Analytical Aspects of Foreign Trade in India

*Somenath Mukherjee
M.Sc. (Economics), M.phil

***Abstract*:** Foreign trade is one of the important mediums to develop a country's GDP and per capita income. As strong the foreign trade of a country, stable will be the internal economy of that country. So, there is an important role of foreign trade in trade balance. Before independence Government of India maintained semi-diplomatic relations with the countries. In free India, trade transform into trading group with major trading partners. We analyze the foreign trade in India with the help of some different statistical and econometrics tools.

Keywords: Gross domestic product (GDP), Internal economy, Per capita income, Trade balance, semi-diplomatic.

1.1**Introduction:** Foreign trade has got an important place in the economic development of a country. What is the importance of foreign trade for economic development of country is stated below:

Firstly, foreign trade helps to produce those commodities which have a comparative cheaper cost than others. It results in less cost of production in producing a commodity. If all the countries adopt this procedure to produce these goods in. which they have less comparative cost, it will lead to availability of goods at a lower price.

Secondly, foreign trade increases the scope of market because of domestic demand and foreign demand for the product. So there is mass production. If the production of goods increases, average cost declines and price of goods declines.

Thirdly, foreign trade helps the people to get different varieties of goods both in quantities terms and qualitative terms.

Fourthly, foreign trade helps a developing country like India in its economic development. Iron and steel industry, has been established due to stored iron-ore and coal. But for the establishment of this type industry, we have to import technical knowledge from foreign countries. Had there been no foreign trade, then it would not have been only difficult but also too expensive.

Without foreign trade, it is not possible to fulfill the demand for petroleum products and it will retard the economic development of our country. There is also scarcity of consumer goods due to natural calamities or due to any other reason. During the time scarcity of consumer goods, we import these goods from foreign countries and keep prices stable which help people to get their commodities.

Industrialization, advanced transportation, globalization, multinational corporations, and outsourcing are all having a major impact on the international trade system. Increasinginternational trade is crucial to the continuance of globalization. Without international trade, nations would be limited to the goods and services produced within their own borders.

International trade is in principle not different from domestic trade as the motivation and the behaviour of parties involved in a trade do not change fundamentally regardless of whether trade is across a border or not. The main difference is that international trade is typically more costly than domestic trade.

The reason is that a border typically imposes additional costs such as tariffs, time costs due to border delays and costs associated with country differences such as language, the legal system or culture. International trade consists of 'export trade' and 'import trade'. Export involves sale of goods and services to other countries. Import consists of purchases from other countries.

International or Foreign trade is recognized as the most significant determinants of economic development of a country, all over the world. The foreign trade of a country consists of inward (import) and outward (export) movement of goods and services, which results into. Outflow and inflow of foreign exchange. Thus it is also called EXIM Trade.

For providing, regulating, and creating necessary environment for its orderly growth, several Acts have been put in place. The foreign trade of India is governed by the Foreign Trade (Development & Regulation) Act, 1992 and the rules and orders issued there under. Payments for import and export transactions are governed by Foreign Exchange Management Act, 1999. Customs Act, 1962 governs the physical movement of goods and services through various modes of transportation.

To make India a quality producer and exporter of goods and services, apart from projecting such image, an important Act – Exports (Quality control & inspection) Act, 1963 has been in vogue. Developmental pace of foreign trade is dependent on the Export-Import Policy adopted by the country too. Even the EXIM Policy 2002-2007 lays its stress to simplify procedures, sharply, to further reduce transaction costs.

1.2**Objective of the study:** Objective of the present study is twofold.

1) Firstly, statistically we analyze the India's trade pattern (export and import) and trade balance.

2) Lastly, we investigate the impulse response function of export, import and trade balance in India. Then we describe forecast result and Granger causality outcome.

1.3 Literature Review: There are many articles on the analysis of export, import and international trade. We analyze the trade balance, export and import in India something different. According to **Abdulai Awudu** and **Philippe Jaquet** (2002) there are short run and long run relationship between economic growths, exports , real investment and labour force for Cote d'Ivoire for the period 1961 to 1997. They used cointegration and error correction techniques and discussed the causal relationship among variables of export along with economic growth. **Philip Omoke** (2010) examined the relationship between economic growth, investment and export in Nigeria. He applied the Johansen Cointegration test and Granger causality test to investigate the bi-directional relationship between Investment and Export. Unfortunately, the result was insignificant. **Ruba Abu Shihab** (2014) investigated the causal relationship between economic growth and exports in Jordan during the period 2000-2012. The study found that there is a one-way causal relationship from economic growth to exports.

1.4 Data Collection: Data were collected from the book 'Indian Development Report 2012-13', edited by Prof. S. Mahindra Dev.

1.5Study design and Methodology

Statistical Investigation:

Figure: 1 Line Plot of Total Export, Total Import and Total Trade Balance

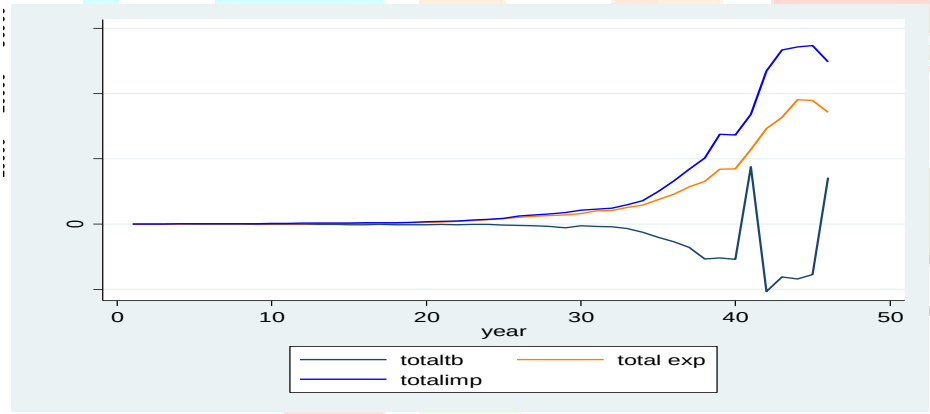


Figure 1 describes the pattern of export, import and trade balance. Firstly, total export, total import and total trade balance do not show any change of curvature up to 1990 (we assume 1970 as 1). Secondly, due to the new economic reform in 1991. All three variables change their inflexion point. Thirdly, total import increase very rapidly and its total amount also increase. Total export increase not very significantly. Fourthly, total trade balance that means total export minus total import, decrease up to 2008, and then slightly become parallel to horizontal axis. After that it starts increasing up to 2011. Fifthly, total trade balance again rapidly increase before the year 2012, it indicates that total export increase in India. This is of course a good signal for development of the Indian economy. Now, next thing we have to know about the distribution pattern of our sample of total export, total import and total trade balance. Using K-S, modified K-S and A-D test suggest that the total export and total import data are both Lognormal and Gamma distribution type.

But we cannot estimate the distribution pattern of total trade balance, because there are negative values and negative values are not considered in estimating the distribution pattern. Table 1 describes the distribution pattern of the total export and total import of India. For this discussion, we use three indicators of detecting the actual nature of distribution. Total export according to K-S, A-D and modified K-S test it is Log normally distributed. The corresponding location parameter is 6.33 and scale parameter is recorded 2.22. on the other hand the total import data is both Gamma and Log normally distributed. The corresponding shape parameter is 0.35 and scale is 14002.20 for Gamma, whereas location and scale parameters are 6.62 and 2.27 respectively for Log normally distribution. Next is the statistical parameters for total export, total import and total trade balance describe that both export and import are positively skewed but trade balance is negatively skewed . The value of standard deviation of total import is

much more than the other two. The coefficient of variation of trade balance is negative but other two are positive. We know that if the coefficient of variation is small that means the readings is more stable. Again, the value of coefficient of variation of export is lower than the import meaning that export is more stable that import.

Table: 1 Distribution pattern of Total Export and Total Import

	Distribution	Goodness of Fit tests	Statistics	P-value	Decision at level (5%)
Total Export	Normal	K-S test	0.28783	7.22153E-4	Reject Normal
		K-S modified test	0.28783	<=0.01	Reject Normal
		A-D test	6.63218	1.58587E-16	Reject Normal
	Lognormal	K-S test	0.12177	0.47223	Can't reject Lognormal
		K-S modified test	0.12177	0.08623	Can't reject Lognormal
		A-D test	0.76388	0.04364	Reject Lognormal
	Exponential	K-S test	0.36484	5.38317E-6	Reject Exponential
		K-S modified test	0.36484	<=0.01	Reject Exponential
		A-D test	19.15177	0	Reject Exponential
	Gamma	K-S test	0.14366	0.27221	Can't reject Gamma
		K-S modified test	0.14438	0.02677	Reject Gamma
		A-D test	1.42824	<0.005	Reject Gamma
Total Import	Normal	K-S test	0.31375	1.59875E-4	Reject Normal
		K-S modified test	0.31375	<=0.01	Reject Normal
		A-D test	7.22613	5.90062E-18	Reject Normal
	Lognormal	K-S test	0.09593	0.80646	Can't reject Lognormal
		K-S modified test	0.09593	>0.15	Can't reject Lognormal
		A-D test	0.55165	0.14683	Can't reject Lognormal
	Exponential	K-S test	0.3866	1.06613E-6	Reject Exponential
		K-S modified test	0.3866	<=0.01	Reject Exponential
		A-D test	21.67836	0	Reject Exponential
	Gamma	K-S test	0.13942	0.30497	Can't reject Gamma
		K-S modified test	0.14314	0.03017	Reject Gamma
		A-D test	1.57759	<0.005	Reject Gamma

Table: 2 Descriptive Statistics of three variables

variables	N	Missing	Mean	Standard Deviation	SE of mean	Median absolute deviation	Robust Coefficient of Variation	Variance	Skewness	Kurtosis	Coefficient of Variation
Total export	46	1	3385.77348	5557.02069	819.338	587.935	1.41231	3.08805E7	1.86655	2.32555	1.64129
total import	46	1	4977.54043	8405.03985	1239.25552	658.27	1.43022	7.06447E7	1.83194	2.05893	1.68859
Trade balance	46	1	-1054.41087	3306.68153	487.54359	83.1	-1.4696	1.09341E7	-0.36647	3.1191	-3.13605

Table: 3 Exponential plot results

Exponential Plot	Total Export	Total Import
Number of Points	46	46
Degrees of Freedom	43	43
Reduced Chi-Sqr	1.00888E6	3.37482E6
Residual Sum of Squares	4.33818E7	1.45117E8
R Value	0.98427	0.97691
R-Square (COD)	0.96878	0.95435
Adj. R-Square	0.96733	0.95223
Root-MSE (SD)	1004.43008	1837.06826
Fit Status	Succeeded (100)	Succeeded (100)

Table: 4 Parameters of Exponential Fit

Variable	y0		A		R0		Statistics	Statistics	Statistics
	Value	Standard Error	Value	Standard Error	Value	Standard Error	Reduced Chi-Sqr	R-Square (COD)	Adj. R-Square
Total Export	-329.39366	241.99955	42.87843	15.78793	0.13534	0.00826	1.00888E6	0.96878	0.96733
Total Import	-653.44403	446.85907	69.73126	30.97243	0.13354	0.00996	3.37482E6	0.95435	0.95223

Remarks: $y = y_0$+A $e^{R_0 x}$ is the function we used here.

Table: 5 Growth Function Fit Status

SGompertz Plot	Total Export	Total Import
Number of Points	46	46
Degrees of Freedom	43	43
Reduced Chi-Sqr	658186.05177	1.57705E6
Residual Sum of Squares	2.8302E7	6.78132E7
R Value	0.98976	0.98928
R-Square (COD)	0.97963	0.97867
Adj. R-Square	0.97869	0.97768
Fit Status	Succeeded (100)	Succeeded (100)

Table: 6 Parameters of Growth Function Fit

	Parameters	Value	Standard Error	t-Value	Prob>|t|	Dependency
Total Export	a	56930.95768	21155.43463	2.69108	0.0101	0.99748
	xc	46.49359	4.13585	11.24162	2.19824E-14	0.99861
	k	0.08391	0.01854	4.52519	4.71226E-5	0.98895
Total Import	a	41966.50134	6064.98625	6.91947	1.68324E-8	0.98224
	xc	39.72754	1.08557	36.5959	0	0.97693
	k	0.15578	0.02552	6.10493	2.57281E-7	0.91885

Remarks: $= ae^{-e^{(-k(x-x_c))}}$, this function is used here.

Table: 7 Decisions Regarding Better Fit Model (Akaike criterion)

Name of Models	RSS	N	Parameters	AIC	Akaike Weight
Model1(Exponential)	1.45117E8	46	3	697.33853	2.5159E-8
Model2(SGompertz)	6.78132E7	46	3	662.34242	1

Remarks: Model2 has lower AIC value and so is more likely to be correct. This Model is 3.97472e+007 times more likely to be correct.

Table: 8 Decisions Regarding Better Fit Model (BIC Criterion)

Name of Models	RSS	N	Parameters	BIC	Diff BIC
Model1(Exponential)	1.45117E8	46	3	703.67748	34.9961
Model2(SGompertz)	6.78132E7	46	3	668.68138	0

Remarks: Model 2 has lower BIC value and so is more likely to be correct .BIC difference greater than 10 gives decisive conclusion that Model 2 is correct.

Table: 9 Final Decisions Regarding Models

Model Name	Decision
AIC	Model2
BIC	Model2
F-Test	No conclusion

Discussion regarding the model fit results exhibit that according to AIC and BIC criteria, model-2 is the best fit for our export and import data. It is to be mentioned that there many models for fitting sample data, but we here choose only exponential and growth type function because these two are most popular and easy for discussion.

For trade balance data it is not fit with exponential and growth functions. So, we go to the other functions like Sin-square, Gauss – amplitude and Lorentz. We only use here only three functions for our present discussion. Among these three we have a strong support to the Lorentz function, because the total trade balance data has some peaks and Lorentz function is also a peak type function.

Table: 10 Decisions Regarding the Fit Status of Total Trade Balance

Variable	Function	Formula	Fit status	F-value	Prob >F	AIC Criteria	BIC Criteria
Total Trade Balance	Model 1(Sin-Square)	$y = y_0 + A Sin^2(\pi \frac{x-x_c}{w})$ [Wave-form Category]	Succeeded	3.69 (R^2COD=0.183)	0.019	746.72(0.132)	754.36(3.76)
	Model 2(Gauss-Amplitude)	$Y=y_0 + A.e^{-\frac{(x-x_c)^2}{2w^2}}$	Succeeded	4.89 (R^2COD=0.247)	.0052	742.96(0.867)	750.60(0)
	Model 3(Lorentz)	$Y=y_0+\frac{2A}{\pi}\frac{w}{4(x-x_c)^2+w^2}$ [Peak function Category]	succeeded	6.81 (R^2COD=0.330)	7.58975E-4	737.56(0.936)	745.21(0)

Remarks: According to AIC, Model-3 is 14.84 times more likely to be correct. BIC gives strong support to Model 3.

1.5.1 Summary of statistical Investigation:

A) Firstly, we have data from 1970 to 2016 for export, import and trade balance. Among these three the trade balance has negative skewness.
B) Secondly, total export and total import is Log normally distributed. Additionally, the import also shows the Gamma type distribution. Total trade balance is best fit by Lorentz function, which belongs to a peak function category.
C) Thirdly, the AIC and BIC criteria both support the Growth type function for fitting the export and import data.

Table: 11 Pearson correlations among variables

Correlations with probability value		Total export	Total import	Trade balance
Total export	Pearson Corr.	1	0.99742*	-0.4573*
	p-value	--	5.32884E-52	0.0014
Total import	Pearson Corr.	0.99742*	1	-0.48021*
	p-value	5.32884E-52	--	7.31701E-4
Trade balance	Pearson Corr.	-0.4573*	-0.48021*	1
	p-value	0.0014	7.31701E-4	--

Remarks: 2 tailed test for significance is used. *correlation is significant at 5% level.

D) Pearson correlation shows that export and import are statistically high correlated and also they are significant at the 5% level. The corresponding probability value is also very low for these two which means we reject the null hypothesis of no correlation. Low probability value is the indicator of highly correlation.
E) Correlation coefficient between trade balance and export shows the negative relation. Probability value for trade balance and export is quite high (.1 %) but low for import (below.1 %). Descriptive statistics explained that export and import are positively skewed and trade balance is negatively skewed. Median absolute deviation is very low and robust coefficient of variation is negative.

1.5.2 Econometrics Investigation: We have three variablestotal export**,** total import, and total trade balance. At the outset, we should check the unit root test of the variables. Lag selection method explained the maximum lag length of the model. Table 12 of lag selection criteria of SBIC decided the 1 maximum lag of our model. Table 13 describes the unit root test of our model. Now, in of unit root test we observe that if we include the drift term then absolute value of test statistics is more than the critical value.

Table: 12 Lag Selection Criteria (For VAR and VEC Estimation)

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	**-9.01**				**.000378**	**0.632583**	**0.678581**	**0.761866**
1	**113.27**	**244.58**	**9**	**0.000**	**9.7e-07**	**-5.33012**	**-5.14613***	**-481299***
2	**123.82**	**21.097***	**9**	**0.012**	**9.1e-07***	**-5.44162***	**-5.08964**	**-4.50664**
3	**126.01**	**4.3852**	**9**	**0.884**	**1.3e-06**	**-5.05338**	**-4.59336**	**-3.76051**
4	**132.47**	**12.924**	**9**	**0.166**	**1.6e-06**	**-4.91975**	**-4.32177**	**-3.23907**

After the selection of lag length we convert the data of export, import and money supply in logarithmic value and then taken the first difference. We convert this because of avoiding the serial correlation and heteroscadasticity problems. The co-integration test at lag length 1 is shown in the table 14. The Trace statistics and Max-Eigen value both co-jointly agree with the fact that there are 3 co-integrating equations. Co-integrating equations signal the long run relationship among variables.

Table: 13 Unit Root Test (Dickey-Fuller)

Total export					Total import					Total trade balance				
Test statistics	1% critical value		5% critical value		Test statistics	1% critical value		5% critical value		Test statistics	1% critical value		5% critical value	
2.615	constant	Drift	constant	Drift	2.160	constant	drift	constant	drift	-5.305	constant	drift	Constant	drift
	-3.614	-2.416	-2.944	-1.681		-3.614	-2.416	-2.944	-1.681		-3.614	-2.416	-2.944	-1.681

There are two methods of checking the co-integration among variables, the Trace statistics explaines the probability value is 0.037, that means about 4%. It is less than 5%, so, we can reject null hypothesis of no co-integrating equation. At most 2 means there are two or more than two co-integrating equations. The same result we can found in Max-Eigen statistics. It also describe there are at least two co-integrating equations at 5% level. Hence, we can conclude that our variables have long run relationship.Co-integration testing is the primary task of calculating the VEC model estimation.

Table:14 Cross Correlogram

Date: 01/23/18 Time: 10:09
Sample: 1 46
Included observations: 46
Correlations are asymptotically consistent approximations

TOTALIMP,TOTAL_EXP(-i)	TOTALIMP,TOTAL_EXP(+i)	i	lag	lead
. |**********	. |**********	0	0.9974	0.9974
. |*********|	. |*********|	1	0.9081	0.9218
. |******** |	. |******** |	2	0.7824	0.8116
. |****** |	. |******* |	3	0.6464	0.6837
. |***** |	. |***** |	4	0.5269	0.5469
. |**** |	. |**** |	5	0.4170	0.4272
. |*** |	. |*** |	6	0.3330	0.3412
. |*** |	. |*** |	7	0.2697	0.2671
. |**. |	. |**. |	8	0.2034	0.1882
. |* . |	. |* . |	9	0.1508	0.1290
. |* . |	. |* . |	10	0.1043	0.0785
. |* . |	. | . |	11	0.0673	0.0390
. | . |	. | . |	12	0.0363	0.0091
. | . |	. | . |	13	0.0112	-0.0127
. | . |	. | . |	14	-0.0114	-0.0315
. | . |	. *| . |	15	-0.0309	-0.0483
. *| . |	. *| . |	16	-0.0509	-0.0654
. *| . |	. *| . |	17	-0.0680	-0.0825
. *| . |	. *| . |	18	-0.0845	-0.0979
. *| . |	. *| . |	19	-0.1011	-0.1125
. *| . |	. *| . |	20	-0.1172	-0.1266

Table: 15 Unrestricted Co-integrating Test

Date: 01/21/18 Time: 20:01
Sample (adjusted): 3 46
Included observations: 44 after adjustments
Trend assumption: Linear deterministic trend
Series: DLOGIMP DLOGEXP DTB
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.601340	71.89989	29.79707	0.0000
At most 1 *	0.459832	31.43551	15.49471	0.0001
At most 2 *	0.093867	4.337028	3.841466	0.0373

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.601340	40.46439	21.13162	0.0000
At most 1 *	0.459832	27.09848	14.26460	0.0003
At most 2 *	0.093867	4.337028	3.841466	0.0373

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

In table 15 we describe the vector error correction model. Now, the important point we have to remember is that the value of the coefficient of error correction model should be negative and significant. The coefficient of error correction model is also called the speed of adjustment. That means how much speed is needed to convergeinthe long run. Lower value of coefficient means much time is needed for convergence. In our VEC model the value of speed of adjustment is 38%. So, it is less than 50%, thatswhy much time required for convergence. In our discussion the target model is

D(DLOGIMP) = C(1)*(DLOGIMP(-1) + 2.11475775044*DLOGEXP(-1) +
0.000483718918516*DTB(-1) - 0.295141908632) + C(2)*D(DLOGIMP(
-1)) + C(3)*D(DLOGEXP(-1)) + C(4)*D(DTB(-1)) + C(5)

Coefficient c(1) is called the error correction term, it explain that every year 38% error will be corrected. The error or innovation value is .2951. In other words, the c(1) is also called the long run coefficient and c(2),c(3) and others are called short run coefficients.

Table:16 Restricted VAR Model

Vector Error Correction Estimates
Date: 01/21/18 Time: 20:06
Sample (adjusted): 3 46
Included observations: 44 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
DLOGIMP(-1)	1.000000
DLOGEXP(-1)	2.114758 (4.33379) [0.48797]
DTB(-1)	0.000484 (6.5E-05) [7.42529]
C	-0.295142

Error Correction:	D(DLOGIMP)	D(DLOGEXP)	D(DTB)
CointEq1	-0.386309 (0.08682) [-4.44969]	-0.378433 (0.08344) [-4.53529]	-3536.057 (548.608) [-6.44551]
D(DLOGIMP(-1))	1.223907 (1.34886) [0.90736]	1.496689 (1.29642) [1.15447]	-13243.05 (8523.64) [-1.55368]
D(DLOGEXP(-1))	3.726302 (1.60475) [2.32204]	2.827159 (1.54237) [1.83300]	-23244.80 (10140.6) [-2.29224]
D(DTB(-1))	7.30E-05 (2.6E-05) [2.80146]	7.27E-05 (2.5E-05) [2.90235]	0.143394 (0.16463) [0.87103]
C	-0.116938 (0.08051) [-1.45239]	-0.115695 (0.07738) [-1.49507]	-270.6503 (508.780) [-0.53196]
R-squared	0.411310	0.411008	0.822385
Adj. R-squared	0.350931	0.350599	0.804168
Sum sq. resids	11.00551	10.16642	4.39E+08
S.E. equation	0.531218	0.510566	3356.832
F-statistic	6.812184	6.803709	45.14407
Log likelihood	-31.94584	-30.20110	-417.0046
Akaike AIC	1.679356	1.600050	19.18203
Schwarz SC	1.882105	1.802799	19.38478
Mean dependent	-0.100139	-0.098255	-161.8609
S.D. dependent	0.659367	0.633571	7585.569

Determinant resid covariance (dof adj.)	10987.08
Determinant resid covariance	7651.000
Log likelihood	-384.0369
Akaike information criterion	18.27440
Schwarz criterion	19.00430

Table: 17 Probability Value Calculations of Coefficients of Target Model

Dependent Variable: D(DLOGIMP)
Method: Least Squares
Date: 01/21/18 Time: 20:15
Sample (adjusted): 3 46
Included observations: 44 after adjustments
D(DLOGIMP) = C(1)*(DLOGIMP(-1) + 2.11475775044*DLOGEXP(-1) + 0.000483718918516*DTB(-1) - 0.295141908632) + C(2)*D(DLOGIMP(-1)) + C(3)*D(DLOGEXP(-1)) + C(4)*D(DTB(-1)) + C(5)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.386309	0.086817	-4.449685	0.0001
C(2)	1.223907	1.348865	0.907361	0.3698
C(3)	3.726302	1.604754	2.322039	0.0255
C(4)	7.30E-05	2.61E-05	2.801456	0.0079
C(5)	-0.116938	0.080514	-1.452389	0.1544

R-squared	0.411310	Mean dependent var	-0.100139
Adjusted R-squared	0.350931	S.D. dependent var	0.659367
S.E. of regression	0.531218	Akaike info criterion	1.679356
Sum squared resid	11.00551	Schwarz criterion	1.882105
Log likelihood	-31.94584	Hannan-Quinn criter.	1.754545
F-statistic	6.812184	Durbin-Watson stat	1.600397
Prob(F-statistic)	0.000294		

We know that VEC model doesn't give the probability value of the coefficients. But probability value is important indicator of the significant of the coefficients. For probability value calculation, we have to calculate the cointegrating equations. We here estimate both target and whole system coefficients. From probability value we observe that the probability value of error correction coefficient is negative as well as significant. That means there is definitely long run relation exists among the variables. One thing we should mention here that we choose the import as the dependent variable. The reason is that more that 50% coefficients are significant when we choose import as a dependent variable. This leads to the validity of our model.

Figure: 2 Confidence Ellipse of Coefficients C(3) and C(4)

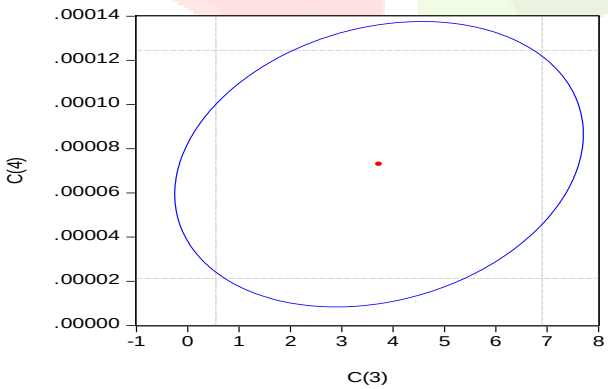


Table: 18Values of Coefficients of Whole System

System: Total System Estimation
Estimation Method: Least Squares
Date: 01/21/18 Time: 20:10
Sample: 3 46
Included observations: 44
Total system (balanced) observations 132

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.386309	0.086817	-4.449685	0.0000
C(2)	1.223907	1.348865	0.907361	0.3661
C (3)	3.726302	1.604754	2.322039	0.0220
C(4)	7.30E-05	2.61E-05	2.801456	0.0060
C(5)	-0.116938	0.080514	-1.452389	0.1491
C(6)	-0.378433	0.083442	-4.535287	0.0000
C (7)	1.496689	1.296425	1.154474	0.2507
C(8)	2.827159	1.542366	1.833002	0.0693
C(9)	7.27E-05	2.50E-05	2.902352	0.0044
C (10)	-0.115695	0.077384	-1.495069	0.1376
C(11)	-3536.057	548.6081	-6.445507	0.0000
C(12)	-13243.05	8523.643	-1.553685	0.1230
C(13)	-23244.80	10140.64	-2.292242	0.0237
C(14)	0.143394	0.164626	0.871031	0.3855
C(15)	-270.6503	508.7800	-0.531959	0.5958

Determinant residual covariance 7651.000

Equation: D(DLOGIMP) = C(1)*(DLOGIMP(-1) + 2.11475775044 *DLOGEXP(-1) + 0.000483718918516*DTB(-1) - 0.295141908632) + C(2)*D(DLOGIMP(-1)) + C(3)*D(DLOGEXP(-1)) + C(4)*D(DTB(-1)) + C(5)
Observations: 44

R-squared	0.411310	Mean dependent var	-0.100139
Adjusted R-squared	0.350931	S.D. dependent var	0.659367
S.E. of regression	0.531218	Sum squared resid	11.00551
Durbin-Watson stat	1.600397		

Equation: D(DLOGEXP) = C(6)*(DLOGIMP(-1) + 2.11475775044 *DLOGEXP(-1) + 0.000483718918516*DTB(-1) - 0.295141908632) + C(7)*D(DLOGIMP(-1)) + C(8)*D(DLOGEXP(-1)) + C(9)*D(DTB(-1)) + C(10)
Observations: 44

R-squared	0.411008	Mean dependent var	-0.098255
Adjusted R-squared	0.350599	S.D. dependent var	0.633571
S.E. of regression	0.510566	Sum squared resid	10.16642
Durbin-Watson stat	1.578533		

Equation: D(DTB) = C(11)*(DLOGIMP(-1) + 2.11475775044*DLOGEXP(-1) + 0.000483718918516*DTB(-1) - 0.295141908632) + C(12) *D(DLOGIMP(-1)) + C(13)*D(DLOGEXP(-1)) + C(14)*D(DTB(-1)) + C(15)
Observations: 44

R-squared	0.822385	Mean dependent var	-161.8609
Adjusted R-squared	0.804168	S.D. dependent var	7585.569
S.E. of regression	3356.832	Sum squared resid	4.39E+08
Durbin-Watson stat	2.007957		

1.5.3 Diagnostic Testing of the Model:In econometrics, there are some errors checking methods that are also called the diagnostic tests. We perform here some of the tests.

Table: 19 Multicollinearity Testing

Variance Inflation Factors
Date: 01/21/18 Time: 20:18
Sample: 1 46
Included observations: 44

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C(1)	0.007537	4.845526	4.845526
C(2)	1.819436	1.094098	1.092936
C(3)	2.575235	1.125230	1.124394
C(4)	6.79E-10	4.790242	4.778167
C(5)	0.006483	1.010772	NA

Figure: 3 Test of Normality

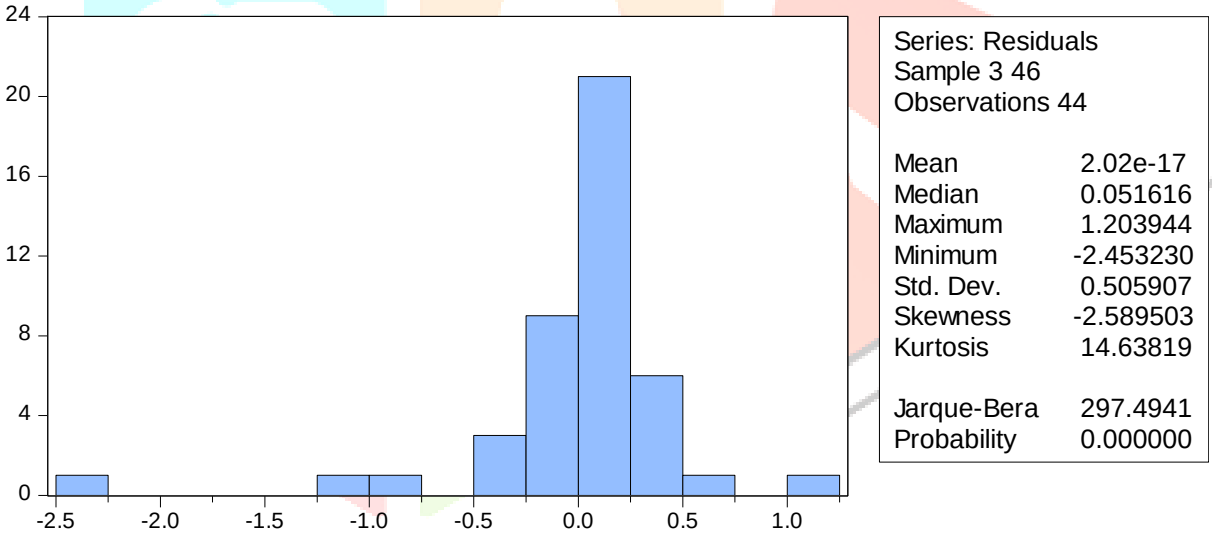


Table: 20Testing of Auto-correlation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.070525	Prob. F(1,38)	0.3074
Obs*R-squared	1.205591	Prob. Chi-Square(1)	0.2722

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 01/21/18 Time: 20:21
Sample: 3 46
Included observations: 44
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.051761	0.100132	0.516932	0.6082
C(2)	0.342489	1.387704	0.246802	0.8064
C(3)	0.371016	1.642915	0.225828	0.8225
C(4)	-2.24E-05	3.38E-05	-0.661460	0.5123
C(5)	0.029496	0.085344	0.345617	0.7315
RESID(-1)	-0.371345	0.358904	-1.034662	0.3074

R-squared	0.027400	Mean dependent var	2.02E-17
Adjusted R-squared	-0.100574	S.D. dependent var	0.505907
S.E. of regression	0.530738	Akaike info criterion	1.697029
Sum squared resid	10.70396	Schwarz criterion	1.940327
Log likelihood	-31.33463	Hannan-Quinn criter.	1.787255
F-statistic	0.214105	Durbin-Watson stat	1.575720
Prob(F-statistic)	0.954397		

Our target model that means the model where we assume import as the dependent variable, passed all the diagnostic tests except normality test of residuals. Since, most of the coefficients are significant, we accept this model. We have performed the chow test for stability diagnostic from the year 1990 to 2016. That means from the new economic reform period to post reform period. We observe from result that there is no break of stability in that period because; the probability value is less than 5%.

Table: 21 Confidence Intervals of coefficients

Coefficient Confidence Intervals
Date: 01/23/18 Time: 09:01
Sample: 1 46
Included observations: 44

		95% CI		99% CI	
Variable	Coefficient	Low	High	Low	High
C(1)	-0.386309	-0.561913	-0.210705	-0.621402	-0.151216
C(2)	1.223907	-1.504430	3.952243	-2.428702	4.876515
C(3)	3.726302	0.480380	6.972223	-0.619233	8.071836
C(4)	7.30E-05	2.03E-05	0.000126	2.44E-06	0.000144
C(5)	-0.116938	-0.279794	0.045917	-0.334964	0.101088

Table: 22 ARCH Effects Testing on Residual

Heteroskedasticity Test: ARCH

F-statistic	1.617585	Prob. F(1,41)	0.2106
Obs*R-squared	1.632100	Prob. Chi-Square(1)	0.2014

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 01/21/18 Time: 20:22
Sample (adjusted): 4 46
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.181880	0.154389	1.178064	0.2456
RESID^2(-1)	0.637854	0.501519	1.271843	0.2106

R-squared	0.037956	Mean dependent var	0.255859
Adjusted R-squared	0.014491	S.D. dependent var	0.944664
S.E. of regression	0.937795	Akaike info criterion	2.754824
Sum squared resid	36.05781	Schwarz criterion	2.836740
Log likelihood	-57.22871	Hannan-Quinn criter.	2.785032
F-statistic	1.617585	Durbin-Watson stat	1.036209
Prob(F-statistic)	0.210596		

The F-value is 135.4 and corresponding probability value is 0, which is less than 5%. So, we can reject the null hypothesis of instability. Standard error is low, and R square value is about 60%.

1.5.4Forecasting: We have 46 years' data. If we want to know the path of variables in some twenty years ahead, we should apply the forecasting method. From figure 5 observe that all variables have upward trend, which means they will increase in future. After the 55 point, all variables moving downward but, beyond 60 point they start increase. This is of course a positive indicator for development of a countries domestic product. We don't analyse the rate of growth of total export ,import and trade balance. The forecasting here used for the approximate idea of the variables in the next 20 years. For more accurate result we have to use a different technique that is not possible here.

Table: 23 Stability Diagnostic Testing

Chow Forecast Test
Equation: Stability Testing of Residuals
Specification: D(DLOGIMP) = C(1)*(DLOGIMP(-1) + 2.11475775044 *DLOGEXP(-1) + 0.000483718918516*DTB(-1) - 0.295141908632) + C(2)*D(DLOGIMP(-1)) + C(3)*D(DLOGEXP(-1)) + C(4)*D(DTB(-1)) + C(5)
Test predictions for observations from 20 to 46

	Value	df	Probability
F-statistic	135.4776	(27, 12)	0.0000
Likelihood ratio	251.8125	27	0.0000

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	10.96952	27	0.406279
Restricted SSR	11.00551	39	0.282193
Unrestricted SSR	0.035986	12	0.002999
Unrestricted SSR	0.035986	12	0.002999

LR test summary:

	Value	df
Restricted LogL	-31.94584	39
Unrestricted LogL	93.96042	12

Unrestricted log likelihood adjusts test equation results to account for observations in forecast sample

Unrestricted Test Equation:
Dependent Variable: D(DLOGIMP)
Method: Least Squares
Date: 01/21/18 Time: 20:24
Sample: 3 19
Included observations: 17
D(DLOGIMP) = C(1)*(DLOGIMP(-1) + 2.11475775044*DLOGEXP(-1) + 0.000483718918516*DTB(-1) - 0.295141908632) + C(2) *D(DLOGIMP(-1)) + C(3)*D(DLOGEXP(-1)) + C(4)*D(DTB(-1)) + C(5)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.348925	0.143502	-2.431509	0.0316
C(2)	0.165093	0.204323	0.808002	0.4348
C(3)	0.785321	0.387059	2.028945	0.0652
C(4)	-0.001313	0.000840	-1.564037	0.1438
C(5)	-0.031178	0.019544	-1.595221	0.1366

R-squared	0.599477	Mean dependent var	0.005144
Adjusted R-squared	0.465969	S.D. dependent var	0.074937
S.E. of regression	0.054762	Akaike info criterion	-2.731717
Sum squared resid	0.035986	Schwarz criterion	-2.486654
Log likelihood	28.21959	Hannan-Quinn criter.	-2.707357
F-statistic	4.490203	Durbin-Watson stat	1.336623
Prob(F-statistic)	0.018977		

Table: 24 Stability of VEC Model

Eigenvalue stability condition	
Eigenvalue	**Modulus**
-2.207794	**2.20779**
1	**1**
.03623616	**.036236**
The VECM specification imposes a unit modulus.	

Figure:4 Graph of Stability

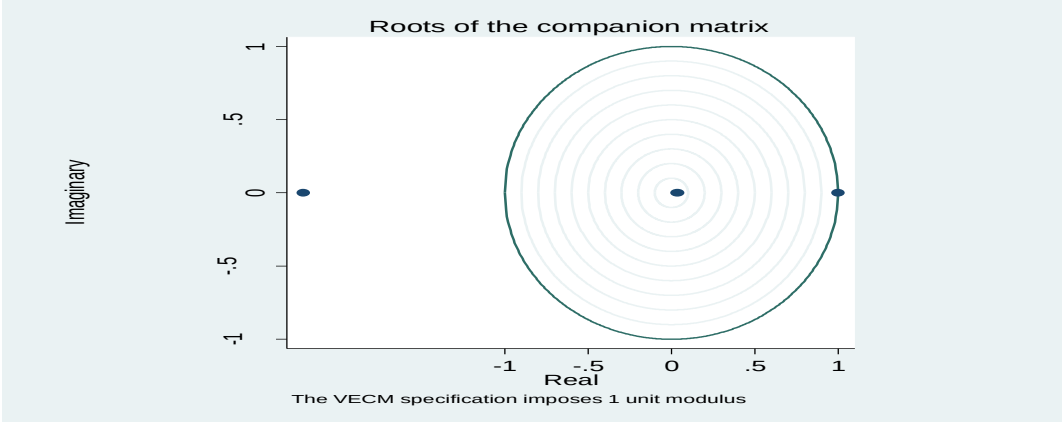
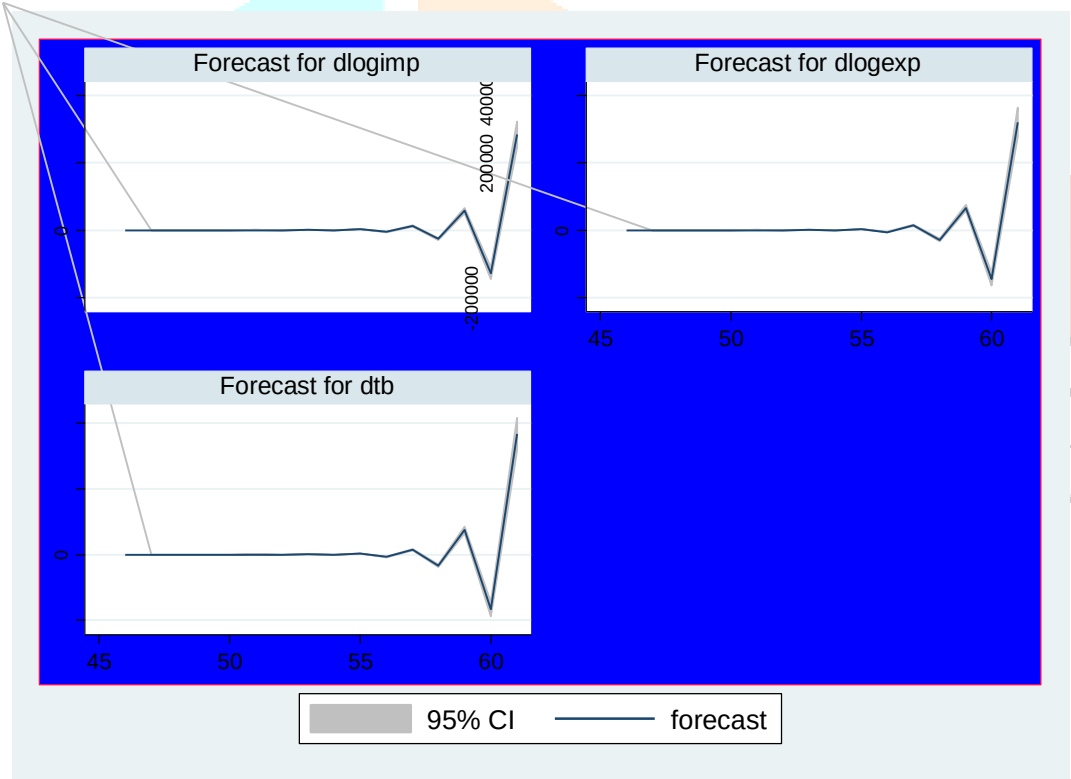


Figure: 5 Forecasting of Variables for Twenty Years Ahead



1.5.5 Impulse Response Function and Variance Decomposition: Impulse response is an important tool to describe the direction of change of a variable when we impose a force to that variable. There are many methods of describing that event. We here apply the generalised one standard deviation innovation shock. Now, the term innovation shock denotes the shock upon the error term. If we impose one standard deviation shock to the error term then, how the variables behave. Figure 7 explain the corresponding impulse function estimation. First panel of the impulse graph shows the effect on import when one standard deviation innovation shock is imposed on import. The result is that import start to rise after the 7.5 point. At point 9 it has a point of inflexion. Import function become steep beyond that point. So it has three points, horizontal portion up to point 7, secondly it has upward rising flat portion and thirdly it become steep beyond point 9. Third graph of first row explain the impulse of import when one standard deviation innovation shock is imposed on trade balance. The graph shows the downward sloping trend .that means import has a negative effect when shock given to trade balance.More or less same result is found in case of first graph of third row. Here we also found that shock on import has negative effect on trade balance. The curve gradually becomes downward sloping. Other graphs can be explained in the similar way.

Figure:6 Decomposition of Variances

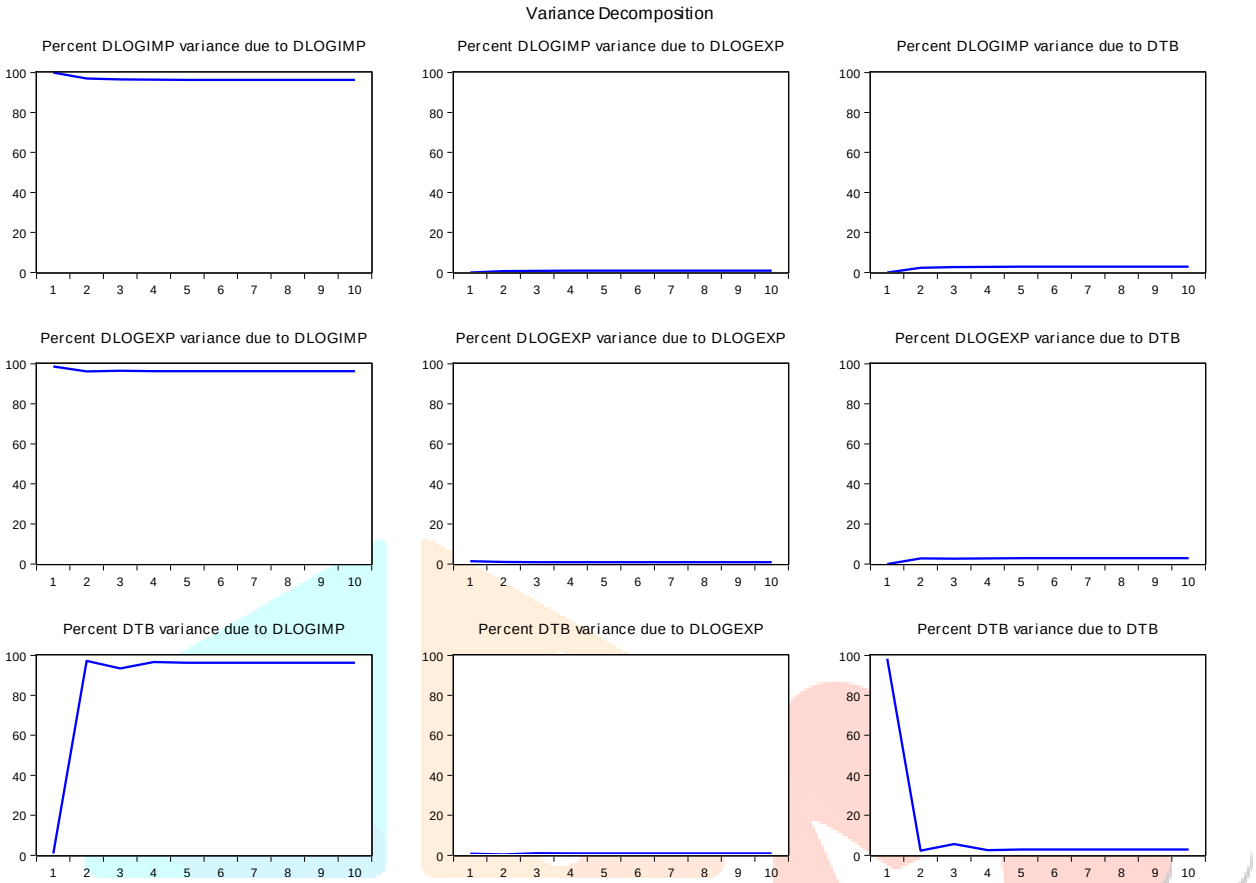


Figure 6 describe the decomposition of variance of variables. First graph of first row shows that change in import leads to change in variance of import , and it is downward sloping gradually. Second graph of first row shows that describe the percentage change of import due to change in export shows about no change of the slope of the curve. First graph of third row shows sharp rise of trade balance when import is changed. This curve has three portions. First portion shows sharp increase of trade balance up to point 2 , second part shows mild decrease of trade balance up to point 3or decrease about 20% variance of trade balance. Third portion describe asymmptotic convergence of trade balance due to change of import. Third graph of second row describe the change of export due to change of trade balance. Export increase due to change in trade balance ,but intensity of change is very weak. So that the curve is asymmptotically converging to about 5% variance. Third graph of third row is the inverse projection of the first graph of third row. Table 25 explain the causality among variables.

Causality of import and export shows that F-statistics is 1.52 and corresponding probability value is more than 5% ,that means it is not singificant . opposite result is the causality between export and import . the F-statistics shows the value 4.36 and related probability value is 4.3 %, it is less that 5% and significant. Next result is the causality between trade balance and import . The F-statistics is recorded 11.45 and related probability value is .0016 or .16% ,which is less than 5% and highly significant. It means there is a strong causality between trade balance and import. We observe the causality between trade balance and export , the F-statistics is recorded 13.02 and corresponding probability value is 0.0008,that is much less than 5%. This strongly supports the causality between trade balance and export. Lastly, the causality from export to trade balance also rejects the null hypothesis that export doesnot Granger cause trade balance. The probability value suggests 0.18%,that is less than 5% strongly supports alternative hypothesis.

Figure:7 Impulse Response FunctionEstimation

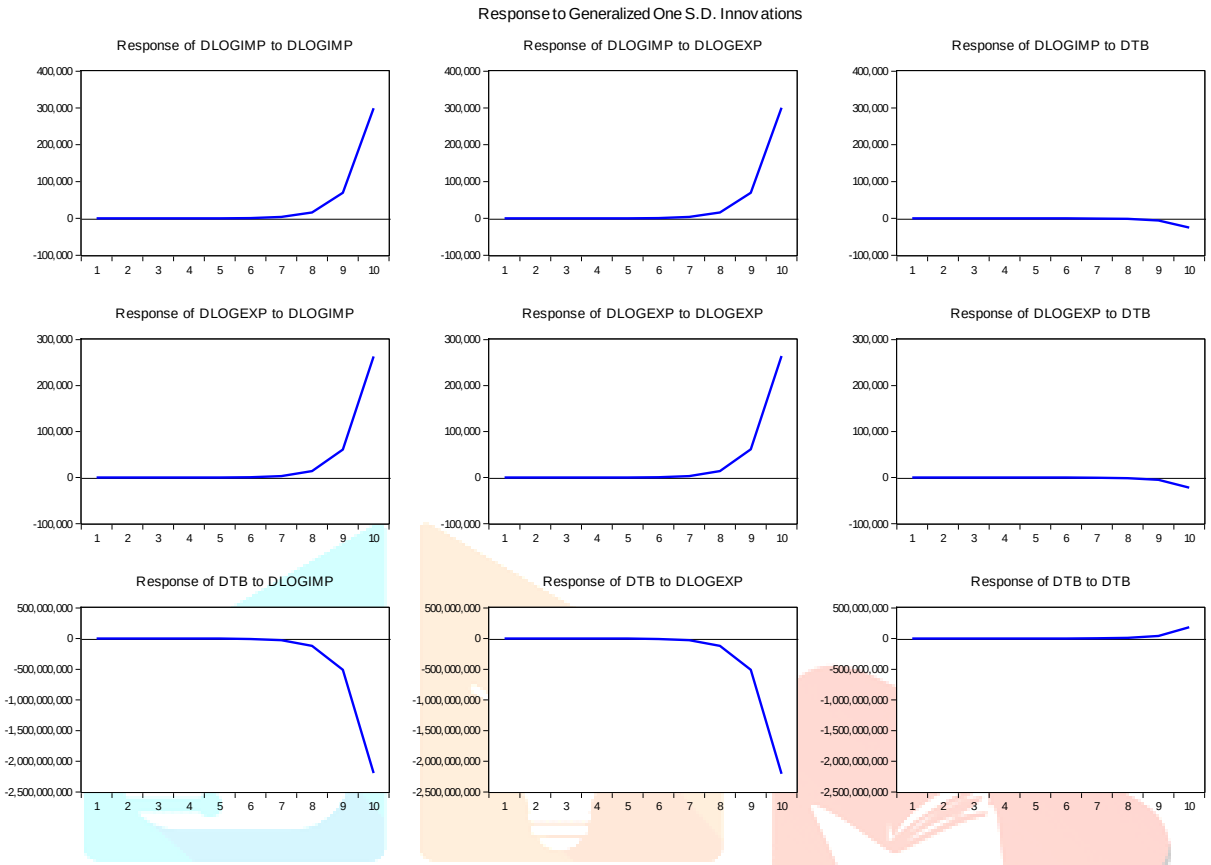


Table: 25CausalityTest of Variables

Pairwise Granger Causality Tests
Date: 01/21/18 Time: 21:47
Sample: 1 46
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DLOGEXP does not Granger Cause DLOGIMP	45	4.36684	0.0427
DLOGIMP does not Granger Cause DLOGEXP		1.52050	0.2244
DTB does not Granger Cause DLOGIMP	45	11.4520	0.0016
DLOGIMP does not Granger Cause DTB		7.24771	0.0102
DTB does not Granger Cause DLOGEXP	45	13.0227	0.0008
DLOGEXP does not Granger Cause DTB		11.1168	0.0018

1.5.6 Summary Results from Econometrics Investigation:

1) Firstly,error correction model describe the long run relation among variables. The value of error correction term is negative as well as significant that means its probability value is less than 5%. We take log and 1st difference of variables to avoid testing failures of the target model.
2) We know that c(2) ,c(3) and c(4) are short run coefficient. So, to know the short run relation we run the Wald test. This test gives the result that the value of test statistics

Table: 26 Establishing short run relation

Wald Test:
System: Short run relation Test

Test Statistic	Value	df	Probability
Chi-square	10.98769	2	0.0041

Null Hypothesis: C(3)=C(4)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(3)	3.726302	1.604754
C(4)	7.30E-05	2.61E-05

Restrictions are linear in coefficients.

is 10.98 and the corresponding probability value is less than 5%, that means there is no short run relation among the lag value of export and total trade balance.

3) Thirdly, the only weakness of our model is that the residuals are not normally distributed. Nevertheless, we accept the model because; about 50% coefficients are significant and passed all other diagnostic tests.
4) The Granger causality test shows that there are causal relations among variables except import to export. Because, probability values are less than 5% except one of them.
5) Confidence ellipse of c(3) and c(4) shows that the ellipse is near about circle ,suggests the strong correlation between coefficients.
6) The lag length of the model we have taken is 1, and it is according to the Bayesian Information Criteria.
7) Cointegration test shows that there are at least two cointegrating equations in lag length 1.
8) Cointegration table shows that the absolute value of test statistics is more than the critical value when we include the drift term.
9) The corresponding cross correlogram shows the apparent view of the correlation between export and import.
10) We have calculated the log value and then taken the first difference of the variable, becausewe want to avoid the serial correlation, heteroskadasticity and multicollenearity problem in our model.
11) For discussion the forecasting to twenty year ahead, we observe that all the variables are support for positive change in the future.
12) Finally we proposed from the line diagram of total export , import and trade balance that import should be decrease and export increase, so that, inflow of foreign currency rise . This helps the country's development of national income and per capita income.

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Appendix

Data on Total export , import and trade Balance

year	total exp	totalimp	totaltb	logexp	logtotalimp	dtb	dlogexp	dlogimp
1	15.35	16.34	-2.16	1.186108	1.213252052	3.2	0.0201777	0.0480108
2	16.08	18.25	1.04	1.206286	1.261262869	-5.36	0.0886209	0.0098814
3	19.72	18.67	-4.32	1.294907	1.271144318	-7.58	0.1070103	0.1994132
4	25.23	29.55	-11.9	1.401917	1.470557485	-0.39	0.1203965	0.1844849
5	33.29	45.19	-12.29	1.522314	1.655042341	12.98	0.0836374	0.066356
6	40.36	52.65	0.69	1.605951	1.721398376	-6.81	0.1052654	-0.0160479
7	51.43	50.74	-6.12	1.711217	1.705350463	-4.73	0.0218202	0.074246
8	54.08	60.2	-10.85	1.733037	1.779596491	-16.39	0.0248147	0.0536144
9	57.26	68.11	-27.24	1.757851	1.83321088	-31.14	0.0495484	0.1278778
10	64.18	91.43	-58.38	1.8074	1.96108872	0.36	0.0193875	0.1375204
11	67.11	125.49	-58.02	1.826787	2.098609119	3.13	0.0656413	0.0351852
12	78.06	136.08	-54.89	1.892429	2.133794301	-5.72	0.0522022	0.0213291
13	88.03	142.93	-60.61	1.944631	2.155123394	6.7	0.0453083	0.0444124
14	97.71	158.32	-53.91	1.989939	2.199535781	-33.72	0.079877	0.034323
15	117.44	171.34	-87.63	2.069816	2.233858763	11.19	-0.032589	0.0596806
16	108.95	196.58	-76.44	2.037227	2.293539331	10.74	0.0580119	0.0095703
17	124.52	200.96	-65.7	2.095239	2.303109622	-14.34	0.0999407	0.0441033
18	156.74	222.44	-80.04	2.19518	2.347212886	3.34	0.110859	0.1035749
19	202.32	282.35	-76.7	2.306039	2.450787792	-29.65	0.135782	0.0973313
20	276.58	353.28	-106.35	2.441821	2.548119052	68.26	0.0708369	0.0872943
21	325.58	431.93	-38.09	2.512658	2.635413369	-58.77	0.1312093	0.0444776

Contd...

22	440.42	478.51	-96.86	2.643867	2.679891018	63.36	0.0860102	1.0444776
23	536.88	633.75	-33.5	2.729877	2.801917972	-39.47	0.1136732	2.0444776
24	697.51	731.01	-72.97	2.84355	2.863923318	-90.28	0.0738185	3.0444776
25	826.74	899.71	-163.25	2.917369	2.954102548	-37.78	0.1093808	4.0444776
26	1063.53	1226.78	-201.03	3.02675	3.088766687	-39.73	0.0481288	5.0444776
27	1188.17	1389.2	-240.76	3.074879	3.142764775	-145.03	0.0394021	6.0444776
28	1301.01	1541.76	-385.79	3.114281	3.188016774	-170.96	0.0310805	7.0444776
29	1397.53	1783.32	-556.75	3.145361	3.25122928	283.73	0.0575656	8.0444776

30	1595.61	2152.37	-273.02	3.202927	3.33291693	-88.8	0.1057892	9.0444776
31	2035.71	2308.73	-361.82	3.308716	3.363373146	-58.87	0.0114678	10.044478
32	2090.18	2452	-420.69	3.320184	3.389520466	-236.72	0.0865898	11.044478
33	2551.37	2972.06	-657.41	3.406773	3.473057573	-599.84	0.0606378	12.044478
34	2933.67	3591.08	-1257.25	3.467411	3.55522508	-782.66	0.1070136	13.044478
35	3753.4	5010.65	-2039.91	3.574425	3.699894068	-647.36	0.0849379	14.044478
36	4564.18	6604.09	-2687.27	3.659363	3.819812983	-877.21	0.0978654	15.044478
37	5717.79	8405.06	-3564.48	3.757228	3.924540818	-1772.32	0.0595856	16.044478
38	6558.64	10123.12	-5336.8	3.816814	4.005314385	154.78	0.1078557	17.044478
39	8407.55	13744.36	-5182.02	3.924669	4.138124522	-223.43	0.0024616	18.044478
40	8455.34	13637.36	-5405.45	3.927131	4.134730305	14200.49	0.1308855	19.044478
41	11429.22	16834.67	8795.04	4.058017	4.226204608	-19143.4	0.1081052	20.044478
42	14659.59	23454.63	-10348.4	4.166122	4.370228586	2244.17	0.0472147	21.044478
43	16343.18	26691.62	-8104.23	4.213337	4.426374933	-302.18	0.0665609	22.044478
44	19050.11	27154.34	-8406.41	4.279897	4.433839252	667.21	-0.001957	23.044478
45	18964.45	27370.87	-7739.2	4.27794	4.437288602	14866.44	-0.043327	24.044478
46	17163.78	24902.98	7127.24	4.234613	4.39625132	-7127.24	-4.234613	25.044478

[1]exp=Export, imp=Import, tb= Trade Balance