RELATION BETWEEN GDP GROWTH RATE AND UNEMPLOYMENT GROWTH RATE IN INDIA SINCE THE REFORM PERIOD

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ABSTRACT

This paper studied that growth of unemployment is decreasing at the rate of 0.677% per year during 1991-2014 insignificantly but its exponential declining growth rate is 0.033% which is significant. The unemployment growth rate series does not follow random walk and it has one downward structural break in 2010.The smooth cycle was obtained through Hodrick-Prescott Filter model.AR and ARIMA models of this series are nonstationary. On the nexus issue ,the study analysed that one percent increase in GDP growth rate led to 0.0579% decline in unemployment growth rate during 1991-2014 in India which is insignificant. The Okun's law is verified but found insignificant. Both have bidirectional causality but Johansen cointegration showed insignificant. The VAR and VEC models are stable but VAR is converging and VECM is diverging where coefficient of error correction in the change of unemployment growth rate is very slow and insignificant. The same observations were found in the nexus between the GDP per capita growth rate and unemployment growth rate in India during 1991-2014.

Keywords - GDP Growth Rate, Unemployment Growth Rate, Causality, Cointegration, VAR, VECM

JEL-E22, E24, D47, J23, J60, J65,

I. INTRODUCTION

Keynesian and post-Keynesian analysis on income-employment theory has become a new part of the research on macroeconomics in the form of nexus between GDP growth and employment growth rate because global liquidity crisis, global current account

imbalance and global financial crises dismantled the theories of employment or unemployment. Neither Classical nor Keynesian or Neo-Keynesian is quite satisfactory to answer all relevant causes of underemployment in relation with the endogenous growth theory. However, there are more than 10000 research papers on the growth-employment/unemployment in which empirical research are many for individual countries and developing and developed countries as a whole.

The nexus between growth rate of GDP and unemployment growth rate varies from country to country, region to region and also varies from period to period. In the long run, this nexus is related to multiple factors which are heterogeneous and are not identical to all countries. In the present digital age the problems of labour market have changed too and aggregate demand and supply analysis for equilibrium have been diversified. Even, there is an impact of global monetary and fiscal policy, global macroeconomic policy, structural adjustment programme, etc on the individual nations in the areas of growth and employment. This global governance in the liberalized world economy is commanding the phases of economic and financial integration process where the role of employment and growth policy of an individual nation is little. Yet, the domestic developmental policy is important and part and parcel of the above phenomenon.

Since the economic reform period, the patterns of unemployment in India pass through many events. Sometimes it abides by mainstream analysis and sometimes not. The trend and cyclical nature showed special characteristics. Therefore, the relation between unemployment growth and GDP growth during the reform period in India is neither general nor abnormal as have been found from other countries and regions. This paper tries to endeavour this behavior and the nexus in exclusive manner.

II. LITERATURE REVIEW

Elshamy (2013) based on data from the year 1970 to 2010 for Egypt, tested the Okun's coefficient. In this study, the long-term cointegration analysis in the short term when using the Error Correction Model was used. According to the obtained results, the long and short-term coefficients are statistically significant. Christopoulos (2004) has been wanted to test the validity of the Okun's law for 13 regions of Greece by using panel data in the period 1971-1993. As a result of the study, 6 of the 13 regions showed that the unemployment and output move together. Zagler (2003) examined Okun's law by using vector error correction model for France, Germany, Italy and the United Kingdom. In conclusion it was determined that, long-term economic growth and unemployment is among the co-integration and direction of the relationship is positive. According to Muscatell and Tirelli (2001) for OECD countries, the relationship between growth and unemployment in the years 1955-1990, were examined using structural VAR model. After all a negative relationship between unemployment and growth were found. ILO (1996) examined the nature of the relationship between employment and economic growth in the G7 nations. The elasticity of employment with respect to real GDP was estimated to be significantly different from zero in five of the six nations studied – ranging from 0.14 in Germany to 0.33 in the UK.

Walterskirchen (1999) found employment elasticities for the EU of 0.65 when employing a cross-country analysis of EU countries from 1988-98. Using data from 1970-98 for 7 countries plus the EU as a whole, employment elasticity ranged from 0.24 for Austria to 0.76 for Spain (the elasticity for the US was 0.53). Pini (1997) estimated that the employment elasticity in Germany and Japan rose between the period 1979-95 compared to 1960-79 while it declined in France and Sweden and showed little change in Italy, UK and US. He also detected negative employment elasticity in Italy and Sweden for the period 1990-95.

Slimane (2015) showed long-term employment–GDP elasticities which are estimated using an unbalanced panel of 90 developing countries from 1991 to 2011 using a two steps estimation strategy. The most important results are: (i) Elasticity estimates vary considerably across countries. (ii) Employment elasticity tends to be higher in more advanced and closed countries. (iii) Macroeconomic policies aimed at reducing macroeconomic (price) volatility are found to have significant effect in increasing employment elasticity. (vi) Employment intensity of growth tends to be higher in countries with a larger service sector. (v) Countries with a higher share of urban population are typically characterized by larger employment elasticity. Aksoy (2013) by using quarterly data during 1988-2010 uncovered the relationship between growth and employment in aggregate and industrial respects and also to investigate the impacts of investment and employment incentives on employment for Turkish Economy. The findings showed that the relationship between growth and employment varied with the industries. the findings about Granger Causality from the employment to the economic growth for aggregate series, the energy production and distribution industry, and financial intermediation industry tell that employment expansion in those create economic growth. These findings point out that employment increase creates economic growth rather than economic growth creates employment. Seyfried (2005) examined the relationship between economic growth, as measured by both real GDP and the output gap, and employment in the ten largest states from 1990 to 2003. Models are developed to estimate the employment intensity of economic growth as well as the timing of the relationship between employment and economic growth. Employment intensity is estimated to range from 0.31 to 0.61 in specific states with an estimate of 0.47 for the US as a whole.

Padalino and Vivarelli (1997) found that the employment intensities of economic growth from 1960 to 1994 for the cross countries are vary US to be approximately 0.5; Japan 0.06; Canada 0.56; Germany 0.38; France 0.25; Italy 0.13; and UK 0.36. They concluded that the linkage between growth and employment in the whole economy did not decline in the post-Fordist period for the short-run. Akkemik, K. Ali (2007) tested in Turkey during 1988-2004 and found no cointegration between growth and employment. An ECM establishes a link between the long-run equilibrium and the short-run dynamics. The deviation from the long-run equilibrium is adjusted by short-sun adjustments. Employment is, then, a function of change in real GDP and real wage in the long-run. The results of the ECM in Model 1 can be interpreted as follows: a percentage increase in GDP raises employment by 0.73 percent, in model-2, a percentage increase

in GDP raises employment by 0.29 percent. In Model 1, the impulse response functions imply that the response of employment to GDP and wage shocks is negligible until the fifth period. In Model 2, the response of employment to GDP, wage level, and user cost of capital is very small until the fifth period.

Ramirec and Ramírez (2014) showed relationship between growth, employment and investment for the Uruguayan economy considering the period 1988-2011, and analyzed the possible relationship between investment, non agricultural GDP and urban employment through Vector Error Correction Model. The estimation implies the existence of a long-term relationship between these three variables. From this model we found a positive relationship between GDP and the other two variables, where GDP precedes both employment and investment. Madariaga (2011) established that 1 per cent of economic growth seems on average to increase employment by only 0.6 per cent during 1990-2010 in South and East Mediterranean Countries. Mosikari (2013) in South Africa, unemployment on GDP investigate the effect aimed at in the study, from 1980 to 2011, covering the years of time series based on the analysis, the Augmented Dickey-Fuller (ADF) test, Johansen Cointegration Test and Granger Causality Test was applied. According to the results obtained, a causal relationship between GDP growth rate and unemployment has not been found. Saungweme, Matsvai and Sakuhuni (2014) analysed the effect of formal unemployment to national output and the subsequent growth in informal sector in Zimbabwe during 1985-2013. The results showed that employment and output are positively related, that is, a growth in one variable must drive the other in the same direction. Boubtane et al. (2013) between the years 1987-2009 using VAR analysis, conducted studies in 22 OECD countries, immigration, the relationship between growth and unemployment have been introduced. Immigration from countries GDP per capita rates of unemployment emerges in the positive results that have been affected negatively.

III. METHODOLOGY AND DATA

In explaining the behavioral patterns of the unemployment growth rate in India during 1991-2014,we use semi-log linear model, exponential model, random walk hypothesis, Bai-Perron model(2003) for structural breaks, Hodrick-Prescott filter model(1997) for smooth cycle, and also used asymmetric Christiano-Fitzgerald frequency filter test(1999) for cyclical pattern. Also we used AR and ARIMA model for stationarity. In analyzing the nexus between the two, we used Granger Causality test (1969) Johansen cointegration test (1988, 1996), VAR model, VEC model and impulse response functions of Johansen (1991,1995,1996). We also verified the Okun's Law (1962) in India. We have collected data on GDP growth rate and unemployment growth rate of India from the World Bank from 1991 to 2014.

IV. OBSERVATIONS FROM ECONOMETRIC MODELS

[1] Behaviour of growth rate of unemployment in India during reform period

The growth rate of unemployment of India had been declining steadily at the rate of 0.677% per annum during 1991-2014 which is statistically significant at 5% level. The

estimated trend line is given below.

Log(U)=1.46647-0.006770t

(57.00)*(-3.760)*

R^2=0.3912, F=14.13*, DW=1.38, U= growth rate of unemployment, *=significant at 5% level and t=year

In Fig-1, the downward fitted trend line is shown clearly along with actual and residual lines.

Fig-1: The trend line of unemployment rate

Source-Computed by author

The residual test of this fitted trend line of unemployment rate showed autocorrelation and partial autocorrelation problems whose values are arranged along with Q-stat and their values have not been decaying and they are insignificant at 5% level.In Table-1,the values are given.

Table-1: Autocorrelation and Partial Autocorrelation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.306	0.306	2.5388	0.111
		2	0.116	0.024	2.9189	0.232
		3	0.248	0.228	4.7485	0.191
		4	0.003	-0.15...	4.7489	0.314
		5	-0.32...	-0.35...	8.1326	0.149
		6	-0.05...	0.112	8.2319	0.222
		7	-0.04...	0.017	8.2943	0.307
		8	-0.21...	-0.06...	10.097	0.258
		9	-0.03...	0.031	10.137	0.340
		1...	-0.20...	-0.42...	12.059	0.281
		1...	-0.37...	-0.22...	18.631	0.068
		1...	-0.26...	-0.12...	22.305	0.034

Source-Computed by author

Breusch-Godfrey Serial Correlation LM test of residuals showed that it has serial correlation problem because $nR^2=2.26758 \sim \chi^2(1)$ which is insignificant and is greater than tabulated F=2.1911.

$\varepsilon_t=0.000752+0.308865\varepsilon_{t-1}-8.68E-05t$

(0.030) (1.48) (-0.049)

$R^2=0.0944$, F=1.09, DW=2.01

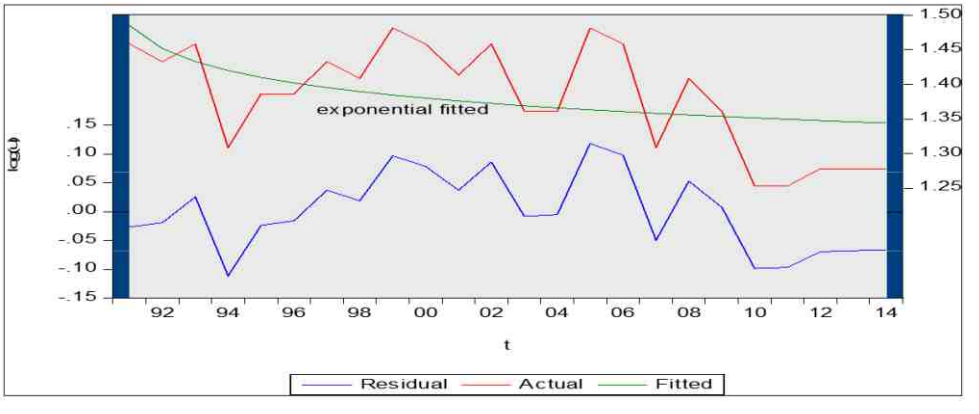
The growth rate of unemployment series of India during 1991-2014 can be fitted exponentially whose estimated equation is given below,

$$\log Ut = e^{-0.6045+t-0.03306}$$

$R^2=0.235$, DW=1.1, t values of the constants are -20.33858 and -2.4359 which showed significant at 5% level.

In Fig-2, the exponential fitted line of unemployment growth rate of India is given below and it is declining.

Fig-2: Exponential curve of unemployment growth rate



Source-Computed by author

The growth rate of unemployment series during 1991-2014 does not follow random walk hypothesis because the coefficient of U_{t-1} is significant at 5% level .The estimated equation is given below,(H0= no random walk)

$\Delta U=U_t-U_{t-1}=1.7937-0.4549U_{t-1}$

(2.375)* (-2.4228)*

$R^2=0.2184$, F=5.87*, DW=2.17, SC=0.323, AIC=0.224,*=significant at 5% level.

The variance ratio test signifies that maximum absolute z value is not statistically significant at 5% level and even all the z values of variance ratios are also insignificant at 5% level which proved that null hypothesis of log (U) Martingale is rejected assuming Lags specified as grid: min=2, max=16, step=1 and Heteroskedasticity robust standard error estimates .It also verified that it does not follow random walk. The values of z are given in the Table-2.

Table-2: Variance Ratio Test

Joint Tests	Value	df	Probability	
Max |z| (at period 3)*	1.900933	23	0.5874	
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.691265	0.194935	-1.583781	0.1132
3	0.422761	0.303661	-1.900933	0.0573
4	0.404394	0.389156	-1.530504	0.1259
5	0.476302	0.456384	-1.147496	0.2512
6	0.333785	0.512179	-1.300745	0.1933
7	0.309386	0.559869	-1.233528	0.2174
8	0.368028	0.600566	-1.052294	0.2927
9	0.266590	0.636140	-1.152907	0.2489
10	0.309534	0.668096	-1.033483	0.3014
11	0.395253	0.697136	-0.867473	0.3857
12	0.358112	0.724067	-0.886503	0.3753
13	0.285992	0.749355	-0.952830	0.3407
14	0.385581	0.773419	-0.794420	0.4270
15	0.235468	0.796605	-0.959738	0.3372
16	0.088835	0.818817	-1.112783	0.2658

Source-Computed by author

Applying Bai-Perron test of L+1 vs. L sequentially determined breaks selecting Trimming 0.15, Max. breaks 5, Sig. level 0.05 and using HAC standard errors & covariance (Prewhitening with lags = 1, Quadratic-Spectral kernel, Andrews bandwidth = 0.7297),we get one structural break in 2010 which was downward, its coefficient, standard error their t statistic with significant level are given in the Table-3.

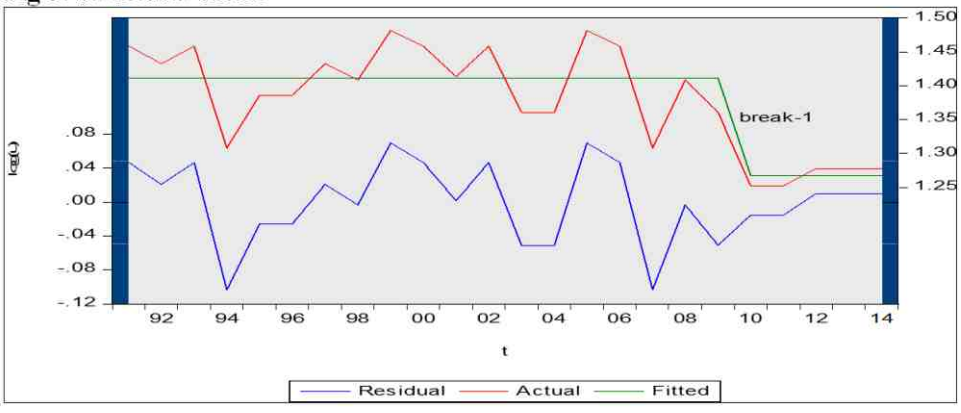
Table-3: Structural Breaks

Variable	Coefficient	Std. Error	t-Statistic	Prob.
	1991 - 2009 -- 19 obs			
C	1.411810	0.012761	110.6362	0.0000
	2010 - 2014 -- 5 obs			
C	1.267997	0.009702	130.6906	0.0000
R^2=0.6077 ,F=34.088* ,AIC=-3.11 , SC=-3.015 , DW=1.97				

Source-Computed by author

In Fig-3, the structural break in 2010 is clearly shown in the fitted line.It shifts downward.

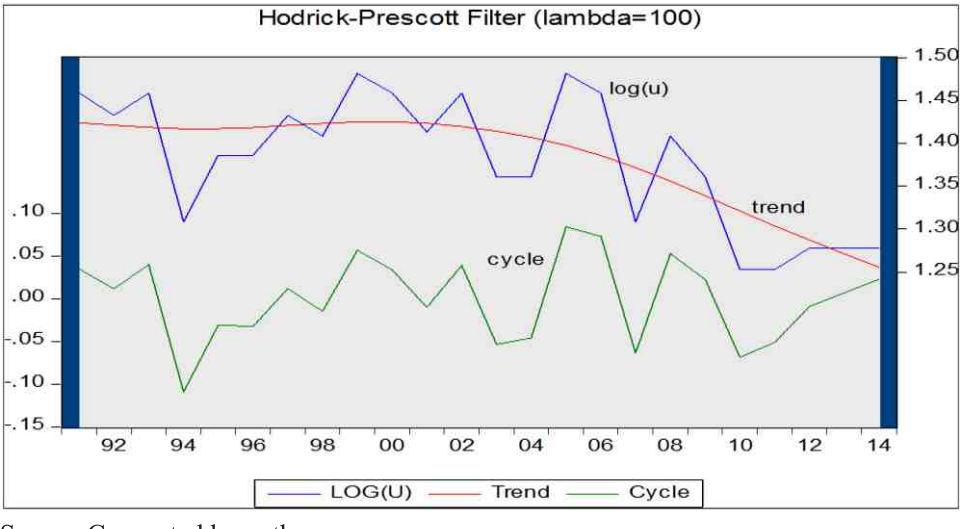
Fig-3: Structural break



Source-Computed by author

The cyclical patterns of the unemployment growth rate during 1991-2014 can be eliminated by the Hodrick-Prescott Filter model to obtain a smooth trend curve which is clearly visible in Fig-4

Fig-4:HP Filter of unemployment growth



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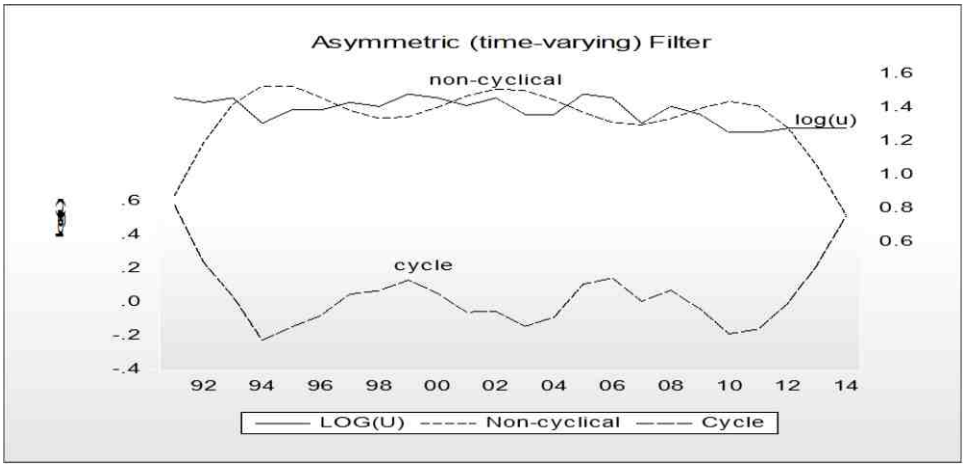
Assuming Hodrick-Prescott Filter (λ=100), we can show that this cyclical pattern is not symmetric which can be shown by asymmetric Christiano-Fitzgerald frequency filter test with I(0) (ie, non-random walk hypothesis) in Fig-5.

Fig - 5 : Asymmetric Filter



Source-Computed by author

The AR(1) process of the series is stable and stationary but AR(2) is stable and non-stationary.

$Log(U_t)=1.368426+0.56243logU_{t-1}$

(42.728)*(3.0275)*

R^2=0.3038, F=9.165*, DW=2.183, SC=-2.438, AIC=-2.537, inverted AR root=0.56,*=significant at 5% level.

Since the root is less than one and lie inside the unit root circle and the impulse response function approaches to zero AR(1) is stable and stationary.

The estimated AR(2) is given below.

$logU_t=1.359176+0.46568logU_{t-1}+0.178928logU_{t-2}$

(30.418)* (2.0419)* (0.761)

R^2=0.3095, F=4.28*, DW=2.085, SC=-2.27, AIC= -2.42, inverted AR roots=0.72 and -0.25,*=significant at 5% level.

Since roots are less than one and lie inside the unit root circle, the model is stable but it is nonstationary because t value of coefficient of U_{t-2} is insignificant.

ARIMA(1,1,1) model is estimated below:

$logU_t=1.274821+0.935563logU_{t-1}+\varepsilon_t-0.563173\varepsilon_{t-1}$

(3.1823)* (4.1922)* (-1.631)

R^2=0.3548 ,F=5.499* ,DW=1.94,AIC=-2.52,SC=-2.37 , inverted AR root=0.94 , inverted MA root=0.56,*=significant at 5% level.AR process is stationary but MA process is nonstationary, so ARIMA model is nonstationary but it is stable because roots are less than one and lie inside the unit root circle.

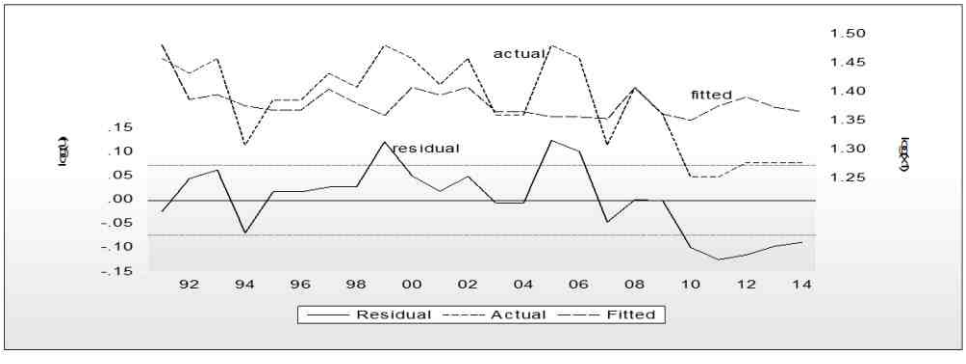
[2] Nexus between GDP growth rate and growth rate of unemployment since reform period

Now, double log regression model states that one percent increase in GDP growth rate per year leads to 0.0579% decrease in unemployment growth rate per annum in India during 1991-2014 which is insignificant at 5% level but significant at 10% level. The estimated equation is given below.

$Log(U)=1.4859-0.057934\log(X_1)$
(25.679)*(-1.8612)*
R^2=0.136, DW=0.86,F=3.464*,SC=-2.226,AIC=-2.32,*=significant at 10% level., where X_1= growth rate of GDP

In Fig-6, the estimated line is plotted clearly and is shown below.

Fig-6: Growth and unemployment



Source-Computed by author

In India, Okun's law became insignificant because 1% fall in the change in unemployment growth rate led to 1.39% increase in growth rate of GDP per annum during 1991-2014 which showed statistically insignificant.

$Log(X_1) = 1.861583-1.390136\ \Delta\log(U)$
(28.234)*(-1.4879)
R^2=0.0953, F=2.214, DW=1.559,*=significant at 5% level.

Granger Causality test proved that the growth rate of unemployment and the growth rate of GDP in India during 1991-2014 has bi-directional causality which is shown below.

Table-4: Test of Causality

Null Hypothesis:	Obs	F-Statistic	Prob.
X_1 does not Granger Cause U	23	0.02863	0.8673
U does not Granger Cause X_1	0.06980	0.7943	

Source-Computed by author

Johansen unrestricted cointegration rank test showed that the Trace Statistic has no cointegrating vector at 5% level but has two cointegrating vector at 10% level. Max Eigen Statistic has one cointegrating vector at 10% level but no cointegrating vector at 5% level.

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Table-5: Johansen Cointegration Test

Hypothesized no. of CE(s)	**Eigen value**	**Trace statistic**	**0.05 critical value**	**Prob****
None	0.391586	13.84826	15.49471	0.0872
At most 1	0.124155	2.916451	3.841466	0.0877
Hypothesized no. of CE(s)	**Eigen value**	**Max Eigen Statistic**	**0.05 critical value**	**Prob****
None	0.391586	10.93181	14.26460	0.1576
At most 1	0.124155	2.916451	3.841466	0.0877

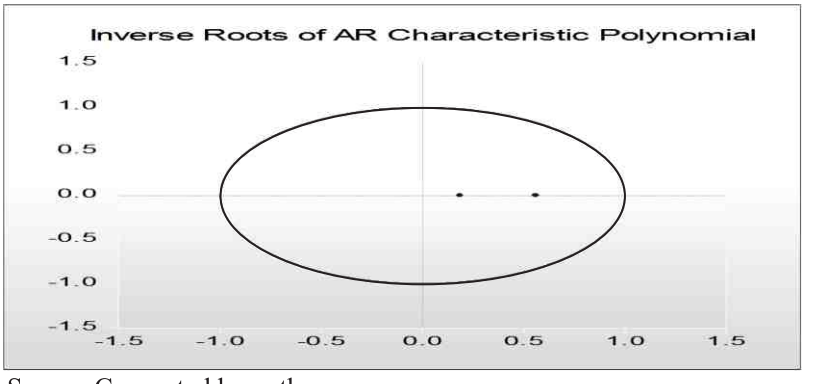
**MacKinnon-Haug-Michelis (1999) p-values.Source-Computed by author

The estimated VAR model is given below which is insignificant

U_t=1.7200+0.55644U_{t-1}+0.0043X_{1t-1}
(1.938) (2.7327)* (0.264)
R^2=0.287, F=4.033, SC=0.458 AIC=0.310, *=significant at 5% level
X_{1t}=3.86+0.424165U_{t-1}+0.19299X_{1t-1}
(0.005) (0.264) (0.9589)
R^2=0.04409, F=0.4613, SC=4.58, AIC=4.44

But this VAR model is stable because two roots (0.56 and 0.188) lie inside the unit root circle which is plotted in Fig-7.

Fig-7: Stability Condition of VAR



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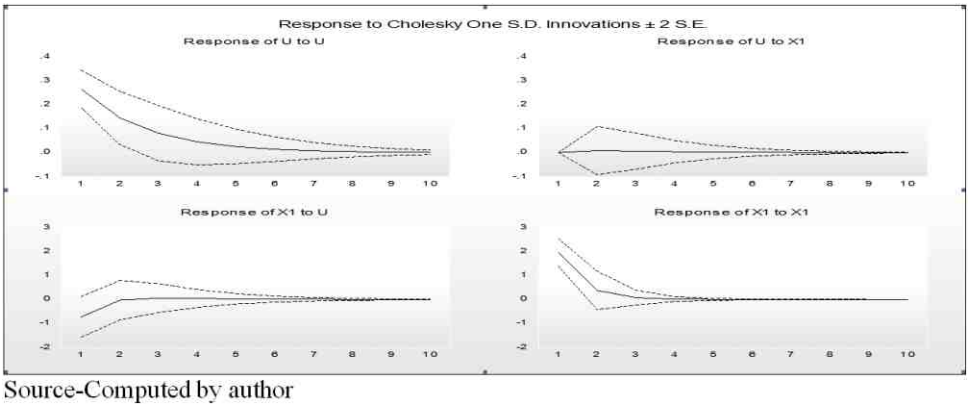
But the impulse response function showed that they are converging to zero which are shown in Fig-8.It means that exogenous shocks can back the model towards equilibrium.

Fig-8: Impulse Response Functions



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The estimated VECM is given below.

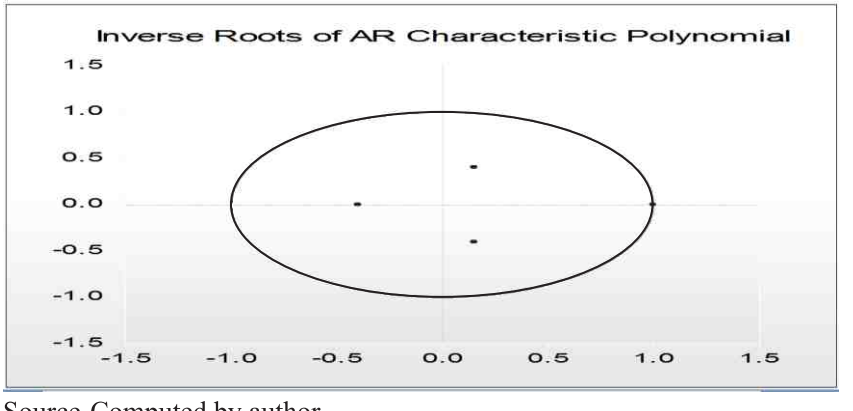
ΔU_t=-0.04053-0.35294ΔU_{t-1}+0.007053ΔX_{1t-1}-0.014879EC
(-0.6416) (-1.498) (0.2432) (-0.178)
R^2=0.141, F=0.989, SC=0.747, AIC=.549

ΔX_{1t}=0.1679+2.9207ΔU_{t-1}+0.15018ΔX_{1t-1}-1.894048EC
(0.3622) (1.729) (0.7054) (-3.096)*
R^2=0.4548, F=5.005, SC=4.73, AIC=4.53

In case of ΔU_t, the error correction process is very slow and insignificant but in case of ΔX_{1t},the error correction process is very fast and significant .The t values of other coefficients are quite insignificant.

This VEC Model is stable whose four roots (1.0, 0.151001±0.402751i,-0.397838) lie inside the unit root circle which is plotted in Fig-9.

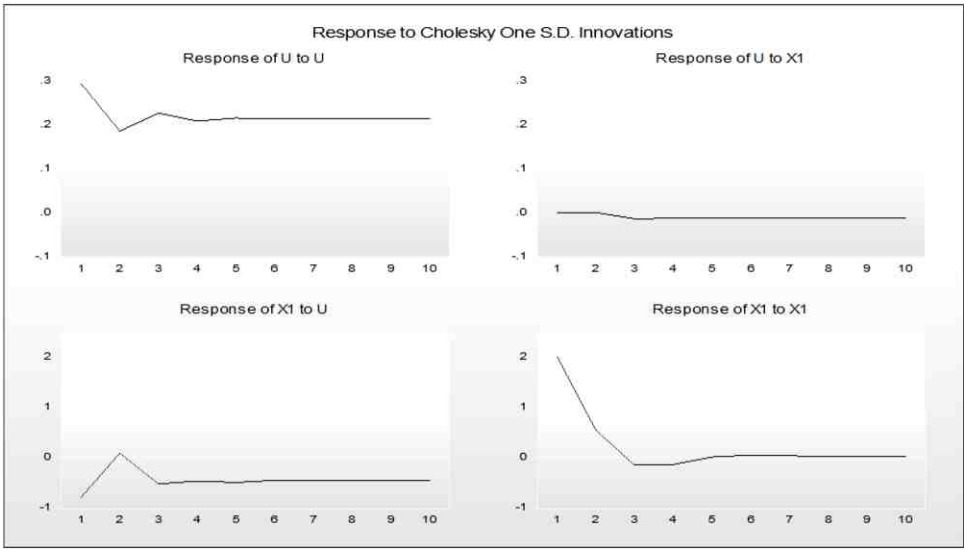
Fig-9: Stability of VEC Model



Source-Computed by author

Moreover, the VEC Model is nonstationary and diverging because the impulse response functions are not approaching to zero which is seen in Fig-10.

Fig-10: IRF of VECM



Source-Computed by author.

During 1991-2014 in India,the growth rate of GDP per capita and unemployment growth rate has inverse relation but it is insignificant.One percent increase in per capita GDP growth rate per year leads to 0.130% decrease in growth rate of unemployment per year during 1991-2014.The estimated equation is stated below.

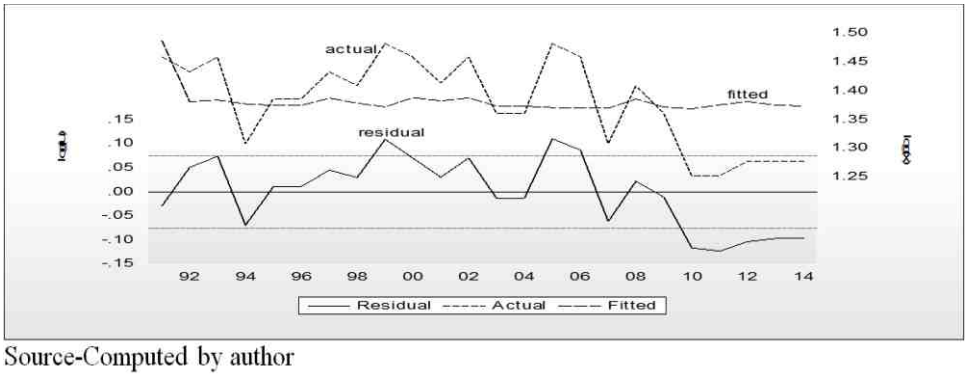
Log(U)=1.3970-0.10303log(X)

(76.270)* (-1.4928)

R^2=0.0919, F=2.228, DW=0.907, where x=growth rate of GDP per capita,*=significant at 5% level

In Fig-11, the fitted line is clearly visible.

Fig-11: Relation between growth of GDP per capita and growth of unemployment



Source-Computed by author

Granger causality test assures that the growth rate of GDP per capita and growth rate of unemployment rate in India during 1991-2014 has bidirectional causality which is shown in Table-6.

Table-6: Granger Causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
X does not Granger Cause U	23	0.00225	0.9626
U does not Granger Cause X	0.03298	0.8577	

Source-Computed by author

In applying Johansen unrestricted cointegration rank test, we find that both Trace and Max-Eigen statistic have no cointegrating vector so that growth rate of GDP per capita and growth rate of unemployment has no cointegration. In Table-7, it is shown.

Table-7: Johansen Cointegration Test

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None	0.370015	13.05423	15.49471	0.1128
At most 1	0.123058	2.888920	3.841466	0.0892
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.370015	10.16531	14.26460	0.2013
At most 1	0.123058	2.888920	3.841466	0.0892

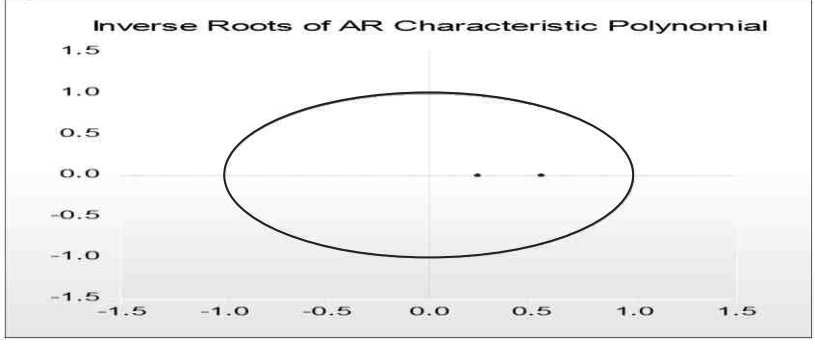
Source-Computed by author,**= MacKinnon-Haug-Michelis (1999) p-values

The estimates of VAR model is given below. It is insignificant. The coefficient of U_{t-1} in relation with U_t is found significant.

U_t=1.7730+0.5487U_{t-1}+0.001248X_{t-1}
(1.998) (2.648)* (0.0474)
R^2=0.2864, F=4.015, SC=0.4597, AIC=0.3116 ,*=significant at 5% level
X_t=2.6796+0.299384U_{t-1}+0.24138X_{t-1}
(0.3796) (0.1815) (1.153)
R^2=0.0665, F=0.70, AIC=4.459, SC=4.607

Yet the VAR model is stable because the roots (0.549 and 0.24) are less than one which lie inside the unit root circle. It is shown in Fig-12.

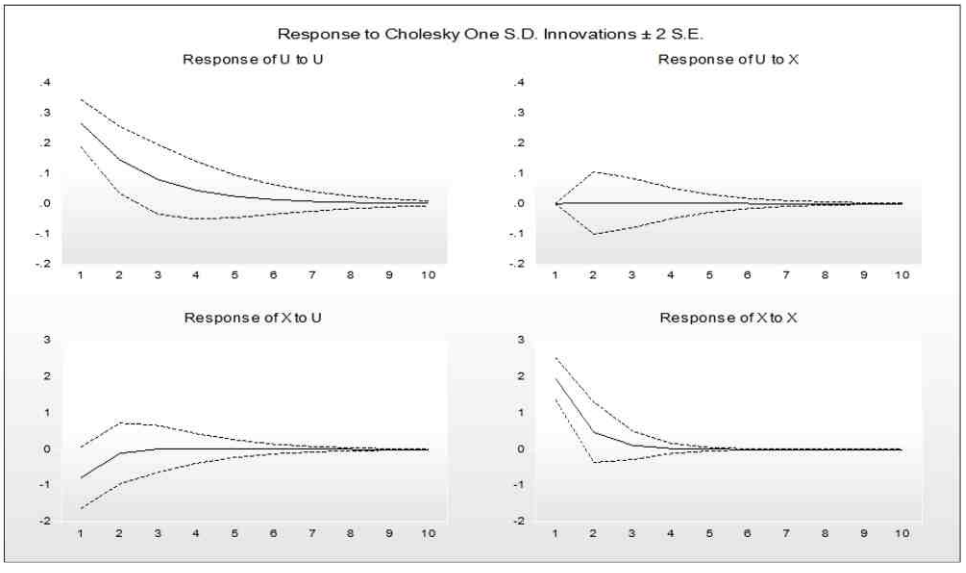
Fig-12: Stable VAR model



Source-Computed by author

Even the impulse response functions have been converging to zero which proved that any exogenous shock in the VAR model might be moved to the equilibrium level. It is shown in Fig-13.

Fig-13: IRF of VAR



Source-Computed by author.

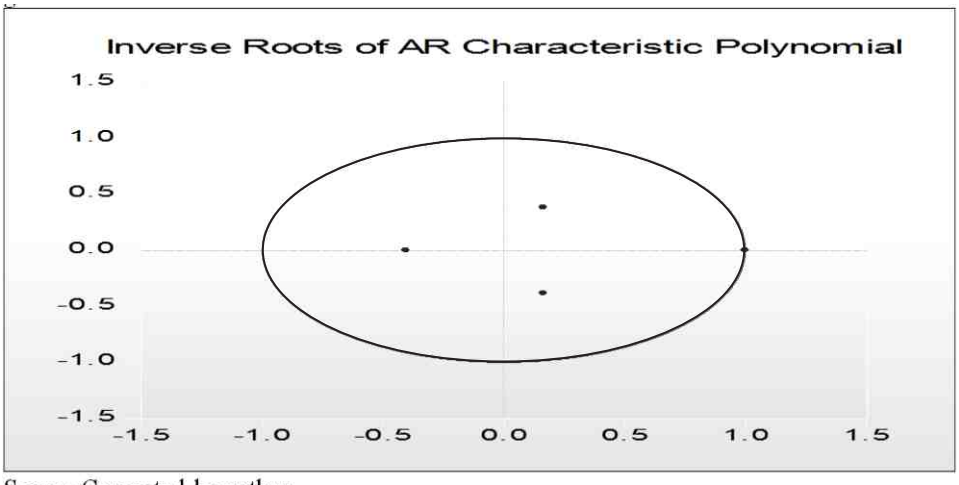
In VECM, the process of error correction of Δx_t is significant but Δu_t is insignificant which are estimated below.

$\Delta x_t = 0.18144 + 2.947\Delta u_{t-1} + 0.12315\Delta x_{t-1} - 2.1425EC$
(0.3850) (1.661) (0.5486) (2.861)*
$R^2 = 0.4263$, F=4.45, AIC=4.56, SC=4.75

$\Delta U_t = -0.0408 - 0.34641\Delta U_{t-1} + 0.00046\Delta x_{t-1} - 0.030419EC$
(-0.6479) (-1.460) (0.3152) (-0.3036)
$R^2 = 0.144$, F=1.01, AIC= 0.5457, SC=0.7441

This VEC Model is stable because the four roots (1.0, 0.165935 ± 0.383519i, -0.404091) lie inside the unit root circle which is plotted in Fig-14.

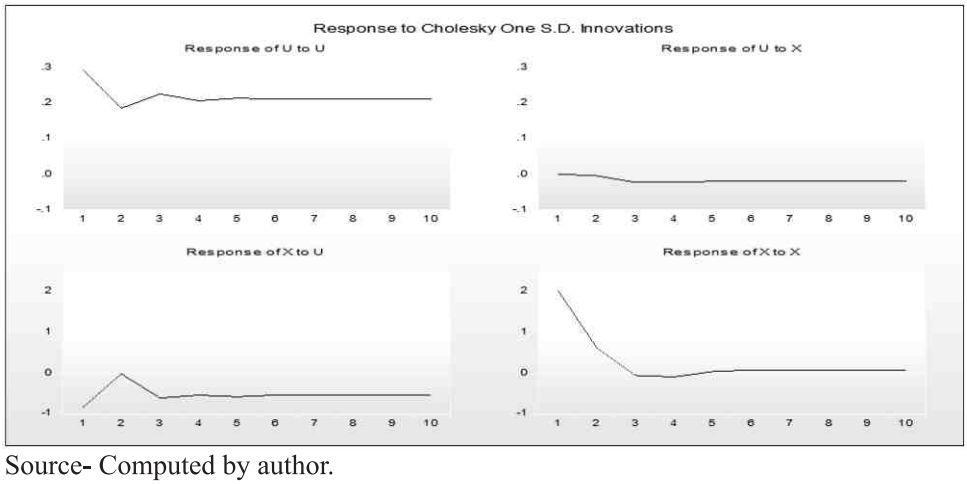
Fig-14: Stability of VEC Model between per capita GDP growth and unemployment growth rates



Source-Computed by author

This VEC Model is diverging because any exogenous shock can't bring the system back to equilibrium which was observed in Fig-15 by the impulse response functions.

Fig-15: IRF of VEC Model between per capita GDP growth and unemployment growth rates



Source- Computed by author.

V. LIMITATION AND FUTURE SCOPE OF THE STUDY

Since we are explaining the growth unemployment nexus from the reform period then we have short fall of sample size for VAR and VEC model. More explanatory variables can be included in this study. Even this model is extended for sectoral analysis for India. If data is available then comparative study is possible between pre reform and post reform periods. Besides, Newey-West asymmetric test can be done to obtain details of deepness and steepness of cycles. Modification of Okun's law is also applicable in our study.

VI. CONCLUSION

This study concludes that growth of unemployment is decreasing at the rate of 0.677% per year during 1991-2014 significantly but its exponential declining growth rate is 0.033% which is significant. The unemployment growth rate series does not follow random walk and it has one downward structural break in 2010.The smooth cycle was obtained through Hodrick-Prescott Filter model.AR and ARIMA models of this series are nonstationary.

On the nexus issue, the study concludes that one percent increase in GDP growth rate led to 0.0579% decline in unemployment growth rate during 1991-2014 in India which is insignificant. The Okun's law is verified but found insignificant. Both have bidirectional causality but Johansen cointegration showed insignificant. The VAR and VEC model are stable but VAR is converging and VECM is diverging where the coefficient of error correction in change of unemployment growth rate is very slow and insignificant. The same observations were found in the nexus between the GDP per capita growth rate and unemployment growth rate in India during 1991-2014.

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