MATTEL

Derivatives Project

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On my honor, I have neither received nor given any unauthorized assistance on this assignment.

Company Background

The company that I examined for this project is Mattel (MAT). Mattel is a multinational American toy manufacturing and entertainment company headquartered in El Segundo, California, founded in 1945. Mattel is best known for some of its brands, such as Barbie, Fisher Price, Uno, Hot Wheels, and many more. Mattel has a market capitalization of 6.53 billion dollars. Mattel's credit rating has recently gone up to a BBB.

Hedging

Hedging mitigates risk in case the stock moves in an opposite direction. Hedging is significant when writing calls to prevent exposure risk. Since there is potential for unlimited loss when writing calls, offsetting the risk by hedging is very important.

Description of Work

I went to Yahoo Finance and found the stock price of Mattel from March 17, 2024, to April 17, 2024. I copied the days and the closing price for the month and then used the values to create a regression and predict the stock price of the twenty-second day using the slope and intercept from the regression. After I found those values, I made a scatterplot for the number of days along with the price to visualize the movements in price over the month. Next, I found a Mattel option that was out of the money and decided to use that to calculate the Black-Scholes Martin value of the call option for the prediction day. I used the strike price, stock price, and the implied volatility listed on Yahoo Finance, found the risk-free rate for the prediction day, and calculated the time to maturity based on the option's expiration date. Once I collected all the values for the variables, I solved for d1, d2, N(d1), N(d2), call value, delta, gamma, vega, rho, theta, and vega/100. I chose another option with the same expiration date, found the new strike price and volatility, and solved for the same values. Then, I performed delta hedging by figuring out how many shares of the stock I would need to buy to make the portfolio delta-neutral. I solved for W1 and W2 using the gamma and vega of the portfolio and the options separately and determined to sell both options when I split and had 50,000 of each option in my portfolio.

Interpreting the Greeks

Delta measures the rate of change of the option price relative to changes in the underlying asset's asset price. My delta was around .456, which means that for every $1 increase in the stock price, the option price will increase by $0.46. Gamma measures the rate of change of an option's delta in response to changes in the underlying asset's price. A gamma of 0.1536 means that for every $1 change in the underlying asset's price, the option's delta will change by 0.1536. Vega measures the rate of change in an option's price in response to changes in the underlying asset's implied volatility. A vega of 2.094 means that for every 1% increase in implied volatility of the underlying asset, the option's price will increase by $2.09. For every 1% decrease in implied

volatility, the option's price will decrease by $2.09. Rho measures the rate of change in an option's price in response to changes in the risk-free interest rate. A rho of 0.59979 means that for every percentage point increase in the risk-free interest rate, the option's price will increase by $0.60. For every percentage point decrease in the risk-free interest rate, the option's price will decrease by $0.60. Theta measures the rate of change in an option's price concerning the passage of time. A theta of -6.5885 means that the option's price will decrease by $6.59 per day, all else equal.

Final Results

Assuming that Mattel sold 100,000 call option contracts, I performed hedging of a portfolio regarding the greeks: delta, gamma, and vega. Using the Black-Scholes Martin formula, I calculated the delta of the portfolio, which was 53396.886. That means the company would have to buy 53396.886 shares of stock to make the position delta-neutral. The gamma of my portfolio is 15598.1924, which means I would have to purchase 15598.1924 shares to make my position gamma-neutral. This would ensure that there is no drastic increase in the rate of change of the call option value and delta after a $1 increase in the value of Mattel. The vega of the portfolio is 205954.453, meaning that a 1% change in implied volatility of Mattel would result in the company having to short shares of stock at a different strike price to be vega neutral to remove most of the volatility risk.

Links

https://finance.yahoo.com/quote/MAT/history?period1=1710633600&period2=1713312000&interval=1d&filter=history&frequency=1d&includeAdjustedClose=true
https://finance.yahoo.com/quote/MAT/options?straddle=false
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