

Pentanomial - Spread of Two Assets American Put (3D Binomial) - Multinomial Lattice Solver

File Help

Comment Pentanomial - Spread of Two Assets American Put Option (3D Binomial Equivalence)

Lattice Type

Trinomial
  Trinomial Mean-Reverting
  Quadranomial Jump-Diffusion
  Pentanomial Rainbow Two Asset

Basic Inputs

PV Underlying Asset (\$) 100 Dividend Rate (%)

PV Underlying Asset 2 (\$) 98 Long-Term Rate (%)

Implementation Cost (\$) 103.15 Reversion Rate (%)

Volatility (%) 25 Market Price of Risk (t)

Risk-Free Rate (%)

Maturity (Years)

Lattice Steps

Blackout Steps and

Example: 1, 2, 10-20

Terminal Node Equation

Max(Cost-(Asset\*Qu...))

Example: Max(Asset...)

Intermediate Node Equation

Max(Cost-(Asset\*Qu...))

Example: Max(Asset...)

Intermediate Node Equation

Max(Cost-(Asset\*Qu...))

Example: OptionOp...

Expand Contract Abandon Customized Option II - Single Asset Super Lattice Solver

File Help

Comment Customized Expansion, Contraction, and Abandonment Options with changing salvage values.

Option Type

American
  Bermudan
  Custom

Custom Variables

Variable Name	Value	Starting Step
Expansion	1.3	0
ExpandCost	25	0
Contraction	0.9	0
ContractSavi...	25	0
Salvage	100	0
Salvage	101	11
Salvage	102	21
Salvage	103	31
Salvage	104	41

Basic Inputs

PV Underlying Asset (\$) 100 Risk-Free Rate (%) 5

Implementation Cost (\$) 100 Dividend Rate (%) 0

Maturity (Years) 5 Volatility (%) 15

Lattice Steps 100 \* All inputs are annualized rates

Blackout Steps and Vesting Period (For Custom & Bermudan Option)

1-50

Example: 1, 2, 10-20, 35

Terminal Node Equation (Options at Expiration)

Max(Asset, Asset\*Expansion-ExpandCost, Asset\*Contraction-ContractSavings, Salvage)

Example: Max(Asset-Cost, 0)

Benchmark:

	Call	Put
Black-Scholes	26.00	3.88
Closed-Form American	28.00	6.41
Binomial European	26.00	3.88
Binomial American	26.00	6.44

Intermediate Node Equation

Max(Asset, Asset\*Exp...

Intermediate Node Equation

Max(Asset\*Contraction...

Example: OptionOpen

Super Lattice Solver

Real Options Valuation

Create a New Single Asset Option Model

Create a New Multiple Asset Option Model

Create a New Multinomial Option Model

Create a Lattice

Open an Example Model

Exotic Financial Options Valuator

Language

Default

Chinese

English

German

Italian

Japanese

Portuguese

Spanish

1. License Real Options SLS

2. License Functions & Options Valuator

Exit

MSLS Multiple-Phased Complex Sequential Compound Option - Multiple Asset Super Lattice Solver

File Help

Comment Multiple-Phased Complex Sequential Compound Option

Maturity 5

Underlying Assets

Name	PV Asset	Volat
Underlying	100	

Option Valuations

Blackout and Vesting Period Steps 0-20

Name	Cost	Risk Free...	Dividend...	Ste
Phase3	50	5	0	
Phase2	0	5	0	
Phase1	0	5	0	

Lattice Maker

Basic Inputs

PV Asset (\$) 100

Volatility (%) 25

Risk-free (%) 2

Dividend (%) 0

Maturity (Years) 2

Lattice Steps 2

Basic Option

Implementation Cost (\$)

Combination Options

Expansion Factor (t) 1.25  
 Expansion Cost (\$) 25  
 Contraction Factor (t) 0.9  
 Contraction Savings (\$) 100  
 Abandonment Salvage (\$) 105

American Option  
 European Option

Show Formulae

Compute

Create Audit Sheet

Run

ROV Options Valuator - (C:\Program Files\Real Options Valuation\Real Options SLS\ModuleDefaultVa...)

File Languages

Model Category

All Categories

Basic Options Models

Bond Related Options, Pricing and Yields

Delta Gamma Hedging

Exotic Options and Derivatives

Put-Call Parity and Option Sensitivity

Real Options Analysis

Value at Risk, Volatility, Portfolio Risk and Returns

Search

Model Selection

Two Asset Cash or Nothing Call

Two Asset Cash or Nothing Down Up

Two Asset Cash or Nothing Put

Two Asset Cash or Nothing Up Down

Two Asset Correlation Call

Two Asset Correlation Put

Value at Risk (Correlation Method)

Volatility Implied for Default Risk

Model Description

Computes the Value at Risk of a portfolio of correlated options

Single Input Parameters

Horizon Days 10.00 Percentile 0.90 Input3

Input4 Input5 Input6

Input7 Input8 Input9

Input10 Input11 Input12

Input13

Multiple Series Input Parameters (Values are SPACE separated, Rows are SEMICOLON separated):

Asset Prices Quantities Deltas Load Sample Values

102.5; 12; 12; 11; 13; 13;

Result: 3303.028968

Compute Exit

Customized Real Options Results

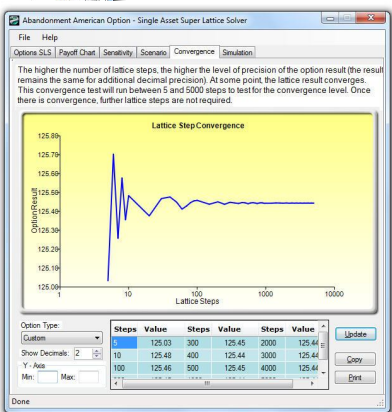
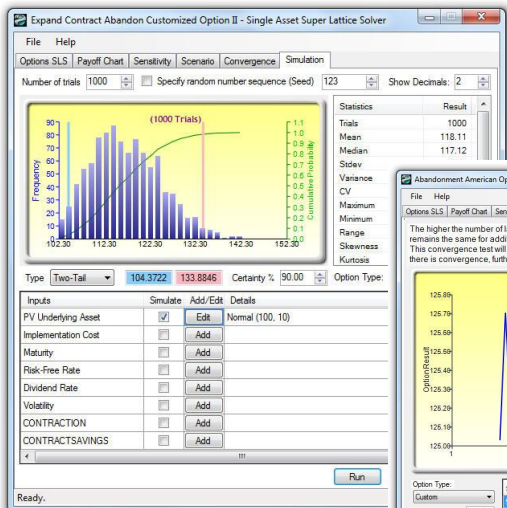
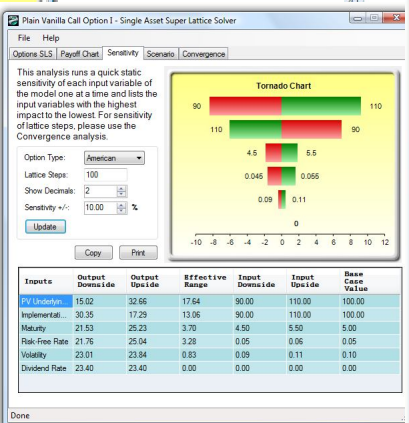
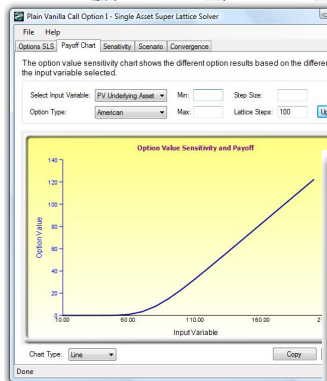
Assumptions	Value	Intermediate Computations	Value
PV Asset Value (\$)	\$100.00	Stepping Time (dt)	0.1000
Volatility (%)	25.00%	Up Step Size (up)	1.0823
Risk-free Rate (%)	5.00%	Down Step Size (down)	0.9240
Dividends (%)	0.00%	Up Probability	0.5119
Maturity (Years)	1.00	Down Probability	0.4881
Lattice Steps	10	Discount Factor	0.9950
Option Type	American	Implementation Cost (\$)	\$100.00

Underlying Asset Lattice											
100.00	108.23	117.13	126.77	137.19	148.48	160.70	173.92	188.22	203.71	220.47	
	92.40	100.00	108.23	117.13	126.77	137.19	148.48	160.70	173.92	188.22	
		85.38	92.40	100.00	108.23	117.13	126.77	137.19	148.48	160.70	
			78.89	85.38	92.40	100.00	108.23	117.13	126.77	137.19	
				72.89	78.89	85.38	92.40	100.00	108.23	117.13	
					67.35	72.89	78.89	85.38	92.40	100.00	
						62.23	67.35	72.89	78.89	85.38	
							57.50	62.23	67.35	72.89	
								53.13	57.50	62.23	
									49.09	53.13	
										45.36	

Option Valuation Lattice											
12.09	16.98	23.27	31.06	40.34	50.95	62.68	75.40	89.22	104.21	120.47	
Continue	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Execute
	7.09	10.55	15.33	21.65	29.63	39.17	49.97	61.69	74.41	88.22	
	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Execute
		3.54	5.66	8.86	13.50	19.92	29.25	39.19	49.96	60.70	
		Continue	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Execute
			1.35	2.36	4.08	6.90	11.39	18.12	27.26	37.19	
			Continue	Continue	Continue	Continue	Continue	Continue	Continue	Continue	Execute
				0.30	0.59	1.15	2.26	4.44	8.73	17.13	
				Continue	Continue	Continue	Continue	Continue	Continue	Continue	Execute
					0.00	0.00	0.00	0.00	0.00	0.00	
					Continue	Continue	Continue	Continue	Continue	Continue	Execute
						0.00	0.00	0.00	0.00	0.00	
						Continue	Continue	Continue	Continue	Continue	Execute
							0.00	0.00	0.00	0.00	
							Continue	Continue	Continue	Continue	Execute
								0.00	0.00	0.00	
								Continue	Continue	Continue	Execute
									0.00	0.00	
									Continue	Continue	Execute
										0.00	
										Continue	Execute
											0.00
											Continue
											End
											End
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											End
											End






The Single Asset Option Model is used primarily for solving options with a single underlying asset within a single phase using binomial lattices. Even highly complex options with a single underlying asset can be solved. The typical types of options solved using this approach include American, Bermudan, and European options to abandon, choose, contract, defer, execute, expand, wait, with barriers, as well as any customized combinations of these options with changing inputs.


 Create a New Single Asset Option Model

 Create a New Multiple Asset Option Model

 Create a New Multinomial Option Model

 Create a Lattice

 Open an Example Model

 Exotic Financial Options Valuator

Language

- Default
- Default
- Chinese Simplified
- Chinese Traditional
- English
- French
- German
- Italian
- Japanese
- Korean
- Portuguese
- Spanish



Exit



1. License Real Options SLS
2. License SLS Functions in Excel (Optional)

File Help

Options SLS Payoff Chart Sensitivity Scenario Convergence Simulation

Comment Customized Expansion, Contraction, and Abandonment Options with changing salvage values.

Option Type  American  European  Bermudan  Custom

Custom Variables

Name	Value	Start...
Contraction	0.9	0
ContractSa...	25	0
Salvage	100	0
Salvage	101	11
Salvage	102	21
Salvage	103	31
Salvage	104	41

Basic Inputs

PV Underlying Asset (\$)  Risk-Free Rate (%)

Implementation Cost (\$)  Dividend Rate (%)

Maturity (Years)  Volatility (%)

Lattice Steps  \* All inputs are annualized rates

Blackout Steps and Vesting Period (For Custom & Bermudan Option)

Example: 1, 2, 10-20, 35

Terminal Node Equation (Options at Expiration)

Example: Max(Asset - Cost, 0)

Benchmark

	Call	Put
Black-Scholes	26.00	3.88
Closed-Form American	26.00	6.41
Binomial European	26.00	3.88
Binomial American	26.00	6.44

Custom Equations

Intermediate Node Equation (Options Before Expiration)

Example: Max(Asset - Cost, OptionOpen)

Intermediate Node Equation (During Blackout and Vesting Period)

Example: OptionOpen

Result

Custom Option: 117.7994

Create Audit Sheet

Ready.



The option value sensitivity chart shows the different option results based on the different values of the input variable selected.

Select Input Variable:  Min:  Step Size:   
Option Type:  Max:  Lattice Steps:

Update Chart

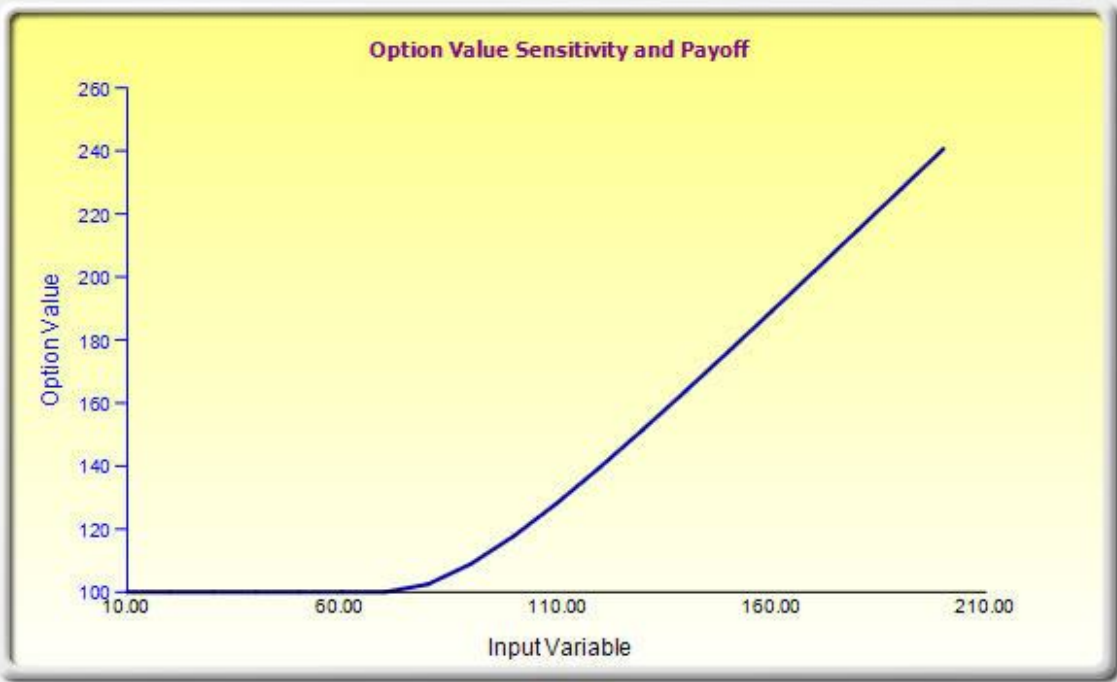


Chart Type:

Copy

Print

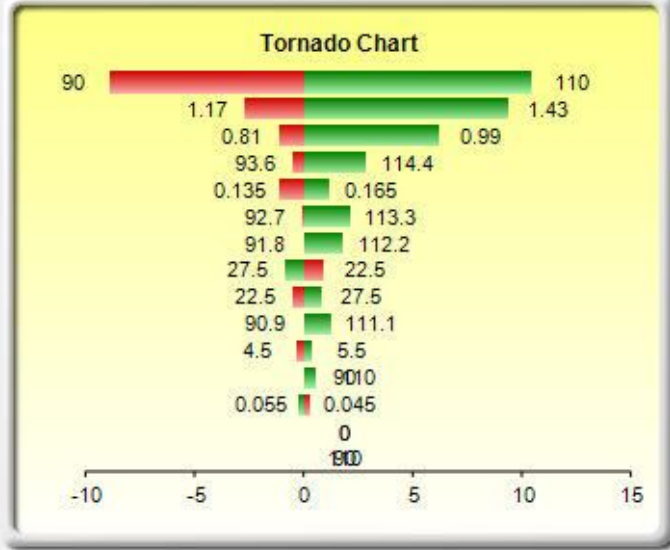
This analysis runs a quick static sensitivity of each input variable of the model one at a time and lists the input variables with the highest impact to the lowest. For sensitivity of lattice steps, please use the Convergence analysis.

Option Type:

Lattice Steps:

Show Decimals:

Sensitivity +/-:  %



Inputs	Output Downside	Output Upside	Effective Range	Input Downside	Input Upside	Base Case Value
PV Underlyin...	108.94	128.20	19.26	90.00	110.00	100.00
EXPANSION	115.10	127.16	12.06	1.17	1.43	1.30
CONTRACTI...	116.72	124.00	7.28	0.81	0.99	0.90
SALVAGE5	117.33	120.66	3.33	93.60	114.40	104.00
Volatility	116.69	118.98	2.30	0.14	0.17	0.15
SALVAGE4	117.78	119.93	2.15	92.70	113.30	103.00
SALVAGE3	117.79	119.59	1.80	91.80	112.20	102.00
EXPANDCOST	118.72	116.96	1.76	27.50	22.50	25.00

The following table returns the option results based on different scenarios you specify below:

Column Variable (Across): PV Underlying Asset  
 Min: 100, Max: 160, Step Size: 10

Row Variable (Down): Implementation Cost  
 Min: 100, Max: 200, Step Size: 10

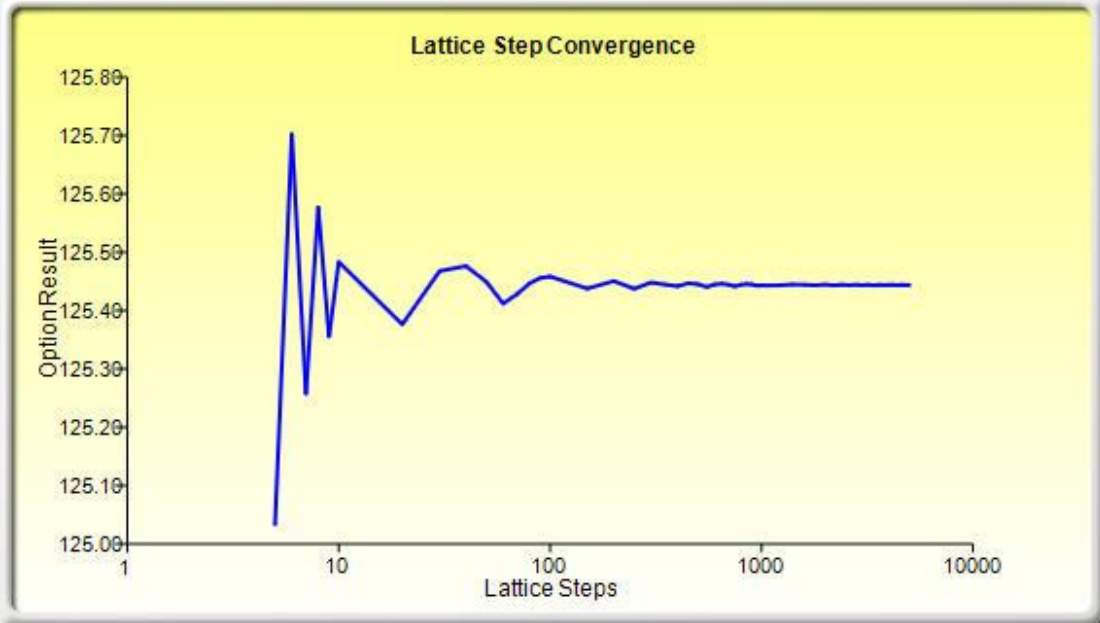
Option Type: Custom  
 Lattice Steps: 100  
 Show Decimals: 2

Update Table

	100.00	110.00	120.00	130.00	140.00	150.00	160.00
100.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10
110.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10
120.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10
130.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10
140.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10
150.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10
160.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10
170.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10
180.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10
190.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10
200.00	117.80	128.20	139.56	151.51	163.83	176.39	189.10

Copy Print

The higher the number of lattice steps, the higher the level of precision of the option result (the result remains the same for additional decimal precision). At some point, the lattice result converges. This convergence test will run between 5 and 5000 steps to test for the convergence level. Once there is convergence, further lattice steps are not required.



Option Type:

Custom

Show Decimals: 2

Y - Axis

Min: Max:

Steps	Value	Steps	Value	Steps	Value
5	125.03	300	125.45	2000	125.44
10	125.48	400	125.44	3000	125.44
100	125.46	500	125.45	4000	125.44

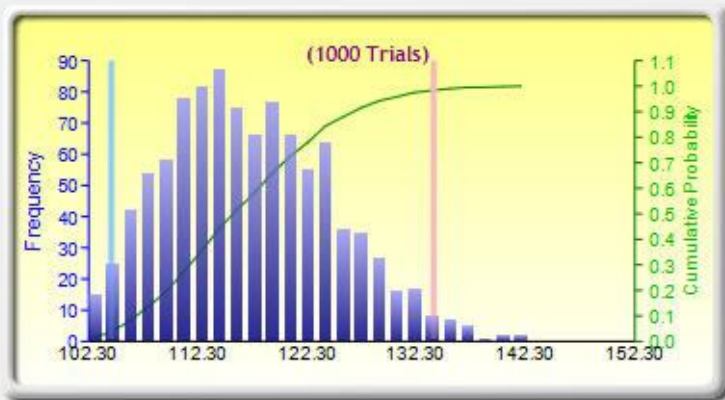
Update  
Copy  
Print



File Help

Options SLS Payoff Chart Sensitivity Scenario Convergence Simulation

Number of trials 1000  Specify random number sequence (Seed) 123 Show Decimals: 2



Statistics	Result
Trials	1000
Mean	118.11
Median	117.12
Stdev	9.16
Variance	83.87
CV	0.08
Maximum	149.11
Minimum	100.00
Range	49.11
Skewness	0.42
Kurtosis	-0.20

Type Two-Tail 104.3722 133.8846 Certainty % 90.00 Option Type: Custom

Inputs	Simulate	Add/Edit	Details
PV Underlying Asset	<input checked="" type="checkbox"/>	Edit	Normal (100, 10)
Implementation Cost	<input type="checkbox"/>	Add	
Maturity	<input type="checkbox"/>	Add	
Risk-Free Rate	<input type="checkbox"/>	Add	
Dividend Rate	<input type="checkbox"/>	Add	
Volatility	<input type="checkbox"/>	Add	
CONTRACTION	<input type="checkbox"/>	Add	
CONTRACTSAVINGS	<input type="checkbox"/>	Add	

Run Copy Print

Ready.



MSLS Multiple-Phased Complex Sequential Compound Option - Multiple Asset Super Lattice Solver

File Help

Maturity  Comment Multiple-Phased Complex Sequential Compound Option

Underlying Assets

Name	PV Asset	Volatility (%)	Notes
Underlying	100	25	
*			

Option Valuations

Blackout and Vesting Period Steps

Name	Cost	Risk...	Divi...	Steps	Terminal Equation	Intermediate Equation	Blackout Equation
Phase1	0	5	0	10	$\text{Max}(\text{Phase2}, \text{Salvage}, 0)$	$\text{Max}(\text{Salvage}, \text{OptionOpen})$	OptionOpen
Phase2	0	5	0	30	$\text{Max}(\text{Phase3}, \text{Phase3} * \text{Contract} + \text{Savings}, \text{Salvage}, 0)$	$\text{Max}(\text{Phase3} * \text{Contract} + \text{Savings}, \text{Salvage}, \text{OptionOpen})$	OptionOpen
Phase3	50	5	0	50	$\text{Max}(\text{Underlying} * \text{Expansion} - \text{Cost}, \text{Underlying}, \text{Salvage})$	$\text{Max}(\text{Underlying} * \text{Expansion} - \text{Cost}, \text{Salvage}, \text{OptionOpen})$	OptionOpen
*							

- Apply the Average Volatility from Underlying Asset Lattices to Valuation Lattices
- Apply the Correlated Portfolio Volatility from Underlying Asset Lattices to Valuation Lattices

Custom Variables

Name
Salvage
Salvage
Salvage
Contract
Expansion
Savings
*

Result PHASE1: 1

Create

File Help

Comment Pentanomial - Spread of Two Assets American Put Option (3D Binomial Equivalence)

Lattice Type

- Trinomial
  Trinomial Mean-Reverting
  Quadranominal Jump-Diffusion
  Pentanominal Rainbow Two Asset

Basic Inputs

PV Underlying Asset (\$)	<input type="text" value="100"/>	Dividend Rate (%)	<input type="text"/>
PV Underlying Asset 2 (\$)	<input type="text" value="98"/>	Long-Term Rate (%)	<input type="text"/>
Implementation Cost (\$)	<input type="text" value="103.15"/>	Reversion Rate (%)	<input type="text"/>
Volatility (%)	<input type="text" value="25"/>	Market Price of Risk (.)	<input type="text"/>
Volatility 2 (%)	<input type="text" value="12"/>	Jump Rate (%)	<input type="text"/>
Risk-Free Rate (%)	<input type="text" value="9.53"/>	Jump Intensity (.)	<input type="text"/>
Maturity (Years)	<input type="text" value="1.25"/>	Correlation (.)	<input type="text" value="0"/>
Lattice Steps	<input type="text" value="50"/>	* All inputs are annualized rates	

Custom Variables

Name	Value	Start Step
Quantity1	1	0
Quantity2	1	0
*		

Blackout Steps and Vesting Period

Example: 1, 2, 10-20, 35

Terminal Node Equation (Options at Expiration)

Example: Max(Asset - Cost, 0)

Custom Equations

Intermediate Node Equation (Options Before Expiration)

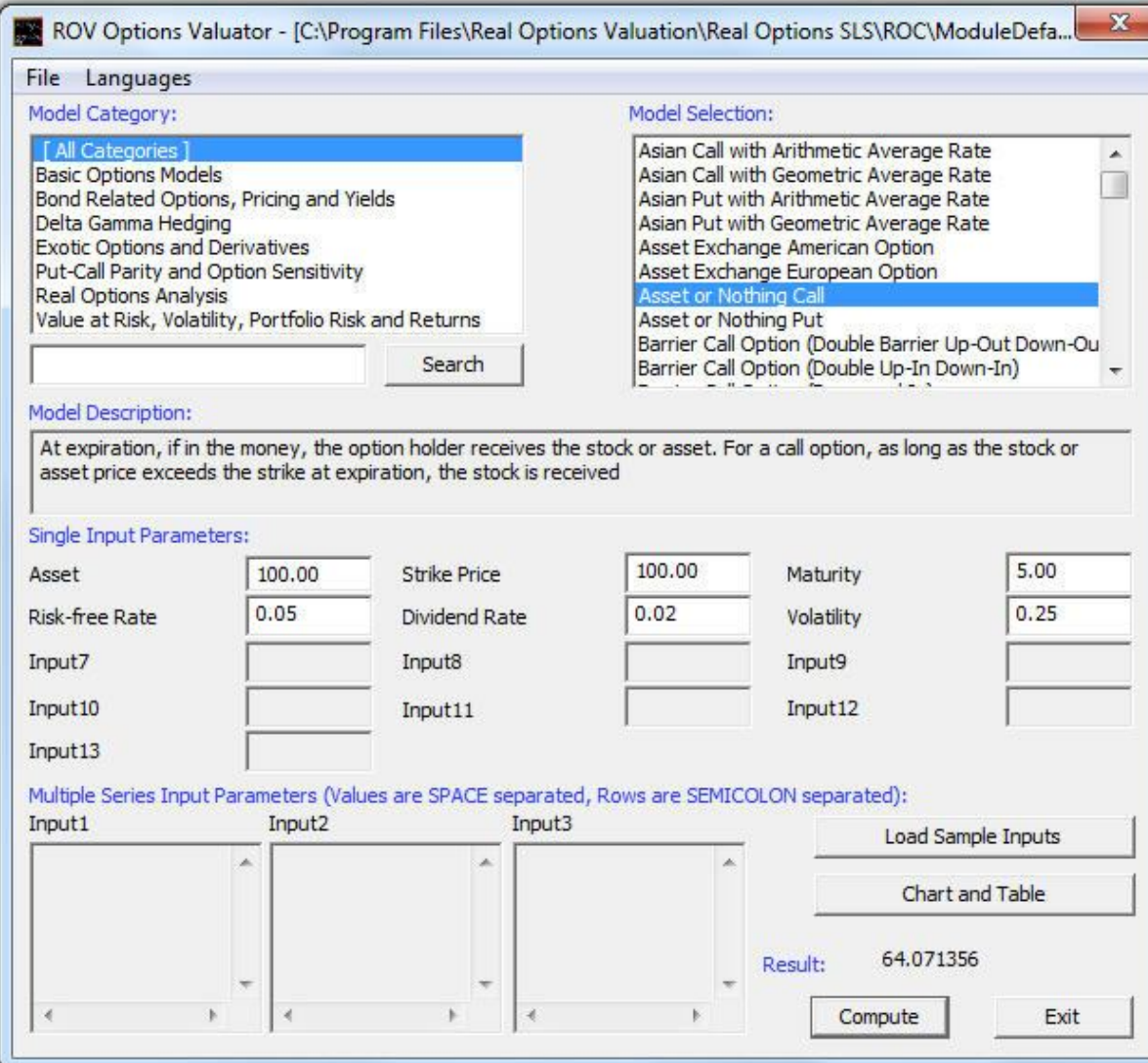
Example: Max(Asset - Cost, OptionOpen)

Intermediate Node Equation (During Blackout and Vesting Period)

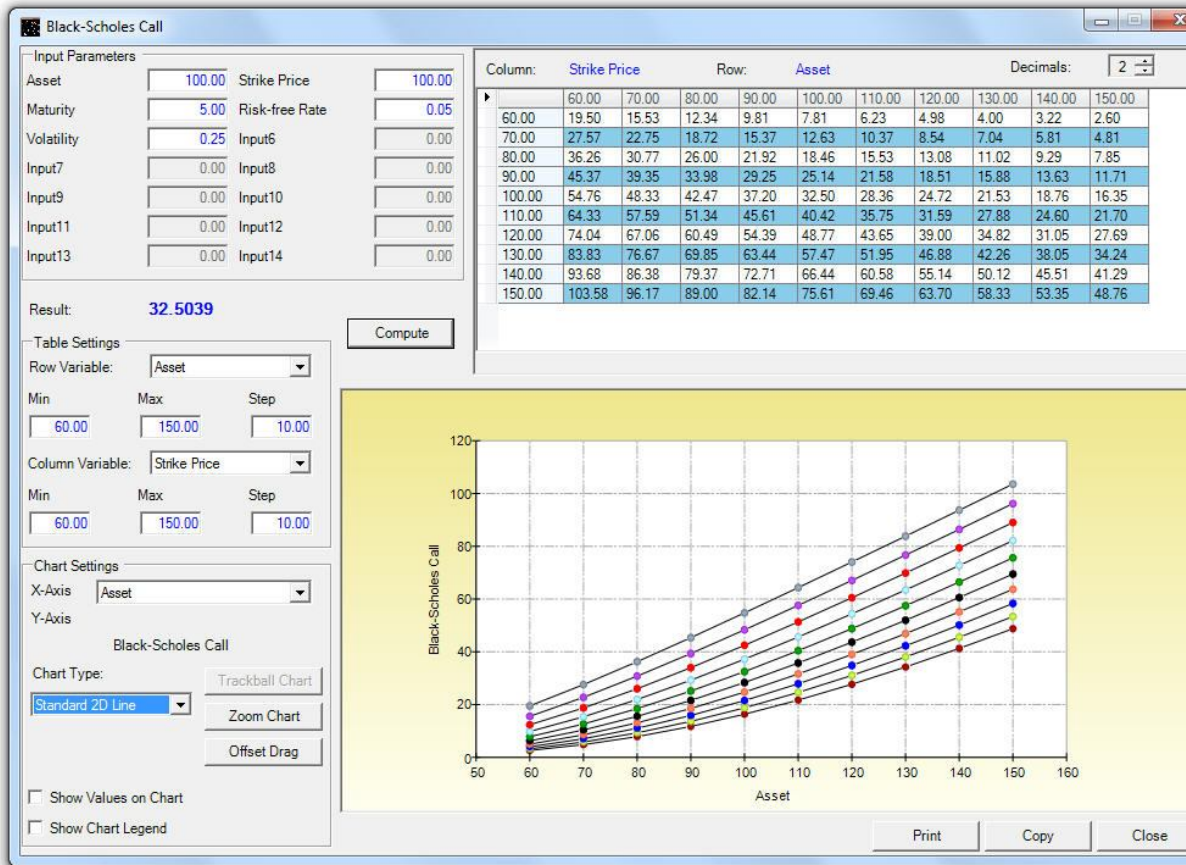
Example: OptionOpen

Result: Pentanominal Rainbow Two-Asset Lattice: 101.1500

Run







## Customized Real Options Results

### Assumptions

PV Asset Value (\$)	\$100.00
Volatility (%)	25.00%
Risk-free Rate (%)	5.00%
Dividends (%)	0.00%
Maturity (Years)	1.00
Lattice Steps	5
Option Type	American

### Intermediate Computations

Stepping Time (dt)	0.2000
Up Step Size (up)	1.1183
Down Step Size (down)	0.8942
Up Probability	0.5169
Down Probability	0.4831
Discount Factor	0.9900

Implementation Cost (\$)	\$100.00
Expansion Cost (\$)	---
Contraction Cost (\$)	---
Contraction Saving (\$)	---
Abandonment Salvage (\$)	---

### Underlying Asset Lattice

100.00	111.83	125.06	139.85	156.39
	89.42	100.00	111.83	125.06
		79.96	89.42	100.00
			71.50	79.96
				63.94

### Option Valuation Lattice

12.79	19.61	29.17	41.83	57.39	74.90
Continue	Continue	Continue	Continue	Continue	Execute
	5.77	9.79	16.23	26.05	39.85
	Continue	Continue	Continue	Continue	Execute
		1.59	3.10	6.05	11.83
		Continue	Continue	Continue	Execute
			0.00	0.00	0.00
			Continue	Continue	End
				0.00	0.00
				Continue	End
					0.00
					End

**Lattice Maker**

<b>Basic Inputs</b>		<b>Basic Option</b>
PV Asset (\$)	100	<input checked="" type="checkbox"/> Implementation Cost (\$)
Volatility (%)	25	
Risk-free (%)	5	<input type="checkbox"/> Expansion Factor (.)
Dividend (%)	0	Expansion Cost (\$)
Maturity (Years)	1	<input type="checkbox"/> Contraction Factor (.)
Lattice Steps	5	Contraction Savings (\$)
		<input type="checkbox"/> Abandonment Salvage (\$)
<input checked="" type="radio"/> American Option		<input type="checkbox"/> Show Formulae
<input type="radio"/> European Option		<input type="button" value="Compute"/>

