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Impact of Exchange Rate, Interest Rate and Inflation on Indian Stock Market

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Abstract

This paper will analyse the impacts of macroeconomic variables such as foreign exchange rates (Dollar, Euro, Pound), Inflation rate and the Interest rate on India stock Indices such as Sensex and Nifty 50. Here we have considered data of the last 29 years from 1991-2019 from various sources. The focus will be on finding the relationship between macroeconomic variables such as foreign exchange rates, inflation rates, and interest rates on India Stock Indices through coefficient, regression and ANOVA analysis.

Keywords: *Indian Stock Indices, Exchange rates, Inflation, Interest rates*

1.0 Introduction

The stock market plays a crucial role in the context of economic development in India. To observe the impact of various independent factors such as Indian currency fluctuation (in context with USD, Euro and Pound), Interest rate and Inflation on the Indian Stock Indices like Bombay stock exchange and national stock exchange. The study has been conducted from the period of 1991 to 2019(Forecast) and by calculating the regression analysis to check the relationship between the independent and dependent factors.

Interest Rate - Sum of the amount of interest due per quarter/year, as a proportion of the amount lent, borrowed or deposited. Principal sum, the interest rate, the compounding frequency, and the length of time over which it is lent deposited or borrowed are the factors on which total interest on an amount lent or borrowed depends. One of the factors that affect stock prices is expected earnings which, in turn, is affected by interest rates as companies operate with some borrowings in their balance sheet. If the repo rate continues to go up, banks will raise loan rates, sooner or later. This will lead to higher loan repayment costs for corporates. Rising costs reduce the net profit, which reflects in stock prices. This is applied to equity stocks in aggregate, it translates to a negative impact. Hence, when the interest rate cycle is on an upward trend, equities are unlikely to give high returns. The reverse happens when interest rates are cut. After studying the relationship between macroeconomic variables, we find that the independent variable Interest rate has a lesser impact on the indices than what inflation has on the indices wherein they have an even lesser impact on Sensex.

Exchange Rate - And the exchange rate is the value of one nation's currency that is exchanged with the currency of another nation or economic zone. After studying the

relationship between these two macroeconomic variables we find a strong relationship between them. This study objective is to learn the dynamics, feature manipulation and effects of variation. The review is set to find the overtone between the currency fluctuation and indices. The researchers extracted the data from BSE and NSE from 1991 to 2019 (Forecast).

Inflation - Inflation can be defined in numerous ways but the apt test way which defines inflation is it is the increase in the overall average price level of the products/services and not an increase in any particular product/services. The most widely reported measure of inflation in India after 2014 (Governor - Raghuram Rajan) is the consumer price index (CPI) which measures the changes in the average prices of consumer goods and services. Kevin and Solman explain that inflation may be either demand-pull inflation or cost-push inflation. Demand-pull inflation is caused by persistent rises in aggregate demand thus the firms responding by raising prices and partly by increasing output. After studying the relationship between macroeconomic variables, we find that the independent factor Inflation has a very weak relationship with the dependent factor Nifty 50 and Sensex.

1.1 The objective of the Study

1. To study the trend of the macro-economic variables like exchange rate, inflation, Interest rate and Indian stock Indices between the period of 1991-2019.
2. To know the relationship between the independent variables like interest rates, inflation and exchange rates (Dollar, Euro, Pound) and dependent variables Indian stock indices (Sensex, Nifty50).
3. To understand the fluctuation in the stock market and its volatility.

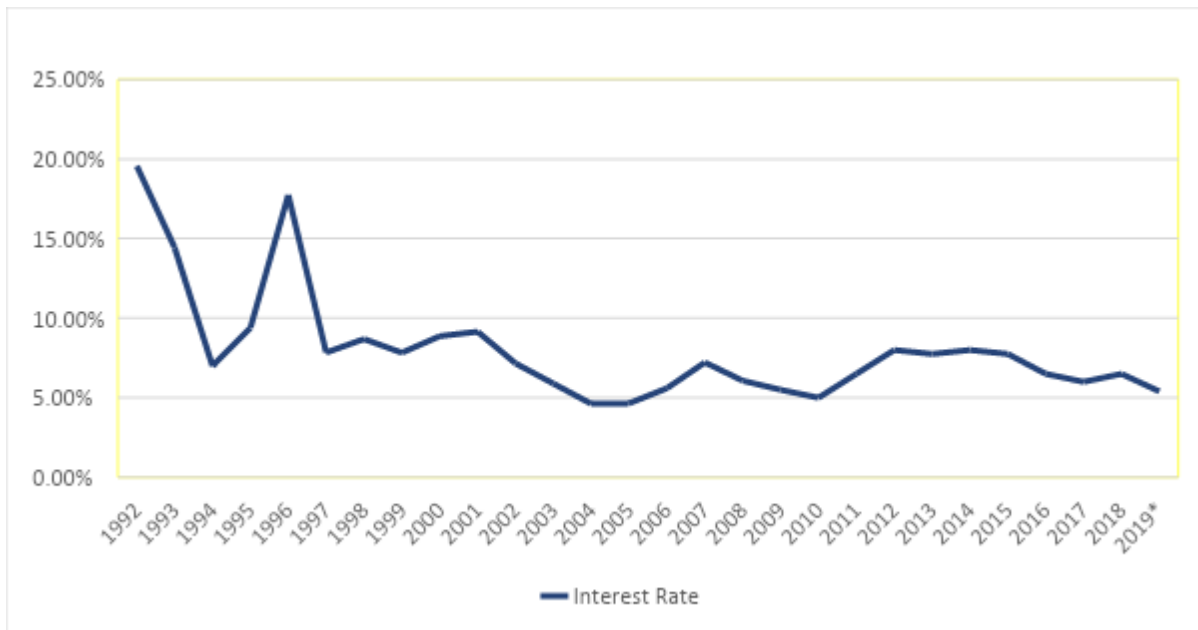
2.0 Theoretical Review

2.1 Interest Rates

In India, the Reserve Bank of India (RBI) is India's central banking institution that decides the interest rate after looking into the condition and requirement of the economy of the nation. After studying the data of the period 1991-2019 We have seen that there is a negative correlation between interest rates and Indian stock indices. Interest rate is the cost of borrowing for the borrowers so if the interest rate increases the expectation of the borrower from the stock market also increases as the rising interest rate regime, the cost of borrowing increases and profitability is affected.

In India, the stock market and rates are inversely related (Negative Correlation) i.e. related. When Interest is higher the value of the equity reduces and also increases the FD more favourable. Inversive when the interest rate is lower than it will give a boost to the stock market.

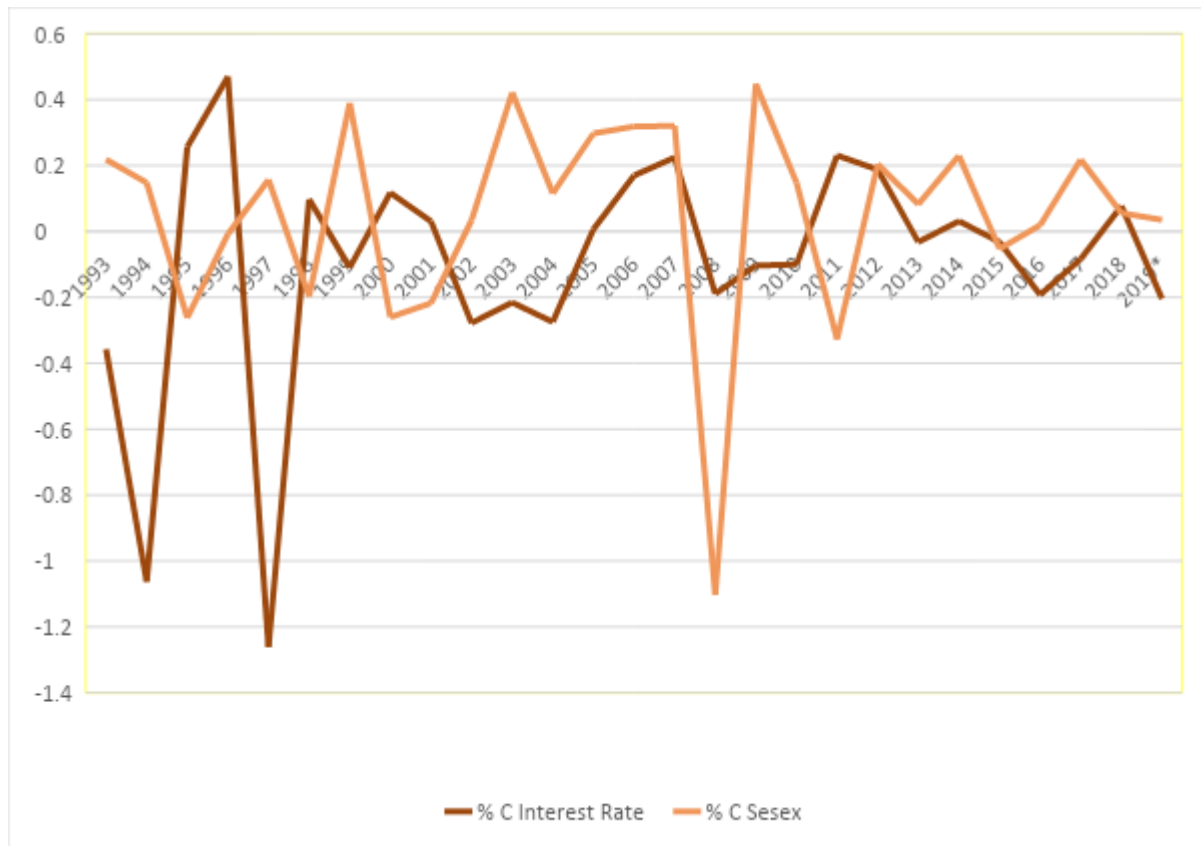
Graph 1: Interest rates from the period 1991-2019



Graph 2: Percentage Change in Nifty and Percentage change in Interest rate (1991-2019)



Graph 3: Percentage Change in Sensex and Percentage change in Interest rate (1991-2019)

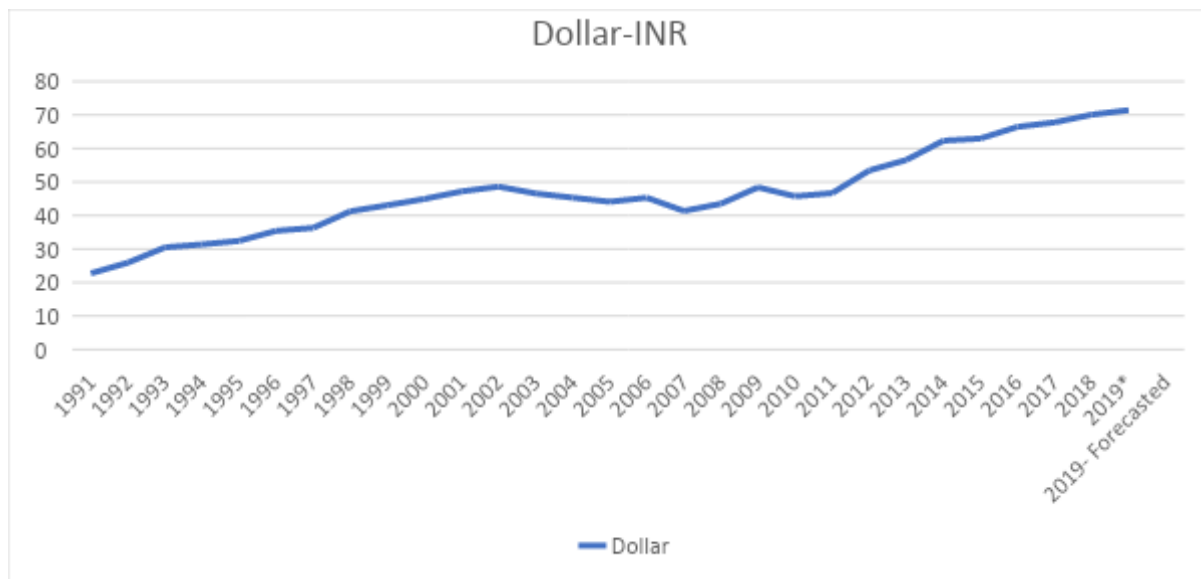


2.2 Exchange Rates

The exchange rate shows the relation between one country's currency with the other country currencies. Factors which affect the stock market the most are Foreign Direct Investment (FDI) and Foreign Institutional Investors (FII), as we have observed at the time of budget presented by Nirmala Sitharaman when FII have pulled off 1.2 Billion US Dollar due to the income tax surcharge on the superrich investors. In the union budget, the government proposed to increase income tax surcharge on the super-rich which would also include non-corporate foreign entities. The research and data show the strong correlation between the Indian indices and foreign exchange (Dollar, Pound, Euro) wherein Indian indices have the strongest positive correlation with the Euro and pound being the least. The country where technological advancements are present in their economy when the currency depreciates will lead to lesser FDI inflows whereas in developing countries like India where there is a restriction on technological advancement, whenever currency depreciates it promotes more FDI and FII in the country.

To test the relationship between the Stock market (Nifty 50 Sensex) and foreign exchange rate (Dollar, Euro, Pound) we have taken the 29 years of data from 1991 to 2019 that give us the impression that there is a strong positive relationship between the exchange rate and stock market which means that if the exchange rate increases then the stock market also increases and vice-versa.

Graph 4: Exchange Rate (INR-Dollar) from the period of 1991-2019



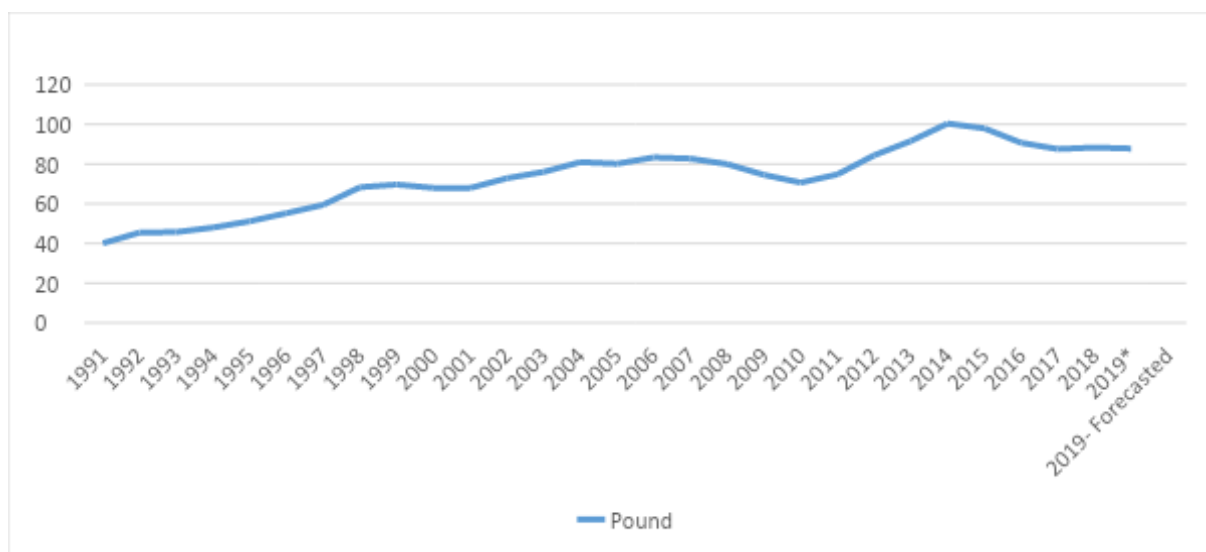
The graphs show the trend of USD and INR since 1991. This Graph shows the fluctuation between the USD and INR as between 1991-2000 the exchange between both currencies, In 1991 1\$=22INR whereas in 2000 it was 1\$=45INR which states that the rate was between 22INR to 45INR. In 2000-2010 USD-INR rate was between 45INR to 46INR. In this period the fluctuation between the USD-INR was least in the past 3 decades. In the current decade, the range of exchange rate was between 46INR to 72INR which makes the current decade the most volatile decade in terms of the exchange rate between USD-INR.

Graph 5: Exchange Rate (Euro-INR) from the period of 1991-2019



The graphs show the trend of EURO and INR since 1991. This Graph shows the fluctuation between the EURO and INR as between 1991-2000 the exchange between both currencies, In 1991 1 EURO = 35 INR whereas in 2000 it was 1 EURO = 42 INR which states that the rate was between 35 INR to 42 INR in this period the fluctuation between the EURO-INR was least in the past 3 decades. In 2000-2010 EURO - INR rate was between 43 INR to 60 INR. In the current decade, the range of exchange rate was between 60 INR to 80 INR which makes the current decade the most volatile decade in terms of the exchange rate between EURO-INR.

Graph 6: Exchange Rate (Pound-INR) from the period of 1991-2019



The graphs show the trend of Pound and INR since 1991. This Graph shows the fluctuation between the Pound and INR as between 1991-2000 the exchange between both currencies, in 1991 1 Pound =48INR whereas in 2000 it was 1 Pound =68INR which states that the rate was between 48INR to 68INR. In 2000-2010 Pound -INR rate was between 67INR to 70INR in this period the fluctuation between the Pound -INR was the least in the past 3 decades. In the current decade, the range of exchange rate was between 69INR to 90INR which makes the current decade the most volatile decade in terms of the exchange rate between Pound-INR.

2.3 Inflation

Inflation can be defined in numerous ways but the apt way which defines inflation is it is the increase in the overall average price level of the products/services and not an increase in any particular product/services. Any unexpected rise in the inflation, CPI in India, is considered worrisome for the corporates as it takes several months for them to pass on higher input costs to consumers. Even customers feel the pinch when goods and services become pricier. They also tend to hold less liquid money in hand in such a scenario, as inflation eats away most of their savings and also the investors with less cash holding in their hand tend to invest less in the stock market during such periods. They also get confused since the impact is likely to affect the economy and stock prices, however not at the same rate. Sometimes any rise in inflation is also considered good as it can help in stimulating growth in developed countries which is seen in countries like the US. But it can also impact profits of the corporates through higher input costs as firms stop hiring a greater number of employees. It's therefore much required for an investor to make wise decisions during periods of high inflation. After studying the data of the period 1991-2019 of inflation and testing the secondary data, we have seen a moderate negative correlation between inflation and the Indian stock market. In which Inflation affects less to Sensex compared to Nifty. Inflation and the Indian Stock market is in inverse relation if inflation increases, the stock market decreases and vice-versa.

Graph 7: Inflation (%) from the period of 1991-2019



The graphs show the trend of inflation in 1991. This Graph shows the fluctuation in inflation from 1991-2000. The inflation in the country varies year to year. In 1991 in Indian Inflation = 10.24% whereas in 2000 it was 4.41% which states that the rate was between 10.24% to 4.41%. In 2000-2010 inflation rate was between 4.22%-8.47%, In this period the fluctuation between the Pound -INR was the least in the past 3 decades. In the current decade, the range of exchange rate was between 10.34% to 4.85% which makes the current decade the most volatile decade in terms of inflation rate in the country.

3.0 Data Analysis and Interpretation

3.1.1 Interest Rate

Interest rate and Nifty (Anova)

Sources of variation	Degree of Freedom	Sum of square	Mean Square	F	Significance F
Between Samples	1	17349254.53	17349254.53	1.288815	0.26624419
Within Samples	27	363457777.9	13461399.18		
Total	28	380807032.4			

The Table value is equal to 4.2100 whereas the calculated value is equal to 1.288

Interpretation of the table

H0: There is no significant relationship between the interest rate and Nifty

H1: There is a significant relationship between the interest rate and nifty

The table value is more than the calculated value so the null hypothesis is accepted.

3.1.2 Interest rate and Sensex (ANOVA)

Table: 2 ANOVA Table between Interest Rate and Sensex					
	Df	SS	MS	F	Significance F
Regression	1	142899453.2	142899453.2	1.110829848	0.301242488
Residual	7	3473335940	128642071.9		
Total	8	3616235393			

The table value is equal to 4.2100 whereas the calculated value is equal to 1.11

Interpretation of the table

H0: There is no significant relationship between the interest rate and Sensex

H1: There is a significant relationship between the interest rate and Sensex

The table value is more than the calculated value so the null hypothesis is accepted.

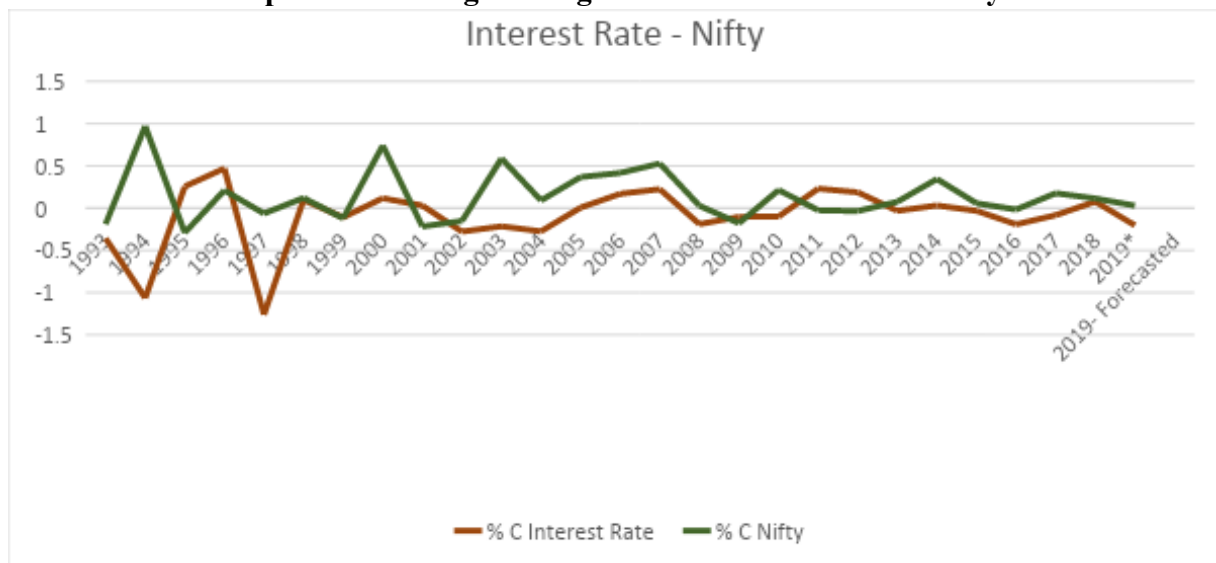
3.1.3 Correlation Between interest rate and Nifty, Sensex

Table:3 Correlation Between interest rate and Nifty, Sensex	
Correlation between the interest rate and Nifty	-0.213445955
Correlation between the interest rate and Sensex	-0.198786523

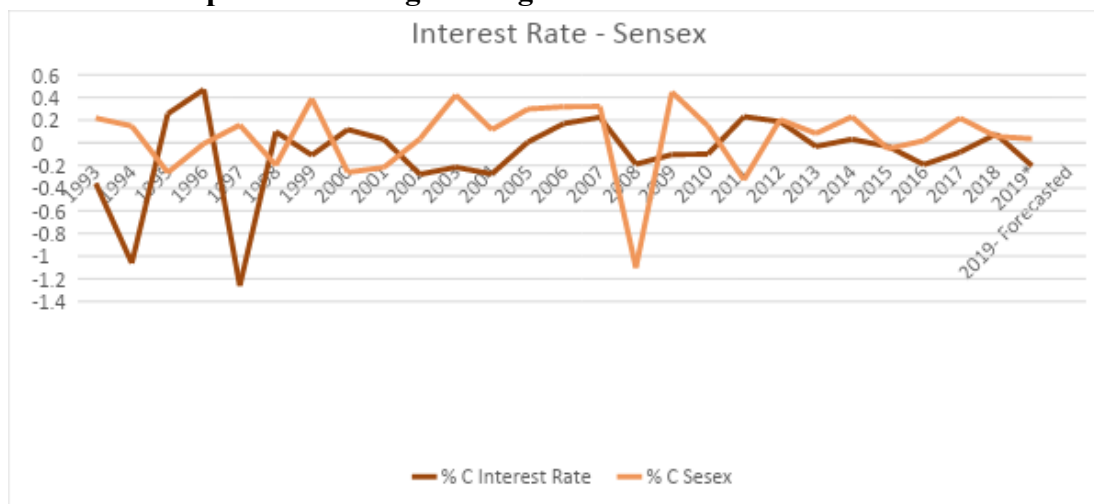
Interpretation of Carrel Pearson Correlation:

- The Correlation between the interest rate and the Indian stock market is negatively moderate.
- Negatively moderate means that the interest rate does not affect Nifty and Sensex.
- The direction of the movement of both the variable is inverse

Graph 8: Percentage Change in the interest rate and Nifty



Graph 9: Percentage Change in the interest rate and Sensex



3.2 Exchange Rate

3.2.1 Dollar and Sensex

Table: 4 ANOVA Table between Dollar and Sensex

Sources of variation	Degree of Freedom	Sum of square	Mean Square	F	Significance F
Regression	1.00	366380404.02	366380404.02	685.70	0.00
Residual	27.00	14426628.41	534319.57		
Total	28.00	380807032.43			

The table value is equal to 4.2100 whereas the calculated value is equal to 685.70

Interpretation of the table

H0: There is no significant relationship between the dollar and Sensex

H1: There is a significant relationship between the dollar and Sensex

The table value is less than the calculated value so the null hypothesis is rejected.

3.2.2 Dollar and Nifty

Table: 5 ANOVA Table between Euro and Sensex

	df	SS	MS	F	Significance F
Regression	1.00	327488902.03	327488902.03	165.84	0.00
Residual	27.00	53318130.40	1974745.57		
Total	28.00	380807032.43			

The table value is equal to 4.2100 whereas the calculated value is equal to 165.84

Interpretation of the table

H0: There is no significant relationship between the dollar and Nifty

H1: There is a significant relationship between the dollar and Nifty

The table value is less than the calculated value so the null hypothesis is rejected.

3.3.3 Correlation Between Dollar and Nifty, Sensex

Table 6: Correlation Between Dollar and Nifty, Sensex	
Correlation Between dollar and Nifty	0.877604
Correlation Between dollar and Sensex	0.876914

Interpretation of Carrel Pearson Correlation:

- The Correlation between the Dollar and the Indian stock market is Positive and strong.
- The direction of the movement of both variables is the same. 0.877 and .876

3.3 Pound and Sensex

Table: 7 ANOVA Table between Dollar and Sensex					
	df	SS	MS	F	Significance F
Regression	1	2127372976	2127372976	38.57916599	1.21497E-06
Residual	27	1488862418	55143052.5		
Total	28	3616235393			

The table value is equal to 4.2100 whereas the calculated value is equal to 38.57

Interpretation of the table

H0: There is no significant relationship between the Pound and Sensex

H1: There is a significant relationship between the Pound and Sensex

The table value is less than the calculated value so the null hypothesis is rejected.

3.3.1 Pound and Nifty

Table: 8 ANOVA Table between Pound and Nifty					
	df	SS	MS	F	Significance F
Regression	1.00	232431970.00	232431970.00	42.30	0.00
Residual	27.00	148375062.43	5495372.68		
Total	28.00	380807032.43			

The table value is equal to 4.2100 whereas the calculated value is equal to 42.30

Interpretation of the table

H0: There is no significant relationship between the Pound and Sensex

H1: There is a significant relationship between the Pound and Sensex

The table value is less than the calculated value so the null hypothesis is rejected.

3.3.2 Correlation Between Pound and Nifty, Sensex

Table: 9 Correlation Between Pound and Nifty, Sensex	
Correlation Between Pound and Nifty	0.78126
Correlation Between Pound and Sensex	0.766997

Interpretation of Carrel Pearson Correlation:

- The Correlation between the Pound and the Indian stock market is Positive and strong.
- The direction of the movement of both variables is the same.

3.4 Euro and Sensex

Table: 10 ANOVA Table between Euro and Sensex					
	df	SS	MS	F	Significance F
Regression	1	3054443997	3054443997	146.7982395	1.9906E-12
Residual	27	561791396.1	20807088.74		
Total	28	3616235393			

The table value is equal to 4.2100 whereas the calculated value is equal to 146.79

Interpretation of the table

H0: There is no significant relationship between the Euro and Sensex

H1: There is a significant relationship between the Euro and Sensex

The table value is less than the calculated value so the null hypothesis is rejected.

3.4.1 Euro and Nifty

Table: 11 ANOVA Table between Euro and Nifty					
	df	SS	MS	F	Significance F
Regression	1.00	327488902.03	327488902.03	165.84	0.00
Residual	27.00	53318130.40	1974745.57		
Total	28.00	380807032.43			

The table value is equal to 4.2100 whereas the calculated value is equal to 165.84

Interpretation of the table

H0: There is no significant relationship between the Euro and Sensex

H1: There is a significant relationship between the Euro and Sensex

The table value is less than the calculated value so the null hypothesis is rejected.

3.4.2 Correlation Between Euro and Nifty, Sensex

Table: 12 Correlation Between Euro and Nifty, Sensex	
Correlation Between Euro and Nifty	0.927354564
Correlation Between Euro and Sensex	0.919047033

Interpretation of Carrel Pearson Correlation:

- The Correlation between the Euro and Indian stock market is Positive and strong.
- The direction of the movement of both variables is the same.

3.5 Inflation

Table: 13 ANOVA Table between Inflation and Nifty					
	df	SS	MS	F	Significance F
Regression	1	18588942.16	18588942.16	1.385633274	0.249416944
Residual	2	362218090.3	13415484.83		
	7				
Total	8	380807032.4			

The table value is equal to 4.2100 whereas the calculated value is equal to 1.385

Interpretation of the table

H0: There is no significant relationship between Inflation and Nifty

H1: There is a significant relationship between Inflation and Nifty

The table value is less than the calculated value so the null hypothesis is accepted.

Table: 14 ANOVA Table between Inflation and Sensex					
	df	SS	MS	F	Significance F
Regression	1	205390216.8	205390216.8	1.625853877	0.213140797
Residual	2	3410845177	126327599.1		
	7				
Total	8	3616235393			

The table value is equal to 4.2100 whereas the calculated value is equal to 1.625

Interpretation of the table

H0: There is no significant relationship between Inflation and Sensex

H1: There is a significant relationship between Inflation and Sensex

The table value is less than the calculated value so the null hypothesis is accepted.

3.5.1 Correlation Between Inflation and Nifty, Sensex

Table: 15 Correlation Between Inflation and Nifty, Sensex	
Correlation Between Inflation and Nifty	-0.22094026
Correlation Between Inflation and Sensex	-0.23832057

Interpretation of Carrel Pearson Correlation:

- The Correlation between Inflation and the Indian stock market is negative and weak.
- The direction of the movement of both the variables is inverse in relation.

4.0 Findings

- The relationship between inflation and the stock market is weak and inverse in a relationship whereas its effects are nifty more than Sensex.
- Relationship between the Interest rate and stock market (Nifty, Sensex) and inverse in a relationship whereas its effects Sensex more than nifty.
- Relationship between the Exchange rate and stock market (Nifty, Sensex)
 - Pound and stock market are strong and direct in relationship
 - The dollar and the stock market are having a strong and direct relationship
 - Euro and stock market are having a strong and positive relationship
 - Euro is relatively stronger than other currencies
 - Exchange rate and stock market price are interconnected directly or indirectly, because today, the world is turning into a global village due to trade liberalization and globalization.

5.0 Study of Scope

- Knowing about the more economic variables that have a strong relationship with the Indian Stock market
- Why the Euro affects more than the dollar and pound
- Knowing about the relationship between nifty and Sensex

6.0 Table

Year	Dollar	Euro	Pound	Interest Rate	Inflation	GDP	Nifty	Sensex
1991	22.74	34.48	40.1	15.85	13.88%	1.06%	407.49	1908.85
1992	25.92	43.73	45.48	19.57%	11.88%	5.48%	826.16	2615.37
1993	30.49	38.71	45.73	14.42%	6.31%	4.75%	669.45	3346.06
1994	31.37	39.78	48.01	6.99%	10.24%	6.66%	1318.56	3926.90
1995	32.43	44.93	51.17	9.40%	10.22%	7.57%	935.04	3110.49
1996	35.43	45.38	55.25	17.73%	8.98%	7.55%	1132.05	3085.20
1997	36.31	43.57	59.44	7.84%	7.25%	4.05%	1059.80	3658.98
1998	41.26	50.37	68.33	8.69%	13.17%	6.18%	1188.10	3055.41
1999	43.06	50.73	69.66	7.83%	4.84%	8.85%	1044.45	5005.82
2000	44.94	42.32	67.99	8.87%	4.02%	8.00%	1818.15	3972.12

2001	47.19	42.25	67.92	9.15%	3.77%	4.15%	1422.95	3262.33
2002	48.61	45.92	72.85	7.16%	4.31%	5.39%	1205.95	3377.28
2003	46.58	52.61	76.05	5.89%	3.81%	3.88%	1914.40	5838.96
2004	45.32	56.3	80.96	4.62%	3.77%	7.97%	2088.45	6602.69
2005	44.1	54.81	80.15	4.65%	4.25%	7.05%	2857.00	9397.93
2006	44.31	56.84	83.36	5.60%	5.79%	9.48%	4046.85	13786.91
2007	41.35	56.42	82.73	7.22%	6.39%	9.57%	6185.40	20286.99
2008	43.51	63.31	79.97	6.07%	8.32%	9.32%	6357.10	964.31
2009	48.41	67.36	74.56	5.50%	0.83%	6.72%	5221.85	17464.81
2010	45.73	60.59	70.65	5.00%	10.83%	8.59%	6338.50	20509.09
2011	46.67	64.89	74.77	6.50%	8.87%	8.91%	6181.05	15454.92
2012	53.44	68.6	84.41	8.00%	9.30%	6.69%	5965.15	19426.71
2013	56.57	77.93	91.6	7.75%	10.92%	4.47%	6415.25	21170.68
2014	62.33	81.04	100.4	8.00%	6.37%	4.47%	8626.95	27499.42
2015	62.97	71.02	98	7.75%	5.88%	8.15%	9119.20	26117.54
2016	66.46	74.37	90.72	6.50%	4.97%	7.11%	8968.70	26626.46
2017	67.79	73.53	87.56	6.00%	2.49%	6.68%	10552.40	34056.83
2018	70.09	85.8	88.33	6.50%	4.85%	6.81%	11760.20	36068.33
2019 *	71.44	78.48	87.8	5.40%	7.54%	5.81%	12103.05	37384.99

7.0 Conclusion

After studying the data from the period of 1991 to 2019 of dependent variables like Nifty and Sensex and independent variables like exchange rate (Dollar, Pound, Euro), Interest rate and Inflation rate. It was found that the correlation between the exchange rates and Indian indices is direct/Positive and very strong in which Euro is the strongest amongst them (Dollars, Euro, Pound) whereas Interest Rate and Inflation have a weak and inverse/negative relationship with the Indian Stock Market (Nifty and Sensex). Correlation between the dollar with Nifty and Sensex is 0.877 and .876; Pound with Nifty and Sensex is .78 and .76 whereas Euro has the strongest correlation with the Nifty and Sensex is .92 and .91.

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