


MAT116 Project 3
Chapter 10

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10-2 & 10-3: Stocks and Options

What is the difference between a stock and a stock option?

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10-3: Stocks and Options

What is the difference between a call option and a put option?

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10-1: Introduction

What is a call option?

What is a strike price?

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10-3: Stocks and Options

What is the difference between a European option and an American Option?

Which one will we use in the Project?

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10-3: The Value of Options

How do you calculate the value of a call option?

Let C be price of a share of stock at the end of an option period and S be the strike price. Then:

$$Value = \begin{cases} C - S & \text{if } C > S \\ 0 & \text{if } C \leq S \end{cases}$$

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Example:

□ You have purchased the option to buy Boeing stock with a strike price of \$30. Find the value of the option, if the price of the stock is:

- \$29.50 per share
- \$32.75 per share

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Example

□ You paid \$2.95 for the option to buy Boeing stock with a strike price of \$30. Find your overall profit (or loss), if the price of the stock at the end of the option period is:

- \$29.50 per share
- \$33.05 per share

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Example

□ You have \$400 to invest. Currently a stock costs \$80 per share. A call option with a strike price of \$85 costs \$5 per share. Three months later, the stock drops to \$65. Find the profit made from:

- Buying 5 shares of stock
- Buying 80 shares of a call option

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Assumptions

□2. The past history of prices for a given stock can be used to predict the amount of future variation in the price of that stock. Market history shows stocks whose price has fluctuated widely in the past will continue to fluctuate; those with limited variability will retain that trait. The extent of a stock price's variability is called its **volatility**.

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Assumptions

□3. All investments are assumed to give the same rate of return. If this were not so, then all smart investors would switch their money to the investment with the highest predicted rate of return. This would raise the cost of the chosen investment, and destroy its predicted rate of return.

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Assumptions

□4. We will assume that the common growth rate mentioned in assumption 3 is the same as the rate of return on a United States Treasury Bill. Since the federal government guarantees the rate for this investment, it is called the risk-free rate.

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Assumptions

5. All investments with the same expected rate of growth are considered to be of equal value to investors. Obviously, some people will prefer one type of investment to another. However, tastes will vary, so we will ignore it in our pricing. This is called the risk neutral assumption.

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Assumptions

6. The stock does not pay dividends, and commissions are not charged for purchasing the option. While in “real life the opposite is normally true, dividends and commissions vary so much that we will not consider them in pricing the option.
7. The option is a European call option.

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Class Project

- We suppose that it is Friday, January 11, 2002. Our goal is to find the present value, per share, of a European call on Walt Disney Company stock. The call is to expire 20 weeks later, with a strike price of \$23. Our work is to be based upon the stock’s price record of weekly closes for the past 8 years.

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Class Project

□ In practice, both a bid (what someone is willing to pay) and an asked price (at which someone is willing to sell) are quoted for options. To simplify things, we will assume that these are the same.

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Class Project

□ Walt Disney trades on the New York Stock Exchange under the ticker symbol DIS. Information downloaded from <http://finance.yahoo.com> on January 11, 2002 is shown in the sheets Yahoo and DL of the Excel file **Option Data.xls**. Relevant data have been copied into the sheet Data of that file.

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Class Project

□ One important fact is that Walt Disney closed at an actual value of \$21.8700 on January 11, 2002. We can use our historical data to gather information on volatility, as discussed in Assumption 2.

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Example Calculation: Percent Change

□ What is the percent change for the most recent pair of weekly data in the file?

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Class Project

□ Finally, we will suppose that on January 11, 2002 the annual interest rate for a 20 week United States Treasury Bill was 4%, compounded continuously. This will be used as the risk-free rate, which is discussed in Assumption 4.

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Class Project

□ Our only goal is to determine a fair option price. We have no interest in the question of whether or not people should have bought such an option, or even whether or not they should have bought Disney stock on January 11, 2002.

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Class Project

□ Likewise, we have no interest in any attempt on January 11, 2002 to predict the closing value of Disney stock at the expiration of the option. According to Assumption 1, this is completely impossible.

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Class Project

- Each team will be given the following
- The name and ticker symbol of its stock.
 - The starting date for its option.
 - The number of years of historical data that will be used in pricing the option.
 - The number of weeks for which its option is to run, and its strike price.
 - The starting date risk-free interest rate of a Treasury Bill for the same period as the option.

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Class Project

□ Each team is to use the class method and its team data to determine the value per share, at the option's starting date, of a European call on its stock.

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