

# Chapter 7, Problem 8

## VCR International: Option to Contract

### (Effect of Volatility)

(Please enter values for input data in blue.)

#### Input Parameters

Present value of future cash flows	\$400	million
Volatility	30%	annual
Risk-free rate of return	5%	annual
Time to expiration	5	years
Contraction factor	0.25	
Time step	1	year(s)
Savings of contraction	\$200	million

#### Results

NPV	\$400
ROV	\$413
Value added	\$13

#### Calculated Parameters

Up factor ( $u$ )	1.350
Down factor ( $d$ )	0.741
Risk-neutral probability ( $p$ )	0.510

#### Asset Valuation Lattice

Time period	0	1	2	3	4	5
Valuation of underlying asset	\$400	\$540	\$729	\$984	\$1,328	\$1,793
		\$296	\$400	\$540	\$729	\$984
			\$220	\$296	\$400	\$540
				\$163	\$220	\$296
					\$120	\$163
						\$89

#### Option Valuation Lattice

Time period	0	1	2	3	4	5
Valuation of contraction option	\$413	\$544	\$729	\$984	\$1,328	\$1,793
		\$321	\$408	\$540	\$729	\$984
			\$264	\$313	\$400	\$540
				\$241	\$256	\$296
					\$230	\$241
						\$222



# Chapter 7, Problem 8

## VCR International: Option to Contract

### (Effect of Volatility)

(Please enter values for input data in blue.)

#### Input Parameters

Present value of future cash flows	\$400	million
Volatility	40%	annual
Risk-free rate of return	5%	annual
Time to expiration	5	years
Contraction factor	0.25	
Time Step	1	year(s)
Savings of contraction	\$200	million

#### Results

NPV	\$400
ROV	\$426
Value added	\$26

#### Calculated Parameters

Up factor ( $u$ )	1.492
Down factor ( $d$ )	0.670
Risk-neutral probability ( $p$ )	0.464

#### Asset Valuation Lattice

Time period	0	1	2	3	4	5
Valuation of underlying asset	\$400	\$597	\$890	\$1,328	\$1,981	\$2,956
		\$268	\$400	\$597	\$890	\$1,328
			\$180	\$268	\$400	\$597
				\$120	\$180	\$268
					\$81	\$120
						\$54

#### Option Valuation Lattice

Time period	0	1	2	3	4	5
Valuation of contraction option	\$426	\$605	\$890	\$1,328	\$1,981	\$2,956
		\$312	\$417	\$597	\$890	\$1,328
			\$250	\$301	\$400	\$597
				\$230	\$245	\$268
					\$220	\$230
						\$214



# Chapter 7, Problem 8

## VCR International: Option to Contract (Effect of Volatility)

### Input Parameters

Present value of future cash flows	\$400	million
Volatility	50%	annual
Risk-free rate of return	5%	annual
Time to expiration	5	Volatility
Contraction factor	0.25	
Time Step	1	year(s)
Savings of contraction	\$200	million

### Results

NPV	\$400
ROV	\$442
Value added	\$42

### Calculated Parameters

Up factor ( $u$ )	1.649
Down factor ( $d$ )	0.607
Risk-neutral probability ( $p$ )	0.427

### Asset Valuation Lattice

Time period	0	1	2	3	4	5
Valuation of underlying asset	\$400	\$659	\$1,087	\$1,793	\$2,956	\$4,873
		\$243	\$400	\$659	\$1,087	\$1,793
			\$147	\$243	\$400	\$659
				\$89	\$147	\$243
					\$54	\$89
						\$33

### Option Valuation Lattice

Time period	0	1	2	3	4	5
Valuation of contraction option	\$442	\$678	\$1,090	\$1,793	\$2,956	\$4,873
		\$306	\$431	\$665	\$1,087	\$1,793
			\$241	\$295	\$410	\$659
				\$222	\$237	\$261
					\$214	\$222
						\$208



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## VCR International: Option to Contract (Effect of Volatility)

### Input Parameters

Present value of future cash flows	\$400	million
Volatility	20%	annual
Risk-free rate of return	5%	annual
Time to expiration	5	years
Contraction factor	0.25	
Time Step	1	year(s)
Savings of contraction	\$200	million

### Results

NPV	\$400
ROV	\$404
Value added	\$4

### Calculated Parameters

Up factor ( $u$ )	1.221
Down factor ( $d$ )	0.819
Risk-neutral probability ( $p$ )	0.577

### Asset Valuation Lattice

Time period	0	1	2	3	4	5
Valuation of underlying asset	\$400	\$489	\$597	\$729	\$890	\$1,087
		\$327	\$400	\$489	\$597	\$729
			\$268	\$327	\$400	\$489
				\$220	\$268	\$327
					\$180	\$220
						\$147

### Option Valuation Lattice

Time period	0	1	2	3	4	5
Valuation of contraction option	\$404	\$489	\$597	\$729	\$890	\$1,087
		\$336	\$402	\$489	\$597	\$729
			\$285	\$333	\$400	\$489
				\$255	\$282	\$327
					\$245	\$255
						\$237



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## VCR International: Option to Contract (Effect of Volatility)

### Input Parameters

Present value of future cash flows	\$400	million
Volatility	10%	annual
Risk-free rate of return	5%	annual
Time to expiration	5	years
Contraction factor	0.25	
Time step	1	year(s)
Savings of contraction	\$200	million

### Results

NPV	\$400
ROV	\$400
Value added	\$0

### Calculated Parameters

Up factor ( $u$ )	1.105
Down factor ( $d$ )	0.905
Risk-neutral probability ( $p$ )	0.731

### Asset Valuation Lattice

Time period	0	1	2	3	4	5
Valuation of underlying asset	\$400	\$442	\$489	\$540	\$597	\$659
		\$362	\$400	\$442	\$489	\$540
			\$327	\$362	\$400	\$442
				\$296	\$327	\$362
					\$268	\$296
						\$243

### Option Valuation Lattice

Time period	0	1	2	3	4	5
Valuation of contraction option	\$400	\$442	\$489	\$540	\$597	\$659
		\$362	\$400	\$442	\$489	\$540
			\$328	\$362	\$400	\$442
				\$298	\$327	\$362
					\$273	\$296
						\$261



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## VCR International: Option to Contract (Effect of Volatility)

Volatility %, annual	Contraction ROV \$ millions
10	0.7
15	5
25	21
35	40
45	59
55	78
100	148

