



Relation between GDP and FCE of India

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ABSTRACT

The results regarding evolution of *Gross Domestic Product* (GDP) are presented in this review paper. One of the major aspects of analysis of GDP is the correlation between GDP and *Final Consumption Expenditure* (F.C.E), which is an important macroeconomic indicator. The evolution of GDP is highly related with the evolution of final consumption. For analyzing the correlation, linear regression model has been used as it is one of the most suitable instruments for such approach. The regression model in this review paper uses FCE as the independent variable and GDP as the dependent variable.

Keywords: correlation, final consumption expenditure, gross domestic product, linear regression

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INTRODUCTION

Gross Domestic Product (GDP) is referred to the money value of all the net goods and services produced in an economy during a time period. It is the absolute money related or show-case approximation of all the completed products and ventures created inside a nation's fringes in a particular time-frame. As a wide proportion of by and large household creation, it works as an thorough scorecard of a given nation's monetary well being. It is an important concept of macro-economic and acts as a development indicator between countries.

Final consumption expenditure is the sum of Private F.C.E (by household sector) and the Government F.C.E (by government sector). The private F.C.E comprises of the F.C.E of (1) household and (2) non-profitable institutions like gurudwaras, temples etc. The household F.C.E additionally incorporates the attributed net lease of owner-occupied abodes, utilization of Own-account creation assessed at makers' costs and installments in sort of wages and pay rates esteemed at cost, e.g., arrangement for food, safe house and attire to the workers. The F.C.E of non-profit foundations serving families incorporates the estimation of products and enterprises delivered for own utilization on current record i.e., the estimation of gross yield diminished by the total of the estimation of their ware and non-commodity deals.

Regression models can be used to check the influence of F.C.E on the evolution of gross development product of India. Thus, I have used the data on yearly basis from 1990-2018. We shall measure the correlation between F.C.E and GDP.

METHODOLOGY

2.1 Collection of data:

Various sites were referred for collecting the data, however most of the data was obtained from data.worldbank.org and Wikipedia. (www.wikipedia.com)

The data was collected for the time span 1990-2018, i.e. a period of 29 years. The Gross Development Product (GDP) and F.C.E on yearly basis has been arranged in a tabular form.

MS Excel and SPSS have been used for regression analysis and MS Excel has been used for data visualization.

2.2 Review of literature:

- The data has been represented in form of bar graphs and trend line to get a simplified view of the entire data.
- Trend line of both GDP and F.C.E has been shown in a single graph to show a comparative study and draw conclusions easily.
- Simple Linear Regression has been applied on the data set for F.C.E and GDP of India and a regression line has been calculated to show the relation between GDP and F.C.E of India.

The main motive is to observe the relationship between GDP and the F.C.E (the sum of private and government consumption) in our country.

We have defined the GDP as the dependent variable and F.C.E as the independent variable for our regression analysis.

Hence, the regression model may be written under the following mathematical expression:

$$GDP = a + b \cdot FC \quad - (1)$$

Understanding the economic angle, the model should have a residual variable as well, which is the difference between the values calculated theoretically and those measured in the real economy, thus the mathematical equation can further be re-written as:

$$GDP = a + b \cdot FC + c$$

where,

GDP= Gross Development Product i.e. dependent variable

FC= Final Consumption i.e. independent variable

a & b are the parameters of regression model

c is the residual variable.

For determination of the values of a and b, the parameters of the regression model, we have considered the following data-set during the time period 1990-2018.

TABLE-1 (GDP and FCE values for the time-period 1990-2018)

YEAR	GDP(million USD)	F.C.E (million USD)
1990	326608	251521
1991	274842	210944
1992	293262	220939
1993	284194	213534
1994	333014	246362
1995	366600	267476
1996	399791	294225
1997	423189	311654
1998	428767	319042
1999	466841	349552
2000	476636	354513
2001	493934	368490
2002	523768	382824
2003	618369	439853
2004	721589	487584
2005	834218	555766
2006	949118	619748
2007	1238700	798454
2008	1224096	805841
2009	1365373	904694
2010	1708460	1101420
2011	1822992	1226760
2012	1828120	1227160
2013	1857237	1261470
2014	2033652	1398200
2015	2089867	1460640
2016	2273556	1595160
2017	2652245	1856920
2018	2716746	1919921

We shall analyze the correlation between F.C.E and GDP of the country, for the time period 1990 to 2018, using the above table. (Table-1)

On studying the individual evolution of each of the two macro-economic indicators, GDP and FCE, for the time period 1990 to 2018, the following information and the graphical representations have been obtained.

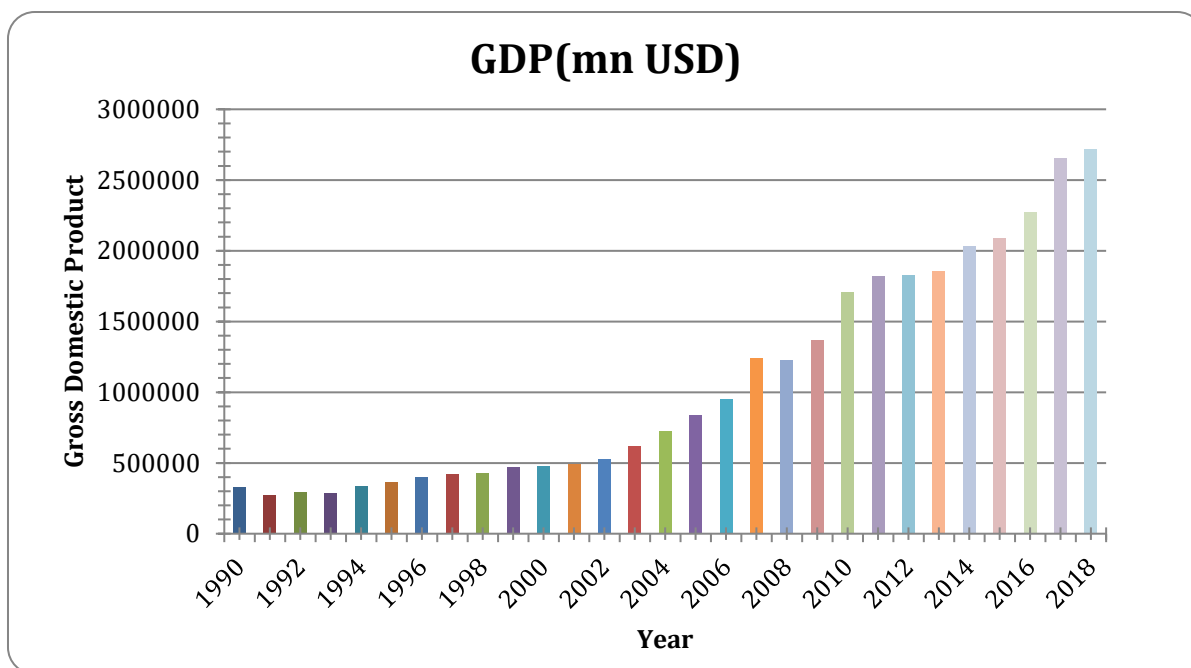


Fig-2.1

From the above bar graph (Fig-2.1), it is quite visible that during the time period 1990-2013, India's GDP has increased constantly over the years, whereas from 2013 onwards, it has increased at a significant rate.

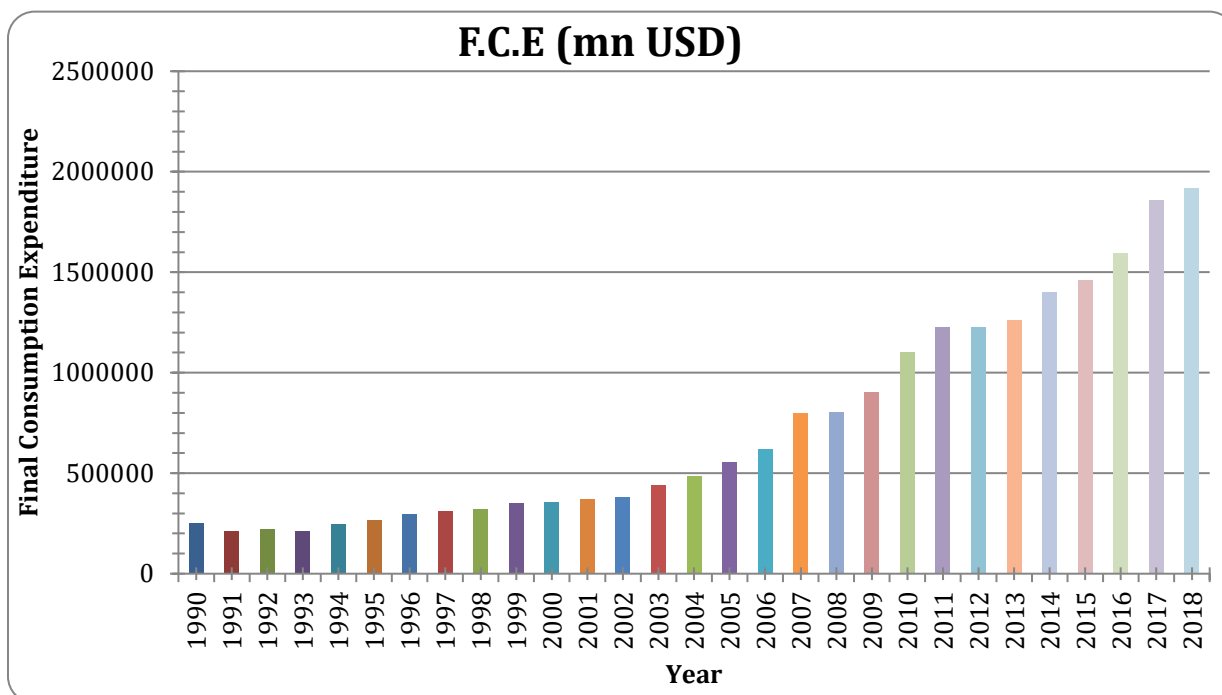


Fig-2.2

The above graph (Fig-2.2) shows us that during the time period 1990-2018, there has been a significant increase in the final consumption expenditure. Thus, India's final consumption expenditure is increasing at a significant rate as well.

Hence, we can say that the GDP and the F.C.E are strongly interdependent. To confirm this, we have performed regression analysis on the given set of data.

1. CORRELATION AND REGRESSION

Correlation describes the measure of strength of linear relationship between two random variables. Regression, on the other hand, describes the linear relationship where a factor variable(independent) is used to estimate or explain the behavior/trend of the response(dependent) variable.

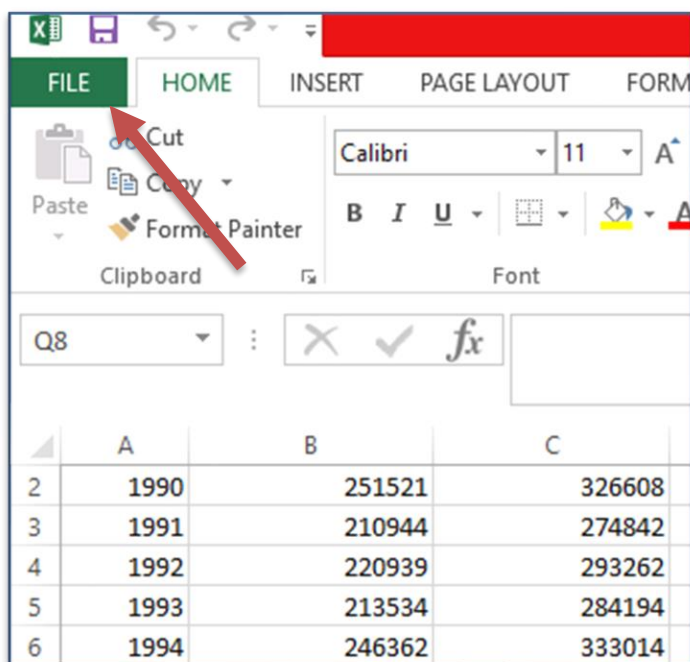
Correlation and linear regression are the most usually utilized strategies for exploring the connection between two quantitative factors.

The objective of a correlation analysis is to see whether two estimation factors co change, and to measure the strength of the relation between the factors, though regression expresses the relationship in equation form.

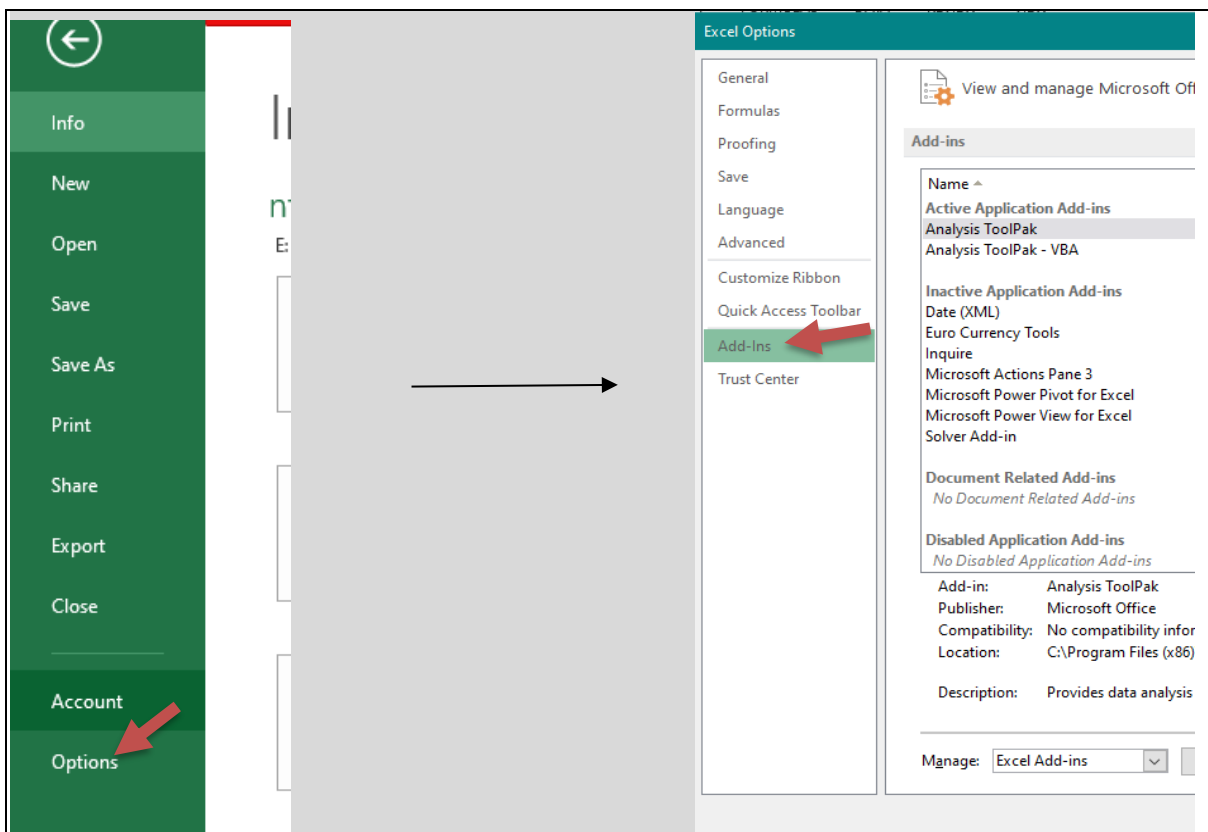
3.1 REGRESSION ANALYSIS USING EXCEL

To perform regression analysis in Microsoft Excel, you need to activate the Analysis tool pack first. To activate the Tool pack, follow the steps below:

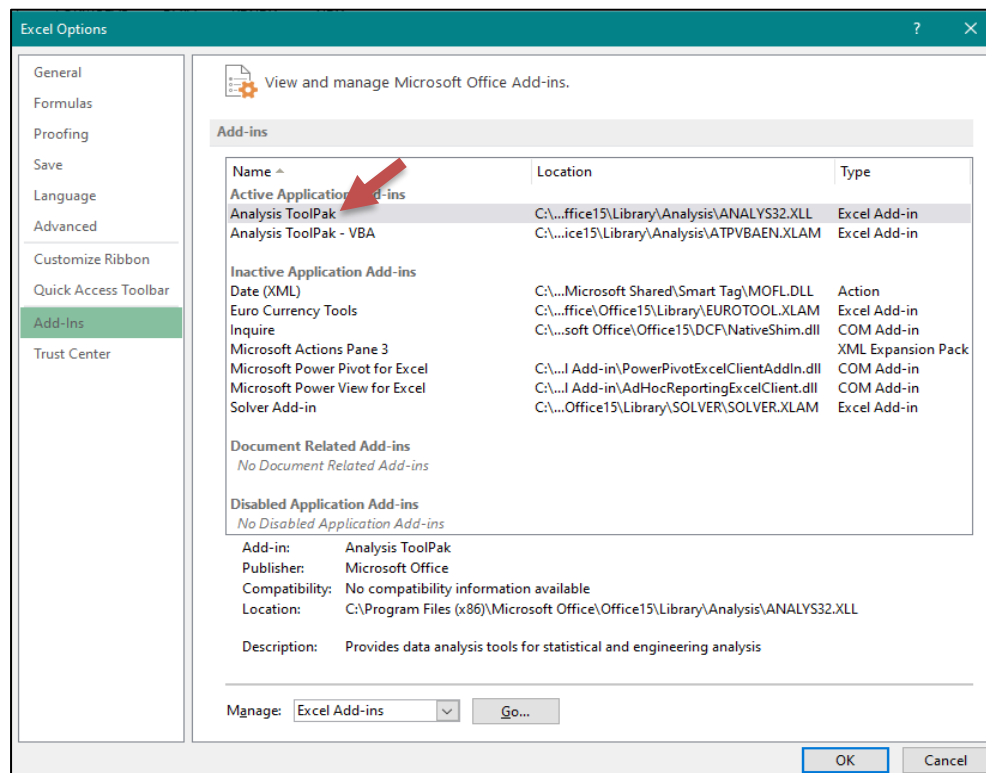
Step-1 Click on the file option on the ribbon



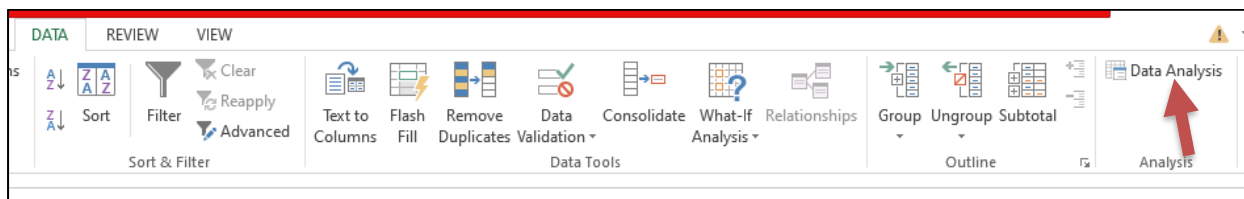
Step-2 Go to the 'Options' section and select 'Add-ins'



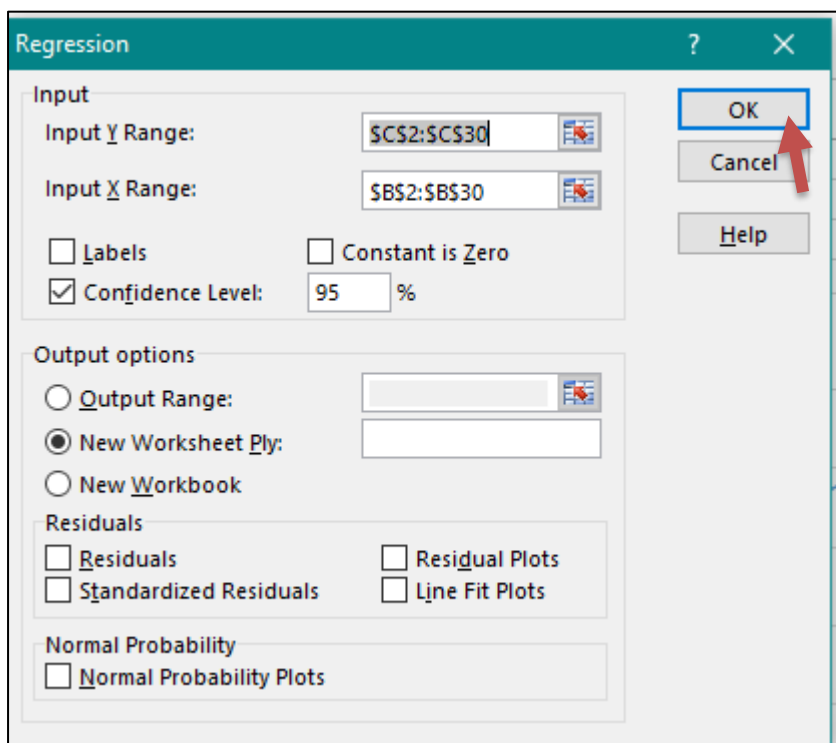
Step-3 Select the 'Analysis Toolpak' and click OK to activate



Step-4 Now to perform the regression analysis, Go to the 'Data' on the ribbon, click 'Data Analysis' in the Analysis section and then select Regression.



Step-5 Input the range for both- independent (X) and dependent variable (Y) data and modify the settings as desired. Click OK for the required output.



REGRESSION ANALYSIS USING EXCEL

<i>Regression Statistics</i>	
Multiple R	0.998452249
R ² coefficient	0.996906894
Adjusted R ² coefficient	0.996792335
Standard Error (S.E)	44653.41341
No. Of observations	29

Fig-3.1

Regression Analysis

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1.73513E+13	1.74E+13	8702.09103	2.00999E-35
Residual	27	5.38E+10	1.99E+09	-	-
Total	28	1.74052E+13	-	-	-

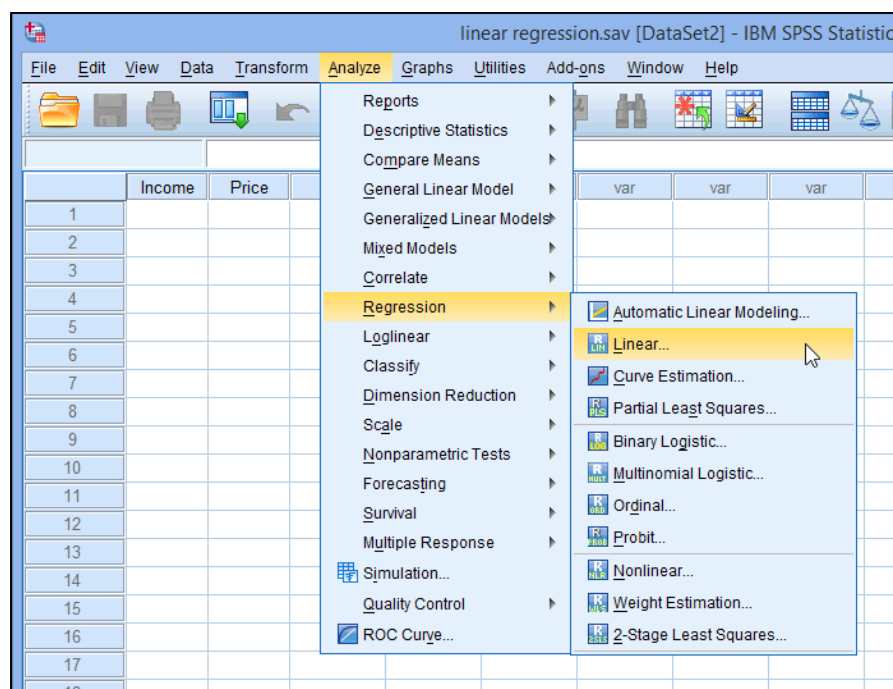
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-statistic</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-13038.36583	14265.76015	-0.91396	0.36882678	-42309.28785	16232.55619
F.C.E (million USD)	1.4640056	0.015693902	93.285	2.01E-35	1.431804374	1.496206826

Fig-3.2

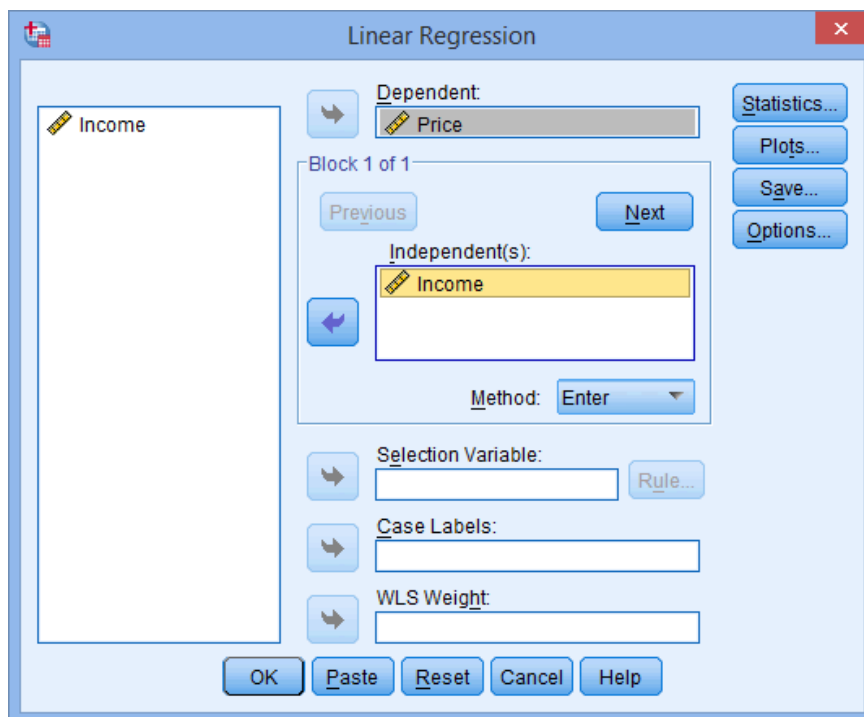
3.2 REGRESSION ANALYSIS USING SPSS

First export the data from your excel file or directly input the data. To perform Linear regression analysis using SPSS, follow the steps below:

Step-1 Go to the ‘Analyse’ section on the ribbon, select ‘Regression’ and choose ‘Linear’



Step-2 Drag the respective variables in their corresponding sections. For example, in this figure, ‘Price’ is the dependent variable and ‘Income’ is the independent variable and select OK for the desired output.



REGRESSION ANALYSIS USING SPSS

Model Summary								
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					F Change	df1	df2	Sig. F Change
1	.998 ^a	.997	.997	44653.413	8702.091	1	27	2.01E-35
a. Predictors: (Constant), F.C.E (million USD)								

Fig 3.3

ANOVA ^a						
Model		df	Sum of Squares	Mean Square	F	Sig.
1	Regression	1	17351337129529.125	17351337129529.125	8702.091	2.01E-35
	Residual	27	53836037881.704	1993927328.952		
	Total	28	17405173167410.828			
a. Dependent Variable: GDP(million USD)						
b. Predictors: (Constant), F.C.E (million USD)						

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-13038.366	14265.760		-.914	.369
	F.C.E (million USD)	1.464	.016	.998	93.285	2.01E-35

a. Dependent Variable: GDP(million USD)

Fig-3.4

The correlation coefficient (R) between the GDP and the F.C.E of India form 1990 to 2018 comes out to be 0.998452249.

The main aim of every regression model is to determine the values of its parameters, which have been calculated using MS Excel and SPSS.

The Fig-3.1 and Fig-3.3, that we have achieved from MS Excel and SPSS respectively, show that the probability of the model being correct is very large, approximately 99.7%.

R-square value = 0.996906984 and the Adjusted R-square value= 0.996792335.

The validity of the model can be confirmed by the F-value i.e. 8702.09103 (Fig-3.2 and Fig-3.4) which is very large compared to the table level which is marked as a validity point for econometric models, and the alternative hypothesis i.e. F.C.E strongly influences the evolution of GDP and is confirmed by the p-value (2.01E-35) which is < 0.05 (usually taken as rejection point).

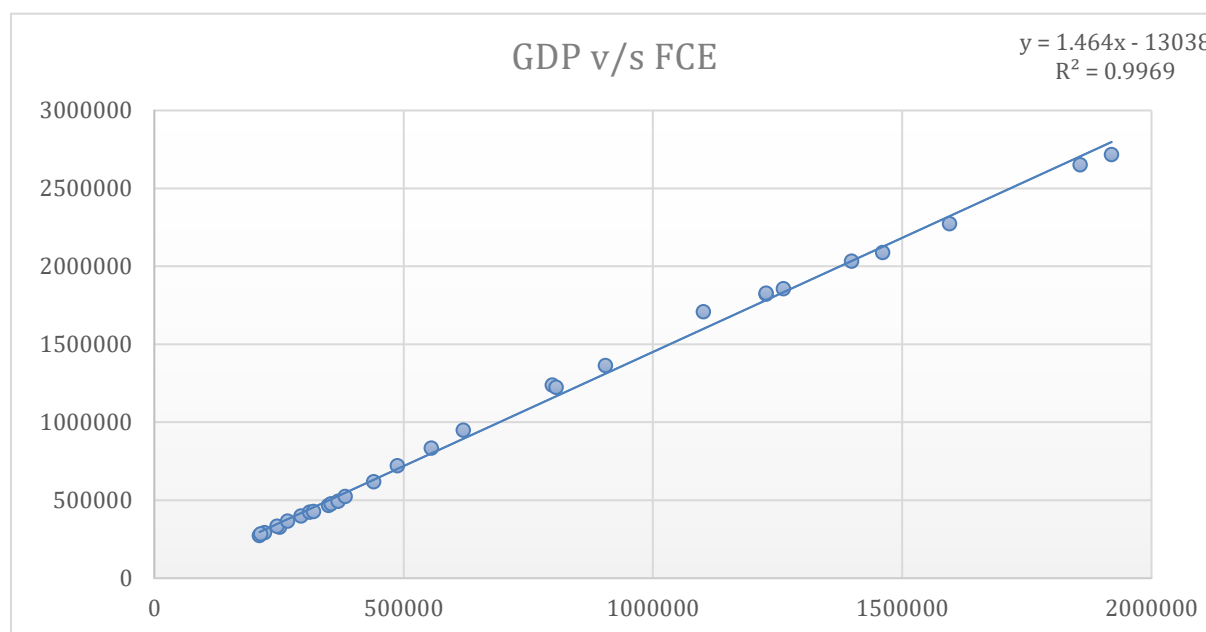


Fig-3.5

The above scatter plot (Fig-3.5) shows the linear trend of the growth of GDP with respect to the FCE of India over the years 1990-2018. The regression equation comes out to be

$$y = 1.464x - 13038$$

which when compared to the equation (1), gives the value of a=1.464 and b= -13038. And the value of R-squared comes out to be 0.9969.

Thus, we can consider the above regression model as a valid model to describe the correlation between the value of GDP and F.C.E in our country. Hence, it is evident that there is a significant relation between the evolution of GDP and the F.C.E in India for the time period 1990-2018.

The regression analysis can't be considered complete without stating that the free term indicates the fact that the factors which haven't been included in the model have great affect on the value of Gross Domestic Product. The free term's value, when less than zero, suggests that the “not included” variables, as a whole, have a negative impact on the evolution of GDP of our country. However, on the basis of the factors included in the regression model, it can be concluded that India’s GDP is highly influenced by the F.C.E, i.e. the sum of private and government consumptions.

2. LINEAR TREND ANALYSIS

The following trend lines represent the trends/patterns of GDP and the F.C.E of India for the time period 1990-2018:

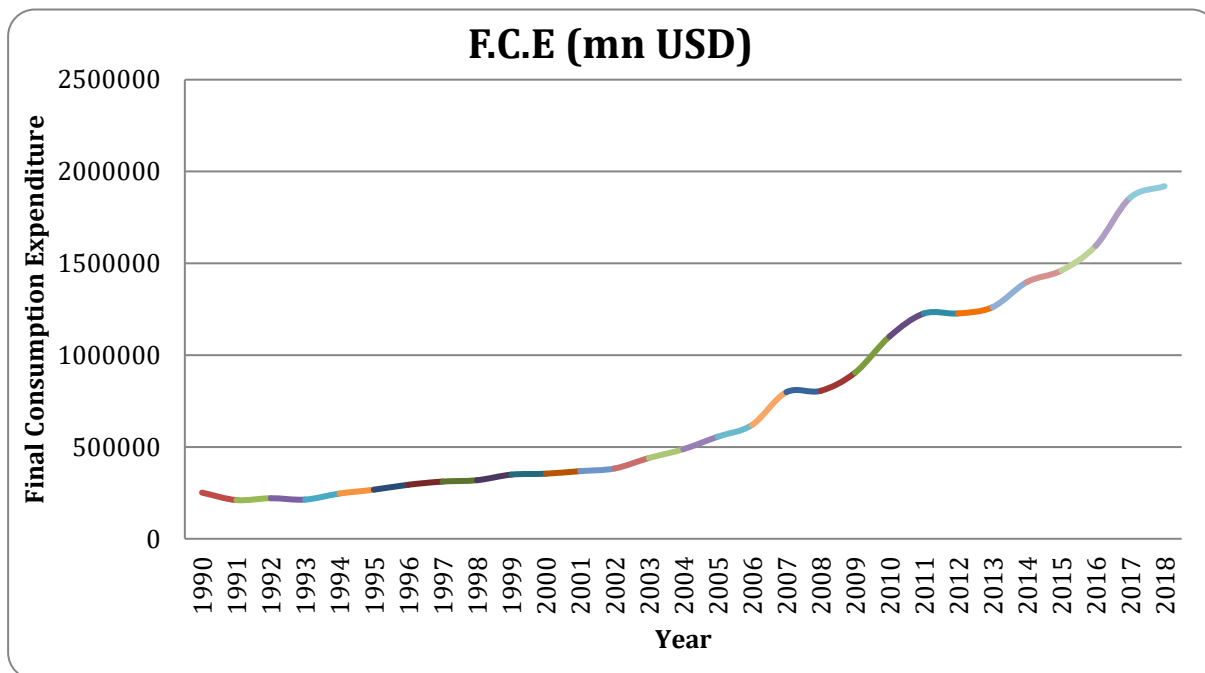


Fig-4.1

The above trend line (Fig-4.1) shows the pattern of F.C.E of India over the time span of 29 years starting from 1990 till 2018. We can see that the rate of change of F.C.E is not as significant at the start, however the rate of increase becomes significant after the year 2006, decreases during 2008 and again increases thereafter.

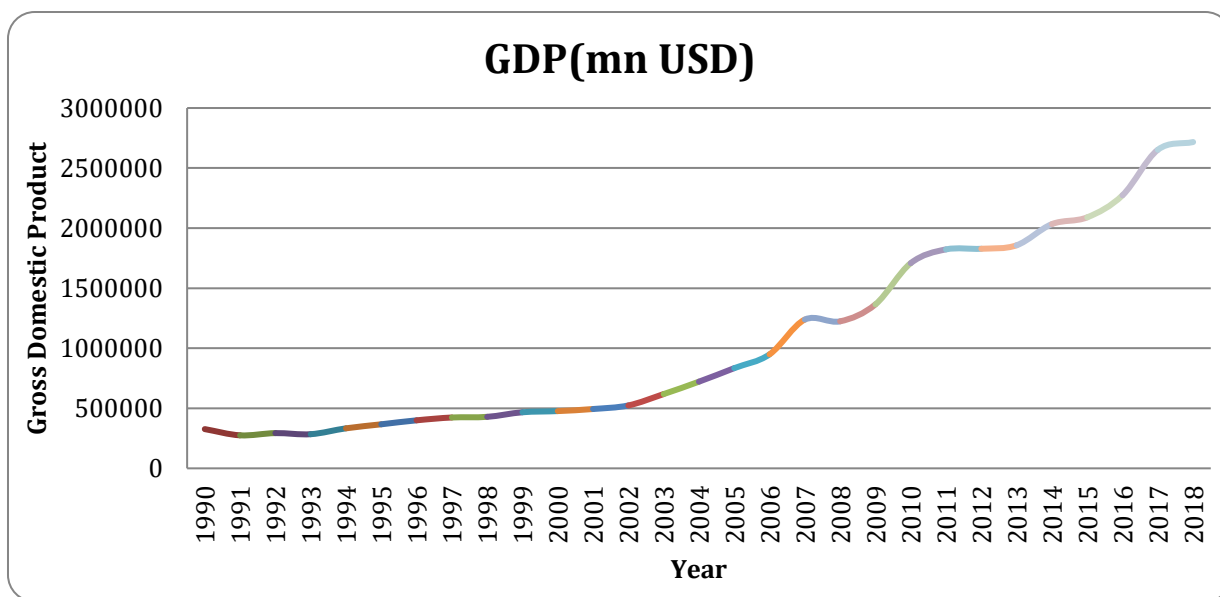


Fig-4.2

The above trend line (Fig-4.2) shows the pattern of F.C.E of India over the time span of 29 years starting from 1990 till 2018. Similarly as we saw in the case of F.C.E, we can see that the rate of change of GDP of India is not as significant at the start, however the rate of increase becomes significant after the year 2006, decreases during 2008 and again increases thereafter.

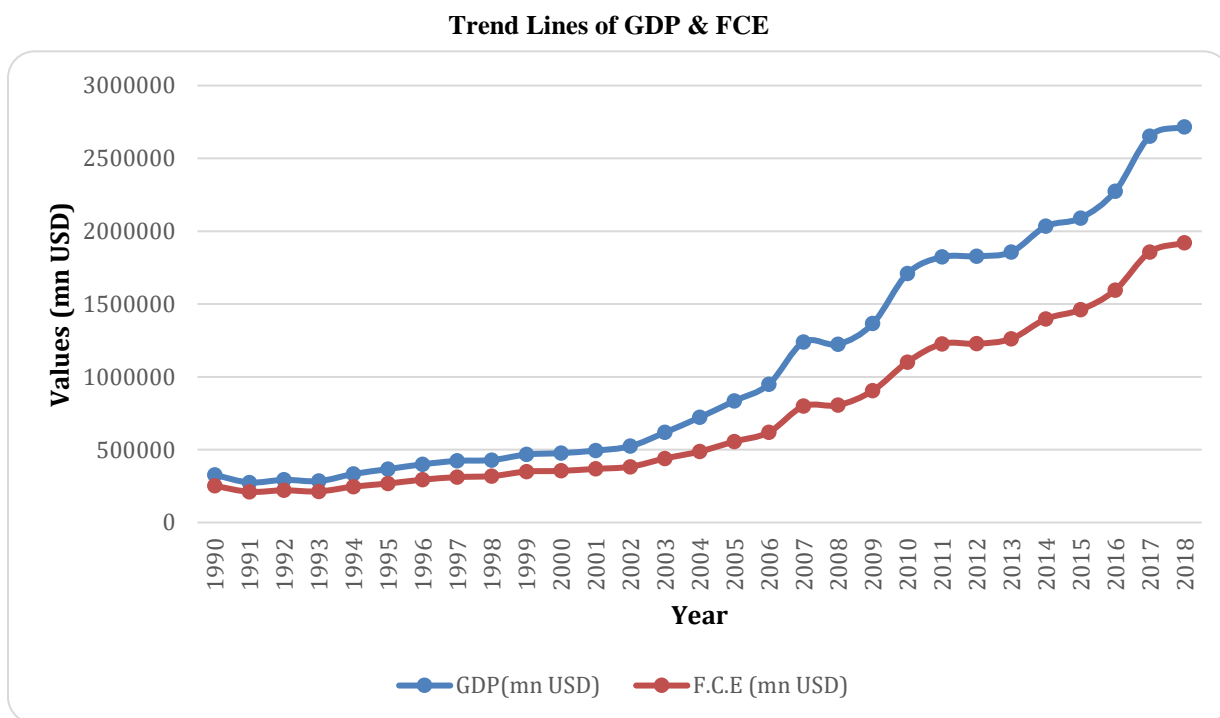


Fig-4.3

The above figure (Fig-4.3) shows the trend lines of both GDP and F.C.E of India in a single graph over the time span of 29 years starting from 1990 till 2018 which makes it easy to compare the patterns of both F.C.E and GDP of the country.

3. CONCLUSION

From the above graph (Fig-4.3), we can see that the trend lines of both GDP & F.C.E., over the time period 1990 to 2018, quite evidently follow a similar pattern, thus we can say that the GDP of India is highly correlated to the F.C.E. of India and that the GDP of the country is strongly influenced by the F.C.E of the country.

Thus, we can say that the evolution of GDP of India depends on the evolution of F.C.E. of India for the research period, i.e. 1990 to 2018. The decrease in the F.C.E and GDP of India was because of the economic crisis that happened in 2008.

4. REFERENCES

- [1] Das, S., Das, T. (2012). A Time-series Analysis of Impact of FDI on Economic Development In India during Post-reforms Era (1991-2010). *JSS Academy of Technical Education*.
- [2] Sinharay, A. (2013). Estimation of private final consumption expenditure in India: Issues regarding data availability and validation. *Journal of Income & Wealth (The)*, 35(1), 159-170.
- [3] Mishra, P. K. (2011). Dynamics of the relationship between real consumption expenditure and economic growth in India. *Indian Journal of economics & Business*, 10(4), 553-563.
- [4] Zoubir, Soufiane. (2019). Impact of Government and Household Final Consumption Expenditures, Net Trade, and Foreign Direct Investment on Gross Domestic Product. 10.13140/RG.2.2.30733.49124.
- [5] Singh, R. (2018). Impact of GDP and inflation on unemployment rate:" A study of Indian Economy in 2011–2018". *International journal of management, IT and Engineering*, 8(3), 329-340.
- [6] Karamazova, E., Jusufi Zenku, T., & Trifunov, Z. (2017). Analysing and Comparing the Final Grade in Mathematics by Linear Regression Using Excel and SPSS. *International Journal of Mathematics Trends and Technology*, 52(5), 334-344.
- [7] Abbott, M. L. (2014). *Understanding educational statistics using Microsoft Excel and SPSS*. John Wiley & Sons.
- [8] Freund, R. J., Wilson, W. J., & Sa, P. (2006). *Regression analysis*. Elsevier.
- [9] Kumari, K., & Yadav, S. (2018). Linear regression analysis study. *Journal of the practice of Cardiovascular Sciences*, 4(1), 33.
- [10] Mudelsee, M. (2019). Trend analysis of climate time series: A review of methods. *Earth-science reviews*, 190, 310-322.
- [11] *Linear Regression Analysis in SPSS Statistics - Procedure, assumptions and reporting the output*. (laerd.com)