Analysing the impact of covid-19 on the sectoral indicies of major sectors of Indian economy.

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***Abstract*—Covid-19 is an unprecedented event of the 21st century which initiated a financial crisis in the Indian economy. The lockdown which was imposed for preventing the outbreak of covid-19 led to stagnation of industrial and economic activities. This affected the cash flow and equity markets witnessed a sharp decline due to high volume selling of the equity. Eventually, the lockdown was lifted and the economic activity slowly started reviving itself. In this paper, we are analyzing its impact on four major sectors of the Indian economy which are the Bank, IT, FMCG, and Pharmaceutical sectors, and on their respective equity markets. The impact on the sectors is measured using their respective performance indices and the impact on equity markets is assessed using earnings per share (EPS), price to earning ratio (P/E), return on equity (ROE), and compound annual growth rate (CAGR). This type of analysis helps in determining how economically resilient India is.**

***Index Terms*—Financial crisis, Covid-19, Economic resilience, Banking sector, IT sector, FMCG sector, Pharmaceutical sector.**

I. Introduction

India is one of the fastest emerging and growing economy of the world. It is expected to be one of the top three economic powers in the world over the next 10 - 15 years. The top performing sectors of Indian economy are the agriculture sector, industry sector, service sector, manufacturing sector and food processing sector. This paper aims to study some areas such as banking and IT from service sector, FMCG and pharma from food processing and manufacturing sectors to get an idea on how covid-19 had affected Indian economy.

The total assets of Banking sector stood at Rs. 107.83 lakh crore (US$ 1.52 trillion) in FY20. The financial and economic conditions in the country are far superior to any other country in the world. As per the Reserve Bank of India (RBI), India's banking sector is sufficiently capitalised and well-regulated. Indian banking industry has recently witnessed the roll out of innovative banking models like payments and small finance banks. Credit, market and liquidity risk studies suggest that Indian banks are generally resilient and have withstood the global downturn well.

IT industry is one of the major sectors of India, and it accounted for 8% of India's GDP in 2020. India is one of the largest exporters of IT services, it has attracted significant investment from many countries. The domestic revenue of the Indian IT industry is estimated at US$ 45 billion, and export revenue is estimated at US$ 150 billion in FY21. IT industry's timely transition to remote working environments has helped it to keep up with the industry's growth amid the coronavirus pandemic. Some of the leading Indian IT firms are Infosys, Wipro, TCS and Tech Mahindra etc. and these companies are diversifying their offerings and are showcasing their leading ideas in blockchain and artificial intelligence to clients through their innovation hubs and research centres.

India's pharmaceutical sector is important for its economic growth. The Indian pharmaceutical sector supplies over 50% of global demand for various vaccines, 40% of generic demand in the US and 25% of all medicine in the UK. India globally stands at 3rd position in terms of pharmaceutical production by volume and 14th by value. The pharmaceutical industry also contributes around 4% to India's GDP and generates significant employment. However, in contrast to many other sectors, the impact of COVID-19 was a positive one on the pharmaceutical sector. This can be mainly attributed to 2 main reasons. First, Covid-19 has pushed up sales of medicines and resulted in positive growth for the pharmaceutical sector. Second, since several countries aim to develop a COVID-19 vaccine, the Ministry of Health and Family Welfare (MoHFW) of the Government of India has been providing various incentives. These incentives had a positive impact on this sector.

Fast-moving consumer goods (FMCG) sector is India's fourth-largest sector with household and personal care accounting for 50% of FMCG sales in India. Growing awareness, easier access and changing lifestyles have been the key growth drivers for the sector. The urban segment (accounts for a revenue share of around 55%) is the largest contributor to the overall revenue generated by the FMCG sector in India. Semi-urban and rural segments are growing at a rapid pace and FMCG products account for 50% of the total rural spending. The FMCG Business over the world is encountering solid instability after the outburst of worldwide epidemic, Covid-19. Due to a scarcity of food, workers and tight government lockdown on restaurants and retail food establishments face problems. Demand is also growing at an unprecedented rate of growth for organic and natural product enriched food. Cosmetic and paint goods are predicted to decline. Other non-critical goods are required to compensate for market shortages in the later half of the year in addition to certain items that are considered necessary during such a crisis. On the other side, demand is rising at an alarming pace worldwide for personal hygienic goods such as side sanitary equipment and hand washing in physical retail and online retail.

II. Data sources and collection

To analyse the performance of various Indian market sectors during the COVID-19 pandemic, the data is collected using various API's and python libraries such as GOOGLEFINANCE, yfinance and also from NSE website, various other third party websites such as MoneyControl and EquityMaster . Also, data required for analysing the banking sector is also obtained from the RBI website and

III. Nifty Bank

Nifty Bank is an NSE index which comprises of highly liquid and largely capitalised stocks of Indian banks. It acts as a benchmark that captures the market performance of Indian bank stocks. The nifty bank index is based on 10 stocks from the banking sector. The following 10 banks are - HDFC Bank Ltd. [HDFCBANK], ICICI Bank Ltd. [ICICIBANK], State Bank of India [SBIN], Kotak Mahindra Bank Ltd [KOTAKBANK], Axis Bank Ltd. [AXISBANK], IndusInd Bank Ltd [INDUSINDBK], AU Small Finance Bank Ltd. [AUBANK], Bandhan Bank Ltd. [BANDHANBNK], Federal Bank Ltd. [FEDERALBNK], IDFC First Bank Ltd. [IDFCFIRSTB]. The share of each of these bank stocks in the index is represented using the pie chart in Fig 1.

A. Objectives of study

The study on the banking sector and on the Nifty Bank is expectd to acheive the following objectives:

- Analysis of the condition of the banks during the pre covid time.
- Understand the impact of covid-19 on the equity markets of this sector.
- Quantification of the economic resilience shown by the equity markets of this sector.

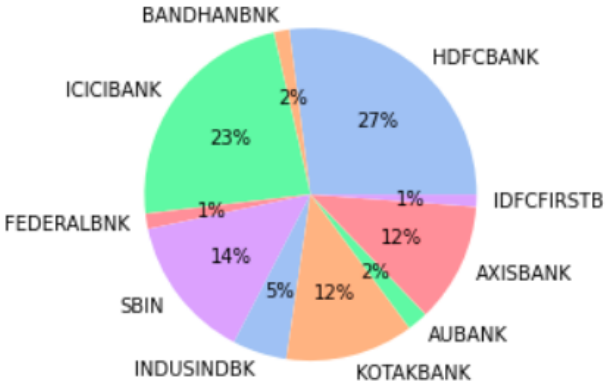

Fig. 1. The weightage of Nifty-BANK constituents [as of Oct 2021]

B. Hypothesis

Hypothesis chosen for this study is as follows:

- H_0 (Null hypothesis) - Nifty Bank witnessed a short term large scale sell off during the initial waves of covid-19.
- H_A (Alternate hypothesis) - Nifty Bank didn't witness a short term sell off during the initial waves of covid-19.

C. Indian banking sector during the Pre-covid times

Banking sector is a lifeline of any modern economy. It is one of the important financial pillars of the which plays a vital role in the functioning of the economy. This section contains a description about the some of the key financial indicators which are used to asses the performance of the banking sector. The movement of these indicators during the period of last 5 years will describe the condition of the banking sector and its progress. This analysis is done for four major companies which comprise of 75% of the nifty bank index.
The key indicators are described as follows:

1) ***Assest Growth****:* An assest is something which has value and is used to produce something. For a bank assets means the reserves it is holding. The growth in assets indicates the increase in the lending capacity of the bank. Bank can hold assests in different forms. It can be cash or it can be investments in a company or it can even be in the form of a investment outside India. The graph in figure 2 indicates a positive assest growth for the banks which are a sign of progress.

2) ***Earnings****:* Total Annual Earning of a bank indicates all the money that it generates during that financial year. The most prominent income source for the bank is the intreset that it earns from investments, balances with RBI etc. Another source of income for the banks is the money that is generates from the sale of land, sale of investments and from the sale of other assets. The graph in the figure 3 indicate the growth in earnings of these banks during the pre covid time.

3) ***Return on Assets****:* ROA is an indicator that characterizes the ratio of the bank's net profit after paying taxes to the bank's

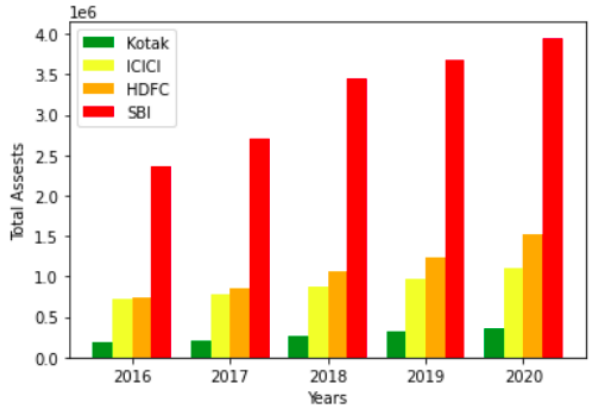

Fig. 2. Movement of Total assets of the banks over the period of 2016-2020

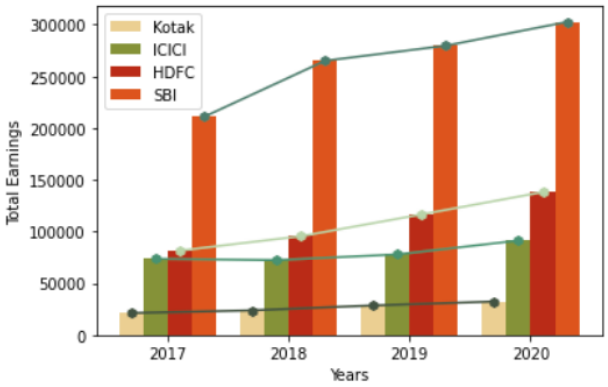

Fig. 3. Total earnings of the banks over the period of 2017-2020

assets and shows how much net profit the unit of the bank's assets gives.

$$ROA = \frac{NP}{A}$$

where NP – the net profit of the bank; A – the assets of the bank. It shows the effectiveness of the bank's internal policy and how well the assets are used to generate profit. The figure 4 summarises the movement of this metric during the pre covid time.

*4) **Return on Investment**:* Return on investment is the ratio of the net profit by the invested value. It indicates how much profit the respective banks are making from their investments.

$$ROI = \frac{NP}{I}$$

where NP – the net profit of the bank; I – value of the investment. The figure 5 summarises the movement of this metric during the pre covid time.

*5) **Return on Equity**:* Return on equity is an indicator characterizing the ratio of the net profit of the bank after paying taxes to the share capital of the bank.

$$ROE = \frac{NP}{SC}$$

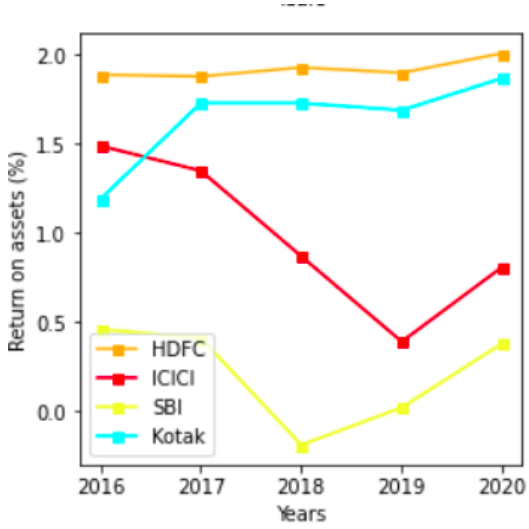

Fig. 4. Return on asset ratio of the banks over the period of 2016-2020

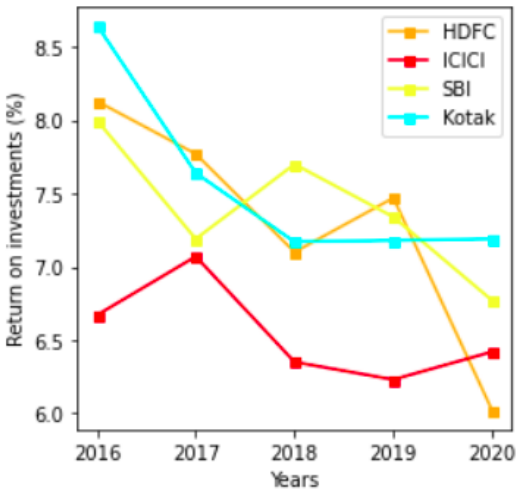

Fig. 5. Return on investment ratio of the banks over the period of 2016-2020

where NP – the net profit of the bank; SC – the share capital of the bank. The figure 6 summarises the movement of this metric during the pre covid time.

*6) **Return on Advances**:* The ratio gives the average lending rate of the portfolio. High yield on advances is an indication that the entity is into financing riskier assets and may see asset quality issues. It is calculated using the formula:

$$ROAD = \frac{IE}{AD}$$

where IE - interest earned and AD - Net advances of the bank. High yield on advances is an indication that the entity is into financing riskier assets and may see asset quality issues. The graph in the figure 8 shows the movement of this metric in the pre covid time.

*7) **Net NPA to Net Advances**:* A non performing asset (NPA) is a loan or advance for which the principal or interest payment remained overdue for a period of 90 days. Net

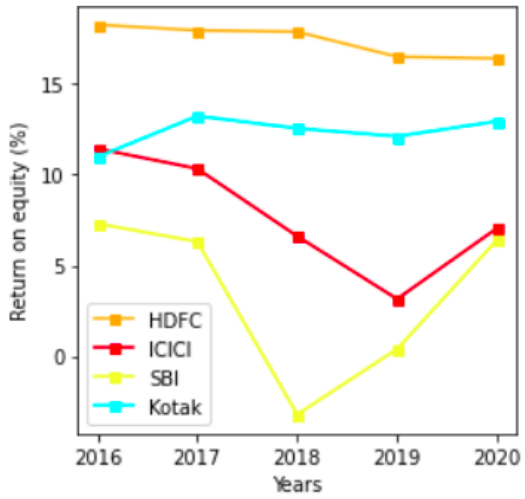

Fig. 6. Return on equity ratio of the banks over the period of 2016-2020

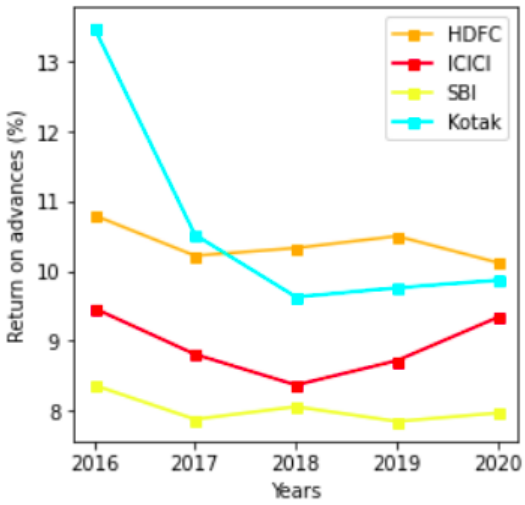

Fig. 7. Return on advances ratio of the banks over the period of 2016-2020

NPA% denotes the proportion of advances which turned into NPA after adjusting for the provisions already made by the bank/financial institution. The decrease in the the ratio over the years of 2016-202 indicates that the asset quality is improving. The figure 8 summarises the movement of this metric.

This section summarises the movement of some of the key financial indicators which help in assessing the condition of the banks during the pre-covid times. While observing the asset growth and earnings the banks were performing pretty good. The decrease in the net NPA to net Advances ratio also conveys the sector is in good health. Even though ICICI bank and SBI observed a poor values for return on assets and return on equity in the year of 2018 they bounced back in the year 2020.

D. Assessing the performance of Nifty Bank during covid-19

This section deals with the performance assessment of nifty bank using some of the key financial indicators used to asses the equity markets. The variation in these indicators try to convey the impact covid 19 and also tell us about the bounce back of the index by the end of FY21.

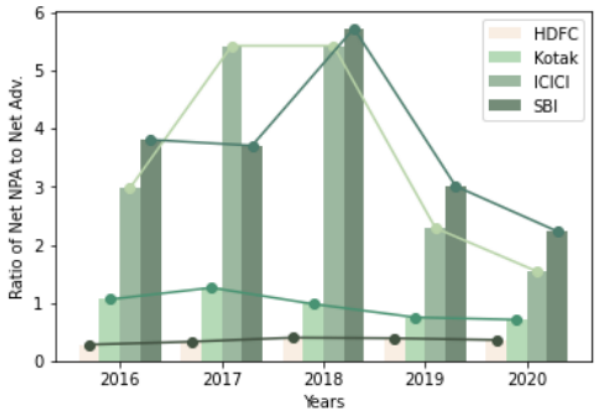

Fig. 8. Net NPA to Net Advances of the banks over the period of 2016-2020

The key indicators are:

1) ***Earnings Per Share****:* Earnings per share (EPS) is an important metric in any company's earnings figures. It is calculated by dividing the total amount of profit generated in a period, by the number of shares that the company has listed on the stock market.

$$EPS = \frac{NI}{C_{\mathrm{r}}}$$

NI - Net income of the company during that period and C_{r} - shares in circultation. The EPS of Nifty bank is calcualted by doing weighted sum of the EPS of its constituent stocks. The graph in the figure 9 clearly indicates that even during the covid period the EPS was incresing which clearly denotes that this index has strong fundamentals.

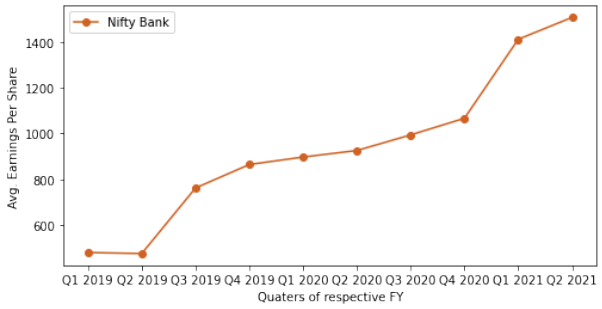

Fig. 9. Movement of EPS values averaged quarterly from FY19 to FY21

2) ***Price to earnings ratio****:* The price to earnings ratio (P/E ratio) is the ratio for valuing a company that measures its current share price relative to its earnings per share (EPS). The price-to-earnings ratio (P/E) is one of the most widely used tools by which investors and analysts determine a stock's relative valuation. The P/E ratio helps one determine whether a stock is overvalued or undervalued.

In the first and second quarter of FY19 steep prices in the P/E values indicate that bank stocks were overvalued during those quarters. But the due to 1st wave of coivd 19 the prices started to fell this had a direct impact on the price and on the valuations of bank stocks. The stock prices fell due to fear in the market. But now the ratio is deteriorating and it is decreasing since the EPS of major companies is on the rise. These recent P/E values indicate that sector is being under valued significantly inspite of having a lot of potential.

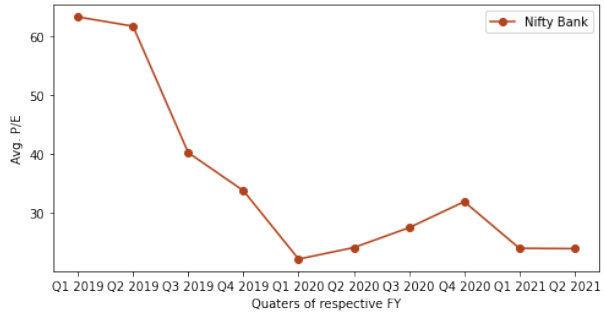

Fig. 10. Movement of P/E values averaged quarterly from FY19 to FY21

3) ***Price to book ratio****:* The book value of a company is the net difference between that company's total assets and total liabilities, where book value reflects the total value of a company's assets that shareholders of that company would receive if the company were to be liquidated. The price to book ratio is calculated by finding the ratio of company's stock price by its book value per share. The book value per share is the ratio of the book value divided by the shares in circulation. It indicates the price per share that the shareholder will get if the company is liquidated. The P/B ratio indicates the comparison of the company's market value with its actual book value. It is calculated using this formual:

$$P/B = \frac{CP}{BV}$$

here CP - is the close price and BV - is the book value of the company. The graph in figure 11 shows the variation of quarterly variation of P/B values. This ratio was also directly affected by covid solely due to the large scale sell of.

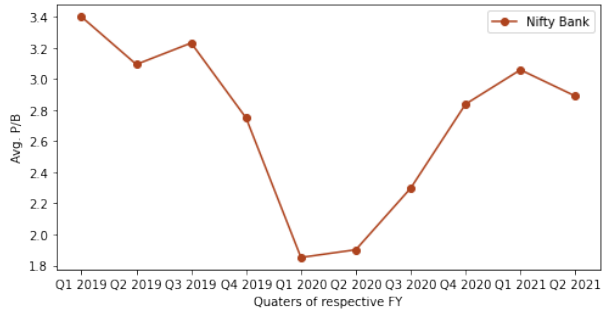

Fig. 11. Movement of P/B values averaged quarterly from FY19 to FY21

4) ***Compound annual growth rate****:* Compound annual growth rate is a value of which also termed as smoothed' rate of return. It is an investor centric metric which tells how much an investment yields on an annually compounded basis. It calculated using the formula:

$$CAGR = \left(\frac{EV}{SV}\right)^{1/T} - 1$$

Here EV - The selling price of the stock, SV - THe buying price of the stock and T - denotes the time in years.
The graph in the figure 12 shows how much an investor would gain if he would invest at the start of that half and sell it at the end of the half year. The improvent in the CAGR values show the revival of the upward trend of the Nifty Bank

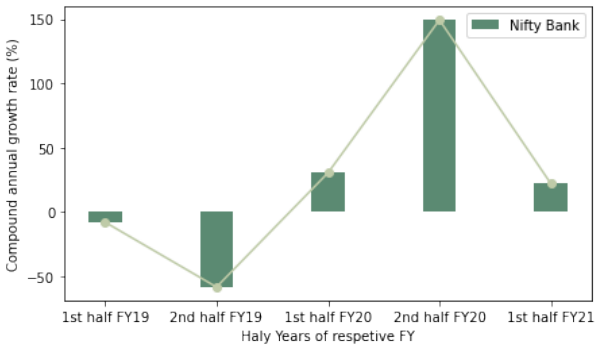

Fig. 12. Movement of CAGR values calculated for every six months from FY19 to FY21

E. Hypothesis conclusion

The analysis of the fundamentals of the major constituents of nifty bank clearly indicated that performance of major banks is good and they are generating enough revenue and profits to keep them going. The growth in assets and earnings show the strength and relevance of the policies they employ. Even though the return on assets and equity of SBI and ICICI tapered a but it bounced back gradually. This analysis portrays that banks are profitable and financially viable.

The analysis and comparison of the nifty bank during the initial waves of covid and now shows the recovery of the index. Nifty Bank witnessed a large scale sell of during the Q1 of FY19 when the country was hit by the first wave of covid 19. The equity markets of the banks were highly overvalued and this economic disruption hit the valuation the stocks in this sector seriously. The loss of trust of the investors is clearly evident from this analysis.

The situation started to improve when the RBI took some major decisions to bring the economy back on track. The release of vaccine for combating covid also helped in bringing the economic activity back on track. Bank nifty slowly started gaining its trust among investors by the end of FY20. This marked the end of huge sell off and short term bear markets ended. But the stock valuations continue to suffer.

With these metrics we can conclude that the null hypothesis holds true. Covid 19 induced a large scale sell off which was contained by the RBI norms and release of vaccines in a short time span. And investor's gradually gaining trust on the banking sector will completley heal the scar of covid 19 on the banking sector in the comming days.

IV. Nifty IT

A. Objectives of the study on NIFTY IT sector

This study has done to achieve the following objectives:

- To analyze the trend and pattern of NIFTY IT sectoral index during COVID-19 pandemic.
- To compare the performance of NIFTY IT sectoral index before and during the COVID-19 pandemic.

B. Hypothesis

- H_0 (Null hypothesis) - COVID-19 pandemic had a negative impact on the NIFTY IT sectoral index.
- H_A (Alternative hypothesis) - COVID-19 had a positive impact on NIFTY IT sectoral index.

C. Statistical tools used for analysis

The data analysis is carried out by using various python libraries such as Matplotlib, Plotly for visualizing the data, TA-LIB for calculating the trade indicators etc. The different metrics used to measure the performance are dividends of the share, moving average, relative strength index (RSI).

D. Overview of Nifty IT

Nifty IT index captures the performance of the Indian IT companies and it constitutes the following 10 companies which are listed on NSE (National Stock Exchange) - Infosys Ltd [INFY], Tata Consultancy Services Ltd [TCS], Tech Mahindra ltd [TECHM], Wipro Ltd [WIPRO], HCL Technologies Ltd [HCLTECH], L&T Infotech Ltd [LTI], MindTree Ltd [MINDTREE], MphasiS Ltd [MPHASIS], L&T Technology Services Ltd [OFSS], Coforge Ltd [COFORGE]. The weightage of the companies in the Nifty IT index for the semi-anuual period of Jan2021 - Jul2021 is presented in fig. 13.

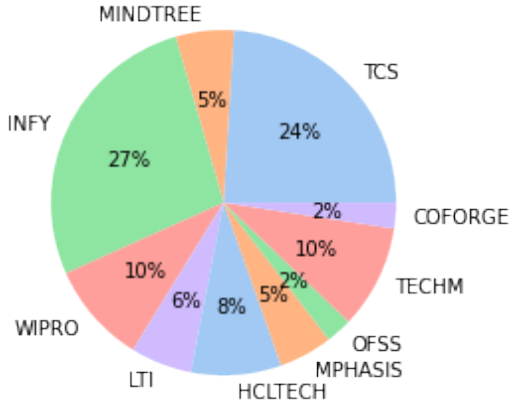

Fig. 13. The weightage of Nifty-IT constituents [Jan2021 - Jul2021]

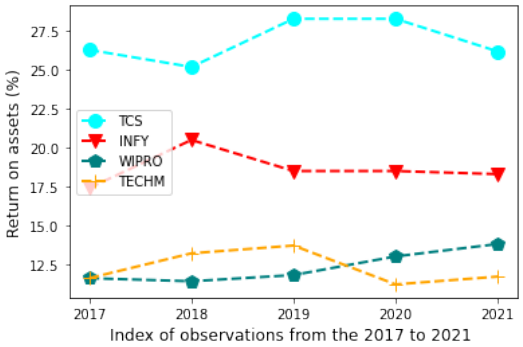

Fig. 14. Return on assets for the period of 2017-2021.

E. Hypothesis testing

1) Nifty-IT sector during pre-covid period: To asses the performance of the Nifty-IT sector before the covid-19 pandemic, the top constituent companies of the sector (refer fig. 13) are selected and analyzed using the following metrics:

- **Return on assets :** This indicator shows how profitable a company is relative to its total assets. From the fig. 14 it is observerd that TCS is doing well off when compared to its peers and remaining companies are also consistent at managing their assets to generate earnings.
- **Return on equity :** This metric is obtained by dividing net income by shareholders' equity and its nothing but the return on net assets. It shows how efficient is the organization generating profits. Similar to that of ROA, TCS is the most profitable compared to its peers and all the other remaining organizations tends to perform consistently (from fig 15).
- **Return on Capital :** This measure is a financial ratio that is used to asses the profitability of the organization which takes both equity and debt of the company into consideration which neutralizes financial performance analysis for companies with significant debt. From the fig. 16 it is observed that the companies are performing consistently through out the duration.
- **Net profit margin :** This metric is the ratio of net profits to revenues for a company. This measure clearly shows the financial health of an organization. From the fig. 17 we observe that on an average the companies are maintaining a consistent profit margins.

2) Nifty-IT sector during covid-19 pandamic:

Average Closing Price	
PreCovid (2018-09/2019-12)	15411.0246
PostCovid (2019-12/2021-09)	21971.9282

The Average Closing Price table shows a significant positive change in the post/during the covid-19 period. The fig. 18 shows how there is a sudden negative change during the first covid wave and there after a exponential growth of the market. Some of the metrics considered below confirms the results:

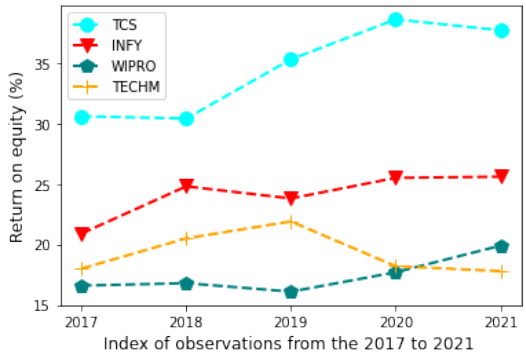

Fig. 15. Return on equity for the period of 2017-2021.

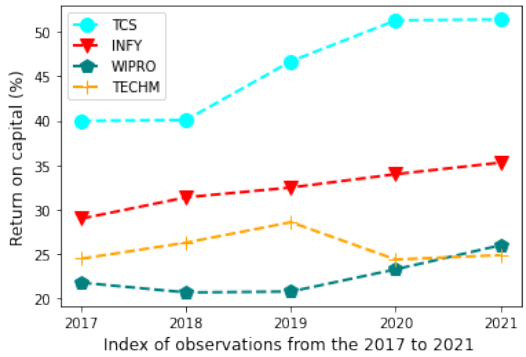

Fig. 16. Return on capital for the period of 2017-2021.

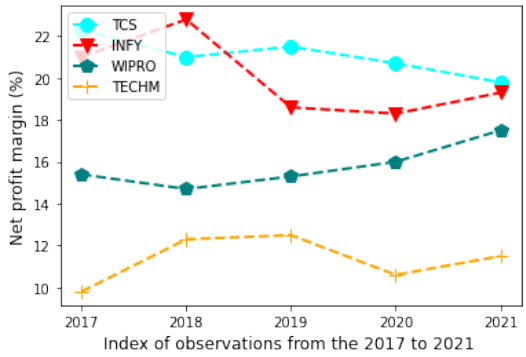

Fig. 17. Net profit margin for the period of 2017-2021.

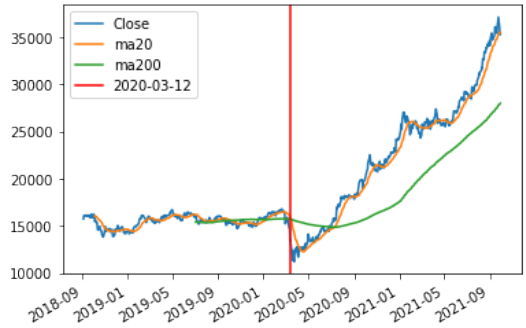

Fig. 18. Moving averages of Nifty-IT closing prices.

- **Moving averages :** This measure is used to analyze data points by creating a series of averages of different subsets of the full data set. This indicator is used for technical analysis since this helps in smoothing the price data. In the fig. 18 ma20 refers to the averaging 20 previous data-points and similarly ma200 refers to averaging 200 previously data-points, both of this measures clearly indicate that their is a sudden dip in the closing prices during the initial phases of covid and then an exponential growth.
- **P/E ratio :** This ratio is used for valuing a company by measuring its current share price relative to its earnings per share (EPS). This is a best measure to compare the company to itself or to an other company with similar traits. Observing the fig. 19 implies that in the initial phase of covid-19 there was a dip in initial ratios and there after a rapid growth.
- **P/B ratio :** Price to book ratio is calculated by dividing the company's stock price per share by its book value per share (BVPS). Book value is the tangible net asset value of a company calculated as total assets minus intangible assets (.e.g. patents, goodwill) and liabilities. This ratio measures the market's valuation of a company relative to its book value. During the initial phase of covid the P/B ratios are low and which is sign of undervaluing the price of stocks but in the later part of the year the P/B ratios increased drastically showing that the IT companies are overvalued.
- **RSI :** Relative strength index (RSI) is a momentum indicator used in technical analysis that measures the magnitude of recent price changes to evaluate overbought or oversold conditions in the price of a stock or other asset. Values of 70 or above indicate that a security is becoming overbought or overvalued, whereas values of 30 or below indicates an oversold or undervalued condition. From the fig. 20 we observe similar trends as we have seen in case of P/B ratios, the companies shares are undervalued in the initial phase of covid and there after its extremely overvalued.
- **CAGR :** Compounded annual growth rate (CAGR) is one of the most accurate ways to calculate and determine returns for anything that can rise or fall in value over time. This is a representational figure which is essentially a number that describes the rate at which an investment would have grown if it had grown at the same rate every year and the profits were reinvested at the end of each year (in case of fig 38, its half yearly based). From figure we clearly observe that during the period of mar 2020 to sep 2020 the cager value is very high indicating a huge difference between the closing prices (start and end of term) indicating a huge return in-spite of a initial negative effect of covid.
- **EPS :** Earnings per share (EPS) is calculated as a

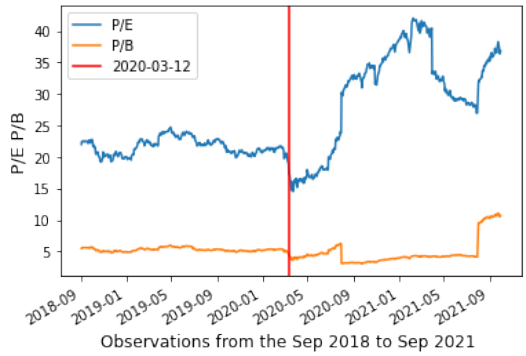

Fig. 19. P/E and P/B of Nifty-IT closing prices.

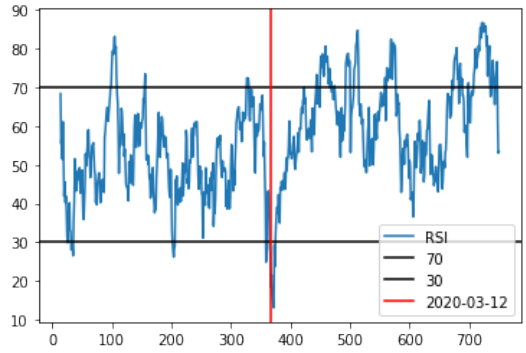

Fig. 20. RSI of Nifty IT index during SEP 2018 to SEP 2021.

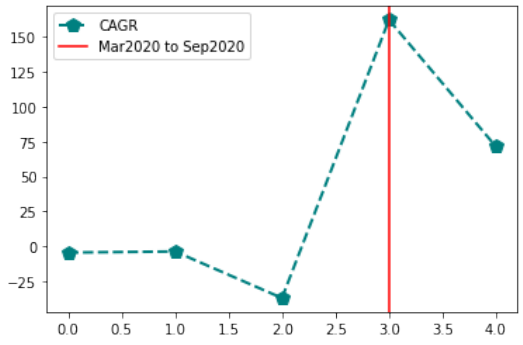

Fig. 21. CAGR of Nifty IT index for half yearly duration during SEP 2018 to SEP 2021.

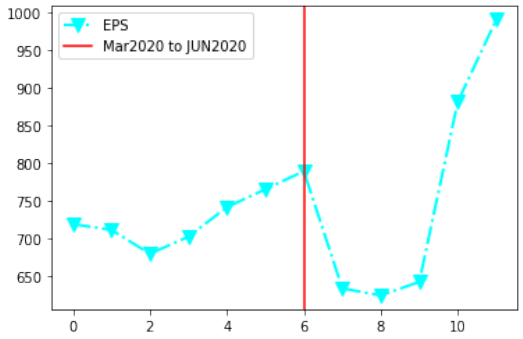

Fig. 22. EPS of Nifty IT index for quarterly duration during SEP 2018 to SEP 2021.

company's profit divided by the outstanding shares of its common stock. The resulting number serves as an indicator of a company's profitability. From the fig. 22 we observe that for the period mar 2020 to dec 2020 the EPS values are not so great during the initial phase of covid by as the time passed there is a drastic improvement in the EPS values.

F. Hypothesis conclusion :

The key financial indicators such as the RSI, CAGR, EPS pictures a clear idea on how the Nity-IT market performed before and during the covid. All these key metrics suggest that though there was an initial negative trend in the IT market similar to that of other markets but unlike those other markets it had an exponential growth in a very short span of time, this could might have not been the case if it was not covid. The growth of the IT market is generally expected but not at pace that happened during covid-19 pandamic.

There are significant proofs from the subsection 2 (Nifty-IT sector during covid-19 pandemic) that at an overall view Nitfy IT sector is one of the least effected sector though it suffered loss at the beginning of the pandemic due to general fear. During the later stages of covid-19, the sector regained its state because of various reasons such as a lot of small and medium scale enterprises shifting to online platforms with the help of services offered by the IT industry. Other major advantage for the industry is that it could run a major percentage of its services offsite which positively helped the sector. From the analysis we can clearly reject the null hypothesis which argues that the Nifty IT sector had suffered losses from covid-19 pandemic.

V. Nifty Pharma

NIFTY Pharma Index captures the performance of the pharmaceutical sector. The Index comprises of 20 companies listed on National Stock Exchange of India (NSE). NIFTY Pharma Index is computed using free float market capitalization method, wherein the level of the index reflects the total free float market value of all the stocks in the index relative to particular base market capitalization value. The top 10 constituents by weightage are - Sun Pharmaceutical Industries Ltd [SUNPHARMA], Divi's Laboratories Ltd [DIVISLAB], Dr. Reddy's Laboratories Ltd [DRREDDY], Cipla Ltd [CIPLA], Lupin Ltd [LUPIN], Laurus Labs Ltd [LAURUSLABS], Aurobindo Pharma Ltd [AUROPHARMA], Gland Pharma Ltd [GLAND], Alkem Laboratories Ltd [ALKEM] and Biocon Ltd [BIOCON].

A. Objectives of the study

- To analyze the effects of the coronavirus pandemic on the NIFTY-Pharma sector
- To analyze the trend, strength of the trend and momentum of the NIFTY-Pharma index during COVID-19 pandemic.

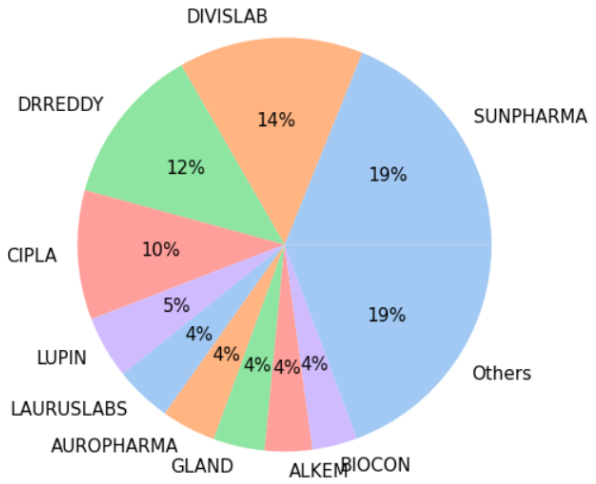

Fig. 23. The weightage of Nifty-Pharma constituents

	Pharma_Index
Pharma_Index	1.000000
Sun_Pharma	0.937226
DR_Reddy	0.969933
Cipla	0.981512
Divis_Lab	0.940018
Lupin	0.926567

Fig. 24. Correlation of Nifty Pharma Index with Top 5 Pharma Companies of India.

- To compare the performance of NIFTY-Pharma sectorial index before and during the COVID-19 pandemic.

B. Hypothesis

- H_0 (Null hypothesis) - COVID-19 did not have a positive impact on the Pharmaceutical Sector.
- H_A (Alternative hypothesis) - COVID-19 had a positive impact on the Pharmaceutical Sector.

C. About Data and its division

For analyzing impact of COVID-19 on Pharma sector index, the data collected for pre Covid-19 is from August 2019 to March 2020 and for during Covid-19 is from March 2020 to December 2020. Here I am considering NIFTY Pharma sectoral index data as it is thoroughly representing all the Pharma stocks. As we can see fig. 24 that the correlation value is greater that 0.9 which is an indication of a strong correlation,so the Pharma Index dataset is taken for further analysis.

D. Statistical tools used for analysis

The data analysis is carried out by using various python libraries such as Matplotlib, Plotly for visualizing the data, Pandas_ta for calculating the technical indicators etc,. The different metrics used to measure the performance are technical indicators like Moving averages, RSI(14) (Relative Strength Index), CCI(20) (Commodity Channel Index), ADX(14) (Average Directional Index).

E. Hypothesis Testing

*1) **Using Moving Average**:* A moving average (MA) is a stock indicator that is commonly used in technical analysis. A simple moving average (SMA) is a tool that tracks stock price over a period of time; for example, over the previous 15, 30, 100, or 200 days and plots it on the line. This essentially smooths out price flutuations to give an a investor a general idea where trend is heading. Here I used Exponential Weighted Moving Average(ewma) for analysis to overcome the lag as much as possible. The time frames I used are 5, 20, 50 and 200 days. As we can see in fig. 25 that the period 5 moving average crosses the period 20 moving average many times after March 2020 which indicates short term bullish trends. And similarly in fig. 26 and fig. 27, we can see the the shorter period moving averages remains predominantly above long term moving averages after March 2020 which indicates medium term and long term bullish trends.

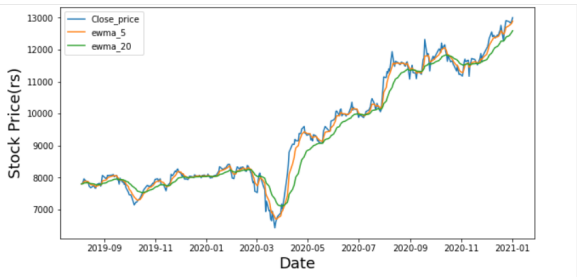

Fig. 25. 5 ewma and 20 ewma of Nifty-Pharma closing prices.

*2) **Using CCI(20)**:* It stands for Commodity Channel Index. It gives an indication of trend change also the momentum within the trend. Time period generally considered is 20 days.CCI is relatively high when prices are far above their average & relatively low when prices are far below their average. The CCI typically oscillates above and below a zero line, above zero line it enters into positive territory below zero into negative territory. Normal oscillations will occur within the range of +200 and 200. Readings above 200 imply

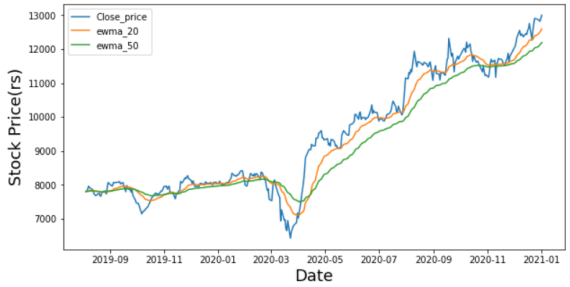

Fig. 26. 20 ewma and 50 ewma of Nifty-Pharma closing prices.

Fig. 27. 50 ewma and 200 ewma of Nifty-Pharma closing prices.

an overbought condition, while readings below 200 imply an oversold condition. CCI between -200 & -50 implies a bearish condition. CCI between -50 & 50 implies neutral condition. CCI between 50 200 implies bullish condition. From fig. 28 and fig. 29 we can observe that the bullish trend is observed more after March 2020.

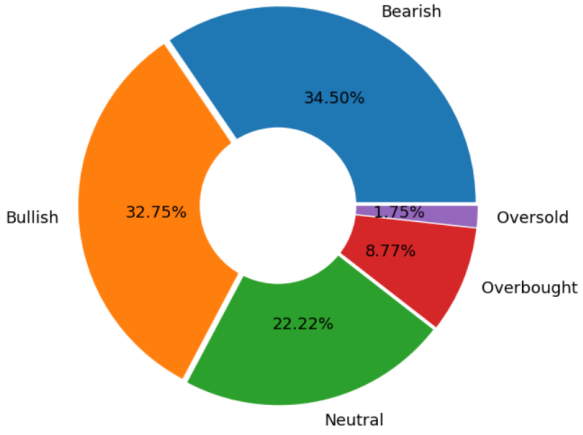

Fig. 28. Trend before Covid-19 using CCI(20) indicator.

*3) **Using RSI(14)**:* RSI Stands for Relative Strength Index. Compares the magnitude of recent gains and losses over a specified time period to measure speed and change of price movements of a security. It is a momentum indicator used to identify overbought or oversold condition in the stock.Time period generally considered is 14 days. RSI reading below 25 is interpreted as oversold. RSI between 25 & 45 is interpreted as a bearish condition. RSI between 45 & 55 is interpreted as

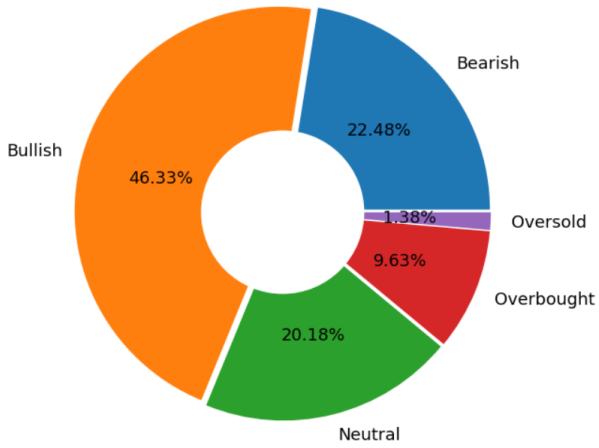

Fig. 29. Trend during Covid-19 using CCI(20) indicator.

a neutral condition.RSI between 55 & 75 is interpreted as a bullish condition. RSI reading greater than 75 is interpreted as an overbought. From fig. 30 and fig. 31 we can again observe that the bullish trend is observed more after March 2020.

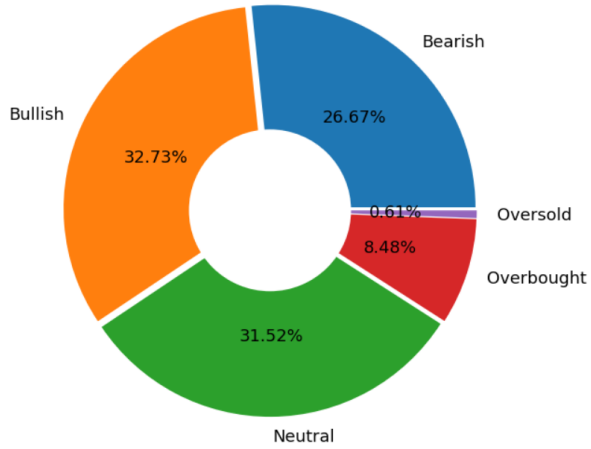

Fig. 30. Momemtum before Covid-19 using RSI(14) indicator.

*4) **Using ADX(20)**:* It stands for Average Directional Index. It indicates only the trend strength. It is a lagging indicator; that is, a trend must have established itself before the ADX will generate a signal. Time period generally considered is 14 days. When the ADX line is rising, trend strength is increasing, and the price moves in the direction of the trend. When the line is falling, trend strength is decreasing, and the price enters a period of retracement or consolidation.A falling ADX line only means that the trend strength is weakening, but it usually does not mean the trend is reversing. We can observe in fig. 32 that after March 2020 the Plus Directional Indicator (+DI) increases during March 2020 and May 2020 which tells that the trend strength in positive direction increases and the overall trend also indicates the increase in positive direction. And after March 2020 the (+DI) indicator remains predominantly above (-DI) indicator.

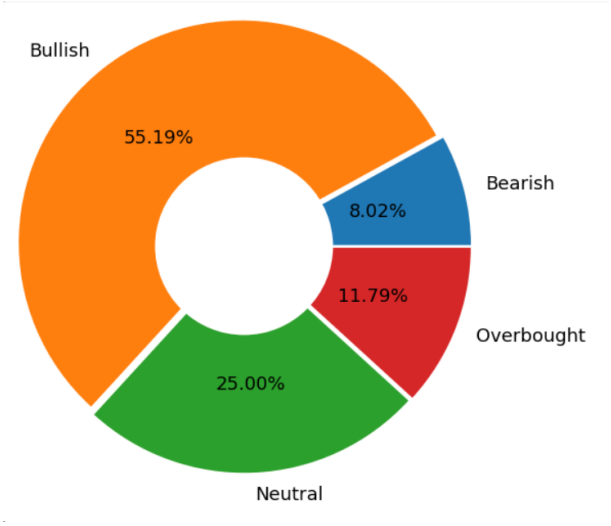

Fig. 31. Momemtum during Covid-19 using RSI(14) indicator.

Fig. 32. Strength of trend using ADX(14) from Aug 2019 to Dec 2020.

*5) **Other Indicators(P/E Ratio, P/B Ratio and Total Returns Index)**:* The price-earnings ratio, also known as P/E ratio, P/E, or PER, is the ratio of a company's share price to the company's earnings per share. The ratio is used for valuing companies and to find out whether they are overvalued or undervalued. The price-to-earnings ratio is also sometimes known as the price multiple or the earnings multiple. It can also be used to compare a company against its own historical record or to compare aggregate markets against one another or over time.

The P/B ratio measures the market's valuation of a company relative to its book value. The market value of equity is typically higher than the book value of a company, P/B ratio is used by value investors to identify potential investments. Price to book ratio is calculated by dividing the company's stock price per share by its book value per share (BVPS). For the initial outlay of an investment, book value may be net or gross of expenses, such as trading costs, sales taxes, and service charges. Some people may know this ratio by its less common name, the price-equity ratio.

A total return index is a type of equity index that tracks both the capital gains as well as any cash distributions, such as dividends or interest, attributed to the components of the index. A look at an index's total return displays a more accurate representation of the index's performance to shareholders. A total return index may be deemed more accurate than other methods that do not account for the activity associated with dividends or distributions, such as those that focus purely on the annual yield. By assuming dividends are reinvested, it effectively accounts for those stocks in an index that do not issue dividends and instead reinvest their earnings within the underlying company as retained earnings. A total return index can be contrasted with a price return or nominal index. So we can observe in fig. 33, fig. 34 and fig. 35 that after March 2020 all the three indicators showed a positive impact after March 2020. So we can tell that Covid-19 was largest contributor to this positive change.

Fig. 33. P/E Ratio from Aug 2019 to Dec 2020.

Fig. 34. P/B Ratio from Aug 2019 to Dec 2020.

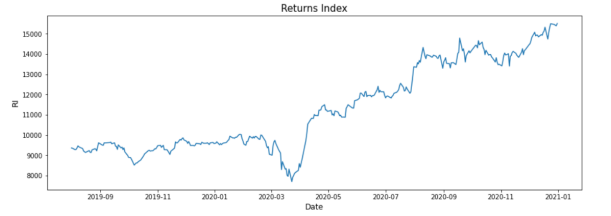

Fig. 35. Total Return Index from Aug 2019 to Dec 2020.

F. Conclusion

So in conclusion we can observe that Covid-19 had impact on Pharmaceutical Sector and was a positive impact. The key technical indicators such as the Moving Averages, RSI(14), CCI(20), ADX(14) gives a clear idea on how the Nity Pharma performed before and during the covid. All these key technical indicators suggest that though there was an initial negative trend in the Pharma market but later on, after March 2020 it had a drastic growth in a very short span of time, this was not possible if Covid-19 had not occured. The initial negative trend during March 2020 can be attributed to the fact of uncertanity

during the period of March 2020. Global economic shutdowns occurred due to the pandemic, and panic buying and supply disruptions exacerbated the overall market. This may be the reason for initial negative trand. But later on i.e. after March 2020, Covid-19 has pushed up sales of medicines and resulted in positive growth for the pharmaceutical sector. And since several countries aimes to develop a COVID-19 vaccine, the Ministry of Health and Family Welfare (MoHFW) of the Government of India has been providing various incentives. These incentives had a positive impact on this sector. So, from the analysis we can clearly reject the null hypothesis which tells that the Covid-19 had no positive impact on Nifty Pharma sector. And so we can conclude that Covid-19 had positive impact on Pharmaceutical Sector.

VI. Nifty FMCG

The NIFTY FMCG Index is designed to reflect the behaviour and performance of FMCGs (Fast MovingConsumer Goods) which are non-durable, mass consumption products and available off the shelf. The NIFTY FMCG Index comprises of 15 stocks from FMCG sector listed on the National Stock Exchange (NSE). Weightage of top 10 companies are shown in Fig-33.

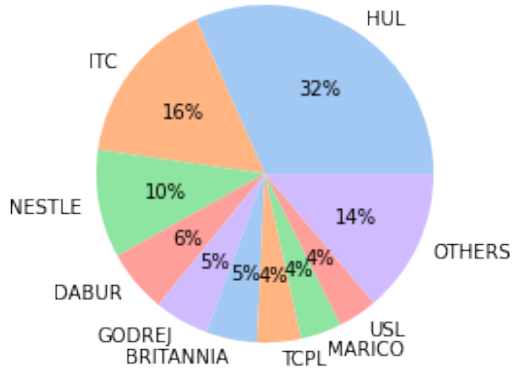

Fig. 36. The weightage of Nifty-FMCG constituents [Jan2021 - Jul2021]

A. Design and Objectives of the Study

- To examine the stationarity of FMCG sector index during pre and post COVID-19.
- To measure the influence of COVID-19 in the price movements of FMCG sector.
- To analyse the volatility index price of FMCG sector during pre and post COVID-19.

B. Hypothesis:

- H0: The Index price return of FMCG sector is not volatile in the COVID-19 period.
- H1: The COVID-19 does not influence the index price returns of FMCG sector.

C. Period of Data:

For analyzing impact of COVID-19 on FMCG sector index, the data collected for pre covid19 is from January 2019 to December 2019 and for post covid19 is from January 2020 to December 2020.

D. Data Analysis and Interpretation:

The data collected are analysed through respective statistical tools like Relative Strength Index (RSI), Augmented Dickey Fuller Test (ADF) and GARCH (1,1) Model.

Measuring the Changes in Price Movements by using Relative Strength Index

The Relative Strength Index(RSI) developed by Welles Wilder, is a technical indicator used in the analysis of financial markets. It is classified as a momentum oscillator, calculates the speed and price movement of stock. RSI compares the average gain and average losses of the stock. The standard has to use 14 periods to calculate the RSI initial value.
The formula for RSI is
RSI = 100 - (100/1+RS)
RS = Average gain per day/ Average loss per day

Price Movements of FMCG Sector during the Pre COVID-19 Period

TABLE I
AVERAGE VALUE OF RSI IN PRE COVID-19 IN FMCG SECTOR

Upward	Downward	Average Up	Average Down	RS	RSI
180.56	-165.53	94.13	95.637	1.31	48.31

In RSI the value ranges from 0 to 100, the value of 70 or more than is overbought condition if reading is 30 or less than, it is oversold condition, the condition prevailed in pre-covid RSI average (48.312) indicates that share is neither overbought nor oversold.

Price Movements of FMCG Sector during the Post COVID-19 Period

TABLE II
AVERAGE VALUE OF RSI IN POST COVID-19 IN FMCG SECTOR

Upward	Downward	Average Up	Average Down	RS	RSI
263.10	-323.58	164.92	149.55	1.77	54.19

In post-covid RSI average (54.19) indicates that share is neither overbought nor oversold but shows there is an increase in price movements when compared to pre-covid.

Measuring Stationarity of Stock Price during the Pre-COVID-19 Period by using Augmented Dickey Fuller Test (ADF)

The Augmented Dickey Fuller Test (ADF) is unit root test to find stationarity. Unit roots can cause unpredictable results in

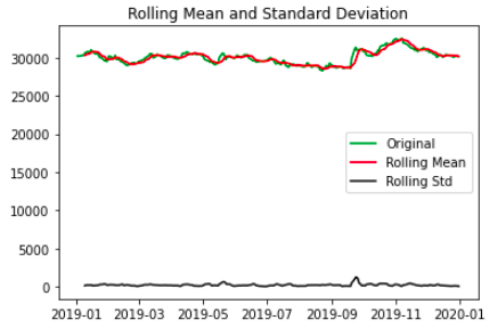

Fig. 37. Rolling Mean and Standard Deviation of Nifty FMCG during JAN 2019 to DEC 2019.

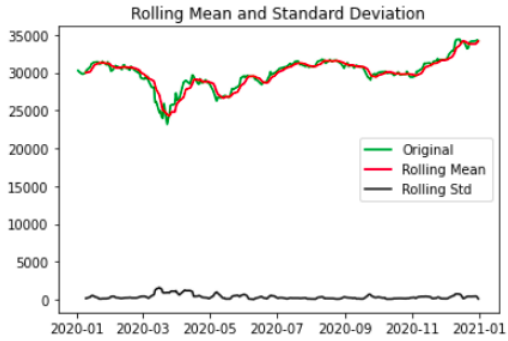

Fig. 38. Rolling Mean and Standard Deviation of Nifty FMCG during JAN 2020 to DEC 2020.

time series analysis. The Augmented Dickey-Fuller test can be used with serial correlation.

In ADF test on pre-covid data(ref Table-3) the t-statistics value(-2.503) is greater than critical values and probability(p) value greater than 0.05 represents that FMCG sector index is not stationary during pre covid.

In ADF test post-covid data(ref Table-4) the t-statistics value(-2.143) is greater than critical values and probability(p) value greater than 0.05 represents that FMCG sector index is not stationary during post covid and shows that the stationarity decreases when compared to pre-covid data.

Measuring Volatility of Stock Price during the Pre COVID-19 Period by using Generalized Autoregressive Conditional Heteroskedasticity [GARCH (1,1)]

The GARCH (1,1) is the simplest and most robust of the family of volatility models. However, the model can be extended and modified in many ways. To examine the volatility level prevailing in the stock market, GARCH (1,1) model has generated different values for different parameters.

Measuring Volatility of Stock Price during the Post COVID-19 Period by using Generalized Autoregressive Conditional Heteroskedasticity [GARCH (1,1)]

From analyzing the results of GARCH(1,1) on pre-covid(Table-5) and post-covid(Table-6) data it is evident that the volatility increased by 17 percent. Hence the hypothesis

TABLE III
ADF OF PRE COVID-19 IN FMCG SECTOR

Unit Root Test for FMCG Index		**t-Statistics**	**Prob.***
Augmented Dickey-Fuller test statistics		-2.503	0.115
Test critical values	1% level	-3.457	
	5% level	-2.873	
	10% level	-2.573	

TABLE IV
ADF OF POST COVID-19 IN FMCG SECTOR

Unit Root Test for FMCG Index		**t-Statistics**	**Prob.***
Augmented Dickey-Fuller test statistics		-2.143	0.2277
Test critical values	1% level	-3.458	
	5% level	-2.873	
	10% level	-2.572	

"The Index price returns of sample indices are volatile" is rejected and confirmed that there is significant volatility existed in FMCG industry during tht study period

E. Reasons for the changes caused in FMCG sector

Impact of COVID–19 on Demand in FMCG Industry of India can be summarized in the below points

- Panic buying increased the demand in the industry initially.
- Essential products like packaged food, groceries, health and hygiene products like soap, sanitizers, etc. saw unprecedented demand.
- FMCG companies struggled to serve the market demand at the panic buying phase in last weeks of March and first half of April, due to disruptions in their supply chain – from sourcing raw materials, manufacturing, till last mile distribution. With lockdown and travel restrictions, companies are still producing at sub optimum levels and pushing sales of only essential items.

Impact of COVID–19 on Supply in FMCG Industry of India can be summarized in the below points

- Supply chain disruption – Due to severe restriction on the movement in India, all nodes of supply chains are being impacted starting from sourcing of raw materials, till the last mile delivery of the finished goods. Severe impact has been on the distribution sector of the supply chain.
- Manufacturing shutdown – Lockdown in the country has impacted production of the goods and even when there are permits to continue production, most of the factories

TABLE V
GARCH (1,1) OF PRE COVID-19 IN FMCG SECTOR

Mean Equation			
Variable	Co-efficient	Std. Error	Z-Statistics
C	3.01E+04	66.043	456.37
Variance Equation			
C	1.56E+04	6029.1	2.603
RESID(-1)^2	0.7856	0.157	5.016
GARCH(-1)	0.2144	0.161	1.333

TABLE VI
GARCH (1,1) OF POST COVID-19 IN FMCG SECTOR

Mean Equation			
Variable	Co-efficient	Std. Error	Z-Statistics
C	3.03E+04	642.4	46.903
Variance Equation			
C	7.86E+04	1.48E+05	0.531
RESID(-1)^2	1	0.238	4.206
GARCH(-1)	0	0.310	0

are operating at the sub optimum levels due to labour shortages and the social distancing guidelines.

Recovery Scenario

While the second point has been a temporary disruption, the first disruption of supply chain given raise to many interesting trends that might shape up the FMCG sector of tomorrow. We will examining one such trend.

Traditionally, FMCG Supply chain has had several layers between the manufacturer and the retailer, who would distribute the products to the consumers. With COVID – 19, this network was disrupted and the companies struggled to move goods from one level to another. This resulted in two phenomena in the market – Direct to Consumer Model (D2C) and partnerships with ride hailing services for delivery. Both of these phenomena are inter related.

Though D2C has not been a new model, many companies which followed traditional supply chain models had no plans of adopting D2C model. In D2C, the FMCG company would try to eliminate all the intermediate levels between itself and the consumer. These levels would have distributors, wholesalers, etc. The company would try to directly reach the retailer or the consumer. This model has its own inherent advantages and disadvantages. COVID – 19 has accelerated this phenomena and FMCG companies are directly trying to reach the consumer eliminating all the intermediate levels. Companies are partnering with ride hailing services like Dunzo, Rapido, etc. for efficient distribution. (refer Table-7)

While these partnerships might be temporary, companies who tried out D2C model during COVID - 19, might examine this model in the post COVID times, and there is a possibility that market of tomorrow would see multiple FMCG companies adopting D2C supply chain model and shunning the traditional supply chain model they always had. This might change the function and role that distributors and wholesalers played in the market.

TABLE VII
PARTNERSHIPS OF FMCG COMPANIES WITH LASTMILE/DISTRIBUTION PROVIDERS IN INDIA

Company	**Lastmile/ Distribution Partners**	**Cities where partnership is operational**
Marico	Zomato, Swiggy	Mumbai, Gurugram, Mumbai, Kolkata, Chandigarh, Ahmedabad
ITC	Domino's(Jubilant FoodWorks)	Bengaluru, Mumbai, Noida, Hyderabad, Kolkata, Chennai
Britannia	Dunzo	Metropoliton cities - Consumers can order Britanniabiscuits, cakes and milkshakes by placing their ordersin the Britannia Essentials Store on the Dunzo app
Spencer's Retail	Uber India, Rapido, Scootsy	Mumbai, Gurugram, Cochin, Hyderabad, Haridwar,Chennai

F. Hypothesis Conclusion

The aim of the study is to analyse the impact of COVID-19 on stock market especially in Fast Moving Consumer Goods (FMCG) sector of National Stock Exchange. Results from Relative Strength Index(RSI) clearly shows that there is a considerable change in the market after COVID-19, the RSI increases slightly due to sudden increase in demand for certain products. From the result of GARCH, we can clearly understand the volatility of the FMCG sector.

While we have examined major trends like direct to consumer model in FMCG and there are multiple trends that are emerging – both due to the changing customer expectation, and due to the disruptions in the supply chain. Dynamics in the economy is driving these changes. To survive in the market,in the post COVID world, a firm must be pro – active in identifying these trends and must adapt to them.

The result of all the analysis it can be understand that the COVID-19 in India made an adverse impact in FMCG sector. Hence from the above result there is a significant changes and impact in the FMCG sector during the study period.

VII. CONCLUSION

In this paper we attempted to analyse the performance of the sectoral indices using the respective metrics and proved the respective hypothesis conclusion. This work attempted to prove the hypothesis and justify the objectives of study. It also shows sudden changes in the equity market trends and tried to reason those changes.