

GROSS FIXED CAPITAL FORMATION SUFFICES AS A DETERMINANT FOR GROSS DOMESTIC PRODUCT IN INDIA

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Abstract - Growth has been the most important determinant of a countries progress and can be identified as an indicator of Progress. India in the near past has been able to break free from her traditional Hindu Growth rate and progressing in acceleration. This paper aims to determine Gross Fixed Capital Formation (GFCF) as an important determinant of economic growth, which is represented by the Gross Domestic Product (GDP) in this paper. There is a further association and a perfect positive correlation between GFCF and GDP, which is in turn proved with the help of calculating the correlation coefficient. However the primary aim of the paper is to determine the impact of GFCF on GDP over the time period 1970 to 2014 for which regression analysis is used respectively and a strong impact has been estimated. Nevertheless it is checked and established that GFCF and GDP are autoregressive with the help of a three year lagged model.

Introduction:

The GFCF is a macroeconomic fundamental, which determines the invested part of the value added in comparison to the consumed. It was used in the past in Simon Kuznets capital formation study and adopted as a standard in 1950's. It very well represents land improvements, all sorts of constructions, machinery, plants, equipment's and many more which are extremely crucial to determine

economic growth. GFCF and GDP are perfectly positively correlated with a coefficient value of .99 which determines their strong association. Data has been collected and compiled from 1970 to 2014 from the United Nations Conference for Trade and Development.

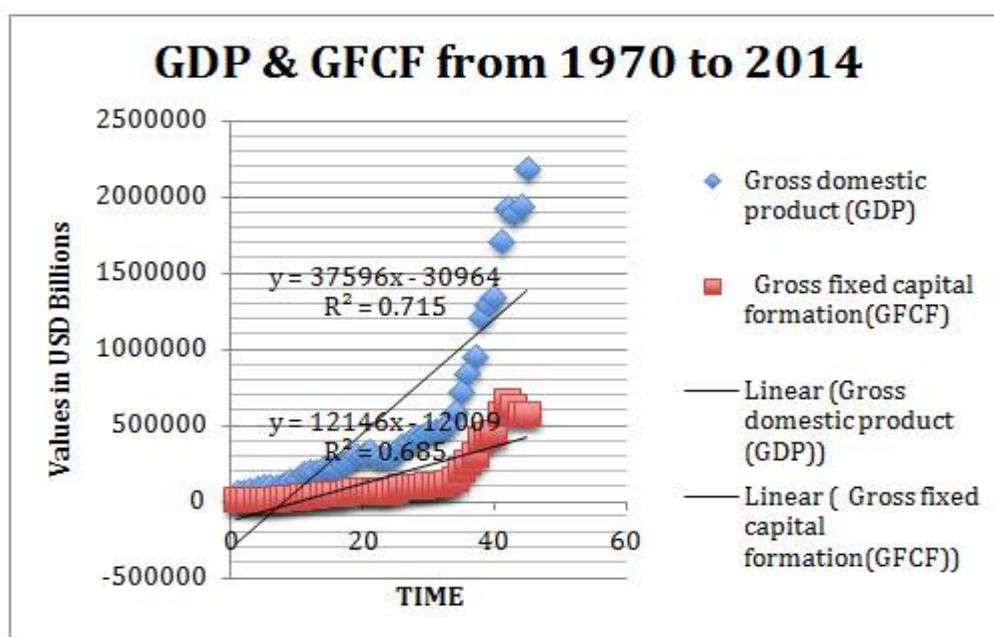
The primary objective of the paper is to analyze the impact of GFCF on GDP from 1970 to 2014 and the secondary objective of the paper to check whether GFCF and GDP is autoregressive.

Gross domestic product: GDP by type of expenditure, VA by kind of economic activity, total and shares, annual, 1970-2013		
US Dollars at current prices and current exchange rates in millions		
Time	Gross domestic product (GDP)	Gross fixed capital formation(GFCF)
1970	61470.15546	9593.631594
1971	65947.35809	10790.55414
1972	71734.70671	12216.65692
1973	85545.92818	13367.90288
1974	96552.08773	15498.84564
1975	100437.0871	18161.77509
1976	101195.9043	19489.81756
1977	117421.468	22486.738
1978	135833.0646	26292.66976
1979	150316.7108	29923.73988
1980	184760.5096	38135.83341
1981	197078.024	41457.68942
1982	201227.9504	43171.62692
1983	219555.4861	45190.53446
1984	217466.9356	45765.90937
1985	226460.2831	50057.96222
1986	248120.2367	56152.77297
1987	274577.5243	63563.09723
1988	303753.831	70248.11574

1989	300719.7311	72285.07011
1990	326795.5263	80848.13488
1991	289681.4486	68495.88413
1992	290914.4724	69945.96797
1993	283985.4352	65381.18369
1994	325342.2739	76629.21502
1995	369240.2414	96550.04517
1996	389168.8525	95210.60818
1997	422572.4281	98434.58426
1998	425273.6619	98149.05952
1999	453377.3405	109611.0336
2000	467787.9305	109595.9968
2001	482967.8985	117060.6823
2002	504946.4136	123218.1019
2003	591332.3521	152943.6271
2004	715459.3547	214509.5521
2005	837499.0671	263420.6379
2006	947912.0526	307564.4449
2007	1206110.39	409993.9628
2008	1294113.176	435192.2044
2009	1338248.386	448728.7905
2010	1704794.872	576763.9781
2011	1930497.517	665888.9919
2012	1892553.257	624662.7663
2013	1937797.016	577096.6451
2014	2189710.631	577090.5733

Source: Compiled from UNCTAD, Data center, Country profile

Table 1: GDP & GFCF



Source: Compiled from Table 1

Figure 1: GDP & GFCF

Noticeable are the movements of GDP and the GFCF which have moreover the same slope that signifies their movement, correlation and strong association. Both growth and investment have shown remarkable improvements after the economic reforms. The R square values of both GDP and GFCF are 0.71 and 0.68 and the deviations of the actual values from the expected are not very significant. Further to estimate the impact of GFCF on GDP, GDP is considered as an dependent variable and GFCF is

the independent variable influencing the GDP. Simple regression is used to analyze the same. The Null Hypothesis is put to test.

Null Hypothesis 1:

H₀₁: There is no significant positive impact of GFCF on GDP

Model 1:

$$GDP_{t=1970-2014} = \alpha + \beta_0 GFCF_{t=1970-2014} + \mu$$

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.99130783					
R Square	0.98269122					
Adjusted R Square	0.98228869					
Standard Error	77674.4966					
Observations	45					
Components	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	76713.0248	15093.2517	5.08260420	7.71982E-06	46274.58	107151.4
Gross fixed capital formation	3.00358010	0.06078964	49.4094044	1.61818E-39	2.880986	3.126174

Source: Calculated from Table 1
Table 2: Regression Output

R square value is 0.98 which thus depicts a strong impact of GFCF on GDP and 98% bearing. Further the value of the coefficient is 3 which signifies that a beta value greater than one demonstrates stronger impact of the independent variable on the dependent. A three fold impact clearly states if GFCF changes by one unit, the GDP will change by 3 units. That is definitely a multiplier effect. The hypothesized critical t value is lesser than the calculated value which compels us to reject the null hypothesis that there is no significant positive impact of GFCF on GDP and accept the alternative hypothesis that there is a significant positive impact of GFCF on GDP respectively.

Substituting values of Table 2 in Model 1:

$$GDP_{t=1970-2014} = 76713.024 + 3 GFCF_{t=1970-2014} + .061$$

Where $\alpha = 76713.024$
 $\beta_0 = 3$ & $\mu = .061$

Further in the paper we have put the GFCF into test to prove whether it is autoregressive and found the past bearing of the GFCF on the present GFCF. We have used the three year autoregressive model in order to test the lagged impact of GFCF on the present investments in the nation. To put our general assumption to test we thus formulate our assumption/hypothesis for the same.

Null Hypothesis 2:

H₀₂: The GFCF is not autoregressive.

Model 2:

$$GFCF_t = \lambda + \theta_1 GFCF_{t-1} + \theta_2 GFCF_{t-2} + \theta_3 GFCF_{t-3} + \mu$$

Where $\mu = \mu_1 + \mu_2 + \mu_3$

GFCF is autoregressive and quite possibly depends on the past three two and recent past years GFCF as well. Distributed lag nature of the GFCF has been shown here. The results are as follows.

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.990246386

R Square	0.980587906					
Adjusted R Square	0.979013952					
Standard Error	28395.07306					
Observations	41					
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	5890.689564	5899.285746	0.998542844	0.3245021	-6062.398752	17843.77
GFCF_{t-1}	1.56378577	0.154446413	10.12510257	3.26569	1.250847612	1.876723
GFCF_{t-2}	0.955301751	0.279388333	-3.419261425	0.0015431	-1.521396286	-0.389207
GFCF_{t-3}	0.43689642	0.193958489	2.252525379	0.030308	0.043899191	0.829893

Source: Calculated from Table 1
Table 3: Auto Regression Output

We have taken a three year lagged model to prove whether the GFCF is autoregressive. The p value 0.03 is less than the alpha value .05 which compels us to reject the null hypothesis H_0 that GFCF is not autoregressive and accepts the alternative hypothesis that GFCF is autoregressive. Hence it demonstrates distributed lag phenomena where the present value usually depends on the past value and in our analysis three year old past values too.

Moreover the past years(t-1) value has more impact than the past two years (t-2) value which has more impact than the past three years (t-3) value of coefficient.

Substituting values of Table 3 in Model 2:

$$\text{GFCF}_t = 5890.68 + 1.56 \text{GFCF}_{t-1} + 0.95 \text{GFCF}_{t-2} + 0.44 \text{GFCF}_{t-3} + 0.15 + 0.27 + 0.19$$

Where $\lambda = 5890.68$

$$\theta_1 = 1.56, \theta_2 = 0.95, \theta_3 = 0.43$$

$$\mu_1 = 0.15, \mu_2 = 0.27, \mu_3 = 0.19$$

Again we have put the GDP into test to prove whether it is autoregressive and found the past bearing of the GDP on the present GDP. We have used the three year autoregressive model in order to test the lagged impact of GDP on the present growth in the nation. To put our general assumption to test we thus formulate our assumption/hypothesis for the same.

Null Hypothesis 3:

H_{03} : The GDP is not autoregressive.

Model 3:

$$\text{GDP}_t = \sigma + \rho_1 \text{GDP}_{t-1} + \rho_2 \text{GDP}_{t-2} + \rho_3 \text{GDP}_{t-3} + \mu$$

Where $\mu = \mu_1 + \mu_2 + \mu_3$

GDP is autoregressive and quite possibly depends on the past three two and recent past years GDP as well. Distributed lag nature of the GDP has been shown here. The results are as follows:

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.994873325					
R Square	0.989772932					
Adjusted R Square	0.98894371					
Standard Error	62118.42753					
Observations	41					
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%

Intercept	3250.497187	14062.837	-0.23114092	0.8184787	-31744.51	25243.51
71734.70671	1.275106459	0.1470216	8.67291536	1.91391E-	0.977212	1.573000
65947.35809	0.731948246	0.2389490	3.06319848	0.0040693	-1.2161049	-0.247791
61470.15546	0.592237686	0.1699439	3.48490058	0.0012844	0.2478985	0.936576

Source: Calculated from Table 1
Table 4: Auto Regression Output

We have taken a three year lagged model to prove whether the GDP is autoregressive. The p value 0.001 is less than the alpha value .05 which compels us to reject the null hypothesis H_0 that GDP is not autoregressive and accepts the alternative hypothesis that GDP is autoregressive. Hence it demonstrates distributed lag phenomena where the present value usually depends on the past value and in our analysis three year old past values too. Moreover the past years (t-1) value has more impact than the past two years (t-2) value which has more impact than the past three years (t-3) value of coefficient.

Substituting values of Table 4 in Model 3:

$$GDP_t = 3250.49 + 1.27 GDP_{t-1} + 0.73 GDP_{t-2} + 0.59 GDP_{t-3} + 0.15 + 0.24 + 0.17$$

Where $\sigma = 3250.49$

$\rho_1 = 1.27, \rho_2 = 0.73, \rho_3 = 0.59$

$\mu_1 = 0.15, \mu_2 = 0.24, \mu_3 = 0.17$

DISCUSSION AND CONCLUSION

GFCF is a necessary but not a sufficient determinant for the economic growth of a nation to escalate. The establishment of econometrics (combination of economics and statistics) in 1950 had opened a large window for social scientists to put their assumptions and pre conceived data into test and further mathematically and statistically prove their existence. It is equally important for us to assert that investment is a mammoth factor for economic growth but there are other factors to boost it too. GDP at market price consists of consumption, investment, government expenditure and net exports hence the major limitation of our study is the concept of ceteris paribus where we have kept all the other variables constant. Apart from that our study focuses on the impact of GFCF on GDP and prove a strong correlation and impact of GFCF. The R square value in our regression table is very high and a three fold impact has been detected from the data taken from

1970 to 2014. Selecting a long term data is a choice, as in this case we could very little but identify the change in movement of both GFCF and GDP after the 1991 reforms. However testing the two variables for auto regression is a factual estimation of the data in order to understand and prove that both the macroeconomic fundamentals have a lagged property and the present value does depend on the past. So new investments are influenced by old investments and new growth is influenced by old growth as well. Nevertheless the values proved both GFCF and GDP to be three year autoregressive fundamentals. Another limitation of the test we feel is the choice of three years. The impact of the immediate past year is more than the lesser immediate years. To boost growth India should focus on more investments and create more values.

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