

Presentation to Queen's University



Options & Volatility An Introduction



Basics

- Forward pricing: What determines the cost of carry and thus the basis (difference) between spot and forward prices?
- For equities:

 $F_T = S_0 e^{(r-d)t}$ (Continuous time)

 $F_T = S_0(1+rt) - PV_{Expected_dividends}$ (Discrete time)

- Assume you're the seller of a 1Y forward on IBM.
 How do you hedge that position?
 - Is this a static hedge?
 - Are there any risks? What could go wrong?
- What if you sold the same forward, but priced in EUR instead of USD?

Extra questions:

- What determines the forward prices of other assets, e.g., of currencies, commodities, or bitcoin? Do other pricing parameters enter the forward equation?
- What about securities lending?
- Do dividend taxes matter? Do they impact the forward price?
- Do asset management fees matter when determining the forward prices of ETPs and mutual funds?

Volatility

Which of the three distributions depicts the highest volatility (sigma)?



Questions:

- Does volatility impact the price of forwards or futures?
- How do futures work?
- Does volatility impact the price of options? If yes, what sort of volatility?
- (Log-)normal distributions: Do they match the returns which we see in the real world? Why do we use them?
- Do we have alternatives to the Black-Scholes model?

Term Structure and Skew

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What can you infer from the below charts?





Put-Call Parity

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• Assumption: European vanilla calls and puts, same strikes, no dividends, same expiration dates

call + discounted strike = put + stock
$$\implies$$
 C + Xe^{-r(T-t)} = P + S
Therefore:

- call = put + stock discounted strike
- put = call stock + discounted strike
- Is this how a trader (e.g., a broker-dealer) hedges (replicates) an options position?
- Street talk: Synthetics, risk reversals, collars, straddles, strangles, calendars
 - Do you know what these terms mean?
- Call-Call Parity? Does an option on the S&P 500 index cost the same as an option on S&P 500 futures, all else being equal? The futures and spot price will be the same at expiration, so...

Sensitivities ("Greeks")

- Key sensitivities: Delta, Gamma, Vega, Theta, Rho, Epsilon
 - What do they measure?
 - How does the price of a vanilla put change if interest rates go up?
- Using vanillas on the same asset only, can you think of an example that would position you net long Vega and net short Gamma at the same time?
- Gamma squeeze: Can you explain what happened in the GME situation? Imagine you are a trader hedging short-dated GME calls. You're caught in a positive convexity feedback loop. What do you do?
- Recommended reading on advanced sensitivities (Charm, Volga, Vanna, Bleed...)
 - \rightarrow Dynamic Hedging (N. Taleb)

Trading Options = Trading Volatility

- Next to options, what other ways exist to trade volatility?
 - Products linked to volatility indices or volatility index derivatives
 - The most popular equity volatility indices are VIX and VSTOXX (measuring implied 1-month variance)
 - Variance swaps
 - Volatility swaps
- Tail hedging vs. active long volatility trading and volatility arbitrage (relative value) trading
- Selling VIX futures vs. selling short-dated OTM puts. Similar BUT very different!
- Shorting volatility is so tempting... but we've all seen what happened to XIV, the CS inverse VIX ETF
- What role to leveraged ETPs (2x, 3x) play? What role do risk parity and volatility target products play?

Basket Options & Correlation

- You're long a call on a basket of two stocks. What role does correlation play?
- S&P 500 index option = option on a basket of ~500 stocks
- Instead of buying an ATM S&P 500 call option, you purchase single ATM call options on each index constituent (same maturities). You weigh each single call by the constituent's weight in the index.
 - Is the S&P 500 index call more expensive than the total cost for all the single calls?
- Implied correlation is the number that equates an option on a basket with the weighted option prices of the basket constituents at a given strike level for the same maturity
- The higher the basket correlation, the higher the volatility and vice versa. When markets crash and volatilities jump, correlations increase (and move toward one)

 $Two_Asset_Basket_Vol = \sqrt{\omega_1 \sigma_1^2 + \omega_2 \sigma_2^2 + 2\rho \omega_1 \omega_2 \sigma_1 \sigma_2}$

Dispersion trading = correlation trading



Thank you!





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