Innovations

The analytic thinking on spot price volatility of stocks and their relative cause with future price

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Abstract

The five-year data of top five companies with derivative instruments in seven important sectors of the Indian equity market were selected based on their market capitalization. In this research, firstly the relationship between volatility of the different companies is analysed. Secondly, we seen how much of an impact the derivative trading has on the spot market. The statistical techniques used in this paper are correlation, regression, unit root test and standard deviation. After all the analysis were done, we found a strong relationship between derivative instruments and spot price volatility and also some other factors that influence the volatility of the spot market like interest rate, global events and so on.

Keywords: *1.Volatility, 2.Future price, 3.stock price return, 4.residual variance, 5.systematic risk and investment decision.*

Introduction

Derivative instruments were introduced in order that a number of the speculative transactions that presently surface within the commodities exchange are often attracted towards the derivatives market. Spin off instruments would alter investors to decide on the extent of portfolio risk that they are snug with. Any risk in far more than this level are often weasel-worded away. Volatility could be an applied mathematics live of the dispersion of returns for a given market index. In most cases, higher volatility could be a sign a better risk in returns. Volatility is commonly measured as either the quality deviation or variance between returns from that market index. Within the securities markets, volatility is commonly related to huge swings in either direction. Futures area unit spinoff money contracts obligating the customer to get associate degree plus or the vendor to sell associate degree plus at a planned future date and set value. A derivative instrument permits associate degree capitalist to take a position on the value of a money instrument or trade goods.

Derivatives were introduced within the early amount of 2000. This was being employed to hedge the chance concerned in equity market. Once plenty of individuals started investment in derivatives promote it began to affect the commodity exchange. Folks started victimization spin off market that is conducive to cost discovery. This impact caused by the derivatives market towards the commodity exchange if calculated properly will facilitate in predicting the movement of the market within the close to future.

In the research paper, high firms supported market capital area unit designated from seven sectors arbitrarily. Sectors enclosed area unit Public Banks, IT, Pharma, FMCG, non-public Banks and Oil & Gas and Chemical. The stock price of all the chosen firms for the past seven-year's area unit collected and compared with the Index price for the past 5 years. The volatility of the stocks is found and compared with the volatility of the indices severally. In doing thus, we will compare the volatility of the stocks with their several index. The pattern of the volatility of the spot costs of the stocks are analysed.

Research Gap

The impact of the future price on the volatility of its underlying assets has not been analysed well so far. The relation between the volatility of different sectors of the market helps to make a proper investment decision to

the investors. Therefore, the goals of this study are to find out how derivatives affects the volatility of the underlying assets and finding the relation between volatility of the different companies.

Statement of the problem

In the study by the Indian Institute of Management, Kozhikode (IIM-K, 2013) it absolutely was seen that beyond the introduction of derivatives commercialism, the relative importance of the 'news coefficient' in determinative plus come back volatility has multiplied. This result assumes bigger importance once seen in light-weight of the very fact that post introduction of derivatives, the unconditional volatility has multiplied, therefore indicating a rise within the amount of data flowing into the commodities market. Introduction of by-product commercialism has resulted during a reduction within the commodities market volatility of the underlying stock. Therefore, this analysis facilitates to know why there's a volatility and therefore it'd help them in taking a calculated risks to avoid loss. In this research paper, we tend to propose to look at however the derivatives have an effect on the volatility of the underlying plus price for various sectors and the relationship between the volatility of the various sectors.

Objectives

- To find out the selected stock return and risk
- To analyse the volatility of the stocks from various sectors
- To find out how the derivatives impact the volatility of its underlying stocks
- To find if there is a pattern in the volatility of prices of the stocks

Theoretical Framework

Studies on Volatility

Schwert (1989) afore said several parts connected to stock volatility square measure examined however no causes of stock worth volatility square measure tested. Rather, the hypotheses concern relationships between stock volatility and different variables like bond come volatility, inflation rates, cash growth, and industrial production growth, yet as stock volatility. The goal is to look at if these mixture volatility measures move along over time. Basic factors like as consumption and production opportunities, yet as needs, would dictate all of those parameters in most general equilibrium models. however, the method of describing conventionalized facts relating to economic volatility aids within the identification of a group of relevant issues which will be translated into tractable theoretical. Bollenserv & Mikkelson (1996), said a novel category of fractionally integrated GARCH and EGARCH models for describing monetary market volatility were analysed. during this context, Monte Carlo simulations show however reliable similar most chance estimate ways, commonplace model choice criteria, and residual-based portmanteau diagnostic tests area unit. consistent with new empirical proof, the apparent long-term reliance in United States securities market volatility is best pictured by a mean-reverting fractionally integrated method, which implies that a shock to the best estimate of future conditional variance dissipates at a slow hyperbolic rate. Backer & Bloom (2019) did associate degree Equity Market Volatility (EMV) huntsman supported the newspaper that moves with the VIX and therefore the accomplished volatility of returns on the S&P five hundred were developed. seventy two % of EMV articles mention the economics. Outlook and forty four % discuss artefact Markets by parsing the underlying content. Another vital explanation for volatility is policy news that's thirty fifth of EMV stories discuss economic policy (primarily Tax Policy), half-hour discuss financial Policy, twenty fifth discuss one or a lot of styles of Regulation, and thirteen discuss National Security problems. The relative importance of assorted policy topics varies considerably throughout time. Following Donald Trump's finish and therefore the step-up of US-China trade hostilities, foreign policy news, as an example, went from a virtual nonfactor in equities market volatility to a number one supply. The proportion of EMV articles dedicated to government policy will increase over time, peaking in 2017-18. They take a look at the activity methodology during a style of strategies. Kearney & Daly, (2019) examined the link between the conditional volatility of stock exchange returns and also the conditional volatility of monetary and variation variables in a very tiny, internationally integrated stock exchange were explored. It uses a low-frequency monthly dataset for Australia from Gregorian calendar month 1972 to Gregorian calendar month 1994, which has stock exchange returns, interest rates, inflation, the money offer, industrial production, and also the accounting deficit. The estimating technique wont to solve the generated repressor downside, that has been a drag in some recent connected studies, may be a novel component of the

analysis. especially, employing a two-stage estimating technique to 1st estimate conditional volatilities so model their interrelationships leads to inefficient estimates, bias in a very range of diagnostic assay statistics, and doubtless inaccurate inferences.

Studies of Derivatives

Chanzu & Gekara (2014) the consequences of use of derivatives on monetary performance of firms listed within the Nairobi Securities Exchange (NSE) were investigated. The objectives were to work out however risk management, efficiency, worth stabilization and worth discovery in derivatives have an effect on the monetary performance of firms in NSE. This study targeted eleven firms that ar listed within the NSE commercialism within the by-product market. form was accustomed collect information from finance officers of the eleven firms listed and NSE officers. the information collected was analyzed by use of descriptive and inferential statistics. Qualitative responses were analyzed victimisation content analysis. A correlation analysis was administered to work out the performance of {the firms|the businesses} listed within the NSE throughout the pre- and post- adoption of the monetary derivatives by these companies. The findings indicated that except for worth stabilization alternative variables contributed absolutely to the monetary performance of firms listed in NSE. Saravanan & Deo (2010), aforementioned capital of India market saw the launching of index futures and choices on NSE on June twelve, 2000 and June four, 2001 severally. This launching of derivatives in Indian securities markets was gave the impression to increase volatility within the stock market by some researchers, at an equivalent time another researchers anticipated decline in volatility. This paper tries to review whether or not the Indian stock markets show some vital modification within the volatility when the introduction of derivatives commerce. The study has been undertaken with a comprehensive daily knowledge set from Jan one, 1996 to March thirty one, 2007. to live the volatility GARCH (1, 1) model has been used. The results show that the presence of derivatives markets on S&P CNX bully have declined the volatility marginally, and fewer reduction of volatility in commodities market appears that presence of naif traders' activities in derivatives market. Marginal volatility reduction in commodities market is related to the rise in market potency and improved market depth in post derivatives amount. This identification rejects "destabilizing forces hypothesis and supports "market completion" hypothesis on derivatives. Babu, Indumati & Krithiga (2009), aforesaid Derivatives in Asian country were introduced in June 2000 with the introduction of stock market index futures within the city securities market (BSE) and also the National securities market (NSE). a vital reason for the introduction of futures and choices in Asian country was the high commerce volatility of the Indian securities market. This paper seeks to supply proof on the impact of futures and choices on commodity exchange volatility. The sample knowledge encompass daily gap and shutting value returns of smashing from January one, 1997 to December 31, 2007. This paper uses family of GARCH techniques to capture the time-varying nature of volatility and volatility bunch development within the knowledge. The study found that there aren't any vital changes within the volatility of the commodity exchange thanks to the introduction of index futures and choices within the smashing Index. Heston & Nandi (2000) mentioned the sphere of theory by proposing closed-form/analytical equations for the evaluation of volatility choices and futures, yet as volatility swaps. The findings of the study ar Volatility is a definite operate of the determined path of plus costs, despite being random. this is often vital in practise as a result of non observability of volatility makes it troublesome (if not impossible) to gain internally consistent costs and hedging ratios for volatility derivatives, very much like not knowing the stock value whereas Associate in Nursing attempt|attempting} to cost an equity spinoff. not like some works, the model doesn't have faith in Associate in Nursing unobserved volatility risk premium or the robust assumption of the existence of a time of choices of all strikes and maturities Rahman (2001) did The result of futures and choices commerce within the Dow-Jones Industrial Average Industrial Average (DJIA) index on the conditional volatility of part stocks were examined. it's at the claim that the introduction of futures and futures choices on the DJIA might enhance volatility within the DJIA's thirty equities. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model is employed to judge the conditional volatility of intraday returns for every stock before and when the introduction of derivatives. The calculated conditional volatility parameters in pre futures and post futures periods area unit then compared to envision if they need modified significantly with the introduction of the assorted derivatives. The findings imply that the introduction of index futures and futures choices on the DJIA has not resulted in any structural changes in part stock conditional volatility.

Singh & Tripathi (2016) examined one in all the foremost necessary problems that have engaged the money managers and also the academicians in Finance everywhere the planet is that the money markets volatility and also the have to be compelled to forecast it accurately. The stock costs depend upon the investment behavior that, in turn, is suffering from the potency of volatility prognostication. the aim of this paper is to look at the volatility within the Indian stock exchange once the introduction of futures contracts on the SENSEX index. To explore the statistic properties Unit Root check and ARCH lumen check are utilized. GARCH (1, 1) model are applied to check the impact on underlying volatility, for this sample amount of twenty six years has been taken. The results of this study indicate that the introduction of futures ends up in a major amendment within the commodities exchange volatility of the SENSEX index and it's in in reducing the volatility. Singh & Tripathi (2016) examined one altogether the foremost necessary issues that have engaged the money managers and additionally the academicians in Finance everyplace the earth is that the money markets volatility and additionally the ought to be compelled to forecast it accurately. The stock prices depend on the investment behavior that, in turn, is full of the efficiency of volatility prognostication. the aim of this paper is to seem at the volatility inside the Indian stock market once the introduction of futures contracts on the SENSEX index. To explore the data point properties Unit Root check and ARCH lumen check area unit used. GARCH (1, 1) model area unit applied to see the impact on underlying volatility, for this sample quantity of twenty six years has been taken. The results of this study indicate that the introduction of futures lands up in an exceedingly major modification inside the commodities exchange volatility of the SENSEX index and it's in in reducing the volatility

Studies on Indices

Bandivadekar & Ghosh (2003) Used the ARCH/GARCH technique, this study investigates the influence of index futures on commodities exchange volatility on the S&P CNX keen and therefore the BSE Sensex. in line with the empirical investigation, once the introduction of index futures, commodities exchange volatility small because the influence of contemporary news grew and therefore the result of uncertainty emanating from recent news small. Bae & Kwon (2009) mentioned the degree of volatility spill over is extremely associated with the amount of market deregulating; throughout the deregulation section, vital come volatility spills over from non-index to index stocks, however within the reverse method throughout the post -deregulation amount. the previous volatility spill over from non-index to index stocks will be explained by the passing contagion result related to the 1997 Korean money crisis and ulterior market deregulating, whereas the latter volatility spill over from index to non-index stocks will be explained by the permanent info spill over result. This latter analysis implies that info regarding investors' expectations for future world organisation parts is 1st mirrored in index stock come volatility, so transferred to non-index stock mercantilism, wherever derivatives don't seem to be listed. Our findings ar unaffected by varied estimating and sample generation approaches. Fang Chi (2016) explained The index future sold-out were used on the Taiwan market to explore the knowledge richness of open interest. Open interest represents market activity, hedging demand, and divergences in traders' beliefs, in step with our findings. will increase in open interest square measure related to higher trade volume, larger depth, and lower market impact prices, implying that higher open interest suggests that a lot of market involvement, that improves liquidity. The findings of significantly positive associations between open interest and 3 spot volatility proxies support the hedging demand hypothesis. They additionally found associate imbalance relationship between mercantilism volume and upward vs downward open interest, still as a depth imbalance between the buy- and sell-sides of the order book. The findings support the construct that a giant open interest indicates divergence in traders' viewpoints. Bhate (2014) his study combines theory and practise within the field of analysis methodology parenthetically the construct of a pilot study - however it is wont to effectively convert a tentative analysis set up into a sensible help for with success implementing the analysis set up. it is also a mix of 2 sensible science faculties: science and applied social science, or money management with a spotlight on personal finance, that is turning into more and more common recently. It shows however, a theory will open up and supply ideas for alpha study in alpha analysis. Kaur (2018) examined the behaviour of Indian open-end fund investor’s exploitation the idea of Planned Behaviour and the client Behaviour Model. This study finds that the investor's data search behaviour is influenced by his or her information and perception. Investors with additional understanding of mutual funds have access to private sources of knowledge, and fund performance influences their call, whereas investors with less information of mutual funds get skilled recommendation and choose funds

supported fund attributes. Investors WHO have a superior come perception for mutual funds disregard performance as a variety criterion, however those that have a poor risk perception tend to decrease their bias by consulting personal sources of knowledge. Investors' information and perceptions of mutual funds ar influenced by their education and financial gain

Background of the study

Shulan & Zhong (2019) Cognitive ability has a negative impact on market liquidity; the explosive information volume enhances market liquidity in the bull, weakens market liquidity in the bear, and has no effect while shocked.

Flowchart

Framework

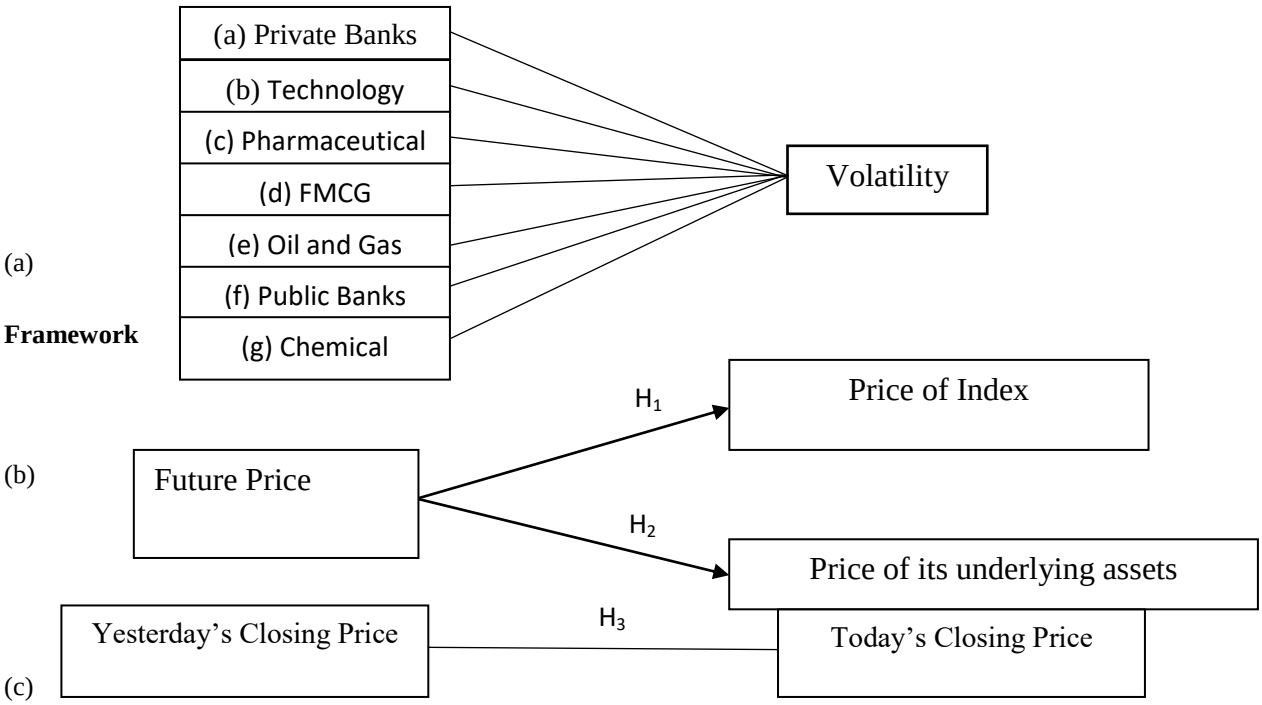


Fig. (a) Comparison of Volatility of stocks between different sectors, (b) Impact of Future Price on its Underlying stocks and index and (c) Pattern of Change of price from one day to another

Hypothesis

H_1 – There is a relationship between Future Price Index and Spot Price Index

H_2 – There is a relationship between Future Price and Volatility of its Underlying Assets

H_3 – There is a relationship between the pattern of change of price from one day to another

Statistical tools used-

This descriptive research focuses on quantitative research method that attempts to collect quantifiable information for statistical analysis of the population sample. It is a popular market research tool that allows us to collect and describe the segment's nature. This research is based on time series. Since there is an involvement of a very large data set, simple random sampling is used. The data was collected from 7 different sectors, with 3 to 5 different companies from each sector. The companies were selected based on market ranking by Forbes India. The industrial sectors that are taken are Private Banks, Technology, Pharmaceutical, FMCG, Oil & Gas, Public Banks and Chemical. We use secondary data in this research collected from different sites like yahoo Finance, NSE, etc. We collected for the time frame of 5 years from 2017 to 2022

Statistical Tools

- Calculation of risk & return

The return ratio is calculated using the formula,

Return Ratio = (Closing Price of present day – Closing price of previous day) / Closing Price of Previous day

- Volatility – Standard Deviation

Standard deviation is a measurement of investment volatility and is often simply referred to as "volatility". For a given investment, standard deviation measures the performance variation from the average. Therefore, an investment with a higher standard deviation will tend to have greater variations from its average performance than an investment with a lower standard deviation. Standard deviation is probably the most commonly quoted investment risk statistic.

- Here, Volatility is the standard deviation of the return ratios.
- Correlation analysis is done to find out the relationship between the volatility of the stock and its corresponding index.
- Correlation and regression

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

r = correlation coefficient
x_i = values of the x-variable in a sample
$\bar{x}$ = mean of the values of the x-variable
y_i = values of the y-variable in a sample
$\bar{y}$ = mean of the values of the y-variable

Regression analysis is used to find to what extend derivatives impact the volatility of stocks and index.

- Unit root test

The Augmented Dickey Fuller test belongs to a category of tests called 'Unit Root Test', which is the proper method for testing the stationarity of a time series. Unit root is a characteristic of a time series that makes it non-stationary. Technically speaking, a unit root is said to exist in a time series of the value of alpha = 1 in the below equation.

$$Y_t = \alpha Y_{t-1} + \beta X_e + \epsilon$$

where, Yt is the value of the time series at time 't' and Xe is an exogenous variable (a separate explanatory variable, which is also a time series).

In this paper, this test helps to analyse if there is a stationary or non-stationary movement between the volatility of stock from one day to another.

Analysis and Interpretation

Sector wise Volatility Analysis

Mean, Standard deviation and β of 34 companies are calculated to find the best company for investment. The β (Beta) denotes the risk and return we can expect from each company stocks. Top companies from major sectors that includes private banks, technology, pharmaceutical, FMCG, oil & gas, public banks

Table 1.1 (a) - Analysis of Private Banks

	x̄					σ					β				
	HDFC	ICICI	KOTAK	AXIS	INDUS	HDFC	ICICI	KOTAK	AXIS	INDUS	HDFC	ICICI	KOTAK	AXIS	INDUS
2017	603.12	239.21	753.26	465.77	1107.30	15.95	8.74	35.57	16.62	57.86	0.71	0.39	0.50	0.37	0.36
2018	812.73	279.86	935.42	507.92	1513.80	102.94	24.65	97.19	24.02	161.36	0.41	0.20	0.24	0.17	0.26
2019	1001.11	314.05	1193.83	566.84	1769.35	47.92	28.93	104.80	43.92	159.51	0.41	0.21	0.26	0.20	0.26
2020	1163.89	420.59	1457.46	724.79	1486.07	75.67	51.17	140.70	47.08	125.22	0.46	0.25	0.30	0.24	0.23

2021	1121.81	411.58	1462.98	513.72	708.95	178.67	82.89	251.30	129.84	321.78	0.57	0.37	0.42	0.33	0.21
2022	1511.52	643.81	1836.15	737.46	1011.48	71.43	63.65	116.73	43.99	83.42	0.55	0.38	0.41	0.34	0.22

From table 1.1 (a), it can be inferred that the average stock price, standard deviation and the beta of top 5 private banks based on market cap is found using the collected data. The average stock price is increasing every year except for the year 2020. The standard deviation is kind of unpredictable as it is fluctuating each year. A beta less than that of 0.1 is being maintained by all the banks. Kotak Mahindra bank has the highest mean value while ICICI bank has the lowest. The standard deviation is the highest for IndusInd bank while ICICI has the lowest standard deviation. IndusInd bank has the highest beta value while ICICI as the lowest beta value. Of all the five selected private banks INDUSIND bank has the highest values and ICICI has the lowest values.

Table 1.2 - Analysis of Tech Companies

	x̄					σ					β				
	TCS	INFY	WIPRO	HCL	TECHM	TCS	INFY	WIPRO	HCL	TECHM	TCS	INFY	WIPRO	HCL	TECHM
2017	1120.20	485.25	171.35	397.23	461.44	37.57	14.31	3.46	11.01	18.93	0.23	0.43	0.36	0.30	0.32
2018	1237.89	482.29	202.15	429.40	448.66	60.43	20.00	17.23	12.62	39.31	0.10	0.15	0.14	0.11	0.10
2019	1787.33	633.13	222.85	488.80	667.94	230.35	57.69	18.14	27.29	55.03	0.10	0.16	0.13	0.11	0.10
2020	2101.16	741.70	263.65	534.58	742.17	106.06	39.89	18.08	26.93	49.65	0.11	0.13	0.13	0.11	0.11
2021	2252.54	866.11	163.30	658.12	709.57	358.28	196.07	63.83	148.07	144.31	0.31	0.31	0.28	0.29	0.27
2022	3309.14	1486.91	531.83	314.00	1139.37	264.88	168.28	92.93	119.10	197.71	0.31	0.32	0.28	0.29	0.26

From table 4.1 (b), it can be inferred that the average stock price, standard deviation and the beta of top 5 tech giants based on market cap is found using the collected data. The average stock price is increasing every year. The standard deviation is also increasing every year. TCS has the highest mean value while, WIPRO has the lowest mean vale. TCS has the highest Standard deviation and WIPRO has the lowest standard deviation. The beta value of TCS is the highest while WIPRO has the lowest beta value. TCS is the highest in all three values and WIPRO is the lowest in all three.

Table 1.3 - Analysis of Pharma Companies

	x̄					σ							
	SUN PHARMA	DIVISLAB	DR. REDDY'S	CIPLA	PARAMEL	SUN PHARMA	DIVISLAB	DR. REDDY'S	CIPLA	PARAMEL	SUN PHARMA	DIVISLAB	
2017	670.74	1128.61	0.09	0.05	0.15	0.27	0.20	3152.60	561.40	1559.78	35.64	140.41	
2018	578.74	768.34	0.09	0.05	0.07	0.14	0.13	2549.58	576.89	2412.40	71.40	150.50	
2019	545.94	1203.22	0.10	0.08	0.08	0.17	0.16	2309.98	592.23	2454.52	59.53	163.53	
2020	426.91	1650.71	0.10	0.09	0.09	0.18	0.15	2704.79	509.25	1987.44	23.89	91.24	
2021	475.19	2633.53	0.20	0.17	0.19	0.22	0.20	4072.26	631.82	1281.23	62.78	622.56	
2022	688.07	4283.05	0.21	0.17	0.18	0.21	0.20	4938.54	896.54	2111.24	78.09	622.38	

From table 4.1 (c), it can be inferred that the average stock price, standard deviation and the beta of top 5 pharma giants based on market cap is found using the collected data. The average stock price is increasing every year, with a massive growth in the last two years. The standard deviation is fluctuating. It is increasing and decreasing regularly. A beta less than that of 0.1 is being maintained by all the companies. Dr.Reddys has the highest mean value while sun pharma has the lowest. Piramel has the highest beta value while Dr.Reddys has the lowest. Dr.Reddys has the highest values of the 5 selected companies while SunPharma has the lowest of all.

Table 1.4- Analysis of FMCG Companies

	x̄					σ					β				
	HUL	ITC	NESTLE IND	DABUR	GODREJ	HUL	ITC	NESTLE IND	DABUR	GODREJ	HUL	ITC	NESTLE IND	DABUR	GODREJ
2017	823.1	233.94	6177.14	279.63	487.19	17.21	8.30	267.56	9.68	14.72	0.44	0.37	0.36	0.34	0.33
2018	1084.06	277.08	6812.62	300.48	604.17	166.15	20.61	558.75	25.11	48.01	0.24	0.18	0.15	0.20	0.14
2019	1562.84	278.68	9426.60	386.25	767.13	163.23	14.91	1200.28	41.75	74.24	0.26	0.23	0.17	0.21	0.15
2020	1839.48	270.13	12146.60	429.04	680.41	137.65	21.12	1476.33	26.81	47.39	0.29	0.26	0.20	0.21	0.15
2021	2146.12	191.03	16418.08	484.58	651.49	177.95	24.34	1441.00	41.76	81.53	0.40	0.34	0.32	0.36	0.26
2022	2428.56	214.33	17913.63	566.53	865.53	166.78	12.15	1137.06	39.17	139.89	0.37	0.33	0.31	0.35	0.23

From table 4.1 (d), it can be inferred that the average stock price, standard deviation and the beta of top 5 FMCG giants based on market cap is found using the collected data. The average stock price is increasing every year, with a massive growth in the last two years. The standard deviation is fluctuating. It is increasing and decreasing regularly. The beta value is fluctuating with massive differences. Nestle has the highest mean value while ITC has the lowest mean value. The standard deviation of Nestle is the highest while ITC has the lowest standard deviation. Nestle has the highest beta value and ITC has the lowest. ITC has the lowest values in all three criteria and nestle has the highest of all the three.

Table 1.5 - Analysis of Oil and Gas Companies

	x̄					σ					β				
	RELIND	ONGC	IOCL	BPCL	HPCL	RELIND	ONGC	IOCL	BPCL	HPCL	RELIND	ONGC	IOCL	BPCL	HPCL
2017	505.68	191.37	152.29	421.92	295.08	14.78	8.71	5.11	12.34	10.74	0.52	0.26	0.31	0.32	0.30
2018	732.59	179.20	200.02	478.66	389.24	129.95	13.33	12.63	32.62	46.88	0.16	0.15	0.16	0.16	0.12
2019	1031.94	171.26	163.23	387.94	297.80	116.50	16.16	20.22	57.61	61.34	0.24	0.18	0.15	0.14	0.10
2020	1309.02	145.59	142.00	401.04	272.31	119.65	15.59	12.51	65.22	26.96	0.25	0.20	0.17	0.15	0.13
2021	1732.42	83.04	89.73	388.52	208.39	386.35	17.04	15.08	56.29	25.20	0.37	0.28	0.28	0.25	0.20
2022	2151.05	117.16	105.88	443.35	263.23	215.95	17.08	11.68	26.41	30.98	0.37	0.26	0.28	0.25	0.19

From table 1.5, it can be inferred that the average stock price, standard deviation and the beta of top 5 oil and gas giants based on market cap is found using the collected data. The average stock price is increasing every year. The standard deviation is also increasing each year except in 2021 where the SD has dropped a bit. A beta less than that of 0.1 is being maintained by all the companies except RELIND. RELIND has the highest mean value while IOCL has the lowest mean value. RELIND has the highest standard deviation while IOCL has the lowest standard deviation. In the beta values also RELIND has the highest values IOCL has the lowest values. Of all the three criteria RELIND has the highest values and IOCL has the lowest values.

Table 1.6 - Analysis of Public Banks

	x̄				σ				β			
	SBI	BoB	PNB	CAN	SBI	BoB	PNB	CAN	SBI	BoB	PNB	CAN
2017	258.77	158.91	133.57	292.62	9.55	7.83	11.44	16.57	0.21	0.11	0.18	0.24
2018	285.67	164.03	152.70	334.84	22.80	14.62	19.18	38.15	0.12	0.09	0.07	0.08
2019	275.12	132.30	93.68	270.18	20.96	19.64	31.18	35.30	0.16	0.11	0.08	0.11
2020	309.25	109.78	73.56	240.80	30.52	13.16	10.56	32.16	0.20	0.14	0.11	0.14
2021	223.55	56.36	36.89	115.31	52.73	17.45	10.49	39.78	0.32	0.21	0.16	0.22
2022	399.93	79.12	38.98	154.90	54.11	7.38	2.89	15.06	0.31	0.20	0.16	0.22

From table 1.6, it can be inferred that the average stock price, standard deviation and the beta of top 5 public sector banks based on market cap is found using the collected data. The average stock price is increasing every year except for the year 2020. The standard deviation is kind of unpredictable as it is fluctuating each year. A beta less than that of 0.1 is being maintained by all the banks. SBI has the highest mean value of all while PNB has the lowest mean value. Canara bank has the highest standard deviation while BoB has the lowest. SBI has the highest beta value while BoB has the lowest beta value. Of all the given

Table 1.7 - Analysis of Chemical Companies

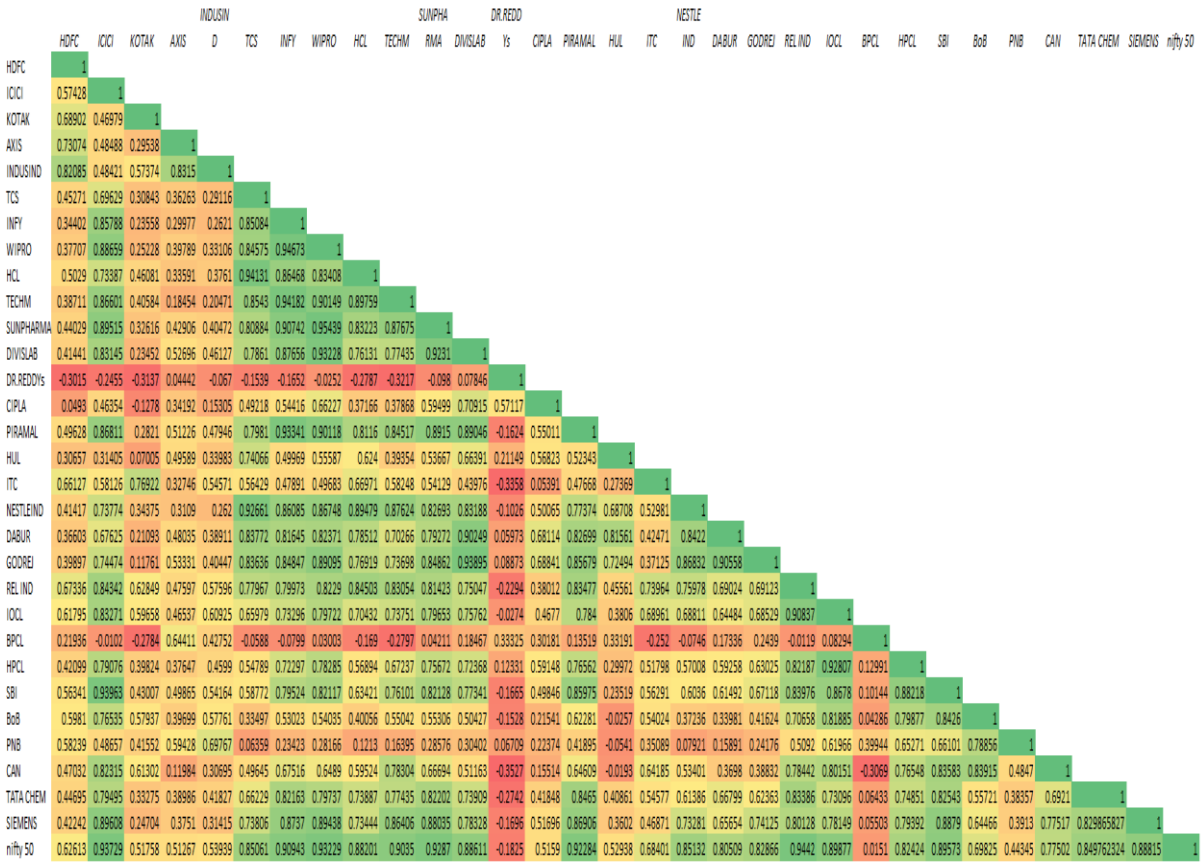
	x̄					σ					β				
	TC	COROO	DN	CHAMBAL	SIE	TC	COROO	DN	CHAMBAL	SIE	TC	COROO	DN	CHAMBAL	SIE
2017	486.21	264.13	95.45	65.03	1102.07	19.54	15.71	6.99	5.06	28.45	0.40	0.24	0.19	0.13	0.25
2018	627.96	413.11	160.26	119.45	1272.15	63.47	69.15	39.32	26.87	78.83	0.25	0.13	0.10	0.06	0.20
2019	709.16	456.32	253.73	156.96	1046.02	30.87	60.23	17.06	13.70	116.64	0.26	0.11	0.11	0.07	0.21
2020	612.89	434.69	285.91	159.97	1253.10	39.87	41.47	42.19	11.13	204.88	0.24	0.12	0.12	0.10	0.24
2021	373.68	688.60	596.29	155.77	1267.27	154.39	95.96	169.72	27.33	167.98	0.19	0.20	0.21	0.17	0.36
2022	749.46	811.73	1812.16	279.77	1978.29	131.42	51.06	484.36	47.44	182.98	0.18	0.18	0.20	0.15	0.36

From table 1.7 , it can be inferred that the average stock price, standard deviation and the beta of top 5 chemical companies based on market cap is found using the collected data. The average stock price is increasing every year with two exceptions during the year 2020. The standard deviation is kind of unpredictable as it is fluctuating each year,but ended on a high note during the years 2020 and 2021. A beta less than that of 0.1 is being maintained by all the companies. Siemens has the highest mean value while Chambal has the lowest mean value. Deepak Nitrate has the highest standard deviation while Chambal has the lowest standard deviation.

Siemens has the highest beta value while Chambal has the lowest beta value. Here Siemens has the highest values of the selected companies while Chambal has the lowest values.

Figure 2.1 - The graph represents the comparison β between different sectors from year 2016 to 2021

From fig 2.1, it can be seen that the private banks have the highest volatility followed by FMCG companies, Oil and Gas companies, Technology companies, Public sector banks, Chemical companies and Pharmaceutical companies



	HDFC	ICICI	KOTAK	AXIS	INDUSIND	TCS	INFY	WIPRO	HCL	TECHM	SUNPHARMA	DIVISLAB	DR.REDDYs	CIPLA	PIRAMAL	HUL	ITC	NESTLEIND	DABUR	GODREJ	RELIND	IOCL	BPCL	HPCL	SBI	BoB	PNB	CAN	TATA CHEM	SIEMENS	nifty 50
HDFC	1																														
ICICI	0.57428	1																													
KOTAK	0.68902	0.46979	1																												
AXIS	0.73074	0.48488	0.29538	1																											
INDUSIND	0.82085	0.48421	0.57374	0.8315	1																										
TCS	0.45271	0.69629	0.30843	0.36263	0.29116	1																									
INFY	0.34402	0.85788	0.23558	0.29977	0.2621	0.85084	1																								
WIPRO	0.37707	0.88659	0.25228	0.39789	0.33106	0.84575	0.94673	1																							
HCL	0.5029	0.73387	0.46081	0.33591	0.3761	0.94131	0.86468	0.83408	1																						
TECHM	0.38711	0.86601	0.40584	0.18454	0.20471	0.8543	0.94182	0.90149	0.89759	1																					
SUNPHARMA	0.44029	0.89515	0.32616	0.42906	0.40472	0.80884	0.90742	0.95439	0.83223	0.87675	1																				
DIVISLAB	0.41441	0.83145	0.23452	0.52696	0.46127	0.7861	0.87656	0.93228	0.76131	0.77435	0.9231	1																			
DR.REDDYs	-0.3015	-0.2455	-0.3137	0.04442	-0.067	-0.1539	-0.1652	-0.0252	-0.2787	-0.3217	-0.098	0.07846	1																		
CIPLA	0.0493	0.46354	-0.1278	0.34192	0.15305	0.49218	0.54416	0.66227	0.37166	0.37868	0.59499	0.70915	0.57117	1																	
PIRAMAL	0.49628	0.86811	0.2821	0.51226	0.47946	0.7981	0.93341	0.90118	0.8116	0.84517	0.8915	0.89046	-0.1624	0.55011	1																
HUL	0.30657	0.31405	0.07005	0.49589	0.33983	0.74066	0.49969	0.55587	0.624	0.39354	0.53667	0.66391	0.21149	0.56823	0.52343	1															
ITC	0.66127	0.58126	0.76922	0.32746	0.54571	0.56429	0.47891	0.49683	0.66971	0.58248	0.54129	0.43976	-0.3358	0.05391	0.47668	0.27369	1														
NESTLEIND	0.41417	0.73774	0.34375	0.3109	0.262	0.92661	0.86085	0.86748	0.89479	0.87624	0.82693	0.83188	-0.1026	0.50065	0.77374	0.68708	0.52981	1													
DABUR	0.36603	0.67625	0.21083	0.48035	0.38911	0.83772	0.81645	0.82371	0.78512	0.70266	0.79272	0.90249	0.05973	0.68114	0.82699	0.81561	0.42471	0.8422	1												
GODREJ	0.39897	0.74474	0.11761	0.53331	0.40447	0.83636	0.84847	0.89095	0.76919	0.73698	0.84862	0.93895	0.08873	0.66841	0.85679	0.72494	0.37125	0.86832	0.90558	1											
RELIND	0.67336	0.84342	0.62849	0.47597	0.57596	0.77967	0.79973	0.8229	0.84503	0.83054	0.81423	0.75047	-0.2294	0.38012	0.83477	0.45561	0.73964	0.75978	0.69024	0.69123	1										
IOCL	0.61795	0.83271	0.59658	0.46537	0.60925	0.65979	0.73296	0.79722	0.70432	0.73751	0.79653	0.75762	-0.0274	0.4577	0.784	0.3806	0.68961	0.68811	0.64484	0.68529	0.90837	1									
BPCL	0.21936	-0.0102	-0.2784	0.64411	0.42752	-0.0588	-0.0799	0.03003	-0.169	-0.2797	0.04211	0.18467	0.33325	0.30181	0.13519	0.33191	-0.252	-0.0746	0.17336	0.2439	-0.0119	0.08294	1								
HPCL	0.42099	0.79076	0.39824	0.37647	0.4599	0.54789	0.72297	0.78285	0.56894	0.67237	0.75672	0.72368	0.12331	0.59148	0.76562	0.29972	0.51798	0.57008	0.59258	0.63025	0.82187	0.92807	0.12991	1							
SBI	0.56341	0.93963	0.43007	0.49865	0.54164	0.58772	0.79524	0.82117	0.63421	0.76101	0.82128	0.77341	-0.1665	0.49846	0.85975	0.23519	0.56291	0.6036	0.61492	0.67118	0.83976	0.8678	0.10144	0.88218	1						
BoB	0.5981	0.76535	0.57937	0.39699	0.57761	0.33497	0.53023	0.54035	0.40056	0.55042	0.55306	0.50427	-0.1528	0.21541	0.62281	-0.0257	0.54024	0.37236	0.33981	0.41624	0.70658	0.81885	0.04286	0.79877	0.8426	1					
PNB	0.58239	0.48657	0.41552	0.59428	0.69767	0.06359	0.23423	0.28166	0.1213	0.16395	0.28576	0.30402	0.06709	0.22374	0.41895	-0.0541	0.35089	0.07921	0.15891	0.24176	0.5092	0.61966	0.38944	0.65271	0.66101	0.78856	1				
CAN	0.47032	0.82315	0.61302	0.11984	0.30695	0.49645	0.67516	0.6489	0.59524	0.78304	0.66694	0.51163	-0.3527	0.15514	0.64609	-0.0193	0.64185	0.53401	0.3698	0.38832	0.78442	0.80151	-0.3069	0.76548	0.83583	0.83915	0.4847	1			
TATA CHEM	0.44695	0.79495	0.33275	0.38986	0.41827	0.66229	0.82163	0.79737	0.73887	0.77435	0.82202	0.73909	-0.2742	0.41848	0.8465	0.40861	0.54577	0.61386	0.66799	0.62363	0.83386	0.73096	0.06433	0.74851	0.82543	0.55721	0.38357	0.6921	1	
SIEMENS	0.42242	0.89608	0.24704	0.3751	0.31415	0.73806	0.8737	0.89438	0.73444	0.86406	0.88035	0.78328	-0.1696	0.51696	0.86906	0.3602	0.46871	0.73281	0.65654	0.74125	0.80128	0.78149	0.05503	0.78392	0.8879	0.64466	0.3913	0.77517	0.829865827	1
nifty 50	0.62613	0.93729	0.51758	0.51267	0.53939	0.85061	0.90943	0.93229	0.88201	0.9035	0.9287	0.88611	-0.1825	0.5159	0.92284	0.52938	0.68401	0.85132	0.80509	0.82866	0.9442	0.89877	0.0151	0.82424	0.89573	0.69825	0.44345	0.77502	0.849762324	0.88815	1

Figure 2.1 - Correlation Matrix between different companies

From the above fig 2.1, we can see that the sector of private banks has a slightly positive correlation when compared with other sectors. The IT sector has a low positive correlation when compared with other sectors. The pharma industry also has a lower positive correlation when compared with other sectors. But Dr. Reddy's has a negative correlation. The FMCG industry has a lower positive correlation with the other industries. But the FMCG industry has a high positive correlation when compared with the IT sector. The oil industry has comparably higher positive correlation with other sectors except BPCL. The PSU banks have a lower positive correlation with other sectors but have a higher correlation when compared with other PSU banks. The chemicals sector has a relatively higher positive correlation when compared with other sectors. The correlation is high in IT companies. So, when the IT companies are on a positive side, there are high chances for the chemical sector to also have a positive movement. Of all the companies listed above, Dr. Reddy's and BPCL have the lowest correlation between other companies of same sector as well as other sectors.

Impact of Derivatives on Stock Volatility

Table 2.1- Correlation between Future and Spot Price of Nifty 50

Correlation		Nifty 50 Future Price
Nifty 50 Spot Price	Pearson correlation Sig. (2 - tailed) N	0.9909 0.1256 244

From the table 2.1, we can infer that there is a very high positive correlation of 0.9909 between the future price and spot price in the case of nifty 50.

Table 2.2 Model Summary - Regression (Nifty 50)

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.99	0.98	0.98	171.98

The R^2 is 0.98 which is highly positive. The regression equation of the Nifty 50 Future and Nifty 50 Spot is Y=175 + 0.988X where Y is Nifty 50 Spot and X is Nifty 50 Future. The alternate hypothesis (H1) is accepted i.e., there is a relationship between spot price and future price of Nifty 50.

Impact on underlying assets

Correlation between Future and Spot Price of Private Banks

From the above correlation table 4.2.2.1(a), it can be inferred that the average correlation for the private banks sector is 0.9553. This is inferred to be a very high positive correlation.

Table 3.1 - Model Summary of Regression (Private Banks)

Companies	R	R Square	Adjusted R Square	Std. Error of the Estimate
HDFC	0.94	0.89	0.89	22.39
ICICI	0.98	0.97	0.97	12.64
Kotak	0.97	0.93	0.93	32.02
Axis	0.95	0.91	0.91	13.37
IndusInd	0.96	0.92	0.92	24.98

The R^2 is 0.94 which is positive for HDFC Bank. The regression equation of the Future and Spot Price of HDFC Bank is Y=71 + 0.952X where Y is HDFC Spot and X is HDFC Future. The R^2 is 0.97 which is positive for ICICI Bank. The regression equation of the Future and Spot Price of ICICI Bank is Y=11.7 + 0.981X where Y is ICICI Spot and X is ICICI Future. The R^2 is 0.97 which is positive for Kotak Bank. The regression equation of the Future and Spot Price of Kotak Bank is Y=51.3 + 0.970X where Y is Kotak Spot and X is Kotak Future. The R^2 is 0.95 which is positive for Axis Bank. The regression equation of the Future and Spot Price of Axis Bank is Y=38.4 + 0.945X where Y is AXIS Spot and X is Axis Future. The R^2 is 0.96 which is positive for IndusInd Bank. The regression equation of the Future and Spot Price of IndusInd Bank is Y=42.2 + 0.956X where Y is IndusInd Spot and X is IndusInd Future. of IndusInd Bank is Y=42.2 + 0.956X where Y is IndusInd Spot and X is IndusInd Future.

Table 3.2 - Model Summary of Regression (IT Companies)

Companies	R	R Square	Adjusted R Square	Std. Error of the Estimate
TCS	0.99	0.97	0.97	43.62
Infosys	0.99	0.99	0.99	20.00
Wipro	0.99	0.99	0.99	20.00
HCL	0.99	0.98	0.98	17.48
Tech Mahindra	0.99	0.98	0.98	17.48

is Y=4.19 + 0.993X where Y is Wipro Spot and X is Wipro Future. The R^2 is 0.99 which is highly positive for HCL. The regression equation of the Future and Spot Price of HCL is Y=1.49 + 0.999X where Y is HCL Spot and X is HCL Future. The R^2 is 0.99 which is highly positive for Tech Mahindra. The regression equation of the Future and Spot Price of Tech Mahindra is Y=3.31 + 1.000X where Y is Tech Mahindra Spot and X is Tech Mahindra Future.

Table 3.3 - Model Summary of Regression (Pharma Companies)

Companies	R	R Square	Adjusted R Square	Std. Error of the Estimate
Sun Pharma	0.99	0.98	0.98	11.57
Divis Lab	0.99	0.99	0.99	71.31
Dr. Reddy's	0.97	0.94	0.94	77.29
Cipla	0.97	0.94	0.94	13.95
Piramal	0.99	0.98	0.98	55.52

The R^2 is 0.99 which is highly positive for Sun Pharma. The regression equation of the Future and Spot Price of Sun Pharma is Y=4.36 + 0.993X where Y is Sun Pharma Spot and X is Sun Pharma Future. The R^2 is 0.99 which is highly positive for Divis Lab. The regression equation of the Future and Spot Price of Divis Lab is Y=26.4 + 0.992X where Y is Divis Lab Spot and X is Divis Lab Future. The R^2 is 0.97 which is positive for Dr. Reddy's. The regression equation of the Future and Spot Price Spot Price of Cipla is Y=25.2 + 0.971X where Y is Cipla of Dr. Reddy's is Y=154 + 0.966X where Y is Dr. Reddy's Spot and X is Dr. Reddy's Future. The R^2 is 0.97 which is positive for Cipla. The regression equation of the Future and Spot and X is Cipla Future. The R^2 is 0.99 which is highly positive for Piramal. The regression equation of the Future and Spot Price of Piramal is Y=26.1 + 0.988X where Y is Piramal Spot and X is Piramal Future.

Table 3.4 - Model Summary of Regression (FMCG Companies)

Companies	R	R Square	Adjusted R Square	Std. Error of the Estimate
HUL	0.98	0.96	0.96	30.78
ITC	0.95	0.91	0.91	3.67
NestleInd	0.99	0.97	0.97	196.88
Dabur	0.98	0.97	0.97	6.56
Godrej	0.99	0.98	0.98	17.39

The R^2 is 0.98 which is positive for HUL. The regression equation of the Future and Spot Price of HUL is Y=22.4 + 0.989X where Y is HUL Spot and X is HUL Future. The R^2 is 0.95 which is positive for ITC. The regression equation of the Future and Spot Price of ITC is Y=10.2 + 0.952X where Y is ITC Spot and X is ITC Future. The R^2 is 0.99 which is highly positive for Nestle. The regression equation of the Future and Spot Price of Nestle Ind is Y=190 + 0.988X where Y is Nestle Ind Spot and X is Nestle Ind Future. The R^2 is 0.98 which is positive for Dabur. The regression equation of the Future and Spot Price of Dabur is Y=4.63 + 0.990X where Y is Dabur Spot and X is Dabur Future. The R^2 is 0.99 which is highly positive for Godrej. The regression equation of the Future and Spot Price of Godrej is Y=8.71 + 0.989X where Y is Godrej Spot and X is Godrej Future.

Table 3.5- Model Summary of Regression (Oil & Gas Companies)

Companies	R	R Square	Adjusted R Square	Std. Error of the Estimate
Reliance	0.99	0.97	0.97	36.35
IOCL	0.99	0.97	0.97	2.11
BPCL	0.97	0.94	0.94	7.94
HPCL	0.99	0.97	0.97	5.46

The R^2 is 0.99 which is highly positive for Reliance. The regression equation of the Future and Spot Price of Reliance is Y=27.3+ 0.986X where Y is Reliance Spot and X is Reliance Future. The R^2 is 0.99 which is highly positive for IOCL. The regression equation of the Future and Spot Price of IOCL is Y=-0.0532+ 1.00 X where Y is IOCL Spot and X is IOCL Future. The R^2 is 0.99 which is highly positive for BPCL. The regression equation of the Future and Spot Price of BPCL is Y=20.0+ 0.953 X where Y is BPCL Spot and X is BPCL Future. The R^2 is 0.99 which is highly positive for HPCL. The regression equation of the Future and Spot Price of HPCL is Y=4.22+ 0.983 X where Y is HPCL Spot and X is HPCL Future.

Table 3.6 - Model Summary of Regression (Public Sector Banks)

Companies	R	R Square	Adjusted R Square	Std. Error of the Estimate
SBIN	0.99	0.98	0.98	8.14
BOB	0.96	0.93	0.93	2.31
PNB	0.93	0.87	0.86	1.01
Canara	0.99	0.97	0.97	4.50

The R^2 is 0.99 which is highly positive for SBI. The regression equation of the Future and Spot Price of SBI is Y=7.69+ 0.981 X where Y is SBI Spot and X is SBI Future. The R^2 is 0.99 which is highly positive for BOB. The regression equation of the Future and Spot Price of BOB is Y=3.44+ 0.957 X where Y is Bank of Baroda Spot and X is Bank of Baroda Future. The R^2 is 0.93 which is positive for PNB. The regression equation of the Future and Spot Price of PNB is Y=2.48+ 0.936 X where Y is PNB Spot and X is PNB Future. The R^2 is 0.99 which is highly positive for Canara Bank. The regression equation of the Future and Spot Price of Canara is Y=2.57+ 0.984 X where Y is Canara Bank Spot and X is Canara Bank Future.

Table 3.7- Correlation between Future and Spot Price of Chemical Companies

Correlation		TATACHEM Future Price
TATACHEM Spot Price	Pearson correlation Sig. (2 - tailed) N	0.9879 0.1256 244
Correlation		SIEMENS Future Price
SIEMENS Spot Price	Pearson correlation Sig. (2 - tailed) N	0.9862 0.1256 244

Table 3.8 - Model Summary of Regression (Chemical companies)

Companies	R	R Square	Adjusted R Square	Std. Error of the Estimate
SBIN	0.99	0.98	0.98	8.14
BOB	0.96	0.93	0.93	2.31

The R^2 is 0.99 which is highly positive for TATA Chemicals. The regression equation of the Future and Spot Price of TATA Chemicals is Y=891+ 0.999X where Y is TATA Chemicals Spot and X is TATA Chemical ls Future. The R^2 is 0.99 which is highly positive for Siemens. The regression equation of the Future and Spot Price of Siemens is Y=45.3+ 0.977 X where Y is Siemens Spot and X is Siemens Future.

Unit Root Test

Table 4.1 Unit Root Test Summary of the companies (The Augmented Dickey-Fuller test)

Sectors	Companies	Particulars	Values
Nifty 50		Sample Size	240
		Estimated Value (a -1)	-0.00882
		P-value	0.701
		1st order autocorrelation Coeff. For e	-0.001
		Lagged differences	F(4,234) = 5.049[0.0006]
Private Banks	HDFC Bank	Sample Size	242
		Estimated Value (a -1)	-0.0505858
		P-value	0.1306
		1st order autocorrelation Coeff. For e	-0.006
		Lagged differences	F(2, 238) = 8.424 [0.0003]
	ICICI Bank	Sample Size	240
		Estimated Value (a -1)	-0.0190548
		P-value	0.462
		1st order autocorrelation Coeff. For e	-0.006
		Lagged differences	F(4, 234) = 2.775 [0.0278]
	Kotak mahindra Bank	Sample Size	244
		Estimated Value (a -1)	-0.0326015
		P-value	0.2826
		1st order autocorrelation Coeff. For e	0.041
		Lagged differences	
	Axis Bank	Sample Size	240
		Estimated Value (a -1)	-0.0430904
		P-value	0.2345
		1st order autocorrelation Coeff. For e	-0.005
		Lagged differences	F(4, 234) = 1.944 [0.1039]
	Indusind Bank	Sample Size	244
		Estimated Value (a -1)	-0.041283
		P-value	0.1948
		1st order autocorrelation Coeff. For e	-0.035
		Lagged differences	
IT	TCS	Sample Size	244
		Estimated Value (a -1)	0.0122255
		P-value	0.689
		1st order autocorrelation Coeff. For e	0.019
		Lagged differences	
	Infosys	Sample Size	242
		Estimated Value (a -1)	-0.00179927
		P-value	0.9275
		1st order autocorrelation Coeff. For e	-0.007

		Lagged differences	F(2, 238) = 6.124 [0.0026]
	Wipro	Sample Size	244
		Estimated Value (a -1)	-0.00438188
		P-value	0.8394
		1st order autocorrelation Coeff. For e	0.08
		Lagged differences	
	HCL	Sample Size	242
		Estimated Value (a -1)	-0.00172078
		P-value	0.938
		1st order autocorrelation Coeff. For e	0.007
		Lagged differences	F(2, 238) = 2.850 [0.0598]
	Tech Mahindra	Sample Size	242
		Estimated Value (a -1)	0.00598269
		P-value	0.9968
		1st order autocorrelation Coeff. For e	-0.012
		Lagged differences	F(2, 238) = 3.271 [0.0397]
Pharma	Sun Pharma	Sample Size	244
		Estimated Value (a -1)	-0.00816127
		P-value	0.7925
		1st order autocorrelation Coeff. For e	-0.037
		Lagged differences	
	Divislab	Sample Size	244
		Estimated Value (a -1)	-0.00793802
		P-value	0.7356
		1st order autocorrelation Coeff. For e	0.021
		Lagged differences	
	Dr Reddy's	Sample Size	243
		Estimated Value (a -1)	-0.0342015
		P-value	0.1857
		1st order autocorrelation Coeff. For e	0.004
		Lagged differences	
	Cipla	Sample Size	244
		Estimated Value (a -1)	-0.0305479
		P-value	0.2998
		1st order autocorrelation Coeff. For e	0.004
		Lagged differences	
	Piramal	Sample Size	243
		Estimated Value (a -1)	-0.0114217
		P-value	0.5713
		1st order autocorrelation Coeff. For e	0
		Lagged differences	
FMCG	HUL	Sample Size	244

		Estimated Value (a -1)	-0.0166703
		P-value	0.5861
		1st order autocorrelation Coeff. For e	0.045
		Lagged differences	
	ITC	Sample Size	243
		Estimated Value (a -1)	-0.0500882
		P-value	0.08649
		1st order autocorrelation Coeff. For e	-0.003
		Lagged differences	
	NestleInd	Sample Size	244
		Estimated Value (a -1)	-0.0113232
		P-value	0.7299
		1st order autocorrelation Coeff. For e	0.011
		Lagged differences	
	Dabur	Sample Size	244
		Estimated Value (a -1)	0.0162311
		P-value	0.5561
		1st order autocorrelation Coeff. For e	-0.031
		Lagged differences	
	Godrej	Sample Size	244
		Estimated Value (a -1)	-0.00981385
		P-value	0.693
		1st order autocorrelation Coeff. For e	-0.015
		Lagged differences	
FMCG	Reliance	Sample Size	241
		Estimated Value (a -1)	-0.0140348
		P-value	0.5981
		1st order autocorrelation Coeff. For e	0.013
		Lagged differences	F(3, 236) = 1.962 [0.1204]
	IOCL	Sample Size	243
		Estimated Value (a -1)	-0.0146815
		P-value	0.5049
		1st order autocorrelation Coeff. For e	0.003
		Lagged differences	
	BPCL	Sample Size	243
		Estimated Value (a -1)	-0.0304828
		P-value	0.3114
		1st order autocorrelation Coeff. For e	0
		Lagged differences	
	HPCL	Sample Size	243
		Estimated Value (a -1)	-0.0178659
		P-value	0.4234

		1st order autocorrelation Coeff. For e	0.006
		Lagged differences	
Public Banks	State Bank of India	Sample Size	240
		Estimated Value (a -1)	-0.0208644
		P-value	0.1821
		1st order autocorrelation Coeff. For e	-0.01
		Lagged differences	F(4, 234) = 2.511 [0.0426]
	Bank of Baroda	Sample Size	240
		Estimated Value (a -1)	-0.0475304
		P-value	0.08271
		1st order autocorrelation Coeff. For e	-0.01
		Lagged differences	F(4, 234) = 3.840 [0.0048]
	Punjab National Bank	Sample Size	244
		Estimated Value (a -1)	-0.0747497
		P-value	0.2593
		1st order autocorrelation Coeff. For e	-0.022
		Lagged differences	
	Canara Bank	Sample Size	244
		Estimated Value (a -1)	-0.0149957
		P-value	0.604
		1st order autocorrelation Coeff. For e	0.004
		Lagged differences	
Chemical	Tata Chemicals	Sample Size	244
		Estimated Value (a -1)	-0.0207249
		P-value	0.2583
		1st order autocorrelation Coeff. For e	0.057
		Lagged differences	
	Deepak Nitrate	Sample Size	205
		Estimated Value (a -1)	-0.0146546
		P-value	0.6308
		1st order autocorrelation Coeff. For e	0.084
		Lagged differences	
	Siemens	Sample Size	244
		Estimated Value (a -1)	-0.0184476
		P-value	0.4184
		1st order autocorrelation Coeff. For e	0.08
		Lagged differences	

For the table 4.3, it can be clearly seen that the p value obtained for all the 34 companies are higher than the significance value of 0.05 or 5%, hence the null hypothesis is accepted in all the cases. The alternate hypothesis (H3) is rejected. There is no relationship between the pattern change of price of stocks from one day to another.

There is a presence of a unit root in all the cases and the time series data is non-stationary. Since the given data is non stationary it is unpredictable and hence cannot be forecasted or modelled.

Findings

- It can be inferred from Mean and Beta of the various industries from 2016 to 2021 is that Private Bank Industry has the highest volatility followed by FMCG, Oil and Gas, Technology, Chemical, Public Banks and Pharma Industry. Market Volatility is caused by various factors and one such important determinant is Derivatives. Private Banks are cyclical and tend to be a harbinger of the performance of other sectors and the broad economy, making them more volatile.
- Banking, IT, Oil and Gas, FMCG stocks can be used for long term investment whereas Chemical and Pharma stocks can be used for short term investments.
- Covid-19 created a huge volatility in the market in the year 2020. All the sectors were impacted temporarily, yet the financial sector faced the worst. Sectors like pharma, consumer goods, and IT had positive or limited impacts. It is because the demand for technology, pharmacies, food and daily consumable goods were not affected and in fact, they were in high demand.
- The correlation matrix table indicates that the coefficient of correlation across the companies returns are positive and strong linkages were detected between IT companies and other companies in the market, showing correlation coefficient in a range between 0.630 and 0.951. All the other sectors depend on IT sectors and IT sectors stocks are not just impacted by other sectors but also by the foreign IT companies. So, it has a high positive correlation between other companies in the market.
- From Correlation and Regression analysis it can be inferred that there is a strong relationship between the Spot and Future price in almost all the companies. It can be inferred that the spot price movement can be predicted with the help of futures. But unit root test proves this wrong by resulting that there is n o particular pattern for stock market movement.
- As unit root test proves that the time series data of spot prices are non-stationary, it can be inferred that the spot price volatility is not just impacted by derivatives but also by caused by uncertainty, which can be influenced by interest rates tax changes, inflation rates, and other monetary policies and by national and global events.

Implications for the study

An analysis on volatility of stocks from the past five years helped to identify that few sectors like IT and FMCG remain healthy even during critical times like COVID. So, it is better to have always have a share on sectors like IT and FMCG in the portfolio. An index's performance increases when most of the shares of that particular index increases. So, while investing in a particular sector, the overall index and inter-dependent sectors must also be considered while investing. The impact of derivatives on its underlying assets was found and the impact is considerably high. Statistical tools like Standard Deviation, Correlation, Regression were used to confirm the impact. This shows that there is a strong relationship between derivatives and spot price volatility. However, the unit root test proves that there is no particular pattern in the volatility of stocks from one day to another. Volatility is also caused by various factors like interest rate changes, global events and so on.

Scope for the further research

The results produced in this research will help investors make a decision on their investing patterns and the stocks that they will choose in investing on. Long term investors will prefer investing in less volatile stocks meanwhile short-term investors and intraday traders will invest in highly volatile stocks. According to the Economic Utility Theory, the individual's investment decision is the trade-off between the immediate consumption and deferred consumption.

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