An Econometric Model of Inflation in India

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Abstract- The paper verified that the inflation model in India is cointegrated in the order I(1) considering GDP growth rate, degree of openness, growth rate of money supply, nominal exchange rate of Rupee with respect to US$, fiscal deficit as per cent of GDP, interest rate (lending rate), and crude oil price US$/barrel respectively as the determinants during the study period of 1970-2013.Johansen cointegration test showed that there is one cointegrating vector as shown by trace statistics and there are two cointegrating vectors as shown by λmax statistics. VECM showed that the inflation rate is associated with interest rate in one period lag and previous period inflation rate is associated with GDP growth rate and growth of money supply significantly. VECM states that the estimated equation 1 is adjusting its error by 23%, equation 2 is adjusting by 14% equation 3 by 34% and equation 7 by 71% respectively within one year but others equations are adjusting negligibly. There are six AR polynomial unit roots and all others roots lie inside the unit circle which proves that the model is unstable where the impulse response functions are diverging.

Index Terms- Inflation rate, Cointegration, VECM

I. Introduction

The determinants of inflation is very much important in building economic forecast in planning models and in several sectors although the factors change from country to country instead of some general variables. Even the relationship changes from one period to other which was found in many econometric studies. We tried to endeavour to locate some determinants of inflation in India such as GDP growth rate, degree of openness, growth rate of money supply, nominal exchange rate of Rupee with respect to US$, fiscal deficit as per cent of GDP, interest rate (lending rate), and crude oil price US$/barrel respectively by applying cointegration and VECM methodology to relate growth of Consumer Price Index with above factors during 1970-2013.

II. Early Studies

There are many econometric models on the determinants of inflation .Some of which are country specific which are quite similar to my model. Bayo (2005) studied that fiscal deficit, money supply, interest rate and exchange rate are positively impacted on inflation rate in Nigeria during 1981-2003.Explanatory variables accounted for 72% and error term captured 28% of variation. Basir (2011) showed that determinants of long run inflation in Pakistan is related with money supply, gross GDP, government expenditure and government revenue during 1972-2010 by applying cointegration and VECM. Lim and Papi (1997) found that money supply ,exchange rate, public sector deficit are the determinants of Turkish inflationary pressure as measured by a multisector macro economic model during 1970-95.Anderson,Masuch and Schiffbovuer(2009) observed that price level and inflation differentials of euro area in the long run depends on GDP per capita or productivity and consumption in country specific stationary cointegration relation during 1999-2006. Kim(2007) verified by using cointegration and error correction model during 1990-1999 in Poland that inflation was determined by increase in wage rate , appreciation of real exchange rate , excess supply of money respectively. Lim and Sek (2015) verified with the data of 28 high and low inflation countries during 1970-2011 in which the VECM and ARDL models indicate that GDP growth and imports of goods and services have significant long run impact on inflation in low inflation countries but money supply, national expenditure and GDP growth rate are determinants of inflation in the long run in high inflation countries. Laryea, and Sumaila (2001) estimated Tanzania's inflation during 1992:1 -1998:4 by using ECM and showed that monetary factors are responsible for more than depreciation of exchange rate or volatility of output. 5 empirical results indicate that money supply ,interest rate and riyal depreciation with respect to US$ are main causes of inflation in Saudi Arabia during 1986-2007. Dua and Gaur(2009) found that output gap is significant in explaining the inflation rate using quarterly data from 1990 to 2005 in 8 Asian countries by applying Phillips curve method and instrumental variable technique. Jaradat, AlZeaud and Rawahneh(2011) showed that inflation in Jordan affected positively by increased credit, transfer of staff, external shock and negatively by GDP growth rate and affected insignificantly with money supply by applying cointegration and Error Correction Model during 2000-2010.Moretti(2013) studied by using 11 countries samples during 1990-2007 in Euro Area, and found that after the adaptation of the euro, product market deregulation has a significant effect in reducing the inflation rate while higher labour market regulation increases inflation persistence and it reduces the responsiveness of inflation to the output gap.

All those models have great role in Indian context in framing the macro econometric model of inflation in the dynamic process of adjustment although all determining variables in those countries are not synonymous with India but much similar studies were done in India to find the macroeconomic determinants of inflation. It is true that some micro determinants of inflation in India are rather different from Euro area and OECD countries. Therefore, some of the important studies in India have been discussed here. Using cointegration method, Ashwani (2014) studied that there is a long run relationship between inflation, money supply, private and social spending and exchange rate during 1981-2011 in India . Mohanty (2010) finds a long run equilibrium relationship among inflation, non

agricultural GDP and money supply during 1952-2010 in a cointegration framework in India which showed output has highly significant and negative relationship with inflation and money supply has a highly significant and positive relationship with inflation. Deviation from the long run equilibrium is found to be statistically significant. Using an augmented Phillips curve framework in India Kapur(2012) showed that non food manufactured products inflation is a core measure of inflation as demand conditions vis-à-vis WPI inflation .Even inflation in non fuel commodities is seen as important driver of domestic inflation rather than fuel inflation .Non food manufactured product inflation is found to be more persistent than headline inflation. He found that the modest exchange rate pass through coefficient but sharp depreciation occurred inflationary pressure during July-September 2011.His estimated equation were found to be satisfactory and forecasting challenges emanates from volatility in international oil and other commodity prices and domestic food supply dynamics. The supply factors exhibited significant volatility in recent years. Patra and Ray(2010) employed Phillips Curve framework in the context of modeling inflation expectations and find support in favour of the relationship using monthly data for the period 1997-2008. Using the quarterly data for 1996-2009 in India Patra and Kapur(2010) found some supports for the New Keynesian Phillips Curve but the estimated equations suffered from the serial correlation but in hybrid New Keynesian Phillips curve the coefficient on lagged inflation was found to be higher than that of the expected inflation. Gulati and Saini (2013) using a linear regression framework showed that the fiscal deficit, rising farm wages and transmission of the global food inflation together accounted for 98% of the food inflation in India during 1995-96 to December 2012.Of them, fiscal deficit with the coefficient of 0.46 with one year lag was the most prominent followed by farm wages with the coefficient of 0.32 with one year lag and 0.30 for global food prices respectively. Saxena and Bhadanriya(2013) showed by applying Johansen Co-integration and VECM taking data during April 2001-March 2011 in India and found a positive relation between GDP and CPI and a high degree of interdependence between money supply, crude oil prices and inflation in India. Jha and Kulkarni (2012) employed method of OLS and ARDL(1,1) and ECM to estimate inflation and expected inflation volatility as well as their changes which showed that actual inflation volatility rises with expected inflation and falls when the level of inflation goes up although output gap has no significant impact. Patnaik(2010) showed that inflation in Indian Economy is a mix of both demand and supply factors.GDP and broad money supply has positive effect on inflation while exchange rate and interest rate have negative association with inflation using VAR,ECM and cointegration model taking data of 1991Q2 to 2008Q2 in India. He found that ECM is highly significant, impulse response function implies that CPI responds to shock after a long where CPI is influenced by index of industrial production, reserve money and import index. Kishore(2009) studied that real money gap is the predicator of inflation in India by using quarterly data on manufacturing inflation from 1982 to 2007 and is also a reliable for predicator of future inflation. Taking data for 1973-1991 of GDP deflator of India ,Chand (1996) estimated inflation equation which was the source of fiscal and monetary instrument and showed that fiscal action is the dominant influence and monetary action do matter to combat inflation in short and long run.

III. Econometric Model: A Case Study of India

[1] Methodology and data

The co-integrating model of inflation rate in India measured by consumer price index has been illustrated by the following manner,

$x = f(y_1, y_2\ y_3, y_4\ , y_5, y_6)$
Where x= growth rate of consumer price index
y_1= GDP growth rate per cent per year
y_2= the growth rate of money supply (M2)
y_3= nominal exchange rate of rupee with US dollar
y_4= fiscal deficit as percent of GDP
y_5= interest rate (lending rate per cent per year)
y_6= crude oil price measured by US$ per barrel

Data have been collected from the International Financial Statistics of IMF ,World Bank, Reserve Bank of India, and inflationindia.com for the year from 1970 to 2013.For co-integration analysis ,the Engle and Granger(1987) , and Johansen (1988) and for VECM Johansen (1991,1996) and Johansen and Juselius (1990) methodologies have been applied.

[2] Co-integration analysis

Following Engle and Granger (1987), the estimated co-integrating equation for the level series (growth rate of consumer price index) becomes,

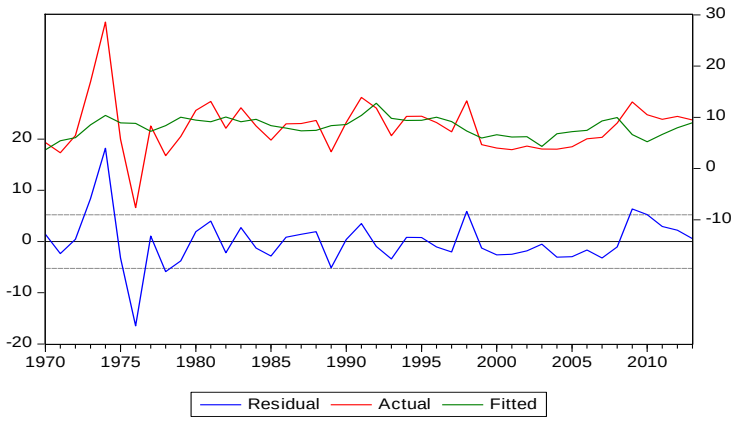
$$x= 1.1170+0.1458y_1+0.000595y_2+0.0866y_3+0.7596y_4+0.7617y_5+0.00246y_6+e_t$$

(0.2032) (0.5013)(0.0042) (1.114) (1.264) (2.061)* (0.0700)

R^2=0.122, F(6,44)=0.8607 , DW=1.62 , *=significant at 95% confidence level.

The ADF test for the residuals is , ADF statistic=-3.930758 which is greater than the critical value of 95% (-2.998) and $\tau_{c(7)}$ = -5.77479 which is greater than critical value of 95% level(-2.93).So, residuals is stationary and has unit root and the variables are I(1).In the Fig-1 , it is seen that the actual and fitted lines crossed more than once and the interest rate and the growth of CPI is positively related significantly.

Fig-1: The Equilibrium



Source- Computed by author

Now , following Johansen (1988), the Johansen test of co-integration for the level series of growth rate of CPI finds out the following Trace Statistics and Maximum Eigen values,

Table-1: Johansen test of growth of CPI (level series)

Hypothesised No. of CE(s)	Eigen value	Trace test	P value	5% C.V	λmax	P value	5%CV
None *	0.798488	162.0402	0.0001	125.6154	67.28007*	0.0001	46.23142
At most 1	0.624537	94.76017	0.0584	95.75366	41.14300*	0.0378	40.07757
At most 2	0.389570	53.61718	0.4782	69.81889	20.73083	0.7042	33.87687
At most 3	0.307083	32.88634	0.5631	47.85613	15.40750	0.7154	27.58434
At most 4	0.215708	17.47884	0.6046	29.79707	10.20491	0.7252	21.13162
At most 5	0.157484	7.273926	0.5460	15.49471	7.197230	0.4661	14.26460
At most 6	0.001824	0.076696	0.7818	3.841466	0.076696	0.7818	3.841466

Source- Computed by author

The values of the Trace test indicate that there is 1 cointegrating vector and λmax statistic has two cointegrating vectors which are significant at 95% level of confidence.

[3] Analysis of VECM of the growth of CPI (level series)

The estimates of the VECM have been given in the following six equations.

[i] $\Delta x_t = -4.3663 - 0.2640\Delta x_{t-1} - 0.05961\Delta y_{1t-1} - 0.2415\Delta y_{2t-1} - 0.6393\Delta y_{3t-1} + 0.6502\Delta y_{4t-1}$
(-1.77)* (-1.69)* (-0.2004) (-1.156) (-1.386) (0.7571)
$+0.4976\Delta y_{5t-1} + 0.0098\Delta y_{6t-1} - 0.2330EC1$
(0.6457)* (0.1274) (-2.2279)*
R^2=0.3210 , DW=2.098 , *= significant at 95%

[ii] $\Delta y_{1t} = -3.2426 + 0.16907\Delta x_{t-1} - 0.1918\Delta y_{1t-1} - 0.07218\Delta y_{2t-1} + 0.01981\Delta y_{3t-1} + 0.4219\Delta y_{4t-1}$
(-2.676)* (2.202)* (-1.31) (-0.702) (0.087) (0.997)
$-0.4827\Delta y_{5t-1} + 0.05806\Delta y_{6t-1} - 0.1418EC1$
(-1.272) (1.533) (-2.7529)*
R^2=0.619, DW=1.97 , *= significant at 95%

[iii] $\Delta y_{2t} = 7.412 - 0.5348\Delta x_{t-1} - 0.7982\Delta y_{1t-1} + 0.08589\Delta y_{2t-1} + 0.1546\Delta y_{3t-1}$
(2.751)* (-3.133)* (-2.451)* (0.375) (0.306)
$+0.7190\Delta y_{4t-1} + 0.9366\Delta y_{5t-1} + 0.03344\Delta y_{6t-1} + 0.3392EC1$
(0.764) (1.110) (0.397) (2.962)*
R^2=0.521 , DW=2.0 , *= significant at 95%

[iv] $\Delta y_{3t} = 0.1109 - 0.00195\Delta x_{t-1} + 0.0419\Delta y_{1t-1} - 0.0943\Delta y_{2t-1} + 0.3049\Delta y_{3t-1}$
(0.1117) (-0.031) (0.349) (-1.119) (1.637)

$-0.48813\Delta y_{4t-1}$ $+0.1866\Delta y_{5t-1}+0.01669\Delta y_{6t-1}-0.03793EC1$
(-1.407) (0.599) (0.537) (0.375)
R^2=0.182 , DW=1.93 , *= significant at 95%

[v] Δy_{4t}= $-0.2521-0.03464\Delta x_{t-1}-0.03364\Delta y_{1t-1}-0.05706\Delta y_{2t-1}+0.043\Delta y_{3t-1}$
(-0.252) (-1.116) (-0.5685) (-1.373) (0.4688)
$-0.1394\Delta y_{4t-1}$ $-0.08505\Delta y_{5t-1}+0.02224\Delta y_{6t-1}-0.01197EC1$
(-0.816) (-0.5548) (1.453) (-0.572)
R^2=0.231 , DW=1.90 , *= significant at 95%

[vi] Δy_{5t}= $-0.03513+0.03009\Delta x_{t-1}-0.0734\Delta y_{1t-1}-0.0133\Delta y_{2t-1}-0.1765\Delta y_{3t-1}$
(-0.0684) (0.925) (-1.183) (-0.3070) (-1.83)*
$-0.0357\Delta y_{4t-1}$ $+0.0279\Delta y_{5t-1}+0.02605\Delta y_{6t-1}-0.01016EC1$
(-0.199) (0.173) (1.622) (-0.4657)
R^2=0.297 , DW=2.09 , *= significant at 95%

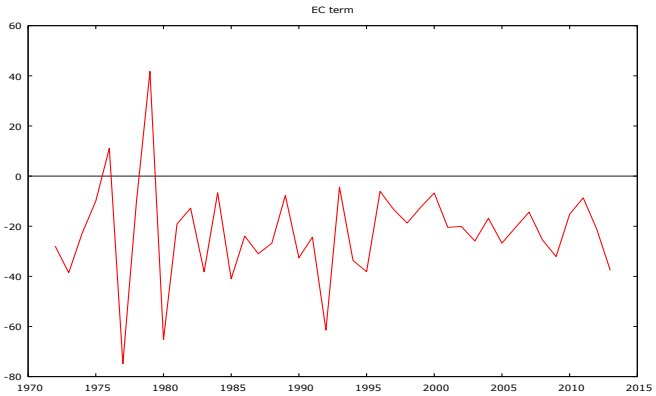
[vii] Δy_{6t}= $20.339+0.186\Delta x_{t-1}-1.816\Delta y_{1t-1}+1.2727\Delta y_{2t-1}-2.3035\Delta y_{3t-1}$
(4.568)* (0.660) (-3.373)* (3.367)* (-2.75)*
$-1.0245\Delta y_{4t-1}$ $+2.0119\Delta y_{5t-1}-0.265\Delta y_{6t-1}+0.715EC1$
(-0.659) (1.442) (-1.905)* (3.777)*
R^2=0.48, DW=1.655 , *= significant at 95%

In equation 1, the growth of CPI of the current period is associated with its previous period and it is significantly related with previous period interest rate positively and the equilibrium error is adjusted by 23% within one year. In equation 2, GDP growth rate of current year is positively associated with previous period growth of CPI and 14% error is corrected in a year. Equation 3 notes that the growth of money supply of the current period is significantly associated with previous period's growth of CPI and GDP respectively and 34% error is corrected in a year.

The equation 4 expressed that no variable is significantly related and only 3% error is corrected in a year. The equation 5 explained that no variable is significantly related and only 1% error is corrected in a year. The equation 6 expressed that exchange rate is positively related with crude oil price significantly and only 1% error is corrected in a year. In equation 7, it is clear that GDP growth rate, money supply, exchange rate and crude oil price of the previous years are significantly related with oil price of the current year and 71% error is corrected in a year. The adjustment vector α is thus shown as follows: [x ,y_1,y_2,y_3,y_4,y_5,y_6]=[-0.23310,-0.14181,0.33928,-0.037930,-0.011907,-0.010169,0.71511].

The Error correction term is not approaching to zero but adjusting the errors slowly.It is shown in Fig-2.

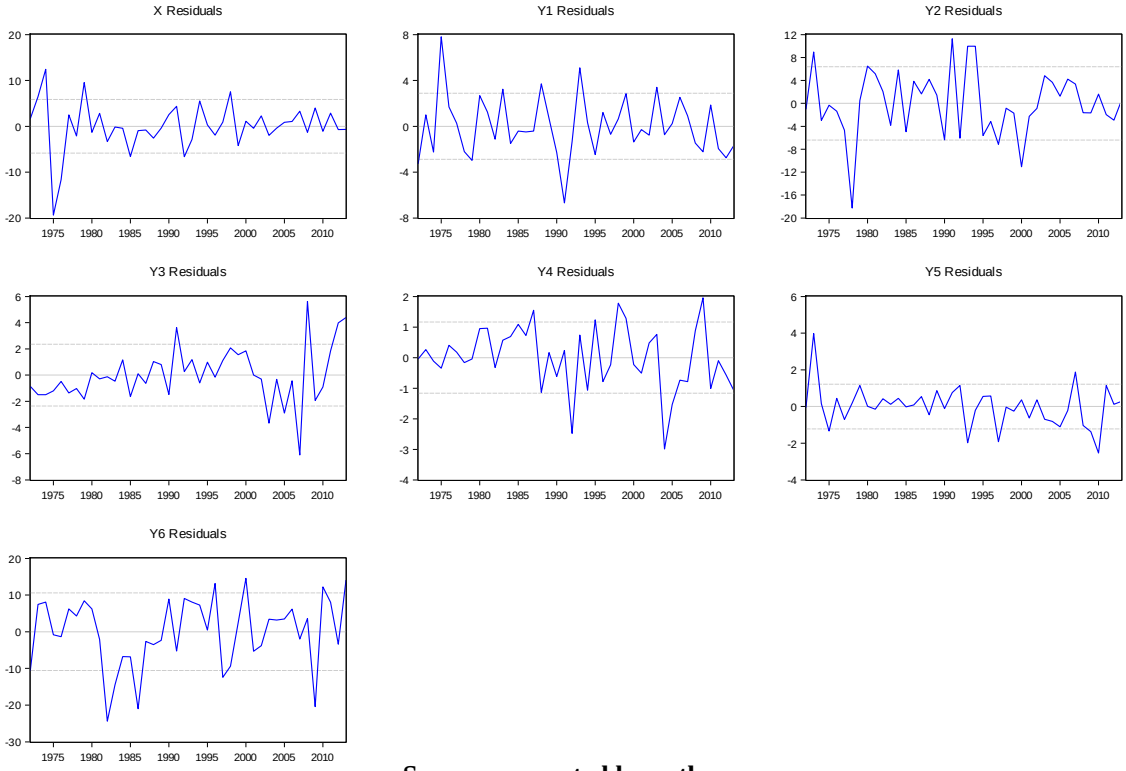
Fig-2: Patterns of error correction



Source-Computed by Author

The residuals of the estimated VECM do not tend to zero or to equilibrium which are shown in the Fig-3.

Fig-3 :The estimated residuals



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Lastly,it is estimated that the cointegrating relation is stable but diverging away from the equilibrium which is shown in Fg-4.

Fig- 4 : Cointegrating relation

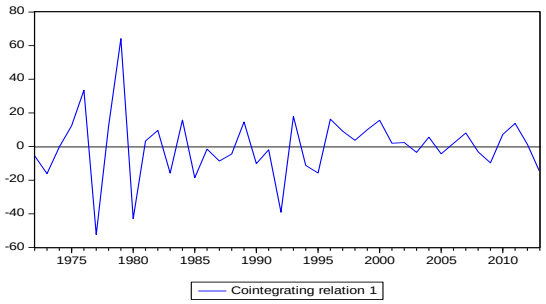

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Table -2: Roots of AR characteristic

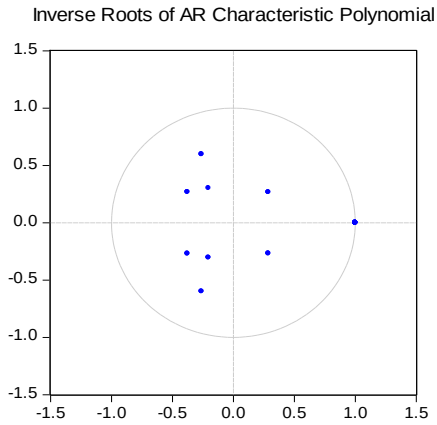
Root	Modulus
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
-0.261440 – 0.598096i	0.652740
-0.261440 + 0.598096i	0.652740
-0.375946 – 0.268363i	0.461902
-0.375946 + 0.268363i	0.461902

0.286630 – 0.266579i	0.391435
0.286630 + 0.266579i	0.391435
-0.204058 – 0.303524i	0.365741
-0.204058 + 0.303524i	0.365741

Source-Computed by author

In the Table-2, the roots of characteristic polynomial of the variables of the level series are given where it confirmed 6 unit roots and others are less than one and all lie inside the circle which are plotted in Fig-5.

Fig-5: Inverse roots of AR characteristic polynomial



Source- Computed by author

All of the roots lie inside the circle and 6 roots are equal to 1 and others are less than one ,and therefore, the variables are cointegrated in the order of CI(1,1).

[4]Diagnostic test

[A] Autocorrelation test (χ2 distribution)

In the Table-3,the values of the Q stat and adjusted Q stat with their probabilities have been arranged through autocorrelation test and it was found that the series suffer from autocorrelation.

Table-3:Autocorrelation

lags	Q stat	prob	Adj.Q stat	prob	df
1	16.75212	NA*	17.16071	NA*	NA*
2	52.99813	0.9995	55.21901	0.9989	91
3	96.34930	0.9981	101.9049	0.9935	140
4	127.2175	0.9998	136.0224	0.9986	189
5	168.3027	0.9998	182.6596	0.9969	238
6	208.2031	0.9999	229.2101	0.9949	287
7	249.6670	0.9999	278.9667	0.9896	336
8	283.3185	1.0000	320.5362	0.9927	385
9	318.3614	1.0000	365.1364	0.9929	434
10	353.5821	1.0000	411.3635	0.9920	483
11	384.0734	1.0000	452.6744	0.9945	532
12	410.2039	1.0000	489.2571	0.9977	581

Source-Computed by author

Thus, no residual autocorrelation =H0 is rejected as had been found in VEC residual Portmanteau test.

[B] VEC Residual Serial Correlation LM test

The serial correlation LM test showed that the values of LM stat for lag 1 to 12 are all insignificant which are listed in the Table -4.

Table-4: Serial correlation

lags	LM stat	prob
1	45.37751	0.6208
2	46.86352	0.5602
3	43.99376	0.6758
4	34.25353	0.9456
5	41.20095	0.7781
6	44.66739	0.6493
7	49.52719	0.4521
8	37.01788	0.8957
9	38.90505	0.8487
10	48.33030	0.5002
11	39.80976	0.8226
12	30.58030	0.9819

Source- Computed by author
The test confirmed that it has serial correlation.

[C] Normality test

The orthogonalized residuals are obtained by a principal component decomposition of the original residual correlation. The orthogonalised residuals are uncorrelated by construction and independent under assumption of normality. Since asymptotic normality and independence of skewness and kurtosis is distributed as $\chi^2(2)$, then the χ^2 tests of skewness , Kurtosis, of those residuals showed insignificant at 95% confidence limit except component 1 and 7 in Skewness and components 1,2,3,4,and 6 in kurtosis which are given in details in the Table-5.But the joint skewness and kurtosis are significantly distributed as $\chi^2(2)$.

Table-5: Orthogonalisation: Residual correlation (Doornik-Hansen)
H0= residuals are multivariate normal

Component	Skewness	Chi-square	df	prob
1	-0.694639	3.796883	1	0.0513
2	-0.040409	0.014641	1	0.9037
3	-0.333998	0.967558	1	0.3253
4	0.073968	0.048998	1	0.8248
5	-0.594961	2.874613	1	0.0900
6	0.611442	3.020887	1	0.0822
7	-0.840195	5.281959	1	0.0215
Joint		16.0055	7	0.0251
Component	Kurtosis	Chi-square	df	Prob.
1	5.452279	7.823882	1	0.0052
2	3.880177	4.751193	1	0.0293
3	4.283114	5.714082	1	0.0168
4	3.744590	3.907915	1	0.0481
5	3.525785	0.240024	1	0.6242
6	6.230771	15.32592	1	0.0001
7	3.227003	1.910615	1	0.1669
joint		39.67	7	0.00

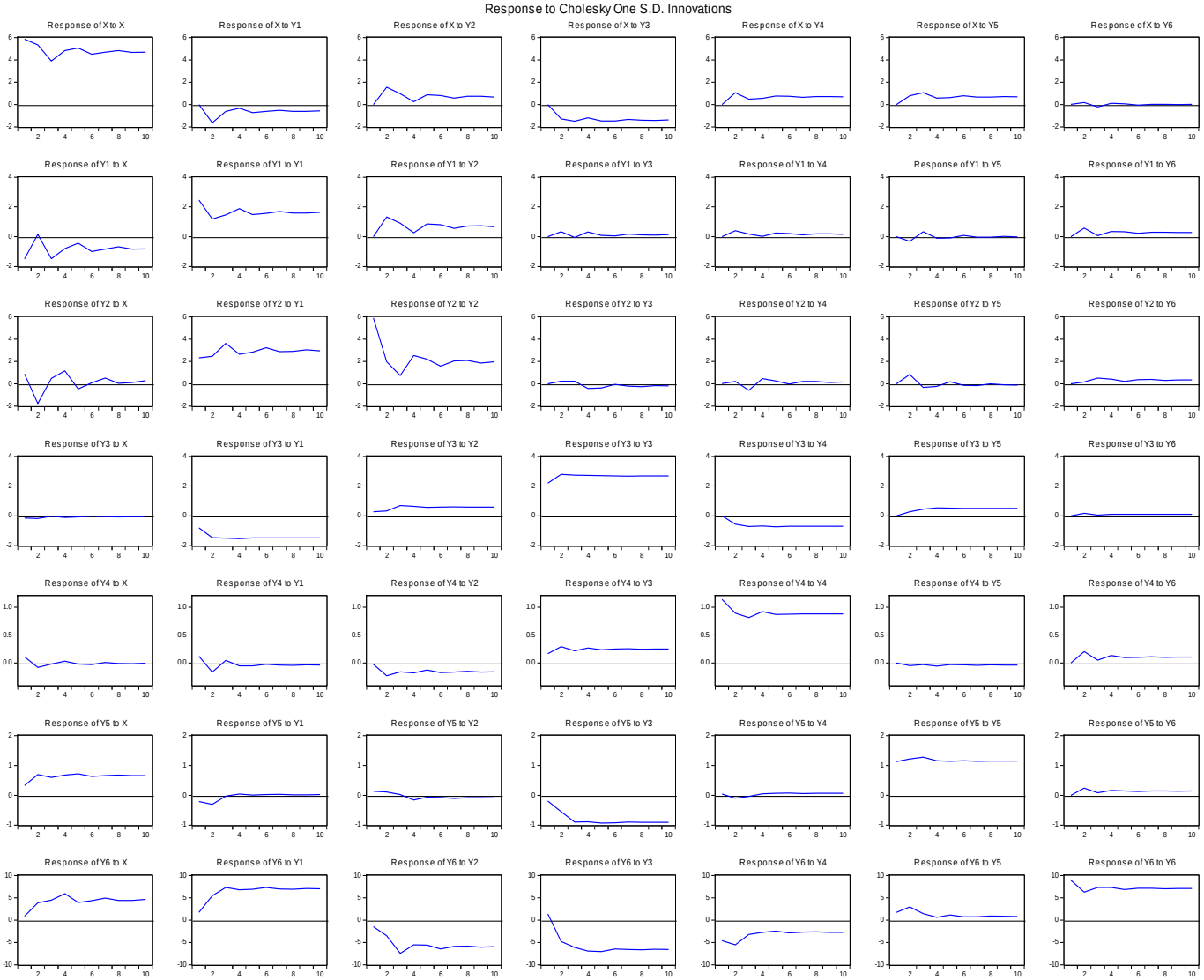
Source-Computed by author

Thus ,the Doornik-Hansen test is not rejected for normality.

[D]The Impulse Response Functions

In Fig-6,the impulse response functions have been plotted where the functions tend away from zero ie diverging which means the model is unstable.

Fig-6:Impulse Response Functions



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IV. SOME POLICY ISSUES

As far as this econometric model is concerned, the policy implications should lie on the appropriate monetary policy, flexible interest rate policy and achieving higher growth rate which might be brought out to come down inflation in the long run. Moreover, oil price stability and exchange rate stability should be significant policy targets to control inflation in India.
According to Raghuram Rajan, minimum support price, rural wage rate including female wage rate, food prices and inflation expectations are the crucial variables that may determine Indian inflation although he confessed that interest rate cut would not able to come down inflation rate in India in recent times. But he was not in favour of target rate of inflation which require financial stability in the economy. Therefore, medium term or long term inflation targets will be suitable policy measures to control inflation for India.(Rajan,2014)

V. CONCLUSION

The paper concludes that the inflation model in India is cointegrated in the order I(1) during 1970-2014.Johansen cointegration test showed that there is one cointegrating vector as shown by trace statistics and there are two cointegrating vectors as shown by λmax statistics. VECM showed that the change in growth of CPI in previous period is negatively related with the change in growth of money supply significantly and the change in growth of CPI is related negatively with previous period significantly. But the change GDP growth rate is positively related with previous period change in growth of CPI significantly .In the VAR model same conclusion was observed but in double log linear model it was observed that 1% increase in CPI per year would reduce the growth rate of GDP by 0.058% per year during 1961-2011 in India in the current year (Bhowmik,2013).Moreover, the change in previous period growth of CPI is positively related with change in crude oil price, interest rate insignificantly and negatively related with the

change in exchange rate and fiscal deficit insignificantly. VECM states that the estimated equation 1 is adjusting its error by 23%, equation 2 is adjusting by 14% equation 3 by 34% and equation 7 by 71% respectively within one year significantly but others equations are adjusting negligibly. There are six AR polynomial unit roots and all others roots lie inside the unit circle which proves that the variables are co-integrated but the impulse response functions are diverging.

REFERENCES

[1] Ashwini,Dr.,2014, Determinants of inflation in India: A Cointegration Approach .International Journal of Multidisciplinary Consortium,Vol-1,No-1, June.

[2] Basir,Furrukh,et all,2011,Determinants of inflation in Pakistan :An Econometric analysis using Johansen Cointegration Approach.Australian Journal of Business and Management Research,Vol-1, No-5, 71-82,August.

[3] Bayo,Fatukasi.,2005, Determinants of Inflation in Nigeria:An Empirical Analysis.International Journal of Humanities and Social Science,Vol-1,No-18, 262-271.

[4] Bhowmik,Debesh.,2013,Growth-Inflation Trade off in India:A Longrun Analysis.The Indian Economic Journal,Special Issue,December,2013,1-15.

[5] Chand,Sheetal K.,1996, Fiscal and other determinants of the Indian Inflation Rate.National Institute of Public Finance and Policy , NewDelhi.Working Paper no-7, June.

[6] Dua,Pami,. And Upasna Gaur.,2009, Determinants of inflation in an open economy Phillips Curve Framework:The case of Developed and Developing Asian Countries.Working Paper No-178, April, CDE, Delhi.

[7] Enders,Walter.,2011,Applied Econometric Time Series.Wiley Student Edition.

[8] Engle R.F. and Granger C.W.J., 1987, Cointegration and error correction: Representation, estimation and testing. Econometrica, 55:251-276.

[9] Gulati,Ashok and Shweta Saini.,2013, Taming Food Inflation in India.Discussion Paper No-4, April, Ministry of Agriculture , Government of India.

[10] ……., 2002-03, Food Inflation in India:Diagnosis and Reemedies in Uma Kapila(Ed)- Indian Economy since Independence.

[11] Jaradat,M.,H.A. AlZeaud and H.A. Rawahneh.,2011,An Econometric Analysis of the Determinants of inflation in Jordan.Middle Eastern Finance and Economics,Issue-15,

[12] Jha,Raghabendra and Varsha S. Kulkarni.,2012,Inflation Volatility and Inflation Growth Trade off in India.ASARC Working Paper 2012/11.

[13] Johansen,S., 1988,Statistical Analysis of Cointegrating Vectors. Journal of Economic Dynamics and Control, Vol. 12,231-254.

[14] ……..,1991,Estimation of Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models, Econometrica 59,Nov,1551-80

[15] ……..,1994, The role of the constant and linear terms in cointegration analysis of nonstationary variables. Econometric Reviews,13, 205-229

[16] Johansen S., 1995, Likelihood-Based Inference in Cointegrated Vector Autoregressive Models. Oxford University Press.

[17]]…….,1996, Likelihood-Based Inference in Cointegrated Vector Autoregressive Models,2nd edition, Oxford University Press.

[18] …….. and K.Juselius.,1990,Maximum likelihood estimation and cointegration with application to the demand of money. Oxford Bulletin of Economics and Statistics,52(2),169-210.

[19] Johnson.A.,2006,The effects of FDI inflows on Host Country Economic growth.CESIS Electronic working paper series no-58.

[20] Kapur,Muneesh.,2012,Inflation Forecasting:Issues and Challenges in India.RBI Working Paper Series.WPS (DEPR):01/2012,January.

[21] Kim,Bijung-Yeon.,2001, Determinants of inflation in Poland:A Structural Cointegration Approach .Bank of Finland Discussion Paper-16/2001.

[22] Kishore,N.Kundan.,2009,Modelling Inflation in India :The Role of Money.MPRA Paper no- 16098.July.

[23] Laryea,Somuel A and Ussif Rasid Sumaila.,2001, Determinants of Inflation in Tanzania,CMI Working Paper No-12/200,Norway.

[24] Lim,Hoon and Laura Papi.,1997, An Econometric Analysis of the determinants of inflation in Turkey.IMF Working Paper No-97/170,December.

[25] Lim,Yen Chee and Siok KunSek.,2015,An Examination of the determinants of inflation.Journal of Economics, Business and Management.Vol-3,No-7, July.

[26] Mohanty,Deepak.,2010, Inflation Dynamics in India:Issues and Concerns.Reserve Bank of India Bulletin,April.

[27] Moretti,Laura.,2013,Determinants of inflation differentials in the euro area.Goethe University, Frankfurt,February.

[28] Patnaik,Anuradha.,2010,Study of inflation in India :A cointegrated vector auto-regression approach.Journal of Quantitative Economics,Vol-8, No-1.

[29] Patra,M.D. and Partha Ray.,2010,Inflation Expectations and Monetary Policy in India:An Empirical Exploration.Working Paper .WP/10/84,IMF.

[30] Patra,M.D. and Muneesh Kapur.,2010,A Monetary Policy Model without Money for India. Working Paper,WP/10/183,IMF

[31] Rajan,Raghuram.,2014,Inaugural address in the 97th conference of Indian Economic Association in M.L.Sukhadia University,Udaipur on 27th December.

[32] Ramady,Md.A.,2009, External and Internal Determinants of inflation:A case study of Saudi Arabia.Middle East Journal of Economics and Finance,Vol-2, No-1-2, Jan-Dec,25-38.

[33] Saxena, Swami P. and Sonam Bhadanriya.,2013, Co-integration Analysis of the determinants of inflation in India.Arthshastra:Indian Journal of Economics and Reserch,Vol-2, No-2,March-April.

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