# The Black-Scholes calculator

## The Black–Scholes world

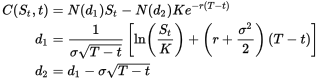
The Black–Scholes model assumes that the market consists of at least one risky asset, usually called the stock, and one riskless asset, usually called the money market, cash, or bond.

Now we make assumptions on the assets (which explain their names):

* (riskless rate) The rate of return on the riskless asset is constant and thus called the risk-free interest rate.
* (random walk) The instantaneous log return of stock price is an infinitesimal random walk with drift; more precisely, it is a geometric Brownian motion, and we will assume its drift and volatility is constant (if they are time-varying, we can deduce a suitably modified Black–Scholes formula quite simply, as long as the volatility is not random).
* The stock does not pay a dividend.

Assumptions on the market:

* There is no arbitrage opportunity (i.e., there is no way to make a riskless profit).
* It is possible to borrow and lend any amount, even fractional, of cash at the riskless rate.
* It is possible to buy and sell any amount, even fractional, of the stock (this includes short selling).
* The above transactions do not incur any fees or costs (i.e., frictionless market).



HD:Users:cammilligan:Dropbox:ActiveProjects:Ethereum-Options-Marketplace:Research:Put Model.png

For above:

* {\displaystyle N(\cdot )}N(.) is the cumulative distribution function of the standard normal distribution
* {\displaystyle T-t}T - t is the time to maturity (expressed in years)
* {\displaystyle S\_{t}}St is the spot price of the underlying asset
* {\displaystyle K}K is the strike price
* {\displaystyle r}r is the risk free rate (annual rate, expressed in terms of continuous compounding{\displaystyle \sigma }
* igma is the volatility of returns of the underlying asset