

Trends in the Valuation of Indian Currency Since 1991

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Abstract:

This paper aims to explore the dynamics of trends in currency valuation by studying the relationship between inflation and exchange rates after the period of Economic Reforms in India. The scope of the paper also explores the interconnection of exchange rates and inflow of FDI in the country and the balance of trade. We examine trends in inflation through the Wholesale Price Index and Consumer Price Index, over the sample period. We aim to use statistical tools, namely correlation, the standard deviation to indicate the relationship between the variables in addition to the tools of data analysis, to extricate the desired results.

Objective

To study the relationship between the trends in inflation and depreciation of the Indian Rupee since the 1991 Economic Reforms.

1. Analysing the trends in the valuation of Indian Currency since the economic reforms
2. To understand and derive a relation between the devaluation of the Indian Rupee and the Inflation Rate.
3. Visualizing the trends in Consumer Price Index (CPI)
4. Identifying and visualizing a relationship between the inflow of FDI in the economy, balance of trade, and its subsequent effects on the currency valuation.

Introduction

The value of a currency depends on many factors that affect the economy such as imports and exports, inflation, employment, interest rates, growth rate, foreign exchange reserves, foreign investment inflows, and macroeconomic policies. This paper will be focusing on some of the major factors such as inflation level in an economy, balance of trade, and foreign direct investment in a country in this paper. These components play a huge role in determining a currency's value and thus its exchange rate with respect to the US dollar.

Inflation means higher prices and generally lower purchasing power for a country's currency. If a country experiences inflation, the prices of its exports increase, making them less attractive to foreigners. Inflation can also decrease domestic demand for domestic goods, leading a country's importers to exchange their currency for foreign ones to buy cheaper goods from abroad. These two effects—reduced foreign demand and increased supply in the market, both works to push a currency's value down. A little bit of inflation, say, prices rising by 1 or 2 percent per year is normal and the sign of a healthy economy. But hyperinflation, an extreme form of inflation in which prices increase out of control, can drastically weaken a country's currency

A country that sells more goods and services in overseas markets than it buys from them has a trade surplus. This means more foreign currency comes into the country than what is paid for imports. This strengthens the local currency. Though the strength of a country's currency is not always an indicator that its economic activities are providing welfare to the population. For example, Japan's economy thrives on exports, so a weaker currency benefits it by making its goods cheaper for consumers abroad. Likewise, most Americans like buying cheap goods. Having a strong dollar makes foreign goods less expensive. Stable countries are considered to be attractive destinations for investments. The more that people want to invest in a country, the more that country's currency will appreciate or be worth. Countries can encourage domestic companies to make a foreign direct investment. Foreign investment in a country raises the demand for that country's currency, as investors need the domestic currency to hire workers and build infrastructure in that country or to make cash investments there.

Up till 1991, India had kept its economy close to the global market for providing a nurturing growth environment to the domestic producers. The Gulf war of 1990-91 led to a sharp rise in oil prices and a fall in remittances from the Gulf workers. This sharp increase in price had a disastrous effect on India's forex reserves, a situation so bad that the country only had 2 weeks' worth of imports left. This was met by an 8% fiscal deficit of GDP, 2.5% current account deficit of GDP, and double-digit inflation rate adding to the woes of the government. The government took drastic measures to revive the Indian economy, devaluing the Indian Rupee against the major currencies in two phases, by 9% and 11% respectively. New policies were announced, exposing the Indian markets to the global economy, and inculcating several changes in the Indian economic policies. Almost 3 decades later, today India has established itself in the global market as a lead producer in several industries, achieved self-sufficiency and is currently the 4th largest holder of forex reserve in the world. Successfully implementing the 'Liberalisation', 'Privatisation' and 'Globalisation' aspect of the Economic Reforms of 1991, India is now home to over 40,000 multinational corporations, has improved its balance of payment position to a great extent and is now positioned more strongly in terms of foreign diplomacy, in comparison to 1991. However, if we talk about our currency, Indian National Rupee which equalled US Dollar on 15th August 1947 has since then depreciated by a great extent and at the time of writing this paper, 1 USD equalled Rs. 74.98. This paper will analyse the factors affecting valuation of currency and explore the decades after the economic reforms were introduced by then Finance Minister Dr. Manmohan Singh Ji under Prime Minister Narsimha Rao Ji. Not much literature is available for this period, this paper is an effort to use the statistical tools in data analysis to analyse and scrutinize the period of economic reforms.

Methodology

This paper aims to explore the dynamics of trends in currency valuation by studying the relationship between inflation and exchange rates after the period of Economic Reforms in India. The scope of the paper also explores the interconnection of exchange rates and inflow of FDI in the country and the balance of trade. We examine trends in inflation through the Wholesale Price Index and Consumer Price Index, over the sample period. We aim to use statistical tools, namely correlation, the standard deviation to indicate the relationship between the variables in addition to the tools of data analysis, to extricate the desired results.

Software to be used: R Programming, Microsoft Excel

To reach a satisfactory analysis, we will be working with the data on the *inflation level in the economy, average exchange rate between INR and USD, Foreign Direct Investment in India, Consumer Price Index, and the balance of trade* over the sample period of 30 years, i.e., from 1991-2021.

Data Sources

Reserve Bank of India, Database on Indian Economy <https://dbie.rbi.org.in/DBIE/dbie.rbi?site=home>

1. Reserve Bank of India <https://www.rbi.org.in/>
2. World Bank <https://dbie.rbi.org.in/DBIE/dbie.rbi?site=home>
3. Economic Times <https://economictimes.indiatimes.com/>
4. Hindustan Times <https://www.hindustantimes.com/>
5. Times Of India <https://timesofindia.indiatimes.com/>

Exchange Rate Analysis of India

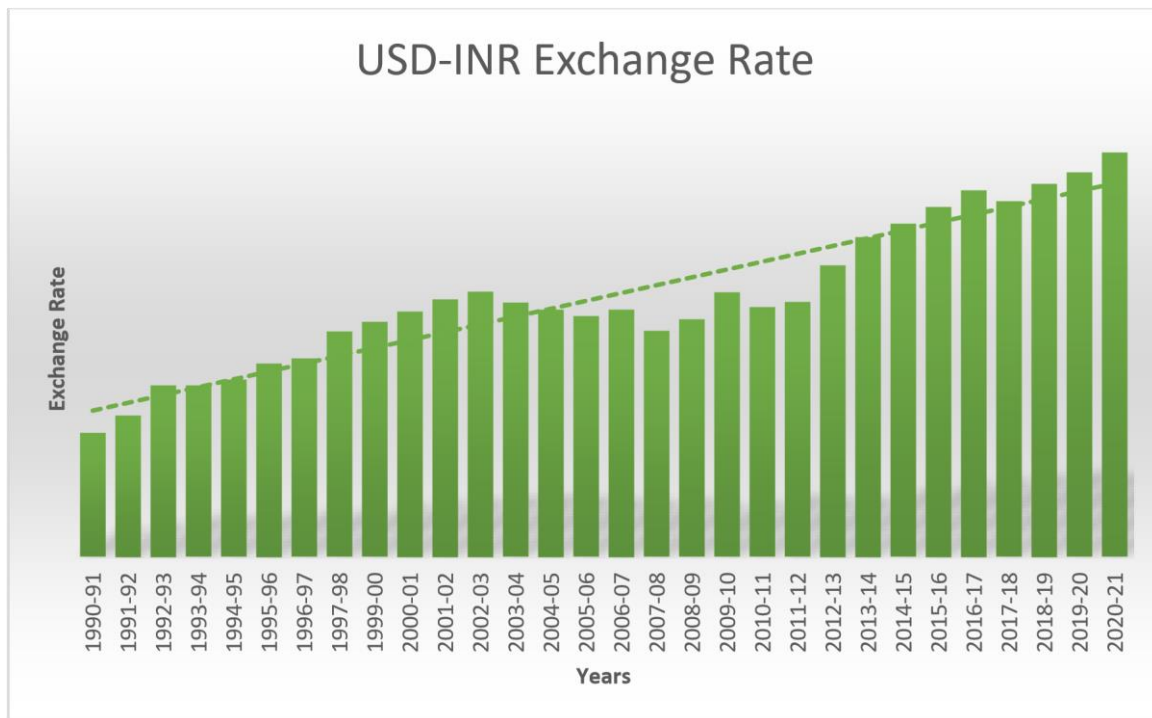


Figure 1: Trend of Exchange Rate (1991-2021)

Exchange Rate for the Indian Rupee was determined to be at 1 INR= I USD on 15th August, 1947. Since then, Indian Rupee has followed a depreciating pattern and at the time of writing this project, the exchange rate stood at 1 USD = 74.47 INR.

There are several reasons as to why a currency fluctuates, few of them we’ll be analysing in our research. Currently, India uses floating exchange rate system and hence the exchange rates have shown the tendency to be extremely fluctuating as the market forces of demand and supply keep fluctuating. As observed from the graph, the rate is on an increasing spree in the timeline 1998-2003, but suddenly the currency appreciates in the years 2003-2006. However, in the past 4 years, the currency is on a depreciating spree and the value has depreciated from Rs. 41.385 in 2007 to approximately Rs. 75 in 2020.

2005	44.1000
2006	45.3070
2007	41.3485
2008	43.5049
2009	48.4049
2010	45.7262
2011	46.6723
2012	53.4376
2013	58.5978
2014	61.0295
2015	64.1519
2016	67.1953
2017	65.1216
2018	68.3895
2019	70.4203
2020	74.0996

Highest and Lowest Exchange Rates between 2007 and 2020. Prepared in Excel using 'Conditional Formatting' feature.

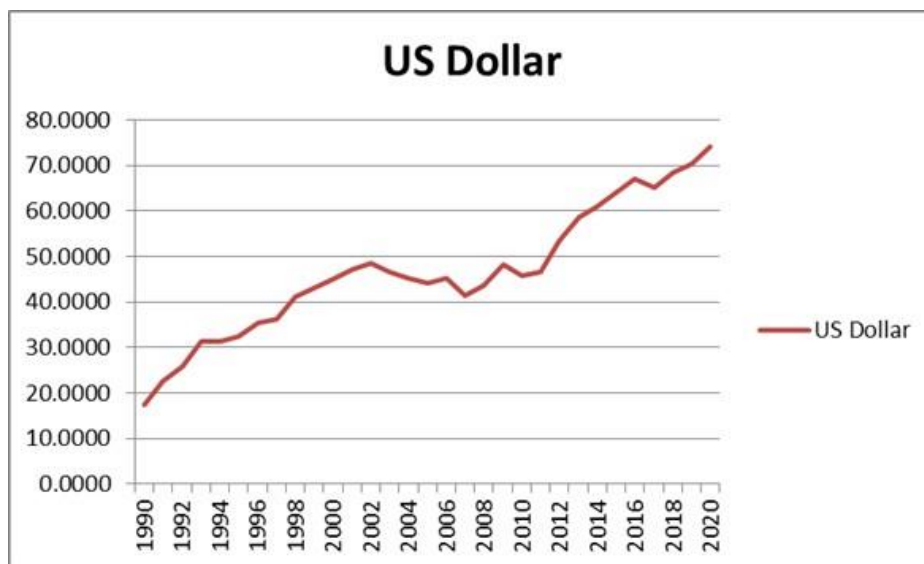
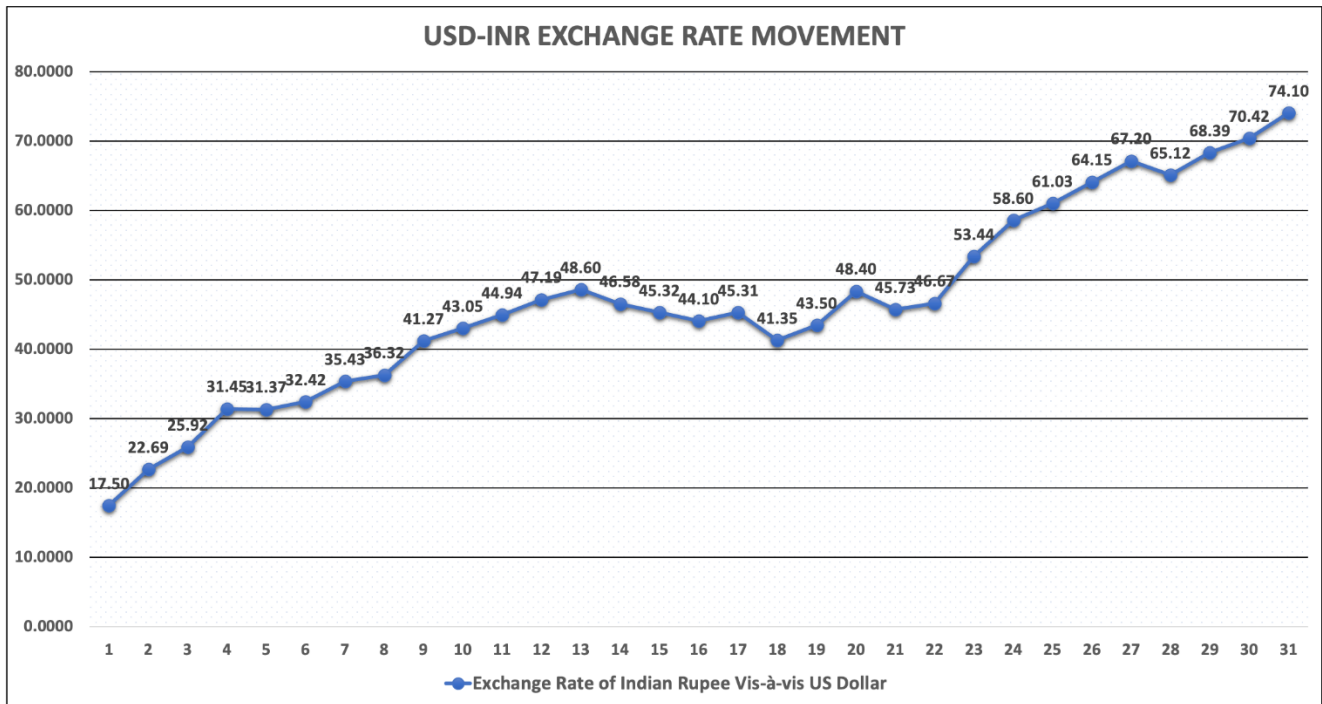


Figure 2: Trend of USD INR Exchange Rate

From the line chart, we observe a general upwards trend in the rate of exchange between Indian Rupees (INR) and US Dollar (USD) over a period of 30 years (1990-2020). In 2007, we observed a dip in the exchange rate which is commensurate with the Global Financial Crisis of 2007-08.

Exchange rate plays a vital role in a country's level of trade, which is critical to almost every free market economy in the world. The Reserve Bank of India through its monetary and regulatory measures is known to play a role in the foreign exchange market during times of high volatility. It was only in 2003-05 and 2007-08 the Rupee had appreciated against the US Dollar due to the weakening of the dollar and large capital inflows into India.



The figure given above shows the trend of Rupee to US Dollar since 1991. The Devaluation of 1992 turned the exchange rate 1 USD to 25.92 INR and the Indian currency value began falling since then with the current rate of 74.57 INR. The line graph shows how the rupee has continued to depreciate for most of the period thus showing an upward trend except for a dip in a few places like the year 2009 after the Global Financial Crisis. In March 2009, the rupee appreciated against the dollar from 51.75 rupees per dollar in mid-March 2009 to 46.29 rupees per dollar at the end of January 2010, constituting a gain of almost 12 per cent. This appreciation was triggered by the resumption of foreign capital inflows into the country after March 2009.

Using R for Descriptive Statistics

```

> getwd()
[1] "/Users/nanditarai/Desktop"
> Rupeeevaluation=read.csv(file.choose())
> Rupeeevaluation
  Financial.Year Exchange.Rate.of.Indian.Rupee.Vis.à.vis.US.Dollar
1             1990                      17.4992
2             1991                      22.6890
3             1992                      25.9206
4             1993                      31.4458
5             1994                      31.3742
6             1995                      32.4232
7             1996                      35.4294
8             1997                      36.3196
9             1998                      41.2677
10            1999                      43.0485
11            2000                      44.9401
12            2001                      47.1857
13            2002                      48.5993
14            2003                      46.5819
15            2004                      45.3165
16            2005                      44.1000
17            2006                      45.3070
18            2007                      41.3485
19            2008                      43.5049
20            2009                      48.4049
21            2010                      45.7262
22            2011                      46.6723
23            2012                      53.4376
24            2013                      58.5978
25            2014                      61.0295
26            2015                      64.1519
27            2016                      67.1953
28            2017                      65.1216
29            2018                      68.3895
30            2019                      70.4203
31            2020                      74.0996
> mean(Rupeeevaluation$Exchange.Rate.of.Indian.Rupee.Vis.à.vis.US.Dollar)
[1] 46.69508
> median(Rupeeevaluation$Exchange.Rate.of.Indian.Rupee.Vis.à.vis.US.Dollar)
[1] 45.3165
> summary(Rupeeevaluation$Exchange.Rate.of.Indian.Rupee.Vis.à.vis.US.Dollar)
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 17.50  38.79  45.32  46.70  56.02  74.10

```

Figure 3: Summary Statistics of USD-INR Exchange Rate

```

> var(Rupeeevaluation$Exchange.Rate.of.Indian.Rupee.Vis.à.vis.US.Dollar)
[1] 203.6795
> sd(Rupeeevaluation$Exchange.Rate.of.Indian.Rupee.Vis.à.vis.US.Dollar)
[1] 14.27163
> range(Rupeeevaluation$Exchange.Rate.of.Indian.Rupee.Vis.à.vis.US.Dollar)
[1] 17.4992 74.0996

```

Five number summary provides a way to determine the shape of the distribution for a set of data.

From the above analysis we can see that the central value of the data set that is the mean comes out to be 46.69508 and the median is 45.3165.

Because Mean > Median, the data is positive or Right Skewed Distribution.

Most of the values in a right-skewed distribution lie in the lower region. Some extremely large values cause the long tail and distortion to the right and cause the mean to be greater than the median.

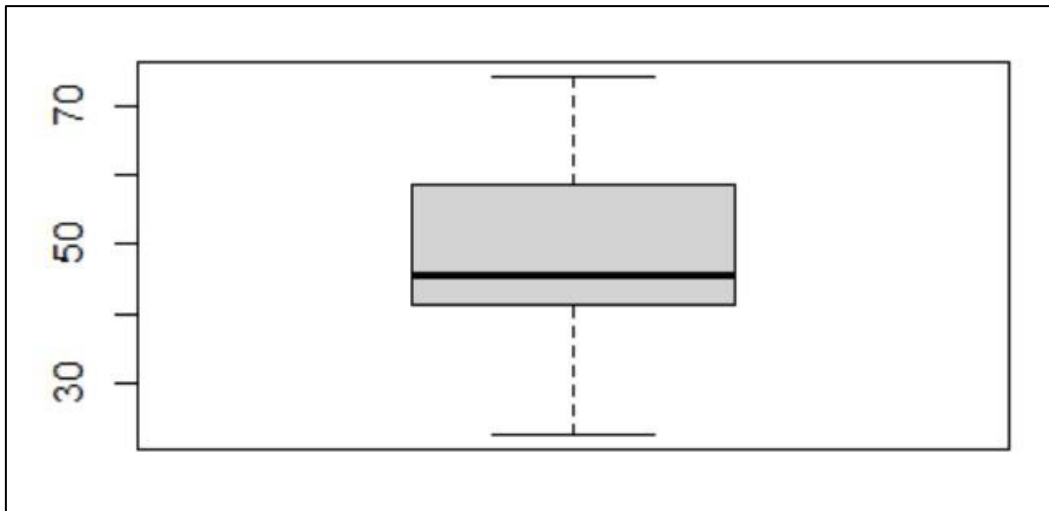


Figure 4: Box Plot of USD -INR Exchange Rate

Box Plot, prepared using R software, shows the ‘5 number summary of the data’, namely, **Mean, Median, Maximum, Minimum, 1st quartile and 3rd quartile.** Code used: `>boxplot(dataset$variable)`

Through the box-plot it can be clearly observed that the data set is positively skewed, that means, the majority of the values lie around the lower values. However, there exists few higher values that elongate the curve. This observation is confirmed by the bar chart (fig 1) that from the past 5-6 years, the currency has been depreciating at a larger rate. From 1991, for the longest time, the exchange rate hovered around the rates of 40s-50s, however, after 2014-15, the currency has been depreciating by a very speedier rate and has almost crossed the thresholds of 70s.

Histogram of exchange_rate\$`US Dollar`

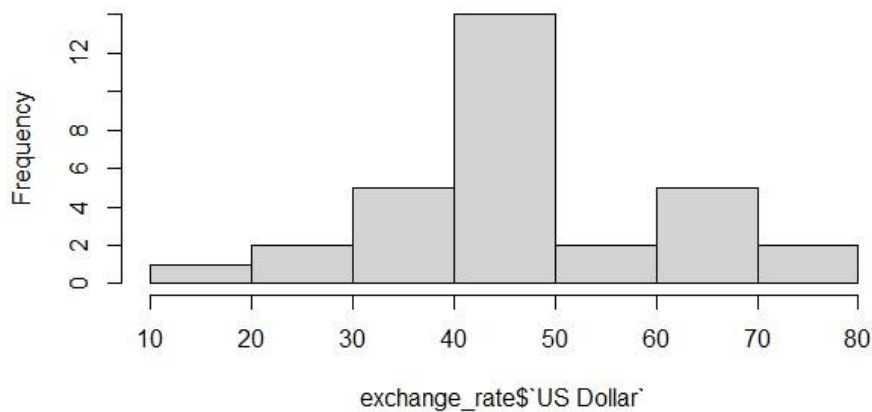


Figure 5: Histogram of USD-INR Exchange Rate

```
> summary(exchange_rate$`us dollar`)
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 17.50  38.79   45.32   46.70   56.02   74.10
```

Figure 6: Summary Statistics of USD-INR Exchange Rate

Figure 4 is obtained by using the command `hist()` in R. Figure 5 is obtained by using the `summary()` command in R.

We observe that the mean rate of exchange between INR and USD in the period of study is ₹45. However, the latest exchange rate is much higher at ₹74. It should be noted that the values are not adjusted for inflation.

In the subsequent sections of this paper, we’ll try and derive a relationship between the exchange rate of Indian Rupee and the variables affecting the same. We’ll analyse the following variables:

1. Inflation
2. Foreign Direct Exchange
3. Balance of Trade

Exchange Rate Analysis with Variable of Inflation

In 1991, the Government of India decided to end its closed-economy policies adopted at the time of independence. After facing severe crisis in the 1980s and the threat of default looming over, the country’s governance adopted the policy of Liberalization, Privatization and Globalization, bringing the economy to a new era. In the 30 years since then, the economy has faced many highs and lows. In this section we examine the performance of Consumer Price Index (CPI) and the resulting inflation rate in order to understand the impact on everyday lives.

Table 1: Consumer Price Index - Monthly (1990-2021)

Year/Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1990-91	180	182	185	189	190	191	195	198	199	202	202	201
1991-92	202	204	209	214	217	221	223	225	225	228	229	229
1992-93	231	234	236	242	242	243	244	244	243	241	242	243
1993-94	245	246	250	253	256	259	262	265	264	263	265	267
1994-95	269	272	277	281	284	288	289	291	289	289	291	293

1995-96	29 5	30 0	30 6	31 3	31 5	31 7	31 9	32 1	31 7	31 5	31 6	31 9
1996-97	32 4	32 8	33 3	33 9	34 3	34 4	34 6	34 9	35 0	35 0	35 0	35 1
1997-98	35 4	35 2	35 5	35 8	35 9	36 1	36 5	36 6	37 2	38 4	38 2	38 0
1998-99	38 3	38 9	39 9	41 1	41 3	42 0	43 3	43 8	42 9	42 0	41 5	41 4
1999-00	41 5	41 9	42 0	42 4	42 6	42 9	43 7	43 8	43 1	43 1	43 0	43 4
2000-01	43 8	44 0	44 2	44 5	44 3	44 4	44 9	45 0	44 6	44 5	44 3	44 5
2001-02	44 8	45 1	45 7	46 3	46 6	46 5	46 8	47 2	46 9	46 7	46 6	46 8
2002-03	46 9	47 2	47 6	48 1	48 4	48 5	48 7	48 9	48 4	48 3	48 4	48 7
2003-04	49 3	49 4	49 7	50 1	49 9	49 9	50 3	50 4	50 2	50 4	50 4	50 4
2004-05	50 4	50 8	51 2	51 7	52 2	52 3	52 6	52 5	52 1	52 6	52 5	52 5
2005-06	52 9	52 7	52 9	53 8	54 0	54 2	54 8	55 3	55 0	119	119	119
2006-07	12 0	12 1	12 3	12 4	12 4	12 5	12 7	12 7	12 7	12 7	12 8	12 7
2007-08	12 8	12 9	13 0	13 2	13 3	13 3	13 4	13 4	13 4	13 4	13 5	13 7
2008-09	13 8	13 9	14 0	14 3	14 5	14 6	14 8	14 8	14 7	14 8	14 8	14 8
2009-10	15 0	15 1	15 3	16 0	16 2	16 3	16 5	16 8	16 9	17 2	17 0	17 0
2010-11	17 0	17 2	17 4	17 8	17 8	17 9	18 1	18 2	18 5	18 8	18 5	18 5
2011-12	18 6	18 7	18 9	19 3	19 4	19 7	19 8	19 9	19 7	19 8	19 9	20 1
2012-13	20 5	20 6	20 8	21 2	21 4	21 5	21 7	21 8	21 9	22 1	22 3	22 4
2013-14	22 6	22 8	23 1	23 5	23 7	23 8	24 1	24 3	23 9	23 7	23 8	23 9
2014-15	24 2	24 4	24 6	25 2	25 3	25 3	25 3	25 3	25 3	25 4	25 3	25 4

2015-16	25 6	25 8	26 1	26 3	26 4	26 6	26 9	27 0	26 9	26 9	26 7	26 8
2016-17	27 1	27 5	27 7	28 0	27 8	27 7	27 8	27 7	27 5	27 4	27 4	27 5
2017-18	27 7	27 8	28 0	28 5	28 5	28 5	28 7	28 8	28 6	28 8	28 7	28 7
2018-19	28 8	28 9	29 1	30 1	30 1	30 1	30 2	30 2	30 1	30 7	30 7	30 9
2019-20	31 2	31 4	31 6	31 9	32 0	32 2	32 5	32 8	33 0	33 0	32 8	32 6
2020-21	32 9	33 0	33 2	33 6	33 8	118	120	120	119	118	119	120

Source: <https://rbi.org.in/>

Consumer Price Index is a price index that calculates the changes in general price level of a basket of consumer goods and services. It is a method of estimating the cost of living.

CPI

$$= \frac{\text{Weighted cost of market basket in current year}}{\text{Weighted cost of market basket in base year}} \times 100$$

The base year is updated periodically to keep the figures relevant for policy implementation. In the given data, figures highlighted in red represent the changes in base year. For the years 1990-2005, CPI was calculated for the base year 1982. From January 2006, the base year was updated to 2001. In September 2020, CPI was recorded at base year 2016. However, differences in base years can lead to misleading results. Therefore, researchers use a 'linking factor', a ratio used to link two indices to form a continuous series.

Illustration 1: CPI for 2005-06 without linking factor:

However, this result is based on prices in 1982 and the huge gap makes the results irrelevant in 2006.

Hence, CPI for 2005-06 has been derived by linking new 2001 series with 1982 series using the linking factor 4.63 and CPI for 2020-21 has been derived by linking the 2016

series with 2001 series using the linking factor 2.88.

$$(529+527+529+538+540+542+548+553+550+119+119+119) / 12 = 434.$$

Illustration 2: CPI for 2005-06 using linking factor $[(529+527+529+538+540+542+548+553+550)/4.63 + 119 + 119 + 119] / 12 = 117$

Similarly, annual average CPI for 2020-21 is calculated using the linking factor 2.88

Illustration 3:

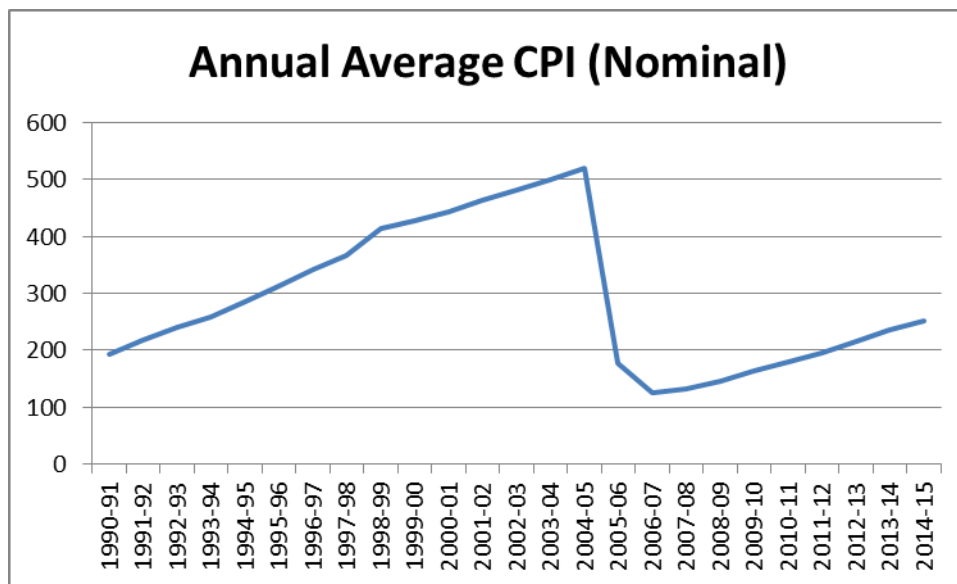


Figure 7: Consumer Price Index - Annual Average (Nominal)

As seen in Figure 6, nominal CPI cannot be used to gain useful insights. This can be attributed to the differences in base years.

Calculation of Inflation from CPI:

Illustration 1: Calculation of inflation for year 2005-06 without adjusting linking factor Inflation for the year 2005-06 = $[(117-520)/520] \times 100 = -77.5$

This is a highly unrealistic scenario. It implies that the economy has deflated by 77.5%. This is due to simultaneous use of two different index series.

Illustration 2: Calculation of inflation for year 2005-06 with linking factor adjusted Inflation for the year 2005-06 = $[(542*-520)/520] \times 100 = 4.23$

This is a more realistic scenario. It implies that the economy has inflated by 4.23%. Here, we make comparison within same indices as the CPI of 2004-05 is based on base year 1982. From the next year, we use base year 2001.

$*[(119+119+119) \times 4.63 + (529+527+529+538+540+542+548+553+550)]/12 = 542$ Similarly, inflation is calculated for year 2020-21 using linking factor 2.88.

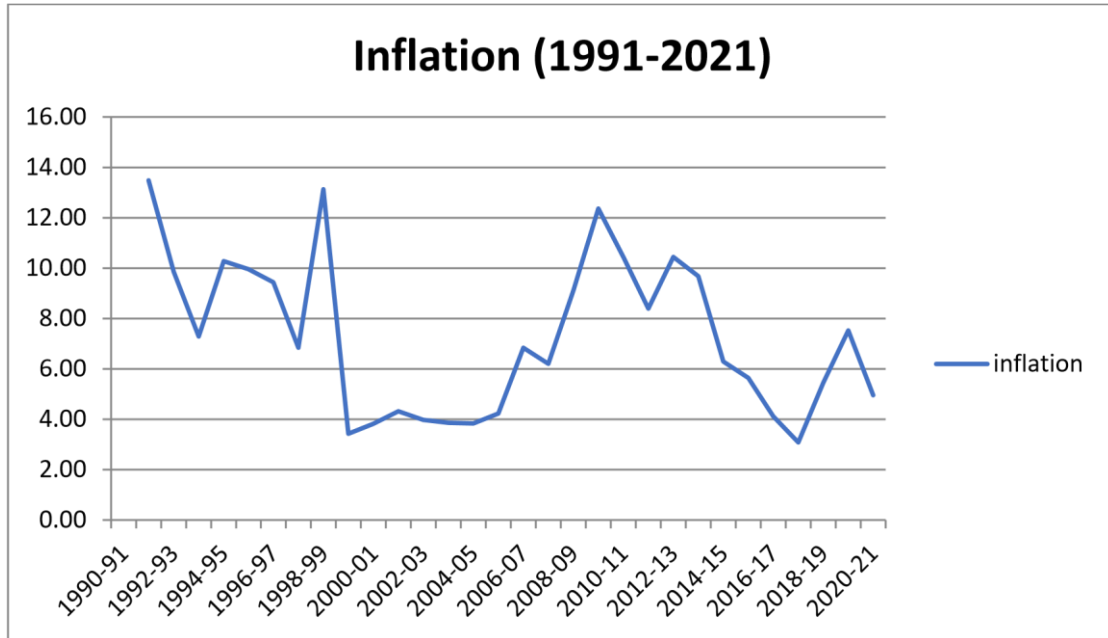


Figure 8: Inflation (1991-2021)

Analysis of Figure 7 and Table 2 gives us more realistic insight into the patterns of inflationary pressures on the economy between the years 1991-2021.

Observations:

1. Inflation peaks in the years 1991-92, 1998-99 and 2009-10. This is consistent with the years of biggest financial crisis in the recent years: Indian Economic Crisis (1991), Asian Financial Crisis (1997) and Global Financial Crisis (2008).
2. After a brief dip, inflation starts to rise again in 2012. This is commensurate with the U. S. debt ceiling crisis in 2011.
3. A consistent decline is observed after 2011 crisis until 2020, the year of COVID-19 pandemic which brought the global economy to a standstill.

Table 2: Calculation of Inflation (1991-2021)

Year/Month	Average	inflation
1990-91	193	
1991-92	219	13.48
1992-93	240	9.86
1993-94	258	7.28
1994-95	284	10.27
1995-96	313	9.96

1996-97	342	9.43
1997-98	366	6.84
1998-99	414	13.13
1999-00	428	3.42
2000-01	444	3.82
2001-02	463	4.32
2002-03	482	3.97
2003-04	500	3.86
2004-05	520	3.83
2005-06	177	4.23
2006-07	125	6.84
2007-08	133	6.20
2008-09	145	9.10
2009-10	163	12.37
2010-11	180	10.45
2011-12	195	8.39
2012-13	215	10.44
2013-14	236	9.68
2014-15	251	6.29
2015-16	265	5.65
2016-17	276	4.12
2017-18	284	3.08
2018-19	300	5.45
2019-20	323	7.53
2020-21	118	4.95

Relationship between Inflation and Exchange Rate

```
> cor.test(exchange_rate$`US Dollar`, exchange_rate$inflation)

Pearson's product-moment correlation

data: exchange_rate$`US Dollar` and exchange_rate$inflation
t = -2.6472, df = 28, p-value = 0.01317
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.6955626 -0.1038856
sample estimates:
 cor
-0.4474097
```

Figure 9: Correlation between Exchange Rate and Inflation

Figure 8 is obtained by using cor.test() command in R. Figure 9 is botained using plot() command in R.

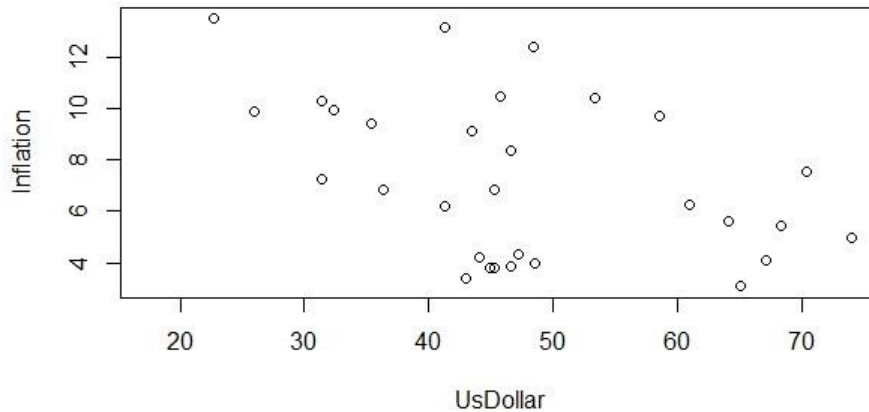


Figure 10: Scatter Plot for Exchange Rate and Inflation

From the above figures, we understand that there exists a negative correlation between inflation and exchange rates. This implies that inflation and valuation of currency are inversely related. It does not establish causality, however, previous studies have shown that there exists bi-directional causality between the two variables.

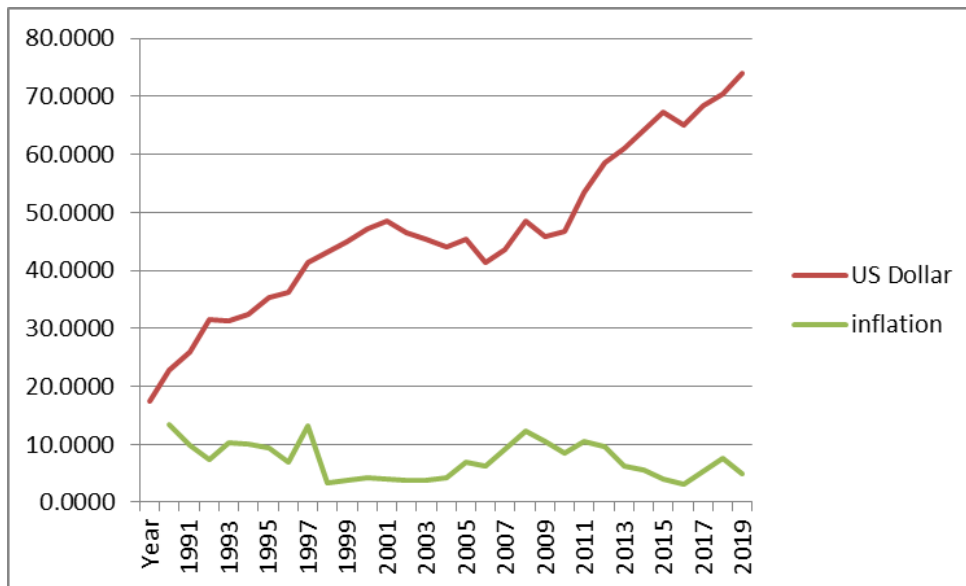


Figure 11: Trend of Exchange Rate and Inflation

In figure 10, we plot a line graph for USD-INR exchange rate and inflation for the years 1990-2020. The pattern observed here is consistent with conclusion of correlation test conducted in R. Therefore, there exists an inverse relationship between inflation and rate of exchange.

Inflation and US Dollar move in opposite directions. As inflation decreases, exchange rate rises. When the inflation rate rises, US Dollar moves downwards, closer to inflation line.

Exchange Rate Analysis with FDI as Variable

Foreign Direct Investment (FDI) is defined as the capital inflows from abroad that are invested in or to enhance the production capacity of the production units. The simplest explanation of FDI would be a direct investment by a corporation in a commercial venture in another country. Growth in FDI in the global landscape over the last three decades has had a striking impact on development. Global FDI growth since the 1990s has been extraordinary as FDI has proven to provide bilateral gains to both, the host and the home country. For eg. the countries that invited FDI benefitted by taking advantage of the vast markets opened by industrial growth while the host countries acquired technological and managerial skills along with supplement domestic savings and foreign exchange.

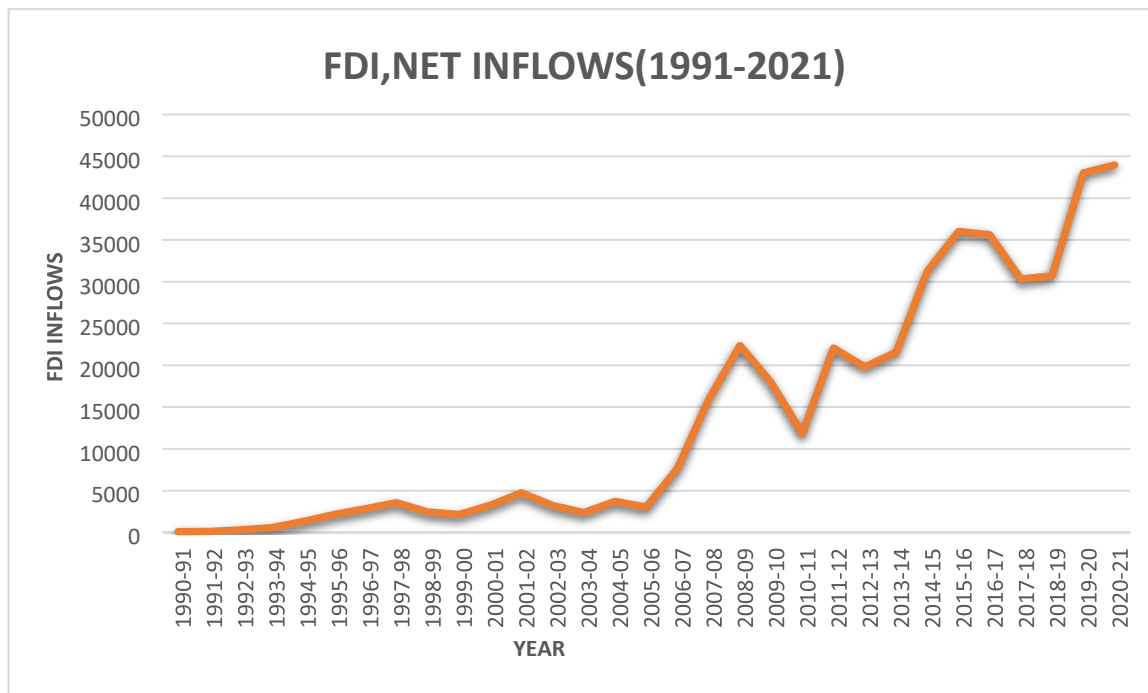


Figure 12: FDI Trend in India (1991-2021)

In India, the last three decades have witnessed an extensive growth in FDI flows. This growth was not so significant until 1991 due to the regulatory policy framework. However, a steady build up has been observed in the Net FDI Inflows in the post liberalization period. The actual inflows increased from US\$ 129 Million in 1991-92 to US\$ 43955 Million in 2020-21, even though we cannot compare the FDI inflows in India to that of China, as China is much ahead of us and we have to struggle to get maximum FDI in our country yet as per the latest report of UNCTAD (United Nations Conference on

Trade and Development) we can see that India stood at fourth position in context of FDI inflow in the region thus surpassing South Korea.

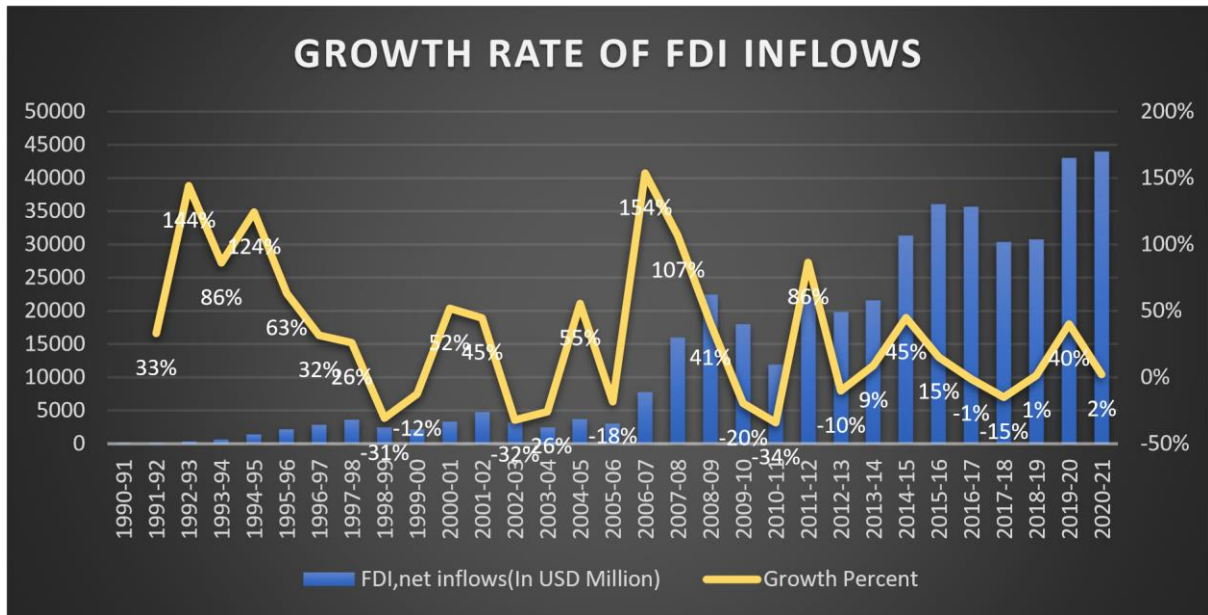


Figure 13: Growth of FDI Inflow in India

The FDI inflow of each year in India (since 1991) and its growth rate are depicted in Figure 13. The growth rate too fluctuated during 1991 to 2021. In the year 1998, 1999, 2002 and 2003 it was negative i.e., -31%, -12%, -32% and -18%% respectively. Thereafter it increased to a maximum in 2006-07 i.e., 154. The major cause behind this was the introduction of automatic route in the year 2006.

We can easily analyse from the Fig 13 that the percentage growth in FDI has not remained consistent. That is, it declined by 32% and 26% in 2002-03 and 2003-04. Again, it went up to 55% in 2004-05 but then it went down by 18% in 2005-06. It significantly increased again by 45% the share for which can be given to the ‘Make in India’ scheme that was introduced in 2014.

MAX	154%
MIN	-34%

Maximum and Minimum growth of FDI Inflows in the country since 1991.

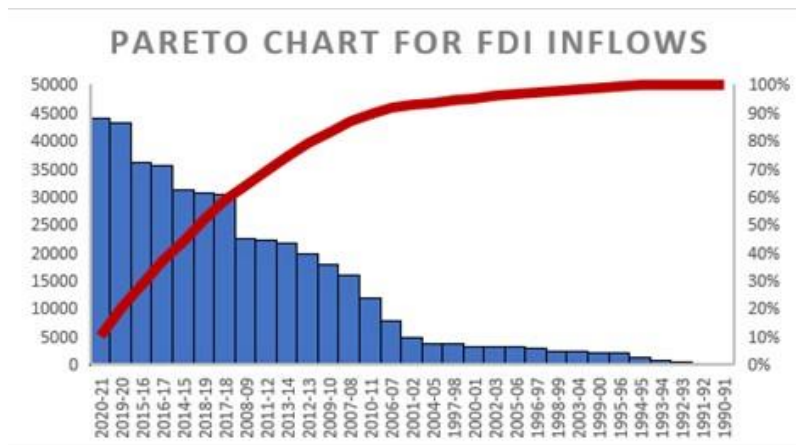


Figure 14: Pareto Trend of FDI Inflow in India (1991-2021)

From Figure 14, we can see that FDI Inflows from the years 2017-2021 comprise of the majority of the inflows with around 60% of inflows coming from this period.

DATA ANALYSIS OF FDI INFLOWS FROM 1991-2021 USING DESCRIPTIVE STATISTICS

MEAN	13741.61

Formula=AVERAGE(B2:B32)

Mean Value of 13741.61 USD Million signifies the average amount of FDI Inflows in the country since the period of liberalisation.

MAX	43955
MIN	97

Formula= MAX(B2:B32), =MIN(B2:B32)

MEDIAN	4734
--------	------

Formula =QUARTILE.INC(B2:B32,2)

The median of 4734 USD Million signifies that half of the values are less than 4734 and half of them are greater than 4734.

VARIANCE	202034742
STANDARD DEVIATION	14213.8926

Formula =VAR.S(B2:B32), =STDEV.S(B2:B32)

The Variance of 202034742 signifies that the individual observations in the dataset vary greatly from the mean value of 13741.61.

The Standard Deviation of USD Million 14213.8926 signifies that FDI inflows clusters around ± USD Million 14213.8926 of the mean.

SKEWNESS	0.811610373
----------	-------------

Formula=SKEW()

Because the skewness is positive, we have a right skewed distribution which means that most of the values lie in the lower portion of the distribution.

KURTIOSIS	-0.71633
-----------	----------

Formula=KURT()

Kurtosis compares the shape of the peak to the shape of the peak of a bell-shaped normal distribution whose Kurtosis is 0. Because the Kurtosis of FDI Inflows is negative, our distribution is Platykurtic which means it has a Slower-rising (flatter) centre peak than the peak of a normal distribution.

QUARTILES

Q1=	2425
-----	------

Formula= QUARTILE.INC (B2:B32,1)

Q1=USD Million 2425 indicates that 25% of FDI inflows from 1990-2021 are equal to or less than this value.

Q3=	22216.5
-----	---------

Formula= QUARTILE.INC (B2:B32,3)

Q3=USD Million 22216.5 implies that 75% of FDI inflows are equal to or less than this value.

INTERQUARTILE RANGE	Q3-Q1	19791.5
---------------------	-------	---------

The interquartile range (mid-spread) measures the difference in the centre of a distribution between the third and first quartiles. Thus, the Interquartile Range is USD Million 19791.5.

R COMMANDS AND GRAPHS

```
> getwd()
[1] "/Users/nanditarai/Desktop"
> FDI=read.csv(file.choose())
> FDI
  Year FDI.net.inflows.In.USD.Million GDP.In.USD.Million.
1 1991-1992                129                267524
2 1992-1993                 315                245553
3 1993-1994                 586                276037
4 1994-1995                1314                323506
5 1995-1996                2144                356299
6 1996-1997                2821                388344
7 1997-1998                3557                410915
8 1998-1999                2462                416252
9 1999-2000                2155                450476
10 2000-2001               3272                460182
11 2001-2002               4734                477849
12 2002-2003               3217                507190
13 2003-2004               2388                599461
14 2004-2005               3713                721573
15 2005-2006               3034                834036
16 2006-2007               7693                951339
17 2007-2008              15893               1242426
18 2008-2009              22372               1215593
19 2009-2010              17966               1377265
> mean(FDI$FDI.net.inflows.In.USD.Million)
[1] 5250.789
> mean(FDI$GDP.In.USD.Million.)
[1] 606411.6
> summary(FDI$FDI.net.inflows.In.USD.Million)
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   129   2150   3034   5251   4224  22372
> summary(FDI$GDP.In.USD.Million.)
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
245553 372322 460182 606412 777804 1377265
> var(FDI$FDI.net.inflows.In.USD.Million)
[1] 40081471
> var(FDI$GDP.In.USD.Million.)
[1] 124707658151
> cov(FDI$FDI.net.inflows.In.USD.Million,FDI$GDP.In.USD.Million.)
[1] 2031170444
```

Figure 15: Summary Statistics of FDI and GDP

Mean FDI and GDP have been calculated on the R software. Mean represents the average for a set of data. USD Million 606411.6 was the average GDP. of the country during the period of 1992-2010.

The cov() command depicts the covariance between the given variable. Since the covariance is positive and high, we can conclude that GDP and FDI are positively related and have a strong relationship.

Boxplot of FDI and GDP:

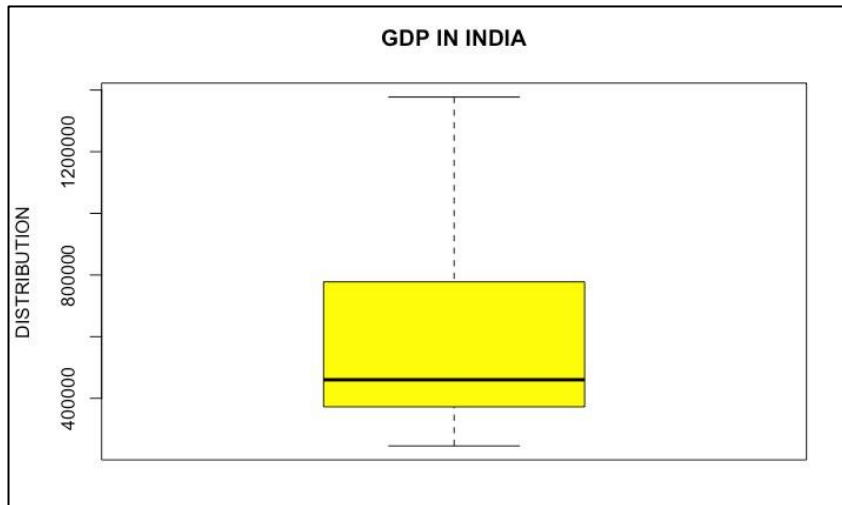


Figure 16: Boxplot of FDI

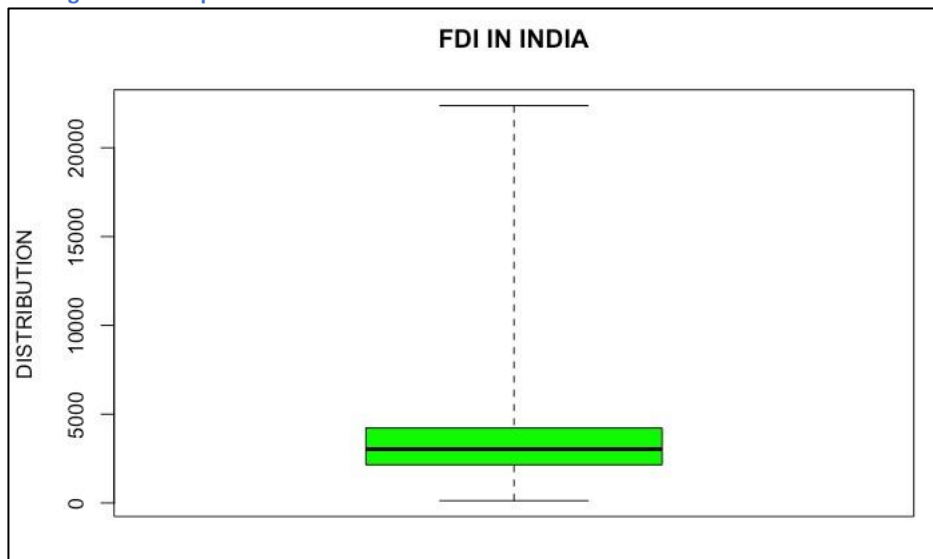


Figure 17: Boxplot of GDP

```
> boxplot(FDI$GDP.In.USD.Million.,main='GDP IN INDIA',ylab='DISTRIBUTION',col='yellow')
> boxplot(FDI$FDI.net.inflows.In.USD.Million,main='FDI IN INDIA',ylab='DISTRIBUTION',col='green')
```

Figure 18: Box Plot Commands

Box plots are used to show overall patterns of response for a group. They provide a useful way to visualise the range and other characteristics of responses for a large group. You can easily read a boxplot to find the five number summary.

We can also identify the skewness of our data by observing the shape of our box plot. From the graphs we can see that both the data sets are positively skewed and most of the values lie in the lower portion of the distribution

PivotTable

Years	SINGAPORE	MAURITIUS	U.S.A	NETHERLANDS	JAPAN	U.K.	GERMANY	CAYMAN ISLANDS	U.A.E.	CYPRUS	Grand Total
Sum of 1991-1995	13849	246745	154217	16478	28355	37975	22128	68	4768	5	524588
Sum of 1996-2000	30983	297689	349576	30521	70995	125902	62839	37257	2226	230	1008218
Sum of 2000-2007	114426	891311	187227	113286	89738	155353	59041	17995	25758	28750	1682885
Sum of 2008-2010	399064	1461572	233148	125261	124061	122862	70820	14473	57387	176489	2785137
Sum of 2010-2016	2529809	324489	661491	875137	1181577	963076	380204	51173	174639	259098	7400693
Sum of 2017-2021	4344634	2786304	1711358	1178693	713545	415652	228925	622629	471684	143995	12617419
Sum of Total FDI Inflows of the countries (1991-2021)	7432765	6008110	3297017	2339376	2208271	1820820	823957	743595	736462	608567	26018940

Country	Total FDI Inflows of the...
MAURITIUS	608567
U.K.	736462
U.S.A	743595
JAPAN	823957
U.A.E.	1820820
CAYMAN ISLANDS	2208271
CYPRUS	2339376
GERMANY	3297017

Figure 19: Pivot Table for Top 10 Countries by FDI

In the above Pivot Table, the data of top 10 countries attracting maximum FDI inflows into the country for the past 30 years has been summarised in an easy manner. The columns have been organised in a descending manner to show that Singapore has the maximum amount of FDI inflows into the country followed by Mauritius. Slicers have also been added to make it convenient for the viewers to select any one country or total FDI inflow and look at the individual data sets.

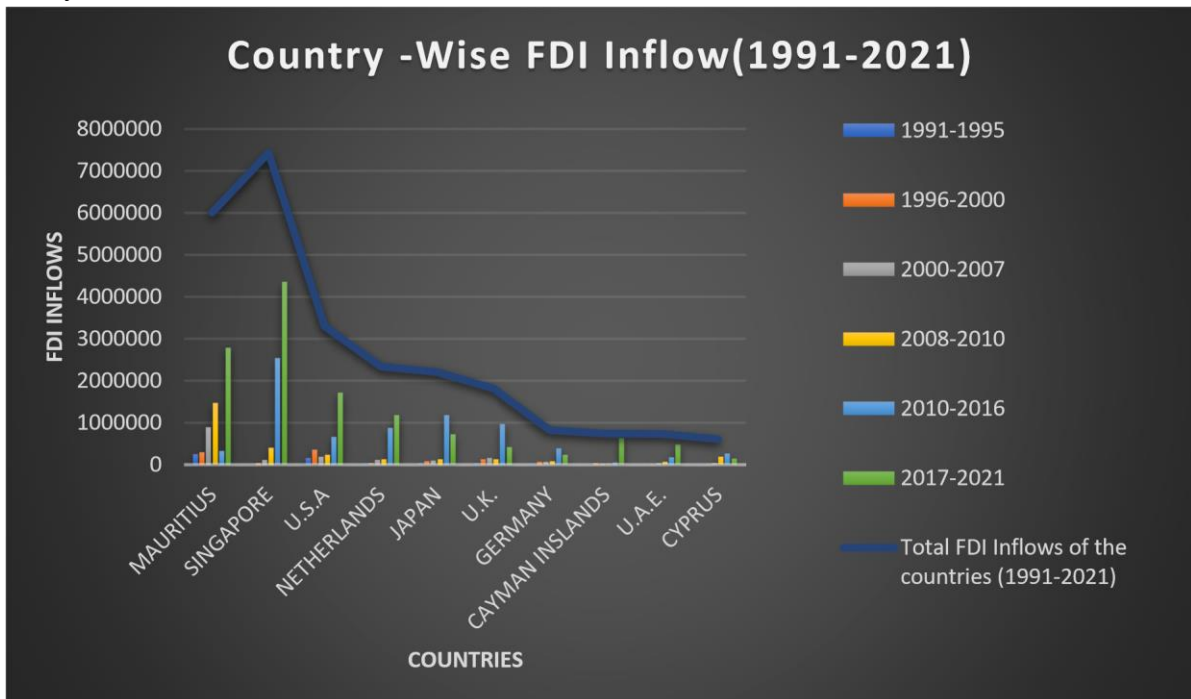
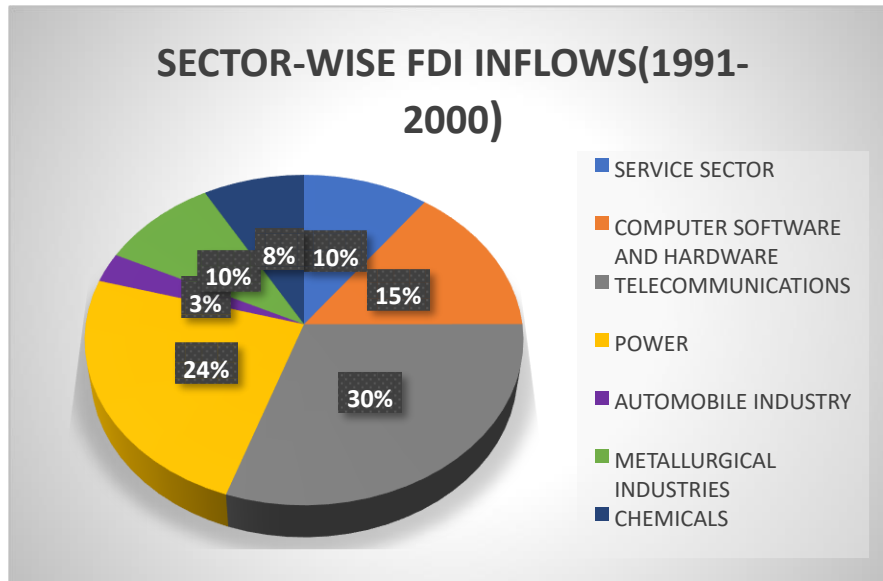


Figure 20: Country-Wise FDI Inflow (1991-2021)

Sector-Wise FDI Inflows from 1991 to 2021



The given pie charts represent the sectorial distribution of FDI inflows with the data being divided into the respective decades.

The first decade experienced maximum FDI inflows from the telecommunications sector with a contribution of about 30% when compared to others.

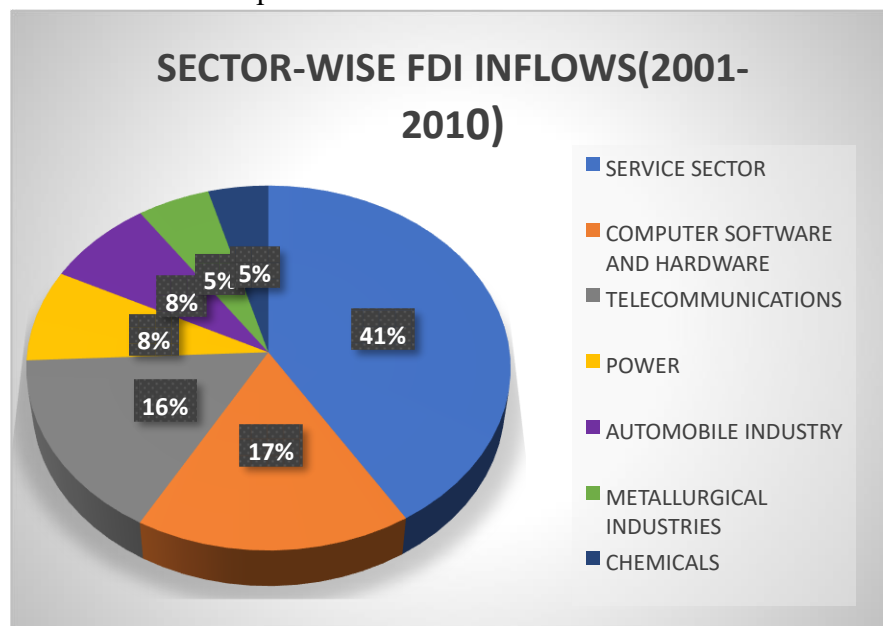


Figure 22: Sector-Wise FDI Inflows (2001-2010)

During 2001-2010, service sector attracted the largest amount of FDI followed by Computer Software and Telecommunication. Liberalization of FDI policy was majorly responsible for this change in sectorial distribution to the service sector.

Computer Software and Hardware sector attracted maximum FDI during 2010-2020 followed by Service sector being at the second position.

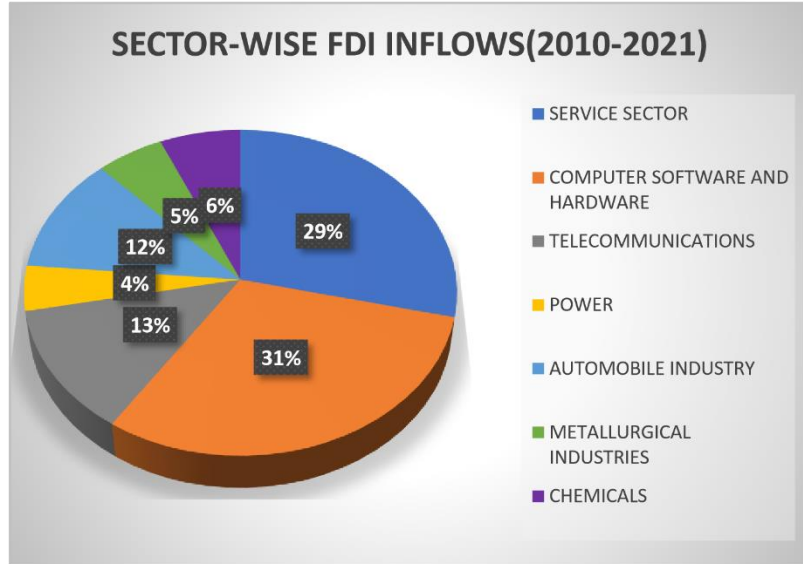


Figure 23: Sector-Wise FDI Inflows (2010-2021)

RELATIONSHIP BETWEEN EXCHANGE RATE AND FDI

The present analysis seeks to identify any kind of relationship that might be present between the Foreign Direct Investment (FDI) inflows in India and the Real Exchange Rate using annual data from 1990-2021.

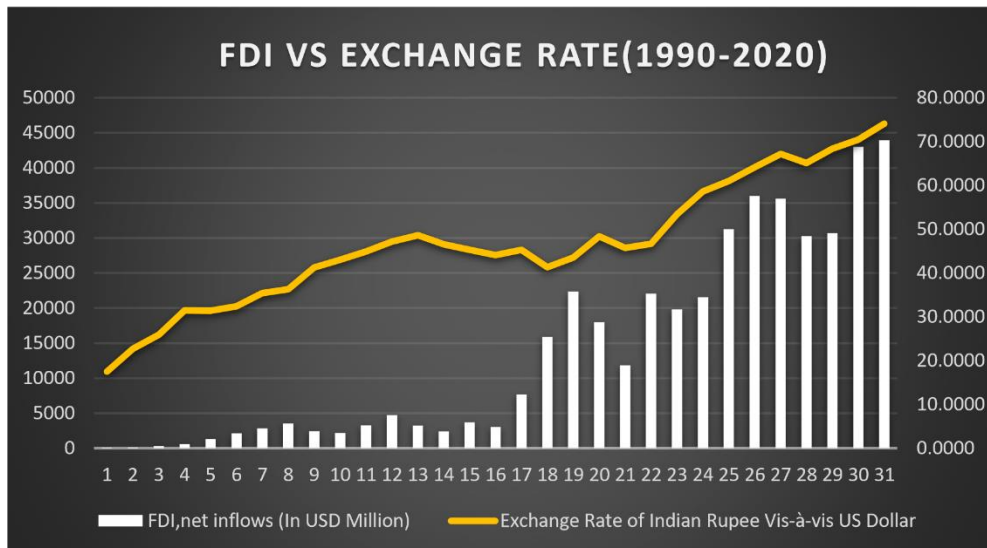


Figure 24: FDI VS Exchange Rate (1990-2020)

It has been observed that exchange rate volatility has an effect on both the prices and quantities of the inputs and outputs of MNC's further leading to competitiveness in the global market. Moreover, in a perfect capital market, the source of financing assets does not matter and hence the decision to locate abroad would not have been affected by the exchange rate.

However, in the real capital markets this theory does not hold true. Further, under the floating exchange rate regime, the uncertainty of exchange rate is only bound to increase more. This volatility in exchange rate causes uncertainty for the future behavior of both exchange rate and FDI. This provides us with an ambiguous relationship between FDI and exchange rate as seen in the Fig 24. The bar graph depicts the FDI inflows and we can see that the year wise investments do not demonstrate a general uniform trend. There is fluctuation throughout but it does represent an upward trajectory. Compared to FDI, exchange rate shows a somewhat linear trajectory with an upward trend.

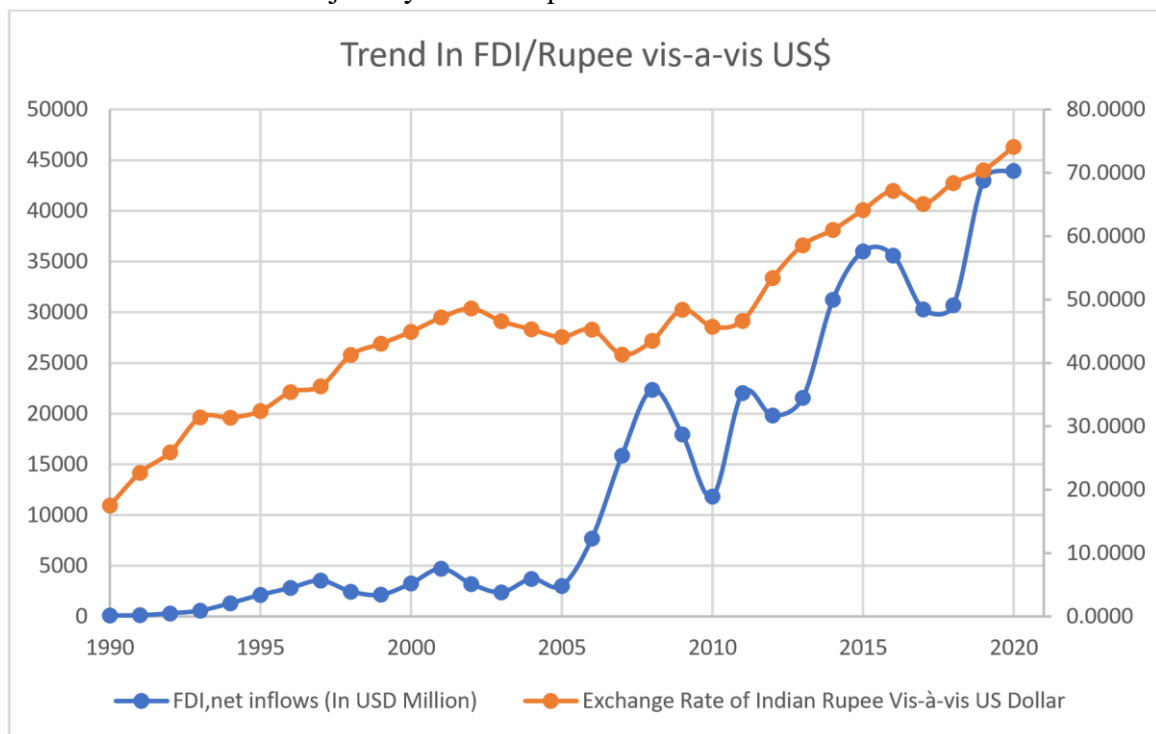


Figure 24: Trend in FDI/Rupee vis-a-vis USD

From Fig 24, it is clear that exchange rate volatility increased markedly from the mid-2000s, especially since the Global Financial Crisis and the continuous depreciation of rupee met with some moderation in January to February 2012 with the rupee coming back to its Rs. 4950/US\$ trajectory. From the graph we can observe that FDI Inflows too showed a high rise during the same time period as Exchange rate i.e 2008-2013.

ESTABLISHING A RELATIONSHIP BETWEEN THE EXCHANGE RATE AND FDI INFLOWS USING DESCRIPTIVE STATISTICS

```
> getwd()
[1] "/Users/nanditarai/Desktop"
> comparing=read.csv(file.choose())
> comparing
  Financial.Year FDI.net.inflows..In.USD.Million. Exchange.Rate.of.Indian.Rupee.Vis.à.Vis.US.Dollar
1          1990                               97                               17.4992
2          1991                               129                               22.6890
3          1992                               315                               25.9206
4          1993                               586                               31.4458
5          1994                              1314                               31.3742
6          1995                              2144                               32.4232
7          1996                              2821                               35.4294
8          1997                              3557                               36.3196
9          1998                              2462                               41.2677
10         1999                              2155                               43.0485
11         2000                              3272                               44.9401
12         2001                              4734                               47.1857
13         2002                              3217                               48.5993
14         2003                              2388                               46.5819
15         2004                              3713                               45.3165
16         2005                              3034                               44.1000
17         2006                              7693                               45.3070
18         2007                             15893                               41.3485
19         2008                             22372                               43.5049
20         2009                             17966                               48.4049
21         2010                             11834                               45.7262
22         2011                             22061                               46.6723
23         2012                             19819                               53.4376
24         2013                             21564                               58.5978
25         2014                             31251                               61.0295
26         2015                             36021                               64.1519
27         2016                             35612                               67.1953
28         2017                             30286                               65.1216
29         2018                             30712                               68.3895
30         2019                             43013                               70.4203
31         2020                             43955                               74.0996
> colMeans(comparing[-1])
  FDI.net.inflows..In.USD.Million. Exchange.Rate.of.Indian.Rupee.Vis.à.Vis.US.Dollar
13741.61290                               46.69508
```

Figure 25: Mean of FDI Inflows and Exchange Rate

The colMeans() command in R returns the mean values of the columns present in the dataset. The mean values of FDI Inflows and Exchange Rate are 13741.61290 and 46.69508.

Covariance is the measure of the relationship between two variables. A high covariance basically indicates that there is a strong relationship between the variables. Covariance calculations provide information on whether variables have a positive or negative relationship but cannot reveal the strength of the connection.

In Excel we use the function COVAR to calculate the covariance.

A covariance of 171795.4315 suggests that a positive relationship exists between the Exchange Rate in India and the FDI Inflows in the period 1991-2021

The command min() returns the smallest values of FDI Inflows and Exchange Rate


```

> min(comparing$Exchange.Rate.of.Indian.Rupee.Vis.à.Vis.US.Dollar)
[1] 17.4992

> min(comparing$FDI.net.inflows..In.USD.Million.)
[1] 97
> max(comparing$Exchange.Rate.of.Indian.Rupee.Vis.à.Vis.US.Dollar)
[1] 74.0996
- -
> max(comparing$FDI.net.inflows..In.USD.Million.)
[1] 43955

```

The command max() returns the largest values of Exchange Rate and FDI Inflows

```

> quantile(comparing$Exchange.Rate.of.Indian.Rupee.Vis.à.Vis.US.Dollar)
  0%    25%    50%    75%   100%
17.49920 38.79365 45.31650 56.01770 74.09960
> quantile(comparing$FDI.net.inflows..In.USD.Million.)
  0%    25%    50%    75%   100%
 97.0 2425.0 4734.0 22216.5 43955.0
> IQR(comparing$Exchange.Rate.of.Indian.Rupee.Vis.à.Vis.US.Dollar)
[1] 17.22405
> IQR(comparing$FDI.net.inflows..In.USD.Million.)
[1] 19791.5

```

To measure the quartile of the data, command quantile() is used

Interquartile range is the difference between the 1st and 3rd Quartile. The command for this function in R is IQR().

	FDI INFLOWS	EXCHANGE RATE
KURTIOSIS	-0.71633	-0.403005329

In our analysis, both FDI Inflows and the Exchange Rate show a negative value for kurtosis. This means that the data sets have a negative or low kurtosis and hence lack outliers. A negative kurtosis (Platykurtic) also means that the data sets have thin tails.

A fundamental task in many statistical analyses is to characterize the location and variability of a data set. A further characterization of the data includes kurtosis. Kurtosis is a measure of whether the data are heavy-tailed or light-tailed relative to a normal distribution.

Effect of FDI on INR-USD Exchange Rate

```
> cor.test(comparing$Exchange.Rate.of.Indian.Rupee.Vis.à.Vis.US.Dollar,comparing$FDI.net.inflows..In.USD.Million.)

Pearson's product-moment correlation

data: comparing$Exchange.Rate.of.Indian.Rupee.Vis.à.Vis.US.Dollar and comparing$FDI.net.inflows..In.USD.Million.
t = 9.7386, df = 29, p-value = 1.2e-10
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.7548439 0.9384523
sample estimates:
cor
0.8751156
```

Figure 25: Correlation between FDI and USD-INR Exchange Rate

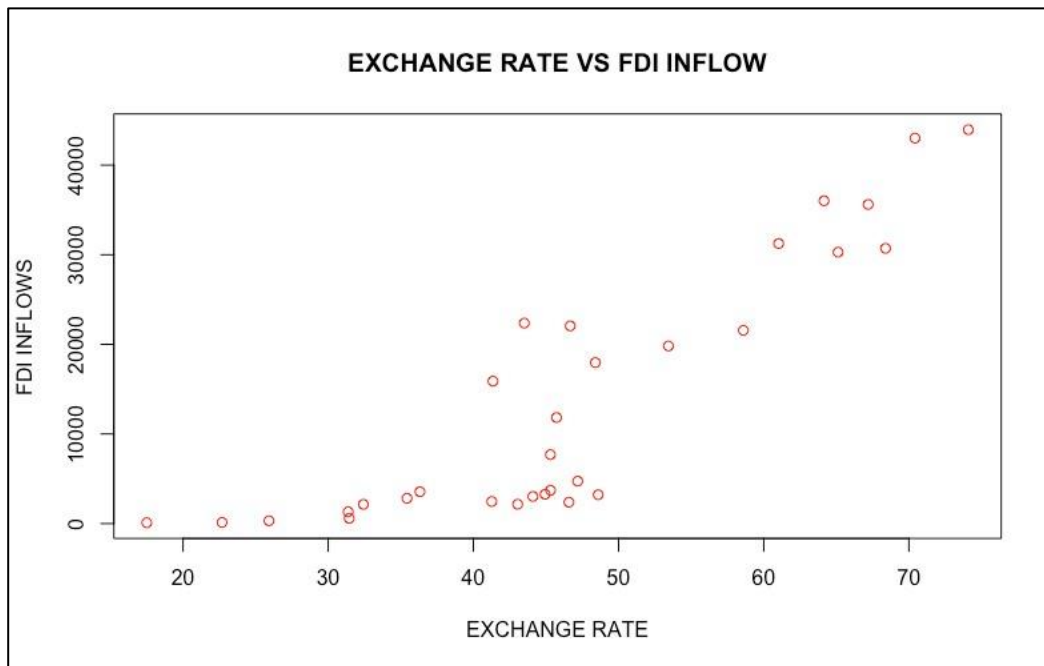


Figure 26: Scatter plot to show correlation in FDI Inflows and the Dollar Exchange Rate

As it can be seen in the demonstration above, there is a strong positive correlation between FDI and exchange rate in India which means they move in the same direction and with the increase in Foreign Direct Investment every year, the value of Indian currency depreciates against the dollar.

From this analysis, we can conclude that increased foreign direct investment is a result of the low exchange rate. This is because low exchange rate acts as an encouragement for foreign investors to enter India.

As India is considered to be one of the biggest developing countries in the world, a continuous inflow of foreign capital in extremely important. Exchange rate changes has an impact on the international wealth of a country. It is therefore suggested that policymakers in India must take into account the fluctuations in exchange rate while framing the foreign policies.

Exchange Rate Analysis with Variable of Balance of Trade

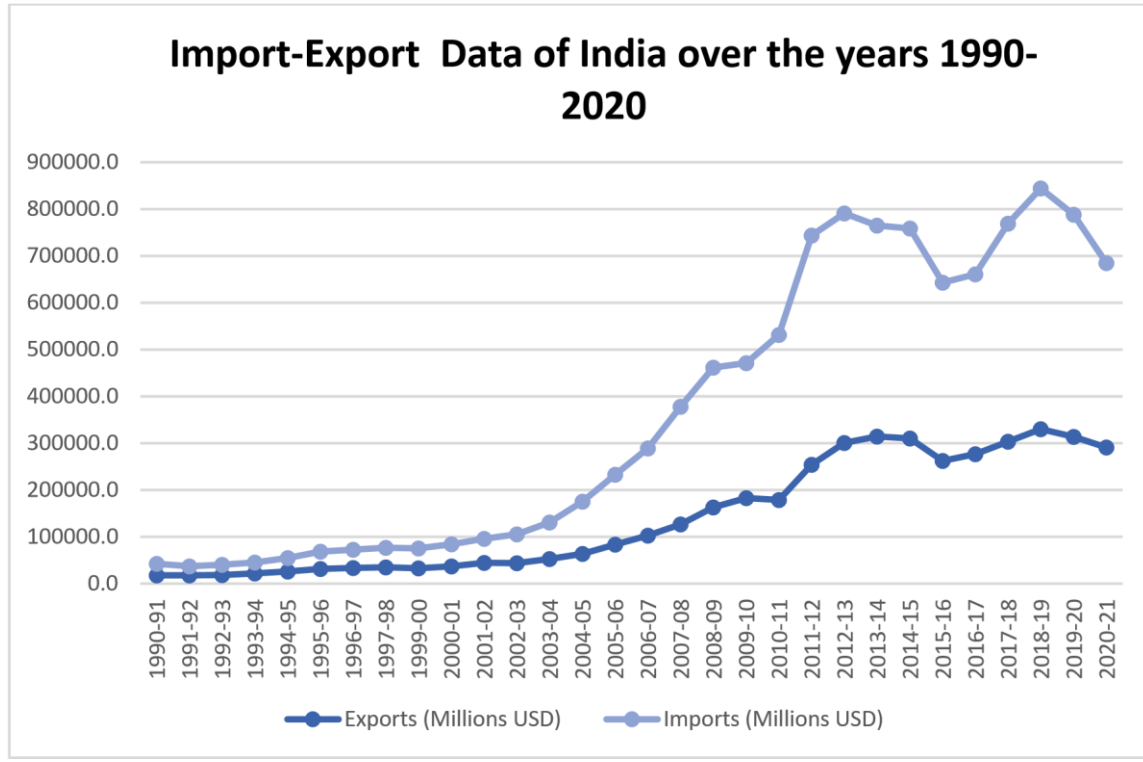


Figure 27: Import-Export Data of India (1990-2020)

Over the course of 30 years, India has gone from being a protective economy to one of the top 100 countries (63rd) in the World Bank’s Ease of Doing Business Index in 2019. From the lowest export of USD 17865.4 Million during 1991-92 to the highest export of USD 33078.1 Million during 2018-19, India has improved its trade trajectory on a Global level since the Economic Reforms of 1991. This project attempts to explore the policy changes that took place in 1991 which opened India’s borders for global trade and strengthened India’s position and its effect on INR.

Trade Policy Changes of 1991

After independence, the leaders of free India outlined the trade policies of India to protect the indigenous industries from intense foreign competition and incentivize their growth. To achieve the said objective, the government used the tools of import restriction and import substitution. Employing a protectionist approach, India remained a closed economy till much of the late 1980s. Import tariffs as high as 123% were imposed to restrict the imports and it was a common belief that the rupee was overvalued to a very large extent.

The infamous License Raj system hinged the wheels of the Indian Economy by obligating a permit for starting a business, expanding the production capacities, hiring processes, or winding up. In addition to these, tariff rates were inflated by 146.4% on intermediate goods, making India the country with the highest tariff rates in the world. The government nationalized the heavy industrial sector and the inflow of FDI in the country was severely constrained.

In 1991, the then Prime Minister Sir Narsimha Rao appointed Dr. Manmohan Singh, an esteemed academician, an economist as the finance minister who turned over a new leaf in the Indian economy. He

made efforts to liberalize the Indian economy in a phased manner, reducing the tariffs, devaluing the rupee, put an end to the era of License Raj to expose

India to the global market as well as improve the economic growth of the country.

Analysis of Indian Exports for the years 1990-2020

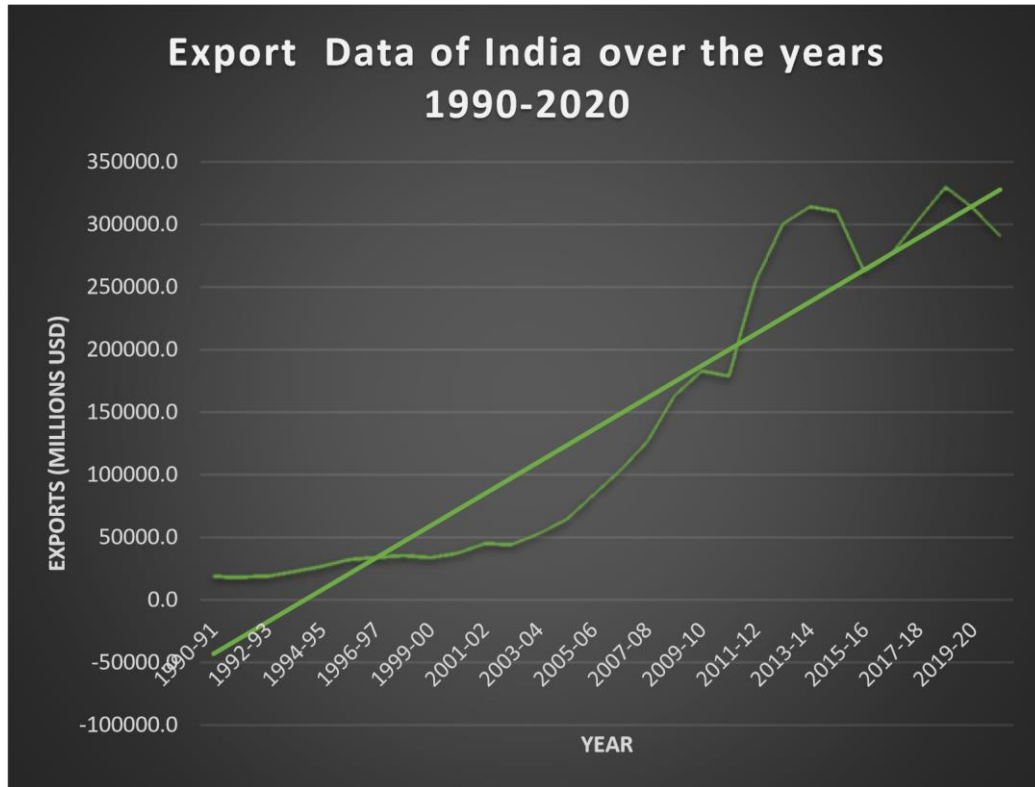


Figure 28: Export Data of India (1990-2020)

It has been 30 years since the reforms were introduced and India was exposed to competition from the west. Over the years, tariffs got reduced to as low as 17.6% in 2019, making India 63rd most desirable country in the World Bank’s Ease of Doing Business Index out of 192 countries. As evident in fig a, the export trajectory of India is on an increasing trend since 1991. From the lowest exports of USD 17865.4 Million during 1991-92 to the highest export of USD 33078.1 Million during 2018-19, India has managed to grow its export territory to a very large extent.

Year	Exports (Millions USD)	
1990-91	18145.2	
1991-92	17865.4	(Lowest)
1992-93	18537.2	
1993-94	22238.3	
1994-95	26330.5	
1995-96	31794.9	
1996-97	33469.7	
1997-98	35006.4	
1999-00	33218.7	
2000-01	36822.4	
2001-02	44560.3	
2002-03	43826.7	
2003-04	52719.4	
2004-05	63842.6	
2003-04	52719.4	
2004-05	63842.6	
2005-06	83535.9	
2006-07	103090.5	
2007-08	126414.1	
2008-09	162904.2	
2009-10	182799.5	
2010-11	178751.4	
2011-12	254402.1	
2012-13	300400.7	
2013-14	314415.7	
2014-15	310533.9	
2015-16	262290.1	
2016-17	276547	
2017-18	303526.2	
2018-19	330078.1	(Highest)
2019-20	313361.0	
2020-21	291163.5	

```

> summary(ImportExport$Exports..Millions.USD.)
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.   NA's
17865  33854  93313 142420 272983 330078     1
  
```

Figure 29: Summary Statistics of Exports

To summarise the export data of India from last 30 years, the minimum export recorded was USD 17685 Million and maximum export was USD 330078 Millions. India has exported an average amount of USD 1,42,420 Million in the last 30 years.

Summarized data prepared in the R Software. Code used: >summary(filename\$variable)

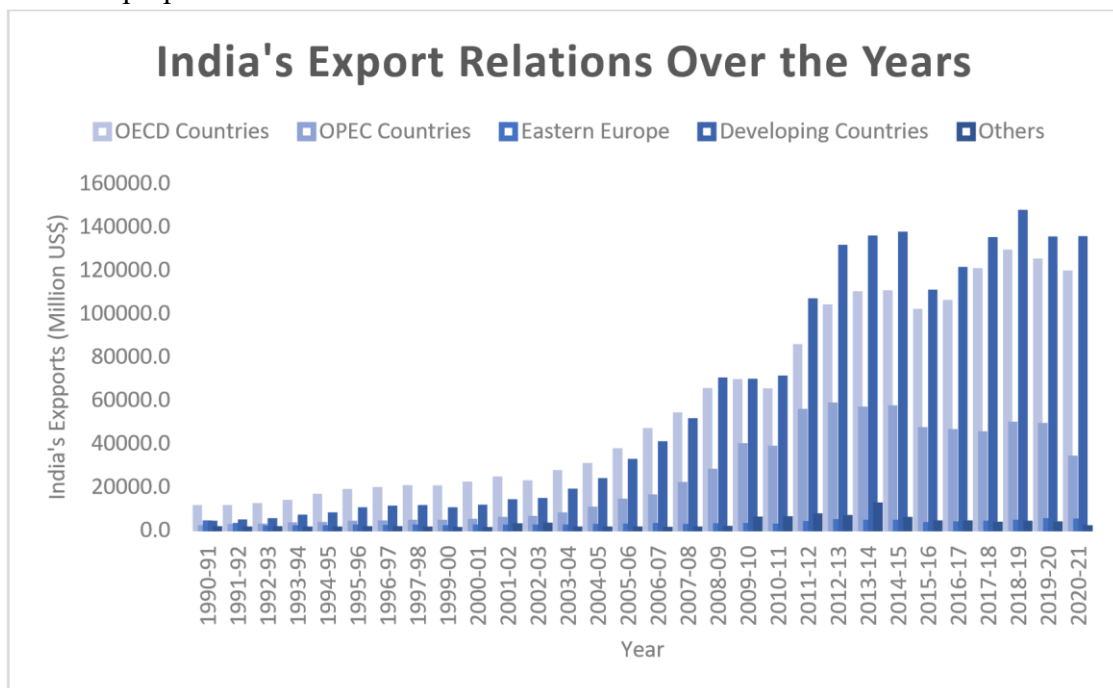


Figure 30: India's Export Relations Over the Years

Not only India has managed to produce enough to achieve self-reliance, but also fostered better trade relations with its neighbours and other countries in the world. The total export has grown from USD 18145.2 Million in 1991-92 to USD 291163.5 Million in 2020-21. India has trading relations with

OECD countries which consist of the European Union, North America, Asia, and Oceania, Switzerland.

Effect of Export on INR-USD Exchange Rate

```
>
> cor.test(importexport$Exports..Millions.USD.,importexport$US.Dollar)

Pearson's product-moment correlation

data: importexport$Exports..Millions.USD. and importexport$US.Dollar
t = 9.0035, df = 28, p-value = 9.263e-10
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.7279674 0.9327031
sample estimates:
cor
0.8621306
```

Figure 31: Correlation between Exports and USD

Pearson’s Correlation measures the strength and direction of association existing between two variables.

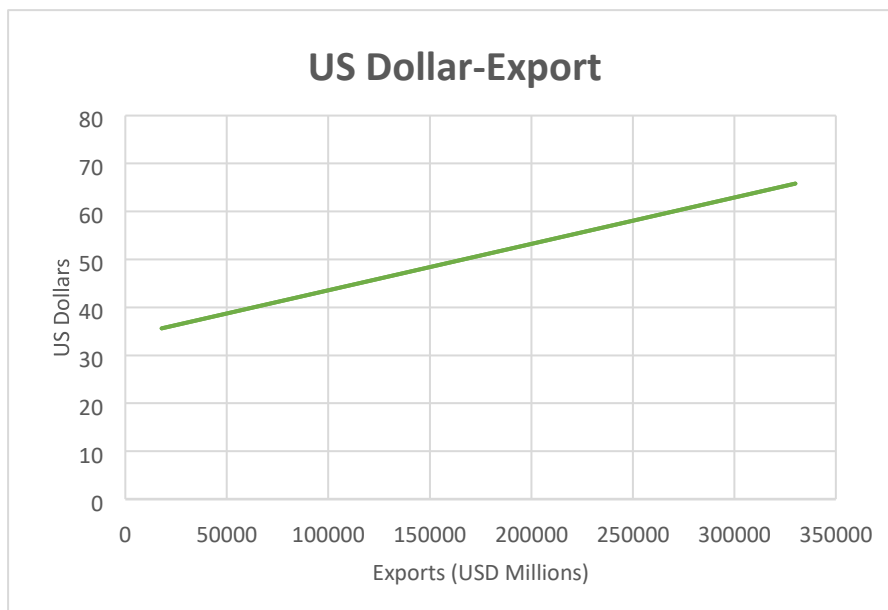


Figure 32: US Dollar-Export

From the analysis performed between the export values and exchange rate of the last 30 years, it can be concluded that correlation between them is strong and positive 0.8621306. a positive correlation refers to the positive relationship between the two variables. When exports increase, the domestic currency appreciates.

Analysis of Indian Imports for the years 1990-2020

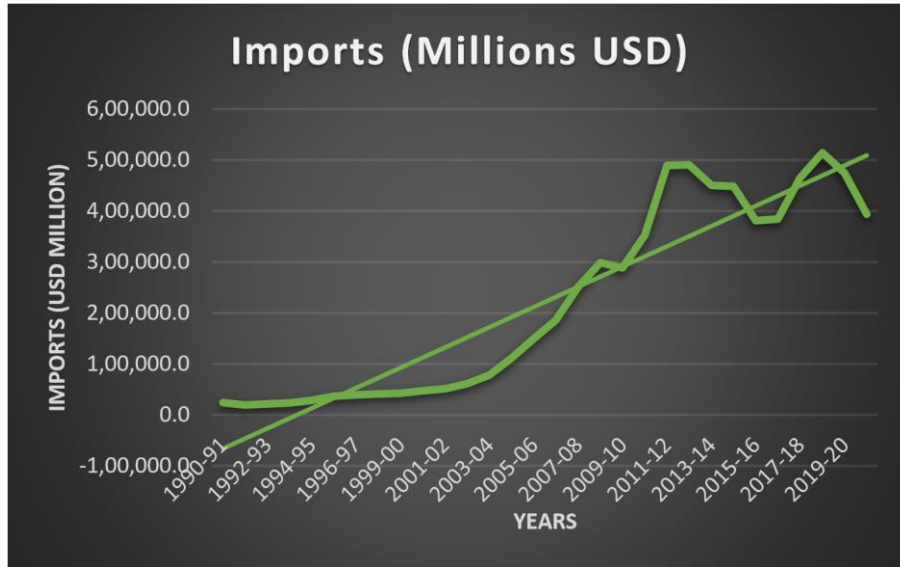


Figure 33: Imports (Millions USD)

India has made tremendous efforts to put itself on the global map after practicing the protectionist approach for decades, restricting imports by employing high tariff rates for decades after independence. While India has achieved the level of self-sufficiency, it still imports a variety of things such as raw materials, petroleum products, precious metals, etc. As evident from the fig 32, imports have followed a zig-zag pattern in the country over the years, going from the lowest USD 19410.9 Million in 1991-92 to the highest USD 514078.4 Million in 2018-19

Year	Imports (Millions USD)	
1990-91	24,072.5	
1991-92	19,410.9	(Lowest)
1992-93	21,881.6	
1993-94	23,306.2	
1994-95	28,654.4	
1995-96	36,675.3	
1996-97	39,132.4	
1997-98	41,484.5	
1999-00	42,388.7	
2000-01	47,212.1	
2001-02	51413.3	
2002-03	61412.1	
2003-04	78149.1	
2004-05	111517.4	
2010-11	352575.0	
2011-12	489417.4	
2012-13	490736.7	
2013-14	450213.7	
2014-15	448033.4	
2015-16	381006.6	
2016-17	384357.0	
2017-18	465581.0	
2018-19	514078.4	(Highest)
2019-20	474709.3	
2020-21	393610.6	

```
> summary(ImportExports$Imports..Millions.USD.)
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.   NA's
19411  41711 167451  221486 391297 514078     1
> |
```

Figure 34: Summary Statistics of Imports

The data has been summarized using the ‘Conditional Formatting feature in Excel, wherein, the 10 highest and lowest values have been highlighted and ‘Summary’ feature in R Software, wherein, the averages have been displayed.

To summaries the Import data of India for over 30 years, India has imported minimum of USD 19411 Million and maximum of USD 514078 Million. In the last 30 years, India has managed to import an average of USD 2,21,486 Million.

Over the years, India has nurtured a trade relationship with OECD, OPEC, Eastern European, and Developing Countries, the imports with whom have been flowing throughout the years. India has reduced its import tariffs from over 123% to just 17.6% in recent years.



Figure 35: India's Import Relations Over the Years

Effect of Import on INR-USD Exchange Rate

```
> cor.test(importexport$Imports..Millions.USD., importexport$US.Dollar)

Pearson's product-moment correlation

data: importexport$Imports..Millions.USD. and importexport$US.Dollar
t = 7.1704, df = 28, p-value = 8.375e-08
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.6257442 0.9031002
sample estimates:
 cor
0.8046223
```

Figure 36: Correlation between Imports and USD

Through the “Pearson’s product-moment Correlation”, the correlation between the import of India and the US Dollar exchange rate for the years 1991-2021 is positive 0.8046223. The correlation suggests a positive relationship between Imports and Exchange Rate. When imports of the country increases, the domestic currency depreciates and foreign currency appreciates.

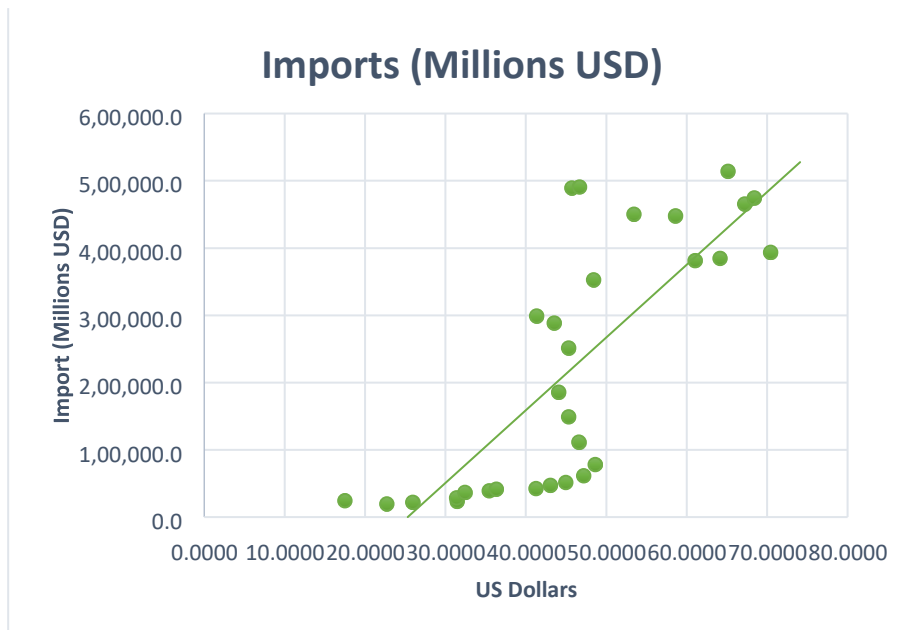


Figure 37: Imports (Millions USD)

Balance of Trade (1991-2020) Balance of trade refers to the difference between a country’s value of exports and imports. The economy that imports more goods than it exports, has a negative balance of trade and if the economy exports more goods than it imports, it has positive balance of trade. India has a negative balance of trade since 1991 and this negative figure is on a continuously increasing trend. Since India’s exports and imports both have been increasing since the reforms, so has the imports and exports, reaching the highest -1,90,336 million USD in 2012-13. The experts say that this deficit was mainly due to the fall in manufacturing sector of the country. In 2012-13, the trade deficit was 22 times than the deficit in 1991-92.

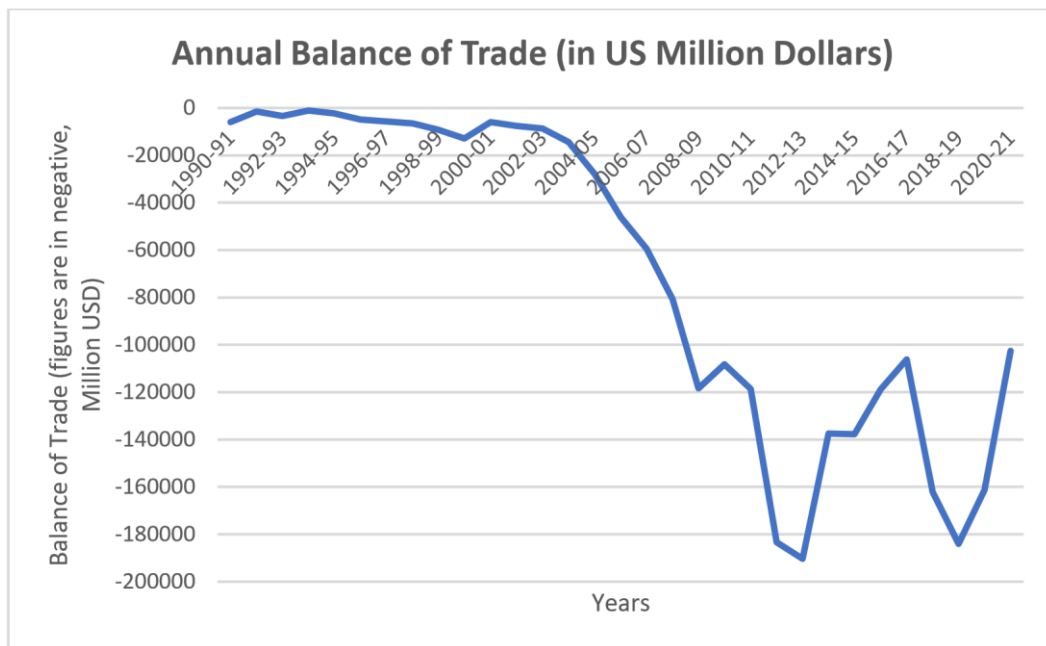


Figure 38: Annual Balance of Trade (in US Million Dollars)

Balance of Trade and Currency Depreciation

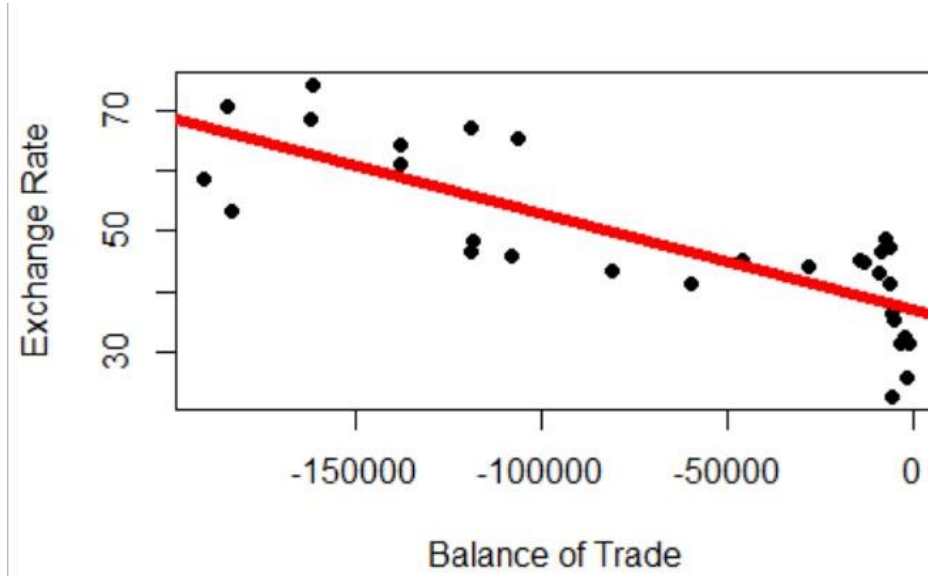
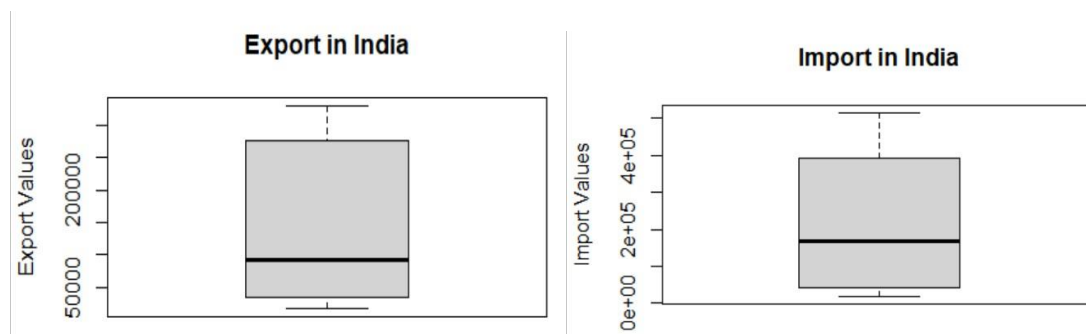


Figure 39: Scatter Plot for Balance of Trade

The balance of trade affects the currency exchange rates and plays a pivotal role in its fluctuations. If the country’s balance of trade is not zero, it may affect the demand for the currency and hence, its exchange rate. If the balance of trade is positive, the currency appreciates as demand for the domestic currency rises. If the balance of trade is negative, the currency depreciates as demand for the domestic currency falls.

In the case of India, the balance of trade has been on negatively increasing since the reforms. Even though India has managed to achieve self-sufficiency, it has to import several raw materials to produce the final product. This is one of the reasons why Indian Currency is depreciating day by day.



Exports and Imports (1991-2020)

The boxplot of both the import and export data shows that the data is positively skewed. The positive skewness shows that majority of the values lie near the lower proportion of the distribution, however, there exists few large value that causes the tail to elongate. In such cases, the mean gets greater than the median.

```
> cor.test(ImportExport$Balance.of.Trade, ImportExport$US.Dollar)

Pearson's product-moment correlation

data: ImportExport$Balance.of.Trade and ImportExport$US.Dollar
t = -7.2549, df = 28, p-value = 6.74e-08
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.9048287 -0.6314621
sample estimates:
 cor
-0.8079301
```

Figure 40: Correlation between Balance of Trade and Currency Exchange Rate

After performing the ‘Pearson’s Product-Moment Correlation’ test on R, we get the correlation of -**0.8079301**, a strong negative correlation which confirms our initial theory of a negative relationship between the balance of trade and the currency exchange rate, i.e., when balance of trade increases (deficit), currency depreciates and when balance of trade (positive) falls, the currency appreciates. In case of India, it can be visualized through the following graphs:

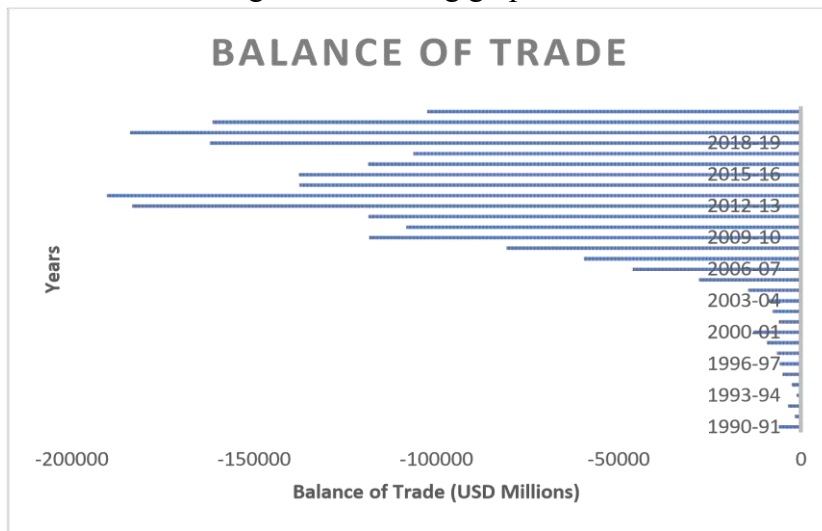


Figure 41: Balance of Trade

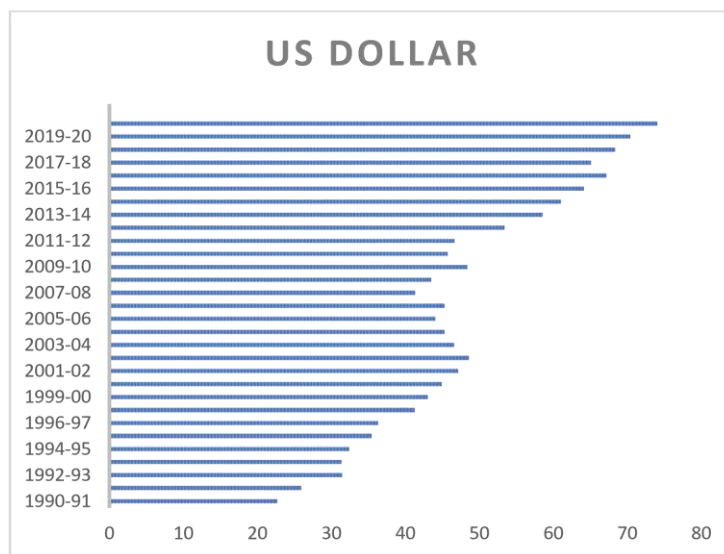


Figure 42: US Dollar

As visible from the graph, as the balance of trade is growing negatively, in fig 40, the US dollar is growing in comparison to the Indian Rupee as visible in the fig 41.

Limitations

- Data used for the Exchange Rates is yearly average, 1991-2021.
- Values of FDI are taken in approximations and may differ due to irregularity in official data available.
- Not all values are adjusted for inflation

Conclusion

The project aimed to analyse the exchange rate of India since the Economic Reforms of 1991 with the variable of Inflation, Foreign Direct Exchange (Inflow) and Balance of Trade.

In 1991, the Government of India decided to open the economy to foreign sector just when it was on the brink of failure. In the first section we analysed trends of Consumer Price Index (CPI), inflation and exchange rate. CPI is a measure of assessing the cost of living and is one of the ways to determine inflation. In the period of study, India's inflation rate has fluctuated erratically as it weathered domestic and global crises. However, we see a fairly consistent rise in the exchange rates over the same period. This implies that India's currency has depreciated against the US Dollar over the years. Analysing the two variables together, we see a clear pattern: inflation and currency exchange rate are inversely related. For example, in recent years, we observed a decline in inflation until the COVID-19 pandemic in 2020 but rise in exchange rate. Previous studies have shown that there exists a bi-directional causality between the inflation and the exchange rate.

This research project also attempted to study the causal nexus among FDI, Exchange rate and its volatility and the project found evidence that the exchange rate has a positive and significant effect on the average rate of FDI inflows under the favourable FDI environment.

Different statistical methods were employed to examine the objective and the analysis revealed a long run relationship among FDI and Exchange Rate. The results generally indicate that the depreciation of the Indian currency attract FDI inflows. However, it has been observed from earlier studies that overvaluation of the currency, which is often resulted due to inappropriate macroeconomic policies, discourages FDI and therefore the government needs to pursue sound macroeconomic policies providing a flexible but stable exchange rate system to successfully attract FDI.

India's trade volume has been on a consistent increasing rate since the years of Economic Reforms of 1991. After several decades of closed economy, India has finally made its entrance on the global map of trade. The increasing exports and imports are increasing the trade deficit of the country as well. This increasing trade deficit forces the domestic currency to fall. As analysed in this section of the project, the correlation between balance of trade and exchange rate between US Dollar and Indian Rupee is strong and negative, **-0.8079301**, based on the data of last 30 years suggesting a negative relationship between the trade deficit and exchange rate.

The export analysis shows that ever since the country has brought the reforms in 1991, the exports have grown with a tremendous speed and India now holds the **19th** position in exporting goods worth the value of **USD 304.1 Billion**. Our analysis shows that India reached its highest value of exports **USD 33078.1 Million** during 2018-19.

The import analysis shows a picture that whilst India has increased its exports, it still needs several commodities imported for the manufacturing sector. Before the reforms were introduced in the country, India had strictly policies regarding import of commodities.

Government had adopted a protectionist approach to give a boost to the domestic industries. Over the years, India reached highest **USD 514078.4 Million** in 2018-19.

Although the policies have opened India's gate to a Globalised world, but it has had certain implications as well. The currency has depreciated by a large percentage in the last three decades. If India wants to gain a stronger threshold for its currency, it'll have to work towards its accumulated trade deficit.