

Structural Break and Trends of Gross Domestic Product in India: An Empirical Analysis

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Abstract: - There has been some discussion about when India's growth began to slow down – did the deceleration occur before or after the onset of the global crisis? In this paper, GDP estimates to a statistical analysis to identify the break point in GDP growth. It also illustrates the possibilities of examining break points in a trend in an interactive manner. This paper usage dummy variable regression model to analyze the trends and structural break in India from 1980- 2010. Results show that the intercepts of GDP are decrease in post reform phase as compression to the pre reform phase and slope coefficients of GDP are increase in post reform phase as compression to the pre reform phase.

Keywords: Gross Domestic Product

Introduction:-

During the last twenty years, issues relating to the growth of Indian economy have been the subject matter of debate and discussion at home as well as abroad. After the process of economic liberalisation was initiated in mid-eighties, there has been a significant acceleration in the growth rate of Indian economy. The long standing barrier of the so called "Hindu Rate of Growth" of around 3.5% has been comprehensively broken and the Indian economy is now cruising along at the rate of around 6% per annum. It would be interesting to examine the trends and pattern of India's growth rate.

In a developing country like India where rapid economic growth has become a national goal, examine the trends of growth assumes special significance not only because it helps to find out what has and what has not been essential in the growth which has already occurred, but also because of the obvious implications it has for the macroeconomic strategy and policies that affect the future growth, its rate as well as pattern. I feel that an analysis of the factors leading to the significant acceleration in the growth of Indian economy witnessed during the last fifteen years would be useful in assessing the possibilities of a further acceleration in India's economic growth over the next decades.

It is not surprising, therefore, to find that Indian economy could not achieve an average growth rate of even 4% nor could the non-agricultural sector achieve an average growth rate of 5% during any of the first three decades of planned economic development after Independence. In fact, the performance of both the agricultural as well as the non-agricultural sectors declined considerably

during the seventies, which turned out to be the worst decade for both sectors. Under these conditions, the growth and efficiency of private non-agricultural sector would be severely constrained and if the public sector could not deliver, the economy would never attain the desired rate of growth. That is precisely what happened. Against the target of 3.5% rate of growth of real per capita income, the actual growth rate during the pre reform period (1950-51 to 1989-90) turned out to be just around 1.5%. While low rates of overall growth of the economy during the pre reform period made it difficult to achieve a significant reduction in the incidence of poverty, the anti-export bias in the country's industrialisation strategy led to a sharp decline in India's share in world exports.

In recent years, the long-term trend growth rate of India's gross domestic product at factor cost in real terms has been a widely debated issue. While the dominant opinion appears to hold the view of a more or less constant growth rate of about 3.5 per cent per annum with considerable yearly fluctuation around the trend, there have been some who seem to perceive an improvement in the growth rate since the middle or the late seventies. It was perhaps Raj (1984), who for the first time clearly stated this proposition. To quote him: "I would venture to place the growth rate now at not less than 4 to 4.25 per cent per annum, certainly much above the so-called 'Hindu' rate of growth" (Raj, 1984 p 1802).

Bradford De Long (2001) brought these obvious statistics out to make the point that the upward break in India's long-term trend growth rate occurred during the so-called "licence raj" while

liberalisation of the economy since 1991-92 did not make a perceptible impact on it. Panagariya (2004) countered De Long's contention by arguing that some liberalisation had actually begun in the early to mid 1980s and that the growth trend of the 1980s would not have been sustainable without the 1990s liberalisation. He points to the large annual fluctuations in growth rates in the 1980s compared to smaller fluctuations in the 1990s, as evidence in support of his unsustainable argument. This, however, is not convincing as India did sustain a 3.5 per cent trend for the period 1950-51 to 1980-81 with much higher fluctuations in annual rates of growth.

These two decades (1980-2000) have been quite special in the course of Indian economic development. The growth rate of GDP that hovered around 3.5 % per annum for 20 years prior to 1980, shot up to about 5% in the eighties (1980 to 1989) and it increased further in the nineties (1990 to 1999) to 6%. Over the last few years, it has reached as high as 9% during the first decade of twenty first century. Moreover, the growth during reform period has also been stable. In the decade of the 1970s, the variance in GDP growth rate was 15.8. It came down to 4.6 in the 1980s (i.e., 1981-82 to 1990-91) and further down to 1.5 in the 1990s (1992- 2002) (Panagariya 2004).

In the light of above discussion and theoretical underpinnings of GDP growth, present study makes an attempt to examine Trends of Gross Domestic Product in India Since 1980.

Literature Review:-

Gross Domestic Product is the major debated issues among the researcher and the academician in the present time. There are a number of studies those draw the attention and develop the idea about the recent work in fields of Indian GDP. There are many empirical literature based on the trends of the Indian GDP. We mainly focused on those studies which support findings of the trends of the Indian GDP such as:

GDP growth series exhibits a structural break at the end of the seventies – beginning of the 1980s can be found in C. Mukharjee (2009), N. Hatekar and A. Dongre (2005), A. Pangariya (2004), A. Sinha and S. Tejani (2004), J. B. Delong (2004), Wallack (2003), M. S. Ahluwalia (2002) and R. Nagaraj (1990) concluded that the magnitudes of inflows have recorded impressive growth, as they are still at a small level compared to the country's potential.

C. Mukherjee (2009) has studied the recent trends in Indian GDP and Its components: An Exploratory Analysis for the period 1996-97:Q1 to 2008-09:Q4. He talks about the two approaches for examine the structural break. One is Chow test those based on the prior assumption and other based on the graph. In the empirical analysis he was developed the Piece-wise linear trend specification with autoregressive components and x-12 Arima to de-

seasonalise the quarterly GDP series. His test result indicates that the deceleration in the Indian GDP growth indeed began before 2007-08. Methodologically, this study is about the possibilities of examining breaks in the trend in an interactive way.

N. Hatekar and A. Dongre (2005) explained on the structural breaks in India's in the 20th century. In his work they mention previous works on the structural break in the Indian economy. They used the dummy variable estimation technique for the structural breaks and Wald test for the joint significance of the model. This paper found the most significant break date in the economy. The result shows that the 1952 is one of the most significant break dates in our economy.

Pangariya (2004) analyzed the growth and reforms during 1980s and 1990s for the Indian economy. In this paper he was also mention Delong (2004) argument that the India's trend breaks in 1980-81 but reform is necessary for sustaining this growth path. This paper come to the some important conclusion that before 1991 was fragile and volatile because growth during 1977-79 was high but it was decline in 1979-80, increase again 1980-82, return to the Hindu rate of growth during the 1982-88 except 1983-84, rise up again in 1988-91 and crisis in 1991-91. In this paper he proceeds with Delong and Rodrik's (2004) view that the 1980s reform played a significant role in spurring growth, and also accepts that the reform of the 1980.

A. Sinha and S. Tejani (2004) examined the trend break in India's growth rate during the period 1951-52 to 2002-03. In this paper they tried to give some supportive argument about the India's trend break around the 1980-81. They countered the Panagariya (2004) for his argument regarding sustainability of the India's trend break on the basic of the decline the variance over a period of time. In this paper they give some relevant argument about the India's growth was accelerated after the 1980-81. They proved his argument on the basis of the labour productivity those increases significantly in 1980-81. The important factor that may led to an increase in labour productivity for the introducing the new machinery in the economy and education was other factor those influence the labour productivity in our economy.

J. B. Delong (2004) had argued his view in his paper India since Independence: An Analytic Growth Narrative. He started his view that the India's growth before 1980s was ordinary and its determinants are also ordinary. His view was supported the India's trend break in the early or mid-1980s but is it not possible to sustain this high growth path without the next reform happen in the 1990s.

M. S. Ahluwalia (2002) analyzed on the economic reforms in India since 1991: has gradualism worked? In his worked also hold the view that the

growth of the 1980 is not explicitly attributable to the policy reforms. Rather, it resulted from the fiscal expansion financed through external and internal borrowings during that period. In the first phase 1980s reforms was not systematic as compared to the second phase 1990s reform because of the open market and the greater role of the private sector.

Wallack (2003) makes an attempt to econometrically determine the dates on which shifts in the growth rate could have taken place. As far as GDP growth is concerned, she finds that 1980 was the most significant date for the break (significant at the 1 per cent level) whereas the break in GNP growth took place in 1987. She finds a significant break in the trade, transports, to rage and communication growth rate in 1992, but fails to find statistically significant break dates for the primary and secondary sectors as well as public administration, defence and other services. Splitting the sample around 1980, she found a break date (significant at the 5 per cent level) in 1974 and a less statistically significant break (10 per cent level) in 1993. Splitting on 1974, she found a significant break date in 1967 and confirmed the 1980 break date and found no break dates after 1993. In her study, she found four potential break dates are then 1967, 1974, 1980, and 1993.

R. Nagaraj (1990) worked on the issue Growth Rate of India's GDP for the period 1950-51 to 1987-88. He was started a debate on the India's long run trend growth and how it was controversial among the researcher. In his paper he formulated the five testable hypotheses. The data was collected from the Central Statistical Organization with 1970-71 as a base year. He focused not only India's growth rate but also its main sector and the subsector also. The test results shows that 1980-81 was significant trend break date, secondary sector leading the other two 1980-81 to 1987-88, 1979-80 was not statistically significant break date, acceleration in GDP was not get significant statistical support and the evidence of last hypothesis was not supported.

From above reviews it is obvious that most of the studies examine about GDP growth and how and when it accelerated or decelerated. Hence, this study is an attempt to fill this gap.

History of Structural Break's in India's GDP:-

The year 1951 was a very significant one in India's economic history because Economic Planning started in the same year. An apparatus, at least ideologically committed to national economic development, was put in place for the first time. A shift in economic policy of this magnitude could surely be expected to increase the growth rate of the economy in the long-term.

The long-term trend growth rate of India's gross domestic product at factor cost in real terms (hereafter imply GDP) has been a widely debated issue in recent years. While the dominant opinion appears to hold the view of a more or less constant growth rate of about 3.5 per cent per annum (Bardhan, 1984) with considerable fluctuation around the trend by yearly, there have been some who seem to perceive an improvement in the growth rate since the middle or the late seventies. It was perhaps who for the first time explicitly stated this proposition.

Indeed, the average growth rate of GDP for 1901-02 to 1946-47 works out to 0.93 per cent per year for undivided India, when GDP is measured in 1948-49 prices. If one ignores the particularly bad year of 1946-47, when growth was -17.2 per cent which was the effect of partition, the average growth rate of undivided India works out to be 1.15 per cent (Sivasubramonian 2000). Per capita GDP was nearly stagnant between 1901 and 1946-47. In 1901, per capita GDP stood at Rs 224 (1948-49 prices) while it was Rs 233 in 1946-47. However, there were phases of growth and decline in this period. During 1901- 1916, per capita GDP grew at a trend rate of growth of 0.9 per cent per annum.

The rate of growth of per capita GDP suddenly dropped by 15 percent in 1918-19, following a massive drought. There was another phase of steady expansion when it increased by 1.1 per cent per annum till 1929-30. After this, growth declined to about 0.5 per cent per annum. Agricultural production remained sluggish and food production actually lagged behind population growth. The average per capita growth rate of agricultural output during 1901-1947 was 0.1 per cent in 1948-49 prices. The progress of the manufacturing sector was somewhat better, even if only because it started from a rather low level. Between 1901 and 1946, manufacturing grew at an average rate of 3.6 per cent in per capita terms. But this growth was on a very small base. The share of manufacturing in the national product saw an increase from an average value of 2.4 per cent (at current prices) in 1901-1910 to an average value of 10.6 per cent in the period 1940-47.

Annual GDP growth averages 3.6 per cent between 1951 and 1980, while per capita GDP growth averages 1.14 per cent for the entire 30-year period. During the 1950s, per capita annual GDP growth averages 1.6 per cent, whereas between 1960 and 1970, it averages 1.7 percent. The average drops slightly in 1970-80 to 1.04 per cent. However, if one ignores the exceptionally bad performance of 1979, the average growth rate is maintained around 1.7 percent. Thus, not only was the rate of growth of per capita GDP during the 1950-1980 period consistently higher than what it was previously, the rate of growth also tended to accelerate, albeit slowly, unlike the 1901-1950 period. Real per capita agricultural output growth was low,

averaging only 0.6 per cent in 1948-49 prices, but this was significantly better than the 0.1 per cent that had been achieved during the previous half century. The share of manufacturing in GDP increased to over 21 percent in current prices. Real manufacturing output per capita continued to increase by 3 per cent (slightly below its rate in the 1901-1947 period), in spite of a much faster population rate of growth, and more importantly, on a much larger base. The average rate of growth of per capita tertiary sector output for the period 1901-1946 works out to be 0.9 per cent. For the 1950-1980 decades, the growth rate works out to be slightly in excess of 2 per cent. It seems fairly clear that the period 1950- 1980 saw a significant improvement in economic performance of pre-independence India and that this performance was driven by the growth in secondary and tertiary sectors.

Chakravarty (1987) suggested that the incremental capital output ratio "appears to have come down somewhat in the course of the last two five-year plans since the annual average rate of growth of GDP has been around 5 per cent over the period 1975-85. Ahluwalia (1988) has argued that "the growth rate over the past ten years or so averages about 4.5 per cent and this is an average over a period in which growth rate was accelerating. The underlying growth rate of the economy in the mid-eighties is nearer 5 per cent per year".

GDP has grown at a distinctly high rate at 4.9 per cent per annum during the eight year period of the eighties compared to the earlier three decades. Moreover, the higher rate of growth has been shared by all the three sectors of the economy. While the growth rate of the primary sector in the eighties is slightly higher than that of the sixties and the seventies, the tertiary sector has witnessed a steady increase in its growth rate over the successive decades.

In the eighties the secondary sector has grown at a faster rate (at 6.9 per cent per annum) than the tertiary sector (at 6.3 per cent). The observed faster growth of the secondary sector in the eighties at 6.9 per cent per annum has not only halted the declining trend of the previous two decades but has also improved over its performance of the fifties at 6 per cent per annum.

To ascertain if the observed trend growth rate of GDP during 1980-81 and 1987-88 at 4.9 per cent per annum is higher than that recorded during the earlier periods of equal length of time, they have computed growth rates for all the successive thirty eight year periods from 1950-51 to 1987-88. It

shows that during the entire period of 38 years growth rate of over 5 per cent per annum was achieved only once between 1979-80 and 1986-87. Further, up to the end of the seventies growth rates were less than 4 per cent per annum in all the periods of 38 year duration except in two cases. On the contrary, growth rates have been over 4 per cent per annum in the recent periods. These results seem to indicate that the relatively better performance record during the eight-year period since the late seventies and the eighties were perhaps not so common in the earlier three decades.

Table 1: Gross Domestic Product and Annual Growth Rates of GDP, 1980-81 to 2009-10 (GDP Measured at 2004-05 prices)

Year	GDP (Rs. in crore)	Growth Rate of GDP in %
1980-81	798506	7.2
1981-82	843426	5.6
1982-83	868091	2.9
1983-84	936269	7.9
1984-85	973357	4.0
1985-86	1013866	4.2
1986-87	1057612	4.3
1987-88	1094992	3.5
1988-89	1206243	10.2
1989-90	1280228	6.1
1990-91	1347889	5.3
1991-92	1367171	1.4
1992-93	1440503	5.4
1993-94	1522343	5.7
1994-95	1619694	6.4
1995-96	1737740	7.3
1996-97	1876319	8.0
1997-98	1957031	4.3
1998-99	2087827	6.7
1999-00	2254942	8.0
2000-01	2348481	4.1
2001-02	2474962	5.4
2002-03	2570935	3.9
2003-04	2775749	8.0
2004-05	2971464	7.1
2005-06	3253073	9.5
2006-07	3564364	9.6
2007-08	3896636	9.3
2008-09	4158676	6.7
2009-10	4516100	8.6

Source: RBI Handbook of Statistics 2012-13, Central Statistics Office (CSO).

Figure 1: Trend of Gross Domestic Product

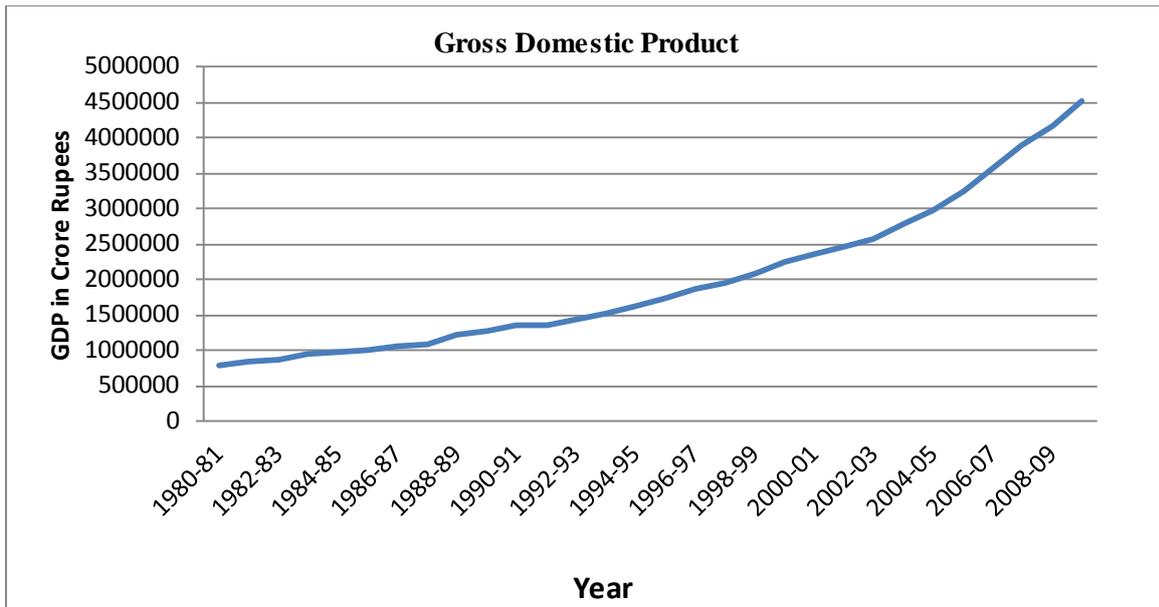
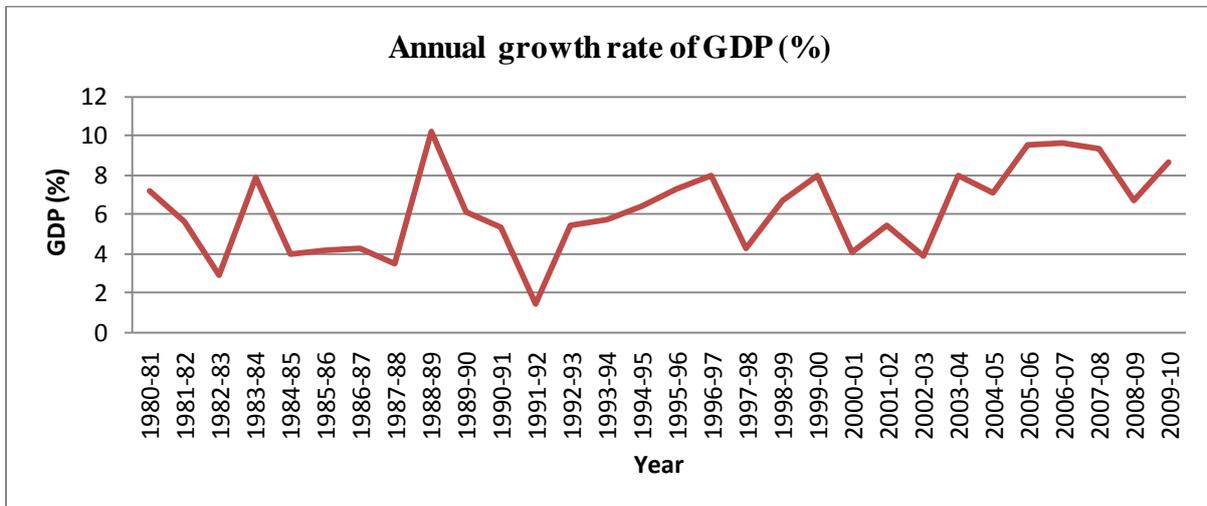


Figure 2: Annual Growth Rate of GDP in %.



In figure (1), it is obvious that the India's GDP increasing since 1980 but with slow pace. In the year 1984-85 the GDP accelerated, whereas, when reform phase started the acceleration was very fast as compare to the previous phase or the pre reform phase. In the fig (2), the annual growth rate of GDP with trend since the 1980-81 to 2009-10 is stated. From trend line, it is clear that the growth performance gained better position during reform period than that of pre reform period.

Modelling and Empirical Results (Methodology Part):-

This chapter deals with the issue of econometrics modelling of the trend/pattern of GDP in India. For this purposes we have used dummy variable regression model, follow:

Dummy Variable Regression Model:-

In the econometrics analysis the dummy variable regression model provides a significant tool for the structural breaks in the two time periods. The dummy variable approach is useful to the difference in terms of the intercepts as well as the slope of the two time period. So the dummy variable regression model is

$$\ln(GDP_t) = \alpha + \beta D_1 + \gamma t + \delta(D_2 t) + u_i \dots \dots \dots (1)$$

Where,
 $\ln(GDP_t)$ = Dependent variable under study in nature log form;
 t = time trend;
 D_1 = first dummy for the period 1980-81 to 1989-90,
 D_2 = second dummy for the period 1990-91 to 2009-10.

tD_2 = an interaction variable to capture the interaction effect of the presence of the attribute in the second period (1991-2010) and the time trend on dependent variable,
 α = intercept in the first period (1980-1990);
 β = differential intercept in the second period (1991-2010);
 γ = regression coefficient of time trend in the first period (1980-1990) which shows the magnitude of rate of response of GDP w.r.t. time;
 δ = differential coefficient of time-trend in the second period (1991-2010) to allow a shift/break/structural change in the magnitude of rate of response of GDP w.r.t. time; and
 u_i = error term.

In the above regression, (1) $(\gamma^* + \delta^*)$, (* shows statistically significant) shows an upward shift in GDP w.r.t. time in the second period (1991-2010); (2) $(\gamma^* - \delta^*)$, show a downward shift in GDP w.r.t. time in the second period (1991-2010); (3) $(\gamma^* \pm \delta^*)$, (where ** shows statistically insignificant) shows no shift/ no structural change in GDP w.r.t. time in the second period (1991-2010).

In the above regression the additive and the multiplicative dummies are used. The coefficient α is the differential intercept and δ is the differential slope coefficient. If the differential intercept coefficient β is statistically insignificant, then we accept the hypothesis that the two regressions have the same intercept. And if the differential slope coefficient δ is statistically insignificant but β is significant, we may not the

reject the hypothesis that the two regressions have same slope that two regression lines are parallel.

If we find out the present and absent of the attributes in the model than the following structure of the model is analyzed. The first is

$$E(GDP_t | D_i = 0) = \alpha + \gamma t \dots\dots\dots (2)$$

In the above equation provide the information about the absent the particular attributes. And the second is

$$E(GDP_t | D_i = 1) = \alpha + \beta + (\gamma + \delta)t \dots\dots\dots (3)$$

Above equations provide the information about the particular attributes.

Data, Variable Selection and Empirical Results:

In this empirical analysis, the yearly Gross Domestic Product data from 1980-81 to 2009-10 have been collected from Hand Book of Statistics on Indian Economy published by the Reserve Bank of India. The study has been shows the trends of GDP, structural breaks in GDP. The test results of GDP have discussed below.

Structural Break in Indian Economy (pre and post reform)

In the literature, it was proved that the difference India's growth performance in the pre reform phase and the post reform phase. In the table (11) shows the empirical results in the GDP in pre reform phase and the post reform phase.

Table-11: Structural Break

$$\ln(y)_t = \alpha + \beta D_i + \gamma t + \delta(D_i t) \dots\dots\dots (1)$$

As per above equation (1), the regression results show as follows:

	Coefficients	Standard Error	t -stat	P-value
Intercept (α)	13.5347102	0.020108487	673.0844477	1.13452E-56
Dummy (D1) β	-0.187806756	0.031547467	-5.953148497	2.77835E-06
Time γ	0.050426767	0.003240776	15.56008943	1.0895E-14
Dummy (D2) δ	0.013503143	0.003435926	3.929986449	0.000561012
R-square	0.9970			

In the above table the regression results shows the t-stat on both the differential intercepts and differential slope coefficients are statistically significant at 1 percent level which reflects the regression or the trend growth in both phases is structurally different. And, the structural break of the GDP in pre and post reform phase is also presented in table (12).

Table-12: GDP (Pre Reform and Post Reform)

GDP	Pre Reform		Post Reform					
	α	γ	α	β	$\alpha+\beta$	γ	δ	$\gamma+\delta$
	13.54	0.050	13.54	-0.19	13.35	0.050	0.014	0.064

In the above table shows the structure of the GDP in pre and the post reform phase. The intercepts of GDP are decrease in post reform phase as compression to the pre reform phase. And slope coefficients of GDP are increase in post reform phase as compression to the pre reform phase.

Table-13: GDP (Difference in terms of intercept)

GDP	Pre Reform	Post Reform	Direction (Upward/Downward)
GDP	13.5347102	13.3469034	Downward

Table-14: GDP (Difference in terms of Slope)

GDP	Pre Reform	Post Reform	Direction (Upward/Downward)
GDP	0.050426767	0.06393	Upward

In the table (13) and (14), the structure of GDP in terms of intercepts and slopes in pre reform and the post reform phase had different. In terms of intercept the test results gave similar conclusion that the downward trend. And in terms of slope the test results shows the upward trend.

Figure -14: Trends of GDP [pre reform period (1981-1990)]

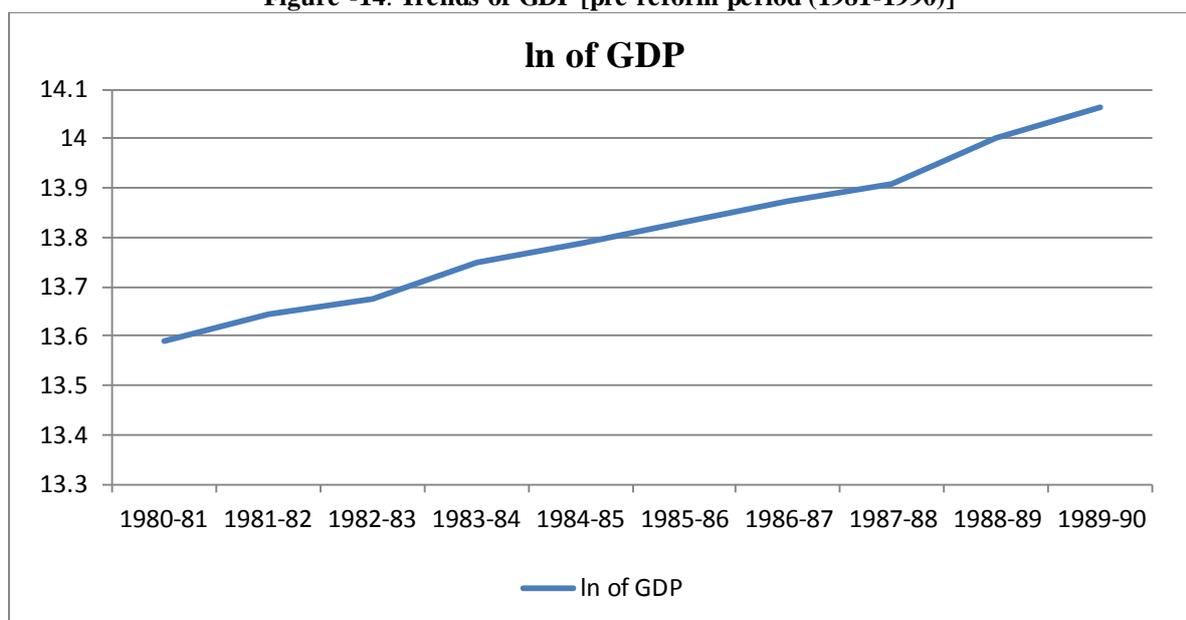


Figure-15: Trends of GDP [post reform period (1991-2010)]

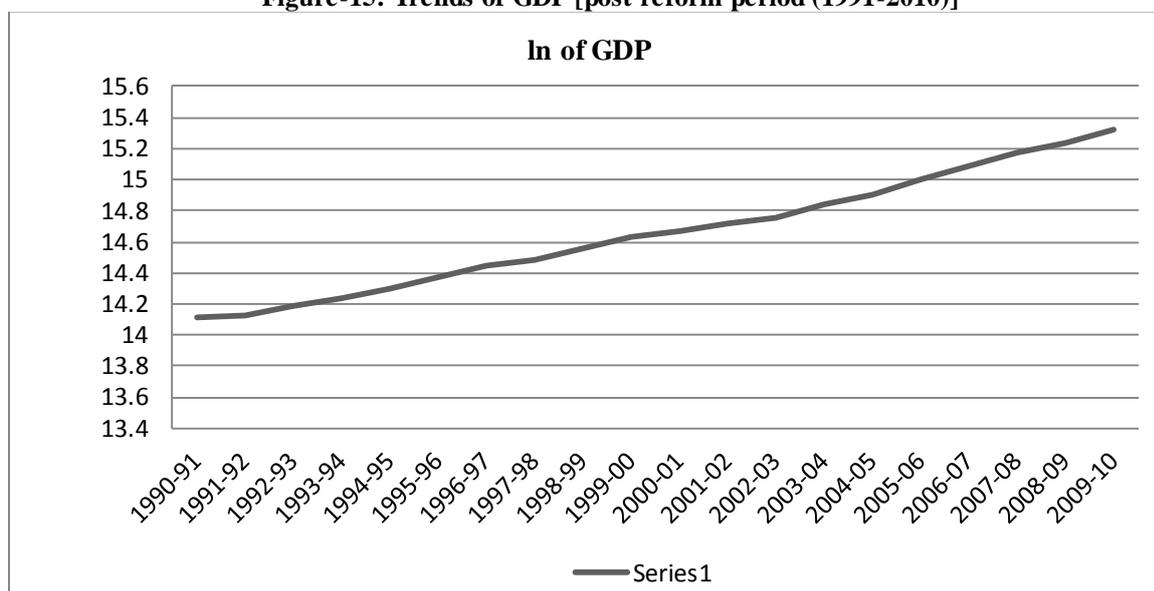
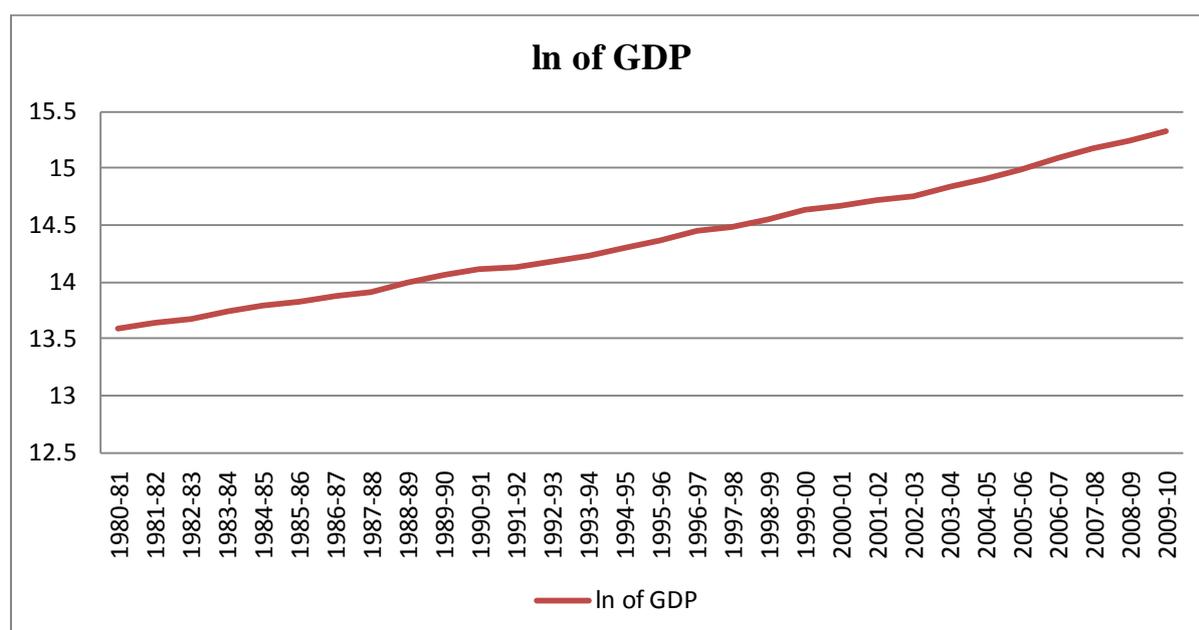


Figure-16: Overall Trends of GDP growth (1981-2010)

In the pre reform period 1981-1990 (figure 14) shows that average annual growth rate had been increased continuously but with slow pace up to 1988. But, during the reform period (figure 15) it is not only entered the high growth age but one of the leading country in the world. Figure 16 shows overall growth rate of GDP, in which growth rate has been increasing continuously.

Conclusion:-

The present study which deals with India's growth performance during pre reform period and during reform period in terms of GDP. The performance of the India's growth has been change time to time due to changes in policies by government and other

factors induced. The objective of this study is to find out trend of GDP in India. In this purpose Dummy Variable Regression Model had been applied.

The result is showing that intercept of post reform period is less than Intercept of pre reform period while Slope of post reform period is greater than Slope of pre reform period. In the analysis of result, average annual growth rate of pre reform period (1981-1990) is 5.04 % while average annual growth rate of post reform period (1991-2010) is 6.40 %. And the statistical test results shows the all the coefficient including the slope dummy and the interaction dummy is statistically significant at 1% level of significant.

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