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Impact on Intraday Volatility due to Introduction of Weekly option expiries

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ABSTRACT

Weekly option expiry was introduced for hedging purpose on 26th May 2016 and 14th February 2019 on Bank Nifty and Nifty 50 respectively. This meant reduction in option premiums due to decrease in the time in expiration. Many retail investors started buying these options to make quick gains, however the study by Securities and Exchange board of India showed otherwise. Nifty and Bank Nifty intraday volatility could be measured through high and low prices these indices trade at during the day. The option buyer pays the time value component of the option premium to the seller. Theta decay (i.e., reduction in the time value) which makes option prices reduce in value is much faster for a weekly expiry as compared to monthly expiry. Increase in Intra-day volatility could give option buyer better opportunities to exit the position during the day provided the direction betted on was correct. This study divided the time frames in two halves' viz. pre-Introduction of weekly option expiry and post the introduction of weekly expiry on the indices. The t-Test paired sample of two means was used to infer the results. The study showed significant spike in intraday volatility in Nifty post the introduction of weekly option expiry whereas Bank nifty showed a significant reduction in intraday volatility post the introduction of weekly option expiry. Bank Nifty being a sectorial index was more volatile as compared to Nifty Index. Bank Nifty weekly option expiry was discontinued from 14th November 2024. So, the data was taken accordingly.

INTRODUCTION

The diversified 50-stock Nifty 50 Index of the NSE includes businesses from 13 different economic sectors. The benchmark was set on November 3, 1995, at 1000. The Bank Nifty was launched on September 3,2003 at 1000. The major purpose of Bank Nifty was to gauge the performance of banking sector in India. The company India Index Services and Products Ltd. (IISL) owns and operates the Nifty 50 and Bank Nifty.

On June 4, 2001, the exchange opened up trading in Index Options. On July 2, 2001, options on individual equities were introduced, and on November 9, 2001, futures were added.

An option grants the buyer the right, but not the responsibility, to purchase (call) or sell (put) at certain values determined by the NSE, known as striking prices, on or before the option's expiration date. Options can be classified as In the Money (ITM), At the Money (ATM), or Out of the Money (OTM). If the spot price is higher than the strike price, the call option is ITM. If the spot price is less than the strike price, the put option is ITM. Option premiums can be divided into two categories: time value and intrinsic value. The only options with inherent worth are ITM options. The highest time value is seen for both ATM call and put options.

Weekly option expiry was introduced for hedging purpose on 26th May 2016 and 14th February 2019 on Bank Nifty and Nifty 50 respectively based on the settlement in the cash market.

Prior to the October 2019 settlement, cash was used to settle both stocks and indexes; however, all stock derivatives were now physically settled. The Securities and Exchange Board of India (SEBI) took this action in an effort to stop speculation and lower volatility in individual stocks.

These actions by NSE of introduction of weekly option expiry and SEBI of physical settlement have meant increased volumes in Nifty weekly options as apparently, they are cheaper as compared to four of five weekly monthly expiries. They are settled in cash so both buyer and seller can wait till the end of Thursday expiration without taking/giving actual delivery of shares even if they are ITM. In case of physical settlement, ITM Call buyer is expected to take actual delivery of shares from ITM Call seller. ITM Put buyer is expected to give actual delivery of shares from ITM Put seller.

The NSE uses the Black-Scholes Model, which states that the price of an option is determined by its strike price, time to expiration, risk-free rate, volatility, and spot price. The NSE measures the volatility index, often known as the fear index, as the India VIX. The NSE provides daily values for the India VIX.

REVIEW OF LITERATURE

The relevant review of literature was done

The option prices between 1966 and 1969 were examined by Black and Scholes (1972), who computed returns for both option buyers and writers, factoring in

transaction costs as well as neglecting them. They determined that the transaction cost in the options market was significantly greater than that of other listed securities. In 1973, they reached the conclusion in the subsequent paper it would not be possible to guarantee profits by creating long and short positions in options and their underlying stocks if options were accurately priced. With the help of this theory, they developed an option pricing model. The detailed pricing model is as follows

$C= S * N(d1) – K e^{(-rT)} * N (d2)$

$P= K e^{(-rT)} * N (-d2) – S * N(-d1)$

Where,

$d1 = [In(S/K) + (r +\sigma^2/2)*T] / [\sigma * Sqrt(T)]$

$d2 = [In(S/K) + (r -\sigma^2/2)*T] / [\sigma * Sqrt(T)] = d1- \sigma * Sqrt(T)$

Variables in the formula

C= European Call option Price

P= European Put option Price

S= Spot Price at time t=0

K= Strike Price

r= Continuously compounded risk-free rate

σ = Stock Price Volatility

T= Time to Maturity of the Option

According to Thorp (1973), the Black-Scholes Model will still function properly even if short selling is restricted. The paper also introduced a model for Bayesian analysis of finite populations.

According to Merton (1973), the option pricing theory originated in 1900 when French mathematician Louis Bachelier determined that an option pricing formula relies on the premise that stock prices exhibit Brownian Motion with zero drift. He took into account the effect of the dividend. He developed the formula for "Down and Out" options.

A straightforward discrete time model for option valuation was introduced by Cox, Ross, and Rubinstein in (1979), they determined the prices of options based exclusively on arbitrage considerations, using a discrete binomial process. The researchers stated that the simple two-state process based on multi-iteration arbitrage principles was superior to the complex models in use at that time.

Taleb (1997) examined the management of vanilla and exotic options using data from 200,000 option transactions. He introduced the intriguing notion of Trader decay, in which strategies that were advantageous in the short term were preferred by traders. However, numerous individuals would adhere to it, rendering it outdated as products became increasingly sophisticated.

Even after employing futures to remove the impact of short sale restrictions in the cash market, Varma (2002) demonstrated that there was serious mispricing in the Indian index options markets. Volatility was significantly under-valued.

Mandelbrot and Taleb (2010) argued in a paper on mild vs. wild randomness that the normal distribution or Gaussian perspective has some irreparable flaws. The normal distribution disregards certain extreme events as outliers; however, these isolated occurrences can disproportionately affect the overall outcome. From the perspective of option sellers, a mild randomness is desirable, while significant price fluctuations in either direction are advantageous for the buyer.

The study by Khan, Gupta, and Siraj (2013) examined how an extra variable affected the Black-Scholes Option Pricing Model, using the risk-free interest rate as a basis. The outcomes that relied on the computed risk-free rate were superior when compared to the value of the risk-free interest rate utilized in calculating specific OTM call and OTM put options.

According to Krznaric (2016), when the actual risk-free rate and volatility were used to assess the value of call options, the results differed from those generated by the Black-Scholes Model. The study found that for call options based on the S&P 500 underlying index, prices predicted by this model were not very accurate. Nonetheless, the model was suitable for stock pricing and served as a good initial reference for that purpose.

Andersen (2020) examined the short-term market risks implied by S&P 500 weekly index options, commonly referred to as "weeklies." The prices of deep out-of-the-money options were mostly unaffected by the volatility level. Short-term options reflect spot volatility more accurately.

The accuracy of 2826 Put option contracts based on the Nifty 50 as an underlying index was examined by Kumar and Agarwal (2017). It was noted that the prices of put option contracts for the Equity Index Nifty 50 index were lower than their value. In 24.87% of Nifty future price contracts, the cost of carry was disregarded. The existing risk-free rate was not taken into account, resulting in a negative cost of carry issue.

Srivastava and Shastri (2020) examined whether the Black-Scholes Option Pricing Model (BSOPM) serves as a reliable indicator of option pricing in India. Derived from the 10 most popular stocks within the industry that are listed on the NSE. The research employs volatility and risk-free rate. BSOPM and actual values are determined using the t test. The study concludes that BSOPM entails a considerable degree of mispricing. The deviation from the market price corresponded to the option's time to maturity and moneyness.

According to the finding of Swapna, Arpana, and Reddy (2020), the Black-Scholes Option Pricing Model mispriced options based on several parameters. Using Black's model, the Binomial Model, and GARCH volatility in their pricing equations, they found that option premiums would have been higher for most stock options based on GARCH volatility. Had it not been for GARCH volatility, option premiums were lower compared to market values.

Dungore et al. (2021) used GARCH model to study the relationship volatility volume and Nifty Index futures on NSE and found that volume has more impact on volatility than the open interest. The study also concluded that the impulse originating from volatility of volume and open interest is low.

RESEARCH GAP

The period of study was from 1st January 2014 to 27th December 2024 for Nifty and from 1st January 2008 to 27th December 2024 for Bank nifty which was not considered by previous researchers. The statistical tool of t- Test paired two sample for means was not considered previously to analyse and interpret the results.

NEED FOR STUDY

There was excessive trading by retail investors in weekly Nifty and Bank nifty options due to lower premiums, cash settlement and nature of the product which gave a potential for high returns turn in a short span of time. However as per the Securities and Exchange Board of India (SEBI) study more than 90% of the retail investors made losses in future and Option trading. So, there was a need to study whether there was a spike in intraday volatility due to increase in option trading activity.

OBJECTIVES OF THE STUDY

I. To Calculate and compare the daily high as percentage increase before and after the introduction of weekly option expiry on Nifty Index.

II. To Calculate and compare the daily high as percentage increase before and after the introduction of weekly option expiry on Bank Nifty Index.

HYPOTHESIS TESTING

Hypothesis I

Null Hypothesis (H_0): There was no significant difference between daily high prices as a percentage increase daily low prices in Nifty after the introduction of weekly option expiry.

Alternative Hypothesis (H_a): There was a significant difference between daily high prices as a percentage increase daily low prices in Nifty after the introduction of weekly option expiry.

Hypothesis II

Null Hypothesis (H_0): There was no significant difference between daily high prices as a percentage increase daily low prices in Bank Nifty after the introduction of weekly option expiry.

Alternative Hypothesis (H_a): There was a significant difference between daily high prices as a percentage increase daily low prices in Bank Nifty after the introduction of weekly option expiry.

RESEARCH METHODOLOGY

Quantitative and descriptive research was done based on the data of Nifty and Bank Nifty.

For Nifty daily data was taken from 1st January 2014 to 27th December 2024. There were total of 2719 daily observations on Nifty Data, which were divided in 2 halves of pre and post the introduction of weekly option expiry.

For Bank Nifty daily data was taken from 1st January 20028 to 14th November 2024. There were total of 4180 daily observations on Nifty Data, which were divided in 2 halves of pre and post the introduction of weekly option expiry.

Population and Sample – The population for the study could be daily data from the inception of options trading on Nifty and Bank Nifty in 2001. The sample was taken such that the two halves pre and post the introduction of weekly options expiry would have similar number of observations.

The logic behind selecting two indices was to observe if there was similar or diverse impact of weekly option expiry on the two indices.

Lognormal distribution was used to calculate daily high as a percentage increase over daily low.

DATA ANALYSIS

Table I

Nifty daily high as a percentage increase over daily low pre and post the introduction of weekly option expiry

t-Test: Two-Sample Assuming Unequal Variances

	Pre	*Post*
Mean	1.02%	1.19%
Variance	0.00%	0.01%
Observations	1262	1457
Hypothesized Mean Difference	0	
Df	2404	
t Stat	-5.73	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.65	
P(T<=t) two-tail	0.00	
t Critical two-tail	1.96	

Based on p- value Null hypothesis I was rejected indicating there was significant change in Nifty daily high as a percentage of daily low post the introduction of weekly option expiry.

Table II

Bank Nifty daily high as a percentage increase over daily low pre and post the introduction of weekly option expiry

t-Test: Two-Sample Assuming Unequal Variances

	Pre	*Post*
Mean	2.34%	1.56%
Variance	0.02%	0.01%
Observations	2075	2105
Hypothesized Mean Difference	0	
Df	3881	
t Stat	17.98	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.65	
P(T<=t) two-tail	0.00	
t Critical two-tail	1.96	

Based on p- value Null hypothesis II was rejected indicating there was significant change in Bank Nifty daily high as a percentage of daily low post the introduction of weekly option expiry.

Observations based on Data Analysis and t-Test

1. Bank Nifty being a sectorial index was more volatile as compared to Nifty Index.
2. For Both the indices there was a significant change in the volatility pre and post the option expiry. However, the impact was not in the same direction.
3. For Nifty there was increase in daily high to low volatility post the introduction of weekly option expiry.
4. For Bank Nifty there was reduction in daily high to low volatility post the introduction of weekly option expiry.

LIMITATIONS AND FUTURE SCOPE OF FURTHER STUDY

The study considered volatility based on daily high and low which gives short term and particularly intraday traders an opportunity to buy and sell call or put options. However actual option prices were not considered. Implied volatility changes on particular day were not considered which could impact the option pricing significantly.

CONCLUSION, DISCUSSION AND IMPLICATION

Weekly option expiries were introduced for better hedging in Bank Nifty and Nifty in 2016 and 2019. Nevertheless, the data particularly on Nifty indicates reduction in option premium due to shorter time frames led to increase in volatility if measured in terms of daily high and low prices. SEBI as a protector of retail investor has taken couple of two key measures in this direction, every retail investors trading in futures and option started getting a message on login indicating more than 90% of the retail investors were making losses in financial year 2022-23 and financial year 2021-22. This initiative was taken in early 2024. The second key initiative was to increase the lot size of the contracts for Nifty from 25 to 75 and for Bank Nifty from 15 to 30 starting October 2024. This meant exposure of Rs. 15 lakh or more per contract was there as per the prevailing Nifty and Bank Nifty prices in October 2024. Bank Nifty weekly option expiry was discontinued from 14th November 2024.

The study supports the actions taken by SEBI as the data indicates increase in volatility and option trading by retail investors. Most options expire worthless or with a substantial loss of premium on most occasions which goes against option buying. To sell the option margin requirements are there which goes against many retail investors who might not have sufficient money to do so. Weekly option expiries even on Nifty deserve a serious relooking form the point of view of all stakeholder. i.e., Exchanges, Brokers, Regulators and Investors or traders (Particularly retail treaders)

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WEBSITES

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2. BSE formerly Bombay Stock Exchange (https://www.bseindia.com/)

3. Securities and Exchange Board of India (https://www.sebi.gov.in/)