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# Dividend Discount Model

## Model description

**The dividend discount model (DDM)** is a procedure for valuing the price of a stock by using the predicted dividends and discounting them back to the present value. If the value obtained from the DDM is higher than what the shares are currently trading at, then the stock is undervalued.

Price per share = D(1) / (r - g), where

D(1) = the estimated value of next year's dividend and calculated as:

D(1) = D(0) x (1 + g)

## Task description and calculations

**Task: calculate current stock price using the Dividend Discount Model if:**

* D(0) = 100 (dividend value)
* g = 2% (the constant growth rate in perpetuity expected for dividends)
* r = 4% (the constant cost of equity capital for the company)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| D(0) | g | r | D(1) | Current value |
| 100 | 0.02 | 0.04 | 102 | 5100 |

# Single-Index Pricing Model

The Single-Index Model relates returns on the IBM stock to the returns on a common index, such as the S&P 500 Stock Index.

Expressed by the following equation:



where: is the return of the stock price, and are constants, is the return of a 

market index and is a random variable with mean 0 and variance

For implementation of the Single-Index Pricing Model I used the close IBM prices and S&P 500 Index from 21 October 2016 to 20 October 2017.

My result is: R = -0.000168796 + 0.722028 \* Rm

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| St.dev(S&P500) | St.dev(IBM) | Corr(S&P500 and IBM) | Beta | Mean(IBM) | Mean(S&P500) | Alpha |
| 0.00457598 | 0.010254375 | 0.322202741 | 0.722028 | 0.0003699 | 0.000746082 | -0.000168796 |

# The Black-Scholes Model

***The Black-Scholes Model*** *is a mathematical model used to estimate the price of European-style options (call and put).*

*The model requires the following inputs to estimate the price of an option:*

*S = forward price*

*K = strike price or exercise price*

*r = risk free rate of interest*

σ *= implied volatility*

*t = time to maturity (in years)*

*The pricing model is:*

c=*- Call option price*

p=*- Put option price*

d1=

d2=

*where*

*N(x) is the cumulative probability distribution function for the standardized normal distribution (mean = 0 and standard deviation = 1). In other words, it the probability that a variable with standard normal distribution N(0, 1) will be less than x.*

## Assumptions of the Black-Scholes Option-Pricing Model

The following are some of the key assumptions underlying the Black-Scholes option pricing model:

1. The risk-free rate is known and constant over the life of the option.

2. The probability distribution of stock prices is lognormal.

3. The variability of a stock’s return is constant.

4. The option is to be exercised only at maturity, if at all.

5. There are no transaction costs involved in trading options.

6. Tax rates are similar for all participants who trade options.

7. The stock of concern does not pay cash dividends.

Source [*[1]*](#_Sources)*.*

## Results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input Parameters:** | | | | |
| **S - forward price** | **K - strike price** | **r - risk-free rate** | **σ - implied volatility** | ***t- time to maturity*** |
| 49 | 49 | 0.001 | 0.25 | 1 |

My result of call and put options price is:

|  |  |
| --- | --- |
| ***Call option price*** | ***Put option price*** |
| 4.896436605 | 4.847461097 |

# Sources

|  |  |  |
| --- | --- | --- |
| |  |  | | --- | --- | | 1 | Financial Markets and Institutions, 11th Edition, Jeff Madura | |