NSE & NYSE Stocks Volatility

Exploratory Data Analysis

Based on Covid and War Situations

A PROJECT REPORT

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Course Code: CSE5007

Course Title: Exploratory Data Analysis

Under the guidance of

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DECLARATION BY THE CANDIDATES

We hereby declare that the project report entitled “NSE & NYSE Stock Volatility - Exploratory Data Analysis (Based on Covid and War situations)” submitted by us to Vellore Institute of Technology, Vellore in partial fulfilment of the requirement for the award of MSc (Data Science) is a record of J-component of project work carried out by us under the guidance of Prof. Rushi Kumar. We further declare that the work reported in this project has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Place- Vellore Institute of Technology, Vellore

Date: 10-06-2022

Signature of the faculty

Signature of the Candidates

ACKNOWLEDGEMENT

We would like to express our special thanks of gratitude to our professor Mr. Rushi Kumar for his continual help and support which led us to complete the project on time and which gave us the golden opportunity to do this wonderful project. We would also like to thank our friends for helping us learn new skills to make our project better and also helped us a lot in finalising

Introduction:

A stock market, equity market, or share market is the aggregation of buyers and sellers of stocks (also called shares), which represent ownership claims on businesses; these may include securities listed on a public stock exchange, as well as stock that is only traded privately, such as shares of private companies which are sold to investors through equity crowdfunding platforms. Investment is usually made with an investment strategy in mind.

National Stock Exchange of India Limited is the leading stock exchange of India, located in Mumbai, Maharashtra.

The New York Stock Exchange is an American stock exchange in the Financial District of Lower Manhattan in New York City.

Stock market analysis is used to gain knowledge of the equity market to arrive at true value of a stock.By using stock analysis, investors and traders arrive at equity buying and selling decisions. Studying and evaluating past and current data helps investors and traders to gain an edge in the markets to make informed decisions.

Objective:

Our main objective in this project is to explore and understand how different major events affect the stock markets globally and domestically.

- To analyse how situations like war and pandemic can affect the stock market.
- How a chain reaction happens throughout different markets.
- Understand the behaviour of investment during different crisis.

Motivation:

Stock Market being stock market is subject to different events all around the globe. The recent major events that are the ongoing Pandemic and Russia - Ukraine War have created a chain of reactions that has created havoc world-wide. Multiple major decisions have been taken and implemented which have been beneficial to some and adversely affected some of the stocks creating major shifts in the stock markets. The sensitivity of the stock market to different factors outside and major shifts in patterns and trends and how it has impacted is our subject of exploration.

Methodology:

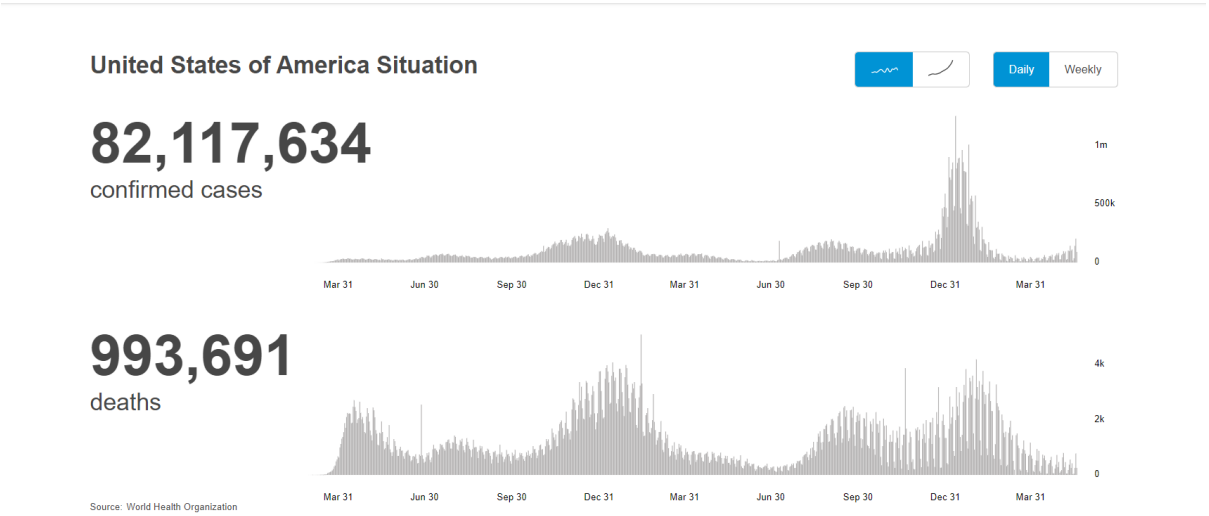
We are performing exploratory data analysis and research on Stock Market data, hence we extracted real time data from trusted source Yahoo Finance. We took stock from the sectors that are impacted from the US and the Indian market so as to compare how big global events or situations affect the market. The tool that we have used for EDA is Python-Jupyter and streamlit for deployment with interactive dashboard using the same. We also performed desktop research so as to understand and interpret our variables and how they were affected over a period of three years to understand trends.

Impact of COVID-19:

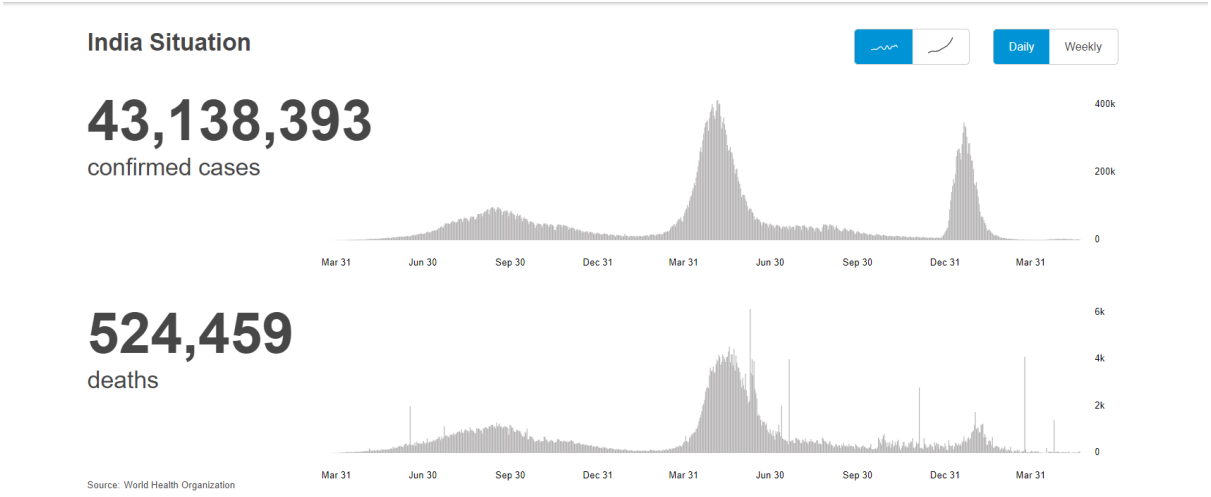
The lockdown in India started from 22nd March, 2020 and in the United States from 15th March, 2020. These nationwide lockdowns all over the world reduced manpower of product based companies while somewhat beneficially impacted service based companies. The shift from physical to remote has been beneficial and disadvantageous for different sectors. In the period of two years from 2020 to 2022 significant impacts have been observed in multiple sectors and evidently in the stock prices of the companies in respective sectors. During the first stage or initial stages the stock market was heavily impacted due to complete shutdown showing steep drop in prices. During partial lockdown stages a few sectors showed growth which was bare minimum but a positive growth. During the later stages where vaccinations came along with multiple doses the growth was significant, in fact sudden and exponential in some sectors

Covid Waves During the period of two years:

United States:



India:



Impact of war:

The Russian invasion on Ukraine started on February 24th, 2022. Russia and Ukraine both are biggest exporters of sunflower oil which is 4th most consumed oil globally. The war situation impacted the prices of oils which eventually was displayed in the fluctuations of stock prices of oil and oil refinery companies and also the oil as a commodity. A certain chain of reactions has impacted which eventually led to make important decisions which impacted the Indian Oil market. Nifty's bank index, financial services index, auto index and IT index were among the top losers, falling between one per cent and two per cent. Asian stock markets suffered heavy losses while oil prices jumped on the worsening Russia-Ukraine conflict, Reuters reported.

Why did we choose these 4 sectors namely Agriculture, Oil, Banking and Tech?

According to our research, these 4 sectors are one of the most affected both in India as well as globally.

Agriculture:-

Enough food is available globally, but COVID-19 is disrupting supply and demand in complex ways. The impact of lockdown imposed in India owing to COVID-19 on the overall production levels in the agricultural and allied sector has been significant with overall production levels

declining in 47% of the sample districts. Some of the reasons for decline in agricultural activities include lack of availability of labour and machines, need for social distancing, and restrictions on free movement of men and machineries.

The war that began on 24 February 2022 has caused extensive damage and loss of life in key population centres, spread across rural areas, and sparked massive displacement. More than 3.6 million people had been forced to abandon their homes and flee across borders to safety. Millions more are internally displaced. It is clear that the war has resulted in a massive, and deteriorating, food security challenge and disrupted livelihoods during the agricultural growing season in Ukraine and has also affected global food security.

Oil:-

COVID-19's impact on the global economy and consumer behaviors has reduced long-term world oil demand by 2.5 million barrels per day. However, COVID-19, alongwith the Saudi-Russian oil price war, has thrown the oil and gas industry into turmoil. With drastic drops. in price, imbalances of supply and demand, and increased stock, typical recovery strategies will be insufficient. As a result, bankruptcies, consolidation, and diversification are inevitable.

Russia's invasion of Ukraine has had rippling humanitarian and economic impacts across the globe. The energy industry is particularly vulnerable. The imperative for oil and gas companies, working in concert with governments, is to mitigate the potential disruption of supplies from Russia. Over the longer term, the industry needs to strengthen its resilience and relevance in a fast-changing energy world. We believe six priority actions will help oil and gas companies become stronger, more agile, and more responsive to global circumstances.

Bank:-

The firms that have stopped working miss out on revenues, and therefore might not be able to repay loans. Similarly, households with members who have lost their jobs or are furloughed have less income, and therefore might not be able to repay their loans. This will result not only in lost revenue but also in losses, negatively affecting profits and bank capital. And as a swift recovery becomes less likely, banks can expect further losses, resulting in the need for additional provisions, further undermining their profitability and capital position. Impact of war on energy prices, inflation and growth amplifies existing vulnerabilities. Market reaction to invasion is largely orderly, but risk of further correction remains. Banks face weaker profitability after strong recovery in 2021.

Technology:

Despite this global crisis, the revenue of the IT Industry was calculated at around USD 190 Billion for 2020-21, and it is expected to reach around USD 300-350 Billion by the year 2025. Around 35-38% of tech organisations are likely to improve or enhance their IT operations and infrastructure due to the COVID-19 outbreak. The leading companies of the sectors have reported an average of 5-10% increase in IT expenditures only because of the COVID-19 pandemic.

Most of the focus has been on cyber security and semiconductor chips. Russia is a world leader in cyber warfare, sowing misinformation and weaponizing digital platforms. And semiconductor bottlenecks could get worse as the Ukraine crisis deepens, with 90% of U.S. semiconductor-grade neon supplies coming from Ukraine, and 45% of the world's palladium coming from Russia, while the Biden administration threatens a chip blockade of Russia — and adding to the uncertainties already roiling semiconductor markets.

TECHNICAL REQUIREMENTS:

Language used :

Python

Libraries Used :

Pandas, Streamlit, Numpy, Matplotlib, yfinance

Data collection:

Data collected through yahoo finance api using yfinance module in python. Hence Real-time data was accessed for this exploratory data analysis. Company share names were passed in to get the data for the same.

Data cleaning:

Data contains NaN values as stock markets are closed for some days throughout the year. That means the stock market did not open for those particular days.

Handling missing values:

We deleted all the records which have NaN values since stock trends are sensitive to any change in prices. Since we are examining a highly volatile period, substituting with any value can be challenging.

Selection of variable:

For Stock price data the most important variable is the closing price of the stock for that particular day, hence we only chose Close columns for plotting the data

CODE:

We have created a function which will take any Indian and US company stock and plot its closing price chart and comparison chart.

Below Function gives us a daily returns chart for the companies we select.

```
def plot_returns(ind_c, us_c ,p ,i):
    names={"ONGC.NS":"","XOM":"Exxon Oil",
       "RALLIS.NS":"Rallis","BAYERCROP.NS":"Bayer's Crop",
       "TECHM.NS":"Tech Mahindra","IBM":"IBM",
       "^NSEBANK":"Bank Nifty","^BKX":"US Bank Index",
          "^CNXIT":"Tech Nifty","DJUSTC":"US tech Index","OIL.NS":"Oil Nifty","CL=F":"US oil Index"}
    name_ind=[]
    name_us=[]
    if ind_c in [i for i in names.keys()]:
        name_ind.append(names[ind_c])
    if us_c in [i for i in names.keys()]:
        name_us.append(names[us_c])
    data_ind = yf.download(tickers=ind_c,
                       period=p,
                       interval=i)

    data_us = yf.download(tickers=us_c,
                       period=p,
                       interval=i)

    plt.figure(figsize = (16, 4))

    data_ind['Day_Perc_Change'] = data_ind['Close'].pct_change()*100
    data_ind.dropna(axis = 0, inplace = True)


    plt.subplot(1, 2, 1)
    plt.title(name_ind[0])
    plt.plot(data_ind['Day_Perc_Change'])
    plt.xticks(rotation=45)
    plt.ylabel("Returns")
    plt.xlabel("Date")

    data_us['Day_Perc_Change'] = data_us['Close'].pct_change()*100
    data_us.dropna(axis = 0, inplace = True)
```

```
    plt.subplot(1, 2, 2)
    plt.title(name_us[0])
    plt.plot(data_us['Day_Perc_Change'])
    plt.xticks(rotation=45)
    plt.ylabel("Returns")
    plt.xlabel("Date")


    plt.show()
```

Below function gives us Closing price comparison chart with highlighted covid period.

```
def plot_close(ind_c, us_c ,p ,i):
    names={"ONGC.NS":"","XOM":"Exxon Oil",
       "RALLIS.NS":"Rallis","BAYERCROP.NS":"Bayer's Crop",
       "TECHM.NS":"Tech Mahindra","IBM":"IBM",
       "^NSEBANK":"Bank Nifty","^BKX":"US Bank Index",
         "OIL.NS":"Oil Nifty","CL=F":"US oil Index"}
    name_ind=[]
    name_us=[]
    if ind_c in [i for i in names.keys()]:
        name_ind.append(names[ind_c])
    if us_c in [i for i in names.keys()]:
        name_us.append(names[us_c])
    data_ind = yf.download(tickers=ind_c,
                       period=p,
                       interval=i)

    data_us = yf.download(tickers=us_c,
                          period=p,
                          interval=i)
    plt.figure(figsize = (16, 4))

    plt.subplot(1, 2, 1)
    plt.title(name_ind[0])
    plt.plot(data_ind['Close'])
    plt.xticks(rotation=45)
    plt.ylabel("Stock Price")
    plt.xlabel("Date")

    plt.subplot(1, 2, 2)
    plt.title(name_us[0])
    plt.plot(data_us['Close'])
    plt.xticks(rotation=45)
    plt.ylabel("Stock Price")
    plt.xlabel("Date")

    plt.show()
```

```
    plt.figure(figsize = (16, 4))
    ss= MinMaxScaler()
    xi = ss.fit_transform(np.array(data_ind['Close']).reshape(-1,1))
    xu = ss.fit_transform(np.array(data_us['Close']).reshape(-1,1))

    print(xi.shape,xu.shape)
    plt.plot(data_ind.index ,xi.reshape(-1,))
    plt.plot(data_us.index ,xu.reshape(-1,))
    ini ,final ='2019-12-31' , '2020-05-03'
    plt.fill_between( data_ind.index,
                      1,0,
                      where=(data_ind.index < final) & (data_ind.index > ini) ,
                      alpha=0.2)

    plt.xticks(rotation=45)
    plt.title(f"{name_ind[0]} v/s {name_us[0]}")
    plt.ylabel("Stock Price")
    plt.xlabel("Date")
    plt.show()
```

Using these functions we will be visualising closing prices and their trends, daily returns and comparison of trends in both Indian and US stock prices.

SECTORS

AGRICULTURE

How damaging these impacts turn out to be for food security, nutrition and the livelihoods of farmers, fishers and others working along the food supply chain will depend in large part on policy responses over the short, medium and long term. In the short term, governments must manage multiple demands – responding to the health crisis, managing the consequences of the shock to the economy, and ensuring the smooth functioning of the food system. While the pandemic poses some serious challenges for the food system in the short term, it is also an opportunity to accelerate transformations in the food and agriculture sector to build its resilience in the face of a range of challenges, including climate change.

We are considering **Rallis, a Tata Enterprise**, is a subsidiary of Tata Chemicals, with its business presence in the farm essentials vertical. It is one of India's leading crop care companies And **Crop Science Division | Bayer.** Bayer's leadership in Crop Science provides tailored solutions for farmers to plant, grow and protect their harvests using less land, water and energy.

Code and Visualisations:

Trend of closing prices:

```
plot_close('RALLIS.NS','BAYERCROP.NS','3y','1d')
```

```
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```

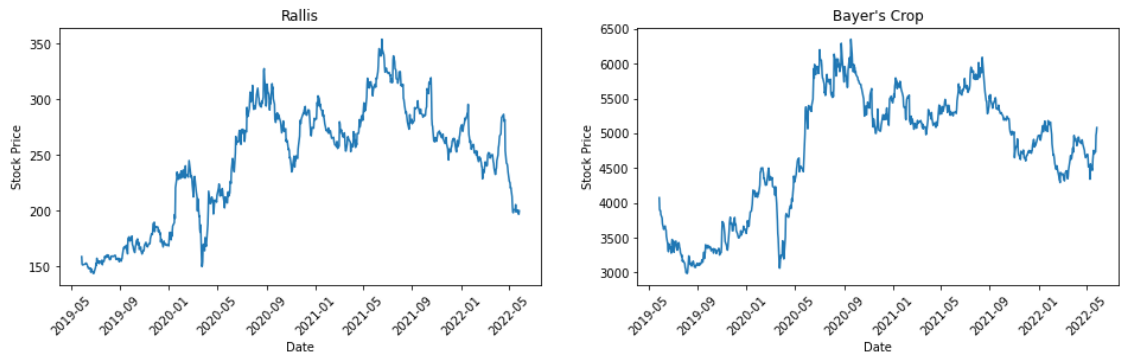


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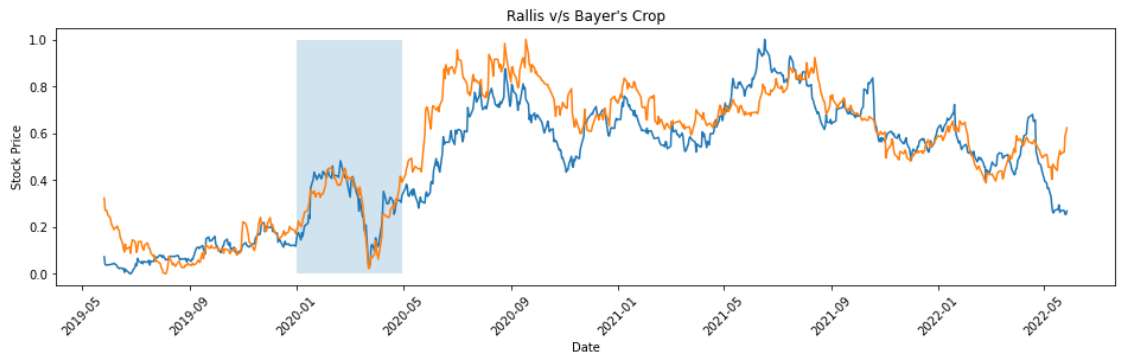

Daily Returns Chart:

```
plot_returns('RALLIS.NS','BAYERCROP.NS','3y','1d')
```

```
[**********100%**********]  1 of 1 completed
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```
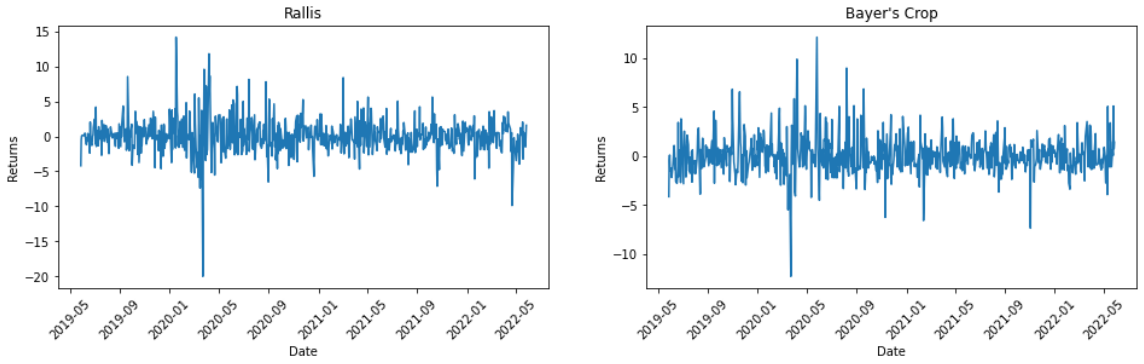



Inference:

Within the period where lockdowns were imposed and stricter the stocks prices were highly volatile as can be observed in the highlighted section. We can observe the uptrend of closing prices of both the stocks, it can be said that post Covid19, Bayer's Crop performed well compared to Rallis.

During March 2020 to May 2020, this sector was highly volatile. Due to this high volatility in the stock market, the daily average returns of this sector were too volatile with a range of -20 to +15 in Rallis and -10 to +10 in Bayer's Crop.

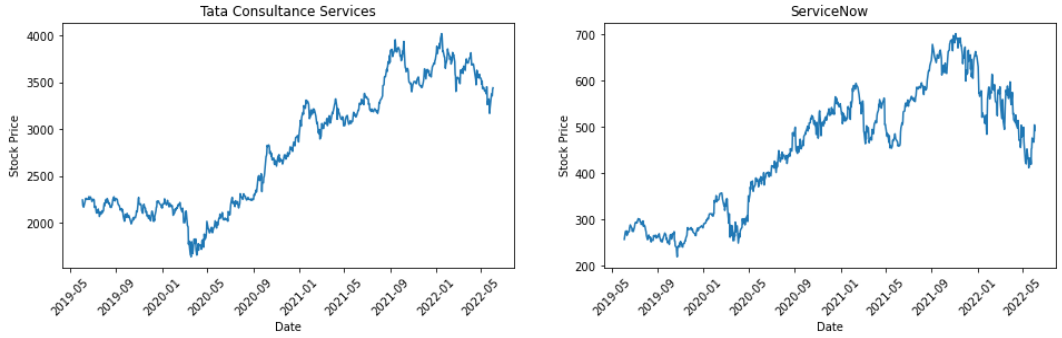
TECH SECTOR

The technology sector depending on if the company is Service-based or product-based has shown different trends. Service based tech companies do require manforce but not in physical form and hence the services that were extended by these companies were used a lot during lockdown periods. The product based companies supply and manufacturing chain was affected since it is heavily dependent on human intervention. And hence we have observed an uptrend in the service based companies and all those companies who rapidly adapted to covid situation and brought in required changes whereas product based companies suffered from losses.

Below we have considered two services based companies TCS from INDIA and Service now from US. In both of them we observe a similar trend starting from 2020.

Code and Visualisations:

Trend of closing prices:

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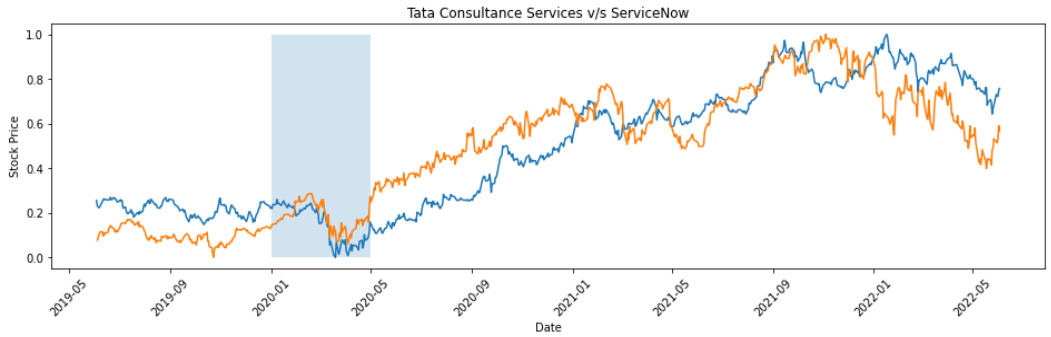
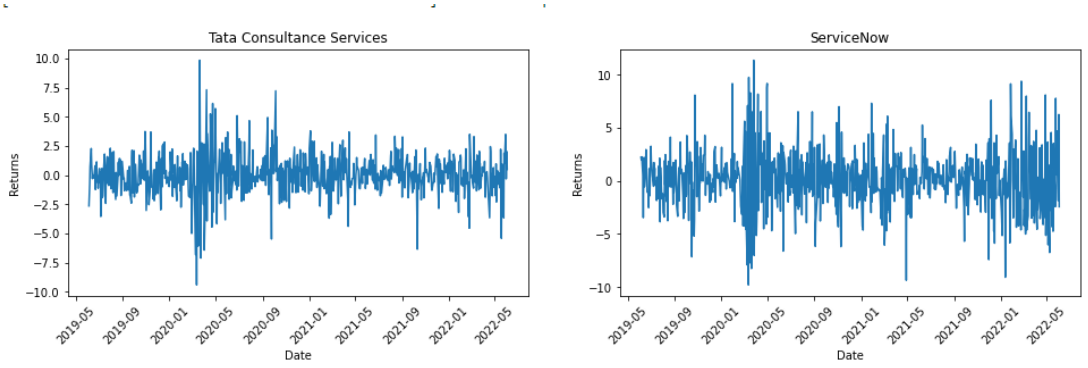


Daily Returns Chart:



Inference:

Within the period where lockdowns were imposed and stricter the stocks prices were highly volatile as can be observed in the highlighted section. We can observe the uptrend of closing prices of both the stocks, it can be said that post Covid19, both TCS and ServiceNow stocks performed well.

During March 2020 to May 2020, this sector was highly volatile. Due to this high volatility in the stock market, the daily average returns of this sector were too volatile with a range of -7.5 to +10 in Tata Consultancy Services and -10 to +10 in ServiceNow.

Oil and Gas:

Factors affecting:

- Covid Lockdowns leading to less manpower and hence affecting the production
- Russia Ukraine War

The Covid lockdowns all over the world led to decreased manpower hence the oil production saw a decline. On top of it Russia Ukraine war strained the exports of oil and hence increasing pressure on other countries that export oil, mainly Indonesia and Malaysia. These situations affect the exports and hence the prices of the oils increase. The ban on export of refined oil and only crude oil can be exported has benefitted the Indian oil refinery companies like Reliance Industries.

Here we are considering Oil Indices of India and US to compare the overall effect of these situations and also ONGC and Exxon to compare individual trends.

Code and Visualisations:

Oil and Natural Gas Corp v/s Exxon Oil

Closing Price Comparison:

```
: plot_close('ONGC.NS','XOM','3y','1d')
```

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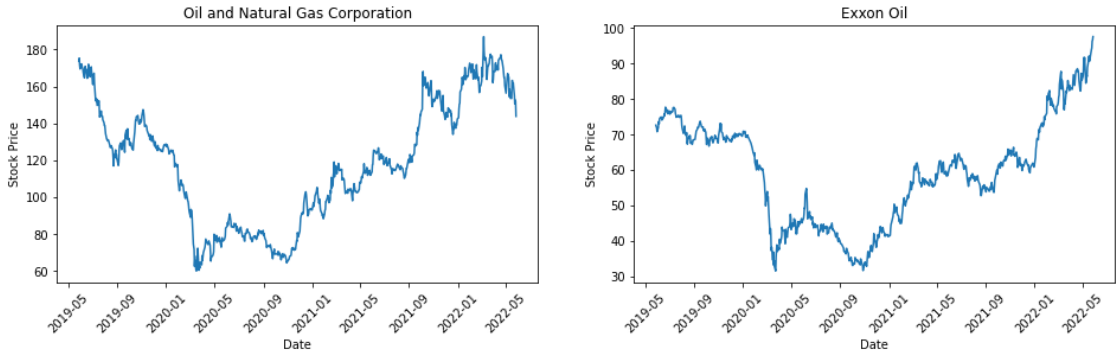
```

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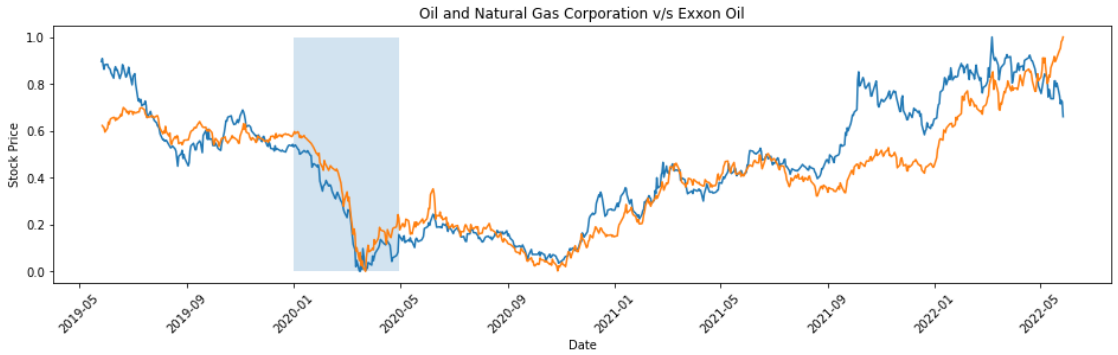

Daily Returns:

```
: plot_returns('ONGC.NS','XOM','3y','1d')
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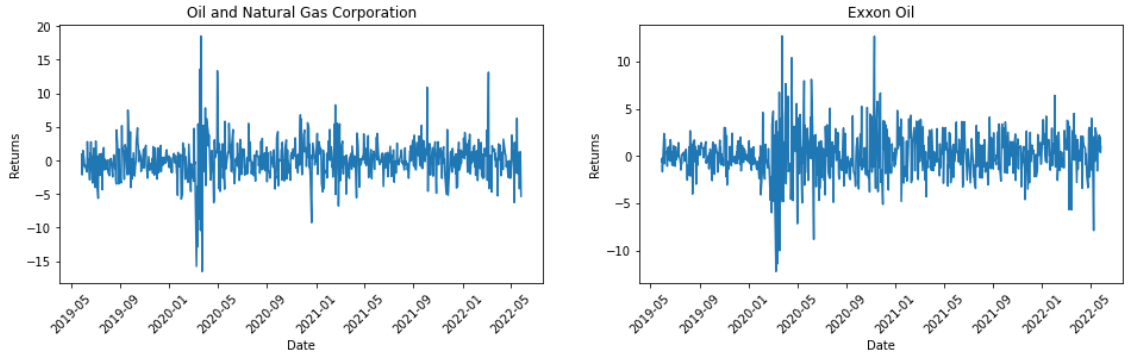

Inference:

Within the period where lockdowns were imposed and stricter the stocks prices were highly volatile as can be observed in the highlighted section. And Hence we can observe the uptrend of closing prices of both the stocks, it can be said that post Covid19, both ONGC and Exxon Oil performed well.

During March 2020 to May 2020, this sector was highly volatile. Due to this high volatility in the stock market, the daily average returns of this sector were too volatile with a range of -15 to +20 in ONGC and -10 to +10 in Exxon Oil.

OIL INDICES:

Novel CoronaVirus outbreak was declared a global pandemic nationwide lockdowns were imposed in countries world wide. Lockdowns restricted socialisation and reduced the manforce to almost bare minimum which affected all those industries which are heavily dependent on manforce. Oil industry being one of such industries was also affected. Oil industry is heavily dependent on manforce for extraction of raw materials which affected the production and production prices in general, hence lockdown induced reduction in manforce impacted oil industries. One of the major exporters of oil (crude and refined) are Indonesia and Malaysia during the pandemic.

February 2022 marked the start of the Russia- Ukraine war. Russia and Ukraine both are major exporters of sunflower oil. The war situation has impacted the supply of most used sunflower oil which pressurised the Indonesian and Malaysian oil exporters. This led to increase of prices locally in Indonesia and Malaysia and hence to handle this situation Indonesia and Malaysia both banned the export of Palm oil (most used oil) and can only export crude oil.

The import of crude for oil refinery companies is a golden opportunity to increase their business. And hence oil refinery companies' stock prices are increasing.

Closing price Comparison:

```
plot_close('OIL.NS','CL=F','3y','1d')
```

```
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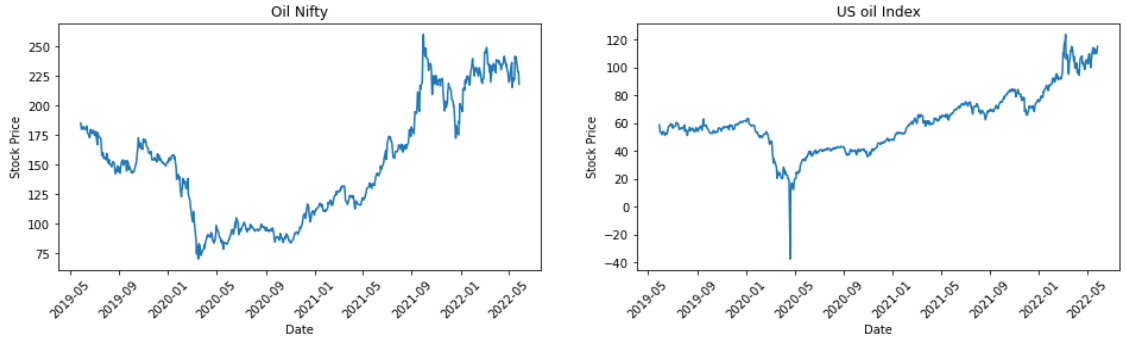


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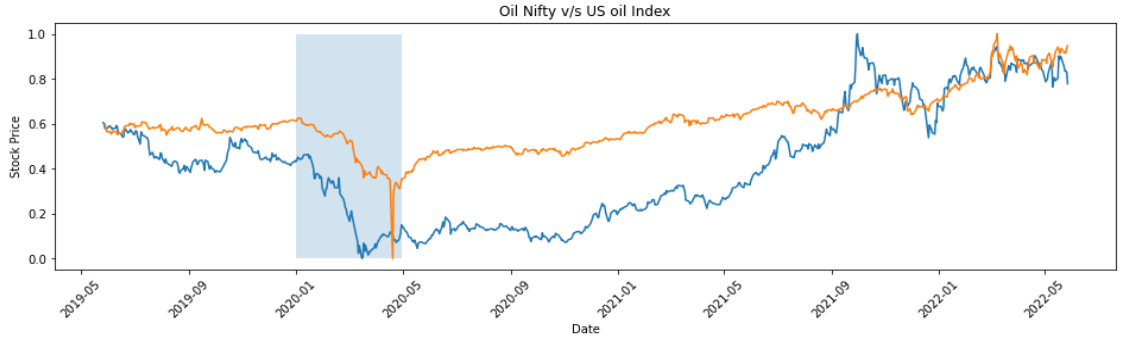

Daily returns:

```
plot_returns('OIL.NS','CL=F','3y','1d')
```

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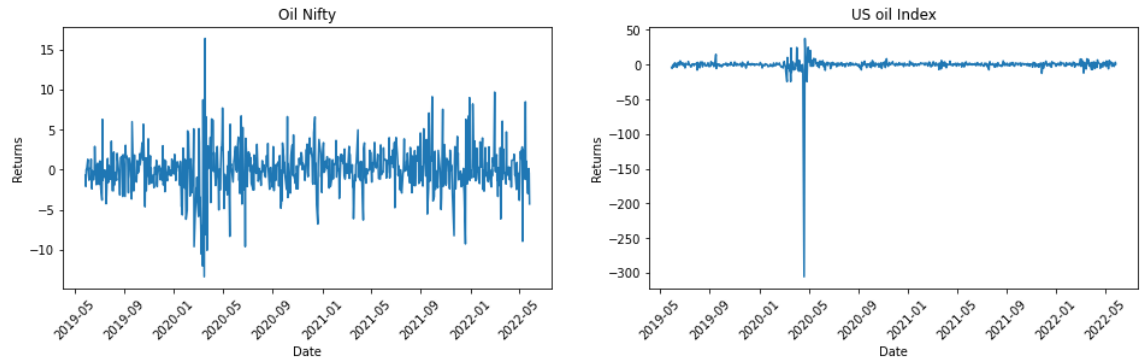

Inference:

Demand for petroleum products in the United States fell sharply in mid-March, which led refiners to curtail operations. Between March 13 and May 8, U.S. weekly gross refinery inputs fell 20% to 13.1 million barrels per day (b/d), based on a four-week rolling average.

U.S. crude oil producers did not respond as fast as refiners did to the sudden drop in demand, and crude oil inventories increased. Between March 13 and May 1, commercial

crude oil inventories in the storage hub of Cushing, Oklahoma, rose by 27 million barrels, reaching 83% of the hub's working storage capacity and contributing to the negative crude oil price on April 20.

Within the period where lockdowns were imposed and stricter the stocks prices were highly volatile, as can be observed in the highlighted section. And Hence we can observe the uptrend of closing prices of both the stocks, it can be said that post Covid19, US Oil Index performed better than Oil Nifty.

During March 2020 to May 2020, this sector was highly volatile. Due to this high volatility in the stock market, the daily average returns of this sector were too volatile with a range of -10 to +15 in Oil Nifty and -10 to +10 in US oil Index.

Overall Oil industry is seeing an uptrend because of this chain reaction of COVID and Russian- Ukrainian war.

Bank

For nearly a decade, banks, especially private sector lenders, were the perfect stocks for investors and fund managers to pick to beat benchmark indices and generate alpha returns in their portfolios. The Covid-19 pandemic has ended this as years of outperformance by banking stocks has been wiped off over the past four months. The outperformance shows the relative importance and future potential attached by the market to the banking component of the headline index, which has contributed to the high weightage of the financial services sector. The quality of assets of Banks, in terms of gross and net Non Performing Assets (NPAs), has shown improvements in the challenging phase of the pandemic. Along with economic recovery, over a period of time, credit off-take from Banks would improve from the current muted levels. Lending rates, as and when the RBI reverses the interest rate cycle, would increase as well. The floating rate loans would be reset faster. For MCLR ((Marginal Cost of Funds Based Lending Rate) refers to the minimum interest rate below which financial institutions can't lend, except in certain cases) based loans, it would take time till deposit rates move up, but that will eventually happen. Fintech companies seem to be giving competition to banks and are threatening to take away business, but it is a “co-opetition” as fintechs do not have banking licences.

Code and Visualisations:

Closing Price Comparison:

```
plot_close('^NSEBANK','^BKX','3y','1d')
```

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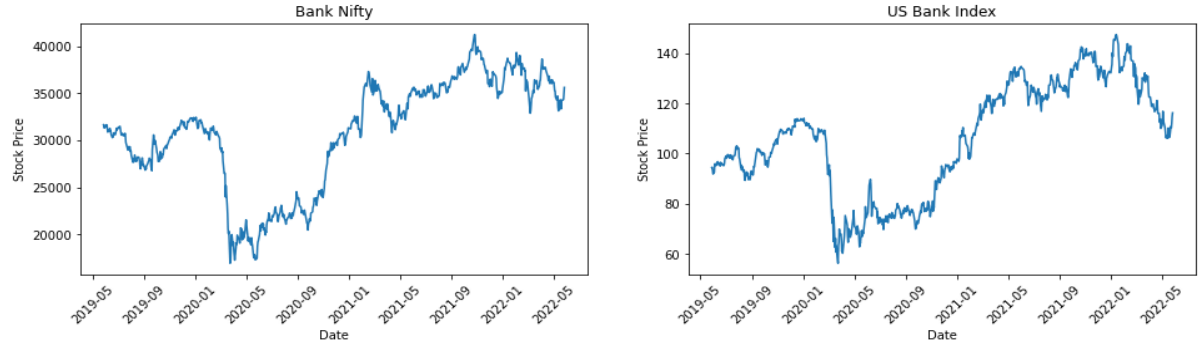


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(741, 1) (759, 1)
```
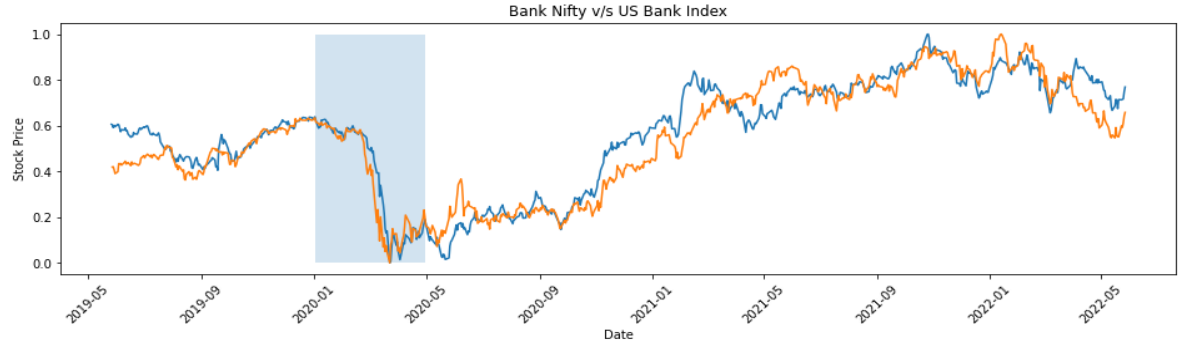
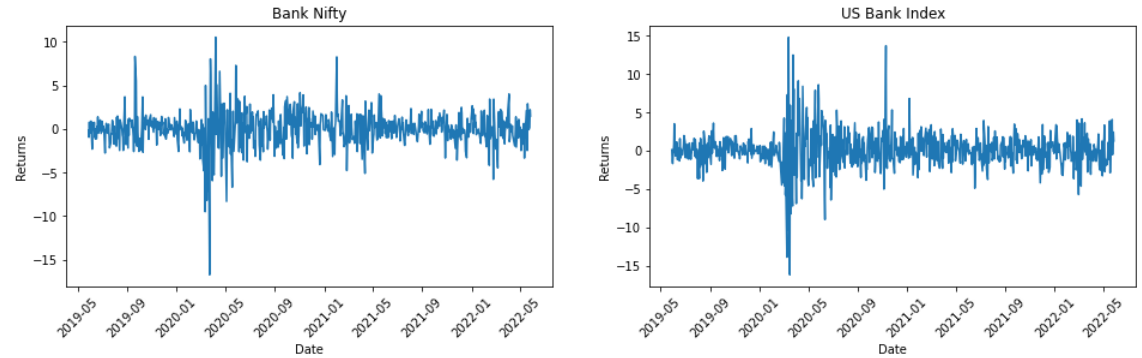



Daily Returns :

```
plot_returns('^NSEBANK','^BKX','3y','1d')
```

```
[**********100%**********]  1 of 1 completed
[**********100%**********]  1 of 1 completed
```



Observation:

Within the period where lockdowns were imposed and stricter the stocks prices were highly volatile as can be observed in the highlighted section. And Hence we can observe the

uptrend of closing prices of both the stocks, it can be said that post Covid19, both Bank Nifty and US Bank Index performed well.

During March 2020 to May 2020, this sector was highly volatile. Due to this high volatility in the stock market, the daily average returns of this sector were too volatile with a range of -15 to +10 in Bank Nifty and -15 to +15 in US Bank Index.

CONCLUSION:

Within the period where lockdowns were imposed and stricter the stock prices were highly volatile. We can observe the uptrend of closing prices of all the stocks, it can be said that post Covid19, both Indian and Global stocks performed well.

Due to this high volatility in the stock market, the daily average returns of the sectors were too volatile. And Hence we can observe the uptrend of closing prices of all the stocks.

As the effects of the Russia-Ukraine war is still in progress, the global market is yet to face many issues. It will be a learning experience to watch how the global market comes out of the repercussions caused by the war.

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