.9729
7	*ln*F(-2)	0.04	0.1767
8	*ln*F(-3)	-0.04	0.1532
9	*ln*F(-4)	-0.07	0.0173**
10	*ln*G	-3.24	0.0420**
11	*ln*G(-1)	3.52	0.0956
12	*ln*G(-2)	2.71	0.2476
13	*ln*G(-3)	1.48	0.3462
14	*ln*G(-4)	3.17	0.0336**
15	*ln*W	11.36	0.0023***
16	*ln*W(-1)	-10.16	0.0239**
17	*ln*W(-2)	-0.83	0.8657
18	*ln*W(-3)	-7.26	0.2824
19	*ln*W(-4)	15.11	0.0053***
20	*ln*RE	.29	0.1300
21	*ln*RE(-1)	-1.36	0.1975
22	*Ln*RE(-2)	-1.50	0.1633
23	TLI	1.42	0.2871
24	TLI(-1)	2.67	0.1018
25	Constant	-214.28	0.0018***
26	Trend	-0.44	0.0040***
27	R^2	0.99	NA
28	F-Statistics	609.46	0.0000***

Note: *** and** denote significant levels at 1%, and 5% level of significance respectively.

It is observed from Table 4 that only 8 determinants are significant. They are *ln*X(-1), *ln*X(-4), *ln*F(-4), *ln*G, *ln*G(-4), *ln*W, *ln*W(-1) and *ln*W(-4). Moreover, the Trend component of the model is significant with a high coefficient values. The R^2 value is very high implying the goodness of fit of our model and the overall significance represented by F statistics is also highly significant.

Table 5: Bound Test
H_0: No Long run relationships exist

Test Statistics	Value	k
F-Statistics	5.41	5

Note: The critical values for lower bound are 2.49, 2.81, and 3.5 at 10%, 5% and 1% level of significant respectively and the critical values for upper bound are 3.38, 3.76 and 4.63 at the same level of significance.

In Table 5, the result of ARDL bound test has been shown. The ARDL bound test was suggested by Pesaran and Shin (1997) to check the cointegration relationship. It is obvious from the above table that the value of F-statistics is greater than the critical values of upper bound in all the level of significance. The null hypothesis is that there is no long run relationship. Since the value is greater than the critical values of upper bound even at one per cent level of significance, we can reject the null hypothesis. The implication is that there is existence of long run relationship between exports and other determinants.

After finding cointegration relationship, we examined the error correction model under ARDL approach. The error correction model shows the short run relationship and causality between exports and its determinants. The results of ECM are presented in Table 6.

Cointegration Based on ECM:

Table 6: Error Correction Mechanism [D(*ln*X) is the Dependent Variable]

Sl No	Coefficient	Coefficient Values	Prob.
1	D(*ln*X(-1))	0.77	0.0001***
2	D(*ln*X(-2))	0.73	0.0002***
3	D(*ln*X(-3))	0.95	0.0001***
4	D(*ln*F)	-0.03	0.1356
5	D(*ln*F(-1))	0.07	0.0020***
6	D(*ln*F(-2))	0.11	0.0001***
7	D(*ln*F(-3))	0.07	0.0010***
8	D(*ln*G)	-3.24	0.0051***
9	D(*ln*G(-1))	-7.37	0.0009***
10	D(*ln*G(-2))	-4.66	0.0004***
11	D(*ln*G(-3))	-3.17	0.0008***
12	D(*ln*WG)	11.36	0.0000***
13	D(*ln*WG(-1))	-7.01	0.0082***
14	D(*ln*WG(-2))	-7.84	0.0148***
15	D(*ln*WG(-3))	-15.11	0.0013***
16	D(*ln*RE)	1.29	0.0347**
17	D(*ln*RE(-1))	1.50	0.0299**
18	D(TLI)	1.42	0.1535
19	Constant	-214.73	0.0000***
20	CointEq(-1) or ECT	-1.07	0.0000***

Note: ***, ** and * denotes significant levels at 1%, 5% and 10* level of significance respectively.

The cointegration and long run causality form the determinants to exports under ARDL are reported in Table 6. The error correction coefficient is represented by cointegrating equation (-1) the value of which is (-1.07) negative and highly significant. It implies, there is long run causality from the determinants to exports. Moreover, the error term corrects the previous year's disequilibrium by 107 per cent indicating strong causality from the determinants to exports. The other coefficients in Table 4 show the short run relationship with exports. Most of the coefficients are significant that shows short run causality to exports. Thus there is both short run and long run causality from these variables to exports. The long run coefficients are reported in Table 7. Since there is long run and short run relationship and causality between exports and its determinants, the regression model is not spurious. Therefore, the results obtained using OLS are the long run coefficients which is presented in Table 7.

Table 7: Long Run Coefficients [*ln*X is the Dependent Variable]

Sl No	Coefficient	Coefficient Values	Prob.
1	*ln*F	-0.09	0.0596*
2	*ln*G	7.18	0.0000***
3	*ln*WG	7.70	0.0350**
4	*ln*RE	-1.48	0.0917*
5	TLI	3.83	0.0014***
6	Trend	-0.41	0.0028***

Note: ***, ** and * denotes significant levels at 1%, 5% and 10* level of significance respectively.

The long run coefficients show that India's own GDP and trade liberalisation index are significant at 1 per cent level of significant and World GDP is significant at 5 per cent level of significance. REER is significant at 10 per cent level, and FDI is also significant at 10 per cent but it is negative which implies no long run influence on exports. Moreover, the trend component is also highly significant.

V. CONCLUSION

Balasubramanyam and Sapsford and cited by Prasanna (2010), argued that there are various factors which determine a country's level of exports other than FDI. on the basis of this argument, the study aims to investigate the determinants of exports in India. With this objective, data are collected for 46 years period and various time series techniques have been used. From the analysis, it is established that there is cointegration between exports and its determinants viz., FDI, India's GDP, World GDP, REER, and TLI. Further, it is found that there is causality from the above mentioned variables to exports. Moreover, the long run coefficient suggests that the variables, except FDI, have their expected signs and high coefficient values and are significant. Therefore, a high GDP has to be maintained along with a stable exchange rate to avoid the export risks of the country. TLI being highly significant, points to the need to liberalize trade further. Therefore, from the findings of the analysis we can conclude that there is long run relationship between these factors and exports and long run and short run causality from these factors to export.

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