



Playing the Odds with Black-Scholes

Portfolio Analysis and Simulation
for better Investing.

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BA225 Derivatives and Risk Management

Abstract

Option analysis adds another dimension to investment management by accounting for potential value of future conditions and opportunities. With automated numerical analysis tools we are now able to provide complex portfolio simulations and analysis in real time enabling us to optimize our portfolio positions.

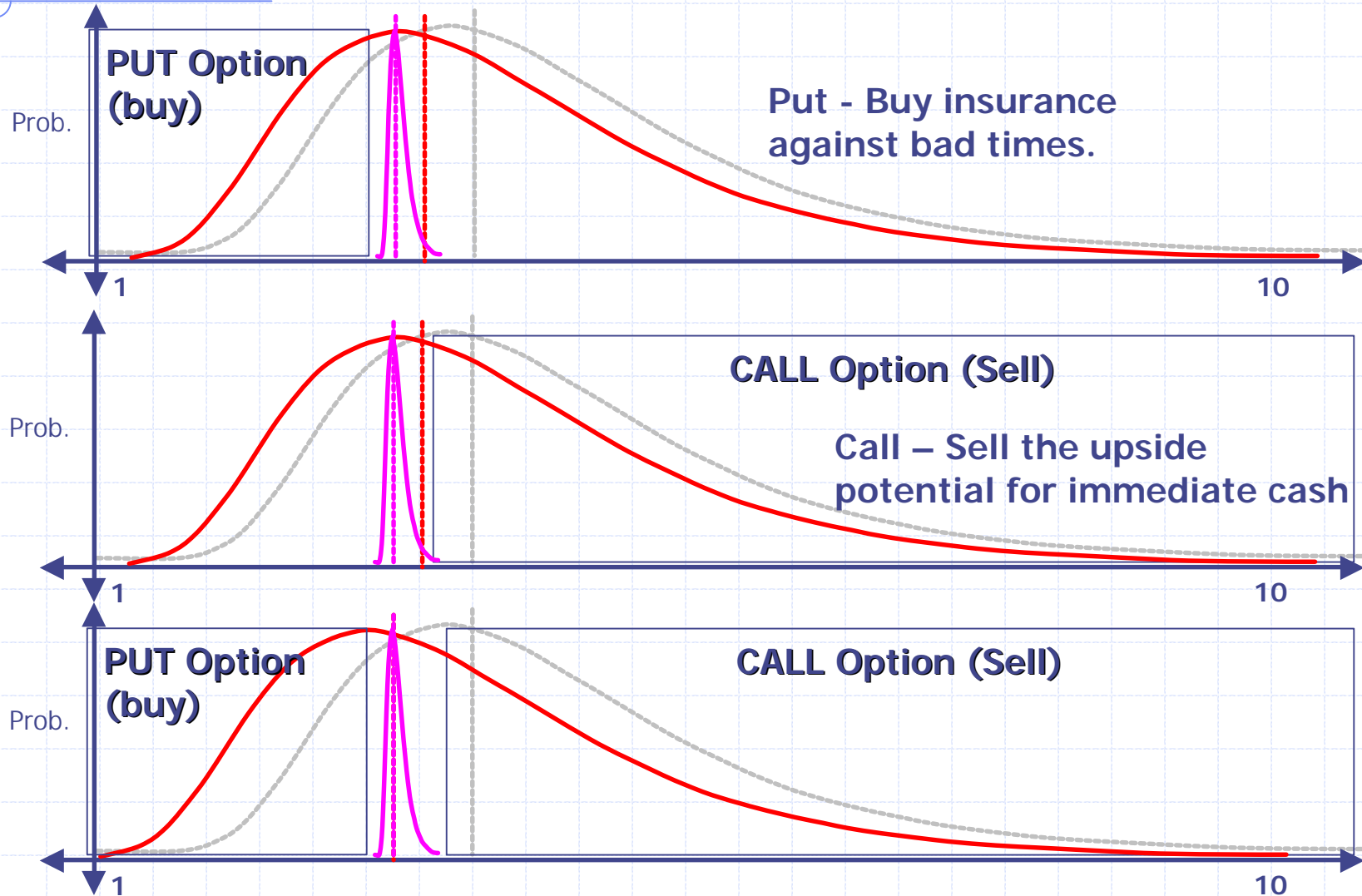
The **Black-Scholes** equations provide a closed form solution to valuation of options based on inputs including time, current and exercise price, risk free rate, and stock volatility.

Binomial tree analysis uses a probability tree to derive the chances of a discrete set of outcomes from a given point. An advantage of the binomial method over Black-Scholes is the ability to account for intermediate transactions which may occur in American options.

Monte Carlo analysis generates predictive outcomes through averaged random simulations based on stock characteristics. Like the binomial model Monte Carlo uses a branching structure, but through automation the number of levels may be extended, and thousands of simulations may be run to provide mean and statistical investment analysis.

An automated solution is presented for each analysis including Black-Scholes options pricing, Binomial Tree analysis, and Monte Carlo simulation. By leveraging these tools the user will be more informed prior to committing to investment decisions, and can evaluate risk management alternatives based on the most recent market data.

Options – Risk Reduction



Black-Scholes Equations

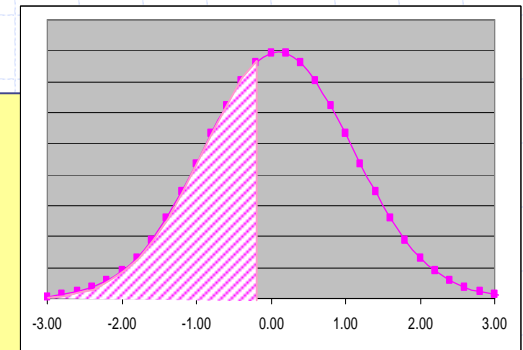
- ◆ Normally Distribution for Percent Returns
- ◆ Log-Normal Distribution for stock price

$$c = S_0 N(d_1) - K e^{-rT} N(d_2)$$

$$p = K e^{-rT} N(-d_2) - S_0 N(-d_1)$$

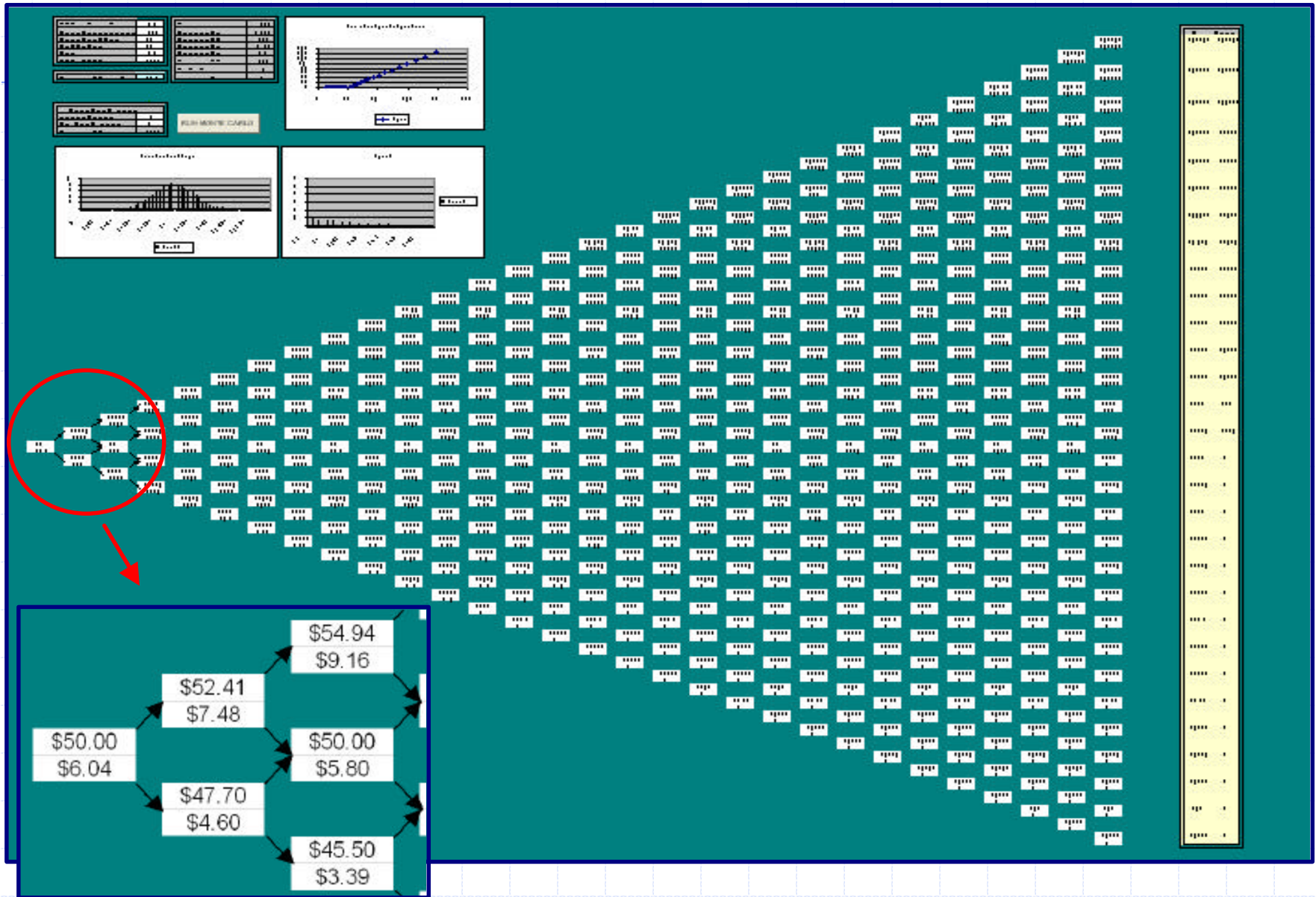
$$\text{where } d_1 = \frac{\ln(S_0 / K) + (r + s^2 / 2)T}{s\sqrt{T}}$$

$$d_2 = d_1 - s\sqrt{T}$$



1. TIME
2. STOCK PRICE
3. OPTION PRICE
4. RISK-FREE RATE
5. VOLATILITY

Binomial Tree Analysis



Monte Carlo Simulations

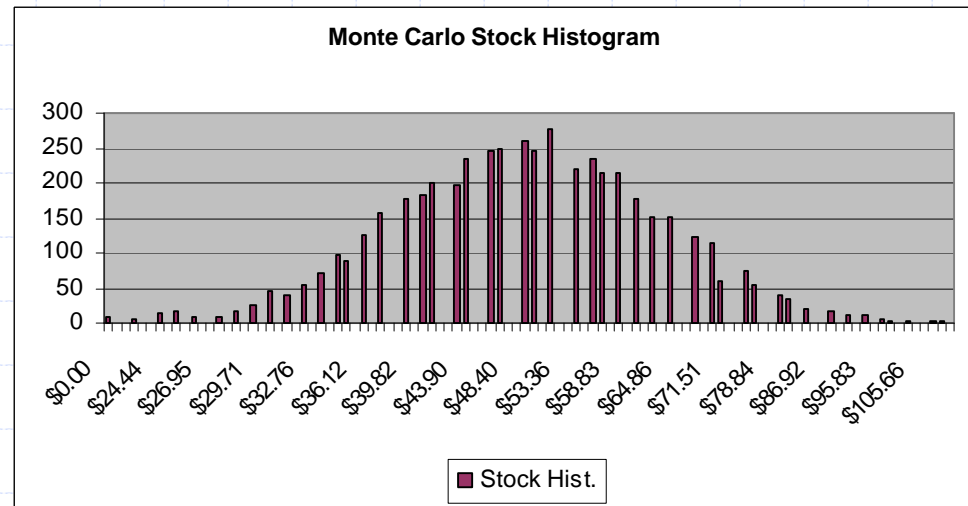
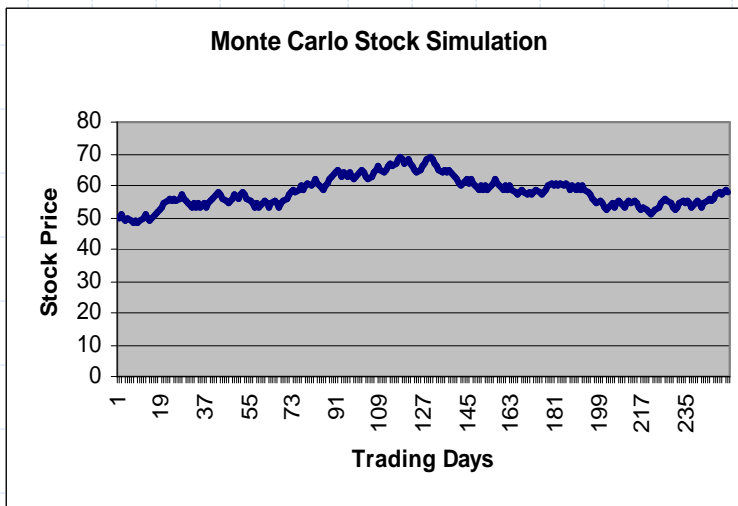
- ◆ Random walk based on real stock parameters.
- ◆ Average of Multiple simulations provides expected return and distribution

Risk Free Rate of Return	10%	Delta t	0.0139
Option Duration (fractional)	0.417	Calculated u	1.0483
Current Stock Price	\$50.00	Calculated d	0.9540
Call Strike Price	\$50.00	Calculated a	1.0014
Volatility	40%	Calculated p	0.5030
PUT or CALL	CALL	Calculated (1 - p)	0.4970
Calculated Option Value		Put-Call Multiplier	-1
		Intervals per Duration	30

\$0.00

Monte Carlo Simulation	
Intervals in Duration	252
Number of Simulations	5000
Calculated Result	\$5.49

RUN MONTE CARLO



Portfolio Analysis introduction

Microsoft Excel - Options Investing 05Apr30.xls

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Arial 10 B I U

Date	4/30/2005	Risk Free Rate	4%	Start Date	4/30/2005
Stock	INTC	Expect Return	10%	End Date	10/22/2005
Current Price	\$23.52	Est. Volatility	20%	User Date	7/26/2005

STOCK - LONG (SHORT)			
#	Quantity	Trade Cost	Curr. Price
1	0	\$0.00	\$0.00
2	0	\$0.00	\$0.00
3	0	\$0.00	\$0.00

SOLVE VALUES

LOAD PORTFOLIO

SAVE PORTFOLIO

CALL OPTIONS - LONG (SHORT)							Implied Volatility
#	Quantity	Trade Cost	Strike Price	Price	Expiration		
1	(1)	\$0.00	\$20.00	\$4.10	10/22/2005		22.41%
2	2	\$0.00	\$22.50	\$2.25	10/22/2005		22.41%
3	(1)	\$0.00	\$25.00	\$1.02	10/22/2005		22.12%

PUT OPTIONS - LONG (SHORT)							Implied Volatility
#	Quantity	Trade Cost	Strike Price	Price	Expiration		
1	0	\$0.00	\$20.00	\$0.40	10/22/2005		28.27%
2	0	\$0.00	\$22.50	\$1.05	10/22/2005		26.61%
3	0	\$0.00	\$25.00	\$2.35	10/22/2005		

CURRENT PORTFOLIO COST	\$62.00
ENDING STOCK PRICE	\$27.23
PORTFOLIO END-POINT VALUE	\$0.00
PERCENTAGE RETURN	100.00%
ANNUALIZED RETURN	208.57%

SIMULATE

Option Data / Portfolio Positions / Time Value / Current Date / User Defined / End Point / Expect

Draw AutoShapes

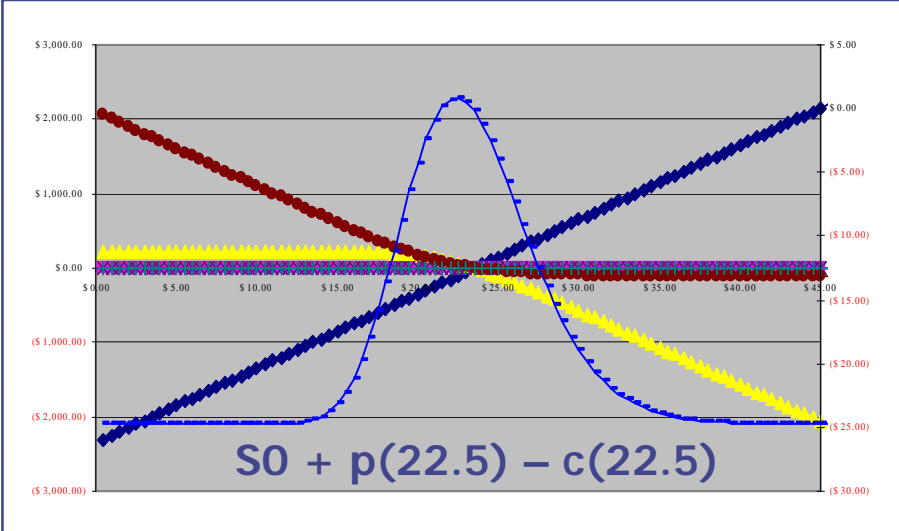
Ready

Portfolio Examples

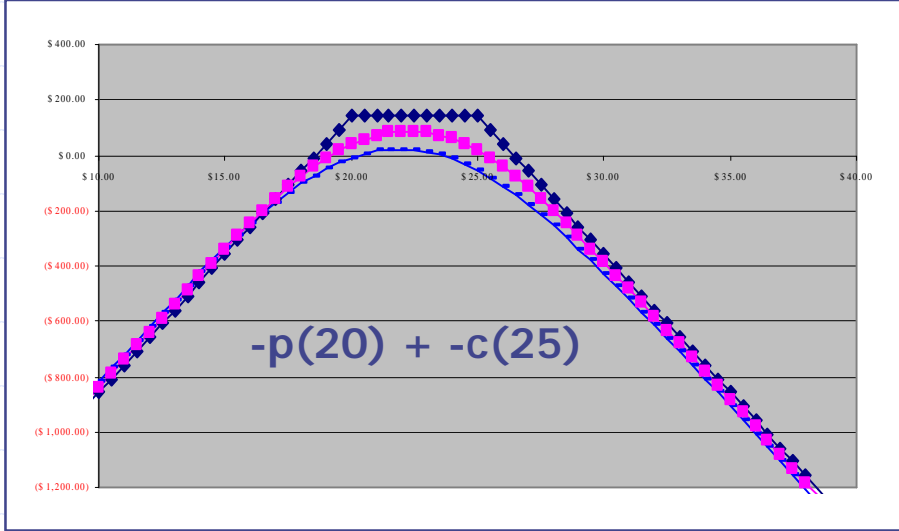
- INTEL - LONG STOCK
- INTEL - LONG STRADDLE
- INTEL - SHORT STRADDLE
- INTEL - BULL SPREAD
- INTEL - BEAR SPREAD
- INTEL - PROTECTIVE PUT
- BUTTERFLY SPREAD (CALLS)
- REVERSE BUTTERFLY SPREAD (CALLS)

Sample Portfolios

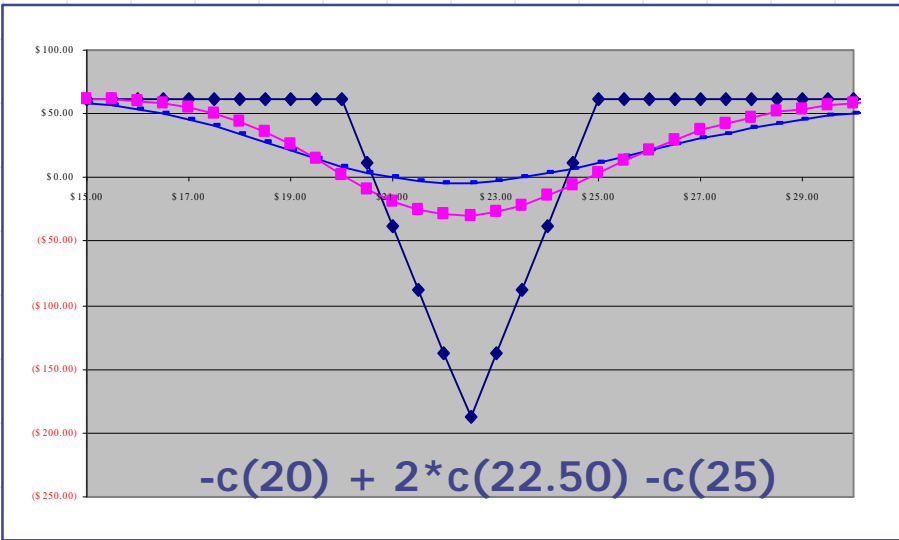
Risk-Free



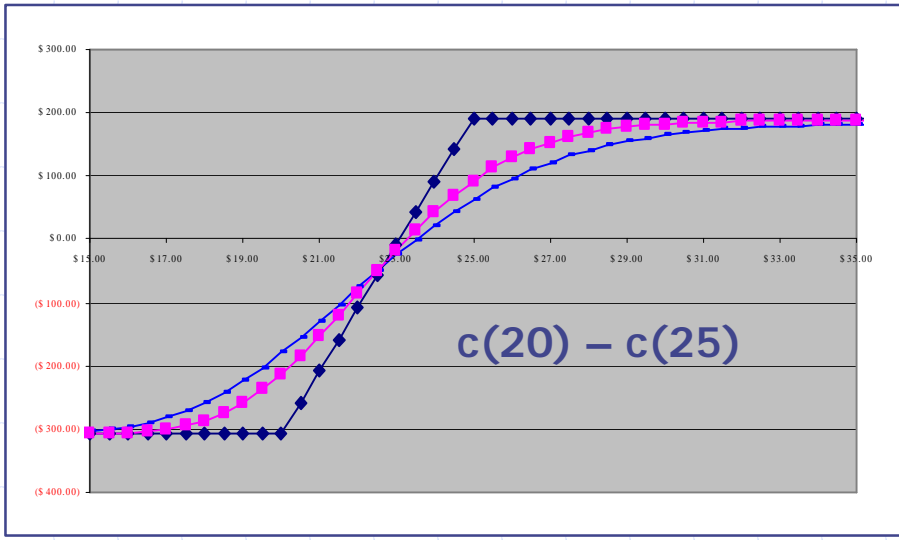
Short Straddle



Reverse Butterfly Spread



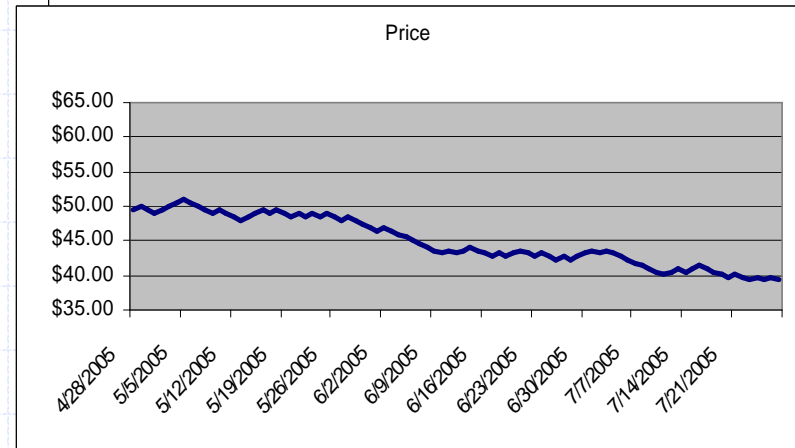
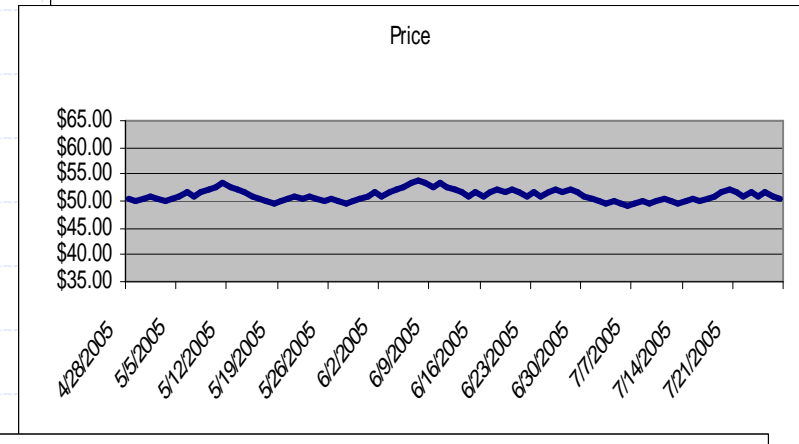
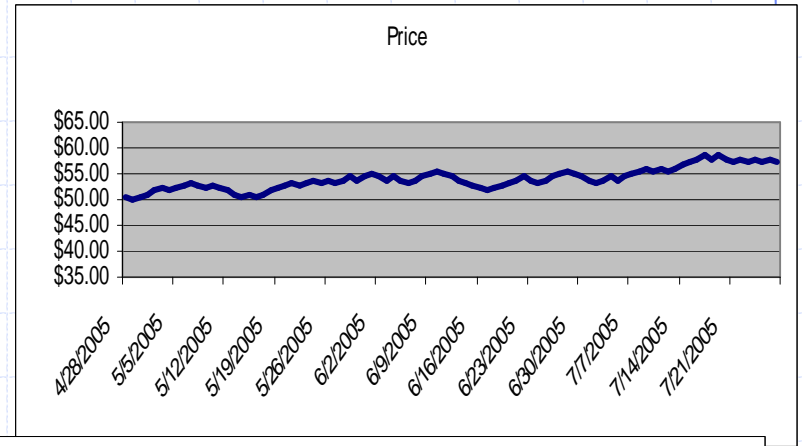
Bull Spread



Portfolio Competition

Place your bets...


- ◆ Choose only from listed stock at options
- ◆ Max \$1,000 options Sold
- ◆ \$10,000 Portfolio



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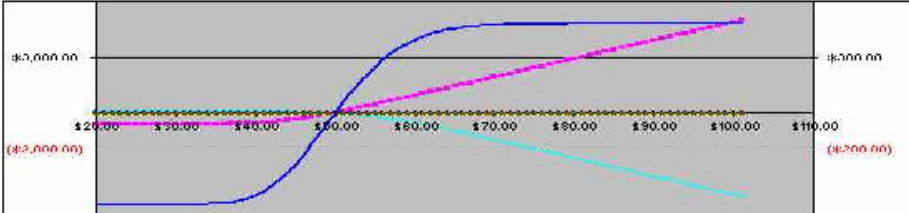
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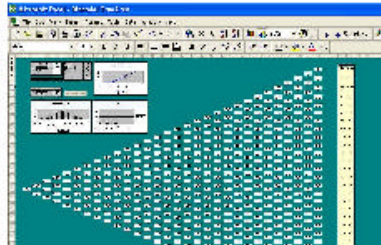
Financial Analysis Models



The following information and files are provided for conducting financial analysis of investments in stocks and options. All models are free to use, but come with no guarantees or support.

Note: Most of the Excel models use Macros to perform specific tasks. If your Excel security is set to "High", Macros will be disabled and these worksheets will not function properly. You can reset your security to "Medium", and Excel will prompt you to allow Macros when the worksheet is opened.

Binomial Tree - This worksheet provides a 30-level binomial tree analysis for pricing of American CALL or PUT options. It also includes a Monte Carlo simulation that can be run to compare against the binomial model results.



Option Models Online

◆ http://www.sunsetmaui.com/finance_models.htm