An Intuition-Based Options Primer for Financial Engineering and Options Trading

Model-independent Relationships vs. Black-Scholes Model

1. European Options

1.1. Options payoffs; prices vs. values; speculation vs hedging
1.2. Put-Call parity; Put-Call parity and forward contracts
IQs: Put-Call parity-based synthetic positions
1.3. No-arbitrage bounds for option prices
1.4. Put-Call parity arbitrage
1.5. Put-Call parity arbitrage with bid-ask spreads
1.6. Convexity of option prices and convexity arbitrage
IQs: Convexity arbitrage

2. Options Trading Strategies

2.1. Bull spreads, bear spreads, butterfly spreads
IQs: Bull spreads, bear spreads, butterfly spreads
2.2. Straddles, strangles
IQs: Straddles, strangles
2.3. Return enhancement strategies
IQs: Return enhancement strategies
2.4. Implementing market views using options strategies
IQs: Implementing market views using options strategies

3. Black-Scholes Framework

3.1. The lognormal model for the evolution of asset prices
3.2. Risk-neutral pricing. Black-Scholes formulas
3.3. Put-Call parity, option bounds, asymptotic values in the Black-Scholes framework
3.4. The three variables underlying the Black-Scholes formulas: log moneyness. total standard deviation, present value of the forward price

4. Greeks and Hedging

4.1. Greeks and model-independent relationships
IQs: Greeks and model-independent relationships
4.2. The magic of Black-Scholes Greeks computations
4.3. No-arbitrage option bounds revisited. The time value of options
IQs: Time value
4.4. Delta- and Gamma-hedging. Dynamic hedging
IQs: Greeks hedging
4.5. Greeks dependence on spot price, volatility, maturity: Black-Scholes framework and intuition
IQs: Greeks dependence

5. Implied Volatility

5.1. Implied volatility and a pitfall of the Black-Scholes model
IQs: Implied volatility

5.2. A model-independent relationship for the implied volatility of call and put options
IQs: Implied volatility for options trading strategies
5.3. Newton's method for implied volatility computations
5.4. Numerical computation of implied volatility from market data: dividend yield OLS estimation
5.5. An explicit implied volatility formula and bounds for implied volatility

Suggested Readings:

A Primer for the Mathematics of Financial Engineering, Second Edition, by Dan Stefanica. FE Press, 2011. http://www.fepress.org/primer-second-ed/
Solutions Manual –A Primer for the Mathematics of Financial Engineering, Second Edition, by Dan Stefanica. FE Press, 2011. http://www.fepress.org/sol-man-primer-second-ed/
150 Most Frequently Asked Questions on Quant Interviews, by Dan Stefanica, Rados Radoicic, and Tai-Ho Wang. FE Press, 2013. http://www.fepress.org/150iqs/
Principles of Financial Engineering, Third Edition, by Salih Neftci and Robert Kosowski. Academic Press, 2014. https://www.amazon.com/dp/0123869684/

About the Author:

Dan Stefanica has been the Director of the Baruch MFE Program since its inception in 2002, and is the author of the best-selling books on financial engineering education and quant interview questions. He teaches graduate courses on numerical methods for financial engineering, as well as pre-program courses on advanced calculus and numerical linear algebra with financial applications. His research spans numerical analysis, graph theory, and geophysical fluid dynamics. He has a PhD in mathematics from New York University and taught previously at the Massachusetts Institute of Technology.