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Debesh Bhowmik[1]

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Abstract

Generally, the economic growth boosts employment growth rate but empirical evidences do not support these views in all cases. In this paper, the author endeavors to relate growth with unemployment rate during 1991-2016 in India using regression models, Granger Causality test, Johansen Cointegration test and Vector Error Correction model. Impulse response functions were fitted for testing stationary. Unit circle was found out to check stability of the Vector Error Correction. Output gap is measured by deducting Hodrick-Prescott Filtered trend value from the actual output. Unemployment gap is measured by deducting natural growth rate of unemployment from the actual unemployment rate. The data on Indian unemployment rate, growth rate and GDP from 1991 to 2016 have been taken from the World Bank. The paper concludes that growth-unemployment nexus is significantly negative at 10% level. Their relation is not causal but is co-integrated at 10% level. VECM is stable and non-stationary where in one error correction process the speed of adjustment is high and significant. The relation between output gap and unemployment is negative and insignificant. They are not co-integrated and have no causality. The nexus between output gap and unemployment gap is significantly negative but the

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relation has no causality and co-integration. VAR model is a good fit where variables are related with previous periods. The relation between growth and unemployment gap is insignificantly negative and co-integrated where VECM is stable but non-stationary and one speed of adjustment is significantly fast and other is insignificantly slow in error correction process.

Keywords: Output gap, Unemployment Gap, Cointegration, Vector Error Correction

JEL Classification: C10, E02, E24, E31, J21, J60

1. Introduction

Since full employment is assumed in classical theory, then equilibrium employment level is determined where labour demand equals labour supply at a specified level of real wage rate. Classicist treated it as full employment level. Excess supply of labour or unemployment appears when the real wage rate is above the equilibrium rate. There is automatic tendency of attainment of full employment level in the labour market which was also assumed by Pigou (1933) and full employment exists when everybody wishes to be employed at the running rate of wages. Underemployment exists when working of free market structure is forced by rigid wage structure or minimum wage legislation.

The classical theory was based on Say's Law of Markets (1821) which was carried forward by classical economists like Marshall (1890) and Pigou (1933). They separately explained and determined the output, money and labour markets. Each market involves a built-in equilibrium mechanism to ensure full employment in the economy. Keynes (1936) argued that in the real world, wages are often inflexible or rigid. In particular, wages are 'sticky downwards'. Generally, workers resist nominal wage cuts. Assume there was a fall in demand for labour and trade unions would reject nominal wage cuts. Thus, in Keynesian model, there is disequilibrium in the labour market. Wages would stay at fixed wage rate, and unemployment would result.

If unemployment rate is higher than the natural rate or if unemployment rate is higher than Non-Accelerating Inflation Rate of Unemployment (NAIRU), then the production will start to fall. In the opposite situation, production and inflation will rise. In the long run if NAIRU exists, it certainly moves around although economists raised debates on conceptual ideas and applicability. The Classical school believes that the economy will tend to return to an equilibrium position whenever it is pushed away, and thus favor the concept of a "natural" rate, other economists searched whether an economy is really a stable system at all. But, Keynes (1936) and Joseph Schumpeter (1936) envisioned economies as more dynamic and evolving. Even the concept of NAIRU was developed by Robinson (1937) in a different version which can be recalled as "in any given conditions of the labour market there is a certain more or less defined level of employment at which money wages will rise" (Robinson, 1937). The Post Keynesian analysis was modified through introduction of an interrelation between aggregate demand, income distribution, capital accumulation, capacity utilization and economic activity without harming inflation. It is declared that unemployment cannot be faced through purely either labour market policies or demand side policies. It is required their efficient combination in the most realistic way.

According to Okun's law (1962) when the unemployment rate was above its natural rate then a country's gross domestic product (GDP) might be lost. Since output is a function of labour, then there is a positive relationship between output and employment. Total employment equals the labor force minus the unemployed, so there is a negative relationship between output and unemployment (conditional on the labor force). Following Okun's law (1962), it can be stated that 1 % decline in the unemployment rate per year, led to 2% faster rise in real GDP than the rate of growth of potential GDP per year. Simply, if the potential rate of GDP growth is 2%, then, GDP must grow at about a 4% rate per annum to achieve a 1 percentage point reduction in the rate of unemployment.

Phillips (1958) analyzed the quantitative relationship between employment growth, inflation and output growth. In his model

unemployment, inflation and stagnation in macroeconomic instability arise when economies move along a non-optimal or golden disequilibrium situation. Then policy makers should know quantitative dynamic relationships between these variables. Otherwise, target rate of inflation rate, level of economic activity or natural rate of unemployment would be failed. Finally, a proper understanding of the employment/inflation/output relationship might also be instrumental to avoiding or at least alleviating cycles.

2. Review of Literature

Sodip and Ogunrihola (2011) examined the employment and economic growth relationship in the Nigerian economy during 1981-2006 using the Ordinary Least Squares technique with time series data which were corrected for non-stationary using Hodrick-Prescott filter and observed that employment and GDP have a strong positive correlation coefficient of 0.899. Thus, the employment elasticity of GDP growth is 0.05 which indicates that a unit change in economic growth brings about a 0.05 percentage change in employment. Kreishan (2011) analyzed empirically on growth unemployment relationship during 1970-2008 in Jordan examining Okun's law through cointegration and ADF technique and concluded that Okun's law was not valid in Jordan. Arewa and Nwakanma (2012) verified the growth –unemployment relation in Nigeria during 1981-2011 through VAR and obtained that the trade-off between output-gap and unemployment gap is positive. It indicates that a decrease in the gap between the natural rate of unemployment and current rate of unemployment leads to a decrease in the difference between potential GDP and real GDP.

Mihaela and Mihaela (2013) studied growth-unemployment relationship in Romania during 2000-2011 and the significant negative coefficient of -0.753 was the result. Khan, Saboor, Mian and Anwar (2013) verified the link between the real GDP growth and unemployment in Pakistan during 1976-2010 and found that a rise of one percentage point of unemployment is associated with a decline of 0.36 percentage point of real GDP growth. Neto and Silva (2013) identified seven links in relating growth and unemployment .They are

[i] reallocation effect (higher growth and lower unemployment rate is possible through reallocation of workers), [ii] leapfrogging effect (a wage increase in one sector is driven by a wage increase in other sectors, leading to higher unemployment due to rise in growth rate), [iii] disciplinary unemployment effect (higher unemployment levels will prevent workers from shirk, which leads to higher growth rates), [iv] minimum wage effect (economic growth may rise when an increase in the minimum wage catapults the disposable income), [v] updating technology effect (upgrading technology leads to higher growth and lower unemployment), [vi] schooling and working effect (increase in human development index implies a negative relationship between unemployment and growth), and [vii] agglomeration effect (increase efficiency in one sector implies higher growth rates and lower unemployment). Umair and Ullah (2013) examined nexus between growth and unemployment in Pakistan during 2000-2010 and observed that the correlation between GDP and unemployment rate was insignificant with a value of 0.196. Levine (2013) studied the relationship between economic growth and unemployment historically and concluded that there is a negative relationship between changes in the rates of real GDP growth and unemployment.

Madito and Khumalo (2014) analyzed the growth-unemployment relationship during 1967-2013 in South Africa with the help of cointegration test and Vector Error Correction Model (VECM) and found significant negative relation along with 62% error corrections. Abdul-Khaliq, Soufan and Abu-Sahib (2014) studied growth-unemployment in 9 Arab countries during 1994-2010 and found significant negative relation and showed that 1% increase in economic growth will decrease the unemployment rate by 0.16% per year. Pinar, Serkan, Deniz and Murat (2014) examined econometric relationship between growth and unemployment in European Union (EU) in 2013 and Turkey during 2001-2011 and obtained a positive long run and negative short run relationships which were significant. It was observed that a 1% increase in unemployment led to 0.35% increase in growth in the long-term, and led to 0.26% decrease in growth in the short term respectively.

Jelilov, Obasa and Isik (2016) studied in 10 Economic Community of West African States (ECOWAS) during 2001-2014 where growth-unemployment nexus showed inverse relation. Abu (2017) employs the Autoregressive Distributed Lag (ARDL) bounds testing technique to examine whether Okun's law exists in Nigeria during 1970-2014 and found that a cointegrating or long term relationship exists between the unemployment rate, economic growth and oil prices. In the long term, unemployment has a negative and significant effect on the economic growth. The coefficient of unemployment (0.18%) for this study is far less than the result reported by Okun and other studies that focused on developed countries. Okun's coefficient is not only unstable but varies for different countries, and does not remain constant for Nigeria. Diwani (2017) studied econometric evidence between income, output and employment in India during 1990-2013 and fitted ARIMA (1,1,2) model and observed that there is a significant positive relationship between GDP growth and unemployment rate with co-efficient 3.80 which is surprising.

3. Objective of the Paper

The empirical studies do not support the positive relation between economic growth and employment in all economies in different time periods. Some researches verified that unemployment rate and growth is inversely related in South Africa, Arab, Nigeria, Romania, Poland, Spain and Pakistan respectively. On the other hand, some studies empirically verified that unemployment rate and growth rate are positively related in Pakistan, Nigeria, 10 Economic Community of West African States ECOWAS and India respectively. In this context, author attempts to analyze the growth-unemployment relationship of India during 1991-2016. Moreover, the relation between output gap and unemployment gap in India during the specified period was also verified. All these relationships were established through Granger Causality test, cointegration test and vector error correction models respectively.

4. Research Methodology and Data

Author used bivariate simple regression and log regression models. Also author used Granger Causality test (1969), Johansen (1988, 1995) unrestricted rank cointegration test and vector error correction model for finding relationship between growth rate and unemployment rate in India. Residual test for autocorrelation, heteroscedasticity and normality (Doornik & Hansen, 2008) have been also done. Impulse response functions were fitted for testing stationary. Unit circle was found out to check stability of the Vector Error Correction (VEC). Even, author tested to find out the relation between unemployment gap, output gap and growth in India during 1991-2016 using those models.

Output gap is measured by deducting Hodrick Prescott (1997) filtered trend value from the actual output (or it is a difference between actual and potential rate of growth). Unemployment gap is measured by deducting natural growth rate of unemployment from the actual unemployment rate (or natural rate of unemployment is called NAIRU i.e. Non Accelerating Inflation Rate of Unemployment). Following Ball and Mankiw (2002), NAIRU is calculated from the regression of change in inflation on unemployment during the specified period where difference between unemployment rate and the coefficient of unemployment rate of the regression equation is the unemployment gap. Indian unemployment rate, growth rate and GDP from 1991 to 2016 have been taken from the World Bank. All the calculations, tables and figures were prepared by the author through E Views 9.5.

5. Econometric Observations and Analysis

5.1. Growth-Unemployment in India

Double log regression model states that one per cent increase in GDP growth rate of India per year led to 0.0654 per cent decrease in unemployment rate per year during 1991-2016 which is significant at 10% level.

$$\text{Log}(y) = 1.4885 - 0.0655 \log(x)$$

$$(23.52)^* \quad (-1.92)^*$$

R^2 = 0.13, F =3.70*, DW = 0.76, * = significant at 10% level, where y = growth rate of unemployment per cent per year, x = growth rate of GDP per cent per year. In Figure 1, the estimated double log regression line is shown.

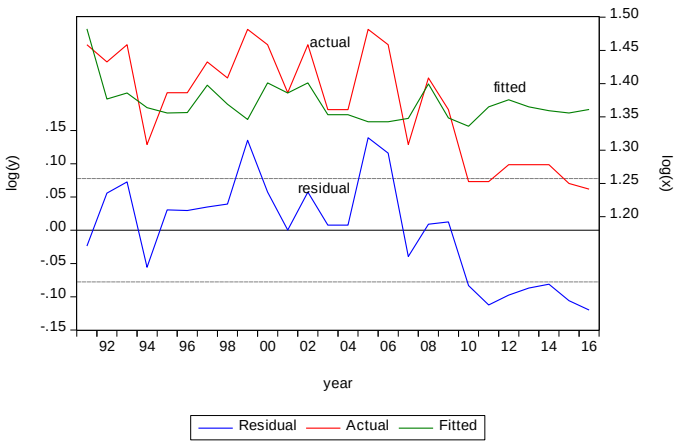

Figure 1: The Estimated Line

Okun's Law (1962) is verified by the following estimated equation in India taking data from 1991 to 2016.

$\Delta y = - 0.0203 - 0.1795\Delta \log(x)$

(-0.3669) (-1.63)

R^2 = 0.104, F = 2.67, DW = 2.55

It suggests that one percent increase in GDP growth rate per year during 1991-2016 led to 0.1795 percent decrease in the change of unemployment rate per year in India which is insignificant at 5% level. This relationship defers from the original work of Okun (1962) for USA.

Table1: Causality(with lag-1)

Null hypothesis	Obs.	F-statistic	p-value
y does not Granger cause x	25	0.0541	0.8182
x does not Granger cause y		0.0034	0.9537

There is no bi-directional causality between growth rate and unemployment rate during 1991-2016 in India which is shown in the -Table 1. It states that growth rate does not Granger cause-unemployment rate and vice versa in India.

Johansen unrestricted rank test between growth and unemployment rate in India confirmed that Trace statistic and Max Eigen statistic showed one cointegrating equation each which is significant at 10% level.

Table 2: Cointegration Test

Hypothesised number of Cointegrating Equations	Eigen Value	Trace Statistic	Critical Value at 5%	p-value
None	0.4121	14.9443	15.4947	0.0604
At most 1	0.0875	2.1969	3.8415	0.1383
None	0.4121	12.7474	14.2646	0.0856
At most 1	0.0875	2.1969	3.8415	0.1383

Since they are cointegrated significantly at 10% level, then vector error correction needs to be checked. The estimated equations in VECM are given below.

$\Delta x_t = 0.1104 + 0.1869\Delta x_{t-1} + 2.9196\Delta y_{t-1} - 0.8910EC$

(0.28) (0.97) (2.01)* (-3.47)*

$R^2 = 0.47$, F = 6.03, SC = 4.47, AIC = 4.27

$\Delta y_t = - 0.0456 + 0.0093\Delta x_{t-1} - 0.3770\Delta y_{t-1} - 0.0106EC$

(-0.77) (0.32) (-1.74)* (-0.27)

$R^2 = 0.16$, F = 1.29, SC = 0.66, AIC = 0.46,

* = significant at 5% level.

In this VECM, the error correction of Δx_t equation is significant where the speed of adjustment is 89.10% per year and in equation Δy_t the error correction is insignificant because its speed of adjustment is 1.05% per year. Δx_t is insignificantly related with Δx_{t-1}. Even, Δy_t is not significantly related with Δx_{t-1} respectively. The estimated equations are not found good fit since R^2 is very low. Yet, the model is stable because all the roots lie inside the unit circle which is shown in Figure 2. The VECM is not stationary and convergent since impulse response functions are moving away from the

equilibrium. Any external shock does not move the model towards zero. In Figure 3, it is plotted below:

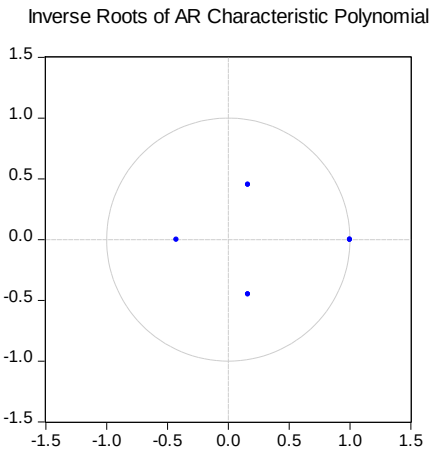

Figure 2: Stable VECM

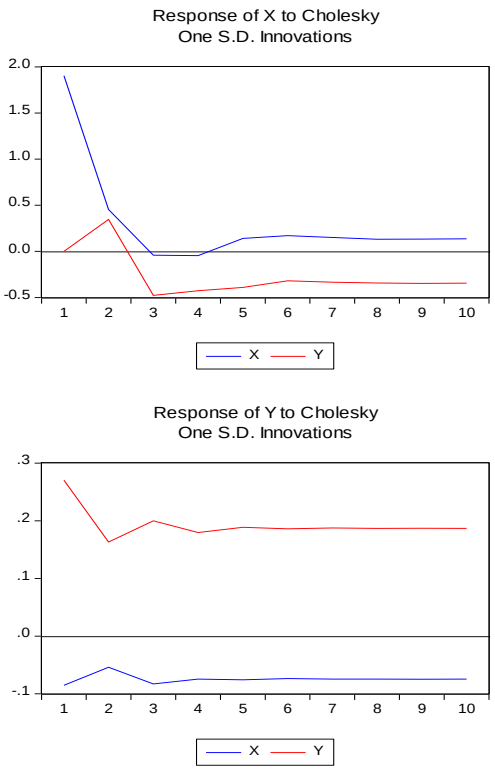

Figure 3: Impulse Response Functions

5.2. Output Gap and Unemployment in India

Output gap has a negative impact on India's unemployment rate during 1991-2016 and has been found from the regression equation which is not significant at 5% level.

U = 3.949501- 0.877978Z

(65.02)* (-1.63)

R^2 = 0.099, F=2.65, DW = 0.707, where Z = output gap, U = unemployment rate,

* = significant at 5% level.

Output gap and unemployment rate have no bi-directional causality. The null hypothesis in causality test is significant at 5% level which states that output gap does not Granger cause unemployment and vice versa. The values have been arranged in Table 3.

Table 3:Causality test(with lag-1)

Null hypothesis	Obs.	F-statistic	p-value
Z does not Granger cause U	25	0.0525	0.8209
U does not Granger cause Z		0.47410	0.4983

Table 4: Johansen Unrestricted Rank Test

Hypothesised Number of Cointegrating Equations	Eigen Value	Trace Statistic	Critical Value at 5%	p-value
None	0.1847	7.5489	15.4947	0.51
At most 1	0.1044	2.6473	3.8414	0.10
		Max Eigen Statistic		
None	0.1847	4.9016	14.2646	0.75
At most 1	0.1044	2.6473	3.8414	0.10

There is no cointegration between output gap and the unemployment growth rate in India during 1991-2016 which is

verified by unrestricted Johansen cointegration test. The values have been shown in Table 4. Therefore, VECM is not required.

5.3. Output Gap and Unemployment Gap in India

Simple regression analysis suggests that the output gap and unemployment gap in India during 1992-2016 is inversely related which is significant at 5% level.

$Z = 0.32517 - 0.142407w$

$(2.025)^* \quad (-2.0819)^*$

$R^2 = 0.158$, $F = 4.33^*$, DW = 0.378, AIC = - 1.56, SC = -1.47,

* = significant at 5% level. It is poorly fitted having serial correlation problem. Where Z = output gap, w = unemployment gap.

In Figure 4, the fitted line is plotted clearly.

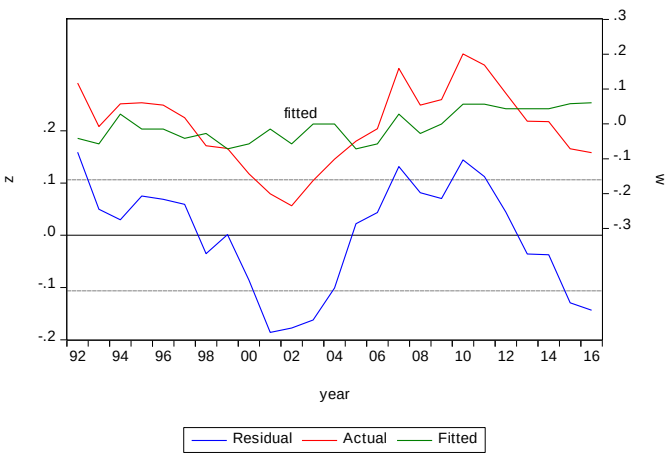

Figure 4 : Fitted Line of Output Gap and Unemployment Gap

Granger causality test suggests that both unemployment gap and output gap have no bi-directional causality which means output gap does not Granger cause unemployment rate and vice versa .It is shown in Table 5. But output gap and unemployment gap in India during 1992-2016 is not cointegrated in the order one at 5% significant level in both Trace Statistic and Max Eigen Statistic.

Table 5 : Causality Test (with lag-1)

Null hypothesis	Observation	F Statistic	p-value
Z does not Granger cause w	24	0.113	0.7392
w does not Granger cause Z		0.4272	0.5204

Table 6: Cointegration between Output Gap and Unemployment Gap

Hypothesised number of Cointegrating Equations	Eigen Value	Trace Statistics	Critical Value At 5%	p-value
None	0.1688	7.5611	15.4947	0.5134
At most 1	0.1340	3.3089	3.8414	0.0689
		Max Eigen Statistic		
None	0.1688	4.2522	14.2646	0.8318
At most 1	0.1340	3.3089	3.8414	0.0689

Since no cointegration is established between ouput gap and unemployment gap in India during 1992-2016 then Vector Autoregressive (VAR) model is to be tested.The estimated equations in the VAR model are given below.

$w_t = 0.9855 + 0.5660w_{t-1} - 0.1887Z_{t-1}$

(2.01)* (2.72)* (-0.33)

$R^2 = 0.33$, F = 5.36, AIC = 0.35, SC = 0.49

$Z_t = - 0.0933 + 0.03611w_{t-1} + 0.8195z_{t-1}$

(-0.71) (0.65) (5.51)*

$R^2 = 0.62$, F = 17.59, AIC = - 2.30 SC = - 2.15, * = significant at 5% level.

Both the unemployment gap and output gap are significantly correlated with previous period but their cross relationships are insignificant at 5% level.

5.4. Unemployment Gap and Growth in India

Double log regression equation between unemployment gap and growth rate states that one per cent increase in growth rate per year in India during 1992-2016 led to 0.1454 % decrease per year in the unemployment gap which is not significant at 5% level.

Log (w) = 1.10592 - 0.145446 log (G)

(6.38)* (-1.59)

R^2 = 0.09, F=2.53, DW = 0.709, where G = growth, w = unemployment gap, * = significant at 5% level.

But, Johansen unrestricted rank test confirmed that they are cointegrated with one cointegrating equation in Trace statistic and Max Eigen statistic respectively (Table 7).

Table 7 : Johansen Cointegration Test

Hypothesised Number of Cointegrating Equations	Eigen Value	Trace Statistic	Critical Value At 5%	p-value
None	0.4609	16.7089	15.4947	0.03
At most 1	0.1028	2.4955	3.8414	0.11
		Max Eigen Statistic		
None	0.4609	14.2134	14.2601	0.0509
At most 1	0.1028	2.4955	3.8414	0.1100

The estimated VECM is given below.

Δw_t = - 0.0479 - 0.3861Δw_{t-1} + 0.0021ΔG_{t-1} - 0.0002EC

(-0.78) (-1.74) (0.06) (-0.004)

R^2 = 0.15, F =1.16, AIC = 0.52, SC = 0.71

ΔG_t = 0.1494 + 2.7486Δw_{t-1} + 0.3267ΔG_{t-1} - 1.2737EC

(-0.38) (1.95) (1.54) (-3.88)*

R^2 = 0.52, F=7.09, AIC = 4.22, SC = 4.41, * = significant at 5% level.

The error correction process is significant and the speed of adjustment is very fast (127.37% per year) in the ΔG_t equation but Δw_t equation is insignificant with very slow error correction process (speed of adjustment =0.022% per year). Unemployment gap and growth are not significantly related with previous period.

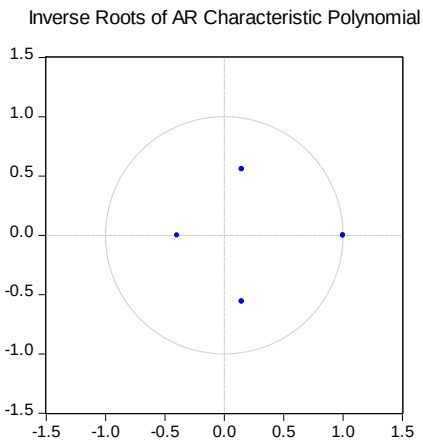

Figure 5: Unit circle

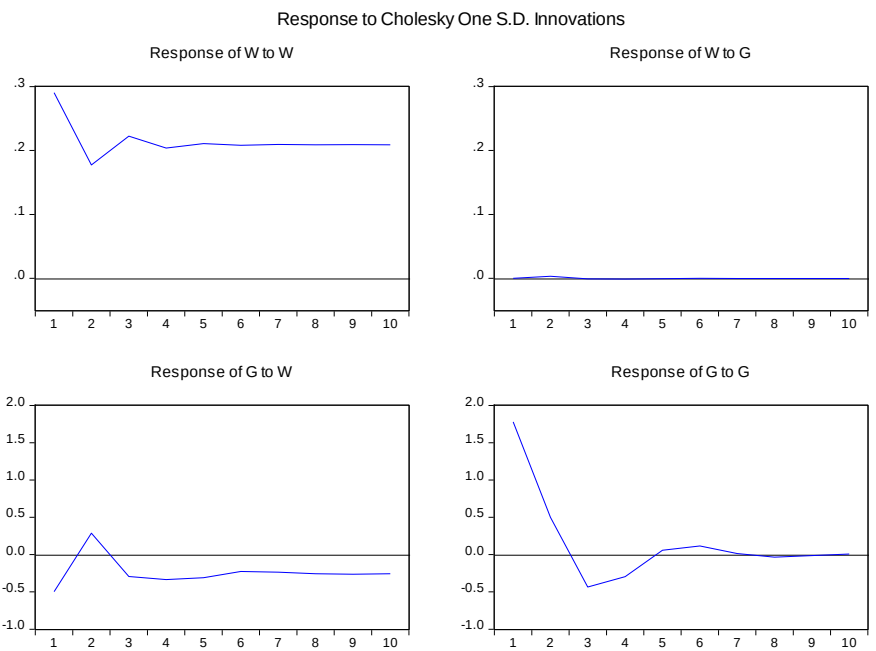

Figure 6: Non-stationary VECM

But the VECM is a stable model because it has one unit root, two imaginary roots and one negative root respectively (1.0, 0.146334 ± 0.557022i, - 0.397379). All roots lie on or inside the unit circle. But the model is nonstationary because its impulse response functions are diverging. In Figure 6, the impulse response functions are plotted clearly.

6. Conclusions

The paper concludes that in India, the relation between growth and unemployment is negative but insignificant at 5% level during 1991-2016. There is no causality between them. They have one significant cointegrating equation at 10% level. Error correction is significant only for growth in VEC model which is stable and non-stationary. On the other hand, in India during 1991-2016, output gap and unemployment rate is negatively related insignificantly. Both the variables are not cointegrated and have no bi-directional causality. The VEC model is stable but non-stationary, non-normal and the error corrections are very slow and insignificant. In India, output gap and unemployment gap is significantly inversely related during 1991-2016 where both have no bi-directional causality and are not cointegrated and that's why VAR model interpreted that both output gap and employment gap are related with their previous period significantly. Moreover, unemployment gap in India is inversely related with growth significantly during 1992-2016 where they are cointegrated and error correction of ΔG_t is significant and fast but error correction of Δw_t is insignificant and very slow. Therefore, jobless growth interpretation is not satisfied in India during 1991-2016 whatever the empirical observations are insignificant or significant.

7. Important Policy Recommendations

- Government of India should target either unemployment rate or growth rate.
- Volatility of growth rate should be checked.
- Government should create sufficient infrastructure for preservation and computation of employment-unemployment data.
- Formulation and realization of successive national and state level employment policies are needed.

- Government of India should maintain inverse unemployment-inflation nexus and fix threshold level of inflation to keep up growth-inflation nexus so that it can achieve a better relation between unemployment and growth.

8. Limitations

The basic limitation is that Indian unemployment rate was considered as percentage of total labour force and how much these are reliable is questionable because there are various types of unemployment in India all of which were not considered in the paper. There may be some critical views regarding computation of output gap and unemployment gap respectively because economists differ on the concepts and axioms on these gaps especially on NAIRU. Lastly, long period study may produce better result.

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