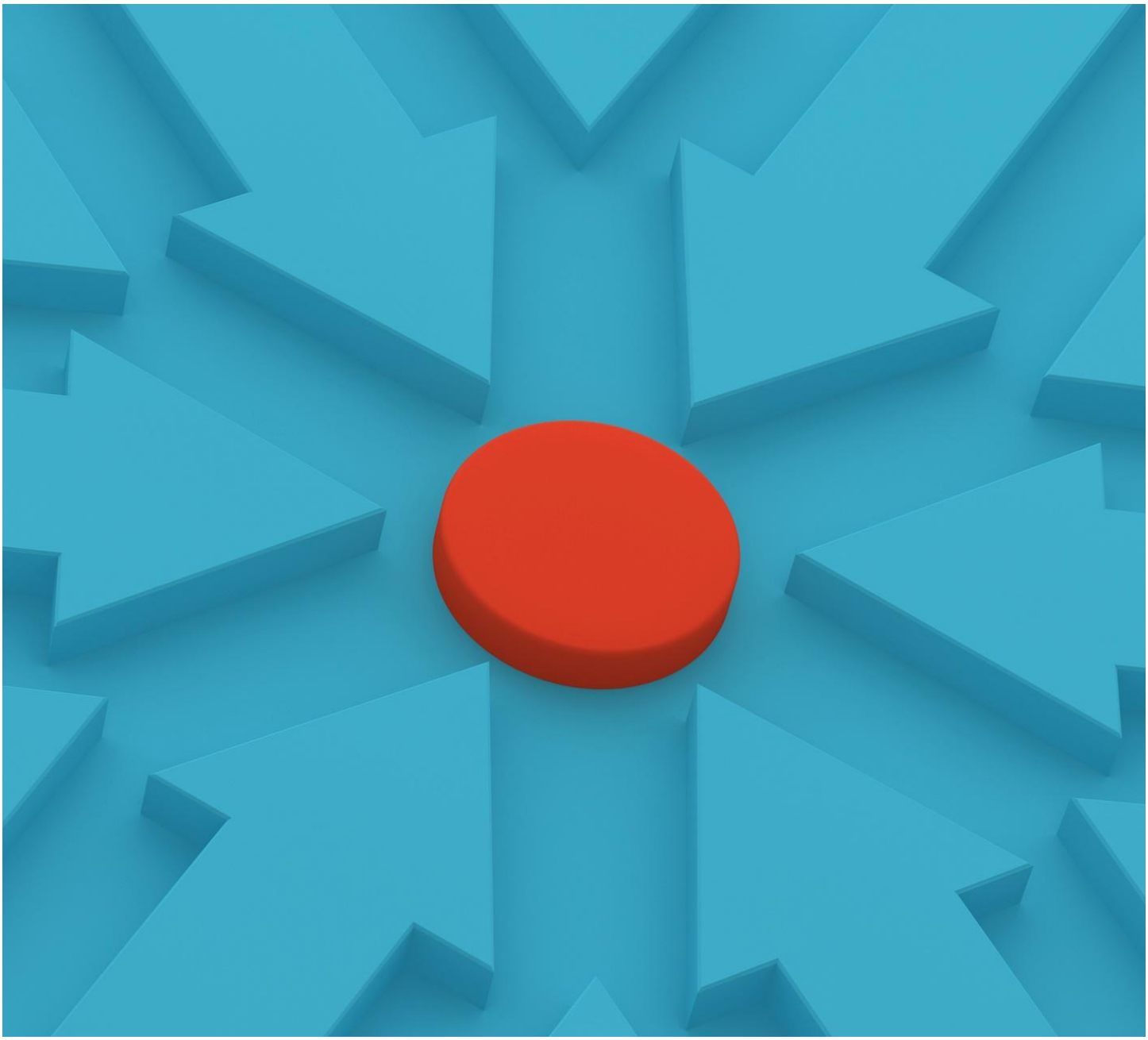


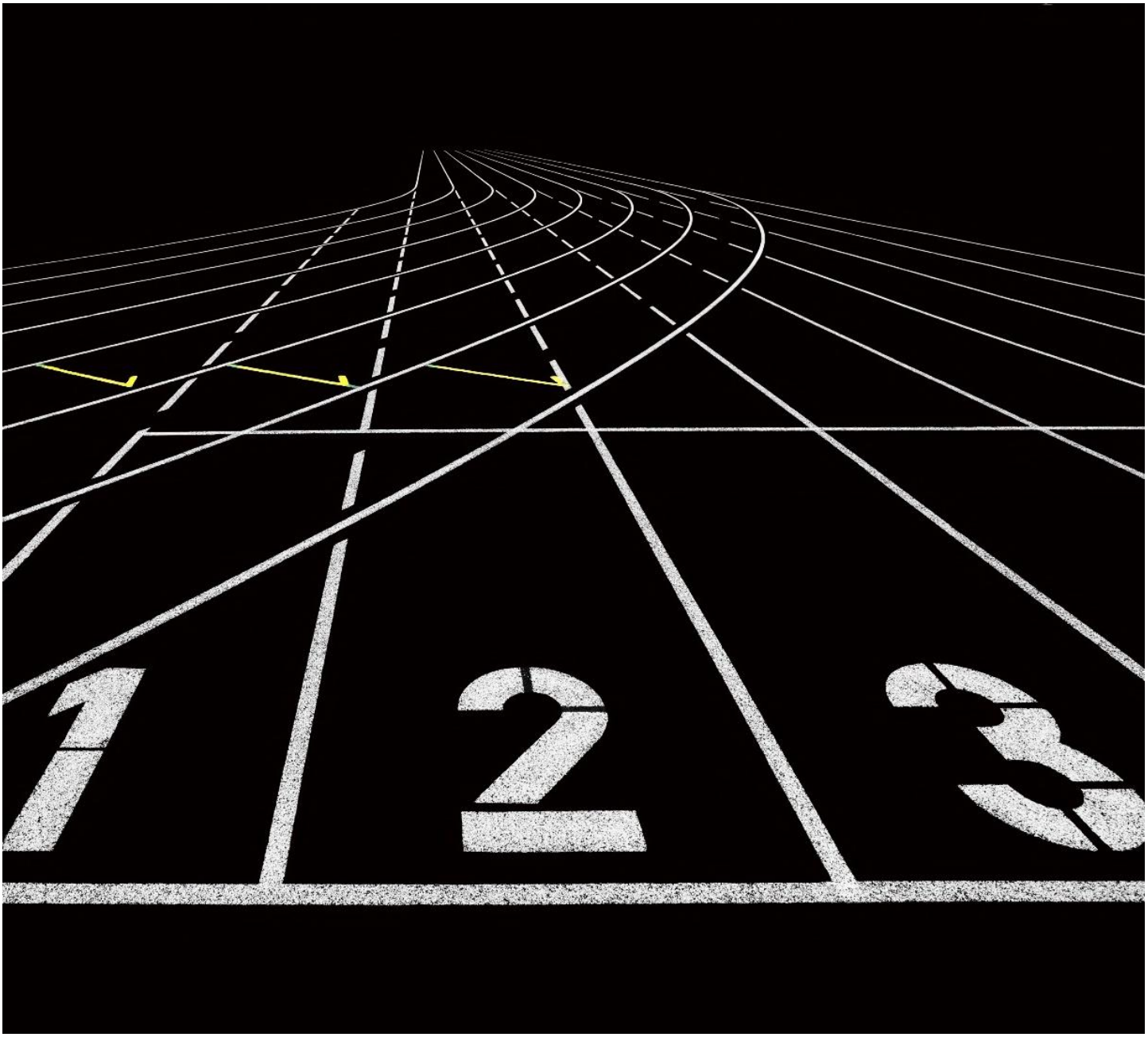
OPTIONS VALUATION:

BLACK-SCHOLES VS BINOMIAL VS MONTE CARLO

MBA 911 – Project 1
eMasters – Quantitative Finance and Risk Management
Quarter 3

Amol Sharma

23358004



EXECUTIVE SUMMARY

This study provides a comprehensive analysis of three widely used methods for option pricing and delves into their mathematical foundations emphasizing their assumptions, computational intricacies and implementation. Key insights include the behavior of option pricing under different methods and the volatility smile patterns for call and put options. A hypothetical scenario was introduced where an institution dynamically hedges an ATM call option, showcasing real-world application and strategy evaluation. Additionally, the project analyzed the variation of option Greeks (Delta, Gamma, Vega, Theta, and Rho) with the underlying price and time, offering valuable inferences for risk management and derivative strategies.

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INTRODUCTION

Derivatives are widely used to transfer a variety of risks from one investor to another. Investment banks, Hedge Funds and Insurance companies use derivatives for the purpose of hedging, speculation and arbitrage on a large scale. Traditionally considered as complex financial products usually reserved for institutional investors, the recent advancement in technology coupled with investor friendly regulations, rise in number of skilled finance professionals and improvements in financial literacy and intermediation have made derivatives more accessible to a broader range of market participants, including individual investors.

A Short History

Weber (2009) traces use of derivatives to Mesopotamians and argues that as the interest in their trading increased, new graphical tools also came into being which further attracted people with scientific temper to use their skills for derivative pricing.

In the 1970s, the Chicago Board Options Exchange (CBOE) introduced exchange-traded options, providing a regulated marketplace for options trading. The option pricing model given by Black and Scholes (1973) revolutionized the valuation of options and provided a framework for understanding derivatives pricing. Interest rate swaps emerged as one of the first widely traded over the counter (OTC) derivatives in the late 1970s, allowing counterparties to exchange fixed and floating interest rate payments to manage interest rate risk. The subsequent decades saw rapid growth in the derivatives market, driven by increasing demand for risk management tools and financial engineering. The establishment of clearinghouses and central counterparties (CCPs) improved counterparty risk management and facilitated the growth of exchange-traded and centrally cleared derivatives markets. Advances in technology and electronic trading platforms accelerated the speed and efficiency of derivatives trading, enabling real-time price discovery and execution. The financial crisis of 2007-2008 highlighted the systemic risks associated with derivatives, leading to increased scrutiny, regulatory reforms, and efforts to improve transparency and risk management practices in the derivatives market.

In India, after independence, trading in futures market for commodities was banned to prevent speculation and misuse. After Liberalization, Privatization and Globalization (LPG) reforms in 1991, the interest in derivatives renewed and subsequently, on the recommendations of Dr L C Gupta committee of SEBI, derivatives trading in the form of index futures was reintroduced in 2000. Index options became available in 2001.Interest rate futures were made available in 2003. Currently, India's 3 national exchanges (BSE, NSE and MSE) and a number of regional exchanges provide a vibrant ecosystem for derivatives to all types of investors.

The definition of derivatives has also evolved with introduction of new derivative products. A simplistic definition that 'it is a financial instrument whose value is derived from the value of some underlying asset' holds no value in case of weather and electricity derivatives where there is no such asset. Hirsa and Neftci (2014) mentions the distinctions between definitions used by practitioners and a more precise academic one. As the former would say, "Derivative securities are financial contracts that 'derive' their value from cash market instruments such as stocks, bonds, currencies and commodities." Ingersoll (1987) defined a derivative security as "a financial contract or a contingent claim, if its value at expiration date T is determined exactly by the market price of the underlying cash instrument at time T".

Modern Scenario

In recent years, the globalization of financial markets has led to a phenomenal growth in financial derivatives, both at organized exchanges and in over-the counter markets. According to a report from BIS, "the notional value of outstanding OTC derivatives reached $715 trillion at end-June 2023, with recent growth mainly driven by outstanding interest rate and forex derivatives". Another report from FIA states that "The total volume of futures and options traded on exchanges worldwide reached 137.3 billion contracts in 2023, up 64% from 2022. This was the sixth consecutive year of record-setting trading activity in the global listed derivatives markets."

In recent years, India has seen extraordinary growth in derivatives. The same FIA report also says "The number of equity index options traded on Indian exchanges reached 84.3 billion contracts in 2023, up 153% from 2022. That helped push the total number of options traded worldwide to 108.2 billion in 2023, up 98% from the previous year."

As per the Economic Times “The National Stock Exchange of India has emerged as world’s largest derivatives exchange group for the fifth consecutive year in 2023. The exchange reported total trading volume of 84.8 billion contracts in 2023, up 123% compared to the amount traded in the previous year. NSE has witnessed growth in the number of clients traded for the tenth year straight in its equity segment. The number of unique registered investors on the exchange surpassed 8.5 crore at the end of the calendar year”.

Numerous factors can be attributed to this surge of Indian retail investors towards futures and options markets: -

I. Amid high unemployment and stagnant wages, the lure of easy money in derivatives market is increasingly becoming irresistible.

II. The boom of smartphones and dirt-cheap internet rates has given rise to ‘finfluencers’ that utilize their social media reach to share advice, opinions, and personal experiences regarding money management, cryptocurrency, financial trends, budgeting, and investments. The popular ones among them have viewers in millions. It has also led to a debate between guidance and manipulation forcing SEBI to bring a host of measures including fines and compulsory registration.

III. Covid-19 induced pandemic brought a large segment of retail investors to the markets delving in options trading. Low or zero commission fees by trading platforms, free time on hands, opportunity to make quick bucks away from prying eyes of colleagues and bosses all contributed to this trend. Events like GameStop stock price increase highlighted negative consequences of feedback loops among retail investors. Critics contend that the collective actions of retail investors in equity derivatives markets have been excessively speculative, necessitating intervention from policymakers to restore equilibrium.

IV. The urge to speculate and ‘beat the market’ combined with lure to take a large exposure with lower investment has increased tensions for regulators worldwide.

V. Lack of adequate regulations by regulators like capping net worth of investors entering derivatives markets has also contributed to this trend.

This options and futures frenzy has not converted into gains for investors and success remains elusive. A recent study by SEBI “examined individual traders' profits and losses, as well as recent trends in

investor participation in the derivatives market. It showed that 9 out of 10 individual traders in the equity futures and options segment suffered considerable losses in financial year 2021-22." The report highlighted: -

I. "Total number of unique individual traders who traded through sample of top 10 brokers in equity F&O segment was 45.2 lakhs during FY22, up from 7.1 lakhs during FY19(500% rise), of which 88% were active traders."

II. "89% of the individual traders (i.e. 9 out of 10 individual traders) in equity F&O segment incurred losses, with an average loss of Rs. 1.1 lakh during FY22, whereas 90% of the active traders incurred average losses of Rs. 1.25 lakh during the same period."

III. "For the group of active traders (excluding outliers), on average

   a. Loss makers registered net trading loss close to ₹50,000 in FY22

   b. The average loss of a loss maker was over 15 times the average profit by a profit maker during FY22

   c. Only 6% of individual traders in equity F&O segment made profit with an average profit of nearly Rs. 3,400 in FY22."

Motivation

One of the reasons for such high number of loss makers is poor understanding of derivatives. Whether one is on buy side or sell side, an in-depth understanding of pricing options is critical to effective investment decision making. Without this knowledge, one cannot determine what to bid or offer for the financial product. This makes a thorough study of options pricing models a prerequisite for success.

Problem Statement

Option pricing is a critical aspect of financial decision-making, and multiple models exist to estimate the fair value of financial derivatives. The Black-Scholes Model, Binomial Tree Model, and Monte Carlo Simulation are three widely used approaches in the finance industry. However, a comprehensive

understanding of the comparative performance of these models is essential for making informed decisions in risk management and derivatives trading.

Research Questions/Hypotheses

This project aims to raise and answer appropriate research questions with following objectives: -

I. To implement models:
    a. Develop robust Python implementations of the Black-Scholes Model, Binomial Tree Model, and Monte Carlo Simulation.

II. To Validate and Test Models:
    a. Validate each model against benchmark cases and known analytical solutions.
    b. Test the models under various scenarios, including different option types and strike prices

III. To Compare Accuracy**:**
    a. Quantitatively compare the accuracy of each model in estimating option prices.

IV. To Explore Real-world Applicability:
    a. Assess the real-world applicability of each model

V. To Provide Recommendations**:**
    a. Provide recommendations on the suitability of each model for different types of options and market conditions

Relevance of the Study

This project aims to enhance the understanding of option pricing models and their practical implications. By comparing these widely used models, I seek to provide a valuable resource for risk managers, financial analysts, and quantitative finance practitioners, aiding in the selection of appropriate models for diverse financial scenarios.

Project Milestones

2 LITERATURE SURVEY

Black and Scholes (1973) provided a closed-form solution for the fair value of an option, considering factors such as the underlying asset's price, volatility, time to expiration, risk-free rate, and strike price. The authors build upon earlier works like Capital Asset Pricing Model. By assuming continuous trading, no transaction costs, and a log-normal distribution of asset returns, the authors provided a rigorous theoretical framework for understanding option prices and hedging strategies. The given model generated testable hypotheses about the relationship between option prices and various factors such as asset volatility, time to expiration, and interest rates.

Boyle (1979) introduces the application of Monte Carlo simulation which involves using random sampling techniques to estimate the value of complex financial instruments like options. The author outlines the basic framework for option pricing, including the concept of stochastic processes governing the movement of underlying asset prices and the importance of risk-neutral valuation. The author presents a Monte Carlo algorithm for pricing European-style options and compared the results obtained with analytical solutions thereby highlighting the advantages and limitations.

Cox, Rox and Rubinstein (1979) presented a simple discrete-time model for valuing options, based on arbitrage methods and elementary mathematics. The model can be generalized to various situations and includes the Black-Scholes model as a special case. The authors illustrate the model with a simple example of a call option on a stock that can have only two possible prices at the expiration date. They show how to construct a riskless hedge portfolio that replicates the payoff of the option, and how to determine the current value of the option by arbitrage arguments. The authors extend the model to multiple periods, where the stock price follows a multiplicative binomial process. They also show how to interpret the formula as the expected discounted payoff in a risk-neutral world.

Bolia and Juneja (2005) reviewed some of the popular variance reduction techniques and their application to pricing options. The authors focused on the recent Monte-Carlo techniques proposed to tackle the difficult problem of pricing American options (regression-based methods, random tree methods and stochastic mesh methods). Further, the authors showed how importance sampling, a popular variance reduction technique, may be combined with these methods to enhance their effectiveness.

Weber (2009) traces the origins and evolution of derivative contracts from ancient Mesopotamia to the Renaissance, focusing on the legal and institutional aspects of derivative trading. The author discusses various types of derivatives and how they were used for hedging, speculation, and arbitrage in different markets and periods. The author notes that derivatives often faced legal and moral challenges, such as bans, edicts, and public scorn, because they were seen as risky, fraudulent, or immoral by authorities and the public. The author highlights the role of financial innovation in creating new derivative products and techniques, such as negotiable bills of exchange, graphical tools, and random walk hypothesis, and how they influenced the work of Bachelier and Bronzin.

Hirsa and Neftci (2014) is an intuitive text providing an introduction to quantitative tools used in pricing financial derivatives. The authors introduced tools in probability theory and stochastic essentials and move on to explain arbitrage theorem in a new setting.

Bendob and Bentouir (2019) studied the effectiveness of Monte Carlo simulation, the Binomial model, and the Black-Scholes model, using the Nifty50 option index from India as the data source (July 2014 to June 2016). The authors also examined the effect of each model on the prediction of the current options prices, using regression analysis, and compared the results across different moneyness categories and time to maturities. The authors concluded that the Monte Carlo simulation method outperforms the other models when the volatility is lower, while the Black-Scholes model and the Binomial model outperform in the entire sample without considering the moneyness.

Hull and Basu (2022) authoritatively dealt with the subject. The authors introduced the necessary financial jargon, determination of forward and futures prices, securitizations, XVAs and trading strategies. Building upon them, the authors introduce stochastic calculus and options pricing models, Greeks and volatilities estimation. Advanced topics like exotic options, martingales and equilibrium models are also explained comprehensively.

3 Mathematical Foundation

3.1 Options Valuation Prerequisites

Arbitrage and Replication

Arbitrage opportunities without risk emerge when the ‘law of one price’ is not upheld. This occurs when the same asset is traded at varying prices in different locations simultaneously. When market participants employ replication strategies, it guarantees the enforcement of the ‘law of one price’ and eliminates the existence of risk-free arbitrage profit opportunities. Portfolio replication is covered in more detail later. In the context of option pricing, the absence of arbitrage opportunities ensures that the price of an option is determined in a manner consistent with the underlying asset's price and the risk-free interest rate. No arbitrage arguments are necessary for option pricing because they provide a theoretical framework for determining fair option prices.

Risk neutral valuation

Risk-neutral valuation is based on the principle that in an efficient market, investors are indifferent to risk and require only the risk-free rate of return on their investments. In the context of option pricing, risk-neutral valuation allows for determination of the fair value of an option by discounting its expected future payoff at the risk-free rate. This approach simplifies the pricing process by removing the need to estimate investors' risk preferences. Valuation done for a risk neutral world gives right option prices for practical world too.

Total Value of an option	=	Intrinsic Value • Difference between the strike price and spot price of underlying • Only ITM options have intrinsic value • Represents the profit if option was exercised immediately. • A measure of the option's tangible value based on its current market conditions.	+	Time Value • Also known as extrinsic value • Reflects the premium paid by buyer for the opportunity to potentially profit from future price movements • As an option approaches expiration, its time value tends to decrease, eventually converging to zero at expiration.

Factors affecting options value

Following six factors affect the value of an option

Factor	Call	Put
Increase in value of underlying	Increases	Decreases
Increase in exercise price	Decreases	Increases
Increase in time to expiration	Increases	May Increase/Decrease
Increase in risk free interest rate	Increases	Decreases
Increase in volatility	Increases	Increases
Increase in Income/cost related to owning the underlying	May Increase/Decrease	May Increase/Decrease

Moneyness of options

Moneyness	Call	Put
In the Money	Spot price of underlying > Strike Price	Strike Price > Spot price of underlying
At the Money	Spot price of underlying = Strike Price	Strike Price = Spot price of underlying
Out of Money	Spot price of underlying < Strike Price	Strike Price < Spot price of underlying

3.2 Black Scholes Merton (BSM) Model

Black and Scholes (1973) provided a key insight that a portfolio (called as replicating portfolio) comprising of an underlying asset and a risk-free asset can be constructed in such a way so as to have the same cash flows as a call or put option. Since no arbitrage opportunities are taken as a given, the authors argued that as the replicating portfolio and the put/call option had same cash flows, their price would also have to be the same.

Black Scholes Merton is the most commonly used model to price options. The model utilizes six variables: volatility of stock (σ), option type – put or call, underlying stock prize (S_0), option duration (T) and risk-free rate of return (r) and strike price (K).

Assumptions

I. The risk-free rate of interest is constant over time
II. No riskless arbitrage opportunity available (as in binomial method)
III. The stock price follows a continuous variable, continuous time stochastic process.
IV. The stock price has lognormal distribution

V. Stock doesn't pay any dividends or returns

VI. Short selling is allowed

VII. No transaction cost and taxes

VIII. European style of options are considered

The Black Scholes Merton differential is given as

$$\frac{\partial f}{\partial t} + rS\frac{\partial f}{\partial S} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 f}{\partial S^2} = rf$$

The differential equation can be solved by taking suitable boundary conditions: -

$$\left.\begin{array}{l}\text{European Call Option} \quad f = \max(S-K,0) \\ \text{European Put Option} \quad f = \max(K-S,0)\end{array}\right\} \text{ when } t = T$$

Solving the differential equation, we get

$$\boxed{c = S_0 N(d_1) - Ke^{-rT} N(d_2)}$$

And

$$\boxed{p = Ke^{-rT} N(-d_2) - S_0 N(-d_1)}$$

Where

$$d_1 = \frac{\ln(\frac{S_0}{K}) + (r + \sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{\ln(\frac{S_0}{K}) + (r - \sigma^2/2)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T}$$

C = European call option price

P = European put option price

K = Strike price

Historical Volatility

The historical volatility is associated with the underlying stock. It is backward looking i.e. volatility is calculated from documented stock price movement. It is defined as annualized standard deviation of logarithmic price changes of underlying stock over a period of time [Natenberg (2014)]. Volatility measures riskiness or uncertainty related to returns. There are periods of high and low volatility. This affects how much data is to be used to estimate historical volatility. Hull and Basu (2022) mention a period of 90 to 180 days of data.

It can be calculated as

$$\hat{\sigma} = \frac{s}{\sqrt{\tau}}$$

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(u_i - \bar{u})^2}$$

$$u_i = \ln\frac{S_i}{S_{i-1}}$$

Where

N = no. of observations

S_i = Stock price at the end of i^{th} interval

τ= length of time interval in years

Implied Volatility

The implied volatility is associated with options and derived using their market price. It is forward looking i.e. market's opinion about future price fluctuations. It is not observed directly. To calculate implied volatility, market prices are reset into Black Scholes formulas to get a value of volatility iteratively. In practice, optimization algorithm like Newton – Raphson method is used. Traders often quote the implied volatility of an option rather than its price as former tends to be less variable than the latter.

Investopedia states that in the interplay of these two metrics, historical volatility acts as the reference point, while changes in implied volatility determine the relative values of options premiums. When both measures align, options premiums are typically deemed to be reasonably valued according to historical

standards. Options traders look for departures from this balance to capitalize on options premiums that are either overpriced or underpriced.

To assess whether an option is undervalued or overvalued, the historical volatility and implied volatility are compared to one another.

Implied Volatility > Historical Volatility $\Longrightarrow$ Option Premiums are Overvalued.

Implied Volatility < Historical Volatility $\Longrightarrow$ Option Premiums are Undervalued.

When premiums are higher than average, options writers gain an advantage as they can initiate sell positions at elevated premiums, a sign of high levels of implied volatility. In such situations, the goal is to close positions profitably as volatility returns to its average levels, leading to a decrease in the value of options premiums. This strategy is essentially a ‘sell high, buy low’ approach.

Conversely, options buyers gain an edge when implied volatility is significantly below the levels of historical volatility, suggesting that premiums are undervalued. In such cases, a reversion of volatility levels to the mean average can lead to an increase in premiums when options holders sell to close positions, adhering to the conventional trading goal of purchasing at a low price and selling at a higher one.

Limitations:-

I. Since it is implicit that options can only be exercised on expiration date, Black-Scholes-Merton model does not accurately predict American style options
II. The risk-free rate of return may change over time. Same goes for volatility.
III. Trading incurs brokerage fees and commission which clashes with no transaction assumption.

3.3 Binomial Option Pricing Model

Binomial Trees are diagrammatical representation of various paths a stock’s price can follow over the life of an option.

Assumptions :-

I. The stock prices are following a random walk with constant volatility

II. Risk- neutral valuation: Investors are risk averse. This means that
   a. The expectation of return on a stock is the risk-free rate
   b. The discount rate to calculate present value of portfolio is the risk-free rate

III. There are no transaction fees and taxes levied.

IV. The risk-free rate of return does not change over time.

One-Step Binomial Tree model

Consider S_0 = Initial Stock Price

f = Current price of stock option

T = Life span of option

p = probability of upward movement of stock

1-p = probability of downward movement of stock price

$\triangle$ = No. of shares

S_0u = Upward price movement of stock where u > 1

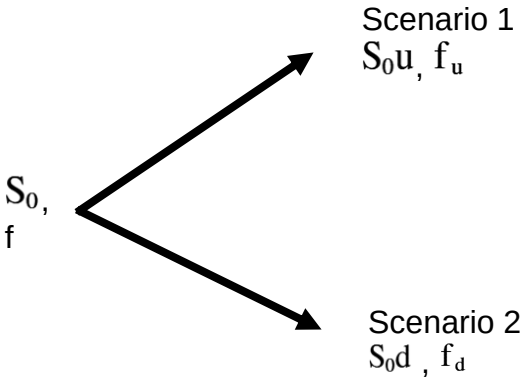
S_0d = Downward price movement of stock where d< 1

f_u = Option payoff when price is S_0u

f_d = Option payoff when price is S_0d

r = risk free rate of return

Consider a portfolio with long position in $\triangle$ shares and short position in one option.



Stock and option prices in one step tree

Portfolio value at scenario 1 = $S_0u\triangle - f_u$

at scenario 2 = $S_0d\triangle - f_d$

$$S_0u\triangle - f_u = S_0d\triangle - f_d$$

Since the portfolio is riskless, the two will be equal when

$$\triangle = \frac{f_u - f_d}{S_0 u - S_0 d} = \text{Hedge Ratio}$$

As there are no arbitrage opportunities, the portfolio must earn risk free rate of return.

Now,

$$PV_{Portfolio} = FV_{portfolio} e^{-rT}$$

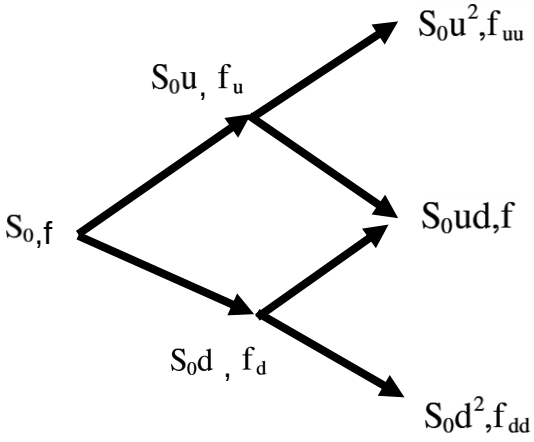
$$S_0 \triangle - f = (S_0 u \triangle - f_u) e^{-rT}$$

Substituting the value of $\triangle$ and simplifying, we obtain

$$\boxed{f = e^{-rT}[pf_u + (1-p)f_d}$$

where $\boxed{p = \frac{e^{rT} - d}{u - d}}$

Two-Step Binomial Tree



Stock and option prices in two-step tree

For a two-step binomial process, the above equation can be generalized as

$$f = e^{-2r\triangle t}[p^2 f_{uu} + 2p(1-p)f_{ud} + (1-p)^2 f_{dd}]$$

Where $\triangle$t = Length of time step

f_{uu} = Value of option after two up movements

f_{dd} = Value of option after two down movements

From Cox, Rox and Rubinstein (1979), the value u and d can be obtained as

$$u = e^{\sigma\sqrt{\triangle t}} \text{ and } d = e^{-\sigma\sqrt{\triangle t}}$$

Where σ = Volatility of stock. It is defined as standard deviation of a continuously compounded return on a stock in 1 year.

Limitations:-

I. There is no such thing as risk neutral world. Investors expect higher return for higher risks. Nonetheless, the option price zeroed in assuming risk neutral world is also the practical price. An investor's risk preferences affect the stock prices but the formula relating an option's price to underlying stock price remains same.
II. The assumption of random walk with constant volatility may not hold true as volatility can change over time
III. Multi – period binomial model becomes complex and computationally intensive

It is to be noted that as the number of time steps increases, the option price calculated using the binomial method starts converging towards price given by Black Scholes model.

3.4 Monte – Carlo simulation

Monte Carlo simulations, a computational method that originated in mid-20th century computational physics, have become an essential tool in quantitative finance. They are particularly versatile for pricing options, allowing for the estimation of the value of financial derivatives in complex and uncertain market conditions. These simulations provide a robust and adaptable strategy for determining option prices under a variety of scenarios

Assumptions:-

I. It assumes that the underlying asset follows a geometric Brownian motion process
II. It employs risk-neutral pricing

III. Market frictions like transaction costs and taxes are not taken under consideration
IV. The price of the underlying asset follows a log-normal distribution

The following steps are performed [Hull and Basu (2022)]: -

I. Create many different random scenarios for how the price of the underlying asset might change over time. Each scenario represents a possible future path for the asset's price.
II. For each scenario, determine the payoff that the option would have at the end of the scenario based on its contract terms and the final asset price
III. Repeat the process of generating random scenarios and calculating option payoffs many times to gather a large collection of potential outcomes.
IV. Calculate the average payoff from all the scenarios. This gives an estimate of the expected payoff of the option under the assumption of a risk-neutral world.
V. Adjust the expected payoff by discounting it back to the present time using the risk-free interest rate to get an estimate of current value of the option.

Limitations:-

I. Monte Carlo simulations can be computationally intensive. Often a tradeoff is required between time and accuracy.
II. It cannot easily handle early exercise preferences. Though, there are complex ways of extending it to value American options.

4. IMPLEMENTATION AND VALIDATION

I. The models were coded using python and validated against solved examples provided in Hull and Basu (2022). Based on results, number of time steps for Binomial method and number of simulations for Monte Carlo were chosen as 2 and 10000 respectively.

II. Stock Options of Tata Steel (TATASTEEL) were chosen for analysis. It is an actively traded stock and does not have significant volatility fluctuations in recent past thereby acting as a representative of an ideal stock behavior.

III. The near month put and call options price volume data was collected from NSE (https://www.nseindia.com/report-detail/fo_eq_security). The option price data is from 01/12/2023 to 27/12/2023 with expiry on 28/12/2023. At any given trading day, multiple options are available on exchange trading at different strike prices.

IV. The historical price data was collected from Yahoo Finance (https://finance.yahoo.com/quote/TATASTEEL.NS/history/). For calculation of historical volatility, data of past 6 months (June to November 2023) was used.

V. India's 10-year Treasury bond yield (7%) is taken as risk free rate for analysis.

VI. The options data was cleaned and bifurcated into 3 data frames – In the Money (ITM) options, At The Money (ATM) options and Out of Money (OTM) options.

VII. The three models were implemented on this data and theoretical prices were calculated.

VIII. To analyze the three models: -

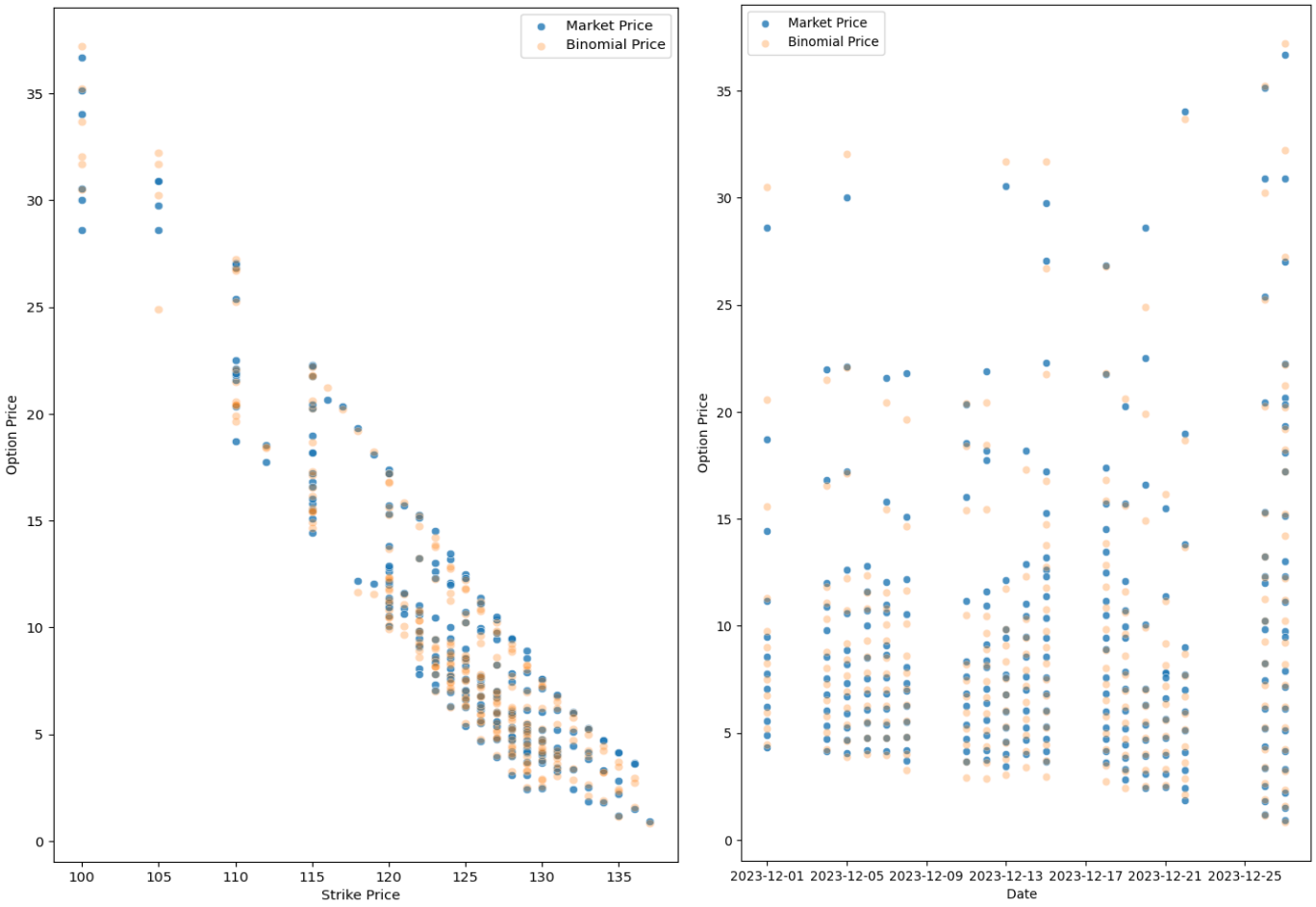
   a. A scatterplot of option price (Market and Model) vs Strike price was made to evaluate trends with respect to changing strike prices.
   b. A scatterplot of option price (Market and Model) vs Date was plotted to know changes in prices in relation to option expiry.
   c. A scatterplot of residuals (Market minus Model) was plotted against market price of options to observe patterns, variability and outliers.
   d. Mean Absolute Error (MAE), Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) were calculated to statistically analyze model performances.

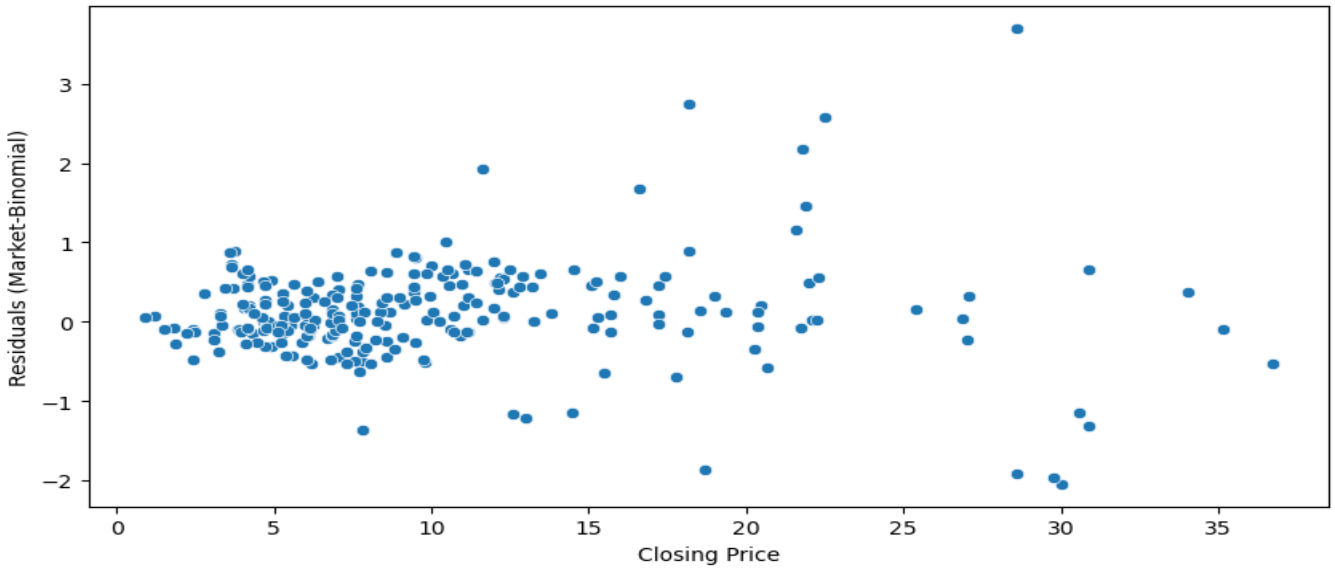
IX. To calculate implied volatility, the market price was taken as input to Black Scholes model and Brent's method was used for optimization.

X. The implied volatility was compared with historical volatility to categorize an option as being overvalued or undervalued.

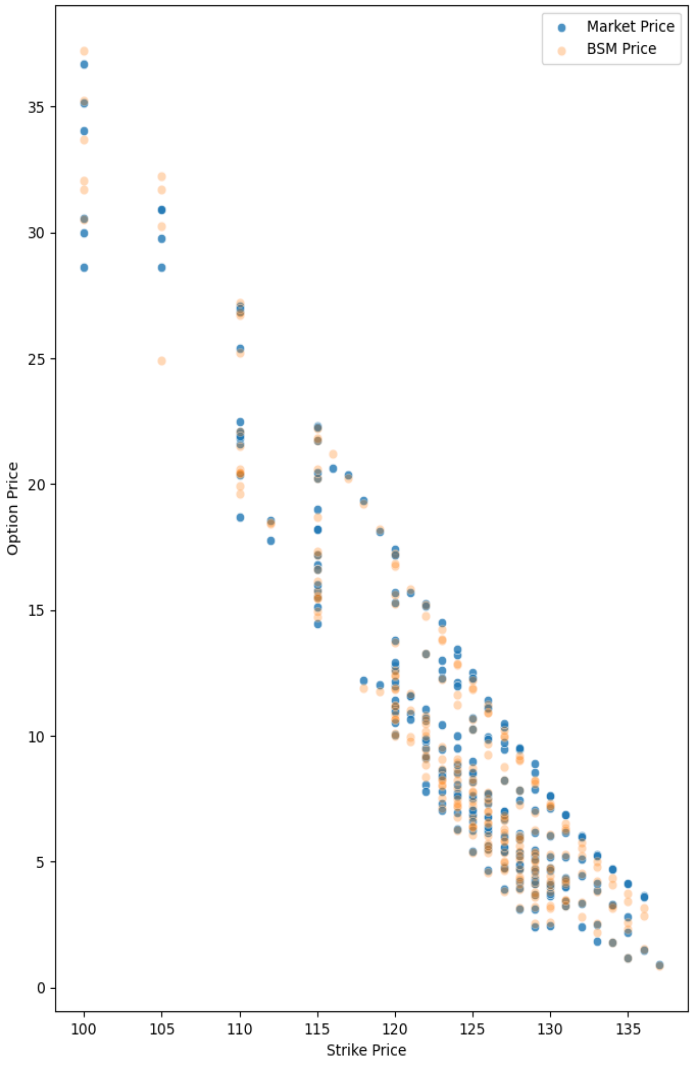
5. COMPARATIVE STUDY WITH REAL WORLD DATA

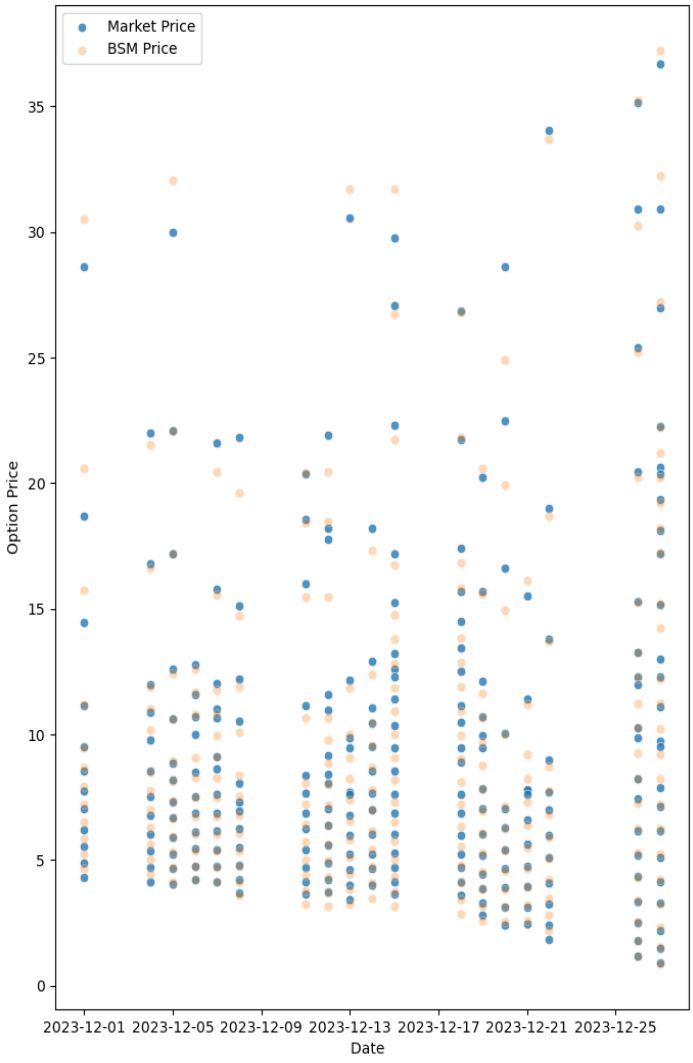
ITM Call Options - Binomial Method

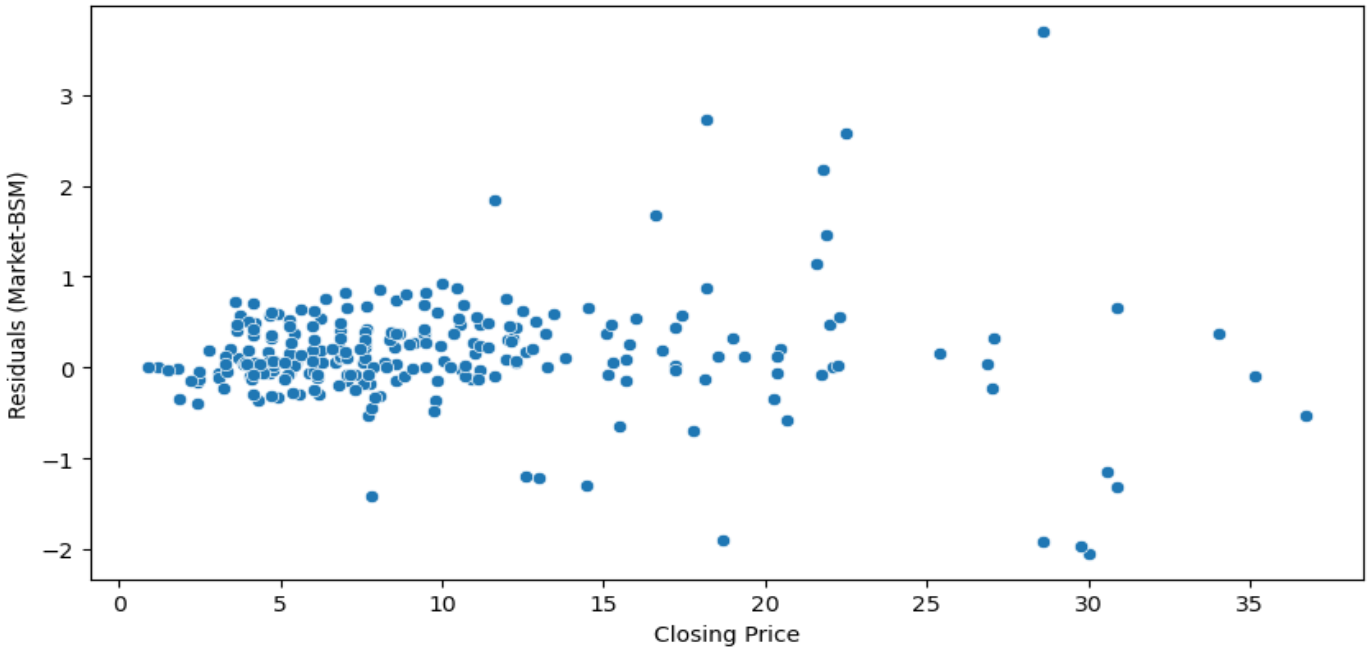




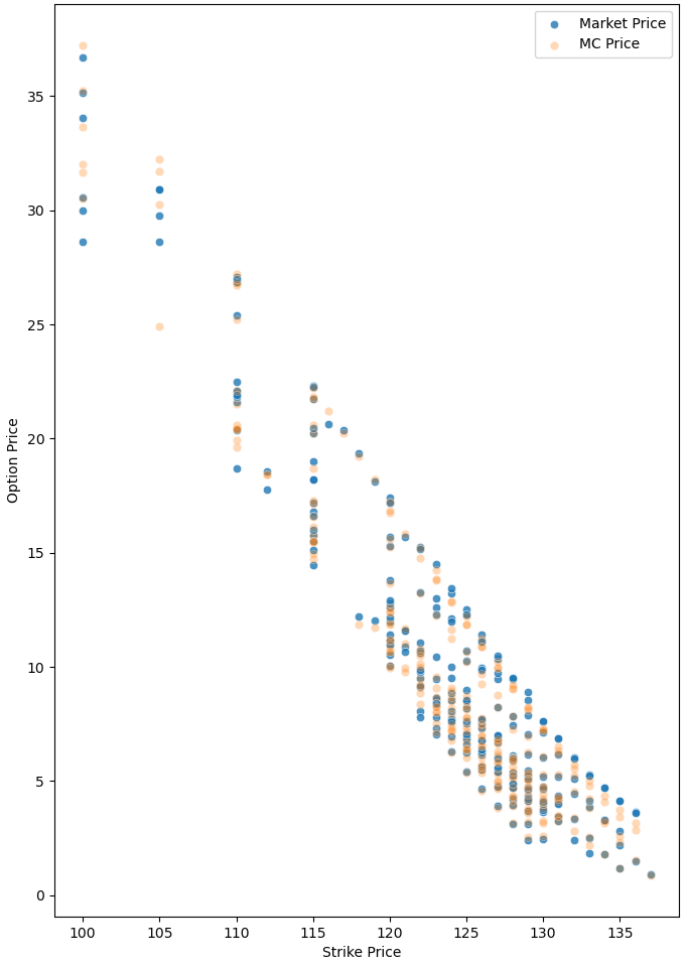
ITM Call Options - BSM Method

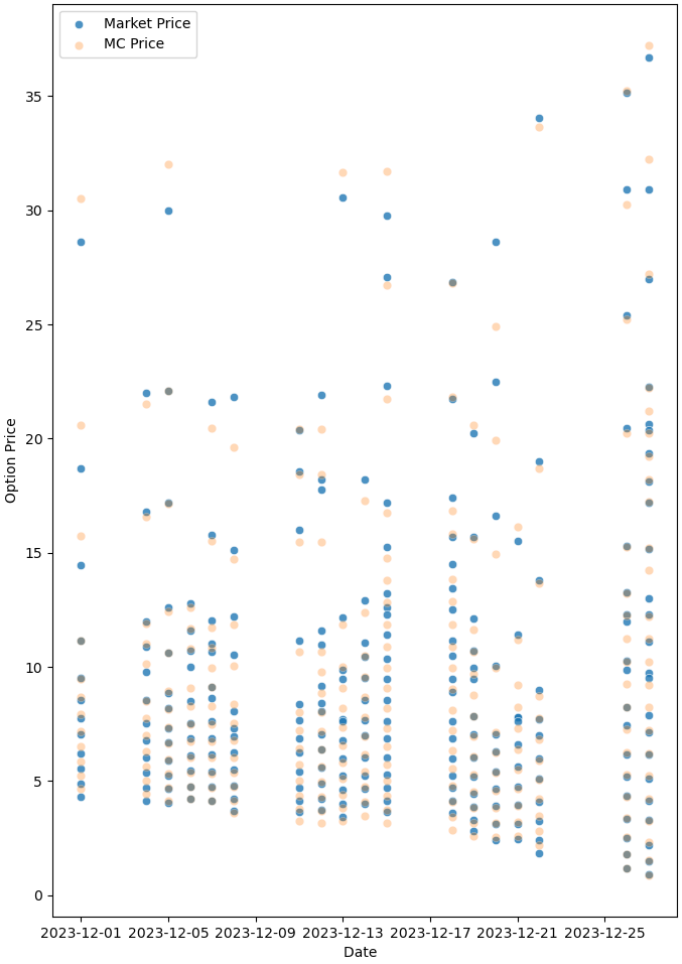


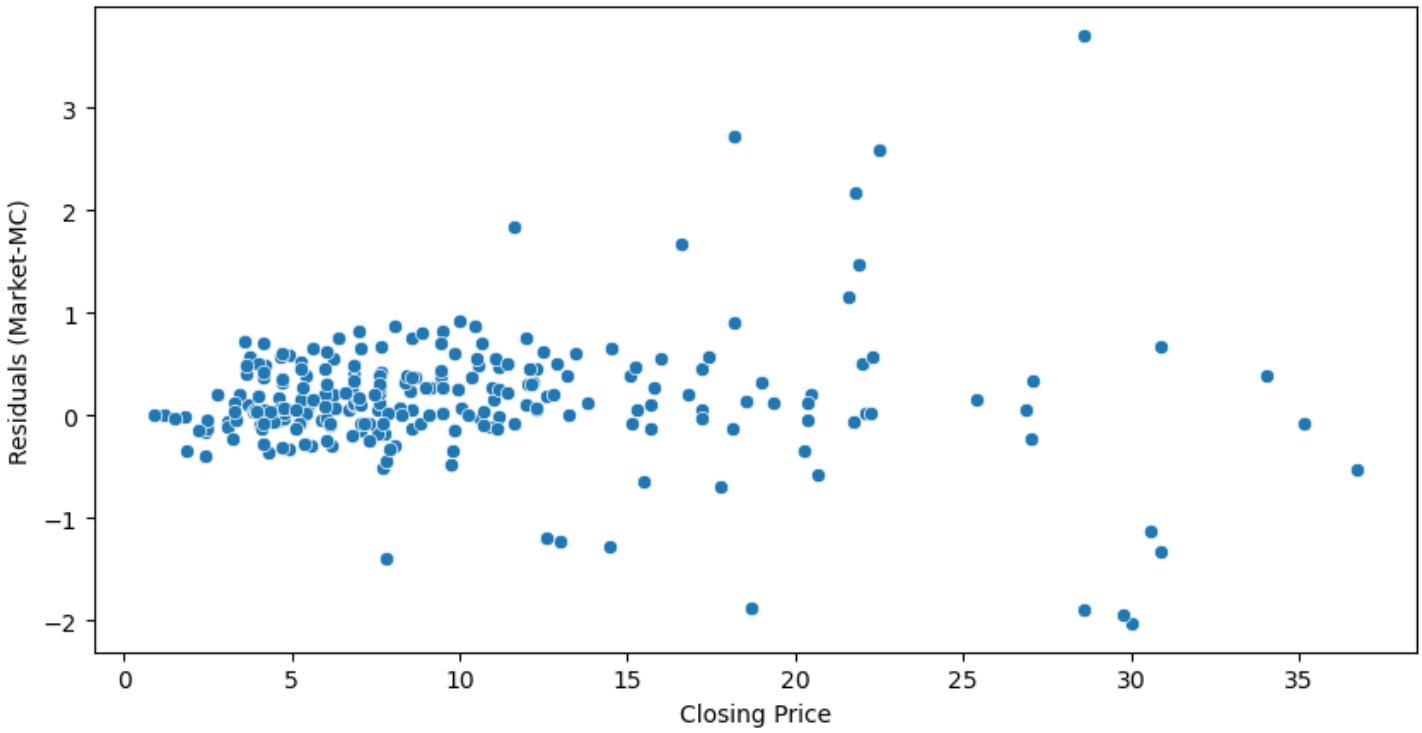




ITM Call Options - MC Method







	MAE	MSE	RMSE
Binomial	0.404821	0.395410	0.628816
BSM	0.381394	0.381686	0.617808
MC	0.384263	0.383816	0.619528

Observations

I. As the strike price is increasing, the option prices are decreasing. The farther away strike prices are from spot prices, the less likely it is that the option will be exercised profitably, as the stock price needs to increase further to make the option profitable.

II. Only ITM options have intrinsic value. As the strike price increases relative to the spot price of stock, the intrinsic value of the option decreases, leading to lower option prices.

III. Models are unable to accurately capture price dynamics at both extreme ends of strike prices. The most congruency can be seen in middle ranges.

IV. At lower end of strike prices, models value options more than the market. On the other hand, at the higher end, market values more than models.

V. On any given trading day, when the option prices are at the higher end on the spectrum, there is considerable mismatch between theoretical and market prices. Generally, the models value more than markets. On the lower end, the market and the models are much more in agreement. (Some disagreement between 11-12-23 and 18-12-23)

VI. As options expiration approaches, there is greater price fluctuations. This can be due to many factors

   a. Fluctuations in implied volatility amplifying price volatility
   b. Market participants may be reassessing their expectations and perceptions of future stock price movements, which may be leading to increased uncertainty and volatility in option prices.
   c. Other trading dynamics, like liquidity, supply-demand imbalance, and trading strategies may also be contributing to this trend.
   d. As time to maturity decreases, the time value of options also decreases. This may lead to larger price fluctuations in response to changes in the underlying stock price.

VII. Heteroscedasticity of residuals can be observed among all the three models. There is larger variation among the residuals as the options prices are increasing, indicating that the accuracy of the theoretical models is dependent on the magnitude of the market price.

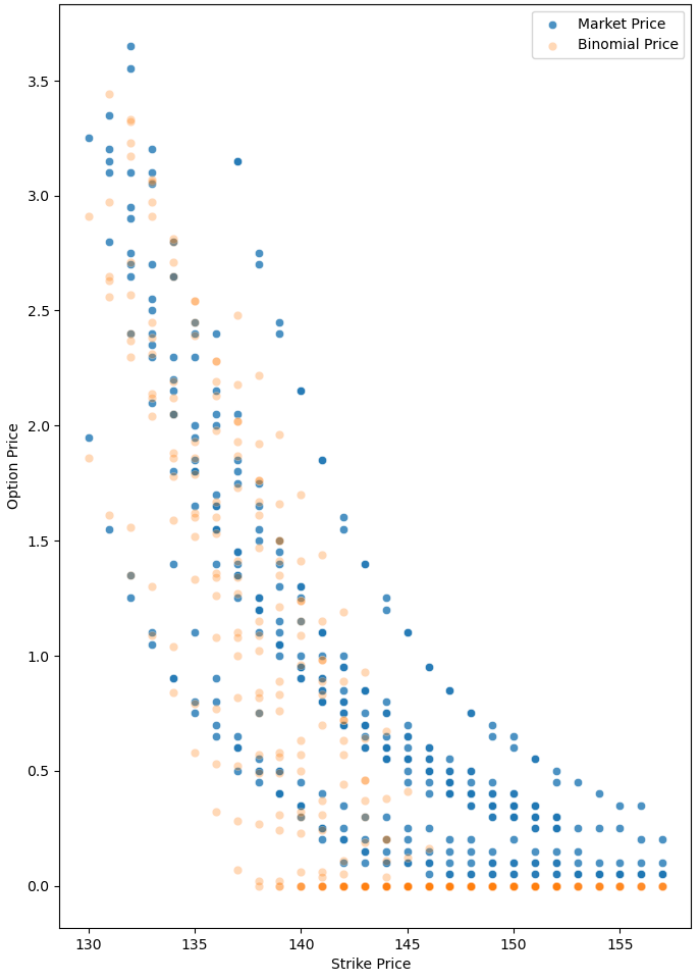
VIII. There are more positive residuals than negative residuals for certain market prices (closing price ≈ 22). This reflects strong demand for options at certain market prices. This could be driven by

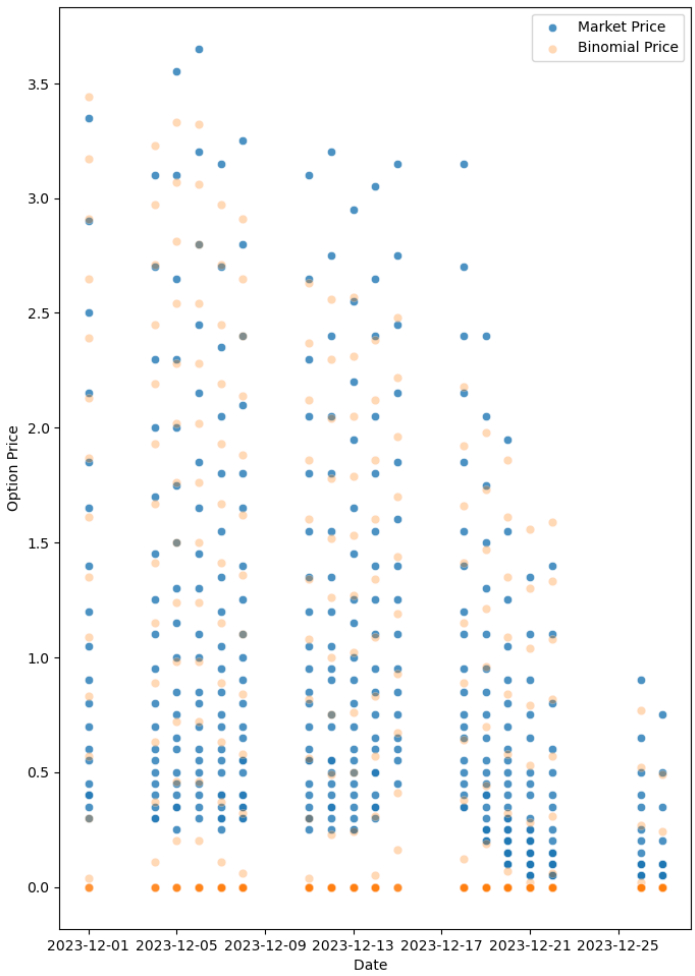
investors' expectations of future price movements, hedging strategies, or trading preferences. This may also be a signal of market inefficiencies or mispricing leading to arbitrage opportunities. However, further analysis is required to determine exact reasons and whether these deviations are persistent and exploitable.

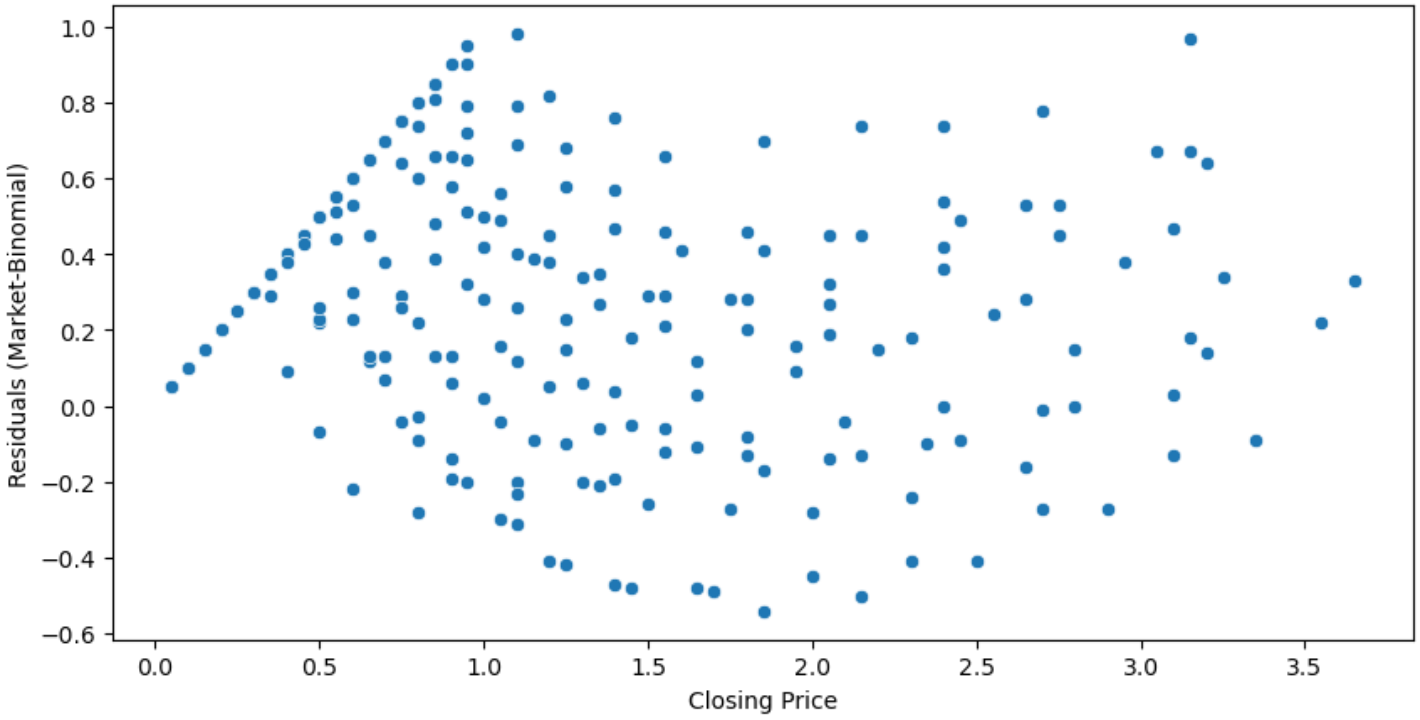
IX. For the provided number of time steps (N=2) in Binomial method and number of simulation (10000) for Monte Carlo (MC), both mean absolute error (MAE) and root mean squared error (RMSE) is highest for Binomial method and lowest for Black Scholes (BSM) method. Errors by Monte Carlo prediction is quite similar to Black Scholes.

X. Among the three models, for ITM European Call options, BSM> MC > Binomial method.

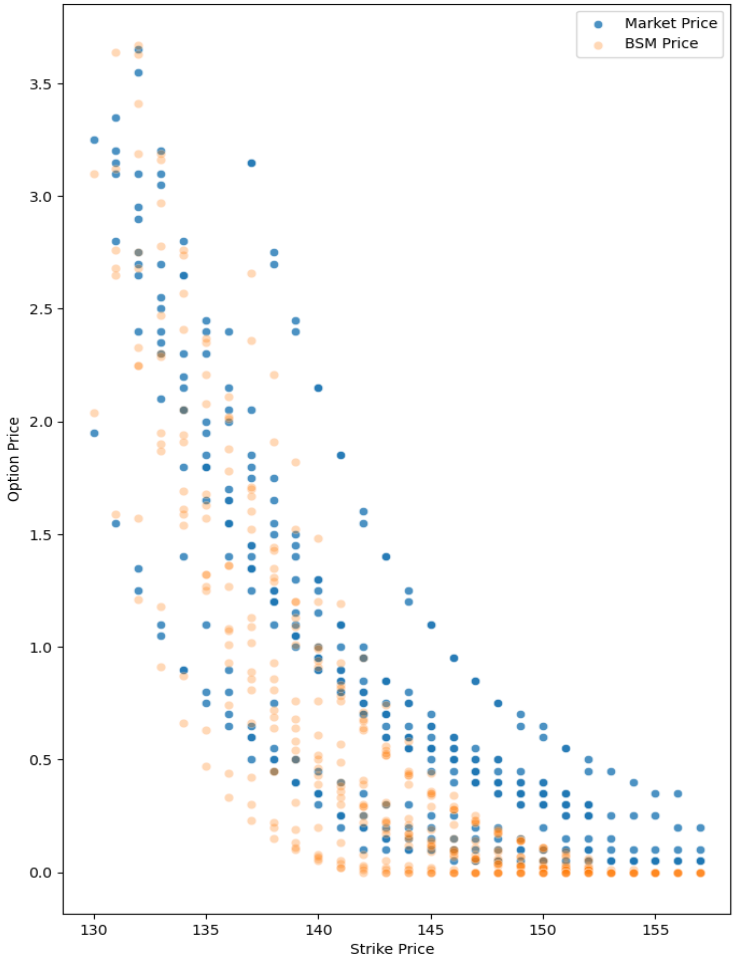
OTM Call Options - Binomial Method

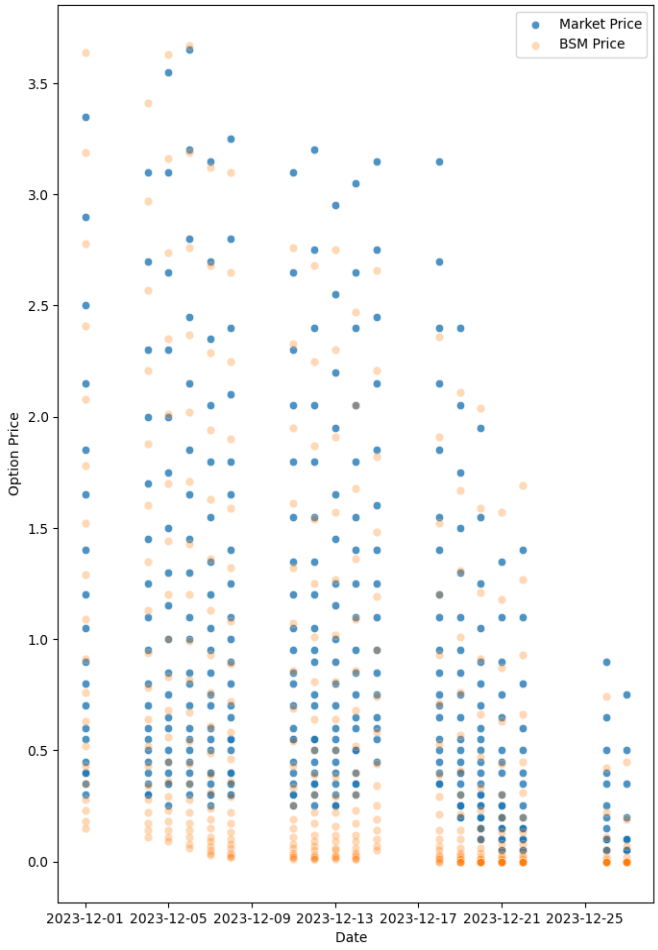


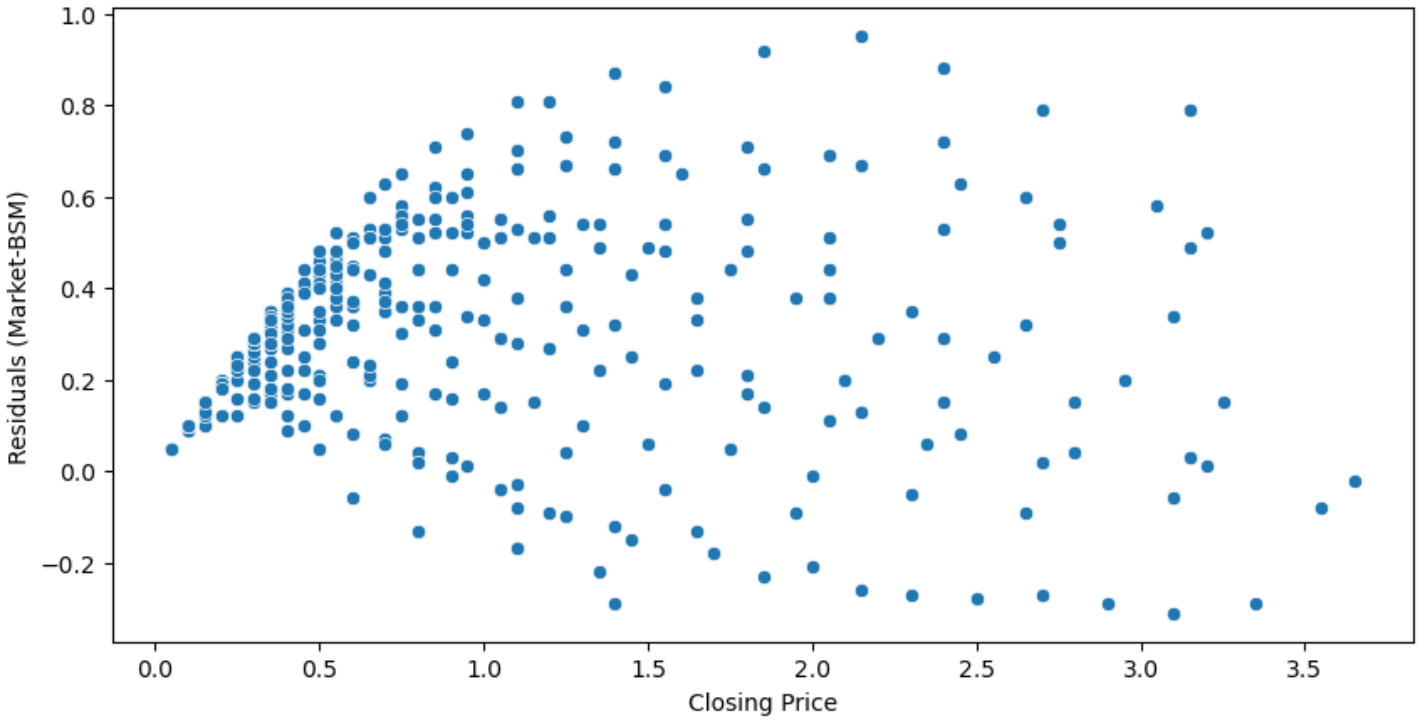




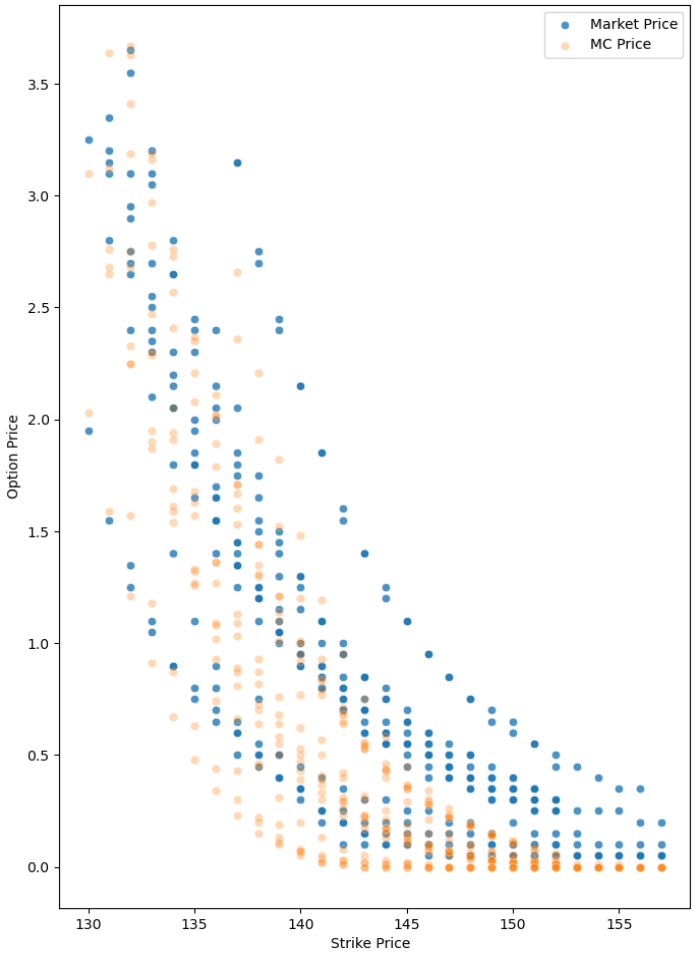
OTM Call Options - BSM Method

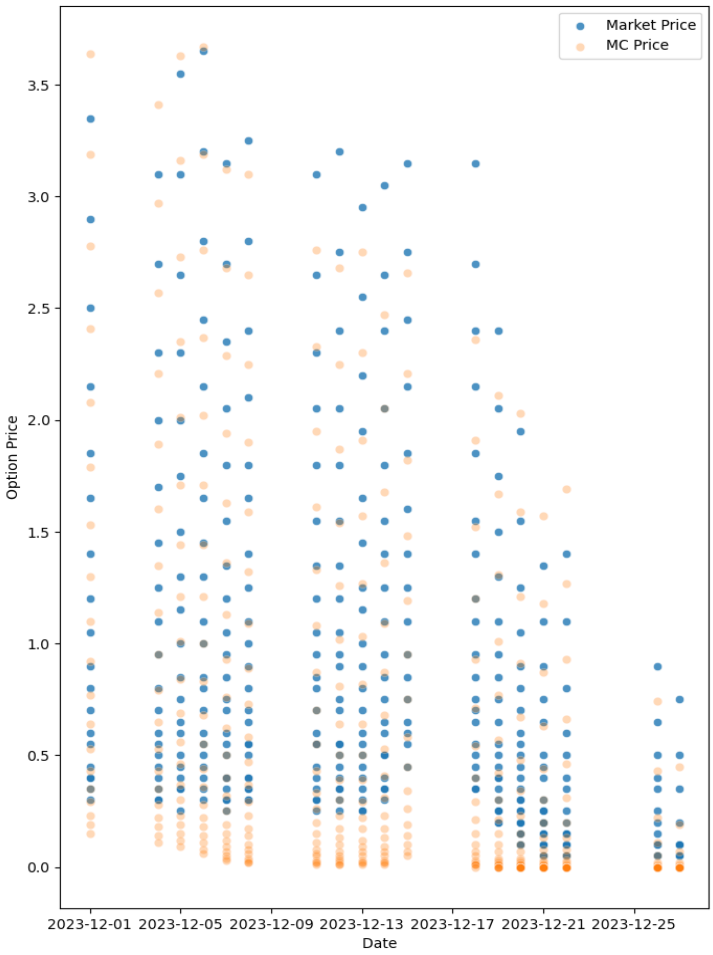


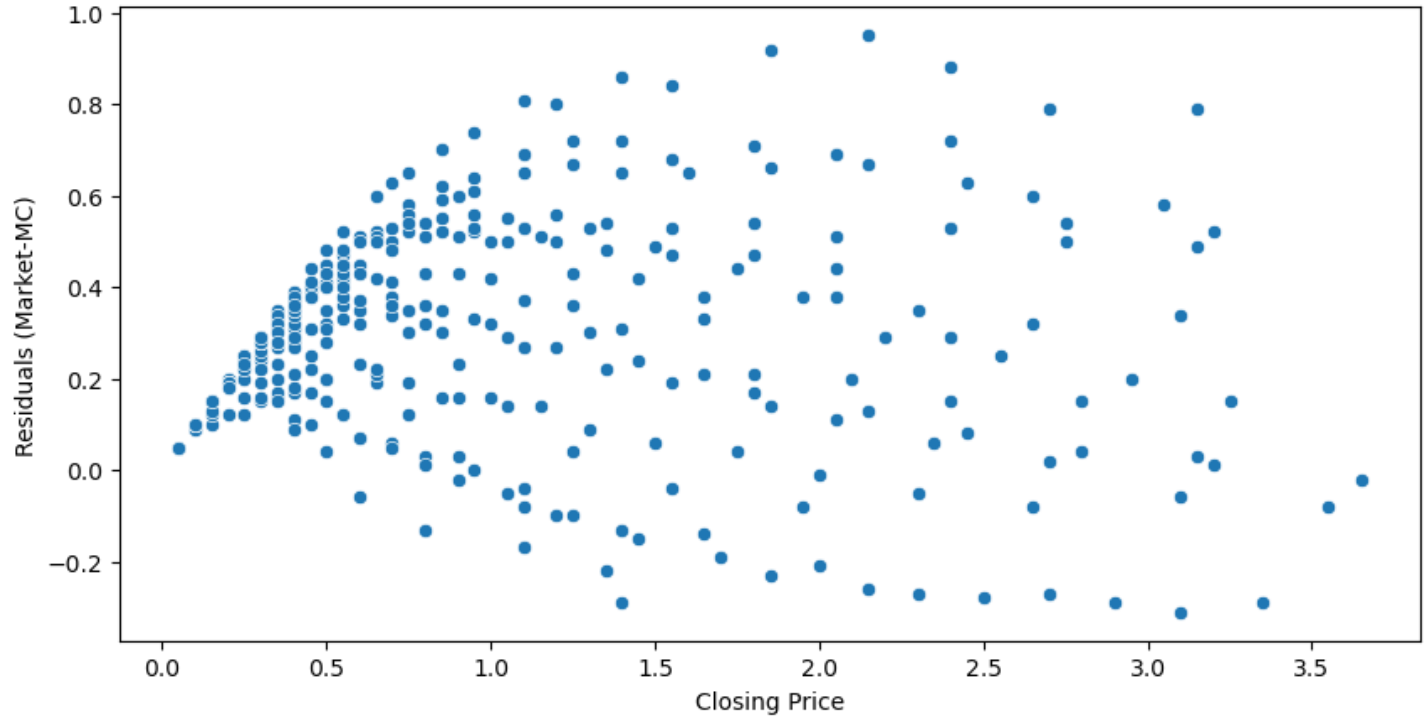




OTM Call Options - MC Method







	MAE	MSE	RMSE
Binomial	0.333990	0.160984	0.401229
BSM	0.294456	0.126944	0.356292
MC	0.292228	0.125282	0.353953

Observations

I. It can be observed that for OTM Call options, there is an inverse relationship between option prices and strike price. Again, this can be explained due to the fact that higher strike prices imply a lower likelihood of the option being exercised profitably.

II. OTM options have only time value. As time to expiry approaches, value of OTM options moves towards zero.

III. All along the strike price spectrum, there is mismatch between market and theoretical prices. This mismatch is more pronounced at higher end of strike prices.

IV. At any given trading day, the market prices are, generally, more than theoretical prices.

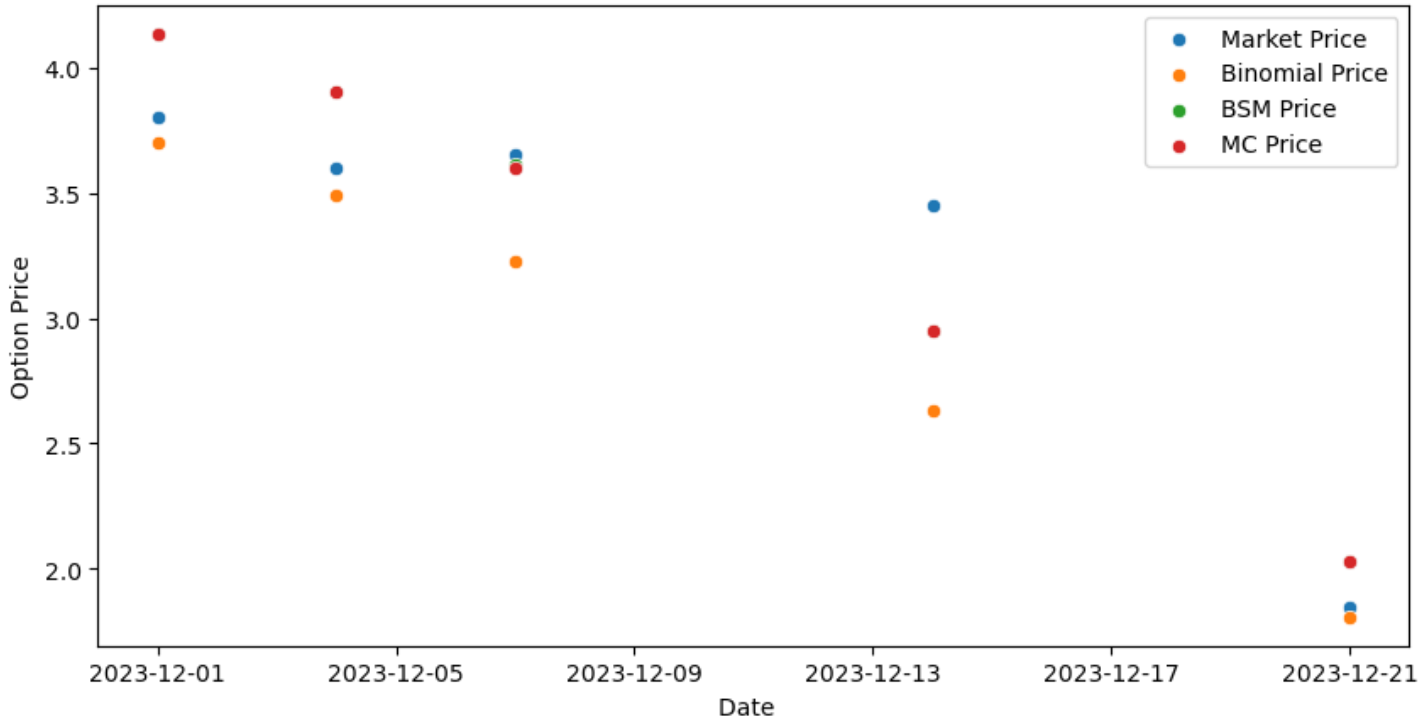
V. As the time to expiration decreases, the volatility of option prices also decreases. This decrease is more pronounced in weeks just before expiry.

VI. The residuals of all three models show a pattern when the option prices are low indicating biases or limitations in the theoretical pricing models. As market prices of options approaches towards zero, the models consistently price options as having no value leaving only positive residuals.

VII. Overall, there are more positive residuals than negative residuals. This indicates that the markets are consistently pricing OTM options more than theoretical models. This can be attributed to bullish sentiment or expectations of future price movements. It may also be that markets are demanding a risk premium for uncertainty and volatility leading to higher option prices in the market compared to theoretical values.

VIII. For the provided number of time steps and number of simulations, both mean absolute error (MAE) and root mean squared error (RMSE) is highest for Binomial method and lowest for Monte Carlo (MC) method. Errors by Monte Carlo prediction is quite similar to Black Scholes. Among the three models, for OTM European Call options, MC > BSM > Binomial method.

ATM Call Options



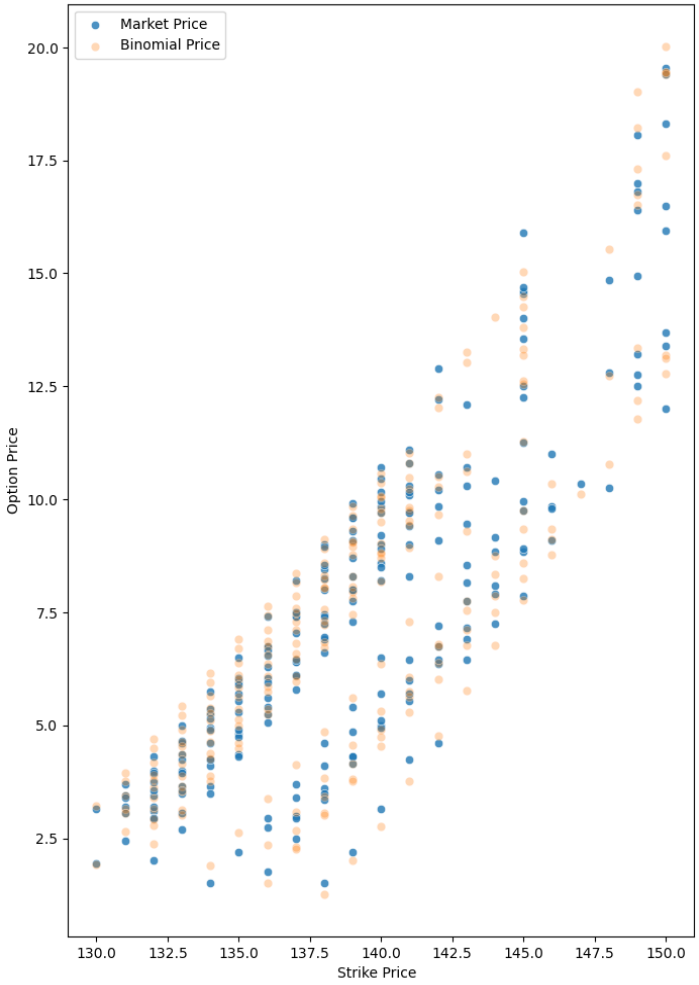
Observations

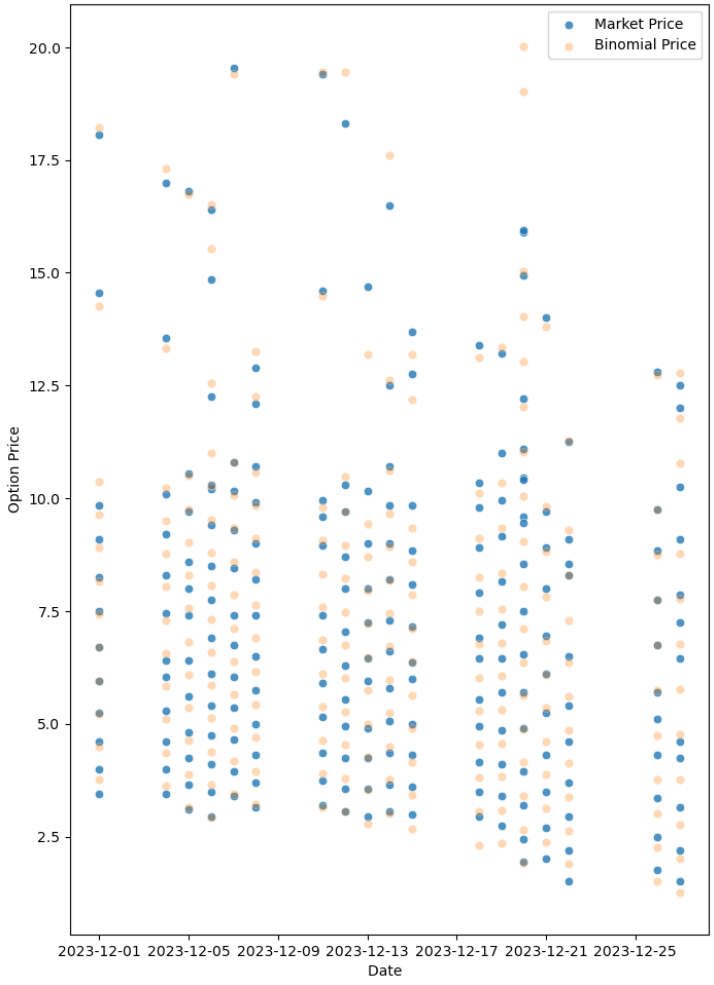
I. Only a few at the money (ATM) options are being traded in the market. This can be due to following reasons: -
   a. Market participants often use options ITM and OTM options for hedging purposes as they offer more significant exposure to directional movements in the underlying asset. This demand supply dynamics can explain lower ATM trading volumes.
   b. For speculative trading and risk management strategies too, investors prefer trading ITM or OTM options over ATM options due to lower upfront costs and higher potential returns.
   c. ATM options may have lower liquidity (ease of buying/selling without significantly affecting prices) compared to ITM and OTM options. This deters investors from trading in them.

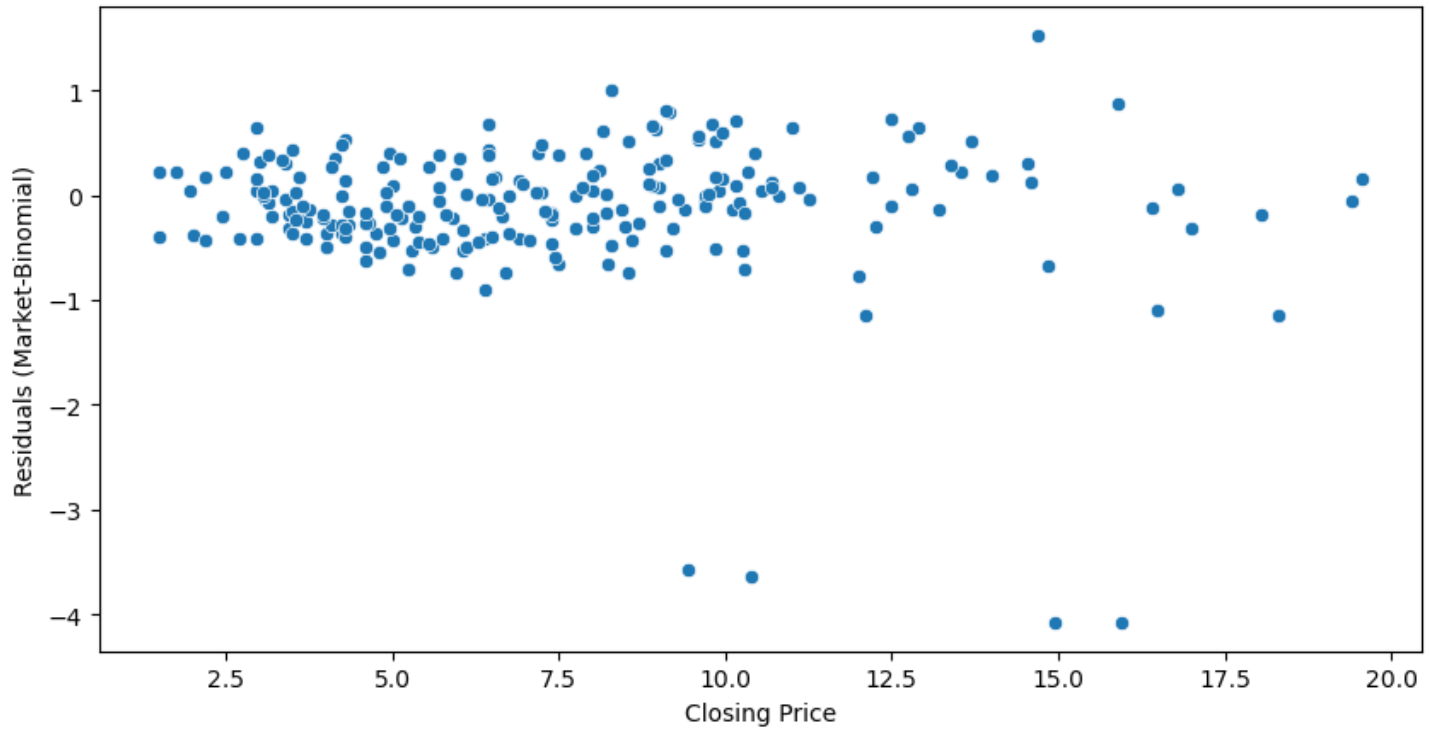
II. No model accurately predicts ATM options highlighting their limitations of assumptions about market dynamics and behavior.

Due to limited data, further inferences would require more study and analysis.

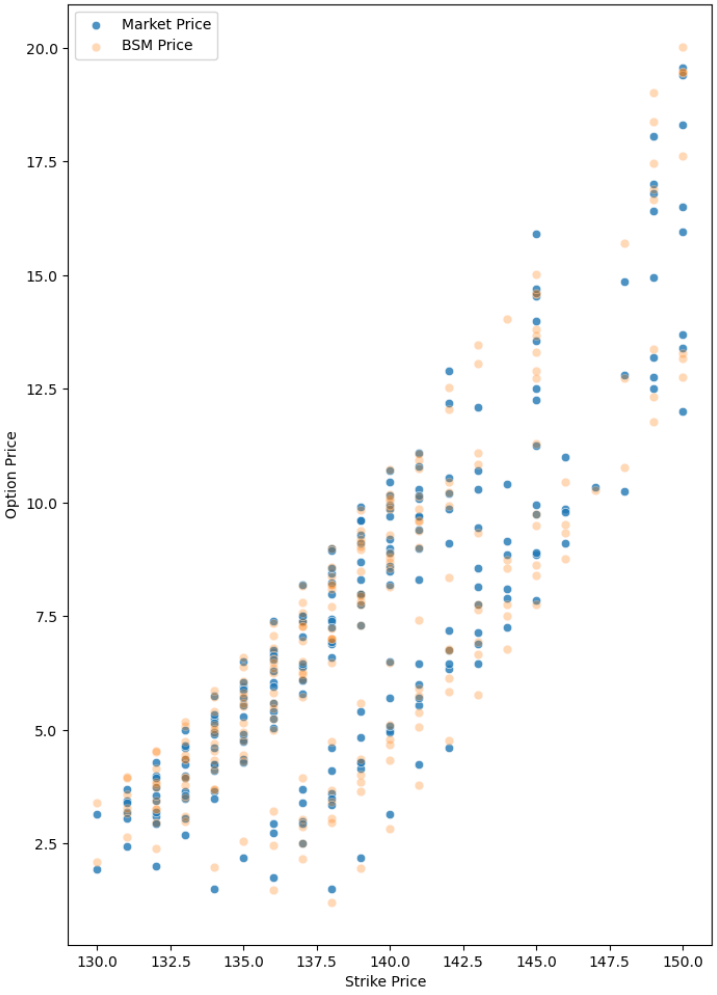
ITM Put Options - Binomial Method

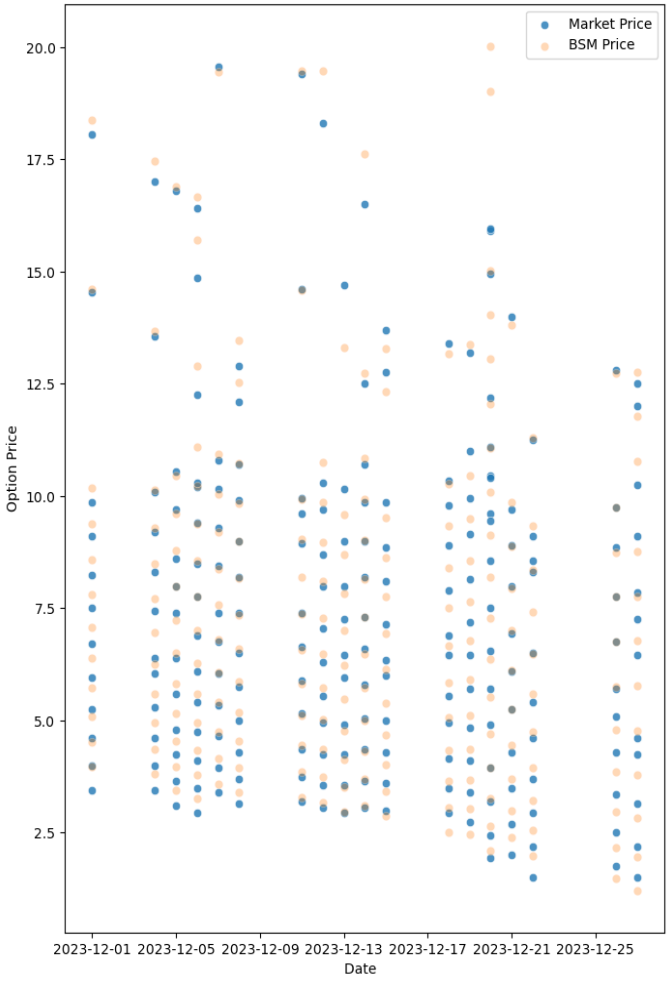


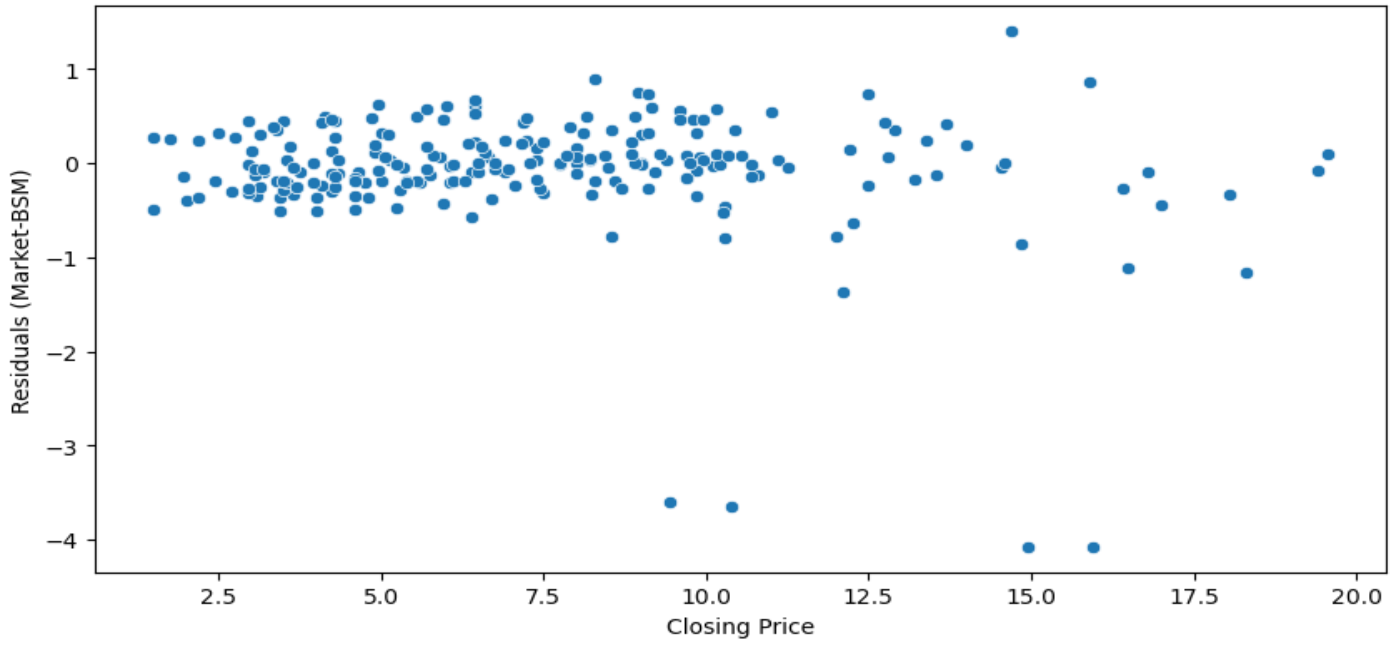




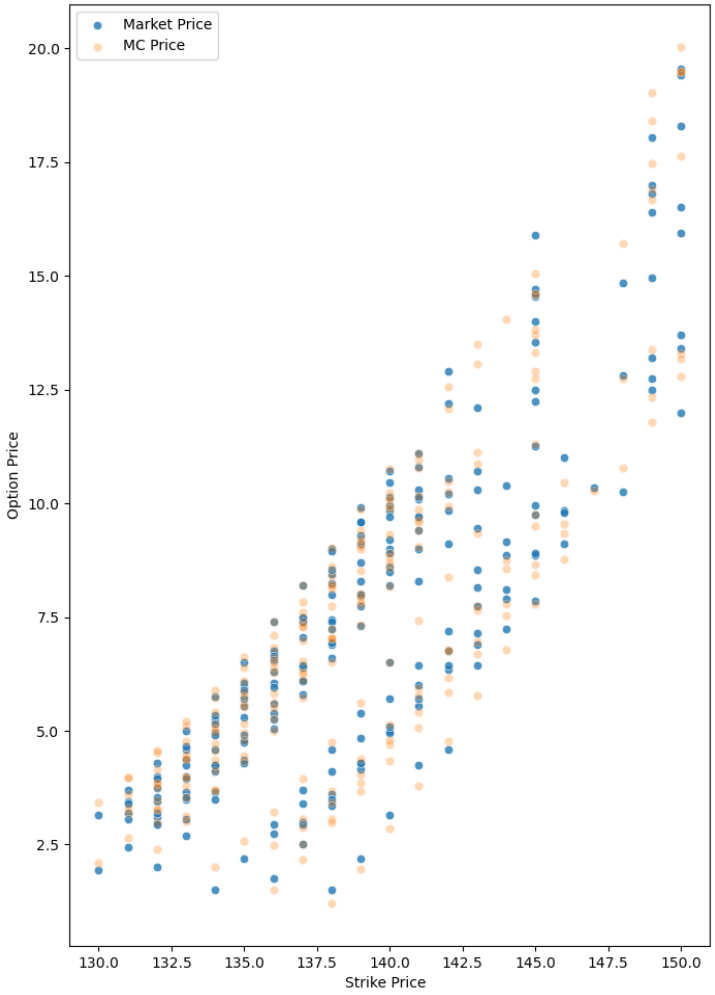
ITM Put Options - BSM Method

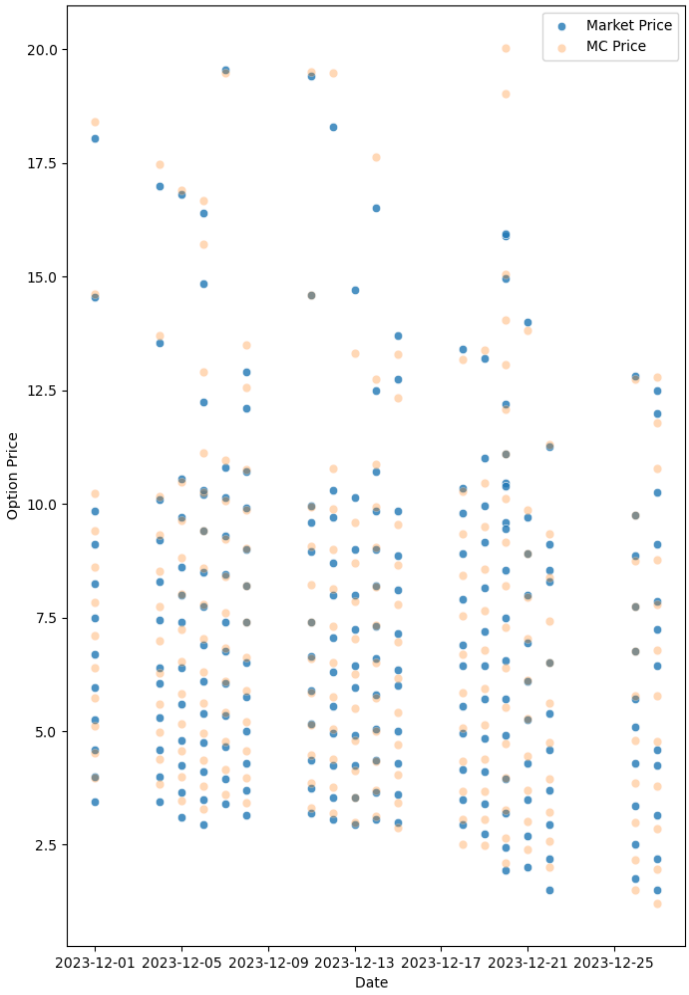


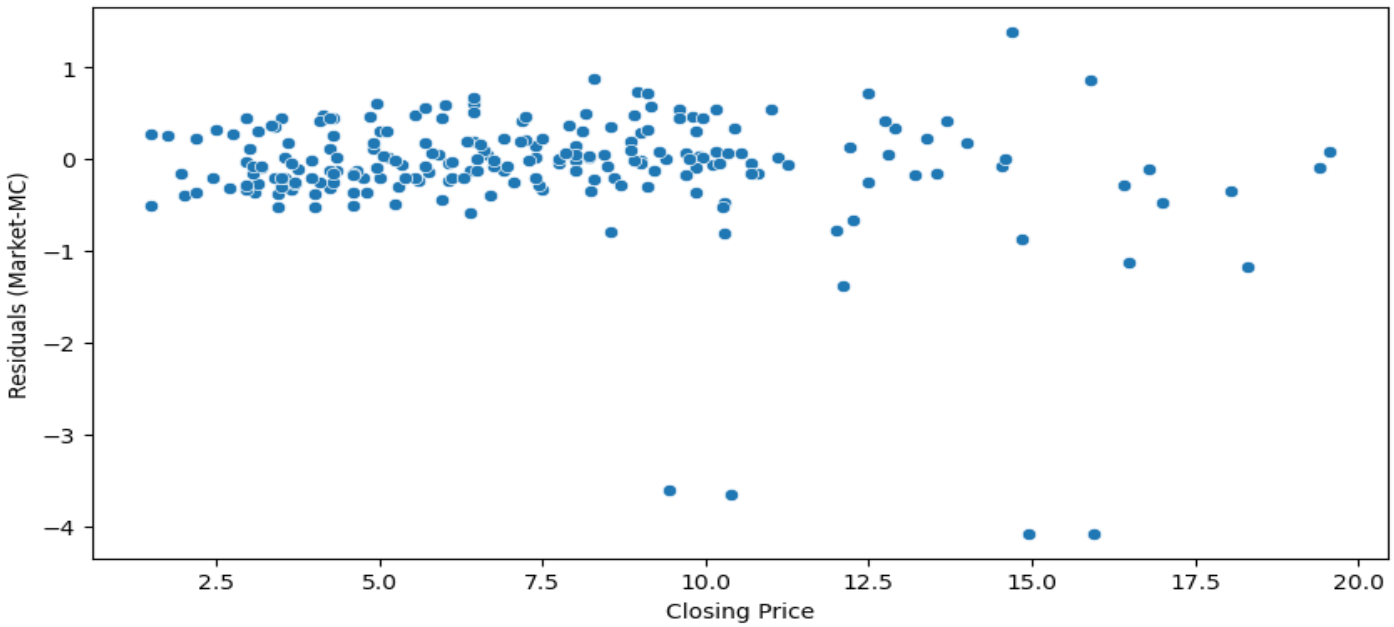




ITM Put Options - MC Method







	MAE	MSE	RMSE
Binomial	0.382691	0.426368	0.652968
BSM	0.336368	0.396386	0.629592
MC	0.338475	0.398365	0.631162

Observations

I. As the strike price is increasing, the option prices are also increasing. The farther away strike prices are from spot prices, the more likely it is that the option will be exercised profitably. This is due to the fact that higher strike prices increase the intrinsic value of the put option.

II. All along the strike price spectrum, there is good convergence between theoretical and actual prices. A few outliers can be observed at the higher end of strike prices.

III. Generally, at any given trading day, as the option price rises, the divergence between theoretical and actual prices also rises. This can be due to various factors: -

   a. Increasing ITM put options may indicate increasing market uncertainty about the stock's future performance due to which investors may be willing to pay higher prices for downside protection thereby driving up option prices. This may not be getting fully captured in theoretical models.
   b. For hedging or speculative purposes, the demand may have increased for ITM put options leading to higher market prices.
   c. Investor characteristics like biases or market inefficiencies like information asymmetry may also contribute to this trend.

IV. As option expiry approaches, a downward trend can be observed among the lower end of option price spectrum. Price volatility also decreases in preceding week of expiry.

V. At certain market prices, there are negative outliers of residuals (closing price ≈ 10, 15) indicating market price is much lower than theoretical prices. This may be explained by: -

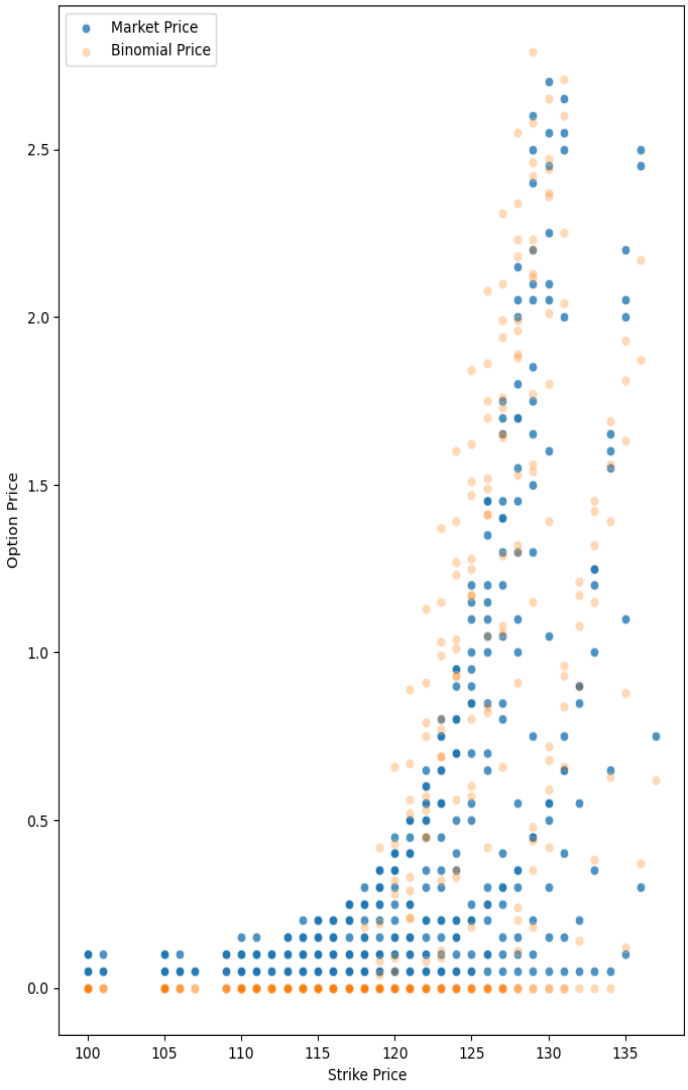
   a. Implied volatility may have decreased resulting in decrease in put option prices leading to more negative residuals. This may be due to changes in market conditions, news events, or investor sentiment which is not being taken into consideration by theoretical models.
   b. Supply-Demand dynamics, liquidity constraints, market inefficiencies and biases may have also contributed to price decline.

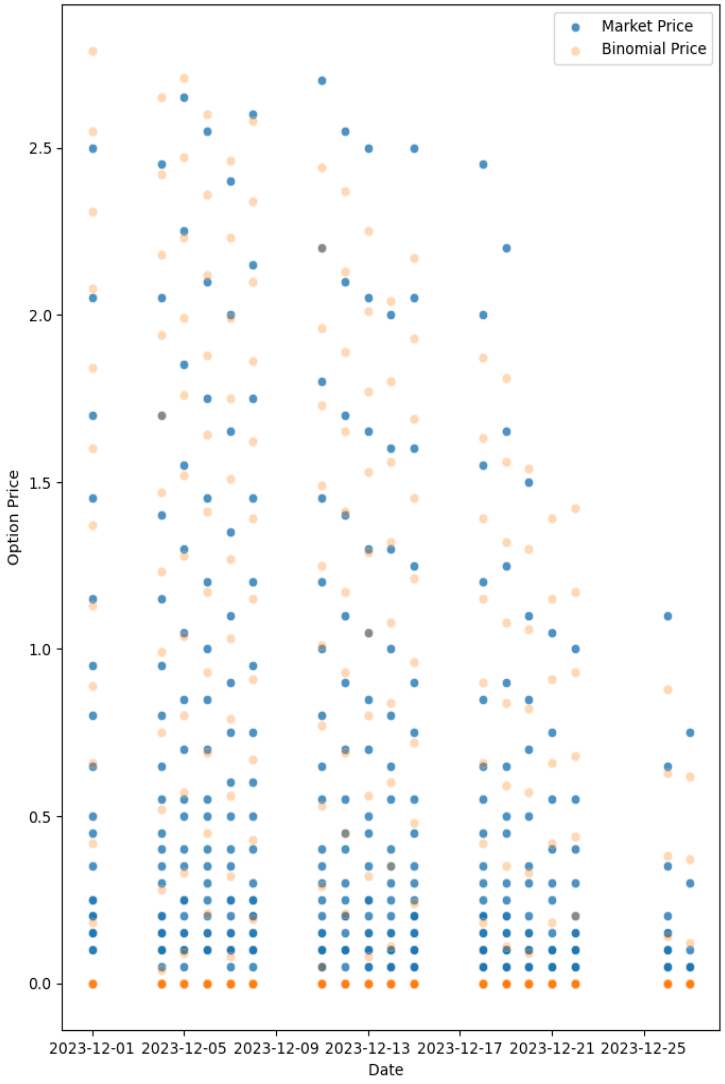
VI. At higher market prices, the theoretical models are valuing options more than the markets.

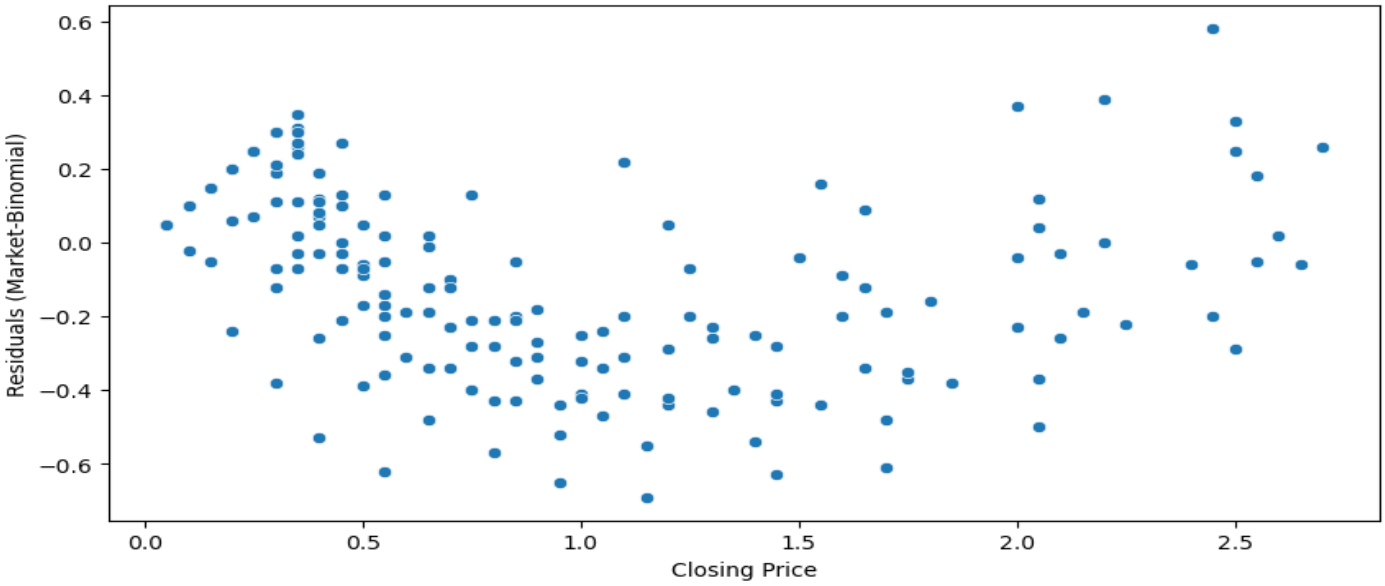
VII. For the provided number of time steps and number of simulations, both mean absolute error (MAE) and root mean squared error (RMSE) is highest for Binomial method and lowest for Black

Scholes method. Among the three models, for ITM European Put options, BSM > MC > Binomial method.

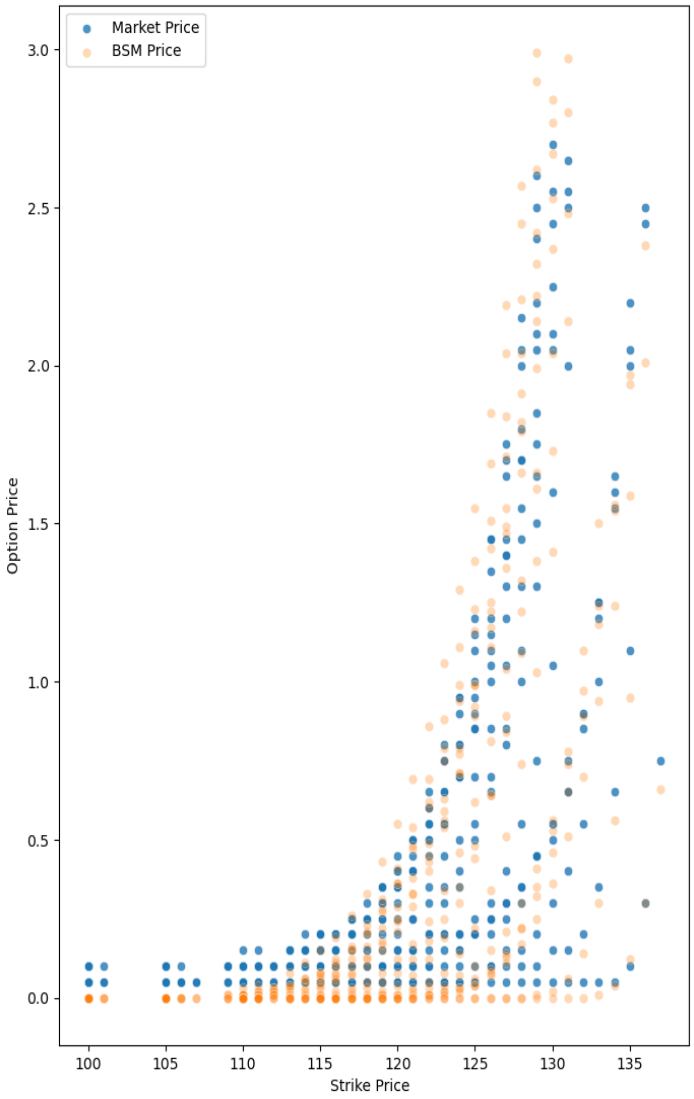
OTM Put Options - Binomial Method

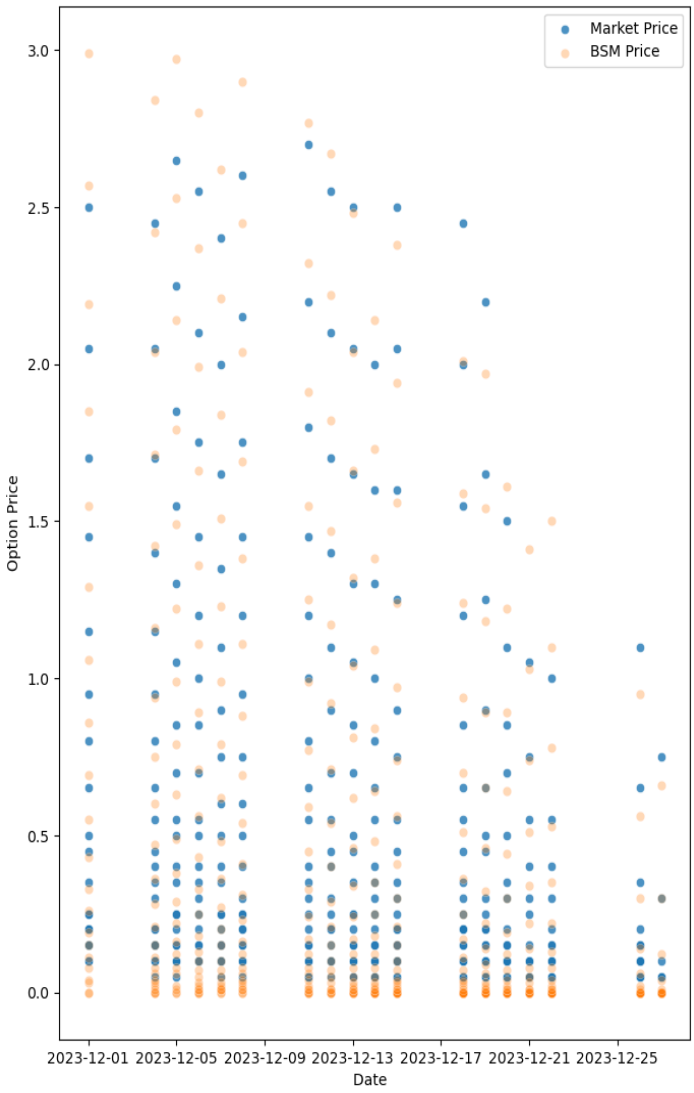


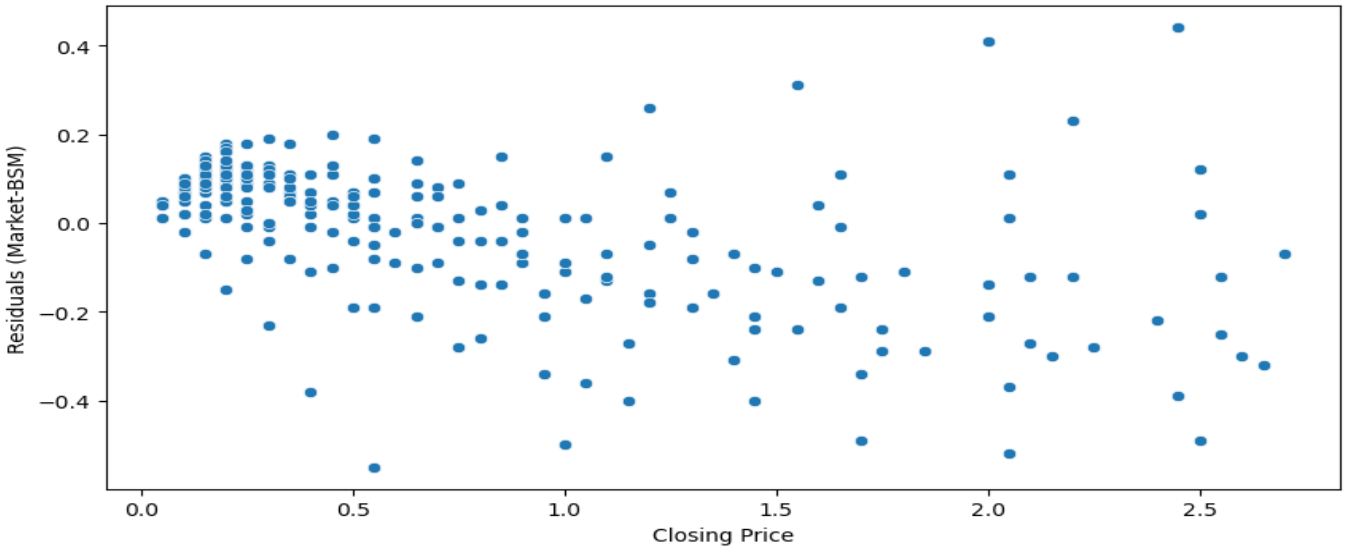




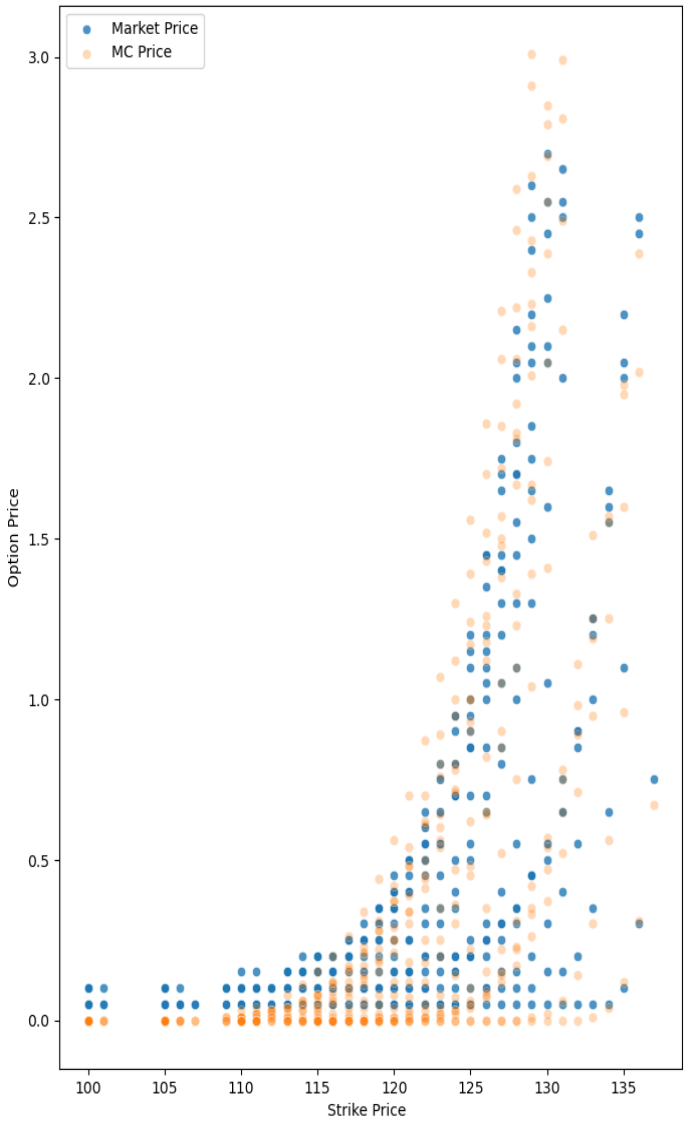
OTM Put Options - BSM Method

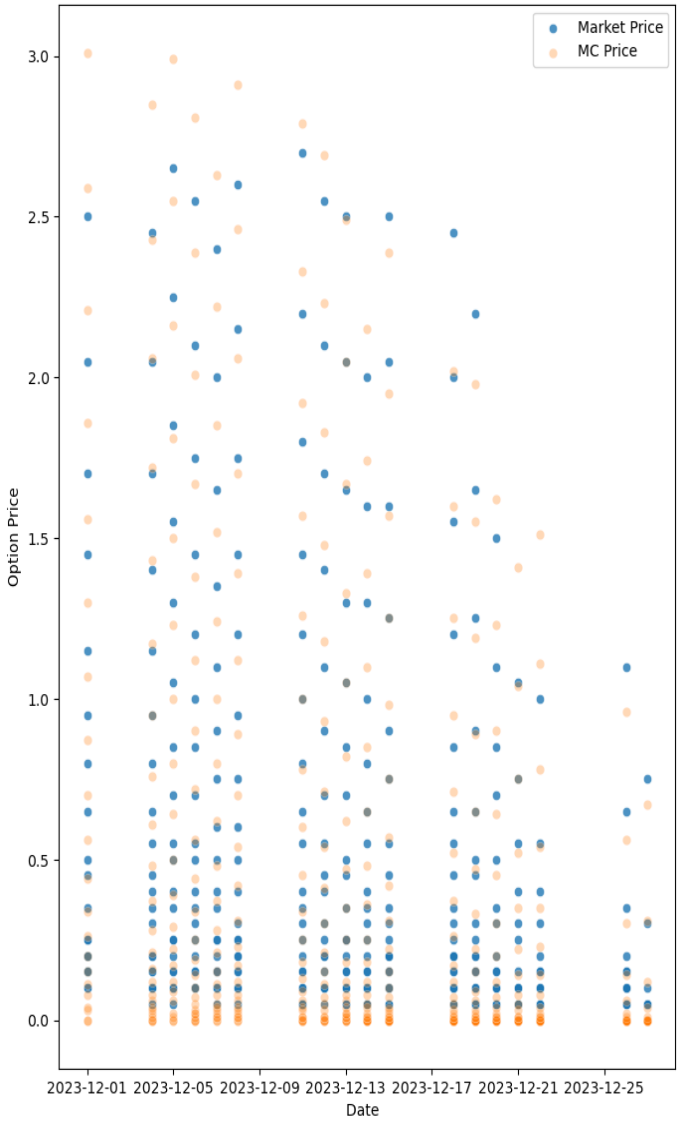


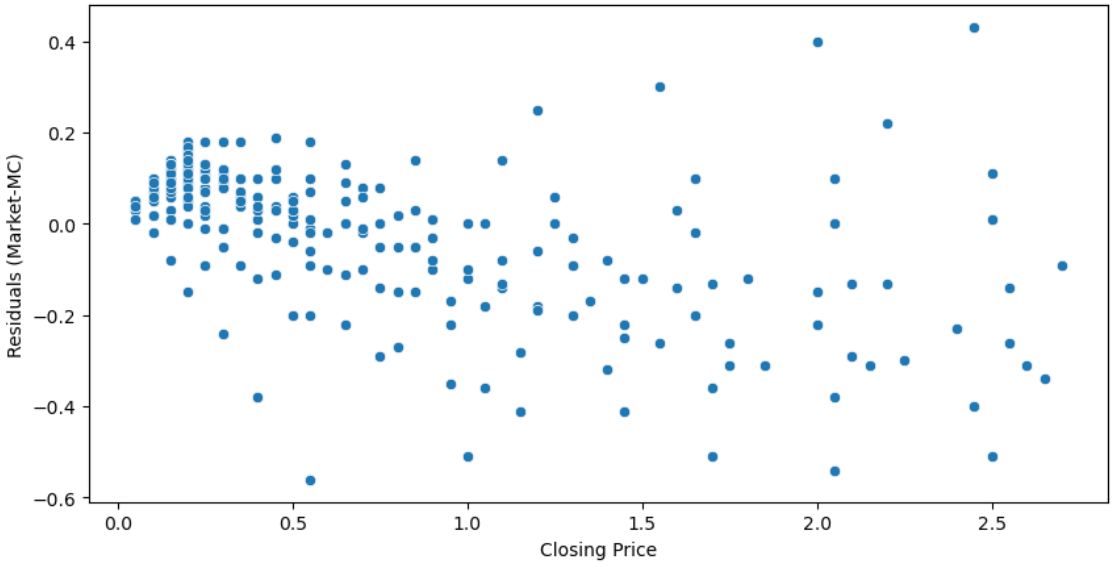




OTM Put Options - MC Method







	MAE	MSE	RMSE
Binomial	0.159321	0.041823	0.204507
BSM	0.100679	0.017402	0.131915
MC	0.101218	0.018012	0.134209

Observations

I. For OTM Put options, prices are directly proportional to strike prices as higher strike prices makes the option profitable.

II. All along the strike price spectrum, theoretical models are more likely to assign zero value to options than markets.

III. As the closing price approaches zero, markets price options more than models indicating limitation of models at such low prices.

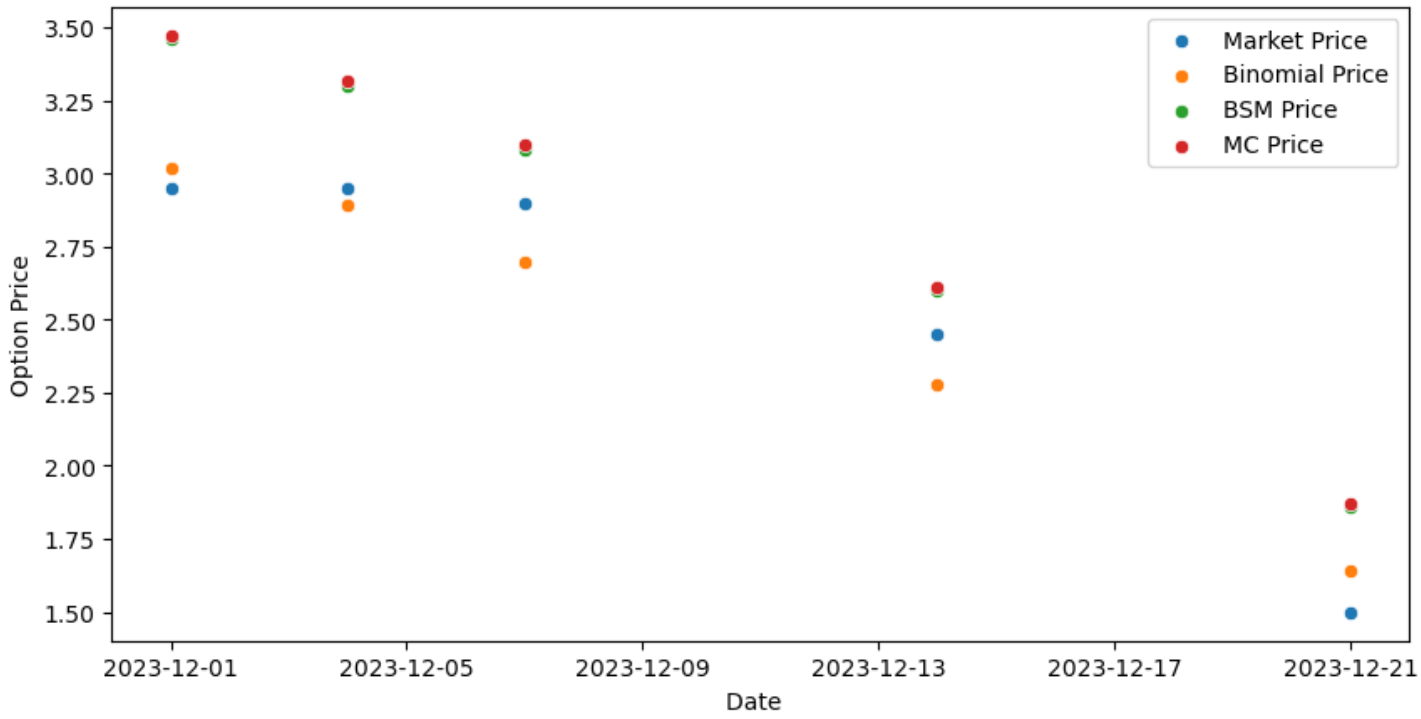
IV. As the strike price (and thereby option prices) are increasing, considerable discrepancies can be observed. Theoretical models are assigning more value to options resulting in more negative residuals. This may be due to: -

   a. Market sentiments may have changed from bear to bull leading to lesser demands of put options. If better prices are available in future, why pay for downside protection.
   b. Unforeseen news or events, market inefficiency, supply-demand dynamics, decreased implied volatility, change in investor preferences may also provide contribution.

V. As time to expiration approaches, the price volatility decreases and trading of higher priced OTM options is getting considerably reduced.

VI. MAE and RMSE for Binomial method is highest and BSM is lowest. For OTM put options, BSM > MC > Binomial.

ATM Put Options



Observations

I. Only 5 put options are being traded ATM. No model is able to correctly predict their prices.

II. More data is required for in depth analysis.

6. CONCLUSION AND RECOMMENDATIONS

In recent times, the participation of retail investors in options trading has increased throughout the world, nowhere higher than in India. Nonetheless, this participation has not resulted in success with overwhelming majority of investors losing money. This indicates gaps in knowledge as to how to value options. An in-depth study of option valuation was undertaken to know about the different methods used for pricing options, their assumptions and limitations and their mathematical foundation. The pricing methods were coded using python and tested on openly available real-world options data. The performance of the models is summarized below: -

Method	Call Options						Put Options					
	ITM			OTM			ITM			OTM		
	MAE	MSE	RMSE	MAE	MSE	RMSE	MAE	MSE	RMSE	MAE	MSE	RMSE
Binomial	.4048	0.3954	0.6288	0.3334	0.1609	0.4012	0.3827	0.4263	0.6529	0.1593	0.0418	0.2045
Black Scholes	0.3813	0.3816	0.6178	0.2945	0.1269	0.3563	0.3364	0.3963	0.6295	0.1007	0.0174	0.1319
Monte Carlo	0.3842	0.3838	0.6195	0.2922	0.1252	0.3539	0.3384	0.3983	0.6312	0.1012	0.0180	0.1342

Additionally, following observations were drawn:-

- While valuing ITM Call options, models are unable to predict price dynamics at extreme ends of strike prices. Relatively better estimates are in middle ranges. Black Scholes and Monte Carlo are best suited.
- For OTM Call options, models generally provide conservative valuations as compared to markets. At lower end of option prices, models are biased as to value options as having no values. This can be seen in OTM residuals having a pattern at low options prices. Again, Black Scholes and Monte Carlo have similar level of efficiency.
- In pricing ITM Put options, the models display similar behavior as to ITM Call options. There are divergences at extreme ends of strike prices with good overlap in middle ranges. Black Scholes show least error.

- OTM Put options are liberally priced by theoretical models with market assigning lesser values. Problem is acute at lower end of price spectrum. Monte Carlo and Black Scholes have similar errors.
- Only a small proportion of ATM Put and Call options are traded as compared to ITM and OTM options. More data is needed to draw meaningful conclusions.

It can be concluded that the models can be reasonably relied upon when pricing ITM options with due care taken at extreme ends of strike prices. For pricing OTM options, a host of factors like trading strategies, investment preferences, future stock potentials and risk preferences must be taken into consideration as models have their limitations.

Both Black Scholes and Monte Carlo methods show similar accuracy in pricing Put and Call options. In the case of computational limitations, Black Scholes can be the model of choice.

Implied volatility has been calculated using market price of options. Based on their comparison, options have been categorized as overvalued and undervalued. A retail investor can buy undervalued options and sell overvalued ones. The full list of options is available in appendix.

7. CHALLENGES AND FUTURE WORK

- Deciding the number of computations for Monte Carlo simulation is a tradeoff between computational time and accuracy required. This also holds true for increasing number of time steps in Binomial method.
- The time period taken for calculation of historical volatility is open to subjective interpretation.
- Plotting of Volatility Surfaces can be studied which are utilized as tools by traders in equity and foreign currency markets.
- Advanced models like GARCH can be used to model volatility to provide more weight to recent price movements.
- The performance of models can be studied using American and Exotic options.

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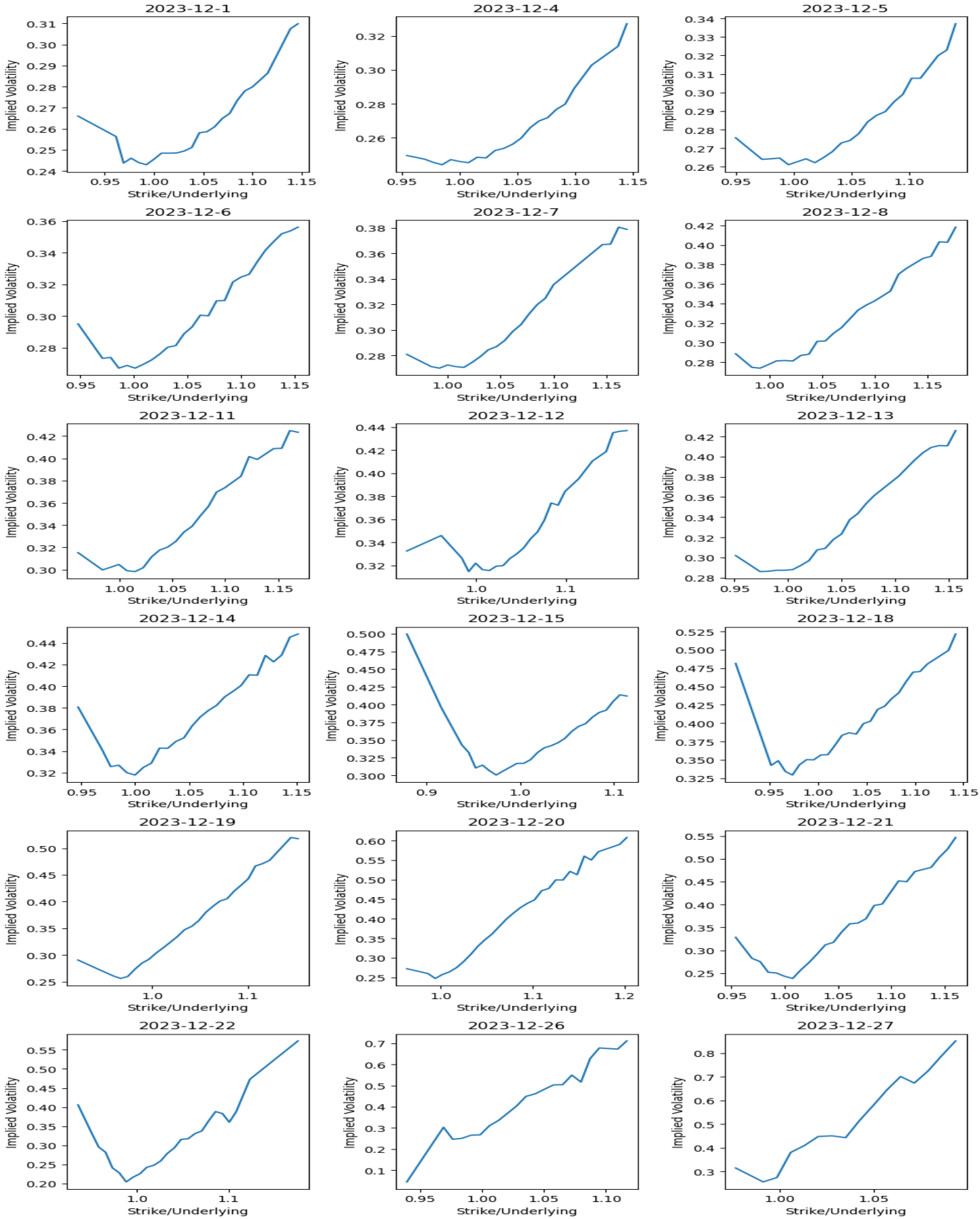
9.1 APPENDIX 1 – VOLATILITY SMILE

Observations: -

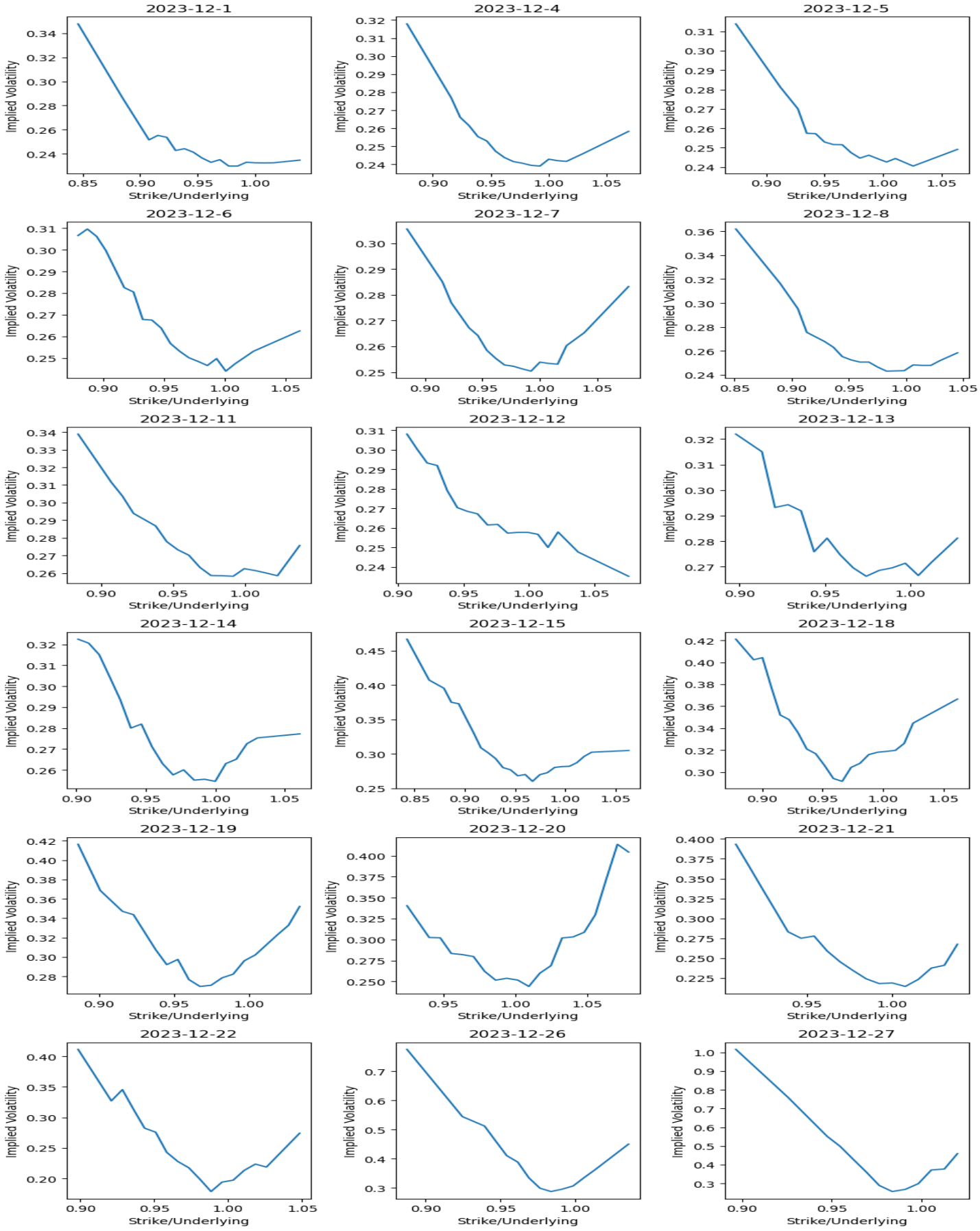
- The vertical axis represents implied volatility. The horizontal axis (Strike/Underlying) indicates moneyness:
    - <1 are ITM Calls and OTM Puts
    - =1 are ATM Options
    - >1 are OTM Calls and ITM Puts.
- For Call Options: -
    - The smile shape indicates that implied volatility (IV) is higher for ITM and OTM options and lower for ATM options. Increasing IV for ITM options reflects that these are priced higher to account for tail risks or illiquidity of contracts. IV is at its lowest for ATMs because these options are the most actively traded, and their prices are more stable. Higher IV for OTMs shows that these options are priced to account for chances of a significant upward price movement in the underlying.
    - There are asymmetries in smiles suggesting market bias. OTM volatilities are steeper indicating market participants expecting bullish moves in the underlying asset. (Conversely, if ITM were steeper, there may be a more bearish market.)
    - As expiry approaches, the implied volatility rises across all moneyness levels indicating traders pricing in final risk or opportunity of a significant movement in underlying asset.
    - Traders may look out for breakout opportunities and buy OTM calls as a speculative strategy. As rising volatility results in increasing premium, hedgers need to act promptly and balance the cost of protection with their risk tolerance.
- For Put Options: -
    - The volatility smile shows higher IV for deep ITM and deep OTM puts and lower IV for ATM ones indicating higher liquidity and more predictable prices for the latter.
    - Hedgers can buy deep ITM puts having a strike price higher than current underlying price to protect their position against large downside risks. Alternatively, deep OTM puts having strike price lower than the current underlying price can be bought as insurance policies for extreme market downturns.

- Near expiry, liquidity decreases for ITM and OTM strikes which further drives up IV due to less predictable prices.
- The smile pattern and its steepening near expiry emphasize the dual role of implied volatility as both a measure of market uncertainty and demand for specific options.

Volatility Smile – Call Options



Volatility Smile – Put Options



9.2 APPENDIX 2 – OPTION GREEKS

- Most options sold by market makers are close to underlying value.
- On 1st December 2023, for an underlying value of 130, following are the contracts sold: -

S.No.	Strike Price	No. of contracts sold
1	135	7612
2	140	6441
3	130	5787
4	145	2918
5	132	2046
6	133	1359
7	131	1294
8	128	1027
9	129	987
10	137	940

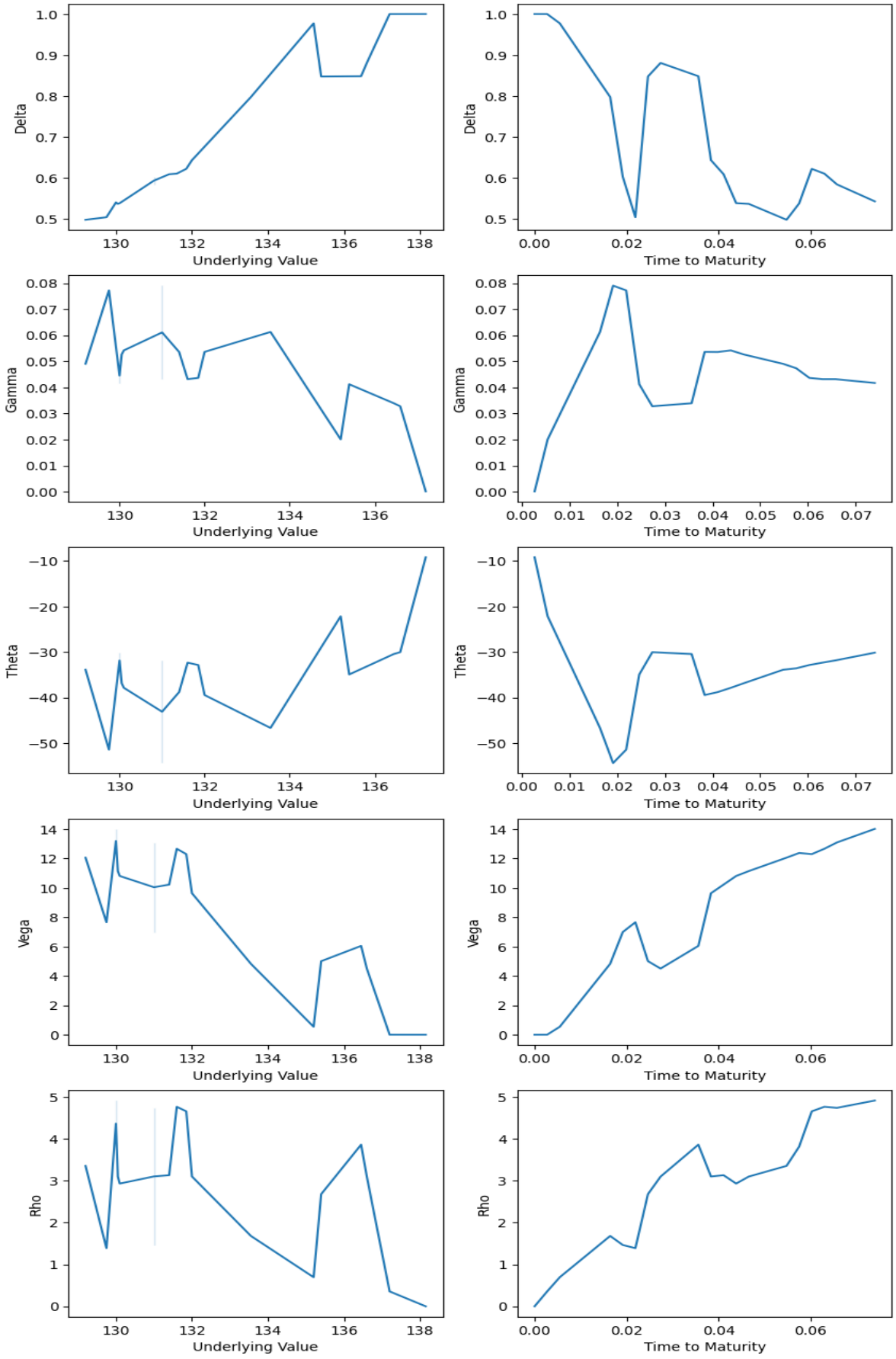
- I am analyzing option greeks for strike price = 130 with following assumptions: -
    - The hedging is assumed to be adjusted daily.
    - The assumptions underlying Black Scholes model holds true with volatility remaining constant.

Strike Price	130
Selling Date	01-Dec-23
Expiry Date	28-Dec-23
No. of options sold	1,00,000
Underlying on Selling Date	130
Volatility	0.2689
Rate of Interest	0.07
Black - Scholes Price per option	4.13

Calculation of Option Greeks: -

S.No.	Date	Expiry	Time to Maturity	Underlying Value	Delta	Gamma	Theta	Vega	Rho
1	01-Dec-23	28-Dec-23	0.0740	130	0.5428	0.0417	-30.14	14.02	4.914
2	04-Dec-23	28-Dec-23	0.0658	131	0.5841	0.0432	-31.84	13.10	4.739
3	05-Dec-23	28-Dec-23	0.0630	131.6	0.6104	0.0432	-32.33	12.67	4.765
4	06-Dec-23	28-Dec-23	0.0603	131.85	0.6221	0.0437	-32.85	12.30	4.656
5	07-Dec-23	28-Dec-23	0.0575	130	0.5377	0.0474	-33.58	12.38	3.814
6	08-Dec-23	28-Dec-23	0.0548	129.2	0.4977	0.0491	-33.89	12.07	3.354
7	11-Dec-23	28-Dec-23	0.0466	130.05	0.5366	0.0526	-36.84	11.15	3.099
8	12-Dec-23	28-Dec-23	0.0438	130.1	0.5384	0.0542	-37.86	10.82	2.931
9	13-Dec-23	28-Dec-23	0.0411	131.4	0.6089	0.0536	-38.80	10.23	3.132
10	14-Dec-23	28-Dec-23	0.0384	132	0.6433	0.0536	-39.45	9.64	3.100
11	15-Dec-23	28-Dec-23	0.0356	136.45	0.8482	0.0339	-30.43	6.05	3.861
12	18-Dec-23	28-Dec-23	0.0274	136.6	0.8806	0.0328	-30.03	4.51	3.098
13	19-Dec-23	28-Dec-23	0.0247	135.4	0.8475	0.0412	-34.93	5.01	2.679
14	20-Dec-23	28-Dec-23	0.0219	129.75	0.5040	0.0772	-51.44	7.66	1.389
15	21-Dec-23	28-Dec-23	0.0192	131	0.6027	0.0791	-54.39	7.00	1.465
16	22-Dec-23	28-Dec-23	0.0164	133.55	0.7973	0.0613	-46.68	4.83	1.681
17	26-Dec-23	28-Dec-23	0.0055	135.2	0.9772	0.0201	-22.15	0.54	0.695
18	27-Dec-23	28-Dec-23	0.0027	137.2	0.9999	0.0001	-9.18	0.00	0.356
19	28-Dec-23	28-Dec-23	0.0000	138.15	1.0000	0.0000	0.00	0.00	0.000

Variation in Option Greeks with stock prices and time to maturity



Observations: -

- Delta increases for call options as underlying price rises approaching 1 for deep ITM options. (0 for deep OTM puts).
- Delta becomes more extreme (either 0 or 1) near expiry due to reduced time value of options.
- Gamma is highest for ATM options as Delta changes rapidly when the underlying price is near the strike. It decreases and becomes 0 for deep ITM and OTM options.
- Closer to expiry, Gamma spikes as small price changes can cause large shifts in Delta.
- Theta becomes more negative as time decay accelerates towards expiry (less time to realize a profit from the options).
- Option writers benefit from high Theta while option buyers face accelerated time decay as expiry approaches.
- Vega is highest for ATM options and decreases as option becomes ITM or OTM.
- Vega decreases as time to maturity decreases as options become less sensitive to changes in implied volatility as time value diminishes.
- Rho increases as underlying prices increases for call options (high interest rates increases call prices) and decreases for put options (put prices decreases with increasing interest rates)
- Rho is larger for options with more time to maturity and decreases as expiration approaches (less time to affect option prices).
- Smoothing techniques can be used to mitigate jagged patterns and help visualize trends better.

Delta Hedging: -

S.No.	Date	Expiry	Time to Maturity	Underlying Value	Delta	Shares Required (Delta*No. of options sold)	Shares Purchased/Sold	Cost of Shares Purchased/Sold	Cumulative Cost including Interest	Interest Cost
1	01-Dec-23	28-Dec-23	0.0740	130	0.5428	54275	-54275	7055775.02	7055775.02	1308.023
2	04-Dec-23	28-Dec-23	0.0658	131	0.5841	58409	-4134	541494.46	7598577.50	1408.65
3	05-Dec-23	28-Dec-23	0.0630	131.6	0.6104	61038	-2630	346056.22	7946042.37	1473.064
4	06-Dec-23	28-Dec-23	0.0603	131.85	0.6221	62209	-1170	154287.25	8101802.68	1501.939
5	07-Dec-23	28-Dec-23	0.0575	130	0.5377	53772	8437	-1096750.68	7006553.94	1298.898
6	08-Dec-23	28-Dec-23	0.0548	129.2	0.4977	49774	3998	-516508.73	6491344.11	1203.387
7	11-Dec-23	28-Dec-23	0.0466	130.05	0.5366	53658	-3884	505092.68	6997640.17	1297.246
8	12-Dec-23	28-Dec-23	0.0438	130.1	0.5384	53836	-178	23190.11	7022127.53	1301.785
9	13-Dec-23	28-Dec-23	0.0411	131.4	0.6089	60893	-7057	927242.53	7950671.84	1473.922
10	14-Dec-23	28-Dec-23	0.0384	132	0.6433	64327	-3434	453336.05	8405481.82	1558.236
11	15-Dec-23	28-Dec-23	0.0356	136.45	0.8482	84819	-20492	2796116.79	11203156.84	2076.879
12	18-Dec-23	28-Dec-23	0.0274	136.6	0.8806	88060	-3241	442694.84	11647928.56	2159.332
13	19-Dec-23	28-Dec-23	0.0247	135.4	0.8475	84752	3308	-447898.01	11202189.88	2076.699
14	20-Dec-23	28-Dec-23	0.0219	129.75	0.5040	50403	34349	-4456843.89	6747422.70	1250.86
15	21-Dec-23	28-Dec-23	0.0192	131	0.6027	60274	-9871	1293165.42	8041838.98	1490.823
16	22-Dec-23	28-Dec-23	0.0164	133.55	0.7973	79731	-19457	2598525.65	10641855.46	1972.823
17	26-Dec-23	28-Dec-23	0.0055	135.2	0.9772	97723	-17992	2432464.40	13076292.67	2424.127
18	27-Dec-23	28-Dec-23	0.0027	137.2	0.9999	99994	-2271	311597.56	13390314.37	2482.341
19	28-Dec-23	28-Dec-23	0.0000	138.15	1.0000	100000	-6	814.04	13393610.75	

Negative is Buy
Positive is Sold

Cumulative Cost (as on 28-Dec-23)	13393610.75
Money received for stocks held (as on 28-Dec-2023)	13000000.00
Cost of Hedging	393610.75
Discounted Cost of Hedging (as on 1-Dec-2023)	391573.10
Premium received for options written (as on 1-Dec-2023)	413000.00

9.3 APPENDIX 3 - LIST OF OPTIONS

In the Money (ITM) Call Options

S.No.	Date	Strike Price	Close	Underlying Value	Maturity Time	Binomial Price	BSM Price	MC Price	Implied Volatility	Valuation
1	01-12-23	100	28.6	130	0.073973	30.52	30.52	30.5	7.57E-07	Undervalued
2	01-12-23	110	18.7	130	0.073973	20.57	20.6	20.58	3.07E-07	Undervalued
3	01-12-23	115	14.45	130	0.073973	15.59	15.74	15.73	4.46E-08	Undervalued
4	01-12-23	120	11.15	130	0.073973	11.28	11.17	11.16	0.265997	Undervalued
5	01-12-23	122	9.5	130	0.073973	9.76	9.49	9.48	0.270437	Overvalued
6	01-12-23	123	8.55	130	0.073973	9	8.69	8.68	0.253735	Undervalued
7	01-12-23	124	7.75	130	0.073973	8.24	7.93	7.92	0.252393	Undervalued
8	01-12-23	125	7.05	130	0.073973	7.49	7.2	7.19	0.25634	Undervalued
9	01-12-23	126	6.2	130	0.073973	6.73	6.5	6.5	0.243694	Undervalued
10	01-12-23	127	5.55	130	0.073973	5.97	5.85	5.84	0.245993	Undervalued
11	01-12-23	128	4.9	130	0.073973	5.21	5.23	5.23	0.243887	Undervalued
12	01-12-23	129	4.3	130	0.073973	4.45	4.66	4.66	0.242948	Undervalued
13	04-12-23	110	22	131	0.065753	21.51	21.52	21.5	0.484635	Overvalued
14	04-12-23	115	16.8	131	0.065753	16.53	16.61	16.59	0.338747	Overvalued
15	04-12-23	120	12	131	0.065753	11.83	11.91	11.9	0.284471	Overvalued
16	04-12-23	121	10.9	131	0.065753	11.07	11.02	11.01	0.247499	Undervalued
17	04-12-23	122	9.8	131	0.065753	10.31	10.16	10.15	0.208167	Undervalued
18	04-12-23	124	8.55	131	0.065753	8.8	8.51	8.5	0.273208	Overvalued
19	04-12-23	125	7.55	131	0.065753	8.04	7.73	7.73	0.249632	Undervalued
20	04-12-23	126	6.8	131	0.065753	7.28	6.99	6.99	0.250748	Undervalued
21	04-12-23	127	6.05	131	0.065753	6.52	6.29	6.29	0.247526	Undervalued
22	04-12-23	128	5.35	131	0.065753	5.77	5.63	5.63	0.245604	Undervalued
23	04-12-23	129	4.7	131	0.065753	5.01	5.01	5.01	0.244222	Undervalued
24	04-12-23	130	4.15	131	0.065753	4.25	4.44	4.43	0.247217	Undervalued
25	05-12-23	100	30	131.6	0.063014	32.04	32.04	32.02	6.34E-07	Undervalued
26	05-12-23	110	22.1	131.6	0.063014	22.08	22.09	22.08	0.280615	Overvalued
27	05-12-23	115	17.2	131.6	0.063014	17.11	17.17	17.15	0.290463	Overvalued
28	05-12-23	120	12.6	131.6	0.063014	12.22	12.42	12.41	0.305294	Overvalued
29	05-12-23	122	10.6	131.6	0.063014	10.7	10.63	10.62	0.265107	Undervalued
30	05-12-23	124	8.85	131.6	0.063014	9.19	8.94	8.93	0.257348	Undervalued
31	05-12-23	125	8.2	131.6	0.063014	8.43	8.14	8.13	0.275552	Overvalued
32	05-12-23	126	7.3	131.6	0.063014	7.67	7.37	7.37	0.26193	Undervalued
33	05-12-23	127	6.7	131.6	0.063014	6.91	6.65	6.64	0.273482	Overvalued
34	05-12-23	128	5.9	131.6	0.063014	6.16	5.96	5.95	0.263978	Undervalued

35	05-12-23	129	5.25	131.6	0.063014	5.4	5.31	5.31	0.264324	Undervalued
36	05-12-23	130	4.65	131.6	0.063014	4.64	4.71	4.7	0.264652	Undervalued
37	05-12-23	131	4.05	131.6	0.063014	3.88	4.15	4.15	0.261079	Undervalued
38	06-12-23	120	12.8	131.85	0.060274	12.36	12.6	12.59	0.31065	Overvalued
39	06-12-23	121	11.6	131.85	0.060274	11.57	11.69	11.68	0.249227	Undervalued
40	06-12-23	122	10.7	131.85	0.060274	10.82	10.8	10.79	0.251212	Undervalued
41	06-12-23	124	10	131.85	0.060274	9.3	9.08	9.07	0.373399	Overvalued
42	06-12-23	125	8.5	131.85	0.060274	8.54	8.27	8.26	0.295006	Overvalued
43	06-12-23	126	7.55	131.85	0.060274	7.79	7.49	7.49	0.274757	Overvalued
44	06-12-23	127	6.85	131.85	0.060274	7.03	6.75	6.74	0.278982	Overvalued
45	06-12-23	128	6.1	131.85	0.060274	6.27	6.05	6.04	0.273166	Overvalued
46	06-12-23	129	5.45	131.85	0.060274	5.51	5.39	5.38	0.27378	Overvalued
47	06-12-23	130	4.75	131.85	0.060274	4.76	4.77	4.77	0.266979	Undervalued
48	06-12-23	131	4.2	131.85	0.060274	4	4.2	4.2	0.268696	Undervalued
49	07-12-23	110	21.6	130	0.057534	20.44	20.45	20.44	0.629879	Overvalued
50	07-12-23	115	15.8	130	0.057534	15.46	15.54	15.52	0.362211	Overvalued
51	07-12-23	119	12.05	130	0.057534	11.56	11.75	11.74	0.328043	Overvalued
52	07-12-23	120	11	130	0.057534	10.8	10.85	10.84	0.296372	Overvalued
53	07-12-23	121	10.65	130	0.057534	10.04	9.96	9.95	0.363896	Overvalued
54	07-12-23	122	9.1	130	0.057534	9.29	9.11	9.1	0.26789	Undervalued
55	07-12-23	123	8.65	130	0.057534	8.53	8.28	8.27	0.313008	Overvalued
56	07-12-23	124	7.6	130	0.057534	7.77	7.49	7.48	0.281793	Overvalued
57	07-12-23	125	6.85	130	0.057534	7.01	6.73	6.73	0.280908	Overvalued
58	07-12-23	126	6.15	130	0.057534	6.26	6.02	6.01	0.281434	Overvalued
59	07-12-23	127	5.4	130	0.057534	5.5	5.35	5.34	0.273658	Overvalued
60	07-12-23	128	4.75	130	0.057534	4.74	4.72	4.72	0.271297	Overvalued
61	07-12-23	129	4.15	130	0.057534	3.98	4.14	4.14	0.27013	Overvalued
62	08-12-23	110	21.8	129.2	0.054795	19.62	19.63	19.62	0.78207	Overvalued
63	08-12-23	115	15.1	129.2	0.054795	14.64	14.72	14.71	0.384911	Overvalued
64	08-12-23	118	12.2	129.2	0.054795	11.65	11.88	11.87	0.336701	Overvalued
65	08-12-23	120	10.55	129.2	0.054795	10.09	10.07	10.06	0.343515	Overvalued
66	08-12-23	122	8.05	129.2	0.054795	8.58	8.36	8.35	0.222727	Undervalued
67	08-12-23	123	7.3	129.2	0.054795	7.82	7.55	7.55	0.236576	Undervalued
68	08-12-23	124	6.95	129.2	0.054795	7.06	6.78	6.78	0.286229	Overvalued
69	08-12-23	125	6.25	129.2	0.054795	6.3	6.06	6.05	0.288612	Overvalued
70	08-12-23	126	5.5	129.2	0.054795	5.55	5.37	5.37	0.280669	Overvalued
71	08-12-23	127	4.8	129.2	0.054795	4.79	4.73	4.73	0.274662	Overvalued
72	08-12-23	128	4.2	129.2	0.054795	4.03	4.14	4.14	0.273868	Overvalued
73	08-12-23	129	3.7	129.2	0.054795	3.27	3.59	3.59	0.277513	Overvalued
74	11-12-23	110	20.35	130.05	0.046575	20.41	20.41	20.4	4.83E-07	Undervalued
75	11-12-23	112	18.55	130.05	0.046575	18.41	18.42	18.41	0.38849	Overvalued
76	11-12-23	115	16	130.05	0.046575	15.42	15.46	15.45	0.458248	Overvalued
77	11-12-23	120	11.15	130.05	0.046575	10.49	10.68	10.67	0.363057	Overvalued
78	11-12-23	123	8.35	130.05	0.046575	8.22	8.04	8.03	0.313582	Overvalued

79	11-12-23	124	7.65	130.05	0.046575	7.46	7.22	7.22	0.322215	Overvalued
80	11-12-23	125	6.85	130.05	0.046575	6.7	6.44	6.44	0.315348	Overvalued
81	11-12-23	126	6.25	130.05	0.046575	5.95	5.71	5.7	0.325966	Overvalued
82	11-12-23	127	5.4	130.05	0.046575	5.19	5.02	5.01	0.306798	Overvalued
83	11-12-23	128	4.7	130.05	0.046575	4.43	4.38	4.37	0.299761	Overvalued
84	11-12-23	129	4.15	130.05	0.046575	3.67	3.79	3.78	0.302191	Overvalued
85	11-12-23	130	3.65	130.05	0.046575	2.92	3.25	3.25	0.304675	Overvalued
86	12-12-23	110	21.9	130.1	0.043836	20.44	20.44	20.43	0.777116	Overvalued
87	12-12-23	112	17.75	130.1	0.043836	18.44	18.45	18.44	1.43E-07	Undervalued
88	12-12-23	115	18.2	130.1	0.043836	15.45	15.48	15.47	0.81145	Overvalued
89	12-12-23	120	10.95	130.1	0.043836	10.47	10.68	10.67	0.332534	Overvalued
90	12-12-23	121	11.6	130.1	0.043836	9.68	9.76	9.76	0.540251	Overvalued
91	12-12-23	122	9.15	130.1	0.043836	8.92	8.87	8.87	0.317589	Overvalued
92	12-12-23	123	8.4	130.1	0.043836	8.16	8.01	8.01	0.326595	Overvalued
93	12-12-23	124	8.05	130.1	0.043836	7.41	7.19	7.18	0.377725	Overvalued
94	12-12-23	125	7.05	130.1	0.043836	6.65	6.4	6.39	0.345879	Overvalued
95	12-12-23	126	6.4	130.1	0.043836	5.89	5.65	5.65	0.349872	Overvalued
96	12-12-23	127	5.6	130.1	0.043836	5.13	4.96	4.95	0.335177	Overvalued
97	12-12-23	128	4.9	130.1	0.043836	4.38	4.31	4.31	0.32633	Overvalued
98	12-12-23	129	4.2	130.1	0.043836	3.62	3.71	3.71	0.314611	Overvalued
99	12-12-23	130	3.75	130.1	0.043836	2.86	3.17	3.17	0.321865	Overvalued
100	13-12-23	100	30.55	131.4	0.041096	31.69	31.69	31.67	7.33E-09	Undervalued
101	13-12-23	120	12.15	131.4	0.041096	11.74	11.86	11.85	0.353643	Overvalued
102	13-12-23	122	9.85	131.4	0.041096	9.83	10	9.99	0.220641	Undervalued
103	13-12-23	123	9.45	131.4	0.041096	9.08	9.09	9.09	0.335627	Overvalued
104	13-12-23	124	7.7	131.4	0.041096	8.32	8.22	8.21	2.04E-08	Undervalued
105	13-12-23	125	7.6	131.4	0.041096	7.56	7.38	7.37	0.301862	Overvalued
106	13-12-23	126	6.8	131.4	0.041096	6.81	6.57	6.56	0.298335	Overvalued
107	13-12-23	127	6	131.4	0.041096	6.05	5.81	5.8	0.291732	Overvalued
108	13-12-23	128	5.25	131.4	0.041096	5.29	5.09	5.09	0.286001	Overvalued
109	13-12-23	129	4.6	131.4	0.041096	4.54	4.43	4.42	0.286281	Overvalued
110	13-12-23	130	4	131.4	0.041096	3.78	3.81	3.81	0.287338	Overvalued
111	13-12-23	131	3.45	131.4	0.041096	3.02	3.25	3.25	0.287306	Overvalued
112	14-12-23	115	18.2	132	0.038356	17.31	17.32	17.3	0.615816	Overvalued
113	14-12-23	120	12.9	132	0.038356	12.32	12.4	12.39	0.417471	Overvalued
114	14-12-23	122	11.05	132	0.038356	10.33	10.5	10.49	0.392632	Overvalued
115	14-12-23	123	10.45	132	0.038356	9.44	9.58	9.57	0.427861	Overvalued
116	14-12-23	124	9.5	132	0.038356	8.69	8.68	8.67	0.405188	Overvalued
117	14-12-23	125	8.55	132	0.038356	7.93	7.81	7.8	0.380678	Overvalued
118	14-12-23	126	7.65	132	0.038356	7.17	6.98	6.97	0.361279	Overvalued
119	14-12-23	127	7	132	0.038356	6.42	6.18	6.18	0.370558	Overvalued
120	14-12-23	128	6.05	132	0.038356	5.66	5.43	5.43	0.340551	Overvalued
121	14-12-23	129	5.25	132	0.038356	4.9	4.73	4.73	0.325601	Overvalued
122	14-12-23	130	4.65	132	0.038356	4.15	4.08	4.08	0.326866	Overvalued

123	14-12-23	131	4	132	0.038356	3.39	3.49	3.49	0.319892	Overvalued
124	15-12-23	105	29.75	136.45	0.035616	31.71	31.71	31.7	5.57E-07	Undervalued
125	15-12-23	110	27.05	136.45	0.035616	26.72	26.72	26.71	0.697633	Overvalued
126	15-12-23	115	22.3	136.45	0.035616	21.74	21.74	21.72	0.656169	Overvalued
127	15-12-23	120	17.2	136.45	0.035616	16.75	16.76	16.75	0.499732	Overvalued
128	15-12-23	122	15.25	136.45	0.035616	14.75	14.78	14.77	0.460966	Overvalued
129	15-12-23	123	12.6	136.45	0.035616	13.76	13.8	13.79	3.69E-07	Undervalued
130	15-12-23	124	13.2	136.45	0.035616	12.76	12.83	12.81	0.399898	Overvalued
131	15-12-23	125	12.3	136.45	0.035616	11.76	11.86	11.85	0.395799	Overvalued
132	15-12-23	126	11.4	136.45	0.035616	10.76	10.91	10.9	0.389781	Overvalued
133	15-12-23	127	10.35	136.45	0.035616	9.77	9.98	9.97	0.353471	Overvalued
134	15-12-23	128	9.45	136.45	0.035616	9.01	9.07	9.06	0.342967	Overvalued
135	15-12-23	129	8.55	136.45	0.035616	8.25	8.18	8.18	0.332304	Overvalued
136	15-12-23	130	7.6	136.45	0.035616	7.5	7.33	7.33	0.310408	Overvalued
137	15-12-23	131	6.85	136.45	0.035616	6.74	6.52	6.51	0.31444	Overvalued
138	15-12-23	132	6.05	136.45	0.035616	5.98	5.75	5.74	0.306604	Overvalued
139	15-12-23	133	5.3	136.45	0.035616	5.23	5.02	5.02	0.300381	Overvalued
140	15-12-23	134	4.7	136.45	0.035616	4.47	4.35	4.35	0.306093	Overvalued
141	15-12-23	135	4.15	136.45	0.035616	3.71	3.73	3.73	0.311413	Overvalued
142	15-12-23	136	3.65	136.45	0.035616	2.96	3.17	3.16	0.316828	Overvalued
143	18-12-23	110	26.85	136.6	0.027397	26.81	26.81	26.8	0.57667	Overvalued
144	18-12-23	115	21.75	136.6	0.027397	21.82	21.82	21.81	6.7E-07	Undervalued
145	18-12-23	120	17.4	136.6	0.027397	16.83	16.83	16.82	0.60496	Overvalued
146	18-12-23	121	15.7	136.6	0.027397	15.83	15.84	15.83	4.35E-07	Undervalued
147	18-12-23	123	14.5	136.6	0.027397	13.84	13.85	13.84	0.542116	Overvalued
148	18-12-23	124	13.45	136.6	0.027397	12.84	12.86	12.85	0.499921	Overvalued
149	18-12-23	125	12.5	136.6	0.027397	11.84	11.88	11.87	0.48142	Overvalued
150	18-12-23	126	11.15	136.6	0.027397	10.84	10.91	10.9	0.365783	Overvalued
151	18-12-23	127	10.5	136.6	0.027397	9.84	9.96	9.95	0.420083	Overvalued
152	18-12-23	128	9.45	136.6	0.027397	8.85	9.02	9.01	0.378959	Overvalued
153	18-12-23	129	8.9	136.6	0.027397	8.02	8.1	8.09	0.426911	Overvalued
154	18-12-23	130	7.6	136.6	0.027397	7.27	7.21	7.21	0.342449	Overvalued
155	18-12-23	131	6.85	136.6	0.027397	6.51	6.36	6.36	0.348818	Overvalued
156	18-12-23	132	6	136.6	0.027397	5.76	5.55	5.55	0.334191	Overvalued
157	18-12-23	133	5.25	136.6	0.027397	5	4.8	4.79	0.329315	Overvalued
158	18-12-23	134	4.7	136.6	0.027397	4.25	4.09	4.09	0.343252	Overvalued
159	18-12-23	135	4.15	136.6	0.027397	3.49	3.45	3.45	0.35026	Overvalued
160	18-12-23	136	3.6	136.6	0.027397	2.73	2.87	2.87	0.349959	Overvalued
161	19-12-23	115	20.25	135.4	0.024658	20.6	20.6	20.59	6.87E-08	Undervalued
162	19-12-23	120	15.7	135.4	0.024658	15.61	15.61	15.6	0.410406	Overvalued
163	19-12-23	124	12.1	135.4	0.024658	11.61	11.65	11.64	0.461271	Overvalued
164	19-12-23	125	10.7	135.4	0.024658	10.62	10.67	10.66	0.290645	Overvalued
165	19-12-23	126	9.95	135.4	0.024658	9.62	9.71	9.7	0.360689	Overvalued
166	19-12-23	127	9.45	135.4	0.024658	8.62	8.76	8.75	0.441798	Overvalued

167	19-12-23	128	7.85	135.4	0.024658	7.73	7.84	7.83	0.272516	Overvalued
168	19-12-23	129	7.05	135.4	0.024658	6.97	6.94	6.94	0.29438	Overvalued
169	19-12-23	130	6.05	135.4	0.024658	6.22	6.09	6.08	0.260678	Undervalued
170	19-12-23	131	5.2	135.4	0.024658	5.46	5.27	5.27	0.256148	Undervalued
171	19-12-23	132	4.45	135.4	0.024658	4.71	4.51	4.51	0.259838	Undervalued
172	19-12-23	133	3.85	135.4	0.024658	3.95	3.81	3.81	0.273329	Overvalued
173	19-12-23	134	3.3	135.4	0.024658	3.2	3.18	3.17	0.284652	Overvalued
174	19-12-23	135	2.8	135.4	0.024658	2.44	2.61	2.6	0.292112	Overvalued
175	20-12-23	105	28.6	129.75	0.021918	24.91	24.91	24.9	1.795311	Overvalued
176	20-12-23	110	22.5	129.75	0.021918	19.92	19.92	19.91	1.326941	Overvalued
177	20-12-23	115	16.6	129.75	0.021918	14.93	14.93	14.92	0.920466	Overvalued
178	20-12-23	120	10.05	129.75	0.021918	9.93	9.98	9.97	0.321994	Overvalued
179	20-12-23	123	7.05	129.75	0.021918	7.02	7.13	7.12	0.237972	Undervalued
180	20-12-23	124	6.3	129.75	0.021918	6.27	6.24	6.23	0.28473	Overvalued
181	20-12-23	125	5.4	129.75	0.021918	5.51	5.38	5.38	0.271977	Overvalued
182	20-12-23	126	4.65	129.75	0.021918	4.76	4.58	4.58	0.281152	Overvalued
183	20-12-23	127	3.9	129.75	0.021918	4	3.84	3.84	0.278618	Overvalued
184	20-12-23	128	3.1	129.75	0.021918	3.25	3.16	3.16	0.259389	Undervalued
185	20-12-23	129	2.4	129.75	0.021918	2.49	2.56	2.56	0.247008	Undervalued
186	21-12-23	115	15.5	131	0.019178	16.15	16.15	16.14	3.07E-07	Undervalued
187	21-12-23	120	11.4	131	0.019178	11.16	11.17	11.17	0.438184	Overvalued
188	21-12-23	122	7.8	131	0.019178	9.16	9.21	9.2	4.59E-07	Undervalued
189	21-12-23	123	7.8	131	0.019178	8.17	8.25	8.24	1.78E-07	Undervalued
190	21-12-23	124	7.6	131	0.019178	7.17	7.3	7.3	0.365678	Overvalued
191	21-12-23	125	6.6	131	0.019178	6.34	6.39	6.38	0.328302	Overvalued
192	21-12-23	126	5.65	131	0.019178	5.59	5.51	5.5	0.302419	Overvalued
193	21-12-23	127	4.75	131	0.019178	4.83	4.68	4.68	0.282256	Overvalued
194	21-12-23	128	3.95	131	0.019178	4.08	3.91	3.91	0.275249	Overvalued
195	21-12-23	129	3.1	131	0.019178	3.32	3.21	3.21	0.251821	Undervalued
196	21-12-23	130	2.45	131	0.019178	2.57	2.58	2.58	0.250281	Undervalued
197	22-12-23	100	34.05	133.55	0.016438	33.67	33.67	33.66	1.352718	Overvalued
198	22-12-23	115	19	133.55	0.016438	18.68	18.68	18.67	0.760162	Overvalued
199	22-12-23	120	13.8	133.55	0.016438	13.69	13.69	13.68	0.468102	Overvalued
200	22-12-23	125	9	133.55	0.016438	8.69	8.74	8.73	0.405836	Overvalued
201	22-12-23	126	7.7	133.55	0.016438	7.69	7.77	7.77	0.175706	Undervalued
202	22-12-23	127	7	133.55	0.016438	6.7	6.83	6.82	0.331345	Overvalued
203	22-12-23	128	6	133.55	0.016438	5.89	5.92	5.91	0.295591	Overvalued
204	22-12-23	129	5.1	133.55	0.016438	5.14	5.05	5.04	0.281937	Overvalued
205	22-12-23	130	4.1	133.55	0.016438	4.38	4.23	4.23	0.241037	Undervalued
206	22-12-23	131	3.25	133.55	0.016438	3.63	3.48	3.48	0.22785	Undervalued
207	22-12-23	132	2.4	133.55	0.016438	2.87	2.8	2.8	0.20428	Undervalued
208	22-12-23	133	1.85	133.55	0.016438	2.12	2.2	2.2	0.216723	Undervalued
209	26-12-23	100	35.15	135.2	0.005479	35.24	35.24	35.23	2.97E-08	Undervalued
210	26-12-23	105	30.9	135.2	0.005479	30.24	30.24	30.23	2.341939	Overvalued

211	26-12-23	110	25.4	135.2	0.005479	25.24	25.24	25.24	1.493461	Overvalued
212	26-12-23	115	20.45	135.2	0.005479	20.24	20.24	20.24	1.274651	Overvalued
213	26-12-23	120	15.3	135.2	0.005479	15.25	15.25	15.24	0.785889	Overvalued
214	26-12-23	122	13.25	135.2	0.005479	13.25	13.25	13.24	0.160399	Undervalued
215	26-12-23	123	12.3	135.2	0.005479	12.25	12.25	12.24	0.637775	Overvalued
216	26-12-23	124	12	135.2	0.005479	11.25	11.25	11.24	1.091202	Overvalued
217	26-12-23	125	10.25	135.2	0.005479	10.25	10.25	10.24	0.089039	Undervalued
218	26-12-23	126	9.85	135.2	0.005479	9.25	9.25	9.24	0.882333	Overvalued
219	26-12-23	127	8.25	135.2	0.005479	8.25	8.25	8.24	0.04415	Undervalued
220	26-12-23	128	7.45	135.2	0.005479	7.25	7.25	7.25	0.539538	Overvalued
221	26-12-23	129	6.15	135.2	0.005479	6.25	6.26	6.25	1.76E-07	Undervalued
222	26-12-23	130	5.2	135.2	0.005479	5.25	5.27	5.27	1.95E-07	Undervalued
223	26-12-23	131	4.35	135.2	0.005479	4.25	4.31	4.31	0.302834	Overvalued
224	26-12-23	132	3.35	135.2	0.005479	3.39	3.39	3.39	0.245869	Undervalued
225	26-12-23	133	2.5	135.2	0.005479	2.63	2.55	2.55	0.250203	Undervalued
226	26-12-23	134	1.8	135.2	0.005479	1.88	1.81	1.81	0.265094	Undervalued
227	26-12-23	135	1.2	135.2	0.005479	1.13	1.2	1.2	0.267047	Undervalued
228	27-12-23	100	36.7	137.2	0.00274	37.22	37.22	37.22	1.22E-07	Undervalued
229	27-12-23	105	30.9	137.2	0.00274	32.22	32.22	32.22	4.18E-07	Undervalued
230	27-12-23	110	27	137.2	0.00274	27.22	27.22	27.22	1.37E-07	Undervalued
231	27-12-23	115	22.25	137.2	0.00274	22.22	22.22	22.22	1.424917	Overvalued
232	27-12-23	116	20.65	137.2	0.00274	21.22	21.22	21.22	4.14E-07	Undervalued
233	27-12-23	117	20.35	137.2	0.00274	20.22	20.22	20.22	1.628158	Overvalued
234	27-12-23	118	19.35	137.2	0.00274	19.22	19.22	19.22	1.554629	Overvalued
235	27-12-23	119	18.1	137.2	0.00274	18.22	18.22	18.22	4.95E-07	Undervalued
236	27-12-23	120	17.2	137.2	0.00274	17.22	17.22	17.22	2.25E-07	Undervalued
237	27-12-23	122	15.15	137.2	0.00274	15.22	15.22	15.22	2.45E-07	Undervalued
238	27-12-23	123	13	137.2	0.00274	14.22	14.22	14.22	6.13E-07	Undervalued
239	27-12-23	125	12.3	137.2	0.00274	12.22	12.22	12.22	0.959556	Overvalued
240	27-12-23	126	11.1	137.2	0.00274	11.22	11.22	11.22	2.37E-08	Undervalued
241	27-12-23	127	9.75	137.2	0.00274	10.22	10.22	10.22	1.25E-07	Undervalued
242	27-12-23	128	9.5	137.2	0.00274	9.22	9.22	9.22	0.981385	Overvalued
243	27-12-23	129	7.9	137.2	0.00274	8.22	8.22	8.22	8.34E-08	Undervalued
244	27-12-23	130	7.15	137.2	0.00274	7.22	7.22	7.22	1.92E-07	Undervalued
245	27-12-23	131	6.15	137.2	0.00274	6.23	6.23	6.22	5.78E-08	Undervalued
246	27-12-23	132	5.1	137.2	0.00274	5.23	5.23	5.22	1.06E-07	Undervalued
247	27-12-23	133	4.15	137.2	0.00274	4.23	4.23	4.23	6.45E-07	Undervalued
248	27-12-23	134	3.3	137.2	0.00274	3.23	3.26	3.26	0.314435	Overvalued
249	27-12-23	135	2.2	137.2	0.00274	2.35	2.34	2.34	3.05E-07	Undervalued
250	27-12-23	136	1.5	137.2	0.00274	1.6	1.53	1.53	0.25563	Undervalued
251	27-12-23	137	0.9	137.2	0.00274	0.85	0.89	0.89	0.274222	Overvalued

Out of Money (OTM) Call Options

S. No.	Date	Strike Price	Underlying Value	Maturity Time	Binomial Price	BSM Price	MC Price	Implied Volatility	Valuation
1	1-12-23	131	130	0.073973	3.44	3.64	3.64	0.248356	Undervalued
2	1-12-23	132	130	0.073973	3.17	3.19	3.19	0.248373	Undervalued
3	1-12-23	133	130	0.073973	2.91	2.78	2.78	0.248454	Undervalued
4	1-12-23	134	130	0.073973	2.65	2.41	2.41	0.249388	Undervalued
5	1-12-23	135	130	0.073973	2.39	2.08	2.08	0.251125	Undervalued
6	1-12-23	136	130	0.073973	2.13	1.78	1.79	0.258068	Undervalued
7	1-12-23	137	130	0.073973	1.87	1.52	1.53	0.258568	Undervalued
8	1-12-23	138	130	0.073973	1.61	1.29	1.3	0.260898	Undervalued
9	1-12-23	139	130	0.073973	1.35	1.09	1.1	0.26479	Undervalued
10	1-12-23	140	130	0.073973	1.09	0.91	0.92	0.267345	Undervalued
11	1-12-23	141	130	0.073973	0.83	0.76	0.77	0.273492	Overvalued
12	1-12-23	142	130	0.073973	0.57	0.63	0.64	0.277995	Overvalued
13	1-12-23	143	130	0.073973	0.3	0.52	0.53	0.279882	Overvalued
14	1-12-23	144	130	0.073973	0.04	0.43	0.43	0.287113	Overvalued
15	1-12-23	145	130	0.073973	0	0.35	0.35	0.286396	Overvalued
16	1-12-23	146	130	0.073973	0	0.28	0.29	0.292222	Overvalued
17	1-12-23	147	130	0.073973	0	0.23	0.23	0.304016	Overvalued
18	1-12-23	148	130	0.073973	0	0.18	0.19	0.307457	Overvalued
19	1-12-23	149	130	0.073973	0	0.15	0.15	0.309882	Overvalued
20	4-12-23	132	131	0.065753	3.23	3.41	3.41	0.245385	Undervalued
21	4-12-23	133	131	0.065753	2.97	2.97	2.97	0.24859	Undervalued
22	4-12-23	134	131	0.065753	2.71	2.57	2.57	0.248227	Undervalued
23	4-12-23	135	131	0.065753	2.45	2.21	2.21	0.252503	Undervalued
24	4-12-23	136	131	0.065753	2.19	1.88	1.89	0.253774	Undervalued
25	4-12-23	137	131	0.065753	1.93	1.6	1.6	0.256249	Undervalued
26	4-12-23	138	131	0.065753	1.67	1.35	1.35	0.259864	Undervalued
27	4-12-23	139	131	0.065753	1.41	1.13	1.14	0.265907	Undervalued
28	4-12-23	140	131	0.065753	1.15	0.94	0.95	0.269923	Overvalued
29	4-12-23	141	131	0.065753	0.89	0.78	0.79	0.27186	Overvalued
30	4-12-23	142	131	0.065753	0.63	0.64	0.65	0.276791	Overvalued
31	4-12-23	143	131	0.065753	0.37	0.52	0.53	0.279917	Overvalued
32	4-12-23	144	131	0.065753	0.11	0.43	0.43	0.289008	Overvalued
33	4-12-23	145	131	0.065753	0	0.34	0.35	0.29594	Overvalued
34	4-12-23	146	131	0.065753	0	0.28	0.28	0.30282	Overvalued
35	4-12-23	147	131	0.065753	0	0.22	0.22	0.308493	Overvalued
36	4-12-23	148	131	0.065753	0	0.17	0.18	0.311999	Overvalued
37	4-12-23	149	131	0.065753	0	0.14	0.14	0.313895	Overvalued
38	4-12-23	150	131	0.065753	0	0.11	0.11	0.327154	Overvalued
39	5-12-23	132	131.6	0.063014	3.33	3.63	3.63	0.262659	Undervalued
40	5-12-23	133	131.6	0.063014	3.07	3.16	3.16	0.26431	Undervalued
41	5-12-23	134	131.6	0.063014	2.81	2.74	2.73	0.26219	Undervalued

42	5-12-23	135	131.6	0.063014	2.54	2.35	2.35	0.264967	Undervalued
43	5-12-23	136	131.6	0.063014	2.28	2.01	2.01	0.26816	Undervalued
44	5-12-23	137	131.6	0.063014	2.02	1.7	1.71	0.272814	Overvalued
45	5-12-23	138	131.6	0.063014	1.76	1.44	1.44	0.27416	Overvalued
46	5-12-23	139	131.6	0.063014	1.5	1.2	1.21	0.277946	Overvalued
47	5-12-23	140	131.6	0.063014	1.24	1	1.01	0.284238	Overvalued
48	5-12-23	141	131.6	0.063014	0.98	0.83	0.84	0.287673	Overvalued
49	5-12-23	142	131.6	0.063014	0.72	0.68	0.69	0.289653	Overvalued
50	5-12-23	143	131.6	0.063014	0.46	0.56	0.56	0.295041	Overvalued
51	5-12-23	144	131.6	0.063014	0.2	0.45	0.46	0.299036	Overvalued
52	5-12-23	145	131.6	0.063014	0	0.36	0.37	0.307698	Overvalued
53	5-12-23	146	131.6	0.063014	0	0.29	0.3	0.307675	Overvalued
54	5-12-23	147	131.6	0.063014	0	0.23	0.23	0.313683	Overvalued
55	5-12-23	148	131.6	0.063014	0	0.18	0.19	0.319862	Overvalued
56	5-12-23	149	131.6	0.063014	0	0.14	0.15	0.322907	Overvalued
57	5-12-23	150	131.6	0.063014	0	0.11	0.12	0.337053	Overvalued
58	5-12-23	151	131.6	0.063014	0	0.09	0.09	0.326444	Overvalued
59	6-12-23	132	131.85	0.060274	3.32	3.67	3.67	0.266954	Undervalued
60	6-12-23	133	131.85	0.060274	3.06	3.19	3.19	0.269351	Overvalued
61	6-12-23	134	131.85	0.060274	2.8	2.76	2.76	0.272082	Overvalued
62	6-12-23	135	131.85	0.060274	2.54	2.37	2.37	0.275815	Overvalued
63	6-12-23	136	131.85	0.060274	2.28	2.02	2.02	0.2802	Overvalued
64	6-12-23	137	131.85	0.060274	2.02	1.71	1.71	0.281276	Overvalued
65	6-12-23	138	131.85	0.060274	1.76	1.43	1.44	0.288653	Overvalued
66	6-12-23	139	131.85	0.060274	1.5	1.2	1.21	0.29314	Overvalued
67	6-12-23	140	131.85	0.060274	1.24	0.99	1	0.30051	Overvalued
68	6-12-23	141	131.85	0.060274	0.98	0.82	0.83	0.300125	Overvalued
69	6-12-23	142	131.85	0.060274	0.72	0.67	0.68	0.309567	Overvalued
70	6-12-23	143	131.85	0.060274	0.46	0.54	0.55	0.309766	Overvalued
71	6-12-23	144	131.85	0.060274	0.2	0.44	0.44	0.321521	Overvalued
72	6-12-23	145	131.85	0.060274	0	0.35	0.36	0.324638	Overvalued
73	6-12-23	146	131.85	0.060274	0	0.28	0.28	0.326405	Overvalued
74	6-12-23	147	131.85	0.060274	0	0.22	0.22	0.334289	Overvalued
75	6-12-23	148	131.85	0.060274	0	0.17	0.18	0.34161	Overvalued
76	6-12-23	149	131.85	0.060274	0	0.14	0.14	0.347039	Overvalued
77	6-12-23	150	131.85	0.060274	0	0.11	0.11	0.35203	Overvalued
78	6-12-23	151	131.85	0.060274	0	0.08	0.08	0.35372	Overvalued
79	6-12-23	152	131.85	0.060274	0	0.06	0.06	0.356218	Overvalued
80	7-12-23	131	130	0.057534	2.97	3.12	3.12	0.27127	Overvalued
81	7-12-23	132	130	0.057534	2.71	2.68	2.68	0.270711	Overvalued
82	7-12-23	133	130	0.057534	2.45	2.29	2.29	0.274576	Overvalued
83	7-12-23	134	130	0.057534	2.19	1.94	1.94	0.279119	Overvalued
84	7-12-23	135	130	0.057534	1.93	1.63	1.63	0.284491	Overvalued
85	7-12-23	136	130	0.057534	1.67	1.36	1.36	0.287004	Overvalued

86	7-12-23	137	130	0.057534	1.41	1.13	1.13	0.291737	Overvalued
87	7-12-23	138	130	0.057534	1.15	0.93	0.93	0.298902	Overvalued
88	7-12-23	139	130	0.057534	0.89	0.76	0.76	0.304194	Overvalued
89	7-12-23	140	130	0.057534	0.63	0.61	0.62	0.312641	Overvalued
90	7-12-23	141	130	0.057534	0.37	0.49	0.5	0.319933	Overvalued
91	7-12-23	142	130	0.057534	0.11	0.39	0.4	0.324917	Overvalued
92	7-12-23	143	130	0.057534	0	0.31	0.32	0.335513	Overvalued
93	7-12-23	144	130	0.057534	0	0.24	0.25	0.337704	Overvalued
94	7-12-23	145	130	0.057534	0	0.19	0.19	0.345899	Overvalued
95	7-12-23	146	130	0.057534	0	0.15	0.15	0.352349	Overvalued
96	7-12-23	147	130	0.057534	0	0.11	0.12	0.348416	Overvalued
97	7-12-23	148	130	0.057534	0	0.09	0.09	0.363071	Overvalued
98	7-12-23	149	130	0.057534	0	0.07	0.07	0.366938	Overvalued
99	7-12-23	150	130	0.057534	0	0.05	0.05	0.367314	Overvalued
100	7-12-23	151	130	0.057534	0	0.04	0.04	0.380615	Overvalued
101	7-12-23	152	130	0.057534	0	0.03	0.03	0.378855	Overvalued
102	8-12-23	130	129.2	0.054795	2.91	3.1	3.1	0.281295	Overvalued
103	8-12-23	131	129.2	0.054795	2.65	2.65	2.65	0.281675	Overvalued
104	8-12-23	132	129.2	0.054795	2.4	2.25	2.25	0.281215	Overvalued
105	8-12-23	133	129.2	0.054795	2.14	1.9	1.9	0.286885	Overvalued
106	8-12-23	134	129.2	0.054795	1.88	1.59	1.59	0.288167	Overvalued
107	8-12-23	135	129.2	0.054795	1.62	1.32	1.32	0.301332	Overvalued
108	8-12-23	136	129.2	0.054795	1.36	1.08	1.09	0.301713	Overvalued
109	8-12-23	137	129.2	0.054795	1.1	0.89	0.89	0.309472	Overvalued
110	8-12-23	138	129.2	0.054795	0.84	0.72	0.73	0.315436	Overvalued
111	8-12-23	139	129.2	0.054795	0.58	0.58	0.58	0.324185	Overvalued
112	8-12-23	140	129.2	0.054795	0.32	0.46	0.47	0.333055	Overvalued
113	8-12-23	141	129.2	0.054795	0.06	0.36	0.37	0.338288	Overvalued
114	8-12-23	142	129.2	0.054795	0	0.29	0.29	0.34241	Overvalued
115	8-12-23	143	129.2	0.054795	0	0.22	0.23	0.353125	Overvalued
116	8-12-23	144	129.2	0.054795	0	0.17	0.17	0.352849	Overvalued
117	8-12-23	145	129.2	0.054795	0	0.13	0.14	0.370111	Overvalued
118	8-12-23	146	129.2	0.054795	0	0.1	0.1	0.376238	Overvalued
119	8-12-23	147	129.2	0.054795	0	0.08	0.08	0.370302	Overvalued
120	8-12-23	148	129.2	0.054795	0	0.06	0.06	0.386221	Overvalued
121	8-12-23	149	129.2	0.054795	0	0.04	0.04	0.388441	Overvalued
122	8-12-23	150	129.2	0.054795	0	0.03	0.03	0.403184	Overvalued
123	8-12-23	151	129.2	0.054795	0	0.02	0.02	0.402691	Overvalued
124	8-12-23	152	129.2	0.054795	0	0.02	0.02	0.418199	Overvalued
125	11-12-23	131	130.05	0.046575	2.63	2.76	2.76	0.299111	Overvalued
126	11-12-23	132	130.05	0.046575	2.37	2.33	2.33	0.298295	Overvalued
127	11-12-23	133	130.05	0.046575	2.12	1.95	1.95	0.301837	Overvalued
128	11-12-23	134	130.05	0.046575	1.86	1.61	1.61	0.311284	Overvalued
129	11-12-23	135	130.05	0.046575	1.6	1.32	1.33	0.317575	Overvalued

130	11-12-23	136	130.05	0.046575	1.34	1.07	1.08	0.320295	Overvalued
131	11-12-23	137	130.05	0.046575	1.08	0.86	0.87	0.325415	Overvalued
132	11-12-23	138	130.05	0.046575	0.82	0.69	0.7	0.333829	Overvalued
133	11-12-23	139	130.05	0.046575	0.56	0.54	0.55	0.338997	Overvalued
134	11-12-23	140	130.05	0.046575	0.3	0.43	0.43	0.348345	Overvalued
135	11-12-23	141	130.05	0.046575	0.04	0.33	0.33	0.356833	Overvalued
136	11-12-23	142	130.05	0.046575	0	0.25	0.26	0.369692	Overvalued
137	11-12-23	143	130.05	0.046575	0	0.19	0.2	0.373523	Overvalued
138	11-12-23	144	130.05	0.046575	0	0.15	0.15	0.375525	Overvalued
139	11-12-23	145	130.05	0.046575	0	0.11	0.11	0.384032	Overvalued
140	11-12-23	146	130.05	0.046575	0	0.08	0.08	0.401638	Overvalued
141	11-12-23	147	130.05	0.046575	0	0.06	0.06	0.398974	Overvalued
142	11-12-23	148	130.05	0.046575	0	0.04	0.05	0.403634	Overvalued
143	11-12-23	149	130.05	0.046575	0	0.03	0.03	0.408662	Overvalued
144	11-12-23	150	130.05	0.046575	0	0.02	0.02	0.408998	Overvalued
145	11-12-23	151	130.05	0.046575	0	0.02	0.02	0.424949	Overvalued
146	11-12-23	152	130.05	0.046575	0	0.01	0.01	0.423395	Overvalued
147	12-12-23	131	130.1	0.043836	2.56	2.68	2.68	0.316339	Overvalued
148	12-12-23	132	130.1	0.043836	2.3	2.25	2.25	0.315541	Overvalued
149	12-12-23	133	130.1	0.043836	2.04	1.87	1.87	0.319259	Overvalued
150	12-12-23	134	130.1	0.043836	1.78	1.54	1.54	0.319799	Overvalued
151	12-12-23	135	130.1	0.043836	1.52	1.25	1.26	0.325996	Overvalued
152	12-12-23	136	130.1	0.043836	1.26	1.01	1.02	0.329958	Overvalued
153	12-12-23	137	130.1	0.043836	1	0.81	0.81	0.335165	Overvalued
154	12-12-23	138	130.1	0.043836	0.75	0.64	0.64	0.34309	Overvalued
155	12-12-23	139	130.1	0.043836	0.49	0.5	0.5	0.348976	Overvalued
156	12-12-23	140	130.1	0.043836	0.23	0.39	0.39	0.359221	Overvalued
157	12-12-23	141	130.1	0.043836	0	0.3	0.3	0.374237	Overvalued
158	12-12-23	142	130.1	0.043836	0	0.22	0.23	0.372219	Overvalued
159	12-12-23	143	130.1	0.043836	0	0.17	0.17	0.384107	Overvalued
160	12-12-23	144	130.1	0.043836	0	0.12	0.13	0.377032	Overvalued
161	12-12-23	145	130.1	0.043836	0	0.09	0.1	0.395231	Overvalued
162	12-12-23	146	130.1	0.043836	0	0.07	0.07	0.403586	Overvalued
163	12-12-23	147	130.1	0.043836	0	0.05	0.05	0.410583	Overvalued
164	12-12-23	148	130.1	0.043836	0	0.03	0.04	0.415824	Overvalued
165	12-12-23	149	130.1	0.043836	0	0.02	0.03	0.418768	Overvalued
166	12-12-23	150	130.1	0.043836	0	0.02	0.02	0.435243	Overvalued
167	12-12-23	151	130.1	0.043836	0	0.01	0.01	0.436446	Overvalued
168	12-12-23	152	130.1	0.043836	0	0.01	0.01	0.436976	Overvalued
169	13-12-23	132	131.4	0.041096	2.57	2.75	2.75	0.288	Overvalued
170	13-12-23	133	131.4	0.041096	2.31	2.3	2.3	0.292064	Overvalued
171	13-12-23	134	131.4	0.041096	2.05	1.91	1.91	0.296914	Overvalued
172	13-12-23	135	131.4	0.041096	1.79	1.57	1.57	0.307467	Overvalued
173	13-12-23	136	131.4	0.041096	1.53	1.27	1.27	0.309093	Overvalued

174	13-12-23	137	131.4	0.041096	1.27	1.02	1.03	0.317861	Overvalued
175	13-12-23	138	131.4	0.041096	1.02	0.81	0.82	0.323311	Overvalued
176	13-12-23	139	131.4	0.041096	0.76	0.64	0.64	0.337515	Overvalued
177	13-12-23	140	131.4	0.041096	0.5	0.5	0.5	0.343623	Overvalued
178	13-12-23	141	131.4	0.041096	0.24	0.38	0.39	0.353268	Overvalued
179	13-12-23	142	131.4	0.041096	0	0.29	0.29	0.36142	Overvalued
180	13-12-23	143	131.4	0.041096	0	0.22	0.22	0.36732	Overvalued
181	13-12-23	144	131.4	0.041096	0	0.16	0.17	0.370803	Overvalued
182	13-12-23	145	131.4	0.041096	0	0.12	0.12	0.380641	Overvalued
183	13-12-23	146	131.4	0.041096	0	0.09	0.09	0.390013	Overvalued
184	13-12-23	147	131.4	0.041096	0	0.06	0.07	0.396858	Overvalued
185	13-12-23	148	131.4	0.041096	0	0.05	0.05	0.403951	Overvalued
186	13-12-23	149	131.4	0.041096	0	0.03	0.03	0.409187	Overvalued
187	13-12-23	150	131.4	0.041096	0	0.02	0.02	0.411129	Overvalued
188	13-12-23	151	131.4	0.041096	0	0.02	0.02	0.410783	Overvalued
189	13-12-23	152	131.4	0.041096	0	0.01	0.01	0.425949	Overvalued
190	14-12-23	133	132	0.038356	2.38	2.47	2.47	0.324779	Overvalued
191	14-12-23	134	132	0.038356	2.12	2.05	2.05	0.328848	Overvalued
192	14-12-23	135	132	0.038356	1.86	1.68	1.68	0.342724	Overvalued
193	14-12-23	136	132	0.038356	1.6	1.36	1.36	0.342517	Overvalued
194	14-12-23	137	132	0.038356	1.34	1.09	1.09	0.348767	Overvalued
195	14-12-23	138	132	0.038356	1.09	0.86	0.87	0.352154	Overvalued
196	14-12-23	139	132	0.038356	0.83	0.68	0.68	0.363195	Overvalued
197	14-12-23	140	132	0.038356	0.57	0.52	0.53	0.371467	Overvalued
198	14-12-23	141	132	0.038356	0.31	0.4	0.41	0.377488	Overvalued
199	14-12-23	142	132	0.038356	0.05	0.3	0.31	0.382218	Overvalued
200	14-12-23	143	132	0.038356	0	0.23	0.23	0.390119	Overvalued
201	14-12-23	144	132	0.038356	0	0.17	0.17	0.395106	Overvalued
202	14-12-23	145	132	0.038356	0	0.12	0.13	0.400531	Overvalued
203	14-12-23	146	132	0.038356	0	0.09	0.09	0.410475	Overvalued
204	14-12-23	147	132	0.038356	0	0.06	0.07	0.41009	Overvalued
205	14-12-23	148	132	0.038356	0	0.04	0.05	0.428434	Overvalued
206	14-12-23	149	132	0.038356	0	0.03	0.03	0.422517	Overvalued
207	14-12-23	150	132	0.038356	0	0.02	0.02	0.428825	Overvalued
208	14-12-23	151	132	0.038356	0	0.01	0.02	0.445254	Overvalued
209	14-12-23	152	132	0.038356	0	0.01	0.01	0.448232	Overvalued
210	15-12-23	137	136.45	0.035616	2.48	2.66	2.66	0.316881	Overvalued
211	15-12-23	138	136.45	0.035616	2.22	2.21	2.21	0.322112	Overvalued
212	15-12-23	139	136.45	0.035616	1.96	1.82	1.82	0.332136	Overvalued
213	15-12-23	140	136.45	0.035616	1.7	1.48	1.48	0.338932	Overvalued
214	15-12-23	141	136.45	0.035616	1.44	1.19	1.19	0.341897	Overvalued
215	15-12-23	142	136.45	0.035616	1.19	0.95	0.95	0.346125	Overvalued
216	15-12-23	143	136.45	0.035616	0.93	0.74	0.75	0.352265	Overvalued
217	15-12-23	144	136.45	0.035616	0.67	0.58	0.58	0.362197	Overvalued

218	15-12-23	145	136.45	0.035616	0.41	0.44	0.45	0.369203	Overvalued
219	15-12-23	146	136.45	0.035616	0.16	0.34	0.34	0.373008	Overvalued
220	15-12-23	147	136.45	0.035616	0	0.25	0.26	0.38224	Overvalued
221	15-12-23	148	136.45	0.035616	0	0.19	0.19	0.388863	Overvalued
222	15-12-23	149	136.45	0.035616	0	0.14	0.14	0.392026	Overvalued
223	15-12-23	150	136.45	0.035616	0	0.1	0.1	0.404273	Overvalued
224	15-12-23	151	136.45	0.035616	0	0.07	0.07	0.413787	Overvalued
225	15-12-23	152	136.45	0.035616	0	0.05	0.05	0.412122	Overvalued
226	18-12-23	137	136.6	0.027397	2.18	2.36	2.36	0.356611	Overvalued
227	18-12-23	138	136.6	0.027397	1.92	1.91	1.91	0.357096	Overvalued
228	18-12-23	139	136.6	0.027397	1.66	1.52	1.52	0.369878	Overvalued
229	18-12-23	140	136.6	0.027397	1.41	1.2	1.2	0.383534	Overvalued
230	18-12-23	141	136.6	0.027397	1.15	0.93	0.93	0.386853	Overvalued
231	18-12-23	142	136.6	0.027397	0.89	0.71	0.71	0.385127	Overvalued
232	18-12-23	143	136.6	0.027397	0.64	0.53	0.54	0.39927	Overvalued
233	18-12-23	144	136.6	0.027397	0.38	0.39	0.4	0.402693	Overvalued
234	18-12-23	145	136.6	0.027397	0.12	0.29	0.29	0.418597	Overvalued
235	18-12-23	146	136.6	0.027397	0	0.21	0.21	0.423135	Overvalued
236	18-12-23	147	136.6	0.027397	0	0.14	0.15	0.433503	Overvalued
237	18-12-23	148	136.6	0.027397	0	0.1	0.1	0.441399	Overvalued
238	18-12-23	149	136.6	0.027397	0	0.07	0.07	0.456181	Overvalued
239	18-12-23	150	136.6	0.027397	0	0.05	0.05	0.46941	Overvalued
240	18-12-23	151	136.6	0.027397	0	0.03	0.03	0.470378	Overvalued
241	18-12-23	152	136.6	0.027397	0	0.02	0.02	0.480416	Overvalued
242	18-12-23	153	136.6	0.027397	0	0.01	0.01	0.488719	Overvalued
243	18-12-23	154	136.6	0.027397	0	0.01	0.01	0.496724	Overvalued
244	18-12-23	155	136.6	0.027397	0	0	0.01	0.49911	Overvalued
245	18-12-23	156	136.6	0.027397	0	0	0	0.521361	Overvalued
246	19-12-23	136	135.4	0.024658	1.98	2.11	2.11	0.303616	Overvalued
247	19-12-23	137	135.4	0.024658	1.73	1.67	1.67	0.313498	Overvalued
248	19-12-23	138	135.4	0.024658	1.47	1.31	1.31	0.323876	Overvalued
249	19-12-23	139	135.4	0.024658	1.21	1.01	1.01	0.334587	Overvalued
250	19-12-23	140	135.4	0.024658	0.96	0.76	0.77	0.347282	Overvalued
251	19-12-23	141	135.4	0.024658	0.7	0.57	0.57	0.353492	Overvalued
252	19-12-23	142	135.4	0.024658	0.44	0.41	0.42	0.36422	Overvalued
253	19-12-23	143	135.4	0.024658	0.19	0.3	0.3	0.379771	Overvalued
254	19-12-23	144	135.4	0.024658	0	0.21	0.21	0.39109	Overvalued
255	19-12-23	145	135.4	0.024658	0	0.14	0.15	0.400976	Overvalued
256	19-12-23	146	135.4	0.024658	0	0.1	0.1	0.405283	Overvalued
257	19-12-23	147	135.4	0.024658	0	0.06	0.07	0.419558	Overvalued
258	19-12-23	148	135.4	0.024658	0	0.04	0.04	0.430858	Overvalued
259	19-12-23	149	135.4	0.024658	0	0.03	0.03	0.442796	Overvalued
260	19-12-23	150	135.4	0.024658	0	0.02	0.02	0.466584	Overvalued
261	19-12-23	151	135.4	0.024658	0	0.01	0.01	0.470982	Overvalued

262	19-12-23	152	135.4	0.024658	0	0.01	0.01	0.477194	Overvalued
263	19-12-23	153	135.4	0.024658	0	0	0	0.479815	Overvalued
264	19-12-23	154	135.4	0.024658	0	0	0	0.499235	Overvalued
265	19-12-23	155	135.4	0.024658	0	0	0	0.519967	Overvalued
266	19-12-23	156	135.4	0.024658	0	0	0	0.517692	Overvalued
267	19-12-23	157	135.4	0.024658	0	0	0	0.533419	Overvalued
268	20-12-23	130	129.75	0.021918	1.86	2.04	2.03	0.257088	Undervalued
269	20-12-23	131	129.75	0.021918	1.61	1.59	1.59	0.263908	Undervalued
270	20-12-23	132	129.75	0.021918	1.35	1.21	1.21	0.274782	Overvalued
271	20-12-23	133	129.75	0.021918	1.09	0.91	0.91	0.290257	Overvalued
272	20-12-23	134	129.75	0.021918	0.84	0.66	0.67	0.308459	Overvalued
273	20-12-23	135	129.75	0.021918	0.58	0.47	0.48	0.329325	Overvalued
274	20-12-23	136	129.75	0.021918	0.32	0.33	0.34	0.346144	Overvalued
275	20-12-23	137	129.75	0.021918	0.07	0.23	0.23	0.360721	Overvalued
276	20-12-23	138	129.75	0.021918	0	0.15	0.15	0.379619	Overvalued
277	20-12-23	139	129.75	0.021918	0	0.1	0.1	0.398484	Overvalued
278	20-12-23	140	129.75	0.021918	0	0.06	0.07	0.414093	Overvalued
279	20-12-23	141	129.75	0.021918	0	0.04	0.04	0.428288	Overvalued
280	20-12-23	142	129.75	0.021918	0	0.02	0.03	0.439468	Overvalued
281	20-12-23	143	129.75	0.021918	0	0.01	0.02	0.448302	Overvalued
282	20-12-23	144	129.75	0.021918	0	0.01	0.01	0.471702	Overvalued
283	20-12-23	145	129.75	0.021918	0	0	0.01	0.47743	Overvalued
284	20-12-23	146	129.75	0.021918	0	0	0	0.499454	Overvalued
285	20-12-23	147	129.75	0.021918	0	0	0	0.499042	Overvalued
286	20-12-23	148	129.75	0.021918	0	0	0	0.521198	Overvalued
287	20-12-23	149	129.75	0.021918	0	0	0	0.512668	Overvalued
288	20-12-23	150	129.75	0.021918	0	0	0	0.560236	Overvalued
289	20-12-23	151	129.75	0.021918	0	0	0	0.55033	Overvalued
290	20-12-23	152	129.75	0.021918	0	0	0	0.571579	Overvalued
291	20-12-23	153	129.75	0.021918	0	0	0	0.595427	Overvalued
292	20-12-23	154	129.75	0.021918	0	0	0	0.573555	Overvalued
293	20-12-23	155	129.75	0.021918	0	0	0	0.590269	Overvalued
294	20-12-23	156	129.75	0.021918	0	0	0	0.608021	Overvalued
295	20-12-23	157	129.75	0.021918	0	0	0	0.621674	Overvalued
296	21-12-23	132	131	0.019178	1.56	1.57	1.57	0.238299	Undervalued
297	21-12-23	133	131	0.019178	1.3	1.18	1.18	0.256952	Undervalued
298	21-12-23	134	131	0.019178	1.04	0.87	0.87	0.273126	Overvalued
299	21-12-23	135	131	0.019178	0.79	0.63	0.63	0.291806	Overvalued
300	21-12-23	136	131	0.019178	0.53	0.44	0.44	0.311674	Overvalued
301	21-12-23	137	131	0.019178	0.28	0.3	0.3	0.317318	Overvalued
302	21-12-23	138	131	0.019178	0.02	0.2	0.2	0.33952	Overvalued
303	21-12-23	139	131	0.019178	0	0.13	0.13	0.357785	Overvalued
304	21-12-23	140	131	0.019178	0	0.08	0.08	0.359358	Overvalued
305	21-12-23	141	131	0.019178	0	0.05	0.05	0.368901	Overvalued

306	21-12-23	142	131	0.019178	0	0.03	0.03	0.397948	Overvalued
307	21-12-23	143	131	0.019178	0	0.02	0.02	0.401056	Overvalued
308	21-12-23	144	131	0.019178	0	0.01	0.01	0.426172	Overvalued
309	21-12-23	145	131	0.019178	0	0.01	0.01	0.451594	Overvalued
310	21-12-23	146	131	0.019178	0	0	0	0.449785	Overvalued
311	21-12-23	147	131	0.019178	0	0	0	0.471962	Overvalued
312	21-12-23	148	131	0.019178	0	0	0	0.496969	Overvalued
313	21-12-23	149	131	0.019178	0	0	0	0.481139	Overvalued
314	21-12-23	150	131	0.019178	0	0	0	0.50316	Overvalued
315	21-12-23	151	131	0.019178	0	0	0	0.520805	Overvalued
316	21-12-23	152	131	0.019178	0	0	0	0.546479	Overvalued
317	21-12-23	153	131	0.019178	0	0	0	0.561887	Overvalued
318	21-12-23	154	131	0.019178	0	0	0	0.525144	Overvalued
319	21-12-23	155	131	0.019178	0	0	0	0.544167	Overvalued
320	21-12-23	156	131	0.019178	0	0	0	0.559448	Overvalued
321	21-12-23	157	131	0.019178	0	0	0	0.571372	Overvalued
322	22-12-23	134	133.55	0.016438	1.59	1.69	1.69	0.225468	Undervalued
323	22-12-23	135	133.55	0.016438	1.33	1.27	1.27	0.242641	Undervalued
324	22-12-23	136	133.55	0.016438	1.08	0.93	0.93	0.2477	Undervalued
325	22-12-23	137	133.55	0.016438	0.82	0.66	0.66	0.258694	Undervalued
326	22-12-23	138	133.55	0.016438	0.57	0.45	0.46	0.278973	Overvalued
327	22-12-23	139	133.55	0.016438	0.31	0.31	0.31	0.293256	Overvalued
328	22-12-23	140	133.55	0.016438	0.06	0.2	0.2	0.315596	Overvalued
329	22-12-23	141	133.55	0.016438	0	0.13	0.13	0.317099	Overvalued
330	22-12-23	142	133.55	0.016438	0	0.08	0.08	0.330552	Overvalued
331	22-12-23	143	133.55	0.016438	0	0.05	0.05	0.337547	Overvalued
332	22-12-23	144	133.55	0.016438	0	0.03	0.03	0.363877	Overvalued
333	22-12-23	145	133.55	0.016438	0	0.02	0.02	0.388267	Overvalued
334	22-12-23	146	133.55	0.016438	0	0.01	0.01	0.383229	Overvalued
335	22-12-23	147	133.55	0.016438	0	0	0	0.360646	Overvalued
336	22-12-23	148	133.55	0.016438	0	0	0	0.387741	Overvalued
337	22-12-23	149	133.55	0.016438	0	0	0	0.405827	Overvalued
338	22-12-23	150	133.55	0.016438	0	0	0	0.472791	Overvalued
339	22-12-23	151	133.55	0.016438	0	0	0	0.497986	Overvalued
340	22-12-23	152	133.55	0.016438	0	0	0	0.523381	Overvalued
341	22-12-23	153	133.55	0.016438	0	0	0	0.495048	Overvalued
342	22-12-23	154	133.55	0.016438	0	0	0	0.510619	Overvalued
343	22-12-23	155	133.55	0.016438	0	0	0	0.534004	Overvalued
344	22-12-23	156	133.55	0.016438	0	0	0	0.553354	Overvalued
345	22-12-23	157	133.55	0.016438	0	0	0	0.573212	Overvalued
346	26-12-23	136	135.2	0.005479	0.77	0.74	0.74	0.309594	Overvalued
347	26-12-23	137	135.2	0.005479	0.52	0.42	0.43	0.334874	Overvalued
348	26-12-23	138	135.2	0.005479	0.27	0.22	0.22	0.369298	Overvalued
349	26-12-23	139	135.2	0.005479	0.02	0.11	0.11	0.404284	Overvalued

350	26-12-23	140	135.2	0.005479	0	0.05	0.05	0.448946	Overvalued
351	26-12-23	141	135.2	0.005479	0	0.02	0.02	0.460828	Overvalued
352	26-12-23	142	135.2	0.005479	0	0.01	0.01	0.482181	Overvalued
353	26-12-23	143	135.2	0.005479	0	0	0	0.502968	Overvalued
354	26-12-23	144	135.2	0.005479	0	0	0	0.5042	Overvalued
355	26-12-23	145	135.2	0.005479	0	0	0	0.549198	Overvalued
356	26-12-23	146	135.2	0.005479	0	0	0	0.516553	Overvalued
357	26-12-23	147	135.2	0.005479	0	0	0	0.627474	Overvalued
358	26-12-23	148	135.2	0.005479	0	0	0	0.677704	Overvalued
359	26-12-23	149	135.2	0.005479	0	0	0	0.712711	Overvalued
360	26-12-23	150	135.2	0.005479	0	0	0	0.672236	Overvalued
361	26-12-23	151	135.2	0.005479	0	0	0	0.711123	Overvalued
362	26-12-23	152	135.2	0.005479	0	0	0	0.746569	Overvalued
363	26-12-23	153	135.2	0.005479	0	0	0	0.790748	Overvalued
364	26-12-23	154	135.2	0.005479	0	0	0	0.825368	Overvalued
365	26-12-23	155	135.2	0.005479	0	0	0	0.863078	Overvalued
366	26-12-23	156	135.2	0.005479	0	0	0	0.883945	Overvalued
367	26-12-23	157	135.2	0.005479	0	0	0	0.912485	Overvalued
368	27-12-23	138	137.2	0.00274	0.49	0.45	0.45	0.380207	Overvalued
369	27-12-23	139	137.2	0.00274	0.24	0.19	0.19	0.40931	Overvalued
370	27-12-23	140	137.2	0.00274	0	0.07	0.07	0.447551	Overvalued
371	27-12-23	141	137.2	0.00274	0	0.02	0.02	0.45053	Overvalued
372	27-12-23	142	137.2	0.00274	0	0	0.01	0.442633	Overvalued
373	27-12-23	143	137.2	0.00274	0	0	0	0.514491	Overvalued
374	27-12-23	144	137.2	0.00274	0	0	0	0.578284	Overvalued
375	27-12-23	145	137.2	0.00274	0	0	0	0.644418	Overvalued
376	27-12-23	146	137.2	0.00274	0	0	0	0.701343	Overvalued
377	27-12-23	147	137.2	0.00274	0	0	0	0.673589	Overvalued
378	27-12-23	148	137.2	0.00274	0	0	0	0.724876	Overvalued
379	27-12-23	149	137.2	0.00274	0	0	0	0.789898	Overvalued
380	27-12-23	150	137.2	0.00274	0	0	0	0.851772	Overvalued
381	27-12-23	151	137.2	0.00274	0	0	0	0.881902	Overvalued
382	27-12-23	152	137.2	0.00274	0	0	0	0.947815	Overvalued
383	27-12-23	153	137.2	0.00274	0	0	0	1.001601	Overvalued
384	27-12-23	154	137.2	0.00274	0	0	0	1.033946	Overvalued
385	27-12-23	155	137.2	0.00274	0	0	0	1.091728	Overvalued
386	27-12-23	157	137.2	0.00274	0	0	0	1.194792	Overvalued

At the Money (ATM) Call Options

S.No.	**Date**	**Strike Price**	**Close**	**Underlying Value**	**Maturity Time**	**Binomial Price**	**BSM Price**	**MC Price**	**Implied Volatility**	**Valuation**
1	1-12-23	130	3.8	130	0.073973	3.7	4.13	4.13	0.245539	Undervalued
2	4-12-23	131	3.6	131	0.065753	3.49	3.9	3.9	0.246117	Undervalued
3	7-12-23	130	3.65	130	0.057534	3.23	3.61	3.6	0.272554	Overvalued
4	14-12-23	132	3.45	132	0.038356	2.63	2.95	2.95	0.317775	Overvalued
5	21-12-23	131	1.85	131	0.019178	1.81	2.03	2.03	0.243083	Undervalued

In the Money (ITM) Put Options

S.No.	Date	Strike Price	Close	Underlying Value	Maturity Time	Binomial Price	BSM Price	MC Price	Implied Volatility	Valuation
1	1-12-23	131	3.45	130	0.073973	3.76	3.96	3.98	0.2325	Undervalued
2	1-12-23	132	4	130	0.073973	4.49	4.51	4.52	0.23258	Undervalued
3	1-12-23	133	4.6	130	0.073973	5.23	5.09	5.11	0.23282	Undervalued
4	1-12-23	134	5.25	130	0.073973	5.96	5.72	5.74	0.233691	Undervalued
5	1-12-23	135	5.95	130	0.073973	6.69	6.38	6.4	0.234757	Undervalued
6	1-12-23	136	6.7	130	0.073973	7.43	7.08	7.1	0.237138	Undervalued
7	1-12-23	137	7.5	130	0.073973	8.16	7.81	7.84	0.24139	Undervalued
8	1-12-23	138	8.25	130	0.073973	8.9	8.58	8.6	0.238176	Undervalued
9	1-12-23	139	9.1	130	0.073973	9.63	9.37	9.4	0.240739	Undervalued
10	1-12-23	140	9.85	130	0.073973	10.36	10.19	10.22	0.229202	Undervalued
11	1-12-23	145	14.55	130	0.073973	14.25	14.6	14.62	0.259701	Undervalued
12	1-12-23	149	18.05	130	0.073973	18.23	18.38	18.4	4.41E-07	Undervalued
13	4-12-23	132	3.45	131	0.065753	3.63	3.81	3.83	0.24208	Undervalued
14	4-12-23	133	4	131	0.065753	4.36	4.36	4.38	0.241712	Undervalued
15	4-12-23	134	4.6	131	0.065753	5.1	4.95	4.97	0.241998	Undervalued
16	4-12-23	135	5.3	131	0.065753	5.83	5.59	5.6	0.246306	Undervalued
17	4-12-23	136	6.05	131	0.065753	6.57	6.26	6.28	0.25124	Undervalued
18	4-12-23	137	6.4	131	0.065753	7.3	6.97	6.99	0.217197	Undervalued
19	4-12-23	138	7.45	131	0.065753	8.04	7.71	7.74	0.243933	Undervalued
20	4-12-23	139	8.3	131	0.065753	8.77	8.49	8.52	0.248943	Undervalued
21	4-12-23	140	9.2	131	0.065753	9.51	9.3	9.32	0.258344	Undervalued
22	4-12-23	141	10.1	131	0.065753	10.24	10.13	10.16	0.265241	Undervalued
23	4-12-23	145	13.55	131	0.065753	13.33	13.68	13.7	0.242559	Undervalued
24	4-12-23	149	17	131	0.065753	17.32	17.45	17.47	3.03E-07	Undervalued
25	5-12-23	132	3.1	131.6	0.063014	3.14	3.45	3.47	0.242562	Undervalued
26	5-12-23	133	3.65	131.6	0.063014	3.88	3.98	3.99	0.244426	Undervalued
27	5-12-23	134	4.25	131.6	0.063014	4.62	4.55	4.56	0.246261	Undervalued
28	5-12-23	135	4.8	131.6	0.063014	5.35	5.16	5.17	0.240488	Undervalued
29	5-12-23	136	5.6	131.6	0.063014	6.09	5.81	5.83	0.251618	Undervalued
30	5-12-23	137	6.4	131.6	0.063014	6.82	6.5	6.52	0.260208	Undervalued
31	5-12-23	138	7.4	131.6	0.063014	7.56	7.23	7.25	0.284617	Overvalued
32	5-12-23	139	8	131.6	0.063014	8.29	7.99	8.02	0.269662	Overvalued
33	5-12-23	140	8.6	131.6	0.063014	9.03	8.79	8.81	0.249063	Undervalued
34	5-12-23	141	9.7	131.6	0.063014	9.76	9.61	9.63	0.279297	Overvalued
35	5-12-23	142	10.55	131.6	0.063014	10.5	10.46	10.48	0.280669	Overvalued
36	5-12-23	149	16.8	131.6	0.063014	16.74	16.89	16.91	0.228784	Undervalued
37	6-12-23	132	2.95	131.85	0.060274	2.91	3.27	3.28	0.243907	Undervalued
38	6-12-23	133	3.5	131.85	0.060274	3.65	3.78	3.8	0.247299	Undervalued
39	6-12-23	134	4.1	131.85	0.060274	4.38	4.34	4.36	0.250179	Undervalued
40	6-12-23	135	4.75	131.85	0.060274	5.12	4.95	4.96	0.253134	Undervalued
41	6-12-23	136	5.4	131.85	0.060274	5.85	5.59	5.61	0.252932	Undervalued

42	6-12-23	137	6.1	131.85	0.060274	6.59	6.28	6.3	0.253189	Undervalued
43	6-12-23	138	6.9	131.85	0.060274	7.32	7	7.03	0.259091	Undervalued
44	6-12-23	139	7.75	131.85	0.060274	8.06	7.76	7.79	0.267366	Undervalued
45	6-12-23	140	8.5	131.85	0.060274	8.8	8.55	8.58	0.262491	Undervalued
46	6-12-23	141	9.4	131.85	0.060274	9.53	9.37	9.4	0.271948	Overvalued
47	6-12-23	142	10.2	131.85	0.060274	10.27	10.22	10.25	0.26575	Undervalued
48	6-12-23	143	10.3	131.85	0.060274	11	11.09	11.11	1.61E-07	Undervalued
49	6-12-23	145	12.25	131.85	0.060274	12.54	12.89	12.91	3.33E-07	Undervalued
50	6-12-23	148	14.85	131.85	0.060274	15.53	15.7	15.72	3.45E-08	Undervalued
51	6-12-23	149	16.4	131.85	0.060274	16.52	16.66	16.68	2.77E-07	Undervalued
52	7-12-23	131	3.4	130	0.057534	3.44	3.59	3.61	0.253361	Undervalued
53	7-12-23	132	3.95	130	0.057534	4.17	4.15	4.16	0.25305	Undervalued
54	7-12-23	133	4.65	130	0.057534	4.91	4.75	4.77	0.260304	Undervalued
55	7-12-23	134	5.35	130	0.057534	5.65	5.4	5.41	0.264959	Undervalued
56	7-12-23	135	6.05	130	0.057534	6.38	6.08	6.1	0.265299	Undervalued
57	7-12-23	136	6.75	130	0.057534	7.12	6.81	6.83	0.26314	Undervalued
58	7-12-23	137	7.4	130	0.057534	7.86	7.57	7.6	0.250198	Undervalued
59	7-12-23	138	8.45	130	0.057534	8.59	8.37	8.4	0.278286	Overvalued
60	7-12-23	139	9.3	130	0.057534	9.33	9.2	9.22	0.281744	Overvalued
61	7-12-23	140	10.15	130	0.057534	10.06	10.05	10.07	0.283236	Overvalued
62	7-12-23	141	10.8	130	0.057534	10.8	10.93	10.95	0.246979	Undervalued
63	7-12-23	150	19.55	130	0.057534	19.4	19.45	19.47	0.321514	Overvalued
64	8-12-23	130	3.15	129.2	0.054795	3.22	3.4	3.42	0.24825	Undervalued
65	8-12-23	131	3.7	129.2	0.054795	3.95	3.95	3.97	0.247929	Undervalued
66	8-12-23	132	4.3	129.2	0.054795	4.69	4.55	4.56	0.247852	Undervalued
67	8-12-23	133	5	129.2	0.054795	5.43	5.19	5.21	0.251753	Undervalued
68	8-12-23	134	5.75	129.2	0.054795	6.16	5.87	5.89	0.257496	Undervalued
69	8-12-23	135	6.5	129.2	0.054795	6.9	6.6	6.62	0.258432	Undervalued
70	8-12-23	136	7.4	129.2	0.054795	7.64	7.36	7.39	0.272469	Overvalued
71	8-12-23	137	8.2	129.2	0.054795	8.37	8.16	8.19	0.273863	Overvalued
72	8-12-23	138	9	129.2	0.054795	9.11	8.99	9.01	0.269948	Overvalued
73	8-12-23	139	9.9	129.2	0.054795	9.85	9.84	9.87	0.277233	Overvalued
74	8-12-23	140	10.7	129.2	0.054795	10.58	10.72	10.75	0.265262	Undervalued
75	8-12-23	142	12.9	129.2	0.054795	12.26	12.54	12.56	0.334098	Overvalued
76	8-12-23	143	12.1	129.2	0.054795	13.25	13.47	13.49	1.02E-07	Undervalued
77	11-12-23	131	3.2	130.05	0.046575	3.16	3.29	3.3	0.261524	Undervalued
78	11-12-23	132	3.75	130.05	0.046575	3.89	3.85	3.86	0.260098	Undervalued
79	11-12-23	133	4.35	130.05	0.046575	4.63	4.46	4.48	0.258584	Undervalued
80	11-12-23	134	5.15	130.05	0.046575	5.37	5.12	5.14	0.271159	Overvalued
81	11-12-23	135	5.9	130.05	0.046575	6.11	5.83	5.85	0.275681	Overvalued
82	11-12-23	136	6.65	130.05	0.046575	6.85	6.58	6.6	0.276654	Overvalued
83	11-12-23	137	7.4	130.05	0.046575	7.58	7.37	7.39	0.272951	Overvalued
84	11-12-23	138	8.95	130.05	0.046575	8.32	8.19	8.21	0.362352	Overvalued
85	11-12-23	139	9.6	130.05	0.046575	9.06	9.04	9.06	0.345354	Overvalued

86	11-12-23	140	9.95	130.05	0.046575	9.8	9.92	9.94	0.274842	Overvalued
87	11-12-23	145	14.6	130.05	0.046575	14.48	14.59	14.6	0.274772	Overvalued
88	11-12-23	150	19.4	130.05	0.046575	19.46	19.48	19.5	3.49E-07	Undervalued
89	12-12-23	131	3.05	130.1	0.043836	3.05	3.18	3.2	0.256676	Undervalued
90	12-12-23	132	3.55	130.1	0.043836	3.79	3.75	3.76	0.250033	Undervalued
91	12-12-23	133	4.25	130.1	0.043836	4.53	4.36	4.38	0.257878	Undervalued
92	12-12-23	134	4.95	130.1	0.043836	5.27	5.03	5.04	0.261367	Undervalued
93	12-12-23	135	5.55	130.1	0.043836	6.01	5.74	5.76	0.247641	Undervalued
94	12-12-23	136	6.3	130.1	0.043836	6.75	6.49	6.51	0.245187	Undervalued
95	12-12-23	137	7.05	130.1	0.043836	7.48	7.29	7.31	0.236089	Undervalued
96	12-12-23	138	8	130.1	0.043836	8.22	8.11	8.13	0.25166	Undervalued
97	12-12-23	139	8.7	130.1	0.043836	8.96	8.97	8.99	0.215542	Undervalued
98	12-12-23	140	9.7	130.1	0.043836	9.7	9.86	9.88	0.235152	Undervalued
99	12-12-23	141	10.3	130.1	0.043836	10.47	10.76	10.78	2.8E-07	Undervalued
100	12-12-23	150	18.3	130.1	0.043836	19.44	19.46	19.47	3E-07	Undervalued
101	13-12-23	132	2.95	131.4	0.041096	2.79	2.97	2.98	0.266599	Undervalued
102	13-12-23	133	3.55	131.4	0.041096	3.53	3.52	3.53	0.27165	Overvalued
103	13-12-23	134	4.25	131.4	0.041096	4.26	4.12	4.14	0.28128	Overvalued
104	13-12-23	135	4.9	131.4	0.041096	5	4.78	4.79	0.281241	Overvalued
105	13-12-23	136	5.95	131.4	0.041096	5.74	5.48	5.5	0.319057	Overvalued
106	13-12-23	137	6.45	131.4	0.041096	6.48	6.23	6.25	0.29493	Overvalued
107	13-12-23	138	7.25	131.4	0.041096	7.22	7.01	7.04	0.299077	Overvalued
108	13-12-23	139	8	131.4	0.041096	7.96	7.84	7.86	0.292307	Overvalued
109	13-12-23	140	9	131.4	0.041096	8.7	8.69	8.71	0.316552	Overvalued
110	13-12-23	141	10.15	131.4	0.041096	9.44	9.58	9.6	0.361007	Overvalued
111	13-12-23	145	14.7	131.4	0.041096	13.18	13.3	13.32	0.530283	Overvalued
112	14-12-23	133	3.05	132	0.038356	3.02	3.11	3.13	0.262951	Undervalued
113	14-12-23	134	3.65	132	0.038356	3.76	3.69	3.7	0.265126	Undervalued
114	14-12-23	135	4.35	132	0.038356	4.5	4.32	4.33	0.272504	Overvalued
115	14-12-23	136	5.05	132	0.038356	5.24	4.99	5.01	0.275313	Overvalued
116	14-12-23	137	5.8	132	0.038356	5.98	5.72	5.74	0.277863	Overvalued
117	14-12-23	138	6.6	132	0.038356	6.72	6.49	6.51	0.282844	Overvalued
118	14-12-23	139	7.3	132	0.038356	7.45	7.3	7.32	0.267731	Undervalued
119	14-12-23	140	8.2	132	0.038356	8.19	8.15	8.17	0.277192	Overvalued
120	14-12-23	141	9	132	0.038356	8.93	9.02	9.04	0.263799	Undervalued
121	14-12-23	142	9.85	132	0.038356	9.67	9.92	9.94	0.250505	Undervalued
122	14-12-23	143	10.7	132	0.038356	10.62	10.84	10.86	0.219412	Undervalued
123	14-12-23	145	12.5	132	0.038356	12.61	12.73	12.75	9.26E-07	Undervalued
124	14-12-23	150	16.5	132	0.038356	17.6	17.62	17.63	3.58E-07	Undervalued
125	15-12-23	137	3	136.45	0.035616	2.68	2.87	2.88	0.281754	Overvalued
126	15-12-23	138	3.6	136.45	0.035616	3.42	3.42	3.43	0.287121	Overvalued
127	15-12-23	139	4.3	136.45	0.035616	4.16	4.02	4.04	0.296319	Overvalued
128	15-12-23	140	5	136.45	0.035616	4.9	4.68	4.7	0.302345	Overvalued
129	15-12-23	141	6	136.45	0.035616	5.64	5.39	5.41	0.336401	Overvalued

130	15-12-23	142	6.35	136.45	0.035616	6.38	6.14	6.16	0.294769	Overvalued
131	15-12-23	143	7.15	136.45	0.035616	7.12	6.94	6.96	0.296934	Overvalued
132	15-12-23	144	8.1	136.45	0.035616	7.86	7.77	7.79	0.317272	Overvalued
133	15-12-23	145	8.85	136.45	0.035616	8.6	8.63	8.65	0.30484	Overvalued
134	15-12-23	146	9.85	136.45	0.035616	9.34	9.52	9.54	0.328812	Overvalued
135	15-12-23	149	12.75	136.45	0.035616	12.18	12.32	12.33	0.377685	Overvalued
136	15-12-23	150	13.7	136.45	0.035616	13.18	13.28	13.29	0.388994	Overvalued
137	18-12-23	137	2.95	136.6	0.027397	2.31	2.5	2.51	0.318938	Overvalued
138	18-12-23	138	3.5	136.6	0.027397	3.06	3.05	3.06	0.319833	Overvalued
139	18-12-23	139	4.15	136.6	0.027397	3.8	3.66	3.67	0.32617	Overvalued
140	18-12-23	140	4.95	136.6	0.027397	4.54	4.33	4.34	0.344595	Overvalued
141	18-12-23	141	5.55	136.6	0.027397	5.28	5.06	5.07	0.33302	Overvalued
142	18-12-23	142	6.45	136.6	0.027397	6.02	5.84	5.85	0.355275	Overvalued
143	18-12-23	143	6.9	136.6	0.027397	6.76	6.66	6.68	0.3088	Overvalued
144	18-12-23	144	7.9	136.6	0.027397	7.5	7.52	7.53	0.339003	Overvalued
145	18-12-23	145	8.9	136.6	0.027397	8.24	8.41	8.42	0.366483	Overvalued
146	18-12-23	146	9.8	136.6	0.027397	9.12	9.33	9.34	0.375321	Overvalued
147	18-12-23	147	10.35	136.6	0.027397	10.12	10.26	10.28	0.298004	Overvalued
148	18-12-23	150	13.4	136.6	0.027397	13.11	13.16	13.17	0.379352	Overvalued
149	19-12-23	136	2.75	135.4	0.024658	2.35	2.47	2.48	0.302088	Overvalued
150	19-12-23	137	3.4	135.4	0.024658	3.09	3.04	3.05	0.312501	Overvalued
151	19-12-23	138	4.1	135.4	0.024658	3.83	3.67	3.68	0.322879	Overvalued
152	19-12-23	139	4.85	135.4	0.024658	4.57	4.37	4.38	0.33273	Overvalued
153	19-12-23	140	5.7	135.4	0.024658	5.32	5.12	5.14	0.352088	Overvalued
154	19-12-23	141	6.45	135.4	0.024658	6.06	5.92	5.94	0.353141	Overvalued
155	19-12-23	142	7.2	135.4	0.024658	6.8	6.77	6.78	0.34732	Overvalued
156	19-12-23	143	8.15	135.4	0.024658	7.54	7.65	7.66	0.370006	Overvalued
157	19-12-23	144	9.15	135.4	0.024658	8.35	8.56	8.57	0.400453	Overvalued
158	19-12-23	145	9.95	135.4	0.024658	9.35	9.49	9.51	0.390591	Overvalued
159	19-12-23	146	11	135.4	0.024658	10.35	10.45	10.46	0.427891	Overvalued
160	19-12-23	149	13.2	135.4	0.024658	13.34	13.37	13.38	2.05E-08	Undervalued
161	20-12-23	130	1.95	129.75	0.021918	1.91	2.09	2.1	0.251724	Undervalued
162	20-12-23	131	2.45	129.75	0.021918	2.65	2.64	2.65	0.244055	Undervalued
163	20-12-23	132	3.2	129.75	0.021918	3.4	3.26	3.27	0.259973	Undervalued
164	20-12-23	133	3.95	129.75	0.021918	4.14	3.95	3.97	0.268851	Undervalued
165	20-12-23	134	4.9	129.75	0.021918	4.88	4.71	4.72	0.30192	Overvalued
166	20-12-23	135	5.7	129.75	0.021918	5.62	5.52	5.53	0.303174	Overvalued
167	20-12-23	136	6.55	129.75	0.021918	6.37	6.37	6.39	0.308678	Overvalued
168	20-12-23	137	7.5	129.75	0.021918	7.11	7.27	7.28	0.329648	Overvalued
169	20-12-23	138	8.55	129.75	0.021918	8.04	8.19	8.2	0.372351	Overvalued
170	20-12-23	139	9.6	129.75	0.021918	9.04	9.14	9.15	0.413593	Overvalued
171	20-12-23	140	10.45	129.75	0.021918	10.04	10.1	10.11	0.404427	Overvalued
172	20-12-23	141	11.1	129.75	0.021918	11.03	11.07	11.09	0.292271	Overvalued
173	20-12-23	142	12.2	129.75	0.021918	12.03	12.06	12.07	0.369953	Overvalued

174	20-12-23	143	9.45	129.75	0.021918	13.03	13.05	13.06	5.59E-07	Undervalued
175	20-12-23	144	10.4	129.75	0.021918	14.03	14.04	14.05	1.68E-07	Undervalued
176	20-12-23	145	15.9	129.75	0.021918	15.03	15.03	15.04	0.658319	Overvalued
177	20-12-23	149	14.95	129.75	0.021918	19.02	19.02	19.03	4.57E-07	Undervalued
178	20-12-23	150	15.95	129.75	0.021918	20.02	20.02	20.03	2.57E-07	Undervalued
179	21-12-23	132	2	131	0.019178	2.38	2.39	2.4	0.214505	Undervalued
180	21-12-23	133	2.7	131	0.019178	3.12	3	3.01	0.223441	Undervalued
181	21-12-23	134	3.5	131	0.019178	3.87	3.69	3.7	0.237636	Undervalued
182	21-12-23	135	4.3	131	0.019178	4.61	4.44	4.46	0.241132	Undervalued
183	21-12-23	136	5.25	131	0.019178	5.35	5.26	5.27	0.267601	Undervalued
184	21-12-23	137	6.1	131	0.019178	6.09	6.12	6.13	0.264892	Undervalued
185	21-12-23	138	6.95	131	0.019178	6.84	7.01	7.03	0.243839	Undervalued
186	21-12-23	139	8	131	0.019178	7.81	7.94	7.95	0.291411	Overvalued
187	21-12-23	140	8.9	131	0.019178	8.81	8.89	8.91	0.273092	Overvalued
188	21-12-23	141	9.7	131	0.019178	9.81	9.86	9.87	1.12E-07	Undervalued
189	21-12-23	145	14	131	0.019178	13.81	13.81	13.82	0.449255	Overvalued
190	22-12-23	134	1.5	133.55	0.016438	1.89	1.99	2	0.19729	Undervalued
191	22-12-23	135	2.2	133.55	0.016438	2.63	2.56	2.57	0.213423	Undervalued
192	22-12-23	136	2.95	133.55	0.016438	3.37	3.22	3.23	0.223625	Undervalued
193	22-12-23	137	3.7	133.55	0.016438	4.12	3.95	3.96	0.218719	Undervalued
194	22-12-23	138	4.6	133.55	0.016438	4.86	4.75	4.76	0.234836	Undervalued
195	22-12-23	139	5.4	133.55	0.016438	5.6	5.6	5.61	0.20392	Undervalued
196	22-12-23	140	6.5	133.55	0.016438	6.35	6.49	6.5	0.274094	Overvalued
197	22-12-23	141	8.3	133.55	0.016438	7.29	7.41	7.43	0.502148	Overvalued
198	22-12-23	142	9.1	133.55	0.016438	8.29	8.36	8.38	0.498223	Overvalued
199	22-12-23	143	8.55	133.55	0.016438	9.29	9.33	9.34	7.34E-07	Undervalued
200	22-12-23	145	11.25	133.55	0.016438	11.28	11.3	11.31	3.1E-08	Undervalued
201	26-12-23	136	1.75	135.2	0.005479	1.52	1.49	1.5	0.335637	Overvalued
202	26-12-23	137	2.5	135.2	0.005479	2.27	2.17	2.18	0.362996	Overvalued
203	26-12-23	138	3.35	135.2	0.005479	3.02	2.97	2.98	0.402068	Overvalued
204	26-12-23	139	4.3	135.2	0.005479	3.76	3.85	3.86	0.458371	Overvalued
205	26-12-23	140	5.1	135.2	0.005479	4.75	4.79	4.8	0.450144	Overvalued
206	26-12-23	141	5.7	135.2	0.005479	5.75	5.76	5.77	4.1E-07	Undervalued
207	26-12-23	142	6.75	135.2	0.005479	6.75	6.75	6.76	0.121859	Undervalued
208	26-12-23	143	7.75	135.2	0.005479	7.75	7.75	7.75	0.035892	Undervalued
209	26-12-23	144	8.85	135.2	0.005479	8.74	8.75	8.75	0.510194	Overvalued
210	26-12-23	145	9.75	135.2	0.005479	9.74	9.74	9.75	0.310869	Overvalued
211	26-12-23	148	12.8	135.2	0.005479	12.74	12.74	12.75	0.612112	Overvalued
212	27-12-23	138	1.5	137.2	0.00274	1.27	1.22	1.22	0.371873	Overvalued
213	27-12-23	139	2.2	137.2	0.00274	2.02	1.96	1.97	0.377102	Overvalued
214	27-12-23	140	3.15	137.2	0.00274	2.77	2.84	2.85	0.459083	Overvalued
215	27-12-23	141	4.25	137.2	0.00274	3.77	3.79	3.8	0.602376	Overvalued
216	27-12-23	142	4.6	137.2	0.00274	4.77	4.78	4.78	3.92E-07	Undervalued
217	27-12-23	143	6.45	137.2	0.00274	5.77	5.77	5.78	0.890013	Overvalued

218	27-12-23	144	7.25	137.2	0.00274	6.77	6.77	6.78	0.872912	Overvalued
219	27-12-23	145	7.85	137.2	0.00274	7.77	7.77	7.78	0.617837	Overvalued
220	27-12-23	146	9.1	137.2	0.00274	8.77	8.77	8.78	0.925624	Overvalued
221	27-12-23	148	10.25	137.2	0.00274	10.77	10.77	10.78	2.24E-07	Undervalued
222	27-12-23	149	12.5	137.2	0.00274	11.77	11.77	11.78	1.424582	Overvalued
223	27-12-23	150	12	137.2	0.00274	12.77	12.77	12.78	4.46E-07	Undervalued

Out of Money (OTM) Put Options

S.No.	Date	Strike Price	Close	Underlying Value	Maturity Time	Binomial Price	BSM Price	MC Price	Implied Volatility	Valuation
1	1-12-23	100	0.1	130	0.073972603	0	0	0	0.475197878	Overvalued
2	1-12-23	105	0.1	130	0.073972603	0	0	0	0.395490628	Overvalued
3	1-12-23	110	0.15	130	0.073972603	0	0.03	0.03	0.347608213	Overvalued
4	1-12-23	111	0.15	130	0.073972603	0	0.04	0.04	0.332960445	Overvalued
5	1-12-23	113	0.15	130	0.073972603	0	0.08	0.08	0.300727818	Overvalued
6	1-12-23	114	0.2	130	0.073972603	0	0.11	0.11	0.303328065	Overvalued
7	1-12-23	115	0.2	130	0.073972603	0	0.15	0.15	0.28650558	Overvalued
8	1-12-23	116	0.2	130	0.073972603	0	0.19	0.2	0.269948961	Overvalued
9	1-12-23	117	0.25	130	0.073972603	0	0.26	0.26	0.268138953	Undervalued
10	1-12-23	118	0.25	130	0.073972603	0.18	0.33	0.34	0.251554555	Undervalued
11	1-12-23	119	0.35	130	0.073972603	0.42	0.43	0.44	0.255257264	Undervalued
12	1-12-23	120	0.45	130	0.073972603	0.66	0.55	0.56	0.253739205	Undervalued
13	1-12-23	121	0.5	130	0.073972603	0.89	0.69	0.7	0.242750715	Undervalued
14	1-12-23	122	0.65	130	0.073972603	1.13	0.86	0.87	0.244250619	Undervalued
15	1-12-23	123	0.8	130	0.073972603	1.37	1.06	1.07	0.24141563	Undervalued
16	1-12-23	124	0.95	130	0.073972603	1.6	1.29	1.3	0.236519435	Undervalued
17	1-12-23	125	1.15	130	0.073972603	1.84	1.55	1.56	0.233034131	Undervalued
18	1-12-23	126	1.45	130	0.073972603	2.08	1.85	1.86	0.235193462	Undervalued
19	1-12-23	127	1.7	130	0.073972603	2.31	2.19	2.21	0.229882431	Undervalued
20	1-12-23	128	2.05	130	0.073972603	2.55	2.57	2.59	0.229938554	Undervalued
21	1-12-23	129	2.5	130	0.073972603	2.79	2.99	3.01	0.233114454	Undervalued
22	4-12-23	100	0.05	131	0.065753425	0	0	0	0.469089703	Overvalued
23	4-12-23	105	0.1	131	0.065753425	0	0	0	0.434153826	Overvalued
24	4-12-23	106	0.1	131	0.065753425	0	0	0	0.414548633	Overvalued
25	4-12-23	110	0.1	131	0.065753425	0	0.01	0.01	0.357333199	Overvalued
26	4-12-23	111	0.1	131	0.065753425	0	0.02	0.02	0.339233536	Overvalued
27	4-12-23	112	0.1	131	0.065753425	0	0.03	0.03	0.322001068	Overvalued
28	4-12-23	113	0.15	131	0.065753425	0	0.04	0.04	0.329916372	Overvalued
29	4-12-23	114	0.15	131	0.065753425	0	0.06	0.06	0.314367435	Overvalued
30	4-12-23	115	0.2	131	0.065753425	0	0.08	0.08	0.31783886	Overvalued
31	4-12-23	116	0.15	131	0.065753425	0	0.11	0.12	0.284997524	Overvalued
32	4-12-23	117	0.2	131	0.065753425	0	0.15	0.16	0.283639092	Overvalued
33	4-12-23	118	0.3	131	0.065753425	0	0.21	0.21	0.292479921	Overvalued
34	4-12-23	119	0.35	131	0.065753425	0.04	0.28	0.28	0.285334782	Overvalued
35	4-12-23	120	0.4	131	0.065753425	0.28	0.36	0.37	0.276781189	Overvalued
36	4-12-23	121	0.45	131	0.065753425	0.52	0.47	0.48	0.266108832	Undervalued
37	4-12-23	122	0.55	131	0.065753425	0.75	0.6	0.61	0.261508962	Undervalued
38	4-12-23	123	0.65	131	0.065753425	0.99	0.75	0.76	0.255400883	Undervalued
39	4-12-23	124	0.8	131	0.065753425	1.23	0.94	0.95	0.253030537	Undervalued
40	4-12-23	125	0.95	131	0.065753425	1.47	1.16	1.17	0.247272397	Undervalued
41	4-12-23	126	1.15	131	0.065753425	1.7	1.42	1.43	0.243828293	Undervalued

42	4-12-23	127	1.4	131	0.065753425	1.94	1.71	1.72	0.241637967	Undervalued
43	4-12-23	128	1.7	131	0.065753425	2.18	2.04	2.06	0.240668101	Undervalued
44	4-12-23	129	2.05	131	0.065753425	2.42	2.42	2.43	0.239463004	Undervalued
45	4-12-23	130	2.45	131	0.065753425	2.65	2.84	2.85	0.239077147	Undervalued
46	5-12-23	100	0.05	131.6	0.063013699	0	0	0	0.484288867	Overvalued
47	5-12-23	105	0.1	131.6	0.063013699	0	0	0	0.448770683	Overvalued
48	5-12-23	110	0.1	131.6	0.063013699	0	0.01	0.01	0.368768591	Overvalued
49	5-12-23	112	0.1	131.6	0.063013699	0	0.02	0.02	0.339119642	Overvalued
50	5-12-23	115	0.15	131.6	0.063013699	0	0.06	0.06	0.313817376	Overvalued
51	5-12-23	116	0.15	131.6	0.063013699	0	0.08	0.09	0.298953554	Overvalued
52	5-12-23	117	0.2	131.6	0.063013699	0	0.12	0.12	0.298247218	Overvalued
53	5-12-23	118	0.25	131.6	0.063013699	0	0.16	0.17	0.295339438	Overvalued
54	5-12-23	119	0.25	131.6	0.063013699	0	0.22	0.22	0.278333073	Overvalued
55	5-12-23	120	0.35	131.6	0.063013699	0.09	0.29	0.29	0.281333396	Overvalued
56	5-12-23	121	0.4	131.6	0.063013699	0.33	0.38	0.39	0.272863835	Overvalued
57	5-12-23	122	0.5	131.6	0.063013699	0.57	0.49	0.5	0.269977118	Overvalued
58	5-12-23	123	0.55	131.6	0.063013699	0.8	0.63	0.64	0.257422597	Undervalued
59	5-12-23	124	0.7	131.6	0.063013699	1.04	0.79	0.8	0.257176454	Undervalued
60	5-12-23	125	0.85	131.6	0.063013699	1.28	0.99	1	0.252866134	Undervalued
61	5-12-23	126	1.05	131.6	0.063013699	1.52	1.22	1.23	0.251586652	Undervalued
62	5-12-23	127	1.3	131.6	0.063013699	1.76	1.49	1.5	0.251456331	Undervalued
63	5-12-23	128	1.55	131.6	0.063013699	1.99	1.79	1.81	0.247431872	Undervalued
64	5-12-23	129	1.85	131.6	0.063013699	2.23	2.14	2.16	0.24459989	Undervalued
65	5-12-23	130	2.25	131.6	0.063013699	2.47	2.53	2.55	0.246056743	Undervalued
66	5-12-23	131	2.65	131.6	0.063013699	2.71	2.97	2.99	0.24425141	Undervalued
67	6-12-23	100	0.1	131.85	0.060273973	0	0	0	0.547426721	Overvalued
68	6-12-23	105	0.1	131.85	0.060273973	0	0	0	0.464176333	Overvalued
69	6-12-23	109	0.1	131.85	0.060273973	0	0	0	0.396557046	Overvalued
70	6-12-23	110	0.1	131.85	0.060273973	0	0.01	0.01	0.380318684	Overvalued
71	6-12-23	112	0.1	131.85	0.060273973	0	0.01	0.02	0.351860679	Overvalued
72	6-12-23	113	0.1	131.85	0.060273973	0	0.02	0.02	0.332712653	Overvalued
73	6-12-23	114	0.1	131.85	0.060273973	0	0.03	0.03	0.319006978	Overvalued
74	6-12-23	115	0.15	131.85	0.060273973	0	0.05	0.05	0.325165685	Overvalued
75	6-12-23	116	0.15	131.85	0.060273973	0	0.07	0.07	0.306591749	Overvalued
76	6-12-23	117	0.2	131.85	0.060273973	0	0.1	0.1	0.30958535	Overvalued
77	6-12-23	118	0.25	131.85	0.060273973	0	0.13	0.14	0.306247625	Overvalued
78	6-12-23	119	0.3	131.85	0.060273973	0	0.18	0.19	0.299697454	Overvalued
79	6-12-23	120	0.35	131.85	0.060273973	0	0.25	0.25	0.291101984	Overvalued
80	6-12-23	121	0.4	131.85	0.060273973	0.21	0.33	0.34	0.282524909	Overvalued
81	6-12-23	122	0.5	131.85	0.060273973	0.45	0.43	0.44	0.280545423	Overvalued
82	6-12-23	123	0.55	131.85	0.060273973	0.69	0.56	0.56	0.267815678	Undervalued
83	6-12-23	124	0.7	131.85	0.060273973	0.93	0.71	0.72	0.267510762	Undervalued
84	6-12-23	125	0.85	131.85	0.060273973	1.17	0.89	0.9	0.263790316	Undervalued
85	6-12-23	126	1	131.85	0.060273973	1.41	1.11	1.12	0.256708623	Undervalued

86	6-12-23	127	1.2	131.85	0.060273973	1.64	1.36	1.38	0.253143255	Undervalued
87	6-12-23	128	1.45	131.85	0.060273973	1.88	1.66	1.67	0.25012646	Undervalued
88	6-12-23	129	1.75	131.85	0.060273973	2.12	1.99	2.01	0.248393485	Undervalued
89	6-12-23	130	2.1	131.85	0.060273973	2.36	2.37	2.39	0.246493937	Undervalued
90	6-12-23	131	2.55	131.85	0.060273973	2.6	2.8	2.81	0.249650077	Undervalued
91	7-12-23	100	0.1	130	0.057534247	0	0	0	0.537552781	Overvalued
92	7-12-23	105	0.1	130	0.057534247	0	0	0	0.448093827	Overvalued
93	7-12-23	109	0.05	130	0.057534247	0	0.01	0.01	0.344429327	Overvalued
94	7-12-23	110	0.1	130	0.057534247	0	0.01	0.01	0.364739352	Overvalued
95	7-12-23	111	0.1	130	0.057534247	0	0.01	0.02	0.349742035	Overvalued
96	7-12-23	112	0.1	130	0.057534247	0	0.02	0.03	0.330856631	Overvalued
97	7-12-23	113	0.1	130	0.057534247	0	0.03	0.04	0.3179855	Overvalued
98	7-12-23	114	0.15	130	0.057534247	0	0.05	0.05	0.32008453	Overvalued
99	7-12-23	115	0.15	130	0.057534247	0	0.07	0.08	0.305501561	Overvalued
100	7-12-23	116	0.2	130	0.057534247	0	0.1	0.11	0.305448881	Overvalued
101	7-12-23	117	0.25	130	0.057534247	0	0.15	0.15	0.300708971	Overvalued
102	7-12-23	118	0.25	130	0.057534247	0	0.2	0.21	0.281964825	Overvalued
103	7-12-23	119	0.35	130	0.057534247	0.08	0.27	0.28	0.285007771	Overvalued
104	7-12-23	120	0.4	130	0.057534247	0.32	0.36	0.37	0.276864826	Overvalued
105	7-12-23	121	0.5	130	0.057534247	0.56	0.48	0.48	0.271973114	Overvalued
106	7-12-23	122	0.6	130	0.057534247	0.79	0.62	0.62	0.267203324	Undervalued
107	7-12-23	123	0.75	130	0.057534247	1.03	0.79	0.8	0.264212884	Undervalued
108	7-12-23	124	0.9	130	0.057534247	1.27	0.99	1	0.258472127	Undervalued
109	7-12-23	125	1.1	130	0.057534247	1.51	1.23	1.24	0.255435832	Undervalued
110	7-12-23	126	1.35	130	0.057534247	1.75	1.51	1.52	0.252814411	Undervalued
111	7-12-23	127	1.65	130	0.057534247	1.99	1.84	1.85	0.252296	Undervalued
112	7-12-23	128	2	130	0.057534247	2.23	2.21	2.22	0.251342202	Undervalued
113	7-12-23	129	2.4	130	0.057534247	2.46	2.62	2.63	0.25040392	Undervalued
114	8-12-23	100	0.05	129.2	0.054794521	0	0	0	0.485529189	Overvalued
115	8-12-23	105	0.1	129.2	0.054794521	0	0	0	0.445903421	Overvalued
116	8-12-23	109	0.1	129.2	0.054794521	0	0.01	0.01	0.378739504	Overvalued
117	8-12-23	110	0.1	129.2	0.054794521	0	0.01	0.01	0.361836326	Overvalued
118	8-12-23	111	0.1	129.2	0.054794521	0	0.02	0.02	0.345235419	Overvalued
119	8-12-23	112	0.1	129.2	0.054794521	0	0.03	0.03	0.330283956	Overvalued
120	8-12-23	113	0.15	129.2	0.054794521	0	0.04	0.04	0.334994222	Overvalued
121	8-12-23	114	0.15	129.2	0.054794521	0	0.06	0.06	0.31550024	Overvalued
122	8-12-23	115	0.2	129.2	0.054794521	0	0.08	0.08	0.316271896	Overvalued
123	8-12-23	116	0.2	129.2	0.054794521	0	0.12	0.12	0.298764448	Overvalued
124	8-12-23	117	0.25	129.2	0.054794521	0	0.16	0.17	0.295213157	Overvalued
125	8-12-23	118	0.25	129.2	0.054794521	0	0.23	0.23	0.275488741	Overvalued
126	8-12-23	119	0.3	129.2	0.054794521	0.19	0.31	0.31	0.267147059	Undervalued
127	8-12-23	120	0.4	129.2	0.054794521	0.43	0.41	0.42	0.267947001	Undervalued
128	8-12-23	121	0.5	129.2	0.054794521	0.67	0.54	0.54	0.263120517	Undervalued
129	8-12-23	122	0.6	129.2	0.054794521	0.91	0.69	0.7	0.255286007	Undervalued

130	8-12-23	123	0.75	129.2	0.054794521	1.15	0.88	0.89	0.252468732	Undervalued
131	8-12-23	124	0.95	129.2	0.054794521	1.39	1.11	1.12	0.250694424	Undervalued
132	8-12-23	125	1.2	129.2	0.054794521	1.62	1.38	1.39	0.250670509	Undervalued
133	8-12-23	126	1.45	129.2	0.054794521	1.86	1.69	1.7	0.246500342	Undervalued
134	8-12-23	127	1.75	129.2	0.054794521	2.1	2.04	2.06	0.243100418	Undervalued
135	8-12-23	128	2.15	129.2	0.054794521	2.34	2.45	2.46	0.243273895	Undervalued
136	8-12-23	129	2.6	129.2	0.054794521	2.58	2.9	2.91	0.243500647	Undervalued
137	11-12-23	100	0.05	130.05	0.046575342	0	0	0	0.531874499	Overvalued
138	11-12-23	105	0.1	130.05	0.046575342	0	0	0	0.497743079	Overvalued
139	11-12-23	106	0.05	130.05	0.046575342	0	0	0	0.432797615	Overvalued
140	11-12-23	110	0.1	130.05	0.046575342	0	0	0	0.405584934	Overvalued
141	11-12-23	111	0.05	130.05	0.046575342	0	0.01	0.01	0.344566921	Overvalued
142	11-12-23	112	0.1	130.05	0.046575342	0	0.01	0.01	0.368545476	Overvalued
143	11-12-23	114	0.1	130.05	0.046575342	0	0.02	0.03	0.333672608	Overvalued
144	11-12-23	115	0.15	130.05	0.046575342	0	0.04	0.04	0.338770114	Overvalued
145	11-12-23	116	0.15	130.05	0.046575342	0	0.06	0.06	0.318318069	Overvalued
146	11-12-23	117	0.2	130.05	0.046575342	0	0.08	0.09	0.316512699	Overvalued
147	11-12-23	118	0.25	130.05	0.046575342	0	0.12	0.13	0.311466377	Overvalued
148	11-12-23	119	0.3	130.05	0.046575342	0	0.17	0.18	0.303701913	Overvalued
149	11-12-23	120	0.35	130.05	0.046575342	0.05	0.24	0.25	0.293945603	Overvalued
150	11-12-23	121	0.4	130.05	0.046575342	0.29	0.33	0.34	0.282627781	Overvalued
151	11-12-23	122	0.55	130.05	0.046575342	0.53	0.45	0.45	0.286827164	Overvalued
152	11-12-23	123	0.65	130.05	0.046575342	0.77	0.59	0.6	0.277857239	Overvalued
153	11-12-23	124	0.8	130.05	0.046575342	1.01	0.77	0.78	0.273302571	Overvalued
154	11-12-23	125	1	130.05	0.046575342	1.25	0.99	1	0.27024066	Overvalued
155	11-12-23	126	1.2	130.05	0.046575342	1.49	1.25	1.26	0.263271673	Undervalued
156	11-12-23	127	1.45	130.05	0.046575342	1.73	1.55	1.57	0.258739668	Undervalued
157	11-12-23	128	1.8	130.05	0.046575342	1.96	1.91	1.92	0.258563142	Undervalued
158	11-12-23	129	2.2	130.05	0.046575342	2.2	2.32	2.33	0.258273885	Undervalued
159	11-12-23	130	2.7	130.05	0.046575342	2.44	2.77	2.79	0.262631524	Undervalued
160	12-12-23	100	0.05	130.1	0.043835616	0	0	0	0.555914135	Overvalued
161	12-12-23	105	0.1	130.1	0.043835616	0	0	0	0.510357054	Overvalued
162	12-12-23	110	0.1	130.1	0.043835616	0	0	0	0.418623337	Overvalued
163	12-12-23	111	0.1	130.1	0.043835616	0	0	0	0.397850011	Overvalued
164	12-12-23	112	0.1	130.1	0.043835616	0	0.01	0.01	0.382136777	Overvalued
165	12-12-23	113	0.1	130.1	0.043835616	0	0.01	0.01	0.358223335	Overvalued
166	12-12-23	115	0.1	130.1	0.043835616	0	0.03	0.03	0.326260194	Overvalued
167	12-12-23	116	0.15	130.1	0.043835616	0	0.05	0.05	0.328252915	Overvalued
168	12-12-23	117	0.2	130.1	0.043835616	0	0.07	0.07	0.328880079	Overvalued
169	12-12-23	118	0.2	130.1	0.043835616	0	0.1	0.11	0.308062909	Overvalued
170	12-12-23	119	0.25	130.1	0.043835616	0	0.15	0.15	0.30035836	Overvalued
171	12-12-23	120	0.3	130.1	0.043835616	0	0.21	0.21	0.293341439	Overvalued
172	12-12-23	121	0.4	130.1	0.043835616	0.21	0.29	0.3	0.29200357	Overvalued
173	12-12-23	122	0.45	130.1	0.043835616	0.45	0.4	0.41	0.279067962	Overvalued

174	12-12-23	123	0.55	130.1	0.043835616	0.69	0.54	0.54	0.270386574	Overvalued
175	12-12-23	124	0.7	130.1	0.043835616	0.93	0.71	0.71	0.268545674	Undervalued
176	12-12-23	125	0.9	130.1	0.043835616	1.17	0.92	0.93	0.267201702	Undervalued
177	12-12-23	126	1.1	130.1	0.043835616	1.41	1.17	1.18	0.261455457	Undervalued
178	12-12-23	127	1.4	130.1	0.043835616	1.65	1.47	1.48	0.261795928	Undervalued
179	12-12-23	128	1.7	130.1	0.043835616	1.89	1.82	1.83	0.257252663	Undervalued
180	12-12-23	129	2.1	130.1	0.043835616	2.13	2.22	2.23	0.257741084	Undervalued
181	12-12-23	130	2.55	130.1	0.043835616	2.37	2.67	2.69	0.257663812	Undervalued
182	13-12-23	100	0.1	131.4	0.04109589	0	0	0	0.647188723	Overvalued
183	13-12-23	101	0.1	131.4	0.04109589	0	0	0	0.630049925	Overvalued
184	13-12-23	110	0.1	131.4	0.04109589	0	0	0	0.449804143	Overvalued
185	13-12-23	112	0.05	131.4	0.04109589	0	0	0	0.370063642	Overvalued
186	13-12-23	113	0.1	131.4	0.04109589	0	0	0.01	0.392374657	Overvalued
187	13-12-23	114	0.1	131.4	0.04109589	0	0.01	0.01	0.372779689	Overvalued
188	13-12-23	115	0.05	131.4	0.04109589	0	0.01	0.02	0.316951895	Overvalued
189	13-12-23	116	0.1	131.4	0.04109589	0	0.02	0.02	0.33714806	Overvalued
190	13-12-23	117	0.15	131.4	0.04109589	0	0.03	0.04	0.340971873	Overvalued
191	13-12-23	118	0.15	131.4	0.04109589	0	0.05	0.06	0.321869056	Overvalued
192	13-12-23	119	0.2	131.4	0.04109589	0	0.08	0.08	0.320714831	Overvalued
193	13-12-23	120	0.25	131.4	0.04109589	0	0.12	0.12	0.315046677	Overvalued
194	13-12-23	121	0.25	131.4	0.04109589	0	0.17	0.18	0.293248509	Overvalued
195	13-12-23	122	0.35	131.4	0.04109589	0.08	0.24	0.25	0.294296863	Overvalued
196	13-12-23	123	0.45	131.4	0.04109589	0.32	0.34	0.35	0.291932714	Overvalued
197	13-12-23	124	0.5	131.4	0.04109589	0.56	0.46	0.47	0.275895761	Overvalued
198	13-12-23	125	0.7	131.4	0.04109589	0.8	0.62	0.62	0.281167277	Overvalued
199	13-12-23	126	0.85	131.4	0.04109589	1.05	0.81	0.82	0.274678789	Overvalued
200	13-12-23	127	1.05	131.4	0.04109589	1.29	1.04	1.05	0.269648115	Overvalued
201	13-12-23	128	1.3	131.4	0.04109589	1.53	1.32	1.33	0.266260075	Undervalued
202	13-12-23	129	1.65	131.4	0.04109589	1.77	1.66	1.67	0.26861035	Undervalued
203	13-12-23	130	2.05	131.4	0.04109589	2.01	2.04	2.05	0.269553187	Overvalued
204	13-12-23	131	2.5	131.4	0.04109589	2.25	2.48	2.49	0.271409201	Overvalued
205	14-12-23	100	0.05	132	0.038356164	0	0	0	0.627352141	Overvalued
206	14-12-23	106	0.05	132	0.038356164	0	0	0	0.506987693	Overvalued
207	14-12-23	107	0.05	132	0.038356164	0	0	0	0.492242861	Overvalued
208	14-12-23	110	0.1	132	0.038356164	0	0	0	0.478041594	Overvalued
209	14-12-23	111	0.1	132	0.038356164	0	0	0	0.456045024	Overvalued
210	14-12-23	113	0.05	132	0.038356164	0	0	0	0.371894209	Overvalued
211	14-12-23	114	0.05	132	0.038356164	0	0	0	0.359870385	Overvalued
212	14-12-23	115	0.05	132	0.038356164	0	0.01	0.01	0.33697124	Overvalued
213	14-12-23	116	0.1	132	0.038356164	0	0.01	0.01	0.360505114	Overvalued
214	14-12-23	117	0.1	132	0.038356164	0	0.02	0.02	0.33996558	Overvalued
215	14-12-23	118	0.15	132	0.038356164	0	0.03	0.04	0.343985675	Overvalued
216	14-12-23	119	0.15	132	0.038356164	0	0.05	0.05	0.322539265	Overvalued
217	14-12-23	120	0.2	132	0.038356164	0	0.08	0.08	0.320568789	Overvalued

218	14-12-23	121	0.25	132	0.038356164	0	0.12	0.12	0.315111907	Overvalued
219	14-12-23	122	0.3	132	0.038356164	0	0.18	0.18	0.304368514	Overvalued
220	14-12-23	123	0.35	132	0.038356164	0.11	0.25	0.25	0.293545591	Overvalued
221	14-12-23	124	0.4	132	0.038356164	0.35	0.35	0.36	0.280024044	Overvalued
222	14-12-23	125	0.55	132	0.038356164	0.6	0.48	0.48	0.281873309	Overvalued
223	14-12-23	126	0.65	132	0.038356164	0.84	0.64	0.65	0.271123197	Overvalued
224	14-12-23	127	0.8	132	0.038356164	1.08	0.84	0.85	0.262956844	Undervalued
225	14-12-23	128	1	132	0.038356164	1.32	1.09	1.1	0.257638925	Undervalued
226	14-12-23	129	1.3	132	0.038356164	1.56	1.38	1.39	0.259979483	Undervalued
227	14-12-23	130	1.6	132	0.038356164	1.8	1.73	1.74	0.25513358	Undervalued
228	14-12-23	131	2	132	0.038356164	2.04	2.14	2.15	0.255451528	Undervalued
229	15-12-23	100	0.1	136.45	0.035616438	0	0	0	0.775145687	Overvalued
230	15-12-23	105	0.05	136.45	0.035616438	0	0	0	0.60308623	Overvalued
231	15-12-23	110	0.05	136.45	0.035616438	0	0	0	0.517536134	Overvalued
232	15-12-23	114	0.05	136.45	0.035616438	0	0	0	0.443491036	Overvalued
233	15-12-23	115	0.1	136.45	0.035616438	0	0	0	0.466754791	Overvalued
234	15-12-23	116	0.1	136.45	0.035616438	0	0	0	0.447188438	Overvalued
235	15-12-23	117	0.1	136.45	0.035616438	0	0	0	0.429403562	Overvalued
236	15-12-23	118	0.1	136.45	0.035616438	0	0	0	0.407298075	Overvalued
237	15-12-23	119	0.1	136.45	0.035616438	0	0.01	0.01	0.384654481	Overvalued
238	15-12-23	120	0.15	136.45	0.035616438	0	0.01	0.01	0.395363981	Overvalued
239	15-12-23	121	0.15	136.45	0.035616438	0	0.02	0.02	0.374982065	Overvalued
240	15-12-23	122	0.2	136.45	0.035616438	0	0.03	0.03	0.372941899	Overvalued
241	15-12-23	123	0.2	136.45	0.035616438	0	0.04	0.04	0.351659061	Overvalued
242	15-12-23	124	0.2	136.45	0.035616438	0	0.07	0.07	0.330966343	Overvalued
243	15-12-23	125	0.2	136.45	0.035616438	0	0.1	0.1	0.308798684	Overvalued
244	15-12-23	126	0.25	136.45	0.035616438	0	0.15	0.15	0.301351274	Overvalued
245	15-12-23	127	0.3	136.45	0.035616438	0	0.21	0.22	0.293045344	Overvalued
246	15-12-23	128	0.35	136.45	0.035616438	0.24	0.3	0.31	0.279866832	Overvalued
247	15-12-23	129	0.45	136.45	0.035616438	0.48	0.41	0.42	0.276780047	Overvalued
248	15-12-23	130	0.55	136.45	0.035616438	0.72	0.56	0.57	0.268046879	Undervalued
249	15-12-23	131	0.75	136.45	0.035616438	0.96	0.74	0.75	0.269880953	Overvalued
250	15-12-23	132	0.9	136.45	0.035616438	1.21	0.97	0.98	0.259853062	Undervalued
251	15-12-23	133	1.25	136.45	0.035616438	1.45	1.24	1.25	0.269744683	Overvalued
252	15-12-23	134	1.6	136.45	0.035616438	1.69	1.56	1.57	0.272510652	Overvalued
253	15-12-23	135	2.05	136.45	0.035616438	1.93	1.94	1.95	0.28015032	Overvalued
254	15-12-23	136	2.5	136.45	0.035616438	2.17	2.38	2.39	0.281356766	Overvalued
255	18-12-23	100	0.05	136.6	0.02739726	0	0	0	0.817881569	Overvalued
256	18-12-23	101	0.05	136.6	0.02739726	0	0	0	0.786598158	Overvalued
257	18-12-23	105	0.05	136.6	0.02739726	0	0	0	0.689500601	Overvalued
258	18-12-23	110	0.05	136.6	0.02739726	0	0	0	0.586158188	Overvalued
259	18-12-23	111	0.05	136.6	0.02739726	0	0	0	0.567124879	Overvalued
260	18-12-23	113	0.1	136.6	0.02739726	0	0	0	0.580466065	Overvalued
261	18-12-23	114	0.05	136.6	0.02739726	0	0	0	0.500766124	Overvalued

262	18-12-23	115	0.05	136.6	0.02739726	0	0	0	0.486534832	Overvalued
263	18-12-23	116	0.1	136.6	0.02739726	0	0	0	0.512677939	Overvalued
264	18-12-23	117	0.1	136.6	0.02739726	0	0	0	0.485902468	Overvalued
265	18-12-23	118	0.1	136.6	0.02739726	0	0	0	0.463660231	Overvalued
266	18-12-23	119	0.1	136.6	0.02739726	0	0	0	0.44377106	Overvalued
267	18-12-23	120	0.1	136.6	0.02739726	0	0	0	0.421022154	Overvalued
268	18-12-23	121	0.15	136.6	0.02739726	0	0	0.01	0.426940265	Overvalued
269	18-12-23	122	0.15	136.6	0.02739726	0	0.01	0.01	0.402330745	Overvalued
270	18-12-23	123	0.2	136.6	0.02739726	0	0.02	0.02	0.404191065	Overvalued
271	18-12-23	124	0.2	136.6	0.02739726	0	0.03	0.03	0.377297498	Overvalued
272	18-12-23	125	0.2	136.6	0.02739726	0	0.04	0.05	0.352011808	Overvalued
273	18-12-23	126	0.25	136.6	0.02739726	0	0.07	0.07	0.347752055	Overvalued
274	18-12-23	127	0.3	136.6	0.02739726	0	0.11	0.12	0.335959913	Overvalued
275	18-12-23	128	0.35	136.6	0.02739726	0	0.17	0.17	0.321001364	Overvalued
276	18-12-23	129	0.45	136.6	0.02739726	0.18	0.25	0.26	0.316792428	Overvalued
277	18-12-23	130	0.55	136.6	0.02739726	0.42	0.36	0.37	0.306124562	Overvalued
278	18-12-23	131	0.65	136.6	0.02739726	0.66	0.51	0.52	0.294188445	Overvalued
279	18-12-23	132	0.85	136.6	0.02739726	0.9	0.7	0.71	0.291648264	Overvalued
280	18-12-23	133	1.2	136.6	0.02739726	1.15	0.94	0.95	0.304267003	Overvalued
281	18-12-23	134	1.55	136.6	0.02739726	1.39	1.24	1.25	0.308018225	Overvalued
282	18-12-23	135	2	136.6	0.02739726	1.63	1.59	1.6	0.31597091	Overvalued
283	18-12-23	136	2.45	136.6	0.02739726	1.87	2.01	2.02	0.318109514	Overvalued
284	19-12-23	105	0.05	135.4	0.024657534	0	0	0	0.708053088	Overvalued
285	19-12-23	109	0.05	135.4	0.024657534	0	0	0	0.618128431	Overvalued
286	19-12-23	110	0.05	135.4	0.024657534	0	0	0	0.591507918	Overvalued
287	19-12-23	111	0.05	135.4	0.024657534	0	0	0	0.566829235	Overvalued
288	19-12-23	113	0.05	135.4	0.024657534	0	0	0	0.527386194	Overvalued
289	19-12-23	115	0.05	135.4	0.024657534	0	0	0	0.480778619	Overvalued
290	19-12-23	116	0.05	135.4	0.024657534	0	0	0	0.459153062	Overvalued
291	19-12-23	117	0.1	135.4	0.024657534	0	0	0	0.487231727	Overvalued
292	19-12-23	118	0.1	135.4	0.024657534	0	0	0	0.466194468	Overvalued
293	19-12-23	119	0.1	135.4	0.024657534	0	0	0	0.438513816	Overvalued
294	19-12-23	120	0.1	135.4	0.024657534	0	0	0	0.416304961	Overvalued
295	19-12-23	121	0.1	135.4	0.024657534	0	0.01	0.01	0.394819338	Overvalued
296	19-12-23	122	0.1	135.4	0.024657534	0	0.01	0.01	0.368649727	Overvalued
297	19-12-23	123	0.15	135.4	0.024657534	0	0.02	0.02	0.373207026	Overvalued
298	19-12-23	124	0.15	135.4	0.024657534	0	0.03	0.03	0.347057556	Overvalued
299	19-12-23	125	0.2	135.4	0.024657534	0	0.06	0.06	0.343620627	Overvalued
300	19-12-23	126	0.2	135.4	0.024657534	0	0.09	0.09	0.318819149	Overvalued
301	19-12-23	127	0.25	135.4	0.024657534	0	0.14	0.15	0.307528288	Overvalued
302	19-12-23	128	0.3	135.4	0.024657534	0.11	0.22	0.22	0.292009723	Overvalued
303	19-12-23	129	0.45	135.4	0.024657534	0.35	0.32	0.33	0.297357844	Overvalued
304	19-12-23	130	0.5	135.4	0.024657534	0.59	0.46	0.47	0.276576971	Overvalued
305	19-12-23	131	0.65	135.4	0.024657534	0.84	0.65	0.65	0.269535237	Overvalued

306	19-12-23	132	0.9	135.4	0.024657534	1.08	0.89	0.89	0.270706501	Overvalued
307	19-12-23	133	1.25	135.4	0.024657534	1.32	1.18	1.19	0.278378209	Overvalued
308	19-12-23	134	1.65	135.4	0.024657534	1.56	1.54	1.55	0.282231989	Overvalued
309	19-12-23	135	2.2	135.4	0.024657534	1.81	1.97	1.98	0.295992548	Overvalued
310	20-12-23	100	0.05	129.75	0.021917808	0	0	0	0.778131733	Overvalued
311	20-12-23	105	0.05	129.75	0.021917808	0	0	0	0.6510968	Overvalued
312	20-12-23	106	0.05	129.75	0.021917808	0	0	0	0.616119866	Overvalued
313	20-12-23	109	0.1	129.75	0.021917808	0	0	0	0.609298353	Overvalued
314	20-12-23	110	0.05	129.75	0.021917808	0	0	0	0.514903331	Overvalued
315	20-12-23	111	0.1	129.75	0.021917808	0	0	0	0.550021044	Overvalued
316	20-12-23	113	0.05	129.75	0.021917808	0	0	0	0.447700455	Overvalued
317	20-12-23	114	0.05	129.75	0.021917808	0	0	0	0.424004789	Overvalued
318	20-12-23	115	0.1	129.75	0.021917808	0	0	0	0.447470571	Overvalued
319	20-12-23	116	0.05	129.75	0.021917808	0	0	0	0.374143499	Overvalued
320	20-12-23	117	0.05	129.75	0.021917808	0	0.01	0.01	0.354205724	Overvalued
321	20-12-23	118	0.1	129.75	0.021917808	0	0.01	0.01	0.363649372	Overvalued
322	20-12-23	119	0.1	129.75	0.021917808	0	0.02	0.02	0.339192043	Overvalued
323	20-12-23	120	0.15	129.75	0.021917808	0	0.04	0.04	0.340406082	Overvalued
324	20-12-23	121	0.15	129.75	0.021917808	0	0.07	0.07	0.311259333	Overvalued
325	20-12-23	122	0.2	129.75	0.021917808	0	0.12	0.12	0.302501754	Overvalued
326	20-12-23	123	0.3	129.75	0.021917808	0.09	0.19	0.2	0.302099207	Overvalued
327	20-12-23	124	0.35	129.75	0.021917808	0.33	0.3	0.3	0.283403806	Overvalued
328	20-12-23	125	0.5	129.75	0.021917808	0.57	0.44	0.45	0.282052942	Overvalued
329	20-12-23	126	0.7	129.75	0.021917808	0.82	0.64	0.64	0.279815008	Overvalued
330	20-12-23	127	0.85	129.75	0.021917808	1.06	0.89	0.9	0.262166255	Undervalued
331	20-12-23	128	1.1	129.75	0.021917808	1.3	1.22	1.23	0.251647968	Undervalued
332	20-12-23	129	1.5	129.75	0.021917808	1.54	1.61	1.62	0.253770957	Undervalued
333	21-12-23	100	0.05	131	0.019178082	0	0	0	0.86075712	Overvalued
334	21-12-23	101	0.05	131	0.019178082	0	0	0	0.824557707	Overvalued
335	21-12-23	110	0.05	131	0.019178082	0	0	0	0.588324346	Overvalued
336	21-12-23	111	0.05	131	0.019178082	0	0	0	0.560069491	Overvalued
337	21-12-23	112	0.05	131	0.019178082	0	0	0	0.526887908	Overvalued
338	21-12-23	115	0.05	131	0.019178082	0	0	0	0.453463876	Overvalued
339	21-12-23	116	0.05	131	0.019178082	0	0	0	0.430637258	Overvalued
340	21-12-23	117	0.05	131	0.019178082	0	0	0	0.402028021	Overvalued
341	21-12-23	118	0.05	131	0.019178082	0	0	0	0.373880707	Overvalued
342	21-12-23	119	0.1	131	0.019178082	0	0.01	0.01	0.393200679	Overvalued
343	21-12-23	120	0.1	131	0.019178082	0	0.01	0.01	0.365949565	Overvalued
344	21-12-23	121	0.1	131	0.019178082	0	0.03	0.03	0.338119933	Overvalued
345	21-12-23	122	0.1	131	0.019178082	0	0.05	0.05	0.310838263	Overvalued
346	21-12-23	123	0.1	131	0.019178082	0	0.08	0.08	0.283193187	Overvalued
347	21-12-23	124	0.15	131	0.019178082	0	0.14	0.14	0.275117373	Overvalued
348	21-12-23	125	0.25	131	0.019178082	0.18	0.22	0.22	0.277922783	Overvalued
349	21-12-23	126	0.3	131	0.019178082	0.42	0.34	0.35	0.259055336	Undervalued

350	21-12-23	127	0.4	131	0.019178082	0.66	0.51	0.52	0.245443674	Undervalued
351	21-12-23	128	0.55	131	0.019178082	0.91	0.74	0.75	0.23435445	Undervalued
352	21-12-23	129	0.75	131	0.019178082	1.15	1.03	1.04	0.224112964	Undervalued
353	21-12-23	130	1.05	131	0.019178082	1.39	1.41	1.41	0.218145662	Undervalued
354	22-12-23	100	0.05	133.55	0.016438356	0	0	0	0.978675488	Overvalued
355	22-12-23	105	0.05	133.55	0.016438356	0	0	0	0.824800558	Overvalued
356	22-12-23	110	0.05	133.55	0.016438356	0	0	0	0.689493007	Overvalued
357	22-12-23	111	0.05	133.55	0.016438356	0	0	0	0.658857031	Overvalued
358	22-12-23	113	0.05	133.55	0.016438356	0	0	0	0.606680516	Overvalued
359	22-12-23	114	0.05	133.55	0.016438356	0	0	0	0.583298276	Overvalued
360	22-12-23	115	0.05	133.55	0.016438356	0	0	0	0.546270519	Overvalued
361	22-12-23	116	0.05	133.55	0.016438356	0	0	0	0.524654589	Overvalued
362	22-12-23	117	0.05	133.55	0.016438356	0	0	0	0.487373214	Overvalued
363	22-12-23	118	0.05	133.55	0.016438356	0	0	0	0.4687409	Overvalued
364	22-12-23	119	0.05	133.55	0.016438356	0	0	0	0.443540046	Overvalued
365	22-12-23	120	0.05	133.55	0.016438356	0	0	0	0.411246646	Overvalued
366	22-12-23	121	0.05	133.55	0.016438356	0	0	0	0.388920055	Overvalued
367	22-12-23	122	0.05	133.55	0.016438356	0	0.01	0.01	0.357020155	Overvalued
368	22-12-23	123	0.05	133.55	0.016438356	0	0.01	0.01	0.326993734	Overvalued
369	22-12-23	124	0.1	133.55	0.016438356	0	0.02	0.02	0.345352392	Overvalued
370	22-12-23	125	0.1	133.55	0.016438356	0	0.04	0.04	0.313247937	Overvalued
371	22-12-23	126	0.1	133.55	0.016438356	0	0.08	0.08	0.2823854	Overvalued
372	22-12-23	127	0.15	133.55	0.016438356	0	0.13	0.14	0.275841182	Overvalued
373	22-12-23	128	0.15	133.55	0.016438356	0.2	0.22	0.23	0.242840407	Undervalued
374	22-12-23	129	0.2	133.55	0.016438356	0.44	0.35	0.35	0.227929423	Undervalued
375	22-12-23	130	0.3	133.55	0.016438356	0.68	0.53	0.54	0.217496405	Undervalued
376	22-12-23	131	0.4	133.55	0.016438356	0.93	0.78	0.78	0.198825048	Undervalued
377	22-12-23	132	0.55	133.55	0.016438356	1.17	1.1	1.11	0.178693316	Undervalued
378	22-12-23	133	1	133.55	0.016438356	1.42	1.5	1.51	0.194150979	Undervalued
379	26-12-23	100	0.05	135.2	0.005479452	0	0	0	1.726866111	Overvalued
380	26-12-23	107	0.05	135.2	0.005479452	0	0	0	1.398845301	Overvalued
381	26-12-23	110	0.05	135.2	0.005479452	0	0	0	1.254055887	Overvalued
382	26-12-23	111	0.05	135.2	0.005479452	0	0	0	1.185359408	Overvalued
383	26-12-23	115	0.05	135.2	0.005479452	0	0	0	1.022385353	Overvalued
384	26-12-23	116	0.05	135.2	0.005479452	0	0	0	0.973704966	Overvalued
385	26-12-23	118	0.05	135.2	0.005479452	0	0	0	0.871774958	Overvalued
386	26-12-23	119	0.05	135.2	0.005479452	0	0	0	0.835240636	Overvalued
387	26-12-23	120	0.05	135.2	0.005479452	0	0	0	0.774634773	Overvalued
388	26-12-23	121	0.05	135.2	0.005479452	0	0	0	0.72383353	Overvalued
389	26-12-23	122	0.05	135.2	0.005479452	0	0	0	0.684923999	Overvalued
390	26-12-23	123	0.05	135.2	0.005479452	0	0	0	0.636623173	Overvalued
391	26-12-23	124	0.05	135.2	0.005479452	0	0	0	0.594225864	Overvalued
392	26-12-23	125	0.05	135.2	0.005479452	0	0	0	0.544286488	Overvalued
393	26-12-23	126	0.1	135.2	0.005479452	0	0	0	0.561393853	Overvalued

394	26-12-23	127	0.1	135.2	0.005479452	0	0	0	0.51203237	Overvalued
395	26-12-23	128	0.1	135.2	0.005479452	0	0	0	0.460957648	Overvalued
396	26-12-23	129	0.1	135.2	0.005479452	0	0.01	0.01	0.410676907	Overvalued
397	26-12-23	130	0.15	135.2	0.005479452	0	0.02	0.02	0.388533361	Overvalued
398	26-12-23	131	0.15	135.2	0.005479452	0	0.06	0.06	0.334706251	Overvalued
399	26-12-23	132	0.2	135.2	0.005479452	0.14	0.14	0.14	0.299092469	Overvalued
400	26-12-23	133	0.35	135.2	0.005479452	0.38	0.3	0.3	0.287582667	Overvalued
401	26-12-23	134	0.65	135.2	0.005479452	0.63	0.56	0.56	0.29570341	Overvalued
402	26-12-23	135	1.1	135.2	0.005479452	0.88	0.95	0.96	0.306799353	Overvalued
403	27-12-23	100	0.05	137.2	0.002739726	0	0	0	2.573685682	Overvalued
404	27-12-23	110	0.05	137.2	0.002739726	0	0	0	1.872159552	Overvalued
405	27-12-23	115	0.05	137.2	0.002739726	0	0	0	1.539230765	Overvalued
406	27-12-23	116	0.05	137.2	0.002739726	0	0	0	1.469267478	Overvalued
407	27-12-23	117	0.05	137.2	0.002739726	0	0	0	1.4059036	Overvalued
408	27-12-23	118	0.05	137.2	0.002739726	0	0	0	1.348452842	Overvalued
409	27-12-23	119	0.05	137.2	0.002739726	0	0	0	1.256734222	Overvalued
410	27-12-23	120	0.05	137.2	0.002739726	0	0	0	1.210066011	Overvalued
411	27-12-23	121	0.05	137.2	0.002739726	0	0	0	1.144758637	Overvalued
412	27-12-23	122	0.05	137.2	0.002739726	0	0	0	1.095880972	Overvalued
413	27-12-23	123	0.05	137.2	0.002739726	0	0	0	1.015611728	Overvalued
414	27-12-23	124	0.05	137.2	0.002739726	0	0	0	0.952362763	Overvalued
415	27-12-23	125	0.05	137.2	0.002739726	0	0	0	0.891079159	Overvalued
416	27-12-23	126	0.05	137.2	0.002739726	0	0	0	0.830162141	Overvalued
417	27-12-23	127	0.05	137.2	0.002739726	0	0	0	0.759556282	Overvalued
418	27-12-23	128	0.05	137.2	0.002739726	0	0	0	0.699484805	Overvalued
419	27-12-23	129	0.05	137.2	0.002739726	0	0	0	0.625011156	Overvalued
420	27-12-23	130	0.05	137.2	0.002739726	0	0	0	0.551615873	Overvalued
421	27-12-23	131	0.05	137.2	0.002739726	0	0	0	0.497967616	Overvalued
422	27-12-23	132	0.05	137.2	0.002739726	0	0	0	0.42903265	Overvalued
423	27-12-23	133	0.05	137.2	0.002739726	0	0.01	0.01	0.361356228	Overvalued
424	27-12-23	134	0.05	137.2	0.002739726	0	0.04	0.04	0.289157059	Overvalued
425	27-12-23	135	0.1	137.2	0.002739726	0.12	0.12	0.12	0.256726327	Undervalued
426	27-12-23	136	0.3	137.2	0.002739726	0.37	0.3	0.31	0.268402874	Undervalued
427	27-12-23	137	0.75	137.2	0.002739726	0.62	0.66	0.67	0.298753792	Overvalued

At the Money (ATM) Put Options

S.No.	Date	Strike Price	Close	Underlying Value	Maturity Time	Binomial Price	BSM Price	MC Price	Implied Volatility	Valuation
1	1-12-23	130	2.95	130	0.073973	3.02	3.46	3.47	0.232638	Undervalued
2	4-12-23	131	2.95	131	0.065753	2.89	3.3	3.32	0.242884	Undervalued
3	7-12-23	130	2.9	130	0.057534	2.7	3.08	3.1	0.253912	Undervalued
4	14-12-23	132	2.45	132	0.038356	2.28	2.6	2.61	0.254505	Undervalued
5	21-12-23	131	1.5	131	0.019178	1.64	1.86	1.87	0.218905	Undervalued