

Impact of Subprime Crisis on Macroeconomic Factors of us and India

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ABSTRACT

For the purpose of studying the impact of sub-prime crisis on macroeconomic factors of US and India the data collected has been split into two parts, Pre-crisis period (from April, 2005 to June, 2007) and Post-crisis period (from July, 2007 to June, 2013). Monthly data (from April, 2005 to June, 2013) of all the variables have been used for analysis purpose. Different set of techniques and tests have been applied to accomplish the objective. Descriptive statistical techniques like mean, standard deviation, variance, etc. are carried out to show the nature and basic features of the variables used in the analysis. ADF test was applied to examine the stationary feature of time series data. After that Johansen Co integration test was applied to see whether the variables Co integrated or not through Trace value and Max Eigenvalues. Next Vector error correction model has been applied to test the short and long term association among the variables to have a deep insight about the impact of sub-prime crisis on macroeconomic factors of US and india. At the last impulse response function was applied which include the application of a unit shock to each variable and see its effect on VAR system.

Keywords: Subprime Crisis, VAR, Impluse Response Function.

INTRODUCTION:

Macroeconomic indicators affect the economy at national level. Major economic indicators are GDP, unemployment, inflation, imports, exports and balance of payment. Monetary and fiscal policies of an economy depend on these indicators. That is why; if these indicators are affected then the economy would also be affected. Sub-prime crisis does affect Indian banking system but not as much as India's trading system. Export and Imports were 40.7% of GDP during the sub-prime crisis period. In the year 2008, due to withdrawal of funds by foreign investors loss to sensex amounts to 250,000 crore. Capital outflow during the crisis period was very high which resulted in the downfall of the stock market. Withdrawal by foreign institutions investors and depreciated value of rupee were the main reasons behind this. Indian exports were badly affected due to the worldwide recession, which cause an increase in current account deficit. Exports decline from 2005/08 to 2008-09 by 11.4 percent. In 2009-10 exports follow the negative trend with 3.5 percent. The study covers the following macro indicators:

GDP: Gross Domestic Product (GDP) indicates the production of the economy. It measures the total amount of goods and services produced in the national territory of the country, which can be monthly, quarterly or annually. GDP provides exact sign of an economy's dimension. In India the base year for GDP calculation had been shifted to March, 2012 from March, 2005. GDP describes the overall image of the situation of the economy. GDP helps policymakers and central banks to evaluate whether the economy is declining or growing, whether it requires an improvement or control, and if a risk such as a downturn or inflation arises in the economy. GDP calculation is based on national income and product accounts and these components helps policymakers, economists and business to examine the impact of such variables as monetary and fiscal policy, economic upsets such as a hike in oil price, as well as tax and expenditure plans.

Inflation: Inflation indicates constant raise in the general price level. The inflation rate is a key value in the economy. Formation of monetary policy depends upon inflation rate. So, sustained low inflation rate in the

economy is helpful to cut down the costs of funds. Inflation study is important because High rates of inflation regularly depress investment and direct to lower long term growth of the economy. High and uneven inflation creates doubt and confusion about future prices and costs, due to these investors withdraw their investment, which in turn reduce growth speed of the economy. This situation creates low demand for goods in the economy. High inflationary growth is often unsafe. To control the high inflation in the economy government often increase interest rates and focus on devaluation of fiscal policy which slowdown the growth rate. High Inflation in a country signs towards the recession situation in the near future and less confidence in trading system. Benchmark for the inflation is 2-4% and if it is near about or cross over 10% then it indicates bad situation of the economy.

Imports: it includes products purchased from outside the country border. For example, industrialized countries usually import oil from OPEC countries. Globalization of trade makes imports as key components of trading system. When demand for goods and services are higher in the nation, then it is not possible for the producers to supply according to market requirement. To solve this problem producers import the products from the other countries which increase the variety of goods and services. Also these goods and service costs cheaper to produce if imported from the abroad.

Exports: It means any sending goods out of the country. Economic stability and trading system depends on the growth of export. Export growth also effects the allocation of money *in* the economy and growth of the economy. There is direct relationship between export growth and growth of the economy. If export rates are higher than the import rates in an economy, then that economy is developed economy. But if export growth is not stable then economic development also suffers. When export rates are lower than earning are also lower in foreign currency which means low purchasing power of a country in the international market. Instability in export earnings means instability in the growth of economy which can be positive or negative. Fluctuation in export creates risk for the producer. But its positive effect is that buyer invests more in nation country which increase the quality of production and economy also improves in financial terms.

Unemployment Rates: It indicates the percentage of total workers who are not working and searching out for the job. Unemployment rate is one of the most important statistics because a growing rate indicates weak performance of the economy that results in reduction in interest rate. A declining rate, similarly, indicates an upward economy which is usually accompanied by higher inflation rate and results in raise in interest rates. This rate is a key indicator about the country performance. When country performs well then the unemployment rate is low and it is high during recession/downturn period. Unemployment rate increase psychological stress to individual and reduces family income. High unemployment rate reflects less job opportunities in the economy which is a bad sign towards the economy's growth. After the recession period young people unemployment rate is continuously increasing because industries cut down the salaries and increase the retrenchment rate to maintain their costs.

Balance of Payment (BOP): BOP determines the payments that run between any individual country and all other countries. It summarizes the all global economic deals for that country during a year. Determinants of BOP includes exports of goods and services, financial capital and financial transfers of the country. Debit side of the statement includes all the payments and liabilities to outside countries and credit side include income received from the outside countries. Balance of payment statement discloses all the financial truncations made by the country during a specified period which is normally one year, comparing the payment made outside the country. If imports of any economy are wider than exports, the current account deficit will be in negative terms which is not a good sign for economy. Current account deficit is also known as trade deficit which plays a important role in formation of fiscal and monetary policy.

LITERATURE REVIEW:

Taulbee (2000) studied the impact of macroeconomic indicators on stock market returns. Daily returns of S & P 500 and Industrial Index (Financial, IT, FMCG and transportation) have been analyzed. Results of the regression test revealed that change in GDP influenced the stock market performance most among other variables. This study provides useful information to investors that how stock market performance is depended on these macroeconomic indicators.

Monch (2002) studied the macro indicators effect on the stock returns of US stock market. Monthly data of S & P 500 was analyzed through Monte Carlo method, Diffusion Index Pricing Model and other volatility forecasting models like VAR, ARCH, GARCH and EGARCH model. Comparison between the results from the test indicated that Volatility models best explained the effect of change in macro Indicators to stock market returns.

Menike (2006) studied how the performance of Sri Lankan stock market affected due to macroeconomic events for the period from September 1991 to December 2002 using monthly data. The results from multivariate

regression revealed that macroeconomic event has significant impact on stock returns. Negative effects of macro indicators described that whenever interest rate of Treasury bill increased stock market follow declining trend.

Humpe and Macmillan (2007) examined the impact of macroeconomic variables on US and Japan stock market. Results of co-integration confirmed the long term relationship industrial production, the consumer price index, money supply, long term interest rates and stock prices in the US and Japan. U.S data has one co-integration equation while Japan data showed two co- integration equations with macro indicators. Total three equations showed positive impact of macro indicators on US and Japanese stock market.

Soderberg (2008) studied the ability of fourteen macroeconomic variables to forecast changes in monthly liquidity on the Scandinavian order-driven stock exchanges through out of sample and in-sample methodology. Results indicated that some variables found significant for out of sample forecast of liquidity on these stock exchanges while others were selected for in- sample forecast.

Vishwakarma and French (2010) examined the relationships between the Indian real estate market and selected macroeconomic variables and found a significant relationship between macroeconomic variables and returns of the Indian real estate sector in March 2000, subsequent to the period when FDI policy was amended by the Indian government. Results of vector autoregressive model showed the negative trend between Rupee and USD forecasts returns.

Sinha et al. (2010) studied the condition of the Indian economy by dividing the study period into three parts- pre, during and post recession. GDP, exchange rate, inflation, capital markets and fiscal deficit macro factors have been analyzed through ARIMA model. Results indicated that Indian economy was recovering after a slowdown during the period of global recession. Upward trend in GDP, foreign investments, fiscal deficit and capital markets economy was forecasted in 2010-11.

Viswanathan (2010) described the causes of global financial crisis and found that it affected most the advanced economies in comparison to world's other economies. Methodology was based on IMF's data. Results of multiple correlations revealed that US and other European countries macro indicators affected badly and showed negative trend in comparison to India.

Asaolu et al (2011) studied the Impact of change in macro indicators on Average share price in Nigeria. Data was selected from 1986-2006. Econometric tests were applied on the data which includes Augmented Dickey Fuller (ADF) test, Granger Causality test, Co-integration and Error Correction Method (ECM). Long term relationship was found between macro indicators and ASP and ASP was not leading Indicator. Further relationship was not very strong among the variables.

Gupta and Modise (2011) studied the performance of South African Stock returns due to change in selected macro indicators. In-sample and out-of-sample methodology was used for prediction in performance change. Results of both the sample differ from each other. In-sample results forecasted that money supply; Oil production and interest rate changes affect the performance of South African Index. Whereas results of out-of-sample forecasted that only money supply and interest rate affect the performance of stock returns.

Junkin (2011) examined the stock returns performance of South Africa during the financial crisis and influence of macroeconomic variables on stock returns. Monthly data for the period 1995 to 2010 of FTSE index and selected sectoral indices has been analyzed through Johansen's cp-integration and VAR model. Results of VAR model has been described by Impulse Response function and Variance decomposition methods. Results revealed that there was a significant influence of macro variables on stock returns. Macro indicators had inconsistent effect on returns. Financial crisis also affected stock returns of indices but Pharma sector was less affected during crisis period.

Mohanasundaram and Karthikeyan (2012) examined the growth of Indian stock market through change in trading volume, turnover and companies listed on sensx. Correlation analysis was applied to measure the relationship between Bombay stock exchange and selected macro indicators. Results from correlation matrix revealed that Indian stock market follow upward trend during the period 2003 to 2011 with strong positive relationship with selected macro indicators.

Naka et al. (2012) analyzed relationships among selected macroeconomic variables and the Indian stock market through vector error correction model. Results revealed that three long-term co integration equations were found among the variables. Results further suggest inflation (CPI) affected most the performance of Indian stock market performance.

Asgharian et al. (2013) predicted the short term and long term components of return variance due to change in macro indicator with the help of GARCH Class model. GARCH- MIDAS model was applied and principal component analysis was used to measure the effect of macro indicators. It was found that low frequency macro event improve the prediction ability for long term variance component.

RESEARCH METHODOLOGY:

Objective:

This paper aims to study the behavior of Indian and U.S. Macro indicators before and after the crisis in terms of variation.

Hypothesis:

H0: There is no difference in the behavior of Macro Indicators before and after the crisis.

H1: There is a difference in the behavior of Macro Indicators before and after the crisis.

DATA AND SAMPLE SELECTION:

Sample unit and Time period: Monthly data (from April, 2005 to June, 2013) of selected variables (GDP, Inflation, Import, Export, unemployment rate, BOP) have been collected from the secondary sources (www.imf.org.com and www.indexmundi.com) for analysis purpose. The data has been divided into two parts:

Pre-crisis Period- April, 2005 to June 2007

Post Crisis Period - July 2007 to June 2013

Statistical tools: The following statistical tools have been used for analysis:

Descriptive statistics: Descriptive statistics describe the patterns and general trends of a dataset and summarize it in a single value. It helps a reader to quickly understand and interpret the set of data that has been collected. In this paper, descriptive statistics provide a useful quantitative summary of macroeconomics variables of India. Study utilizes measures of central tendency (mean) and measures of Variability (standard deviation, skewness and kurtosis) to explain the dataset.

ADF (Augmented Dickey Fuller) test: Stationary feature of a data series is a requirement for drawing meaningful inferences in a time series analysis. It increases the accuracy and reliability of the models constructed. Because if the variable is not stationary it might lead to spurious result of the analysis. Before estimating the models, the unit root properties for the time series data have been tested individually for macroeconomic variable time series through ADF test statistic. The augmented Dickey fuller test is given by the following equation:

$$ADF = \Delta y_t = \alpha y_{t-1} + \sum_{i=1}^p x_{t-i} \delta + e_t$$

Where α and δ are parameters to be estimated and

e_t is white noise error term

The ADF tests the following hypothesis:

H0: $\alpha = 0$ (the series has a unit root)

H1: $\alpha < 0$ (series does not have a unit root) and is evaluated using t ratio.

Johansen's Co integration Test: This test depicts the presence of relationship for long time period between two or more variables. As alternate to depending on OLS estimation Johansen's system generate Co incorporated variables on greatest probability estimation in a straight way. This procedure primarily on the relationship between the positions of a framework. Johansen structured the maximum probability estimation utilizing successive tests for deciding the quantity of co incorporating vectors. This test is based on two Values: Trace rank and Max Eigenvalue.

Unrestricted VAR Model: VAR is an econometric model which is utilized to identify the straight interdependencies among different time series. VAR models figure out the relations between more than one variable. All variables in a VAR have a comparison clarifying its advancement focused around its own slacks and the slacks of the other model variables. Since it is hard to portray VAR demonstrate all in all, it can be portrayed into two sections: 1. Variance Decomposition 2. Impulse Response Function.

The variance decomposition depicts the measure of data every variable influence to alternate variables in the auto regression. It lets us know how a great part of the figure estimated error of each of the variables can be clarified by exogenous shocks to alternate variables.

The impulse response function refers as a shock to VAR framework. It Recognize how the ward variable (endogenous variable) will carry on in the VAR when a shock is put in the error term. A unit Shock was acquainted

with every variable and sees its impact on the VAR framework.

Vector Error Correction Model (VECM): The ECM is an adjustment mechanism in which deviations (variations) from the equilibrium relationship in the previous period, as measured by η_{t-1} , lead to adjustments in y_t .

ANALYSIS AND RESULTS:

Impact of sub-prime crisis on US Macroeconomic variables:

Descriptive Statistics Analysis:

Table 1: Descriptive Statistics for Pre and Post-crisis Period

Statistics	GDP		Inflation		Imports		Exports		Unemployment Rate		BOP	
	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST
Mean	0.572	0.233	3.144	2.129	10.322	4.433	12.167	7.258	4.711	7.979	-5.678	-3.229
Max.	1.210	1.200	4.000	5.300	13.700	31.100	14.800	24.900	5.100	9.900	-5.200	-2.300
Min.	0.070	-2.150	1.900	-1.600	4.600	-34.700	9.600	-25.800	4.400	4.700	-6.200	-4.900
S.D	0.357	0.769	0.685	1.618	4.046	16.560	1.722	13.930	0.247	1.659	0.336	0.821
Skewness	0.089	-1.547	-0.463	-0.346	-0.679	-0.947	0.272	-1.053	0.432	-0.811	-0.365	-0.999
Kurtosis	2.175	5.166	1.967	3.164	1.502	3.324	1.840	3.222	1.623	2.382	2.104	2.470
Jarque-bera	0.802	42.777	2.165	1.518	4.597	11.070	1.848	13.457	2.972	9.032	1.501	12.810
Probability	0.670	0.000	0.339	0.468	0.100	0.004	0.397	0.001	0.226	0.011	0.472	0.002

Table 1 presented a summary of descriptive statistics of all the variables for pre-crisis and post-crisis period. The descriptive statistics reported that GDP mean value declined in post-crisis period and standard deviation increased in post-crisis period. Kurtosis and skewness also increased in post-crisis period. In short GDP data was fluctuated more in post-crisis period. Inflation mean value declined and standard deviation increased in post-crisis period with negative skewness, which indicate variations were increased in post-crisis period. Imports mean value declined, standard deviation, skewness and kurtosis values increased in post-crisis period. Likewise, exports mean value declined, standard deviation, skewness and kurtosis values increased in post-crisis period. Unemployment rate mean value increased in post-crisis period but standard deviation, skewness and kurtosis value increased which indicates variation in post-crisis period. Mean value of BOP indicated negative sign with increased standard deviation, skewness and kurtosis also described negative values in post-crisis period.

In sum sub-prime crisis have impact on US macroeconomic indicators during the post-crisis period as compared to pre-crisis period as reported by the parameters of variation.

ADF Test:

ADF (unit root test) has been applied to understand the level of integration among the variables.

Ho: Variables are non-stationary.

H1: Variables are Stationary.

The result of ADF test statistics is gives in the tables below.

Table 2: ADF level- Pre -Crisis Period

Null Hypothesis	P- values	HO	Result
GDP is not stationary	0.7606	Accept	Variable is not stationary
INFLATION is not stationary	0.4804	Accept	Variable is not stationary
IMPORT is not stationary	0.5453	Accept	Variable is not stationary
EXPORT is not stationary	0.8441	Accept	Variable is not stationary
UNEMPLOYMENT is not stationary	0.7598	Accept	Variable is not stationary
BOP is not stationary	0.5854	Accept	Variable is not stationary

Table 3: ADF level- Post-crisis Period

Null Hypothesis	P- values	HO	Result
GDP is not stationary	0.1650	Accept	Variable is not stationary
INFLATION is not stationary	0.6555	Accept	Variable is not stationary
IMPORT is not stationary	0.5436	Accept	Variable is not stationary
EXPORT is not stationary	0.4764	Accept	Variable is not stationary
UNEMPLOYMENT is not stationary	0.4569	Accept	Variable is not stationary
BOP is not stationary	0.6603	Accept	Variable is not stationary

Results of table 2 revealed that the variables were found non-stationary as the p-values of these variables was more than the critical p-value at 5% level of significance. Likewise in table 3 all the variables were non-stationary in post-crisis time series. Thus the null hypothesis that variables were not stationary was accepted and alternative hypothesis of stationary was rejected.

It was found that all the variables were integrated at same level then Johansen Co integration test can be applied to test the relationship among the variables.

Table 4: Lag Length Criteria

Lag	LR		FPE		AIC		SC		HQ	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
0	NA	NA	1.49E-05	8.27E+01	5.914165	21.44266	6.206695	21.63538	5.9953	21.51921
1	122.1826*	706.0448*	3.28e-07*	0.003154*	2.006245*	11.26417*	4.053956*	12.61326*	2.574193*	11.80004*
2	14.14942	24.03577	3.23E-06	0.005916	3.707126	11.87106	7.510019	14.37652	4.761887	12.86626

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level of significance level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

From the table 4 it was depicted that all the criteria indicated one lag for both the periods for the model. This value was considered in other stages of the co integration tests.

Johansen’s co integration Test:

Once determined the number of lags of the VAR model, the Co integration test was performed to verify the existence of long-term relationship between variables. The result was based on two values i.e. Trace value and Max Eigen value.

Table 5: Johansen’s Multivariate Co integration Test – Pre-Crisis Period

Johansen Co integration Analysis						
Test of Co integration rank						
Series: D(GDP) D(INFLATION) D(IMPORTS) D(EXPORTS) D(UNEMPLOYMENT) D(BOP)						
Eigen Value	0.802413	0.499149	0.398941	0.333333	0.333333	0.24574
Null Hypothesis**	r=0	r≤1	r≤2	r≤3	r≤4	r≤5
Trace	93.96085	55.04298	38.44826	26.23076	16.4996	6.768438
95% Critical Value	95.75366	69.81889	47.85613	29.79707	15.49471	3.841466
p-values	0.066	0.4172	0.2828	0.1219	0.0352	0.0093
Max	38.91788	16.59472	12.21749	9.731163	9.731163	6.768438
95% Critical Value	40.07757	33.87687	27.58434	21.13162	14.2646	3.841466
p-values	0.0671	0.9363	0.9236	0.7694	0.2302	0.0093
* Indicates Significance level at 95%(rejection of the hypothesis at the 0.05 level)						
** Number of Co integrating Equations						
Trace test indicates no co integrating eqn(s) at the 0.05 level						
Max-eigenvalue test indicates no co integrating eqn(s) at the 0.05						

The results obtained for the trace test presented in table 5 and indicated that the null hypothesis that there was no co integration vector establishing the relations of long-term balance between variables was accepted at 5% level of significance level with p- value more than 5 percent and Trace value was less than critical value when r =0. Max Eigen test also indicated no cointegrating equation at the 5% level of significance. For pre-crisis period as there was no co integrated vector, unrestricted VAR model (Vector Auto regression Model) has been applied .

Table 6: Johansen’s Multivariate Co integration Test – Post-crisis Period

Johansen Co integration Analysis						
Test of Co integration rank						
Series:D(GDP) D(INFLATION) D(IMPORTS) D(EXPORTS) D(UNEMPLOYMENT) D(BOP)						
Eigen Value	0.364492	0.333333	0.333333	0.333333	0.333333	0.333333
Null Hypothesis**	r=0	r≤1	r≤2	r≤3	r≤4	r≤5
Trace	171.1653	139.8855	111.9084	83.93128	55.95418	27.97709
95% Critical Value	95.75366	69.81889	47.85613	29.79707	15.49471	3.841466
p-values	0	0	0	0	0	0
Max	31.27983	27.97709	27.97709	27.97709	27.97709	27.97709
95% Critical Value	40.07757	33.87687	27.58434	21.13162	14.2646	3.841466
p-values	0.0343	0.2146	0.0445	0.0047	0.0002	0
* Indicates Significance level at 95%(rejection of the hypothesis at the 0.05 level)						
** Number of Co integrating Equations						
Trace test indicates 6 co integrating eqn(s) at the 0.05 level						

Max-eigenvalue test indicates 1 co integrating eqn(s) at the 0.05	
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The result of above table 6 indicated that we cannot reject the null hypothesis that there were at most 6 co integration vectors from trace test and 1 co integration vectors from Max Eigen Value for post-crisis period of macroeconomic indicators. For VECM model, the Max Eigen results has been selected for cointegration equations.

VAR Model for Pre-Crisis Period:

Johansen’s co integration test for pre-crisis period suggests that there was no co-integrated vector. So, Unrestricted VAR Model has been applied.

Since it is difficult to describe VAR model as a whole, it can be described into two parts: 1. Variance Decomposition 2. Impulse Response Function.

Variance Decomposition:

The variance decomposition described the amount of information each variable affect to the other variables in the auto regression.

Table 7: Variance Decomposition

1. Variance Decomposition of GDP:							
Period	S.E.	GDP	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	0.338577	100	0	0	0	0	0
2	0.418753	96.09514	0.252328	0.053723	2.148038	0.302344	1.14843
3	0.428896	95.29401	0.314226	0.055256	2.54E+00	0.34963	1.446367
4	0.42939	95.20827	0.320726	0.055534	2.58E+00	0.354872	1.477483
5	0.429398	95.20686	0.320855	0.055532	2.58E+00	0.354925	1.478144
6	0.42941	95.20682	0.320857	0.055533	2.58E+00	0.354929	1.478149
7	0.429413	95.20667	0.320868	0.055534	2.58E+00	0.354939	1.478202
8	0.429413	95.20664	0.32087	0.055534	2.58E+00	0.354941	1.478212
9	0.429413	95.20664	0.32087	0.055534	2.58E+00	0.354941	1.478213
10	0.429413	95.20664	0.32087	0.055534	2.58E+00	0.354941	1.478213
2. Variance Decomposition of D(INFLATION):							
Period	S.E.	GDP	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	0.43135	3.750501	96.2495	0	0	0	0
2	0.4419	6.526064	91.82563	0.020959	0.9582	0.132463	0.536687
3	0.455536	11.64	86.4321	0.031063	1.137304	-0.161461	0.598077
4	0.458502	12.57216	85.33288	0.031545	1.226798	0.172395	0.664228
5	0.458752	12.63477	85.24212	0.031697	1.242262	0.174358	0.674796
6	0.458756	12.63483	85.24075	0.031698	1.242922	0.174433	0.675371
7	0.458758	12.63542	85.24017	0.031698	1.242915	0.174432	0.675367
8	0.458759	12.63565	85.23991	0.031698	1.242931	0.174434	0.675376
9	0.458759	12.63568	85.23988	0.031698	1.242935	0.174435	0.675379
10	0.458759	12.63568	85.23988	0.031698	1.242935	0.174435	0.67538

3. Variance Decomposition of D(IMPORTS):

Period	S.E.	GDP	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	1.79477 1	5.10094 3	41.15027	53.74879	0	0	0
2	1.81684 4	6.34499 2	40.27293	52.6158	0.02995	0.005985	0.730341
3	1.84363 8	8.95074	39.12123	51.09969	5.52E-02	0.007188	0.765994
4	1.85130 8	9.56215 1	38.80628	50.67992	1.35E-01	0.01898	0.797561
5	1.85194 9	9.60604 3	38.78094	50.64487	1.44E-01	0.019958	0.80446
6	1.85196 3	9.60631 4	38.78041	50.64407	1.44E-01	0.020036	0.804843
7	1.85196 6	9.60662	38.78028	50.6439	1.44E-01	0.020036	0.80484
8	1.85196 8	9.60676	38.78021	50.64381	1.44E-01	0.020037	0.804845
9	1.85196 8	9.60677 8	38.7802	50.6438	1.44E-01	0.020038	0.804847
10	1.85196 8	9.60677 9	38.7802	50.6438	1.44E-01	0.020038	0.804847

4. Variance Decomposition of D(EXPORTS):

Period	S.E.	GDP	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	1.249553	10.04599	20.10002	41.56672	28.28727	0	0
2	1.255379	10.48801	19.93028	41.20229	28.2717	0.043037	0.064683
3	1.262491	11.40098	19.7105	40.74379	28.0118	0.052414	0.080506
4	1.263938	11.5675	19.66825	40.65058	27.96504	0.054335	0.094291
5	1.264061	11.57867	19.66485	40.64271	27.96277	0.054743	0.096259
6	1.264063	11.57867	19.66482	40.6426	27.9628	0.054754	0.096361
7	1.264064	11.57878	19.66479	40.64255	27.96276	0.054754	0.096361
8	1.264064	11.57882	19.66478	40.64252	27.96275	0.054755	0.096364
9	1.264064	11.57883	19.66478	40.64252	27.96275	0.054755	0.096364
10	1.264064	11.57883	19.66478	40.64252	27.96275	0.054755	0.096364

5. Variance Decomposition of D(UNEMPLOYMENT):

Period	S.E.	GDP	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	0.088705	32.83786	3.584363	9.331756	38.04328	16.20275	0
2	0.08955	32.42426	3.585605	9.738041	37.60451	16.0748	0.572784
3	0.089811	32.7408	3.566349	9.70805	37.40784	15.99162	0.585344
4	0.089928	32.86236	3.559008	9.686436	37.34486	15.95646	0.590867
5	0.089937	32.87189	3.558715	9.684408	37.33861	15.95321	0.593162
6	0.089938	32.87196	3.558714	9.684334	37.33858	15.95311	0.593291
7	0.089938	32.872	3.558712	9.684329	37.33856	15.9531	0.593292
8	0.089938	32.87203	3.558711	9.684325	37.33855	15.9531	0.593293
9	0.089938	32.87203	3.55871	9.684324	37.33854	15.9531	0.593293
10	0.089938	32.87203	3.55871	9.684324	37.33854	15.9531	0.593293

6.Variance Decomposition of D(BOP):							
Period	S.E.	GDP	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	0.296033	50.17594	4.392588	23.61974	0.926925	0.12532	20.75949
2	0.305514	50.98846	4.28749	22.18845	2.008568	0.262723	20.26431
3	0.317845	54.2295	3.989169	20.51189	2.139091	0.285786	18.84456
4	0.320566	54.73038	3.941815	20.16648	2.24152	0.298519	18.62128
5	0.320796	54.75246	3.939311	20.13788	2.260004	0.300848	18.6095
6	0.320799	54.75156	3.939376	20.13741	2.260868	0.300946	18.60983
7	0.320801	54.75196	3.939342	20.13724	2.260851	0.300944	18.60967
8	0.320802	54.75209	3.93933	20.13716	2.260867	0.300946	18.60961
9	0.320802	54.7521	3.939328	20.13715	2.260871	0.300947	18.60961
10	0.320802	54.7521	3.939328	20.13715	2.260872	0.300947	18.60961
Cholesky Ordering: GDP D (INFLATION) D (IMPORTS) D (EXPORTS) D (UNEMPLOYMENT) D (BOP)							

Table 7 described the percentage of variation in one variable due to other variables. The first part demonstrates the decomposition of variance of GDP. In long run period variation to GDP from own shock account for 95.20% and inflation account for 0.32 % variation in GDP variance. Likewise, imports, exports, unemployment and BOP account for 0.05 %, 2.58%, 0.35% and 1.47% variations in GDP variance.

The second part demonstrated the decomposition of variance of inflation. In long run period variation to inflation from own shock account for 85.23% and GDP account for 12.63 % variation in inflation variance. Likewise, imports, exports, unemployment and BOP account for 0.31 %, 1.24%, 0.17% and 0.67% variations in inflation variance.

The third part demonstrated the decomposition of variance of imports. In long run period variation to imports from own shock account for 50.64% and GDP account for 9.60 % variation in imports variance. Likewise, inflation, exports, unemployment and BOP account for 38.78 %, 1.44%, 0.02% and 0.80% variations in imports variance.

The fourth part demonstrated the decomposition of variance of exports. In long run period variation to exports from own shock account for 27.96% and GDP account for 11.57 % variation in exports variance. Likewise, inflation, imports, unemployment and BOP account for 19.66%, 40.64%, 0.05% and 0.09% variation in exports variance.

The fifth part demonstrated the decomposition of variance of unemployment. In long run period variation to unemployment from own shock account for 15.95% and GDP account for 32.87 % variation in unemployment variance. Likewise, inflation, imports, exports and BOP account for 3.55%, 9.68%, 37.33% and 0.59% variations in unemployment variance.

The last part demonstrated the decomposition of variance of BOP. In long run period variation to BOP from own shock account for 18.60% and GDP account for 54.75% variation in BOP variance. Likewise, inflation, imports, exports and unemployment account for 3.93%, 20.13%, 2.26% and 0.30% variation in BOP variance.

IMPULSE RESPONSE FUNCTION:

Figure 1: Impulse Response Graphs for Pre-Crisis Period:

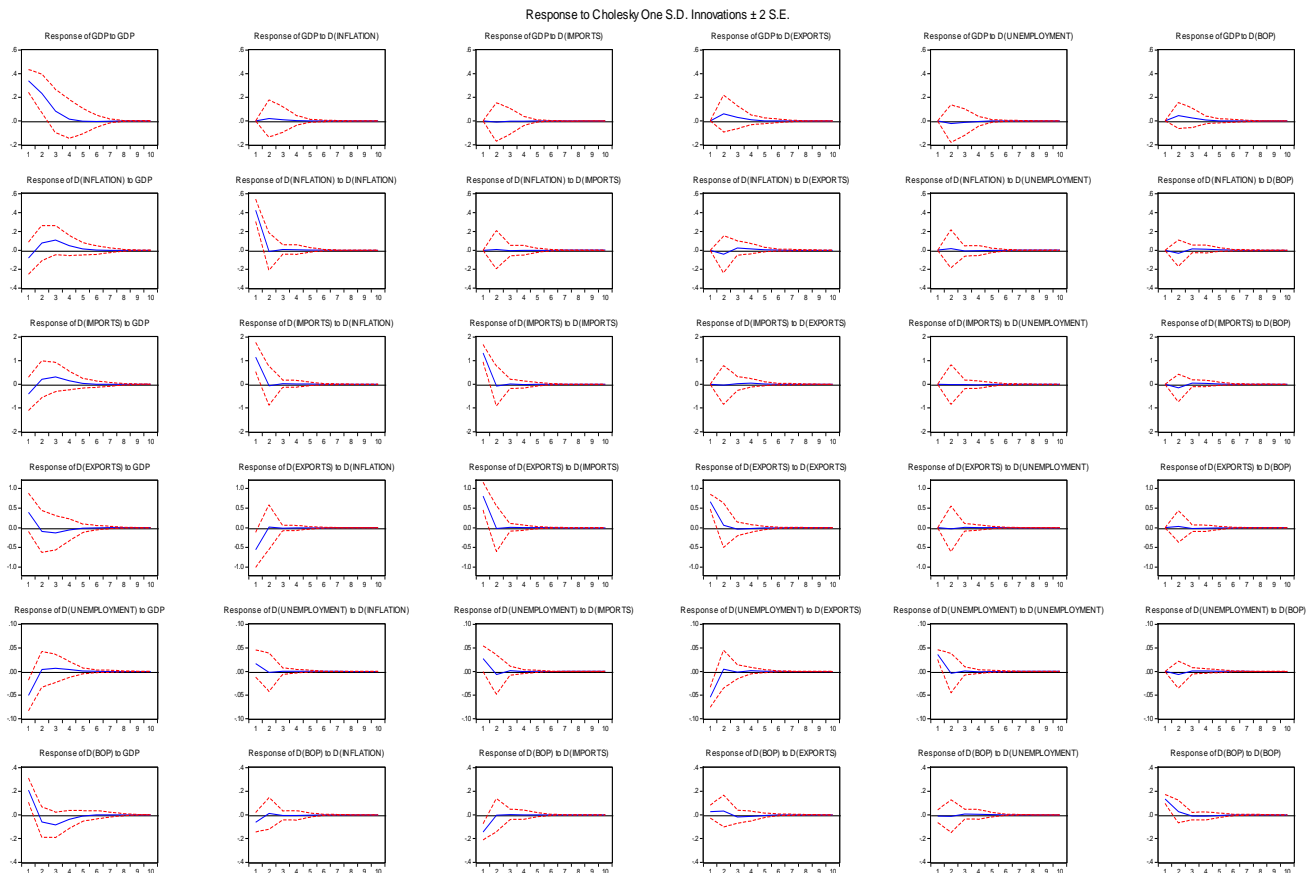


Figure 1 described that one standard deviation shock to the GDP decreases the GDP in pre-crisis period and other variables. In summary we can say that if we introduce one SD shock to one variable it brings decreasing or negative trend in another variable.

Vector Error Correction Model (VECM) for Post-crisis Period:

There was 1 co integration equation by Johansen test. So, VECM model for post-crisis period has been applied.

Table 8: Vector Error Correction Estimates for US Macro Indicators

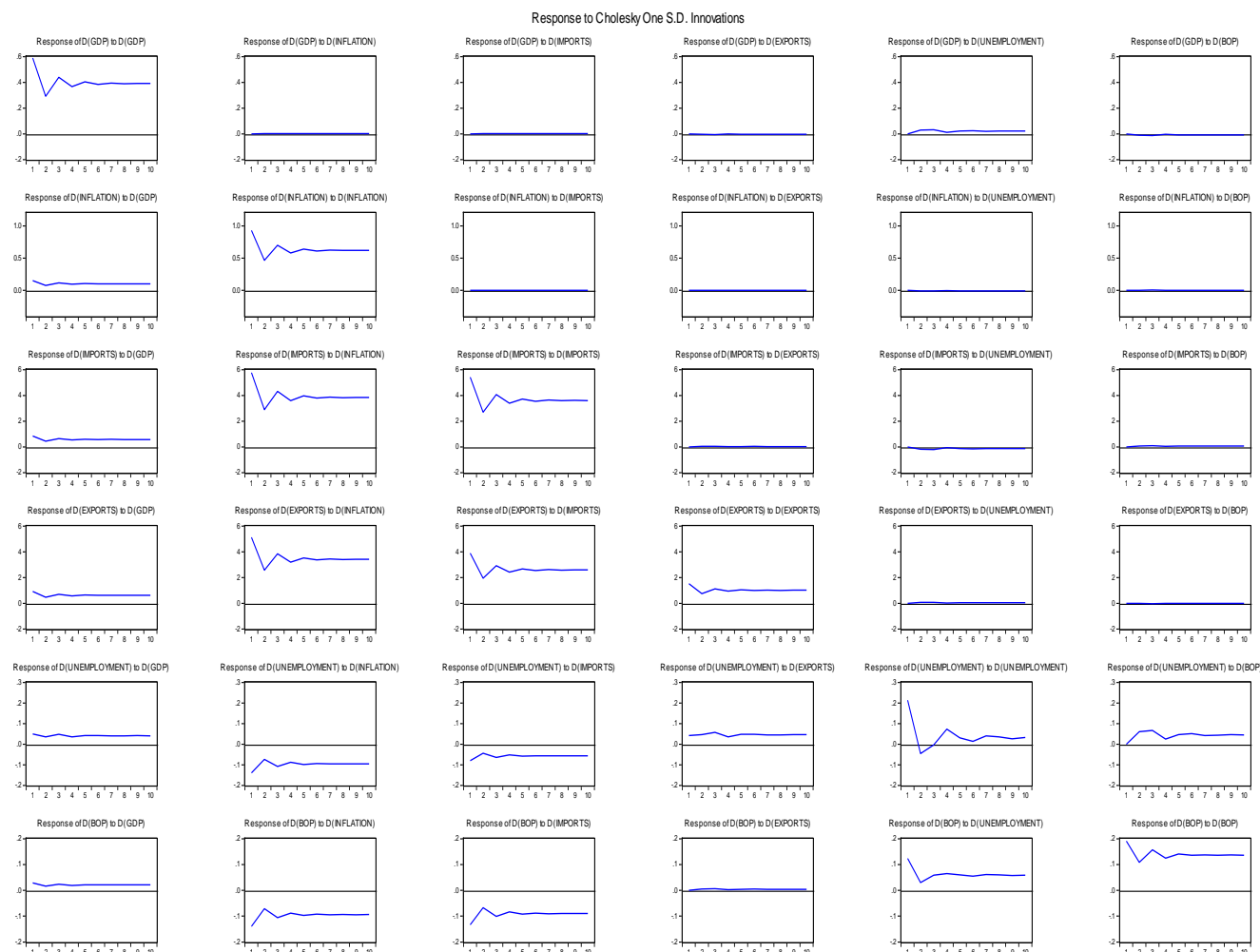
Error Correction:	D(GDP)	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
CointEq1	-0.03367*	0.010632*	0.218635*	-0.06764*	0.175956*	0.03658*
	-0.05806	-0.09286	-0.78385	-0.6558	-0.02713	-0.02958
	[-0.57999]	[0.11450]	[0.27892]	[-0.10315]	[6.48509]	[1.23677]

Note: * shows the value of error correction terms [] shows the “t-values”

Table 8 revealed that coefficients having negative signs indicated long term causality and positive coefficient indicate that there was short run causality between the variables the adjustment coefficients of the equation indicated the speed of adjustment towards the equilibrium decision. The speed of adjustment described that 3% of disequilibrium corrected every month by changes in GDP, 1% of inflation, 21% of imports, 6% of exports, 17% of unemployment and 3% of disequilibrium corrected every month by changes in BOP.

Figure 2: Impulse Response Graphs for Post-crisis Period:

Figure 2 described the results of impulse response function for post-crisis period. From the graphs it can be concluded that some variables decreased in a constant trend, some indicated negative trend and some follows upwards and downwards trend due to innovation of one unit shock in one variable.



Impact of Sub Prime Crisis on Indian Macroeconomic Variables:

Following tests were applied to know the impact of the subprime crisis:

Descriptive Statistics Analysis:

Table 9: Descriptive statistics for pre and post-crisis period

Statistics	GDP		Inflation		Imports		Exports		Unemployment Rate		BOP	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	2.288	1.638	3.144	2.129	31.167	23.033	24.733	20.217	2.007	2.319	-1.211	-2.563
Max.	3.03	5.510	4.000	5.300	49.200	75.800	38.400	57.700	2.220	2.700	2.100	-0.100
Min.	1.46	-1.850	1.900	-1.600	14.200	-24.500	11.000	-20.400	1.800	1.700	-2.500	-4.200
S.D	0.498	1.466	0.685	1.618	10.885	21.867	8.560	18.690	0.165	0.369	1.731	1.084
Skewness	-0.343	0.628	-0.463	-0.346	0.028	-0.003	-0.287	-0.007	0.283	-0.702	1.215	0.613

Statistics	GDP		Inflation		Imports		Exports		Unemployment Rate		BOP	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Kurtosis	2.194	4.701	1.967	3.164	2.311	3.335	2.211	2.612	1.617	2.041	2.677	2.354
Jarque-bera	1.259	13.406	2.165	1.518	0.538	0.336	1.069	0.452	2.514	8.681	6.762	5.766
Probability	0.533	0.001	0.339	0.468	0.764	0.845	0.586	0.798	0.285	0.013	0.034	0.056

Table 9 presented a summary of descriptive statistics of all the variables for pre-crisis and post-crisis period. The descriptive statistics reported that GDP mean value declined and standard deviation increased in post-crisis period. skewness and kurtosis figure also increased in post-crisis period. In short GDP data was fluctuated more in post-crisis period. Inflation mean value declined with increased standard deviation in post-crisis period, negative skewness and kurtosis also indicated variations were increased in post-crisis period. Imports mean value declined, standard deviation, skewness and kurtosis values increased in Post-crisis period. Likewise, exports mean value declined, standard deviation, skewness and kurtosis values increased in post-crisis period. Unemployment rate mean value increased in post-crisis period but standard deviation, skewness and kurtosis value increased which indicated variation in post-crisis period. BOP Mean indicated negative figures in pre and post- crisis period with decreased standard deviation and kurtosis in post-crisis period.

In sum sub-prime crisis have impact on Indian macroeconomic indicators during the post-crisis period as compared to pre-crisis period as reported by the parameters of variation. Only BOP indicator has fewer variations in post-crisis period.

ADF Test:

As already discussed stationary feature of a data series is a requirement for drawing meaningful inferences in a time series analysis and enhances the accuracy and reliability of the models constructed. If the variable is not stationary it might lead to spurious result in the analysis. As a first step, has been applied to test the stationarity of all the variables. Hypothesis for this test for both countries is as follows:

H₀: Variables are non-stationary.

Following are the results of ADF Test:

Table 10: ADF level- Pre-Crisis Period

Null Hypothesis	P- values	H ₀	Result
GDP is not stationary	0.8411	Accept	Variable is not stationary
INFLATION is not stationary	0.4804	Accept	Variable is not stationary
IMPORT is not stationary	0.1239	Accept	Variable is not stationary
EXPORT is not stationary	0.6948	Accept	Variable is not stationary
UNEMPLOYMENT is not stationary	0.3336	Accept	Variable is not stationary
BOP is not stationary	0.3606	Accept	Variable is not stationary

Table 11: ADF level- Post-crisis Period

Null Hypothesis	P- values	H ₀	Result
GDP is not stationary	0.4811	Accept	Variable is not stationary
INFLATION is not stationary	0.6555	Accept	Variable is not stationary
IMPORT is not stationary	0.7751	Accept	Variable is not stationary
EXPORT is not stationary	0.5176	Accept	Variable is not stationary
UNEMPLOYMENT is not stationary	0.8133	Accept	Variable is not stationary
BOP is not stationary	0.1976	Accept	Variable is not stationary

Results of table 10 revealed that as the p-values of all these variables were more than the critical p-value at 5% level of significance, so all the variables were non stationary in the time series. Thus the null hypothesis that variables were not stationary was accepted and alternative hypothesis of stationary was rejected. Likewise in table 11 all the variables were non stationary as the p- values were more than 5% level of significance. So, now all variables were found non-stationary as all the p-values are more than 5% level of significance, Johansen Co integration test has been applied to test the relationship between the variables.

Lag Length Criteria:

Before applying the Johansen Co integration test it is necessary to determine the number of lags of this model. In order to determine the number of lags (p) of the VAR model, following criteria were adopted, **Table 12** present the results:

Lag	LR		FPE		AIC		SC		HQ	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
0	NA	NA	7.0052	3222.7150	18.9737	25.1052	19.2662	25.2980	19.0548	25.1818
1	124.8516*	497.9725*	0.132971*	3.340893*	14.91746*	18.22948*	16.96517*	19.57857*	15.48540*	18.76535*
2	14.1571	21.6397	1.3054	6.5359	16.6177	18.8784	20.4206	21.3839	17.6725	19.8736

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level of significance level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 12 indicated that all the criteria suggested one lag for both the periods. This value was considered in other stages of the co integration tests.

Johansen’s co integration Test:

Once determined the number of lags of the VAR model, the Co integration test was performed to verify the existence of long-term relationship between variables. The result was based on two values i.e. Trace value and Max Eigen value. Table 4.13 indicated results of test for Indian macroeconomic variables for pre-crisis period and table 4.14 indicated results for post-crisis period.

Table 13: Johansen’s Multivariate Cointegration Test: Pre-Crisis Period

Johansen Co integration Analysis						
Test of Co integration rank						
Series: : D(GDP) D(INFLATION) D(IMPORTS) D(EXPORTS) D(UNEMPLOYMENT) D(BOP)						
Eigen Value	0.560722	0.333333	0.333333	0.333333	0.333333	0.333333
Null Hypothesis**	r=0	r≤1	r≤2	r≤3	r≤4	r≤5
Trace	68.39877	48.65581	38.92465	29.19349	19.46233	9.731163
95% Critical Value	95.75366	69.81889	47.85613	29.79707	15.49471	3.841466
p-values	0.7735	0.695	0.2633	0.0586	0.0119	0.018
Max	19.74295	9.731163	9.731163	9.731163	9.731163	9.731163
95% Critical Value	40.07757	33.87687	27.58434	21.13162	14.2646	3.841466
p-values	0.974	1	0.9884	0.7694	0.2302	0.0018

* Indicates Significance level at 95%(rejection of the hypothesis at the 0.05 level)

** Number of Co integrating Equations

Trace test indicates no co integrating eqn(s) at the 0.05 level

Max-eigenvalue test indicates no co integrating eqn(s) at the 0.05

The results obtained for the trace test presented in Table 13 indicated that the null hypothesis that there was no co integration vector establishing the relations of long-term balance between variables was accepted at 5 % significance level. Max Eigen test indicated no cointegrating equation at 5% level of significance. For pre-crisis period as there is no co integrated vector unrestricted VAR model has been applied (Vector Auto regression Model).

Table 14: Johansen’s Multivariate Co integration Test : Post-crisis Period

Johansen Co integration Analysis						
Test of Co integration rank						
Series: : GDP D(INFLATION) D(IMPORTS) D(EXPORTS) D(UNEMPLOYMENT) D(BOP)						
Eigen Value	0.474178	0.345267	0.341685	0.333333	0.333333	0.189717
Null Hypothesis**	r=0	r≤1	r≤2	r≤3	r≤4	r≤5
Trace	172.8928	128.5401	99.31673	70.4698	42.49271	14.51561
95% Critical Value	95.75366	69.81889	47.85613	29.79707	15.49471	3.841466
p-values	0	0	0	0	0	0
Max	44.35268	29.22341	28.84693	27.97709	27.97709	14.51561
95% Critical Value	40.07757	33.87687	27.58434	21.13162	14.2646	3.841466
p-values	0.0155	0.1626	0.0343	0.0047	0.0002	0.0001

* Indicates Significance level at 95%(rejection of the hypothesis at the 0.05 level)

** Number of Co integrating Equations

Trace test indicates 6 co integrating eon(s) at the 0.05 level

Max-eigenvalue test indicates 1 co integrating eqn(s) at the 0.05

The result of table 14 indicated that the null hypothesis cannot be rejected that there were at most 6 co integration vectors from trace test and 1 co integration vectors from Max Eigen Value for Post-crisis period of macro-economic indicators. For VECM model Max Eigen results has been selected for co integration equations.

VAR Model for pre-crisis period:

Johansen’s co integration Test for pre-crisis period suggested that there was no co-integrated vector. So, Unrestricted VAR Model has been applied. VAR is an econometric model which is utilized to identify the straight interdependencies among different time series. VAR models figure out the relations between more than one variable. All variables in a VAR have a comparison clarifying its advancement focused around its own slacks and the slacks of the other model variables. Since it is hard to portray VAR demonstrate all in all, it can be portrayed into two sections: 1. Variance Decomposition 2. Impulse Response Function.

Variance Decomposition:

The variance decomposition described the amount of information each variable affect to the other variables in the auto regression. It tells US how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. Following tables describes the results for variance decomposition.

Table 15: Variance Decomposition of Macro Indicators- India

1. Variance Decomposition of D(GDP):							
Period	S.E.	D (GDP)	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D(BOP)
1	0.747545	100	0	0	0	0	0
2	0.748014	99.87594	0.001024	0.003787	0.006199	0.049616	0.063431
3	0.748218	99.82218	0.001467	0.005428	0.008886	0.071119	0.090921
4	0.748368	99.78257	0.001794	0.006638	1.09E-02	0.086961	0.111173
5	0.748368	99.78244	0.001795	0.006641	0.010871	0.087011	0.111237
6	0.748388	99.77731	0.001837	0.006798	0.011128	0.089065	0.113864
7	0.748389	99.77688	0.001841	0.006811	0.011149	0.089236	0.114082
8	0.74839	99.77658	0.001843	0.00682	0.011164	0.089357	0.114237
9	0.748391	99.77641	0.001845	0.006826	0.011173	0.089424	0.114323
10	0.748391	99.77641	0.001845	0.006826	0.011173	0.089425	0.114324
2. Variance Decomposition of D(INFLATION):							
Period	S.E.	D (GDP)	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	0.585988	17.92024	82.07976	0	0	0	0
2	0.586036	17.91743	82.06621	0.000504	0.000824	0.006599	0.008436
3	0.586058	17.91621	82.06032	0.000722	0.001182	0.009463	0.012098
4	0.586073	17.91531	82.05598	0.000883	0.001446	0.011575	0.014798
5	0.586073	17.91531	82.05597	0.000884	0.001447	0.011581	0.014806
6	0.586075	17.91519	82.05541	0.000905	0.001481	0.011855	0.015156
7	0.586076	17.91518	82.05536	0.000907	0.001484	0.011878	0.015185
8	0.586076	17.91518	82.05533	0.000908	0.001486	0.011894	0.015206
9	0.586076	17.91517	82.05531	0.000909	0.001487	0.011903	0.015218
10	0.586076	17.91517	82.05531	0.000909	0.001487	0.011903	0.015218
3. Variance Decomposition of D(IMPORTS):							
Period	S.E.	D (GDP)	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	10.85454	13.92959	2.602779	83.46763	0	0	0
2	10.87566	13.87974	2.595849	83.15555	0.019176	0.153476	0.196208
3	10.88481	13.85822	2.592856	83.0208	0.027455	0.219741	2.81E-01
4	10.89156	13.8424	2.590656	82.92173	0.033542	0.268463	3.43E-01
5	10.89158	13.84235	2.590649	82.92142	0.033562	0.268616	3.43E-01
6	10.89246	13.8403	2.590364	82.90858	0.03435	0.274929	3.51E-01
7	10.89253	13.84013	2.59034	82.90752	0.034416	0.275452	3.52E-01
8	10.89258	13.84001	2.590323	82.90676	0.034462	0.275825	3.53E-01
9	10.89261	13.83994	2.590314	82.90634	0.034488	0.276032	3.53E-01
10	10.89261	13.83994	2.590314	82.90634	0.034488	0.276034	3.53E-01

4. Variance Decomposition of D(EXPORTS):							
Period	S.E.	D(GDP)	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	7.27706	41.11486	19.15979	12.42094	27.3044	0	0
2	7.311021	40.74378	18.98977	12.3338	27.09714	0.366704	0.468806
3	7.325717	40.5848	18.91693	12.29647	27.00834	0.523808	0.669653
4	7.336535	40.46838	18.86359	12.26913	26.94332	0.638854	0.816731
5	7.336569	40.46802	18.86342	12.26905	26.94311	0.639215	0.817192
6	7.337972	40.45296	18.85652	12.26551	26.9347	0.654094	0.836214
7	7.338088	40.45171	18.85595	12.26522	26.93401	0.655327	0.83779
8	7.338171	40.45082	18.85554	12.26501	26.93351	0.656204	0.838911
9	7.338217	40.45033	18.85532	12.26489	26.93323	0.656692	0.839535
10	7.338217	40.45032	18.85531	12.26489	26.93323	0.656698	0.839543

5.Variance Decomposition of D(UNEMPLOYMENT):							
Period	S.E.	D (GDP)	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	0.086883	0.131355	0.796952	0.262223	8.667569	90.1419	0
2	0.088325	0.162051	0.797573	0.351513	8.546969	88.50413	1.637766
3	0.088944	0.174768	0.79783	0.388505	8.497005	87.82562	2.316273
4	0.089397	0.183922	0.798016	0.415133	8.46104	87.33721	2.804681
5	0.089399	0.183951	0.798016	0.415216	8.460928	87.33569	2.806204
6	0.089458	0.185125	0.79804	0.418631	8.456315	87.27304	2.868852
7	0.089462	0.185222	0.798042	0.418914	8.455933	87.26785	2.874039
8	0.089466	0.185291	0.798043	0.419115	8.455661	87.26416	2.877728
9	0.089468	0.18533	0.798044	0.419227	8.45551	87.26211	2.879779
10	0.089468	0.18533	0.798044	0.419229	8.455508	87.26208	2.879806

6. Variance Decomposition of D(BOP):							
Period	S.E.	D (GDP)	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
1	2.324086	0.882441	1.804255	2.560665	2.73179	56.08845	35.9324
2	2.324283	0.882475	1.804087	2.560742	2.732166	56.08565	35.93488

6. Variance Decomposition of D(BOP):							
Period	S.E.	D (GDP)	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
3	2.324369	0.882489	1.804014	2.560776	2.732328	56.08443	35.93596
4	2.324432	0.8825	1.803961	2.560801	2.732448	56.08353	35.93676
5	2.324432	0.8825	1.803961	2.560801	2.732449	56.08353	35.93676
6	2.32444	0.882501	1.803954	2.560804	2.732464	56.08341	35.93686
7	2.324441	0.882501	1.803953	2.560805	2.732466	56.0834	35.93687
8	2.324442	0.882502	1.803953	2.560805	2.732467	56.0834	35.93688
9	2.324442	0.882502	1.803952	2.560805	2.732467	56.08339	35.93688
10	2.324442	0.882502	1.803952	2.560805	2.732467	56.08339	35.93688

Cholesky Ordering: D(GDP) D(INFLATION) D(IMPORTS) D(EXPORTS) D(UNEMPLOYMENT) D(BOP)

Table 15 described the results in six parts. In first part GDP described the percentage of variation in other variables due to change in GDP. Likewise, in other parts described the percentage of variation in other variable due to change in one variable.

The first part demonstrated the decomposition of variance of GDP. In long run period variation to GDP from own shock account for 99.77% and inflation does not cause variation in GDP variance. Likewise, imports, exports, unemployment and BOP account for 0.00 %, 0.11%, 0.08% and 0.11% variation in GDP variance.

The second part demonstrated the decomposition of variance of inflation. In long run period variation to inflation from own shock account for 85.23% and GDP account for 17.91 % variation in inflation variance. Likewise, imports, exports, unemployment and BOP account for 0.00 %, 0.00%, 0.01% and 0.01% variation in inflation variance.

The third part demonstrated the decomposition of variance of imports. In long run period variation to imports from own shock account for 82.90% and GDP account for 13.83% variation in imports variance. Likewise, inflation, exports, unemployment and BOP account for 2.59 %, 0.03%, 0.27% and 3.53% variation in imports variance.

The fourth part demonstrated the decomposition of variance of exports. In long run period variation to exports from own shock account for 26.93% and GDP account for 40.54 % variation in exports variance. Likewise, inflation, imports, unemployment and BOP account for 18.85%, 12.26%, 0.65% and 0.83% variation in exports variance.

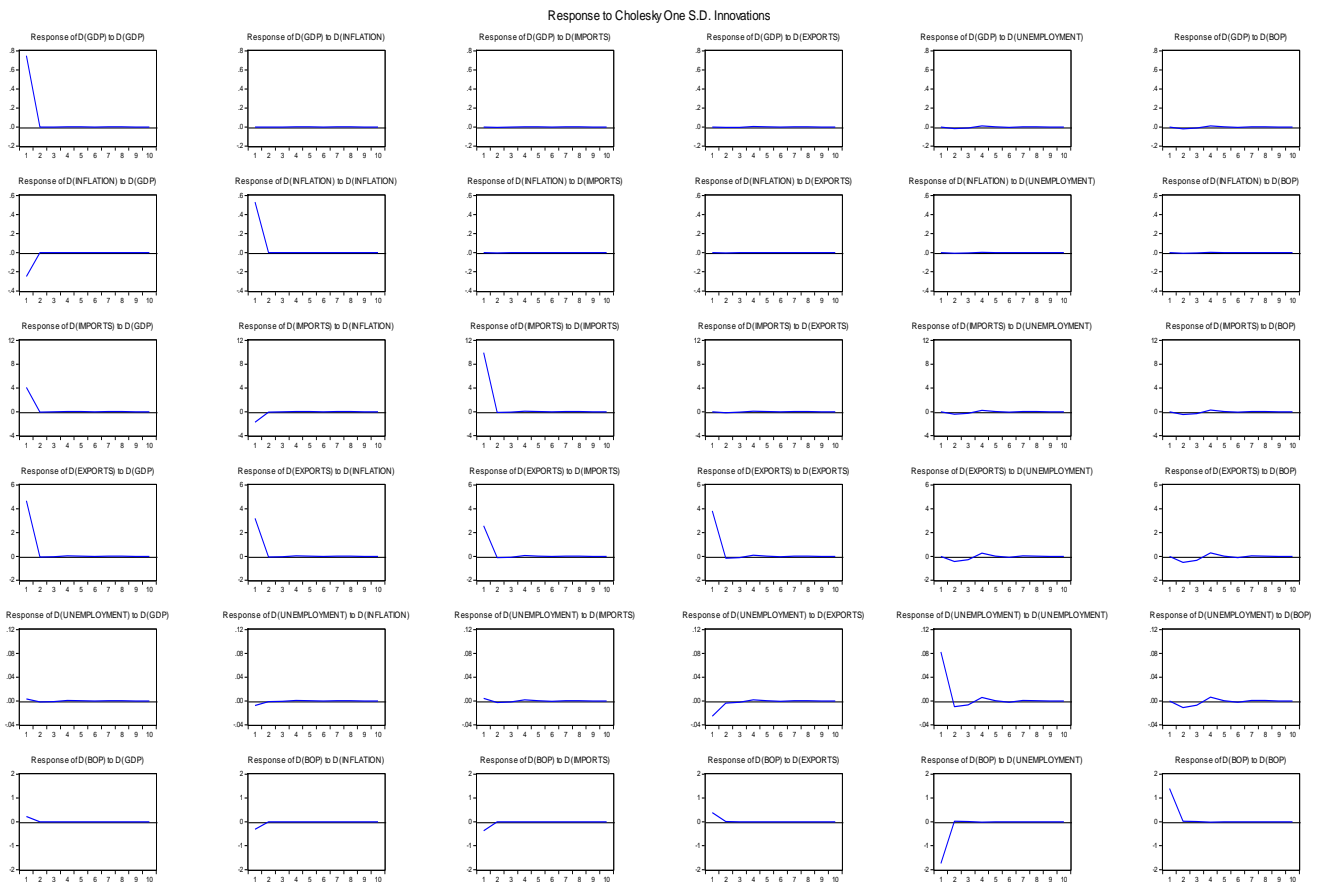
The fifth part demonstrated the decomposition of variance of unemployment. In long run period variation to unemployment from own shock account for 87.26% and GDP account for 0.18 % variation in unemployment variance. Likewise, inflation, imports, exports and BOP account for 0.79%, 0.41%, 8.45% and 2.87% variation in unemployment variance.

The last part demonstrated the decomposition of variance of BOP. In long run period variation to BOP from own shock account for 35.93% and GDP account for 0.88% variation in BOP variance. Likewise, inflation, imports, exports and unemployment account for 1.80%, 2.56%, 2.73% and 56.08% variation in BOP variance.

Impulse Response Function:

The Impulse Response function refers as a shock to VAR system. It Identify how the dependent variable (endogenous variable) will behave in the VAR when a shock is put to the error term. A unit Shock was introduced to each variable and sees its effect on the VAR system.

Figure 4.3: Impulse Response Graphs for Pre-Crisis Period:



Using a Choleski decomposition on a VAR model, the impulse response function has been calculated with ordering 1) GDP, 2) Inflation 3) Import 4) Export 5) Unemployment, and 6) BOP for the Indian macroeconomic indicators:

Figure 4.3 described that introduction of one standard deviation shock to the GDP decreases the GDP during the period and other variables. In summary it can be concluded that if one SD shock to one variable has been introduced it brings decreasing or negative trend in another variable.

Vector Error Correction Model (VECM) for post-crisis period:

There was 1 co integration equation by Johansen test. So, VECM model has been applied for post-crisis period. The ECM is an adjustment mechanism in which deviations (variations) from the equilibrium relationship in the previous period, as measured by η_{t-1} , lead to adjustments in y_{1t} . That is why it is known as an error correction mechanism. To find out the short run dynamics in the model the vector error correction model was applied which described results as follows:

Table 16: Vector Error Correction Estimates for Indian Macro Indicators

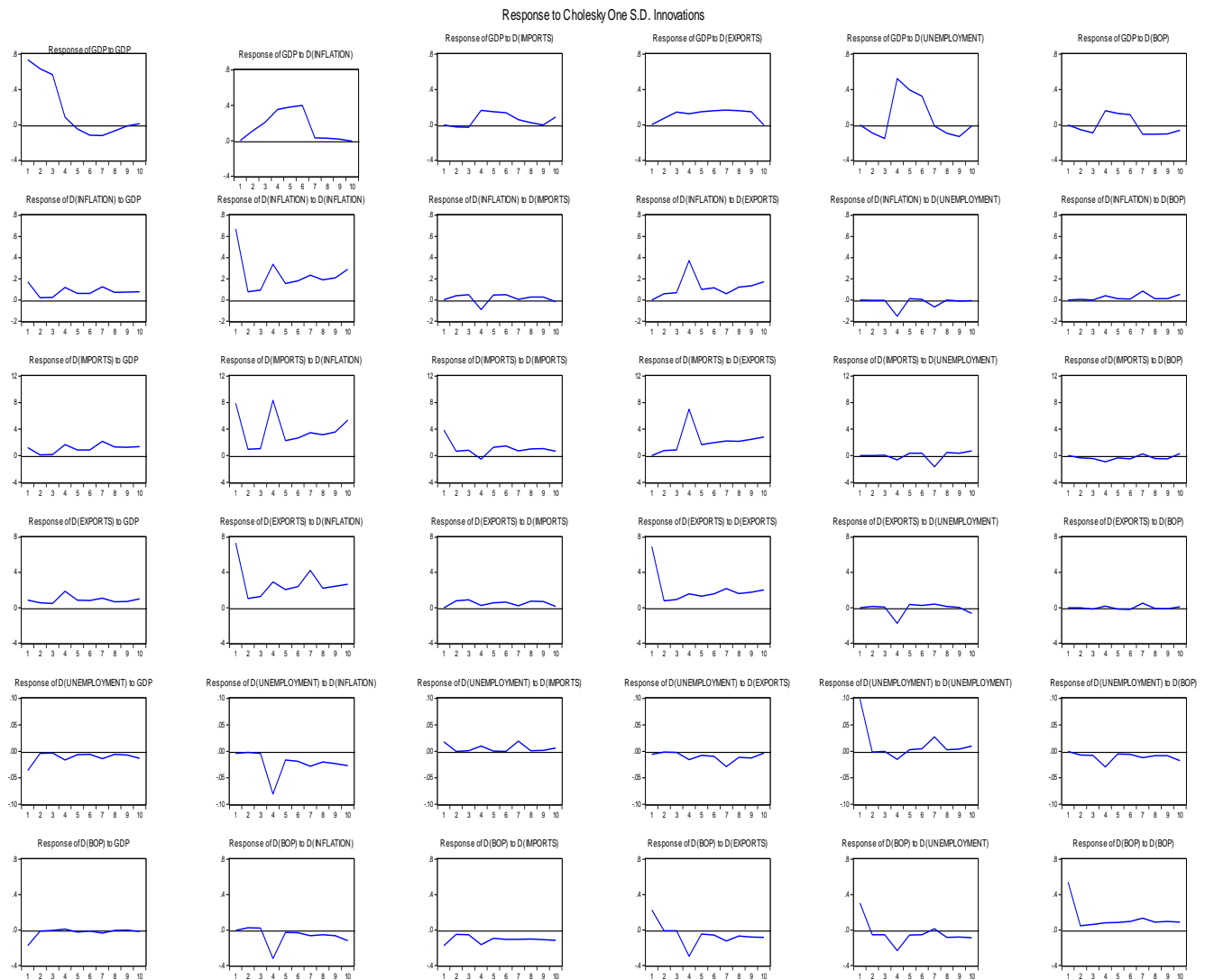
Error Correction:	D(GDP)	D (INFLATION)	D (IMPORTS)	D (EXPORTS)	D (UNEMPLOYMENT)	D (BOP)
CoIntEq1	-0.28755*	0.15199*	1.37034*	1.84134*	-0.03881*	-0.0741*
	-0.08949	-0.06554	-1.05648	-0.82432	-0.0104	-0.06872
	[-3.21332]	[2.31904]	[1.29709]	[2.23378]	[-3.73162]	[-1.07839]

Note:* shows the value of error correction terms [] shows the “t-values”

Table 4.16 revealed that coefficients having negative signs indicates long term casuality and positive coefficient indicates that there was short run casuality between the variables. The adjustment coefficients of the equation indicated the speed of adjustment towards the equilibrium decisions. The speed of adjustment described that 28% of disequilibrium corrected every month by changes in GDP, 15% of inflation, 1.37% of imports, 1.84% of exports, 3% of unemployment and 7% of disequilibrium corrected every month by changes in BOP.

Figure 4: Impulse Response Graphs for post-crisis period:

Figure 4 described the results of Impulse response function for post-crisis period. From the graphs, it can be concluded that some variables decreased in a constant trend, some indicated negative trend and some followed upwards and downwards trend due to innovation of one unit shock in one variable.



CONCLUSION:

To analyze the impact of sub-prime crisis on US and Indian macroeconomic variables, the descriptive statistics of both the countries for pre-crisis period and Post-crisis period have been calculated which indicated that there was high standard deviation present in monthly data of variables and kurtosis was also above 3 in most variables during Post-crisis period. when Jarque bera test was applied for testing the normality in the data, all the variables in US in pre-crisis period were not found normally distributed. Likewise, in India all the variables were not found normally distributed but in post crisis period only GDP and BOP were found normally distributed. In short variation in variables was high in the post-crisis period. It means there was impact of sub-prime crisis on macro indicators of US as well as India. Then next (ADF) unit root test has been applied for stationary. All the variables of US and India were found non- stationary for the pre and post-crisis periods.

Next to check the long term relationship among the variables Johansen Co integration Test has been applied. Before that lag length criteria has been selected on the basis of AIC and SC values which suggested one lag for both the countries. Johansen test indicated one equation for US and one equation for India based on Trace and Max Eigen value for further implementation of VAR model. Both countries during pre-crisis period indicated that there was no co integrated vector, so for the pre-crisis period unrestricted VAR model has been applied. Variance decomposition during pre-crisis period for both the countries described percentage of variation in one variable due to other variable. The results of VECM model indicated that there was long term causality for the post-crisis period for US and India. Most of the error coefficient found negative which described speed of adjustment in all variables during disequilibrium period. From the results of Impulse response it can be concluded that some variables decreased in a constant trend, some indicated negative trend and some followed upwards and downwards trend due to innovation of one unit shock in one variable during pre and post-crisis period.

Thus, from the results of all the tests the null hypothesis that there was no impact of sub-prime crisis on macroeconomic factors of US and India has been rejected and accept the alternative hypothesis that there was impact of sub-prime crisis on macroeconomic factors of US and India.

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