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A Comparative Study of Indian Economy in Pre and Post Reform period: An Econometric Analysis

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ABSTRACT

This paper intends to compare Indian economy in pre and post reform period. This paper tries to analyze how the economic reforms of 1991 in India have affected the GDP growth rate and how it has impacted the contribution of several economic and non-economic factors towards GDP growth rate determination. To carry out this comparative analysis some economic factors and some non-economic factors are considered and their effect on Gross Domestic Product (GDP) growth rate (at factor cost) is analyzed during the period of 1970-2011. The economic factors considered are capital formation rate, agriculture sector growth rate, export growth rate, import growth rate and non-economic factors are electric power consumption (Kwh per capita), poverty head count ratio at $2 a day (PPP) (% population). This paper uses ordinary least square methodology to compare pre and post reform Indian economy. This paper examines and explains how these different economic and non-economic factors have influenced the GDP growth rate in India since 1970 and thus tries to explain how different economic policies can be channelized to promote economic growth.

KEYWORDS : GDP growth rate, capital formation rate, agriculture sector growth rate, export growth rate, import growth rate, electric power consumption, poverty head count ratio.

1. INTRODUCTION

During 1970 and 2011 India's GDP growth rate averaged at 5.6 percent. From 1996 until 2011, India GDP growth rate averaged 6.6 percent reaching an all-time high of 9.6 percent in 2007-08 and a record low of 3.8 percent in 2003-04. The Gross Domestic Product (GDP) growth rate provides an aggregated measure of changes in value of the goods and services produced by an economy within a year. During the financial year 2013-14, India has witnessed a four year low growth rate of 4.4% and it got pegged below 5%. C Rangarajan stated that higher savings and higher productivity of capital can increase the growth rate to 8.5% for Indian economy. GDP growth rate in India has witnessed several fluctuations since 1970s. GDP growth is an important measure of economic growth for an economy, therefore the higher and sustainable the GDP growth rate, the better is the functioning of all the sectors of economy that is one can infer that there is a reverse causality between growth in different sectors of economy and GDP growth rate.

This paper intends to analyze the impact of different factors in economy on GDP growth rate in pre and post reform India during the period of 1970-2011. Section 4 of this paper discusses the research methodology and the main regression model that is used to compare the pre and post reform Indian economy. Section 5 discusses the major findings of the regression analysis undertaken and also discusses trends in different factors considered for the analysis during 1970-2011. Finally section 6 concludes the paper and suggests measures that can lead to a higher as well as sustainable economic growth for India.

2. RESEARCH OBJECTIVE

The objective of this research is to analyze the impact of economic variables like capital formation rate, agriculture sector growth rate, export growth rate, import growth rate, electric power consumption (kwh per capita), poverty head count ratio at $2 a day (PPP) (% population) on GDP growth rate of India during the period of 1970-2011 and then compares the impact of these variables on GDP growth rate during 1970-1990 (pre-reform period) and 1991-2011 (post-reform period) for Indian economy. This paper, on the basis of empirical findings, suggests possible policy targets and actions for the government so as to achieve higher growth rates in future

3. LITERATURE REVIEW

Indian economy during 1950's and 1980's stagnated at 3.5% growth rate (also known as Hindu Growth Rate). This stagnation has been attributed to various impediments such as lack of reforms in improving agricultural productivity which has been considered as the primary cause for such low growth rates in India. It has been found that despite a significant fall in share of agriculture in GDP from 55.1% in 1950-51 to 17% in 2008-09, the importance of agricultural sector in Indian economy is still very considerable. This is due to the fact that agriculture provides a source of employment to a major proportion of the population in India and till date it is providing occupation to more than 60% of the population and thus acts as an important source of sustenance. Different policy agendas pertaining to improvement in health and nutrition, food security etc., also contribute to continuing importance of agriculture sector in India.

Export and import growth rates also play a key role in determining the growth of an economy, Alok Kumar Pandey, in one of his works, discussed the causal relation between export and economic growth in India using causality and error correction mechanism and found presence of causality between the two. Capital formation is also crucial for economic growth that is higher savings and investments in economy will promote growth in all sectors. S Bisaliah, has emphasized on the role of capital formation in promoting agricultural growth rate and reducing poverty by arguing that with more capital in place, policy objectives of government for reducing poverty and ensuring food security can be met by stimulation public investment in the concerned sectors. This, in turn, would not only help in achieving mentioned policies targets but would also indirectly fuel growth for agricultural sector in the economy.

Hrushikesh Mallick has examined whether energy consumption promotes economic growth or vice versa in context of Indian economy. His study suggests that economic growth generates more demand for both crude oil and electricity consumption and it is the only growth of coal consumption which leads to economic growth. Since in Indian economy the major power generation is done through the use of coal, therefore one can infer that the higher the consumption of electricity the more will be the economic growth.

In a study for developing countries, Augustin Kwasi FOSU has emphasized on the role that economic growth can play in reducing poverty by reducing the income inequalities in the country. On the other hand, higher poverty prevalence reflects lack of people's access to proper nutrition and education this in turn acts as a setback for economic growth especially in developing countries where the most dependable factor of production is the human resource itself.

4. RESEARCH METHODOLOGY

In this econometric analysis, to compare pre and post reform Indian economy a multiple linear regression model is considered and economic and non-economic factors are regressed upon GDP growth rates for India. Capital formation rate, agriculture sector growth rate, export growth rate, import growth rate, electric power consumption, poverty head count ratio are the factors that are regressed upon GDP growth rate. Steps followed in the research process are detailed hereunder:-

(i) Capital formation rate, agriculture sector growth rate, export growth rate, import growth rate, electric power consumption,

poverty head count ratio are regressed upon GDP growth rate separately i.e. the effect of each of these factors on GDP growth rate is studied without controlling for any other factor during the period of 1970-2011.

(ii) Capital formation rate, agriculture sector growth rate, export growth rate, import growth rate, electric power consumption, poverty head count ratio are all regressed upon GDP growth rate and a multiple linear regression is estimated for India during the time period of four decades from 1970-2011. This is the main model that this paper considers for explaining the movement of GDP growth rate in India during the past four decades.

(iii) The model developed to carry out above analysis is estimated separately for pre reform period (1970-1990) and for post reform period (1991-2011). And then chow test is applied to figure out whether there is any significant difference in the model analyzing the path of GDP growth rate for India in pre and post reform period or not.

To test for relationships in step-I, simple linear regressions are considered in which each factor is regressed upon GDP growth rate separately, that is, simple linear regression equations are estimated for each variable separately.

In step-II of this research, a multiple linear regression model is constructed that explains the main determinants of GDP growth rate in India during 1970-2011. Following multiple linear regression model is used to carry out the analysis mentioned in step-II of research methodology:

$$(GDPgr)_t = \beta_0 + \beta_1(Cfrate)_t + \beta_2(Expgrwth)_t + \beta_3(Impgrwth)_t + \beta_4(Agrgrwth)_t + \beta_5(Electrc)_t + \beta_6(Poverty)_t + \varepsilon_t$$

where, t denotes time period, εt is the error term, all βi's for i= 1,2,3,4,5,6 are slope coefficients of respective explanatory variable that measures how explanatory variable affects the dependent variable and β 0 is the intercept coefficient. Here, GDPgr is GDP growth rate (at factor cost), Cfrate is Capital formation rate, Expgrwth is Export growth rate, Impgrwth is Import growth rate, Agrgrwth is Agriculture sector growth rate, Electrc is Electric power consumption (Kwh per capita) and Poverty is Poverty head count ratio at $2 a day (PPP)(%population).

According to economic theories, several factors affect the determination of GDP growth rate for any economy. Some factors contribute towards the improvement in GDP growth rate and some acts as an impediment in its path. So one can infer that some factors affect GDP growth rate positively and some affect it negatively. Since, every economy in the world today targets a higher GDP growth rate, therefore, policy makers in each economy attempts to frame policies that will promote GDP growth rate and thus directly and indirectly promote growth in almost all sectors and spheres of economy. So in order to come up with an effective and applicable policy, decision makers must in first place should have strong empirical background along with theoretical economic models regarding the impact of various economic and non-economic factors on GDP growth rate.

Higher capital formation rate indicates more investment across different sectors of an economy (i.e. infrastructure, services etc.). Therefore, production of tangible or intangible assets picks up the pace and this increase in production activities across different sectors generates income, resultantly increases aggregate output of the economy. This in turn leads to an increase in GDP growth rate.

Export of goods and services generates income for the exporting economy. This income received from abroad can be used to carry out different economic activities domestically. This leads to higher aggregate income and thus higher aggregate output leading to an increase in GDP growth rate. On the other hand, imports requires payment to rest of the world, therefore decreases aggregate demand for domestic production and thus adversely affects GDP growth rate. Three major sectors of any economy are: agricultural sector, industrial sector and service sector. Growth in any of these sectors will automatically translate into growth in GDP for that economy.

Almost all of the production activities or service providing activities (like Banking and Insurance, railways, metro trains, telecommunication, Information Technology & software or internet related activities) need electricity power supply, therefore, a rise in electricity consumption indicates that there is an acceleration in economic activities and consequently contributes to GDP growth rate.

An increase in incidence of poverty translates into a lower standard of living, high illiteracy rates, high undernourishment etc. All these factors deteriorate the quality of human resources for an economy. This may result into poor quality (less or unskilled) of labor supply in each sector and thus reducing the GDP growth rate for that economy.

The relationships between GDP growth rate and economic & non-economic factors, which have been considered in our model, that are discussed above help policy makers to formulate/channelize their strategies in such a manner so that the strategies could lead to increase in GDP growth rate.

In step-III of this research, multiple linear regression model constructed in step-II is estimated separately for pre reform period (1970-1990) and for post reform period (1991-2011). Finally, chow test is applied to figure out whether there is any significant difference in this regression model in the context of India during pre and post reform period.

5. DATA TRENDS AND RESULTS

This section discusses all the estimated results and trends in economic and non-economic factors considered during 1970-2011. Section 5.1 discusses trends in all the economic and non-economic factors that are considered for this analysis. Section 5.2 shows the result of estimation for step-I of research in which all factors are regressed upon GDP growth rate separately. Section 5.3 shows the result of estimation for step-II of research in which all the factors are regressed upon GDP growth rate simultaneously i.e. we analyze the effect of each factor on GDP growth after controlling for all other factors. Section 5.4 compares pre and post reform Indian economy by applying chow test to the regression model that we have built in step-II of our research for the period during 1970-1990 and during 1991-2011 for Indian economy.

5.1 DATA TRENDS

Figure 1 shows the trends in GDP growth rate of India during 1970-2011. It can be seen clearly that GDP growth rate in Indian economy has witnessed several troughs and peaks. Before 1990, fluctuations experienced were relatively higher than those experienced after 1990. In early 1990s growth picked up a pace but towards the end of the decade it not only stagnated but also decreased. The increase in growth witnessed till 2008 got reversed due to Global Financial Crisis of 2008.

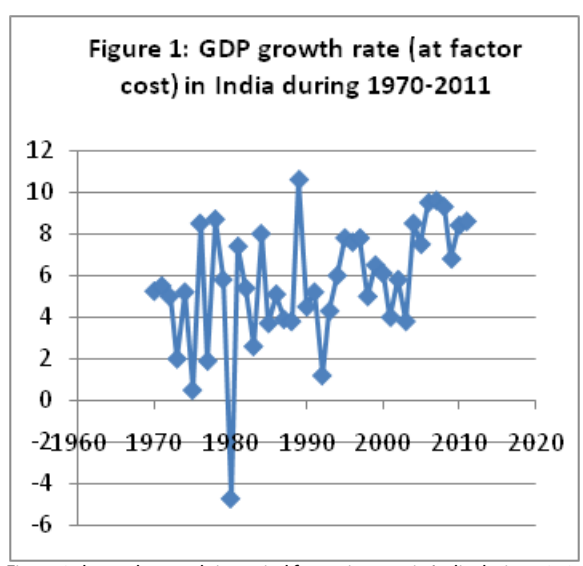


Figure 2 shows the trends in capital formation rate in India during 1970-2011. It, almost during the entire period, showed an upward trend though with some fluctuations. The quantum jump in capital formation rate was witnessed during 2000-2011. This can be attributed to the fact that radical reforms of 1991 that promoted liberalization, privatization, deregulation and globalization had actually started to influence Indian economy by increased investment not only by domestic investors and

entrepreneurs but also by foreign investors/enterprises.

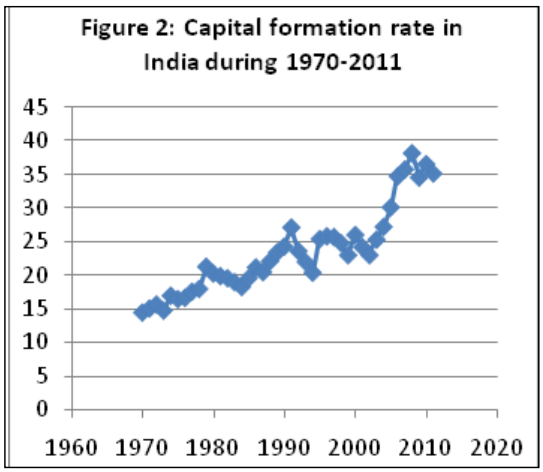


Figure 3 shows trends in export growth rate in India during 1970-2011. The trend shows extreme fluctuations in the export rates and negative rates were also witnessed for the economy. The sharpest decline was experienced in 1990-91 and highest growth was experienced in 2010-11.

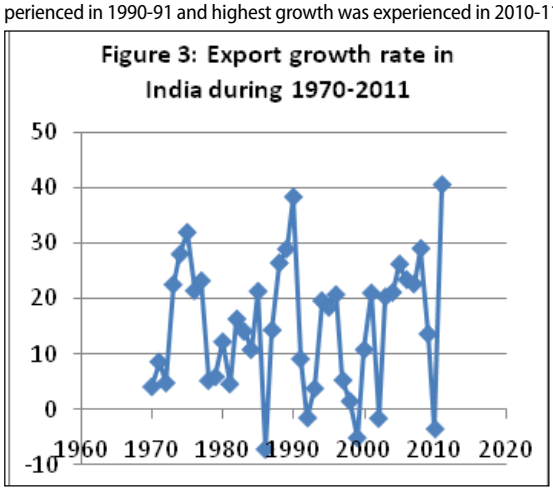


Figure 4 shows trends in import growth rate in India during 1970-2011. The trend exhibits fluctuations in the rates for the entire period of 1970-2011. The import rates were quite low around 2000 but increased in early 2000s and fell steeply during 2008-10 and this fall is attributed to the recessionary phase that Indian economy witnessed due to outbreak of Global Financial Crisis in 2008.

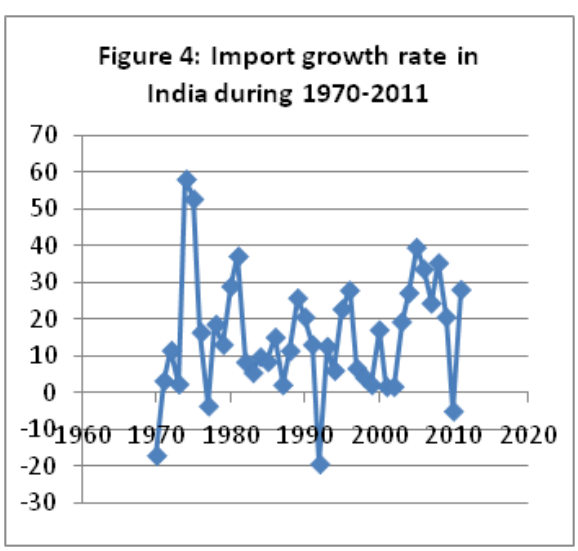


Figure 5 shows trends in agricultural sector growth rate in India during 1970-2011. The trends show that the average rates during pre-reform period were higher than the average for post-reform period in India. This draws our attention towards lack of consideration that reforms of 1991 showed towards the agricultural sector because of which agricultural sector suffered and its share as a proportion in GDP of India declined significantly in post-reform period. Despite the measures taken in 2000 to revive agricultural sector through National Agricultural Policy could not really improve upon the condition of agricultural sector in India.

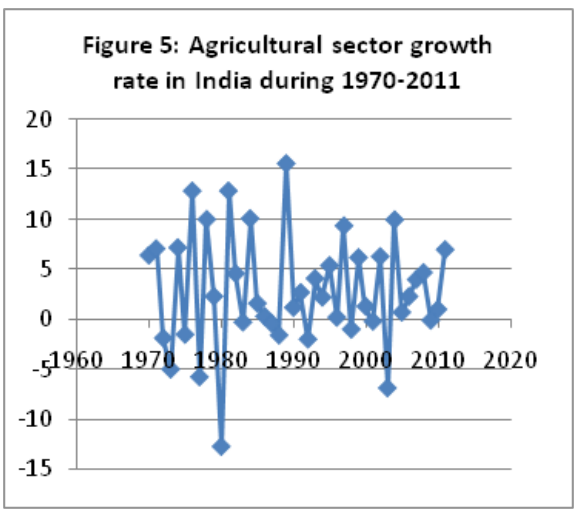


Figure 6 shows trends in electric power consumption in per capita terms in India during 1970-2011. The trends show a clear rise in per capita electric consumption India during the entire period of 1970-2011.

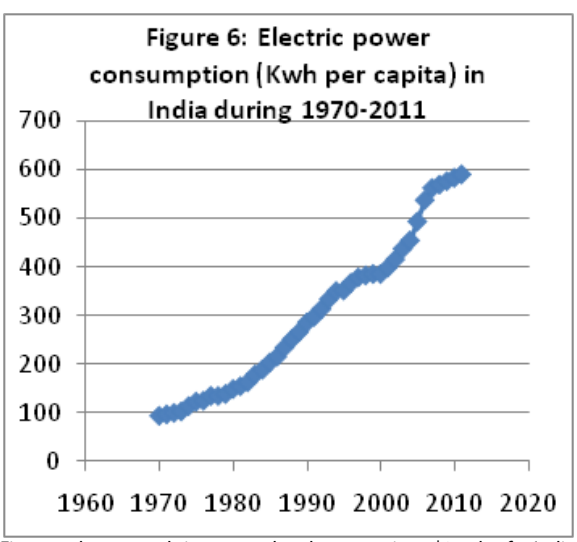
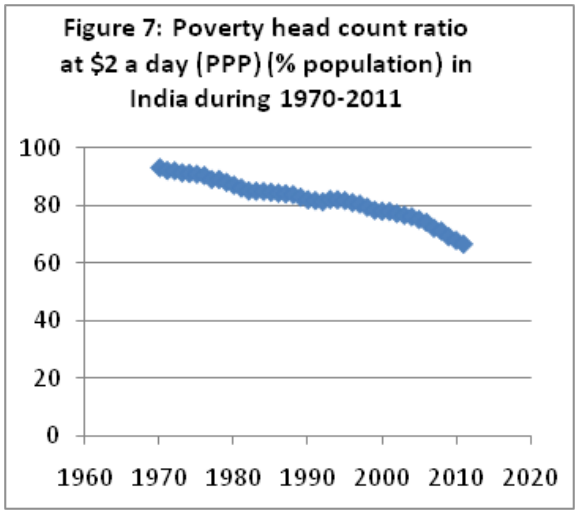


Figure 7 shows trends in poverty head count ratio at $2 a day for India during 1970-2011. The trends suggest a continuous decline in poverty head count ratio in India but important aspect to note is that it is still well above 60% of the population. This shows that incidence of poverty is extremely high in India and the rate of decline in the trend experienced is very slow, therefore some really effective and rapid measures needs to be taken so as to witness a significant decline in incidence of poverty in the future trends.



5.2 INDIVIDUAL EFFECT OF ECONOMIC AND NON-ECONOMIC FACTORS ON GDP GROWTH RATE

This subsection discusses the results of simple linear regression analysis in which each of economic and non-economic factors was regressed upon GDP growth rate individually during the period of 1970-2011. Table 1 shows estimates for coefficients of each factor considered for the analysis when a simple linear regression was estimated using ordinary least square method.

TABLE 1

VARIABLE	Coefficient	Standard error	t-value	R-square
Cfrate	0.2255919	0.0638053	3.54*	0.2381
Expgrwth	0.0188135	0.0393195	0.48	0.0057
Impgrwth	0.0352123	0.0280204	1.26	0.038
Agrgrwth	0.3910551	0.0531557	7.36*	0.575
Electrc	0.0086506	0.0025582	3.38*	0.2223
Poverty	-0.184782	0.0599258	-3.08*	0.1921

(*significant at 5% level of significance)

When each variable was individually regressed on GDP growth rate results obtained show that each of the economic and non-economic factor satisfies economic theory as discussed in section 4 except for import growth rate but the extent of their impact on GDP growth rate vary. The positive relation between GDP growth rate and import growth rate can be attributed to the fact that India has mainly imported raw materials or semi-finished goods that were an input into production process. Along with the import of goods India has been importing technology as well from rest of the world. Thus, imports were leading to an increase in aggregate output due to better technology used in production processes. Therefore, import growth rate affected GDP growth rate positively.

R-square i.e. coefficient of determination is not high for any of the factors but for agriculture sector growth rate R-square is 0.575 which is quite reasonable. For export growth rate it is 0.57% i.e. almost negligible

Effect of capital formation rate, agriculture sector growth rate, electric power consumption and poverty head count ratio on GDP growth rate is significant since $|t| > 2$ at 5% level of significance. On the other hand, the effect of export growth rate and import growth rate on GDP growth rate is insignificant. It shows that on individual basis import growth rate and export growth rate did not contribute in determination of GDP growth rate during the period of 1970-2011.

5.3 JOINT IMPACT OF ECONOMIC AND NON ECONOMIC FACTORS ON GDP GROWTH RATE

This subsection discusses the results of multiple linear regression analysis in which all the economic and non-economic factors were regressed upon GDP growth rate of India during the period of 1970-2011. Table 2 shows estimates for coefficients of each factor considered for the analysis when a multiple linear regression was estimated using ordinary least square method for Indian economy. This subsection pertains to the estimation of the multiple linear regression model constructed in section 4.

TABLE 2

VARIABLE	Coefficient	Standard error	t-value
Constant (β0)	-32.80643	14.69309	-2.23*
Cfrate (β1)	0.2738925	0.1080141	2.54*
Expgrwth (β2)	0.0059858	0.0207765	0.29
Impgrwth (β3)	-0.0123326	0.0161347	-0.76
Agrgrwth (β4)	0.3933647	0.036317	10.83*
Electrc (β5)	0.0125553	0.0062674	2.00*
Poverty (β6)	0.3323077	0.1496059	2.22*

(*significant at 5% level of significance)

Estimated results show that capital formation rate, agriculture growth rate, electricity consumption per capita and poverty head count ratio have significantly affected GDP growth rate of India for period 1970-2011. But the effect of export growth and import growth is insignificant. R-square for this model is 0.8333 which is considerably high indicating that approximately 83% of the variations in GDP growth rate are being explained by the economic variables considered in the model. Also, adjusted R-square is 0.8047 for this model for Indian economy during the period of 1970-2011.

INTERPRETATION OF RESULTS OF REGRESSION ANALYSIS:

Capital formation rate affects GDP growth rate positively that too significantly i.e. 1% point increase in it increased GDP growth rate by 0.27% points.

Export growth rate affects GDP growth rate positively but extent of its effect is too low as well as insignificant i.e. for Indian economy export growth has not contributed much to GDP growth for period 1970-2011 i.e. 1% point increase in it increased GDP growth rate by 0.0059% points.

Import growth rate affects GDP growth rate inversely but extent of its effect is too low as well as insignificant i.e. 1% point increase in import growth rate decreased GDP growth rate by 0.012% points, so for Indian economy import growth has not impacted GDP growth as such for period 1970-2011. But it must be noted that coefficient estimate of import growth is greater than export growth (in absolute terms) i.e. for Indian economy imports had more value than exports for period 1970-2011. This can be attributed to the fact that India is a developing economy and it exports mainly primary products having lower value relative to its imports.

Agriculture growth rate has contributed highly significantly to GDP growth rate, i.e. 1% point increase in agriculture growth rate increased GDP growth rate by 0.39% points. This can be justified by the fact that Indian economy was agrarian for most of the period and there was shift in occupational structure only after 1991 economic reforms.

Electricity consumption has positively affected GDP growth rate i.e. 1% point increase in electricity consumption per capita(kwh) increased GDP growth rate by 0.012% points. An increase in electricity consumption is associated with an increase in economic activities that are using power e.g. industrial production, IT services (information technology), in agricultural fields etc. Thus associated with an increase in aggregate output of economy, thereby, increases GDP growth rate.

Poverty head count ratio at $2 a day according to economic theory should have a negative relation with GDP growth rate but for period 1970-2011 it is positively related for Indian economy. The negative rela-

tion can be interpreted with the help of following arguments:

- For reducing poverty government needs to allocate more of its funds (or resources) in social sector, this means diverting funds away from other sectors like infrastructure sector, industrial sector, agriculture etc., point to note is that the GDP growth rate is primarily determined by infrastructure sector, industrial sector, agriculture etc. Thus GDP growth rate suffers due to poverty.
- The positive relation observed for India can be interpreted as following:
- Whenever growth takes place, its effects are initially realized by a smaller and upper section of society and there is a time lag between growth and its effect to trickle down to poor section of society. Thus, inequality in society increases resulting in higher poverty (in relative sense).
- Durbin Watson statistics test for this regression model is 1.835818 indicating that there is no auto-correlation problem in this data for Indian economy for period of 1970-2011. Also, F value is 29.16, which is quite high. Therefore, this analysis concludes that all the considered economic and non-economic factors jointly have significantly impacted on GDP growth rate for Indian economy during the period of 1970-2011.

5.4 COMPARING PRE AND POST REFORM INDIAN ECONOMY

In this subsection, the effect of economic and non-economic factors on GDP growth rate is analyzed and discussed whether their effect on GDP growth rate in pre reform period (1970-1990) and post reform period (1991-2011) varies or not. Table 3 shows the estimation of our regression model for Indian economy during 1970-1990.

TABLE 3

VARIABLE	Coefficient	Standard error	t-value
Constant (β_0)	-33.11207	26.94749	-1.23
Cfrate (β_1)	0.2064061	0.2721713	0.76
Expgrwth (β_2)	-0.0279154	0.031426	-0.89
Impgrwth (β_3)	-0.0322096	0.0192683	-1.67
Agrgrwth (β_4)	0.4309219	0.0407187	10.58*
Electrc (β_5)	0.0184362	0.017156	1.07
Poverty (β_6)	0.3492369	0.2660658	1.31

(*significant at 5% level of significance)

The analysis shows that during pre-reform period the agricultural growth rate is the only significant variable and 1% point increase in agricultural growth rate increases the GDP growth rate by 0.43% points. Export growth rate has a negative coefficient. This could be because India was exporting goods that could have been used domestically to raise aggregate output of economy. Thus output of economy suffered leading to a decline in GDP growth rate. Poverty affected GDP growth rate positively and we have already discussed the possible reason for this relation. All other variables satisfy economic theory (in terms of their sign). R-square is too high here, i.e. 90% of the variations in GDP growth rate are explained by these economic variables. Durbin Watson statistic is 1.554222 for this model and it shows that there is no auto-correlation problem in data for year 1970-1990.

Table 4 shows the estimation of our regression model for Indian economy during 1991-2011.

TABLE 4

VARIABLE	Coefficient	Standard error	t-value
Constant (β_0)	-38.18272	19.74987	-1.93
Cfrate (β_1)	0.1474711	0.0936111	1.58
Expgrwth (β_2)	-0.0171651	0.0293313	-0.59
Impgrwth (β_3)	0.0416815	0.0280567	1.49
Agrgrwth (β_4)	0.2419183	0.0546163	4.43*
Electrc (β_5)	0.0234179	0.0107917	2.17*
Poverty (β_6)	0.3837222	0.199055	1.93

(*significant at 5% level of significance)

The analysis shows that during post-reform period agricultural growth rate and electric power consumption per capita (Kwh) are significant factors i.e. 1% point increase in agricultural growth rate increases the GDP growth rate by 0.24% points and 1% point increase in electricity consumption increases the GDP growth rate by 0.023% points. Export growth rate has a negative coefficient. This could be because India was exporting goods that could have been used domestically to raise aggregate output instead of exporting them. Thus output of economy suffered leading to a decline in GDP growth rate. Import growth rate positively affected GDP growth rate i.e. a 1% point increase in import growth rate increased GDP growth rate by 0.041% points. This can be attributed to the fact India's imports led to an increase in aggregate output i.e. through import of goods India imported the technology that increased the efficiency of India's production process. Poverty affects it positively and the possible reasons for this are discussed earlier in this paper. R-square is considerably high for this analysis i.e. 86% of the variations in GDP growth rate are explained by these economic variables. Durbin Watson statistic is 1.595261 and it shows that there is no auto-correlation problem in data for Indian economy during the period of 1991-2011.

COMPARING PRE AND POST REFORM INDIAN ECONOMY BY APPLYING CHOW TEST

Chow test is carried out for regression models for year 1970-90 and 1991-2011. Table 5 shows the result of chow test.

TABLE 5

Results of Chow test: Calculated value = 2.95058308602
Critical value = 2.36 = F7, 28 (0.05)

Chow test concludes that there is a significant difference between the two models for Indian economy during the period of 1970-1990 and 1991-2011 at 5% level of significance. This shows that the determination of GDP growth rate in pre and post reform period by different economic and non-economic factors varies in the sense that factors considered in our analysis contribute differently towards economic growth of India and their contribution differs in terms of their extent and significance.

6.CONCLUSION

The major results of this paper shows that GDP growth rate of India has been significantly affected by capital formation rate, agriculture growth rate, electricity consumption per capita (Kwh) and poverty head count ratio (at $2 per day) during the period of 1970-2011 but export growth rate and import growth rate could not contribute towards GDP growth rate as their effect on GDP growth rate is found to be insignificant in our analysis given in section 5.3.

The analysis in this paper shows that, during past four decades, the contribution of agricultural sector towards GDP growth rate has been quite significant. Therefore, this paper concludes that agriculture growth rate has been an important contributor and determinant of GDP growth rate for period 1970-2011. Also agricultural sector being the most important source of occupation in India if coupled with effective policies then it can stimulate the growth of Indian economy and also help government to deal with issues like poverty and health status by making more than half of the population of India, dependent on agriculture for their livelihood, better off.

Capital formation rate throughout the period of 1970-2011 has significantly contributed towards GDP growth rate and has been a key determinant of GDP growth rate. Export growth rate had almost negligible

effect on GDP growth rate for period 1970-2011 i.e. 1% point increase in it increased GDP growth rate on an average only by 0.0059858% points as analyzed in section 5.3.

Poverty (head count ratio) has been significantly affecting GDP growth rate for period 1970-2011 though its effect was positive. Electricity consumption has significantly positively significantly affected GDP growth rate for period 1970-2011.

Chow test showed that there is a significant difference in the regression models for Indian economy during the period 1970-90 and 1991-2011. This shows that pre-reform and post-reform regression models are significantly different and pre and post reform India economy is different in the sense that determination of GDP growth rate by several economic and non-economic factors varied in terms of the extent of their impact on GDP growth rate.

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