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The Relationship Between Gross Domestic Product and Foreign Direct Investment, Inflation, Unemployment, and Exchange Rate

- **Regression Analysis**

In Econometrics, we use the tool of Regression Analysis to understand the economic relationships through quantitative estimation. This quantitative estimation is done by Regression which is one of the most frequent and important tool used to understand economic theories. Hence, it is easy to describe a relationship in a theoretical form but it would be difficult to write it in the form of an equation and estimate the theory by a given data. Also, not only do we find the relationship of the variables but the direction and the amount of change in the variables used in the theory. Thus, to predict both the factors of

1. Amount of change
2. Direction of change as well as the significance of the relationship between the variables, we use Regression Analysis.

Definition

"Regression Analysis is a Statistical technique that actually explains the change in dependent variable due to movement in other independent variables. It is a technique of predicting the unknown variable through the known variables."

Multiple Regression Analysis

Multiple regression analysis in econometrics is a statistical technique used to estimate the relationship between a dependent variable and multiple independent variables. It involves fitting a linear equation that explains how the dependent variable is influenced by the independent variables. The coefficients in the equation represent the degree and direction of the relationship between the dependent variable and each independent variable. Multiple regression analysis is commonly used in econometrics to estimate the effects of various factors on economic outcomes such as GDP, inflation, employment, and trade. It is a powerful tool that helps researchers to understand the complex relationships that exist among economic variables.

- **Objective**

The main aim of this project is to finding the relationship among foreign direct investment, inflation rate, unemployment rate, and exchange rate toward the economic growth based on the multiple linear regression analysis. The study aims to explore how these macroeconomic variables affect GDP and each other, and to identify the factors that contribute to economic growth and development. The analysis will be based on empirical data and will utilize various econometric techniques to measure the causal relationships between the variables.

The following are some that aided in understanding the many facets of the topic and the various findings of this analysis.

- **Gross Domestic Production**

Gross domestic product (GDP) is the total monetary or market value of all the finished goods and services produced within a country's borders in a specific time period. As a broad measure of overall domestic production, it functions as a comprehensive scorecard of a given country's economic health. Gross Domestic Product is one of the most important indicators of the economic status of a country. GDP or Gross Domestic Product is referred to by the economists as the size of an economy.

- **Foreign Direct Investment**

Foreign Direct Investment (FDI) refers to the investment made by a company or individual from one country in another country with the aim of establishing a lasting interest in the business of the host country. In other words, it is a cross-border investment where a company or individual in one country invests in another country with the objective of establishing a long-term business relationship. FDI is an important driver of economic growth.

Foreign Direct Investment (FDI) can bring many advantages to the host country, including:

1. Increased capital inflows and investment opportunities.
2. Creation of new job opportunities and skill development.
3. Transfer of technology and knowledge spillovers.
4. Improved infrastructure and economic growth

- **Inflation**

Inflation refers to a sustained and general increase in the prices of goods and services in an economy over time. Inflation occurs when there is too much money chasing too few goods, leading to an imbalance between supply and demand. The main causes of inflation include an increase in the money supply, rising production costs, and high demand for goods and services. Inflation can have both positive and negative effects on the economy, depending on the level and duration of the inflationary pressures. Moderate inflation can stimulate economic growth and investment, while high or unpredictable inflation can reduce consumer purchasing power, erode savings, and lead to economic instability.

- **Unemployment**

Unemployment refers to the state of being without a job but actively seeking employment. It is a measure of the number of people in the workforce who are willing and able to work but are unable to find employment. Unemployment is a key indicator of the health of an economy, and high levels of unemployment can indicate an underutilization of resources and a decline in economic growth.

- **Exchange Rate**

Exchange rate refers to the value of one currency in terms of another currency. It represents the price at which one currency can be exchanged for another currency in the foreign exchange market. Exchange rates are determined by market forces of supply and demand, and they fluctuate constantly depending on a variety of factors, including trade flows, investment flows, geopolitical events, and monetary policy decisions.

Exchange rates can affect the economy in multiple ways, including:

1. **International trade:** Exchange rates can influence the competitiveness of exports and imports.
2. **Inflation:** Exchange rates can affect the prices of imported goods and services, which can impact domestic inflation.
3. **Capital flows:** Exchange rates can influence the inflow or outflow of foreign investment.
4. **Government finances:** Exchange rates can impact government finances through their effects on exports, imports, and capital flows.

- **Data Collection**

The analysis and regression analysis of the relationship between gross domestic product and foreign direct investment, inflation, unemployment, and exchange rate of India is a complex task that requires a significant amount of time, effort, and resources. To ensure the accuracy and validity of the results, I have decided to use secondary data from reputable sources, such as Git-hub. This approach allows us to leverage the expertise of other researchers and use high-quality data sets, which enhances the rigor and credibility of our analysis. By using secondary data, we can focus our efforts on interpreting and contextualizing the results.

Table 1. Description of the GDP Growth, FDI, Inflation, Unemployment and the Exchange Rate during 1983-2012 periods

Year	GDP Growth (%)	FDI (in million USD)	Inflation (%)	Unemployment (%)	Exchange Rate (%)
1983	8.45	292	11.46	2.00	909.26
1984	7.17	222	8.76	2.00	1025.94
1985	3.48	310	4.31	2.05	1110.58
1986	5.96	258	8.83	2.70	1282.56
1987	5.30	385	8.90	2.62	1643.85
1988	6.36	576	5.47	2.85	1685.70
1989	9.08	682	5.97	2.81	1770.06
1990	9.00	1,093	9.53	2.55	1842.81
1991	8.93	1,482	9.52	2.62	1950.32
1992	7.22	1,777	4.94	2.74	2029.92
1993	7.25	2,004	9.77	2.78	2087.10
1994	7.54	2,109	9.24	4.36	2160.75
1995	8.40	4,346	8.64	7.20	2248.61
1996	7.64	6,194	6.47	4.87	2342.30
1997	4.70	4,677	11.05	4.69	2909.38
1998	-13.13	-241	77.63	5.46	10013.62
1999	0.79	-1,866	2.01	6.36	7855.15
2000	4.92	-4,550	9.35	6.08	8421.78
2001	3.64	-2,977	12.55	8.10	10260.85
2002	4.50	145	10.03	9.06	9311.19
2003	4.78	-597	5.06	9.67	8577.13
2004	5.03	1,896	6.40	9.86	8938.85
2005	5.69	8,336	17.11	11.24	9704.74
2006	5.50	4,914	6.60	10.28	9159.32
2007	6.35	6,928	6.59	9.11	9141.00
2008	6.01	9,318	11.06	8.39	9698.96
2009	4.63	4,877	2.78	7.87	10389.94
2010	6.22	13,771	6.96	7.14	9090.43
2011	6.49	19,241	3.79	6.56	8770.43
2012	6.23	19,618	4.30	6.14	9386.63

The variables used in this study, namely GDP Growth, FDI, Inflation, Unemployment, and Exchange Rate, during the period of 1983-2012. The average value of GDP Growth in the given time frame was **5.47**, with the highest recorded value of **9.08** in 1989 and the lowest recorded value of **-13.13** in 1998. The average FDI was **3,507,390,693** with the highest recorded value of **19,618,049,398** in 2012 and the lowest recorded value of **4,550,355,286** in 2000. The average inflation rate for the given period was **10.17**, with the highest recorded value of **77.63** in 1998 and the lowest recorded value of **2.01** in 1999. The average unemployment rate was **5.67**, with the highest recorded value of **11.24** in 2005 and the lowest recorded value of **2.00** in 1983-1984. Finally, the average Exchange Rate for the given period was **5523.97**, with the highest recorded value of **10389.94** in 2009 and the lowest recorded value of **909.26** in 1983.

- **Descriptive Statistics**

Table 2. Descriptive Statistics of the GDP Growth, FDI, Inflation, Unemployment and the Exchange Rate

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
GDP Growth (%)	30	-13.13	9.08	5.4710	3.96443
FDI (in million USD)	30	-4550	19618	3507.39	5754.764
Inflation (%)	30	2.01	77.63	10.1693	13.13833
Unemployment (%)	30	2.00	11.24	5.6720	2.91898
Exchange Rate (%)	30	909.26	10389.94	5523.9720	3837.35501
Valid N (listwise)	30				

- **Software Use for Analysis:**

When it comes to econometric analysis, there are several software options available, including Excel, EViews, and Stata. However, for the purposes of this study, IBM SPSS was chosen as the software for this study due to its user-friendly interface, reliability, and extensive features for complex econometric modeling. Its robust library of statistical functions allows for efficient analysis and meaningful insights.

- **Ordinary Least Square Method and Its Assumption**

The Ordinary Least Squares (OLS) method is a commonly used approach in econometrics to estimate the parameters of a linear regression model. OLS estimators minimize the sum of the squared errors between observed values and predicted values, making it a computationally efficient and easily implementable method for regression analysis. However, it is crucial to understand the underlying assumptions of OLS regression, as these assumptions play a critical role in ensuring the reliability and validity of the results. Failing to meet the OLS assumptions can lead to biased and inconsistent estimates, which can ultimately result in inaccurate conclusions and decisions. Therefore, it is imperative to pay close attention to the OLS assumptions in any econometric analysis.

- **Assumption of OLS**

1. Linearity: The relationship between the dependent variable and the independent variables is assumed to be linear.
2. Independence: Fixed X values or X values independent of the error term. Here, this means we require zero covariance between u_i and each X variables.
3. Zero mean value of disturbance u_1: $E(u_i|X_{2i}, X_{3i}) = 0$.
4. Homoscedasticity: The variance of the errors or residuals should be constant across all levels of the independent variables.
5. Autocorrelation: No autocorrelation, or serial correlation, between the disturbances

$$cov(u_i, u_j) = 0 \qquad i \neq j$$

6. The number of observations n must be greater than the number of parameters to be estimated, which is 3 in our current case.
7. There must be variation in the values of the X variables.
8. No exact collinearity between the X variables.

No **exact linear relationship** between X_2 and X_3

- **Assumption 1st (Linearity)**

In multiple linear regression econometrics, it is generally assumed that the relationship between the dependent variable and the independent variables is linear. However, it is important to note that this assumption of linearity is just an assumption, and it may not always hold true in practice. Therefore, while it is generally assumed that the relationship between the dependent variable and the independent variables is linear in multiple linear regression, it is important to examine the data and assess whether this assumption holds true.

Table 3. Correlation Analysis of the GDP Growth, FDI, Inflation, Unemployment and the Exchange Rate

Correlations

		GDP Growth (%)	FDI (in million USD)	Inflation (%)	Unemployment (%)	Exchange Rate (%)
GDP Growth (%)	Pearson Correlation	1	.182	-.834**	-.180	-.432*
	Sig. (2-tailed)		.335	.000	.342	.017
	N	30	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

- **Assumption 2nd (Normality of Errors)**

In multiple linear regression econometrics, one of the key assumptions is the normality of the error term (also known as the disturbance term or the residual term). This assumption states that the error term follows a normal distribution with a mean of zero.

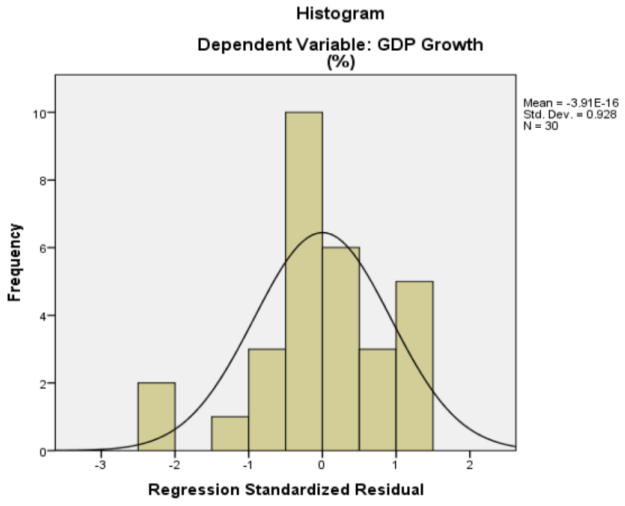


Figure 1. Standardized Residual Histogram

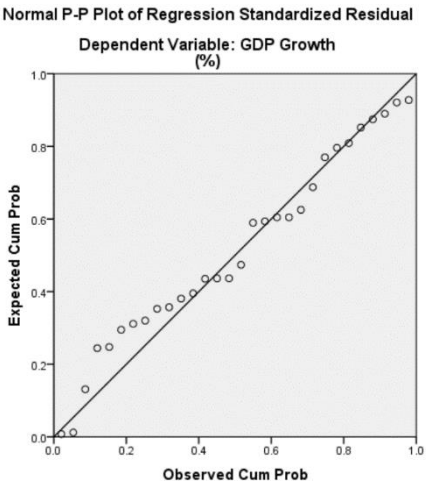


Figure 2. Normal P-P Plot of Standardized residual

Upon observing Figure 1 and Figure 2, we can confidently state that the data exhibits a distribution that closely resembles the normal distribution.

- **Assumption 3rd (Multicollinearity)**

There are no perfect linear relationships among the X variables. One way to detect multicollinearity is by using a metric known as the **variance inflation factor (VIF)**, which measures the correlation and strength of correlation between the predictor variables in a regression model.

Table 3. Variance Inflation Factor of FDI, Inflation, Unemployment and the Exchange Rate

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	FDI (in million USD)	.828	1.208
	Inflation (%)	.796	1.256
	Unemployment (%)	.228	4.384
	Exchange Rate (%)	.205	4.884

We can see that the VIF value for FDI, Inflation, Unemployment and Exchange Rate is 1.2008, 1.256, 4.384 and 4.884 respectively. Thus, the VIF values is smaller than 10. We can conclude that the VIF value is less than 10, meaning that there is no multicollinearity in the independent variables.

- **Assumption 4th (Heteroscedasticity)**

The Heteroscedasticity Test is designed to examine whether there is a disparity in the variance of each residual variable. When the variance of each residual remains constant, it is referred to as homoscedasticity. In order to assess this, the test involves computing the correlation between each independent variable and the absolute value of the corresponding residual using the Spearman Rank correlation method.

$$r_s = 1 - 6\left(\frac{\sum d_i^2}{n(n^2 - 1)}\right)$$

Null Hypothesis ($H_\circ$): No Heteroscedasticity is present.

Alternative Hypothesis(H_1): Heteroscedasticity is present

(i.e. Homoscedasticity is not present)

Table 4. Spearman Rank Correlation Test for Homoscedasticity

			Unstandardized Residual
Spearman's rho	Unstandardized Residual	Correlation Coefficient	1.000
		Sig. (2-tailed)	.
		N	30
	FDI (in million USD)	Correlation Coefficient	.048
		Sig. (2-tailed)	.800
		N	30
	Inflation (%)	Correlation Coefficient	.459*
		Sig. (2-tailed)	.011
		N	30
	Unemployment (%)	Correlation Coefficient	-.055
		Sig. (2-tailed)	.772
		N	30
	Exchange Rate (%)	Correlation Coefficient	.014
		Sig. (2-tailed)	.940
		N	30

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

From table 5, it can be seen that there is a non-significant correlation. It is seen from the p-value (Sig) that is bigger than 0.05. Therefore it can be conclude that there is no Heteroscedasticity in this regression model.

- **Assumption 6th (Autocorrelation)**

The Durbin-Watson test is a widely used method for detecting autocorrelation in regression models. It is popularly known as the Durbin–Watson d statistic, which is defined as:

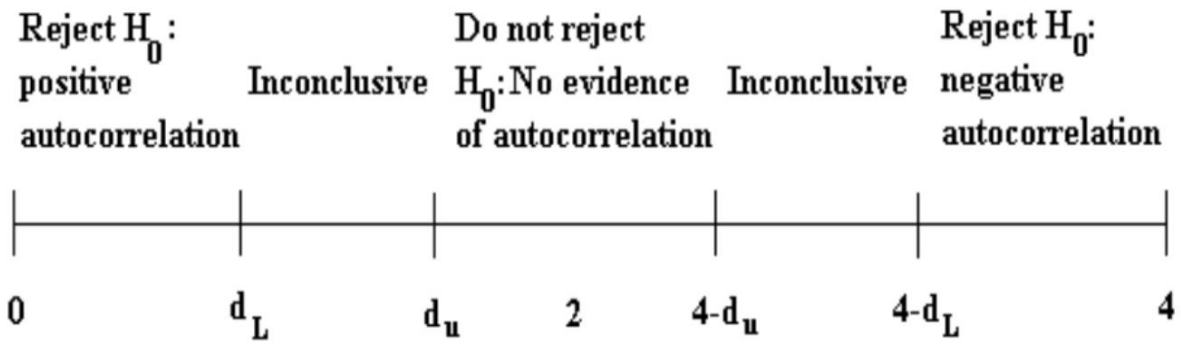
$$d = \frac{\sum_{t=2}^{t=n}(\bar{u}_t - \bar{u}_{t-1})^2}{\sum_{t=1}^{t=n}\bar{u}_t^2}$$

With a sample size of n = 30 and a significance level (α) of 0.05, we have determined the critical values to be d_l = 1.1426 and d_u = 1.7386.

Table 5. Durbin–Watson Test for Autocorrelation

Model	Durbin-Watson
1	1.506

- **Critical Region *d* of test**



Here the value of d_{cal} (d calculated) is 1.506 which lies between

$d_l < d_{cal} < d\_(u)$ Which means the test is inconclusive.

In cases where the Durbin-Watson test fails to provide conclusive evidence regarding autocorrelation in a regression model, further diagnostic tests can be employed to investigate the presence of autocorrelation.

- **Run Test for Detecting Autocorrelation**

The run test is a statistical test used to detect autocorrelation in a time series or sequence of data. It is particularly useful for detecting runs of consecutive increasing or decreasing values in the data, which can indicate the presence of autocorrelation. In the run test the hypotheses are;

Null Hypothesis ($H_\circ$): There are no autocorrelation problem in the model.

Alternative Hypothesis(H_1): There is autocorrelation present in the model.

Table 6. Run Test for Autocorrelation

Runs Test

	Unstandardized Residual
Test Value[a]	-.20520
Cases < Test Value	15
Cases >= Test Value	15
Total Cases	30
Number of Runs	12
Z	-1.301
Asymp. Sig. (2-tailed)	.193

Here the Asymp. Sig. (2-tailed) is greater than significance level (α) 0.05, Then null hypothesis $H_\circ$ is accepted. Which implies there are no autocorrelation problem in the model.

- **Graphical Method of Detecting Autocorrelation**

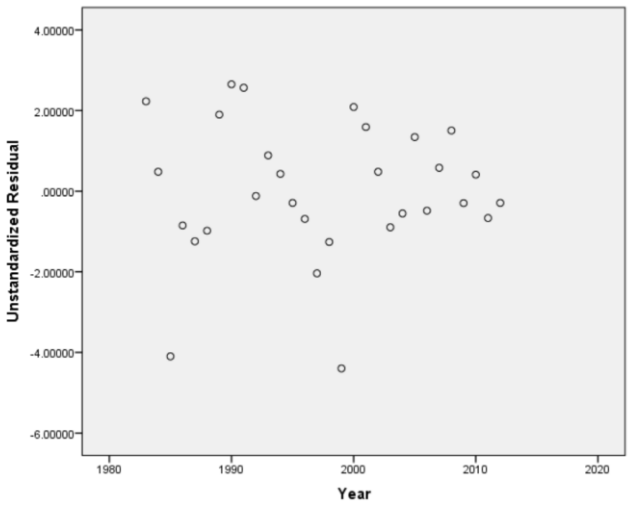


Figure 4. Unstandardized residual v/s Year

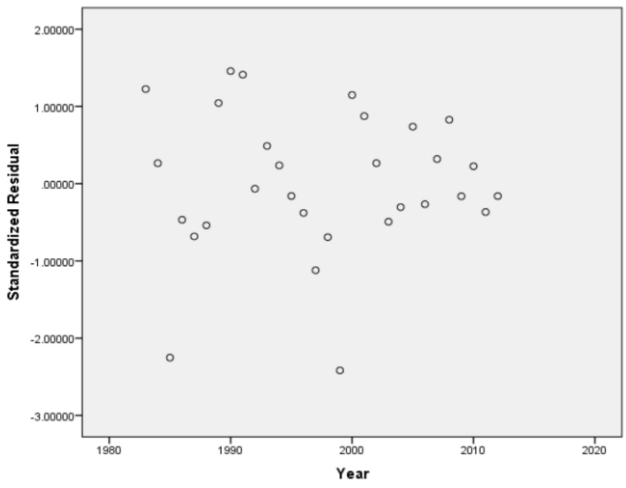


Figure 4. Standardized residual v/s Year

- **Multiple Regression Analysis**

Multiple Linear Regression Analysis is a statistical technique employed to examine the influence of multiple independent variables on a dependent variable. In this specific analysis, we are investigating the impact of four variables, namely Foreign Direct Investment (FDI), Inflation, Unemployment, and Exchange Rate on the Gross Domestic Product (GDP) Growth.

We can represent Dependent variable by Y and Independent variables by $X_1, X_2, X_3\ and\ X_4$ such that-

Y = Gross Domestic Production (GDP)

X_1 = Foreign Direct Investment (FDI)

X_2 = Inflation

X_4 = Unemployment

X_5 = Exchange Rate

β_o = Constant

$\beta_1, \beta_2, \beta_3\ and\ \beta_4$ are Regression Coefficients

By incorporating these variables and regression coefficients, our model can be expressed as:

$$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.268	.838		9.862	.000
	FDI (in million USD)	.000135	.000065	.196	2.091	.047
	Inflation (%)	-.205	.029	-.678	-7.105	.000
	Unemployment (%)	.427	.242	.315	1.763	.090
	Exchange Rate (%)	-.001	.000	-.633	-3.360	.003

a. Dependent Variable: GDP Growth (%)

Table 6. Coefficients Table – Multiple Regression Analysis

Table 6 (Coefficients Table – Multiple Regression Analysis), yields the following multiple linear regression equation:

$$Y = 8.268 + 0.000135X_1 - 0.205X_2 + 0.427X_3 - 0.001X_4$$

- **Interpretation**

The constant term (β_o is 8.268, indicating the expected value of GDP when all independent variables are zero.

The coefficient β_1 suggests that a one-unit increase in FDI (X_1) is associated with an increase of 0.000135 in GDP, holding other variables constant.

The coefficient β_2 indicates that a one-unit increase in inflation (X_2) leads to a decrease of 0.205 in GDP, assuming other variables remain constant.

The coefficient β_3 implies that a one-unit increase in unemployment (X_3) is associated with a rise of 0.427 in GDP, holding other variables constant.

The coefficient β_4 suggests that a one-unit increase in the exchange rate (X_4) results in a decrease of 0.001 in GDP, assuming other variables remain constant.

For hypothesis testing, we will examine the effect of all the independent variables individually on the dependent variable and then check for the joint effect of all independent variables on the dependent variable.

- **Test the Significance of the Coefficients or Partial Hypothesis Testing**

Before testing hypotheses in the multiple regression model, we are going to offer a general overview on hypothesis testing. Hypothesis testing allows us to carry out inferences about population parameters using data from a sample. In order to test a hypothesis in statistics, we must perform the following steps:

1) Formulate a null hypothesis and an alternative hypothesis on population parameters.
2) Build a statistic to test the hypothesis made.
3) Define a decision rule to reject or not to reject the null hypothesis.

Formulation of the null hypothesis and the alternative hypothesis:

The T-Test is utilized to examine the partial hypotheses and determine the significant impact of each independent variable on the dependent variable.

Hypotheses:

H_o: $\beta_1 = 0$ (No significant influence of FDI (X_1) on GDP Growth)

H_1: $\beta_1 \neq 0$ (Significant influence of FDI (X_1) on GDP Growth)

H_o: $\beta_2 = 0$ (No significant influence of Inflation (X_2) on GDP Growth)

H_1: $\beta_2 \neq 0$ (Significant influence of Inflation (X_2) on GDP Growth)

H_o: $\beta_3 = 0$ (No significant influence of Unemployment (X_3) on GDP Growth)

H_1: $\beta_3 \neq 0$ (Significant influence of Unemployment (X_3) on GDP Growth)

H_o: $\beta_4 = 0$ (No significant influence of Exchange Rate (X_4) on GDP Growth)

H_1: $\beta_4 \neq 0$ (Significant influence of Exchange Rate (X_4) on GDP Growth)

These hypotheses enable us to test whether each independent variable has a significant impact on GDP Growth, based on the estimated regression coefficients ($\beta_1, \beta_2, \beta_3 \; and \; \beta_4$).

Table 7. Coefficients Table – Partial Hypothesis Testing

Model		t	Sig.
1	(Constant)	9.862	.000
	FDI (in million USD)	2.091	.047
	Inflation (%)	-7.105	.000
	Unemployment (%)	1.763	.090
	Exchange Rate (%)	-3.360	.003

The findings from Table 4.9 suggest the following results:

For FDI the significance level (Sig) is less than 0.05. Consequently, we reject the null hypothesis H_o and conclude that FDI (X_1) has a significant influence on GDP Growth at the partial level.

For inflation the significance level is less than 0.05. This leads to rejecting H_o and concluding that Inflation (X_2) has a significant impact on GDP Growth at the partial level.

For unemployment the significance level is greater than 0.05. Hence, we reject $H_o$and conclude that there is no significant influence from Unemployment (X_3) on GDP Growth at the partial level.

For exchange rate the significance level is greater than 0.05. As a result, we reject H_o and determine that there is no significant influence from Exchange Rate (X_4) on GDP Growth at the partial level.

These conclusions are derived by comparing the calculated significant value with 0.05 significant level allowing us to assess the partial impact of each independent variable on GDP Growth.

- **Overall Test of Significance (F-Test) or ANOVA**

The F-Test is employed to determine if the independent variables collectively have a significant influence on the dependent variable.

Hypotheses:

H_o: There is no significant influence of FDI (X_1), Inflation (X_2), Unemployment (X_3), and Exchange Rate (X_4) on GDP Growth (Y).

H_1: There is a significant influence of FDI (X_1), Inflation (X_2), Unemployment (X_3), and Exchange Rate (X_4) on GDP Growth (Y).

These hypotheses enable us to assess whether the combination of independent variables as a whole has a significant impact on the dependent variable, GDP Growth (Y).

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	373.073	4	93.268	28.191	.000[b]
	Residual	82.712	25	3.308		
	Total	455.784	29			

a. Dependent Variable: GDP Growth (%)

b. Predictors: (Constant), Exchange Rate (%), Inflation (%), FDI (in million USD), Unemployment (%)

Table 8. ANOVA Table –Overall Hypothesis Testing

The F-Statistic value of 28.191 obtained from the analysis, along with a p-value of 0.000, indicates that the overall model is statistically significant. Therefore, we reject the null hypothesis (Ho) and conclude that the model has a significant influence on the dependent variable. This implies that the combination of the independent variables (FDI, Inflation, Unemployment, and Exchange Rate) collectively contributes to explaining the variability in GDP Growth

- **Calculation of R-Square and Adjusted R-Square**

R-squared is a statistical measure that represents the proportion of the variance for a dependent variable that's explained by an independent variable or variables in a regression model. R-squared explains to what extent the variance of one variable explains the variance of the second variable. Adjusted R-squared is a modified version of R-squared that has been adjusted for the number of predictors in the model.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.905[a]	.819	.789	1.81892

a. Predictors: (Constant), Exchange Rate (%), Inflation (%), FDI (in million USD), Unemployment (%)

b. Dependent Variable: GDP Growth (%)

Table 9. ANOVA Table –Overall Hypothesis Testing

With an R-square value of 0.8615, approximately 86.15% of the variation in the dependent variable (GDP Growth) is explained by the independent variables (FDI, Inflation, Unemployment, and Exchange Rate). This implies that these variables collectively contribute to 81.8% of the influence on GDP Growth. The remaining 18.2% is attributed to factors other than FDI, Inflation, Unemployment, and Exchange Rate.

- **Conclusion**

In conclusion, the regression analysis conducted on the relationship between Gross Domestic Product (GDP) and the independent variables of Foreign Direct Investment (FDI), Inflation, Unemployment, and Exchange Rate reveals the following:

FDI (X1): The analysis demonstrates a significant positive relationship between FDI and GDP Growth. A one-unit increase in FDI leads to a corresponding increase in GDP Growth.

Inflation (X2): The analysis indicates a significant negative relationship between inflation and GDP Growth. Higher levels of inflation are associated with a decrease in GDP Growth.

Unemployment (X3): The analysis suggests that there is no significant relationship between unemployment and GDP Growth. Unemployment does not have a substantial impact on GDP Growth.

Exchange Rate (X4): The analysis reveals a significant negative relationship between the exchange rate and GDP Growth. Changes in the exchange rate negative affect GDP Growth.

Overall, FDI and inflation are the key drivers influencing GDP Growth. However, unemployment and the exchange rate have limited influence on GDP Growth. It is important to consider other factors beyond FDI, inflation, unemployment, and exchange rate to better understand and explain variations in GDP Growth.

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Link for Data-Set

https://github.com/inishantd/FDI_GDP_Data_Econometrics