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The Effect of Government Regulations on Overall EconomicWell Being in India(1995-2020)

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Abstract: Barriers to trade and other market regulations have long been thought to inhibit the ability of aNation's economy to grow and prosper. We test this hypothesis using a multiple regression model and data from The Heritage Foundation and World Bank related to trade freedom and general economic regulation on a country to fully discern the impact of governmental regulation on a country's GDP per capita. We find that GDP per capita rises significantly as a India's business freedom and trade freedom grow. This provides strong confirmation for our hypothesis that deregulated economies experience higher levels of economic prosperity as measured by GDP per capita than their regulated counterparts and indicates that a market-specific look shouldbe taken to fully understand the nuances of the results of different types of economic regulation.

I. INTRODUCTION

Trade can act as a powerful engine for economic growth and development. Developing countrieslike India have long strived for a development strategy that will sustain high economic growth, create employment opportunities and eliminate poverty. Trade policy is being used by the developing countries as a tool for attaining their development objectives, which aim to combine higher economic growth with employment generation in order to alleviate poverty. Trade facilitation is also found to have positive effects on gross domestic product (GDP), economic welfare and government revenue.

Free trade is widely thought to be prerequisite for sustained economic success, but many countries feel the need to promote domestic production by enforcing barriers and regulations on imported goods and regulating different aspects of the economy as a whole. The same is true of regulation in other sectors of the economy, such as the labor and business markets: lawmakers are often compelled to protect the interests of various stakeholders at the expense of economic freedom. Overall, we will look at the impact of regulations and trade barriers on GDP per capita as we analyze whether the statement that completely free trade and deregulated markets are always the most beneficial for an economy is true or if regulation in some or all sectors is of helpas well.

This research is important because it gives guidance as to how much is too much and how little istoo little when it comes to regulations and barriers. It shows the overall, broad trend relating trade freedom and economic regulations and to GDP per capita for a country. Using data from The Heritage Foundation's Index of Economic Freedom and the World Bank, we analyze this relation. Our study focuses on regulatory efficiency and market openness, and within this the variables trade freedom, monetary freedom, and investment freedom, and by extension; FDI. We hypothesize that the overall trend will show a positive relationship between economic freedom and economic well-being as measured by GDP per capita. This hypothesis operates off of the free market assumption that economies do best when they are left to run themselves. Thus,allowing trade, monetary, and investment to happen freely without regulations or interruption should result in the optimal economic conditions for countries.

The testing has been done using Ordinary Least Squares Method under Classical LinearRegression Model.

II. LITERATURE REVIEW

1) *Rajan Sudesh Ratna and Martina Francesca Ferracane:* According to them there is existingliterature on the contribution of trade facilitation to the enhancement of trade as well as to the promotion of GDP growth, welfare improvements and government revenue, all of which go a long way towards poverty reduction. However, the government role is found to be crucial in ensuring that the poor fully benefit from the increased trade opportunities.
2) *Frankel and Romer (1999):* Study provides some strong evidence in favour of the relationship between trade and growth while investigating whether the correlation between openness and growth was because openness causes growth, or because countries that grow faster tend to openup at the same time. Controlling the component of the openness due to such country characteristics as population, land area, and geographic distance that cannot be influenced by economic growth, they found that an increase of one percentage point in the openness ratio increased both the level of income and subsequent growth by around 0.5 per cent.

3) *Nguyen Viet Cuong:* The findings show that improvement in trade facilitation is positively correlated with exports and per capita GDP, and negatively correlated with poverty and inequality. More specifically, deterioration in trade facilitation – which is measured by the increase in the number of documents required and days taken for exporting and importing a good– can reduce per capita GDP, albeit to a small amount. Countries requiring a larger number ofdocuments and more time for imports and exports tend to have higher levels of poverty and inequality (measured by the Gini index) than other countries.
4) *Prabir De and Ajitava Raychaudhuri:* The study reveals that there are many opportunities forthe poor and microenterprises to benefit from trade facilitation measures in Mukdahan and Nakhon Phanom provinces, especially in the agricultural, services and investment sectors. There is growing demand in Viet Nam and China for agricultural products, especially organic rice, tapioca, rubber, sugar and fresh fruit. Farmers and agricultural employees in the two provinces can benefit more now from trade facilitation measures by harvesting and exporting such agricultural products to Viet Nam and China via the improved road infrastructure.

III. DEPENDENT VARIABLE – GDP PER CAPITA(BILLION USD)

GDP stands for "Gross Domestic Product" and represents the total monetary value of all finalgoods and services produced within a country during a period of time.

GDP is the most commonly used measure of economic activity. GDP as an economic indicator is used worldwide to show the economic health of a country. For low-income or middle-income countries, high year-on-year GDP growth is essential to meet the growing needs of the population. Hence, the GDP growth rate of India is an essential indicator of the country's economic development and progress. Besides measuring the health of the economy and helping the government in framing policies, the GDP growth rate numbers are also useful for investors inbetter decision-making related to investments

A. GDP per Capita

Per capita income is national income divided by population size. Per capita income is often used to measure a sector's average income and compare the wealth of different populations. Per capitaincome is often used to measure a country's standard of living. Per capita GDP is a global measure for gauging the prosperity of nations and is used by economists, along with GDP, to analyze the prosperity of a country based on its economic growth.

Small, rich countries and more developed industrial countries tend to have the highest per capitaGDP. per capita GDP shows how much economic production value can be attributed to each individual citizen. Alternatively, this translates to a measure of national wealth since GDP market value per person also readily serves as a prosperity measure.

IV. INDEPENDENT VARIABLE – TRADE FREEDOMINDEX

Trade freedom is a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. It measures the extent of tariff and nontariff barriers that affect imports and exports of goods and services and is calculated based on trade-weighted average tariff rate and rate of non-tariff barriers. An index of economic freedom measures jurisdictions against each other in terms of trade freedom, tax burden, judicial effectiveness, andso on.

Free and open trade has fueled vibrant competition, innovation, and economies of scale, allowingindividuals and businesses to take advantage of lower prices and increased choice

International trade has occurred since the earliest civilisations began trading, but in recent years international trade has become increasingly important with a larger share of GDP devoted to exports and imports. International trade between different countries is an important factor in raising living standards, providing employment and enabling consumers to enjoy a greater variety of goods.

V. INDEPENDENT VARIABLE –MONETARY FREEDOMINDEX

Monetary freedom combines a measure of price stability with an assessment of price controls. Both inflation and price controls distort market activity. Price stability without microeconomicintervention is the ideal state for the free market.

This variable is measured on a scale from 0-100 with 100 indicating a perfectly free market and 0 indicating a completely regulated or unfree market. The score for the monetary freedom component is based on two factors: The weighted average inflation rate for the most recent threeyears and Price controls. Higher index values denote price stability without microeconomic intervention.

As a vital component of human dignity, autonomy, and personal empowerment, economic freedom is valuable as an end itself. Just as important, however, is the fact that monetary freedom provides a proven formula for economic progress and success. Policies that allowgreater freedom in these areas measured tend to spur growth.

VI. INDEPENDENT VARIABLE – INVESTMENT FREEDOMINDEX

Investment freedom refers to constraints associated with the flow of investment capital within a country. It is generated as a composite of a nation's treatment or screening of foreign investment,foreign investment code, restrictions on land ownership, capital controls, and other factors related to investment. This variable is measured on a scale from 0-100 with 100 indicating a perfectly free market and 0 indicating a completely regulated or unfree market.

A country having freedom from restrictions on the movement and use of investment capital, regardless of activity, within and across the country's borders, & where individuals and firms would be allowed to move their resources into and out of specific activities, both internally and across the country's borders, without restriction. Such an ideal country would receive a score of 100 on the investment freedom component of the Index of Economic Freedom.

In practice, most countries have a variety of restrictions on investment; restrict access to foreign exchange; impose restrictions on payments, transfers, and capital transactions.

VII. DUMMY VARIABLE – FOREIGN DIRECTINVESTMENT

Foreign direct investment (FDI) is an investment from a party in one country into a business or corporation in another country with the intention of establishing a lasting interest. Lasting interest differentiates FDI from foreign portfolio investments, where investors passively hold securities from a foreign country. A foreign direct investment can be made by obtaining a lasting interest or by expanding one's business into a foreign country.

Foreign direct investment offers advantages to both the investor and the foreign host country. These incentives encourage both parties to engage in and allow FDI.

Foreign Direct Investment (FDI) has been a major non-debt financial resource for the economic development of India. Foreign companies invest in India to take advantage of relatively lower wages, special investment privileges like tax exemptions, etc. For a country where foreign investment is being made, it also means achieving technical know-how and generating employment.

The Indian Government's favourable policy regime and robust business environment has ensuredthat foreign capital keeps flowing into the country. The Government has taken many initiatives in recent years such as relaxing FDI norms across sectors such as defense, PSU oil refineries, telecom, power exchanges, and stock exchanges, among others.

VIII. EMPIRICAL ANALYSIS

A. Objective

To determine the impact of India's Trade Freedom, Monetary Freedom, InvestmentFreedom, and Foreign Direct Investment on its GDP per capita (billion USD).

B. Data Source

Secondary data has been collected for all the variables from 1995-2020.Following are the sources of the data:

1) The Heritage Foundation's Index of Economic Freedom
2) The World Bank

C. Methodology and Results

Multiple Linear Regression, Double Log Regression, Dummy Variable and Interactive DummyVariable Regression using Ordinary Least Squares Method under the assumptions of Classical Linear Regression Model.

Linear Model

One Dependent And Three Explanatory VariablesMultiple Linear Regression Model

➢ *Interpretation*

Effect of India's Trade Freedom, Monetary Freedom, and Investment Freedom on its GDP percapita (billion USD)

Y: GDP per capita (billion USD) X_{2i} : Trade Freedom (index)
X_{3i} : Monetary Freedom (index) X_{4i} : Investment Freedom (index)

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$$Y = \beta_1 + \beta_2X_{2i} + \beta_3X_{3i} + \beta_4X_{4i} + u_i ,$$

(where β_2, β_3, β_4 are the parameters and u_i is the random error term)

β_1 is the mean value of GDP per capita when there is no Trade, Monetary and InvestmentFreedom

β_2, β_3, and β_4 are the partial slope coefficients of mean GDP per capita w.r.t Trade, Monetary andInvestment Freedom

Estimated equation

$$Y^{\wedge} \text{(Y Hat)} = b_1 + b_2X_{2i} + b_3X_{3i} + b_4X_{4i},$$

(where b_1, b_2, b_3, and b_4 are estimators of β_1, β_2 and β_3, β_4 respectively)

- *Apriori Expectations of Partial Coefficients*

Here, apriori expectations of β_2 are positive as increases in trade freedom result in correspondingincreases in GDP per capita, due to higher trade in goods and services with other countries.

Apriori expectations of β_3 is positive since higher monetary freedom leads to price stability, thusencouraging savings and investment, hence leading to a higher per capita GDP.

Apriori expectations of β_4 is positive because higher is the investment freedom, higher would bethe investment in the country by residents and foreigners, hence greater would be the GDP per capita.

- *Running the Regression by OLS method:*

Model 1: OLS, using observations 1995-2020 (T = 26)Dependent variable: GDPPERCAPITAUSD

	Coefficient	Std. Error	t-ratio	p-value	
Const	−3998.06	810.534	−4.933	<0.0001	***
TRADEFREEDOM	101.152	11.1091	9.105	<0.0001	***
MONETARYFREEDOM	−29.6823	12.8667	−2.307	0.0309	**
INVESTMENTFREEDOM	6.49479	7.04364	0.9221	0.3665	

Mean dependent var	1070.181	S.D. dependent var	597.2691
Sum squared resid	1199325	S.E. of regression	233.4840
R-squared	0.865520	Adjusted R-squared	0.847182
F(3, 22)	47.19782	P-value(F)	9.42e-10
Ln-likelihood	−176.5016	Akaike criterion	361.0033
Schwarz criterion	366.0357	Hannan-Quinn	362.4524
Rho	0.857601	Durbin-Watson	0.358754

$$\boxed{\mathbf{Y^{\wedge} \text{ (Y Hat)} = -3998.06 + 101.152X_{2i} - 29.6823X_{3i} + 6.49479\ X_{4i}}}$$

According to the regression run by OLS method, it can be seen that the estimated coefficients are:$b_1 = -3998.06$

$b_2 = 101.152$

$b_3 = -29.6823$

$b_4 = 6.49479$

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According to this estimated model, if there is no Trade, Monetary & Investment freedom in India, then the estimated mean value of India's Per Capita GDP (in billion USD) is $b_1 = -3998.06$

b_2 is positive implies that as India's Trade Freedom (index) increases by 1 unit, the estimated mean value of its per capita GDP increases by 101.152 billion USD, holding everything else constant

b_3 is negative implying that as India's Monetary Freedom (index) increases by 1 unit, the estimated mean value of its per capita GDP decreases by 29.6823 billion USD , holding everything else constant. *This does not conform to our apriori expectations of β_3 being positive, possibly because of some CLRM assumptions not being satisfied.*

b_4 is positive implies that as India's Investment Freedom (index) increases by 1 unit, the estimated mean value of its per capita GDP increases by 6.49479 billion USD, holding everything else constant

R^2 value (overall goodness of fit measure) of 0.865520 means that 86.552% of total variation in the India's GDP per capita around its mean value is explained by India's Trade, Monetary and Investmentfreedom together.

➢ *t-Testing of b_2 and b_3*

H_o: $\beta_2 = 0$; $\beta_3 = 0$; $\beta_4 = 0$ H_a: $\beta_2 > 0$; $\beta_3 > 0$; $\beta_4 > 0$

Assuming that b_1, b_2 and b_3, b_4, u_i all follow approx. normal distribution with mean β_1, β_2 and β_3,β_4, and 0 respectively:

At 5% Level of Significance

- For β_2: As the t ratio or t_{calc} (9.105) is greater than the $t_{critical,0.05,22}$ (1.717), we reject H_o at5% Level Of Significance (or β_2 is statistically significant at 5% LOS).
- For β_3: As the t ratio or t_{calc} (−2.307) is less than the $t_{critical,0.05,22}$ (-1.717), we reject H_o at5% Level Of Significance (or β_3 is statistically significant at 5% LOS).
- For β_4: As the t ratio or t_{calc} (0.9221) is less than the $t_{critical,0.05,22}$ (1.717), we fail to reject H_o at 5% Level Of Significance (or β_4 is statistically insignificant at 5% LOS).

At 10% Level of Significance

- For β_2: As the t ratio or t_{calc} (9.105) is greater than the $t_{critical,0.10,22}$ (1.321), we reject H_o at10% Level Of Significance (or β_2 is statistically significant at 10% LOS).
- For β_3: As the t ratio or t_{calc} (−2.307) is less than the $t_{critical,0.10,22}$ (-1.321), we reject H_o at10% Level Of Significance (or β_3 is statistically significant at 10% LOS).
- For β_4: As the t ratio or t_{calc} (0.9221) is less than the $t_{critical,0.10,22}$ (1.321), we fail to reject H_o at 10% Level Of Significance (or β_4 is statistically insignificant at 10% LOS).

➢ *Comparing p-value and α*

H_o: $\beta_2 = 0$; $\beta_3 = 0$; $\beta_4 = 0$ H_a: $\beta_2 > 0$; $\beta_3 > 0$; $\beta_4 > 0$

When p value ≤ α ; we reject H_o When p value > α ; we fail to reject H_o

When α is 5%

- β_1 is statistically significant as its p-value $6.20e^{-05}$ (0.04177) is less than 5% α or(0.04177) ≤ 0.05.
- β_2 is statistically significant as its p-value $6.46e^{-09}$ (7.97×10^{-4}) is less than 5% α or 0.0007≤ 0.05
- β_3 is statistically significant as its p-value is less than 5% α or (0.0309) ≤ 0.05
- β_4 is statistically insignificant as its p-value is greater than 5% α or (0.3665) > 0.05

When α is 10%

- β_1 is statistically significant as its p-value $6.20e^{-05}$ (0.04177) is less than 10% α or(0.04177) ≤ 0.1.
- β_2 is statistically significant as its p-value $6.46e^{-09}$ (7.97×10^{-4}) is less than 10% α or0.0007 ≤ 0.1.
- β_3 is statistically significant as its p-value is less than 10% α or (0.0309) ≤ 0.1
- β_4 is statistically insignificant as its p-value is greater than 10% α or (0.3665) > 0.1

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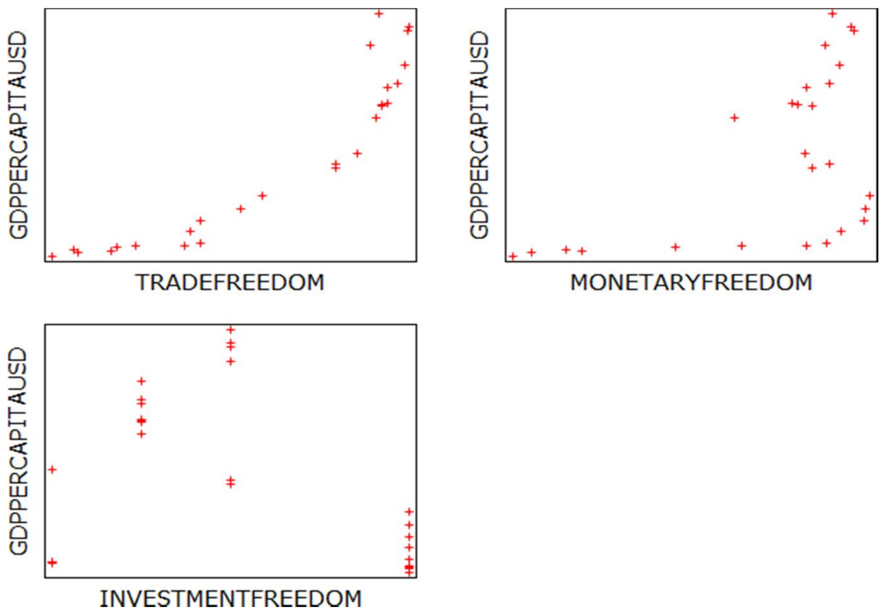
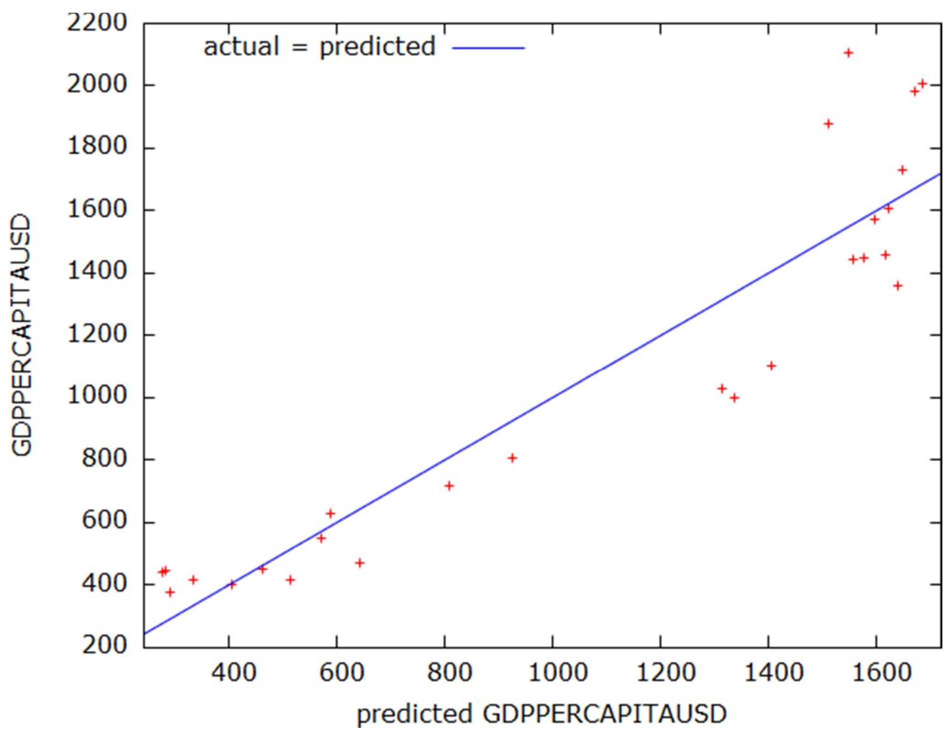
According to both t testing and p-value testing, it is evident that β_1, β_2 and β_3, are statistically significant and β_4 *is* statistically insignificant at both 5% and 10% LOS

Scatter Plot of X2, X3 and Y



Actual vs. Fitted Graph



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- *ANOVA Table*

Analysis of Variance:

	Sum of squares	df	Mean square
Regression	7.71893e+006	3	2.57298e+006
Residual	1.19932e+006	22	54514.8
Total	8.91826e+006	25	356730

R^2 = 7.71893e+006 / 8.91826e+006 = 0.865520
F(3, 22) = 2.57298e+006 / 54514.8 = 47.1978 [p-value 9.42e-010]
To check if this model is significant or not:

Test Statistic = 47.1978
When α is 5%
Critical Values: $F_{0.05,3,22} = 3.05$

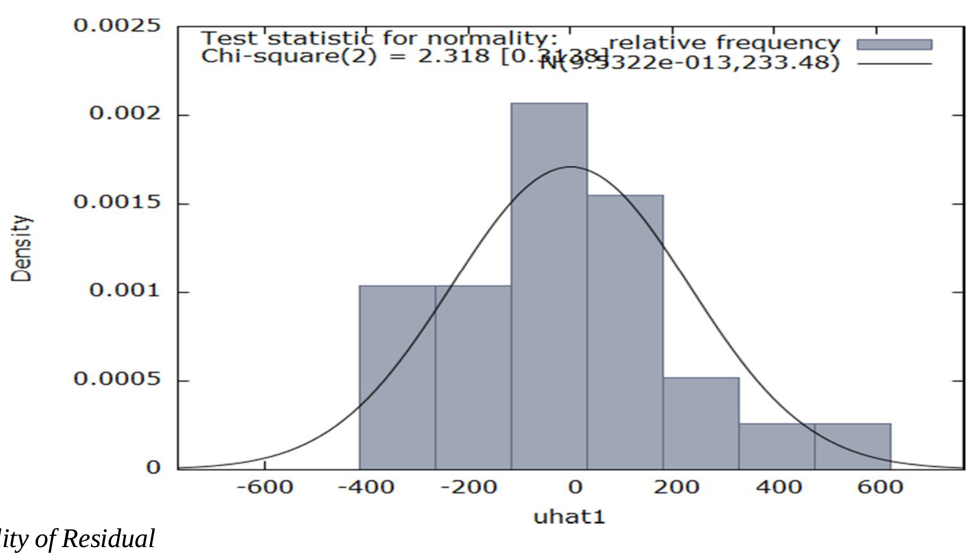
H_0: $R^2 = 0$ H_a: $R^2 > 0$
As Test Statistic value is greater than the Critical Value, it lies in the rejection region. Hence we reject H_0 at 5% LOS.

Model is significant at 5% LOS.

When α is 10%
Critical Values: $F_{0.1,3,22} = 2.35$
As Test Statistic value is greater than the Critical Value, it lies in the rejection region. Hence we reject H_0 at 10% LOS.

Model is significant at 10% LOS.

Normality of Residual



- *Test for Normality of Residual*

H_0 : u_i is normally distributed H_a : u_i is not normally distributed
Chi-square(2) = 2.318 with p-value 0.31385
When α is 5%
Since p-value (0.31385) is greater than α (0.05), we fail to reject H_0 at 5% LOS. This means that error terms are normally distributed at 5% LOS.

When α is 10%
Since p-value (0.31385) is greater than α (0.1), we fail to reject H_0 at 10% LOS. This means that error terms are normally distributed at 10% LOS.

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Testing For Heteroscedasticity

- *BP Test*

Breusch-Pagan test for heteroskedasticity OLS, using observations 1995-2020 (T = 26)Dependent variable: scaled uhat^2

	coefficient	std. error	t-ratio	p-value	
const	−5.48372	4.90202	−1.119	0.2753	
TRADEFREEDOM	0.118478	0.0671869	1.763	0.0917	*
MONETARYFREEDOM	−0.0309425	0.0778167	−0.3976	0.6947	
INVESTMENTFREEDOM	0.0142674	0.0425992	0.3349	0.7409	

Explained sum of squares = 10.312Test statistic: LM = 5.156023,
with p-value = P(Chi-square(3) > 5.156023) = 0.160722

When α is 5%
Ho : $R^2_{aux} = 0$
Ha : $R^2_{aux} > 0$

As nR^2_{aux} (Test statistic: LM = 5.156023) is less than $\chi^2_{0.05, 3}$ (7.8147), we fail to reject Ho at 5% LOS

Thus there is no evidence of heteroscedasticity in the model at 5% LOS

When α is 10%
As nR^2_{aux} (Test statistic: LM = 5.156023) is less than $\chi^2_{0.1, 3}$ (6.2514), we fail to reject Ho at 10% LOS

Thus there is no evidence of heteroscedasticity in the model at 10% LOS

- *White's Test*

White's test for heteroskedasticity
OLS, using observations 1995-2020 (T = 26)
Dependent variable: uhat^2

	coefficient	std. error	t-ratio	p-value
const	−1.80930e+06	7.11417e+06	−0.2543	0.8025
TRADEFREEDOM	18305.1	154558	0.1184	0.9072
MONETARYFREEDOM	42002.6	232144	0.1809	0.8587
INVESTMENTFREEDOM	−15703.4	97645.4	−0.1608	0.8742
sq_TRADEFREEDOM	−1021.17	1485.88	−0.6873	0.5018
X2_X3	1190.19	2233.87	0.5328	0.6015
X2_X4	1056.79	1025.39	1.031	0.3180
sq_MONETARYFREED~	−794.184	1975.38	−0.4020	0.6930
X3_X4	−386.702	1051.25	−0.3678	0.7178
sq_INVESTMENTFRE~	−290.749	945.516	−0.3075	0.7624

Unadjusted R-squared = 0.428191

Test statistic: TR^2 = 11.132958,

with p-value = P(Chi-square(9) > 11.132958) = 0.266705

When α is 5%

Ho : $R^2_{aux} = 0$

Ha : $R^2_{aux} > 0$

As nR^2_{aux} (Test statistic: TR^2 = 11.132958) is less than $\chi^2_{0.05,9}$ (16.919), we fail to reject Ho at 5% LOS

Thus there is no evidence of heteroscedasticity in the model at 5% LOS

When α is 10%

As nR^2_{aux} (Test statistic: TR^2 = 11.132958) is less than $\chi^2_{0.1,9}$ (14.6837), we fail to reject Ho at 10% LOS

Thus there is no evidence of heteroscedasticity in the model at 10% LOS

Hence both BP and White's Test show no heteroscedasticity in the model at 5% & 10% LOS

- *BG Test*

Testing for Autocorrelation

Breusch-Godfrey test for first-order autocorrelationOLS, using observations 1995-2020 (T = 26)

Dependent variable: uhat

	coefficient	std. error	t-ratio	p-value	
const	171.967	475.196	0.3619	0.7211	
TRADEFREEDOM	2.79461	6.51703	0.4288	0.6724	
MONETARYFREEDOM	−3.34293	7.54917	−0.4428	0.6624	
INVESTMENTFREEDOM	−2.69740	4.14363	−0.6510	0.5221	
uhat_1	0.883187	0.134372	6.573	1.65e-06	***

Unadjusted R-squared = 0.672899

Test statistic: LMF = 43.200294,

with p-value = P(F(1,21) > 43.2003) = 1.65e-006

When α is 5%

Ho: There is no autocorrelation in the modelHa: There is autocorrelation in the model

As $(n-p)R^2_{aux}$ (Test statistic: LMF = 43.200294) is greater than $\chi^2_{0.05,1}$ (3.8415), we reject Ho at 5% LOS

Thus there is evidence of autocorrelation in the model at 5% LOS

When α is 10%

As $(n-p)R^2_{aux}$ (Test statistic: LMF = 43.200294) is greater than $\chi^2_{0.1,1}$ (2.7055), we reject Ho at 5% LOS

Thus there is evidence of autocorrelation in the model at 10% LOS

BG Test shows evidence of autocorrelation in the model at 5% and 10% LOS. This may be a possible reason for nonconformity of b_4 with its apriori expectation

- *Durbin-Watson Test*

Durbin-Watson statistic 0.358754

H_0 : No positive auto-correlation H_0' : No negative auto-correlation

At alpha = 0.05, n=26, $k' = 3$, $d_L = 1.143$, $d_u = 1.652$

As, **0 < Sample calculated d test statistic = 0.358754 < d_L** , therefore we reject H_0 i.e. there is evidence of positive auto-correlation.

This could be a possible reason for non-conformity of estimated coeffecient (β_4) with our apriori expectations.

Testing for Multicollinearity

Variance Inflation Factors Minimum possible value = 1.0

Values > 10.0 may indicate a collinearity problem

TRADEFREEDOM	2.562
MONETARYFREEDOM	2.103
INVESTMENTFREEDOM	1.334

VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficientbetween variable j and the other independent variables

Since none of the VIF's are > 10, there is no evidence of Multicollinearity in the estimated model

- *Correlation Matrix*

Correlation coefficients, using the observations 1995 - 20205% critical value (two-tailed) = 0.3882 for n = 26

GDPPERCAPITAUSD	TRADEFREEDOM	MONETARYFREEDOM	INVESTMENTFREEDOM	
1.0000	0.9115	0.5340	-0.4010	GDPPERCAPITAUSD
	1.0000	0.7173	-0.4848	TRADEFREEDOM
		1.0000	-0.2606	MONETARYFREEDOM
			1.0000	INVESTMENTFREEDOM

- *Confidence Intervals for Coefficients*

t(22, 0.025) = 2.074

Variable	Coefficient	95 confidence interval
const	-3998.06	(-5679.00, -2317.11)
TRADEFREEDOM	101.152	(78.1130, 124.191)
MONETARYFREEDOM	-29.6823	(-56.3663, -2.99831)
INVESTMENTFREEDOM	6.49479	(-8.11283, 21.1024)

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- *Extension*

Restricted vs. Unrestricted

Restricted Model: $Y = \beta_1 + \beta_2 X_{2i} + u_i$ ($R^2_r = 0.830801$)

Unrestricted Model: $Y = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + u_i$ ($R^2_{ur} = 0.865520$)

(m is number of restrictions imposed = 2)

Ho: $\beta_3 = \beta_4 = 0$

Ha: At least one of either β_3 or $\beta_4 \neq 0$

$$f_{calc} = \frac{(R^2_{ur} - R^2_r)/m}{(1 - R^2_{ur})/(n-k)} = 2.845$$

When α is 5%: As f_{calc} is less than $f_{crit\ 0.05,\ 2,\ 22}$ (3.44), we fail to reject Ho at 5% LOS *Restrictions imposed are valid at 5% LOS.* *When α is 10%*: As f_{calc} is greater than $f_{crit\ 0.1,\ 2,\ 22}$ (2.56), we reject Ho at 5% LOS *Restrictions imposed are not valid at 10% LOS.*

The restricted model has both lower Schwartz criterion and Akaike criterion than the unrestrictedmodel, therefore, we can conclude that restricted model is better.

Linear Model

One Dependent And Three Explanatory VariablesFunctional Forms: Double Log Model

- *Interpretation*
  - Effect of log Trade freedom, log monetary freedom and log investment freedom on log of GDPper capita

Y: GDP per capita (billion USD) X_{2i} : Trade Freedom (index)

X_{3i} : Monetary Freedom (index) X_{4i} : Investment Freedom (index)

$$\ln Y = \beta_1 + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + u_i$$

(where β_2, β_3, β_4 are the parameters and u_i is the random error term)

β_1 is the mean value of ln GDP per capita when Trade, Monetary and Investment Freedom are all1.

β_2 is the elasticity of GDP per capita with respect to trade freedom, holding other variablesconstant.

β_3 is the elasticity of GDP per capita with respect to monetary freedom, holding other variablesconstant.

β_4 is the elasticity of GDP per capita with respect to investment freedom, holding other variablesconstant.

Estimated equation

$$\ln \hat{Y} \text{ (Y Hat)} = b_1 + b_2 \ln X_{2i} + b_3 \ln X_{3i} + b_4 \ln X_{4i},$$

(where b_1, b_2, b_3 and b_4 are estimators of β_1, β_2, β_3 and β_4 respectively).

- *Apriori Expectations of Partial Coefficients*

Here, apriori expectations of β_2 are positive, an increase in ln trade freedom results in corresponding increase in ln GDP per capita, due to higher trade in goods and services with othercountries.

Apriori expectations of β_3 is positive, an increase in ln monetary freedom leads to price stability, thus encouraging savings and investment, hence leading to a higher ln per capita GDP.

Apriori expectations of β_4 is positive because an increase in the ln investment freedom, higher would be the investment in the country by residents and foreigners, hence greater would be lnGDP per capita.

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- *Running the Regression by OLS method*

Model 1: OLS, using observations 1995-2020 (T = 26)Dependent variable: l_GDPPERCAPITAcurrentUS

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Const	−16.4788	2.03094	−8.114	<0.0001	***
l_TRADEFREEDOM	7.06879	0.480212	14.72	<0.0001	***
l_MONETARYFREEDOM	−1.74612	0.587367	−2.973	0.0070	***
l_INVESTMENTFREEDOM	0.240161	0.176585	1.360	0.1876	

Mean dependent var	6.804483	S.D. dependent var	0.616540
Sum squared resid	0.500334	S.E. of regression	0.150806
R-squared	0.947350	Adjusted R-squared	0.940171
F(3, 22)	131.9516	P-value(F)	3.25e-14
Ln-likelihood	14.46507	Akaike criterion	−20.93015
Schwarz criterion	−15.89776	Hannan-Quinn	−19.48100
Rho	0.643499	Durbin-Watson	0.742500

$$\mathbf{\hat{Y}\ (Y\ Hat) = -16.4788 + 7.06879X_{2i} - 1.74612X_{3i} + 0.24161X_{4i}}$$

According to the regression run by OLS method, it can be seen that the estimated coefficients are:b1 = −16.4788

b2 = 7.06879

b3 = −1.74612

b4= 0.240161

b1, Theoretically, when trade freedom, monetary freedom and investment freedom are all 1, then the estimated mean value of ln GDP per capita would be −16.4788 per USD. In the current, it is insignificant as India's Trade freedom, monetary freedom, and investment freedom have not beenzero in the last 25 years.

b2 is positive implying that an increase in the trade freedom will lead to an increase in per capita GDP. In other words, an increase in India's trade freedom by 1% leads to an increase in estimatedmean GDP per capita by 7.06879%, holding other factors constant.

b3 is negative implying that an increase in the monetary freedom will lead to a decrease in per capita GDP. In other words, an increase in India's monetary freedom by 1% will lead to a decrease in estimated mean GDP per capita by 1.74612%, holding other factors constant. *But thisdoes not conform to our apriori expectations of b3 possibly because of some CLRM assumptions not being satisfied.*

b4 is positive implying that an increase in the investment freedom will lead to an increase in per capita GDP. In other words, an increase in India's investment freedom by 1%, leads to an increase in estimated mean GDP per capita by 0.24161 %, holding other factors constant.

R^2 value (overall goodness of fit measure) of 0.947350 means that 94.73% of total variation inthe ln GDP per capita around its mean value is explained by ln trade freedom, ln monetary freedom and ln investment freedom together.

- t-Testing of b2 and b3

H_0: $\beta_2 = 0$; $\beta_3=0$; $\beta_4 = 0$ H_a: $\beta_2 > 0$; $\beta_3 > 0$; $\beta_4 > 0$

Assuming that b1, b2, b3 and b4 follow approx. normal distribution with mean β1, β2, β3 and β4respectively:

At 5% level of significance

- For β 2: As the t-ratio or t_{cal} = 14.72 is greater than $t_{critical,0.05,22}$ = 1.717, we reject H_0 at 5%level of significance (or data is statistically significant at 5% LOS).
- For β 3: As the t ratio or t_{calc} = -2.973 is less than $t_{critical,0.05,22}$ = -1.717, we reject H_0 at 5%level of significance (or data is statistically significant at 5% LOS).

- For β 4: As the t ratio or t_{calc} = -1.360 is greater than $t_{critical,0.05,22}$ = -1.717, we fail to reject H_0 at 5% level of significance (or data is statistically insignificant at 5% LOS).

At 10% level of significance

- For β 2: As the t-ratio or t_{cal} = 14.72 is greater than $t_{critical,0.10,22}$ = 1.321, we reject H_0 at 10% level of significance (or data is statistically significant at 10% LOS).
- For β 3: As the t ratio or t_{calc} = -2.973 is less than $t_{critical,0.10,22}$ = -1.321, we reject H_0 at 10% level of significance (or data is statistically significant at 10% LOS).
- For β 4: As the t ratio or t_{calc} = -1.360 is greater than $t_{critical,0.10,22}$ = -1.321, we reject H_0 at 10% level of significance (or data is statistically significant at 10% LOS).

➢ *Comparing p-value and α*

When α is 5%

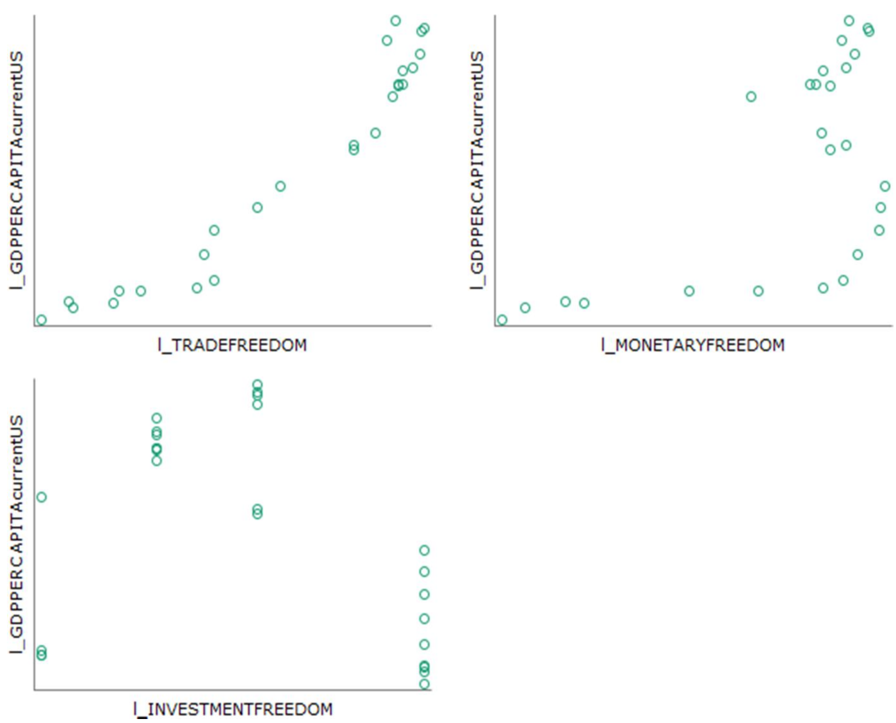
- β2 is statistically significant as its p-value $7.17e^{-013}$ (1.62×10^{-5}) is less than 5% α or (1.62×10^{-5}) ≤ 0.05.
- β3 is statistically significant as its p-value 0.0070 is less than 5% α or 0.0070 ≤ 0.05.
- β4 is statistically insignificant as its p-value 0.1876 is greater than 5% α or 0.1876 ≥ 0.05.

When α is 10%

- β2 is statistically significant as its p-value $7.17e^{-013}$ (1.62×10^{-5}) is less than 10% α or $1.62\times10^{-5} \leq 0.1$.
- β3 is statistically significant as its p-value 0.0070 is less than 10% α or 0.0070 ≤ 0.1
- β4 is statistically insignificant as its p-value 0.1876 is greater than 10% α or 0.1876 > 0.1

According to both t testing and p-value testing, it is evident that β_1, β_2 and β_3, are statistically significant and β_4 *is* statistically insignificant at both 5% and 10% LOS

Scatter Plot of X_2, X_3 and Y



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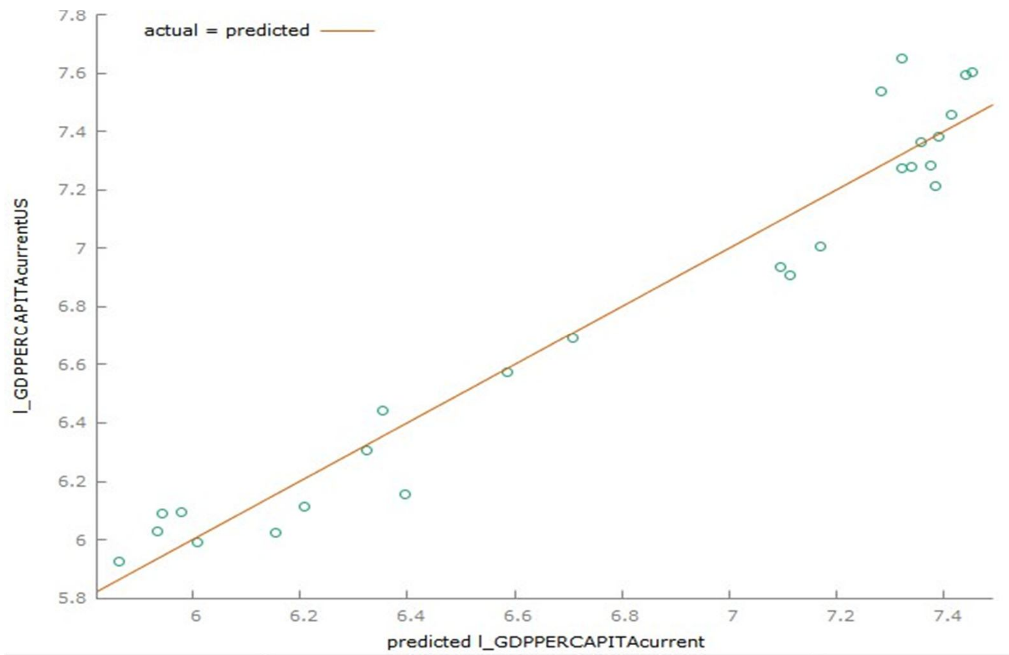
Actual vs. Fitted



- *Anova Table*

Analysis of Variance:

Sum of squares		df	Mean square
Regression	9.00272	3	3.00091
Residual	0.500334	22	0.0227425
Total	9.50305	25	0.380122

$R^2 = 9.00272 / 9.50305 = 0.947350$

$F(3, 22) = 3.00091 / 0.0227425 = 131.952$ [p-value 3.25e-014]

To check if the model is significant or not

Test Statistic= f=131.952

When α is 5%

Critical Values: $F_{0.05,3,22} = 3.05$

- $H_0 : R^2=0 \quad H_a : R^2>0$

As Test Statistic value is greater than the Critical Value, it lies in the rejection region. Hence we reject H_0 at 5% LOS.

Model is significant at 5% LOS.

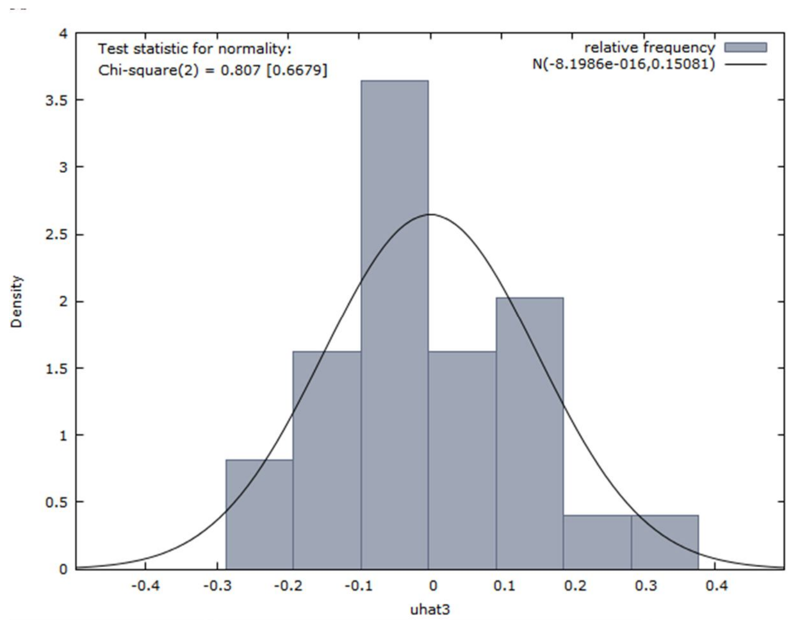
When α is 10%

Critical Values: $F_{0.1,3,22} = 2.35$

As Test Statistic value is greater than the Critical Value, it lies in the rejection region. Hence we reject H_0 at 10% LOS.

Model is significant at 10% LOS.

Normality of Residual



➢ *Test for Normality of Residual:*

H_0 : u_i is normally distributed

H_a : u_i is not normally distributed

Chi-square (2) = 0.807 with p-value 0.6679

When α is 5%

Since p-value (0.6679) is greater than α (0.05), we fail to reject H_0 at 5% LOS. This means that errorterms are normally distributed at 5% LOS.

When α is 10%

Since p-value (0.6679) is greater than α (0.1), we fail to reject H_0 at 10% LOS. This means that errorterms are normally distributed at 10% LOS.

Testing for Heteroscedasticity

It is possible that are model is suffering from heteroskedasticity as there are few statistical insignificantratios, as a result t test are unreliable.

➢ *Breush-Pagan Test*

Breusch-Pagan test for heteroskedasticity

OLS, using observations 1995-2020 (T = 26)

Dependent variable: scaled uhat^2

	coefficient	std. error	t-ratio	p-value
const	−16.5880	18.3590	−0.9035	0.3760
l_TRADEFREEDOM	3.37788	4.34097	0.7781	0.4448
l_MONETARYFREEDOM	0.272133	5.30961	0.05125	0.9596
l_INVESTMENTFREE~	0.582898	1.59627	0.3652	0.7185

Explained sum of squares = 2.63358

Test statistic: LM = 1.316791,

with p-value = P(Chi-square(3) > 1.316791) = 0.725150

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When α is 5%

H0: R^2_{aux} =0

Ha: R^2_{aux} >0

As nR^2_{aux} (Test statistic: LM = 1.316791) is less than $\chi^2_{0.05, 3}$ (7.8147), we fail to reject Ho at 5% LOS

Thus there is no evidence of heteroscedasticity in the model at 5% LOS

When α is 10%

As nR^2_{aux} (Test statistic: LM = 1.316791) is less than $\chi^2_{0.1, 3}$ (6.2514), we fail to reject Ho at 10% LOS

Thus there is no evidence of heteroscedasticity in the model at 10% LOS

- *White's General Test*

White's test for heteroskedasticity
OLS, using observations 1995-2020 (T = 26)
Dependent variable: uhat^2

	coefficient	std. error	t-ratio	p-value
const	−47.7713	48.0176	−0.9949	0.3346
l_TRADEFREEDOM	−1.80242	18.4971	−0.09744	0.9236
l_MONETARYFREEDOM	25.2109	26.4965	0.9515	0.3555
l_INVESTMENTFREE~	−1.18796	6.11119	−0.1944	0.8483
sq_l_TRADEFREEDOM	−1.53762	3.02609	−0.5081	0.6183
X2_X3	2.66111	4.54450	0.5856	0.5663
X2_X4	0.957254	1.03397	0.9258	0.3683
sq_l_MONETARYFRE~	−4.01616	3.86481	−1.039	0.3142
X3_X4	−0.639635	1.21299	−0.5273	0.6052
sq_l_INVESTMENTF~	−0.000732506	0.616480	−0.001188	0.9991

Unadjusted R-squared = 0.297537 Test statistic: TR^2 = 7.735972,
with p-value = P(Chi-square(9) > 7.735972) = 0.560957

When α is 5%

H0: R^2_{aux} =0

Ha: R^2_{aux} >0

As nR^2_{aux} (Test statistic: TR^2 = 7.73597) is less than $\chi^2_{0.05,9}$ (16.919), we fail to reject Ho at 5% LOS

Thus there is no evidence of heteroscedasticity in the model at 5% LOS

When α is 10%

As nR^2_{aux} (Test statistic: TR^2 = 7.73597) is less than $\chi^2_{0.1, 9}$ (14.6837), we fail to reject Ho at 10% LOS

Thus there is no evidence of heteroscedasticity in the model at 10% LOS

Hence both BP and White's Test show no heteroscedasticity in the model at 5% & 10% LOS

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Testing For Autocorrelation

There is possibility that the model is suffering from autocorrelation.

- *BG Test*

Breusch-Godfrey test for first-order autocorrelationOLS, using observations 1995-2020 (T = 26) Dependent variable: uhat

	coefficient	std. error	t-ratio	p-value	
const	0.0977565	1.65504	0.05907	0.9535	
l_TRADEFREEDOM	0.0119301	0.391289	0.03049	0.9760	
l_MONETARYFREEDOM	0.00190859	0.478584	0.003988	0.9969	
l_INVESTMENTFREE~	−0.0406852	0.144353	−0.2818	0.7808	
uhat_1	0.653370	0.187537	3.484	0.0022	***

Unadjusted R-squared = 0.366286

Test statistic: LMF = 12.137973,
with p-value = P(F(1,21) > 12.138) = 0.00221

- *Ho: There is no autocorrelation in the modelHa: There is autocorrelation in the model*

When α is 5%

As $(n-p)R^2_{aux}$ (Test statistic: LMF = 12.137973) is greater than $\chi^2_{0.05,1}$ (3.8415), we reject Ho at 5% LOS *Thus there is evidence of autocorrelation in the model at 5% LOS*

When α is 10%

As $(n-p)R^2_{aux}$ (Test statistic: LMF = 12.137973) is greater than $\chi^2_{0.1,1}$ (2.7055), we reject Ho at 5% LOS *Thus there is evidence of autocorrelation in the model at 10% LOS*

BG Test shows evidence of autocorrelation in the model at 5% and 10% LOS. This may be a possible reason for nonconformity of b_4 with its apriori expectation

- Durbin Watson Test

Durbin-Watson statistic = 0.7425p-value = 1.05318e-005

H_0 : No positive auto-correlation H_0' : No negative auto-correlation
At alpha = 0.05, n=26, $k' = 3$, d_L = 1.143, d_u = 1.652
As , 0 < Sample calculated d test statistic = 0.7425 < d_L , therefore we reject H_0 i.e. there is evidence ofpositive auto-correlation.

This could be a possible reason for non-conformity of estimated coeffecient (b_4) with our apriori expectations.

Testing For Multicollinearity

Variance Inflation Factors Minimum possible value = 1.0
Values > 10.0 may indicate a collinearity problem

l_TRADEFREEDOM	2.569
l_MONETARYFREEDOM	2.242
l_INVESTMENTFREEDOM	1.239

VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficientbetween variable j and the other independent variables

Since none of the VIF's are > 10, there is no evidence of Multicollinearity in the estimated model

- *Coefficient Covariance Matrix*

Const	l_TRADEFREEDOM	l_MONETARYFREEDOM	l_INVESTMENTFREEDOM	
4.12471	-0.217126	-0.575486	-0.201566	const
	0.230603	-0.203932	0.0313437	l_TRADEFREEDOM
		0.345000	-0.0107057	l_MONETARYFREEDOM
			0.0311822	l_INVESTMENTFREEDOM

- *Confidence Intervals for Coefficients*

t(22, 0.025) = 2.074

Variable	Coefficient	95 confidence interval
const	-16.4788	(-20.6907, -12.2668)
l_TRADEFREEDOM	7.06879	(6.07289, 8.06469)
l_MONETARYFREEDOM	-1.74612	(-2.96424, -0.527991)
l_INVESTMENTFREEDOM	0.240161	(-0.126054, 0.606375)

Dummy Model

One Dependent, Two Explanatory Variables And Two DummyVariables

- *Interpretation*

Effect of India's Trade Freedom, Monetary Freedom and level of Foreign Direct Investment onGDP per capita (USD) along with effect of Investment Freedom on GDP per capita (USD) by enacting structural break in data set for two different periods :1995-2007 and 2007-2020.

Y: GDP per capita (billion USD) X_{2i} : India's Trade Freedom (index)

X_{3i} : India's Investment Freedom (index)

D_{1i} = 1 if FDI (% of GDP) is ≥ 2%0 if FDI (% of GDP) is < 2%

D_{2i} = 1 for the time period 1995-20070 for the time period 2008-2020

$$Y = \beta_1 + \beta_2 X_{2i} + \beta_3 D_{1i} + \beta_4 D_{2i} X_{3i} + u_i$$

(where β_2, β_3, β_4 are the parameters and u_i is the random error term)

- Reference category: $\beta_1 = E(Y^\wedge|X=0, D_{1i} = 0 \text{ and } D_{2i} = 0)$ - The mean GDP per capita for the period 2008-2020 when India's trade freedom and investment freedom are zero and FDI(% ofGDP) is < 2%.
- Slope Coefficient : $\beta_2 = E(Y^\wedge|X=1, D_{1i} = 0 \text{ and } D_{2i} = 0)$ is the partial slope coefficients of mean GDP per capita w.r.t Trade Freedom.
- Differential Intercept Coefficient: $\beta_3 = E(Y^\wedge|X=0, D_{1i} = 1 \text{ and } D_{2i} = 0)$ is the difference between the mean GDP per capita when FDI(% of GDP) is greater than 2% as compared to the reference category, keeping everything constant.
- Differential Slope Coefficient: $\beta_4 = E(Y^\wedge|X=1, D_{1i} = 0 \text{ and } D_{2i} = 1)$, when India's investment freedom increases by 1 unit, the estimated mean GDP per capita for the period 1995-2007 is higher by β_4 units as compared to the estimated mean GDP per capita for the period 2007-2020,keeping everything else constant.

$$Y^\wedge \text{ (Y Hat)} = b_1 + b_2 X_{2i} + b_3 D_{1i}, + b_4 D_{2i} X_{3i}$$

(where b_1, b_2, b_3, b_4 and b_5 are estimators of β_1, β_2, β_3, β_4 and β_5 respectively).

➢ *Running the Regression by OLS method*

Model 2: OLS, using observations 1995-2020 (T = 26)Dependent variable: GDPPERCAPITAUSD

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Const	−3574.08	956.585	−3.736	0.0011	***
TRADEFREEDOM	70.2234	13.0030	5.401	<0.0001	***
DummyFDI	−274.899	107.342	−2.561	0.0178	**
DiInvFree	−5.43497	3.57790	−1.519	0.1430	

Mean dependent var	1070.181	S.D. dependent var	597.2691
Sum squared resid	1011109	S.E. of regression	214.3816
R-squared	0.886625	Adjusted R-squared	0.871165
F(3, 22)	57.34871	P-value(F)	1.46e-10
Ln-likelihood	−174.2824	Akaike criterion	356.5648
Schwarz criterion	361.5972	Hannan-Quinn	358.0139
Rho	0.638151	Durbin-Watson	0.686341

$$\boxed{Y^\wedge \text{ (Y Hat)} = -3574.08 + 70.2234 X_{2i} - 274.899\, D_{1i}, -5.43487 D_{2i} X_{3i}}$$

According to the regression run by OLS method, it can be seen that the estimated coefficients are:$b_1 = -3574.08$

$b_2 = 70.2234$

$b_3 = -274.899$

$b_4 = -5.43497$

b_1 in the current model is insignificant as India's trade freedom, investment freedom and FDI(%of GDP) have not been zero in the last 26 years.

b_2 is positive implying that an increase in India's trade freedom by 1 unit, leads to an increase inestimated mean GDP per capita by 70.2234 billion USD.

$b_3 = -274.899$ billion USD is the difference between the mean GDP per capita when FDI(% ofGDP) is greater than 2% as compared to the reference category, keeping everything constant.

b_4, when India's investment freedom increases by 1 unit, the estimated mean GDP per capita for the period 1995-2007 is less by 5.43497 billion USD as compared to the estimated mean GDP percapita for the period 2007-2020, keeping everything else constant. *But this does not confirm to our apriori expectations of b_2 possibly because of some CLRM assumptions not being satisfied.*

R^2 value (overall goodness of fit measure) of 0.886625 means that 88.6625 % of total variationin estimated GDP per capita around its mean value is explained by Trade freedom, Investment freedom and FDI(% of GDP)

- *t-Testing of b2 and b3*

Assuming that b1, b2 and b3 follow approx. normal distribution with mean β1, β2 and β3respectively:

At 5 % level of significance

- For β2: As the t ratio or t_{calc} = 5.401 is greater than the $t_{critical,0.05,22}$ = 1.717, we reject H_0 at5% level of significance (or β2 is statistically significant at 5% level of significance).
- For β3: As the t ratio or t_{calc} = −2.561 is less than the $t_{critical,0.05,22}$ = -1.717, we reject H_0 at5% level of significance (or β3 is statistically significant at 5% level of significance).
- For β4: As the t ratio or t_{calc} = −1.519 is less than the $t_{critical,0.05,22}$ = -1.717, we fail to rejectH_0 at 5% level of significance (or β4 is statistically insignificant at 5% level of significance).

At 10% level of significance

- For β 2: As the t ratio or t_{calc} = 5.401 is greater than the $t_{critical,0.05,22}$ = 1.321, we reject H_0 at5% level of significance (or β2 is statistically significant at 5% level of significance).
- For β 3: As the t ratio or t_{calc} = −2.561 is less than the $t_{critical,0.05,22}$ = -1.321, we reject H_0 at5% level of significance (or β3 is statistically significant at 5% level of significance).
- For β 4: As the t ratio or t_{calc} = −1.519 is more than the $t_{critical,0.05,22}$ = -1.321, we reject H_0 at5% level of significance (or β4 is statistically significant at 5% level of significance).

- Comparing p-value and α

When α is 5%

- β1 is statistically significant as its p-value 0.0011 is less than 5% α or(0.0011) ≤ 0.05.
- β2 is statistically significant as its p-value <0.0001 is less than 5% α or <0.0001 ≤ 0.05
- β3 is statistically significant as its p-value 0.0178 is less than 5% α or (0.0178) ≤ 0.05
- β4 is statistically insignificant as its p-value 0.1430 is greater than 5% α or (0.1430) >0.05

When α is 10%

- β1 is statistically significant as its p-value 0.0011 is less than 10% α or(0.0011) ≤ 0.1.
- β2 is statistically significant as its p-value <0.0001 is less than 10% α or <0.0001 ≤ 0.1.
- β3 is statistically significant as its p-value 0.0178 is less than 10% α or (0.0178) ≤ 0.1
- β4 is statistically insignificant as its p-value 0.1430 is greater than 10% α or (0.1430) >0.1

According to t testing, it is evident that β_1, β_2 and β_3, are statistically significant at both 5% and 10% LOS and β_4 *is* statistically insignificant at 5% and significant at 10%

Accordint to p value, it is evident that β_1, β_2 and β_3 are statistically significant and β_4 *is* statistically insignificant at both 5% and 10% LOS.

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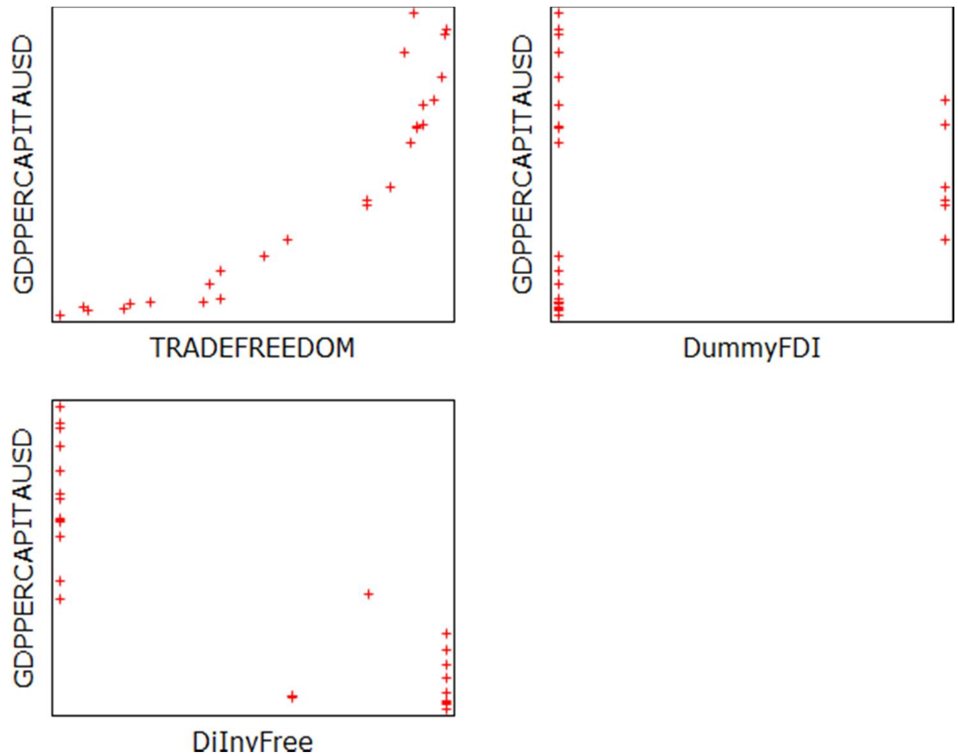
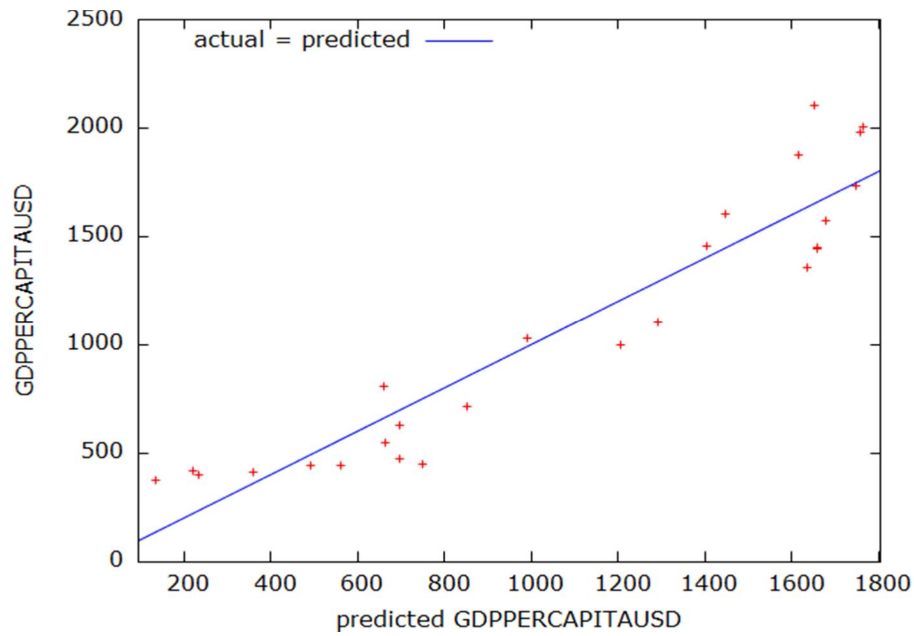
Scatter Plot of X2, X3 and Y



Actual vs. Fitted Graph



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- *Anova Table*

Analysis of Variance:

	Sum of squares	df	Mean square
Regression	7.90715e+006	3	2.63572e+006
Residual	1.01111e+006	22	45959.5
Total	8.91826e+006	25	356730

R^2 = 7.90715e+006 / 8.91826e+006 = 0.886625
F(3, 22) = 2.63572e+006 / 45959.5 = 57.3487 [p-value 1.46e-010]

To check if this model is significant or not:

Test Statistic = 57.3487
When α is 5%
Critical Values: $F_{0.05,3,22} = 3.05$

- H_0: $R^2 = 0$ H_a: $R^2 > 0$

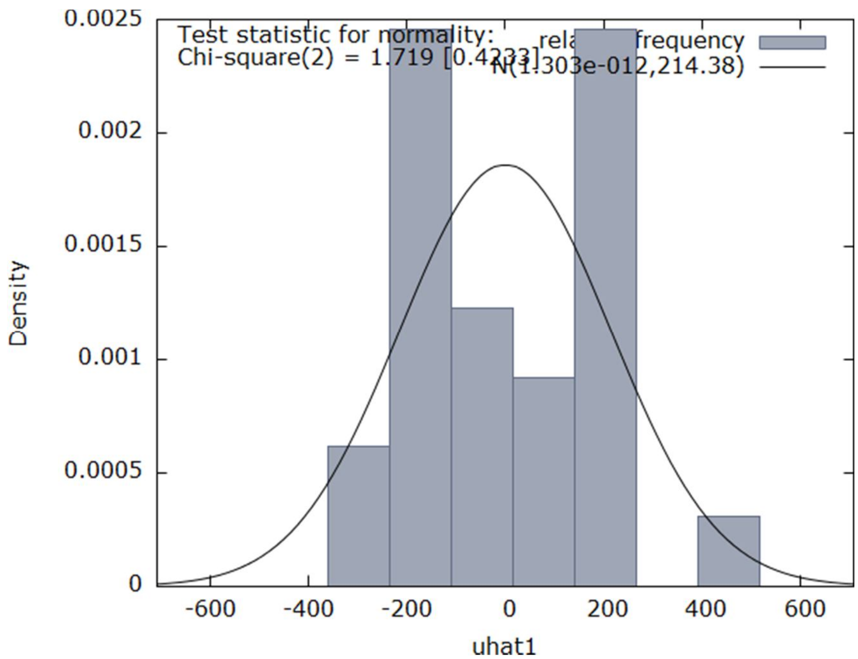
As Test Statistic value is greater than the Critical Value, it lies in the rejection region. Hence we reject H_0 at 5% LOS.

Model is significant at 5% LOS.

When α is 10%
Critical Values: $F_{0.1,3,22} = 2.35$
As Test Statistic value is greater than the Critical Value, it lies in the rejection region. Hence we reject H_0 at 10% LOS.

Model is significant at 10% LOS.

Normality of Residual



- *Test for Normality of Residual:*

H_0 : u_i is normally distributed H_a : u_i is not normally distributed

Chi-square(2) = 1.719 with p-value 0.4233

When α is 5%

Since p-value (0.4233) is greater than α (0.05), we fail to reject H_0 at 5% LOS. This means that errorterms are normally distributed at 5% LOS.

When α is 10%

Since p-value (0.4233) is greater than α (0.1), we fail to reject H_0 at 10% LOS. This means that errorterms are normally distributed at 10% LOS.

Testing for Heteroscedasticity

It is possible that are model is suffering from heteroskedasticity as there are few statistical insignificantratios, as a result t test are unreliable.

- *Breusch-Pagan Test*

Breusch-Pagan test for heteroskedasticity OLS, using observations 1995-2020 (T = 26)Dependent variable: scaled uhat^2

	coefficient	std. error	t-ratio	p-value
const	1.75129	4.71488	0.3714	0.7139
TRADEFREEDOM	−0.00295394	0.0640899	−0.04609	0.9637
DummyFDI	−0.721107	0.529072	−1.363	0.1867
DiInvFree	−0.0171132	0.0176350	−0.9704	0.3424

Explained sum of squares = 5.14258Test statistic: LM = 2.571289,

with p-value = P(Chi-square(3) > 2.571289) = 0.462545

$$Ho : R^2_{aux} = 0$$
$$Ha : R^2_{aux} > 0$$

When α is 5%

As nR^2_{aux} (Test statistic: LM = 2.571289) is less than $\chi^2_{0.05,3}$ (7.8147), we fail to reject Ho at 5% LOS

Thus there is no evidence of heteroscedasticity in the model at 5% LOS

When α is 10%

As nR^2_{aux} (Test statistic: LM = 2.571289) is less than $\chi^2_{0.1,\,3}$ (6.2514), we fail to reject Ho at 10% LOS

Thus there is no evidence of heteroscedasticity in the model at 10% LOS

- *White's Test*

White's test for heteroskedasticity

OLS, using observations 1995-2020 (T = 26)

Dependent variable: uhat^2

	coefficient	std. error	t-ratio	p-value
const	−5.19205e+06	6.92426e+06	−0.7498	0.4636
TRADEFREEDOM	155024	187131	0.8284	0.4189
DummyFDI	−649578	1.74311e+06	−0.3727	0.7140
DiInvFree	18983.1	56614.6	0.3353	0.7415
sq_TRADEFREEDOM	−1133.10	1275.77	−0.8882	0.3868
X2_X3	8157.61	23388.7	0.3488	0.7315

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X2_X4	−324.652	692.187	−0.4690	0.6450
X3_X4	2737.37	3394.07	0.8065	0.4311
sq_DiInvFree	13.6848	187.439	0.07301	0.9427

Unadjusted R-squared = 0.252721Test statistic: TR^2 = 6.570747,
with p-value = P(Chi-square(8) > 6.570747) = 0.583571

$$\mathbf{Ho : R^2_{aux} = 0}$$
$$\mathbf{Ha : R^2_{aux} > 0}$$

When α is 5%

As nR^2_{aux} (Test statistic: TR^2 = 6.570747) is less than $\chi^2_{0.05,9}$ (16.919), we fail to reject Ho at 5% LOS

Thus there is no evidence of heteroscedasticity in the model at 5% LOS

When α is 10%

As nR^2aux (Test statistic: TR^2 = 6.570747) is less than $\chi^2 0.1, 9$ (14.6837), we fail to reject Ho at 10% LOS

Thus there is no evidence of heteroscedasticity in the model at 10% LOS

Hence both BP and White's Test show no heteroscedasticity in the model at 5% & 10% LOS

Testing for Autocorrelation

- *BG Test*

Breusch-Godfrey test for first-order autocorrelationOLS, using observations 1995-2020 (T = 26) Dependent variable: uhat

	coefficient	std. error	t-ratio	p-value	
const	−371.815	757.418	−0.4909	0.6286	
TRADEFREEDOM	4.78096	10.2868	0.4648	0.6469	
DummyFDI	63.9707	85.9299	0.7445	0.4649	
DiInvFree	1.57927	2.83968	0.5561	0.5840	
uhat_1	0.691260	0.180436	3.831	0.0010	***

Unadjusted R-squared = 0.411385

Test statistic: LMF = 14.676996,
with p-value = P(F(1,21) > 14.677) = 0.000972
Alternative statistic: TR^2 = 10.696021,
with p-value = P(Chi-square(1) > 10.696) = 0.00107Ljung-Box Q' = 10.3135,
with p-value = P(Chi-square(1) > 10.3135) = 0.00132

- *Ho: There is no autocorrelation in the modelHa: There is autocorrelation in the model*

When α is 5%

As $(n-p)R^2_{aux}$ (Test statistic: LMF = 14.676996) is greater than $\chi^2_{0.05,1}$ (3.8415), we reject Ho at 5% LOS

Thus there is evidence of autocorrelation in the model at 5% LOS

When α is 10%

As $(n-p)R^2aux$ (Test statistic: LMF = 14.676996) is greater than $\chi^2 0.1, 1$ (2.7055), we reject Ho at 5% LOS

Thus there is evidence of autocorrelation in the model at 10% LOS

BG Test shows evidence of autocorrelation in the model at 5% and 10% LOS. This may be a possible reason for nonconformity of** b_4 **with its apriori expectation

Testing for Multicollinearity

Variance Inflation Factors Minimum possible value = 1.0
Values > 10.0 may indicate a collinearity problem

TRADEFREEDOM	4.163
DummyFDI	1.157
DiInvFree	3.861

VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficientbetween variable j and the other independent variables

Since none of the VIF's are > 10, there is no evidence of Multicollinearity in the estimated model

- *Correlation Matrix*

Correlation coefficients, using the observations 1995 - 20205% critical value (two-tailed) = 0.3882 for n = 26

GDPPERCAPITAUSD	TRADEFREEDOM	DummyFDI	DiInvFree	
1.0000	0.9115	0.0901	-0.8560	GDPPERCAPITAUSD
	1.0000	0.3170	-0.8546	TRADEFREEDOM
		1.0000	-0.1733	DummyFDI
			1.0000	DiInvFree

- *Confidence Intervals for Coefficients*

t(22, 0.025) = 2.074

Variable	Coefficient	95 confidence interval
Const	-3574.08	(-5557.91, -1590.24)
TRADEFREEDOM	70.2234	(43.2569, 97.1899)
DummyFDI	-274.899	(-497.512, -52.2859)
DiInvFree	-5.43497	(-12.8551, 1.98514)

IX. DISCUSSION OF RESULTS & POLICYRECOMMENDATIONS

All things considered, we find compelling evidence that with lower levels of governmental regulation andfewer trade barriers along with substantial level of Foreign Direct Investment in the country lead to greater economic prosperity as measured by GDP per capita.

Perhaps the most interesting takeaway is that of the many variables experimented with during the modelspecification process, we ended up achieving the best results (on the basis of Schwartz Criterion) using only one of the original indices -- trade freedom. This suggests that of all the sectors in an economy, it ismost critical for a nation to be open to international trade. It seems that in the absence of free trade nations struggle to achieve economic prosperity.

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We set out to examine how economic freedoms influence GDP per capita and found that trade and to a lesser extent monetary freedom were explanatory of the dependent variable in all models while investment freedom ended up being insignificant in all models. However, in particularmodels, monetary freedom did not conform to our prior expectations.

Future work could consider even more aspects of an economy overall, including potential indices for variables such as taxation and presence of black markets. It could additionally control for more factorsthat influence GDP per capita, including health facilities, literacy level etc, to help capture more of thevariance of the independent variable within the model.

In conclusion, the research has significant implications with respect to a nation's economic policy and decision making. The primary goal of every governing entity is to maximize overall economic prosperityfor its citizens. With lower barriers and fewer stringent economic policies, greater economic welfare can be achieved.

X. LIMITATIONS AND DIRECTIONS FOR FUTURE WORK

No work is free from limitations and this paper is no exception and thus the limitations need to behighlighted for better critical appreciation.

It was hard finding accurate data for the variables. Since we could not find appropriate data in our stipulated time frame for an important factor-Labour Freedom, this variable had to be dropped from ourmodel.

The apriori expectations of the impact of Monetary Freedom were not matching with the regression results in the Multiple Linear and Double Log Regression Model, possibly due to CLRM assumption ofNo Autocorrelation not being satisfied, which could be rectified by using a larger database for more accurate result or by applying a 'p' period lag on the estimated equation (for model suffering from AR_p)

XI. CONCLUSION

This study analysed the impact of government regulations and trade barriers on India's Overall EconomicWellbeing for 26 years from 1995-2020. The apriori expectations of the impact of Monetary Freedom were not matching with the regression results in the Multiple Linear and Double Log Regression Model, possibly due to CLRM assumption of No Autocorrelation not being satisfied. Residuals were normally distributed.

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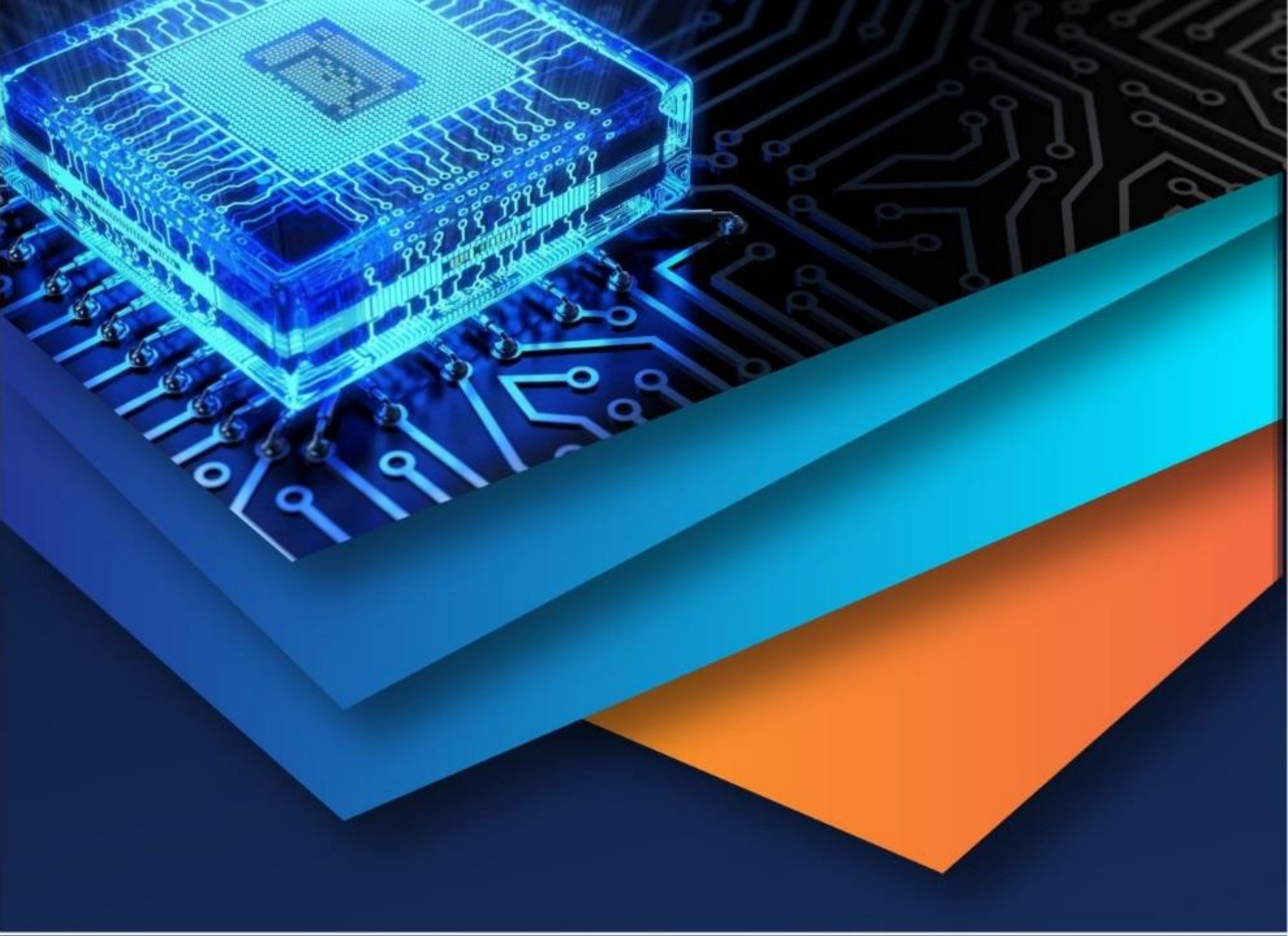

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