Hedging Strategy (hedge the option)

Hedge a short option with an equivalent long option. Reverse hedge refers to hedge a long option with an equivalent short option. Since delta and option value is node dependent, the delta hedging strategy is path dependent which gives a perfect hedge in theory as completely eliminates the risk.

Risk Neutral Valuation

The **binomial model** is a special case of the risk neutral valuation approach for valuing options. The current value of an option equals to the present value of its future payoff in the risk neutral world discounted at the risk free rate.

1. In the risk neutral world, investors do not care about risk in valuing assets.
2. In a RNW, the expected return on stocks (and all assets) is the risk free rate.
3. RNW assumes risk neutrality only for purpose of valuing the option, even though most investors are risk avers.
4. It can be shown that the value of the option derived in a RNW is the same as the value in a risk averse world.

The variable miu expected stock return, does not appear in the **BSM** equations. The equation is independent of all variables affected by risk preference. This is consistent with the risk-neutral valuation principle. Assume the expected return from an asset is the risk-free rate, calculate the expected payoff from the derivative and discount at the risk-free rate.

Assumptions of BSM

- Market is frictionless: no transaction costs and no taxes	- One can borrow/lend at the risk-free rate
- No dividends are paid prior to expiration	- Stock prices follow the **random walk**
- The risk-free interest rate is constant	- Sock price **variance is constant**
- No riskless arbitrage opportunities exist	- Stock prices **moves continuously, no big jumps**

Historical Volatility

Advantage: simple and intuitive

Drawback: (typically, 2-3 years of daily data)(higher frequency data yield more accurate volatility assessment)

1. require selection of data window (40 years/1 month) and frequency (daily/monthly)
2. gives the same weight to all past observations
3. future may not closely reflect the past (future very different)

Implied Volatility (one-to-one correspondence between option price and the implied volatilities)

The expected standard deviation of the underlying asset returns over the remaining life of the option. It is calculated by given an option pricing model and observed market price, the volatility that makes model price equal to market price.

Advantages: forward looking

Drawbacks: if the option is not traded (no market price) and it assumes the adopted option pricing model is used by majority of the market participants.

BSM Option Pricing Formula and Implied Volatility		
	A	B
1	S	__ current stock price
2	K	__ strike price
3	r	__ risk-free rate of interest
4	T	__ time to maturity of the option (in years)
5	SIGMA	__ random variable stock volatility
6	d1	Formula insert
7	d2	Formula insert
8	N(d1)	Function of B6 -> uses formula NormSDIST(d1)