



LISBON  
SCHOOL OF  
ECONOMICS &  
MANAGEMENT  
UNIVERSIDADE DE LISBOA

## Corporate Investment Appraisal

Masters in Finance

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Fall Semester

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### Problem Set 3: Valuation of Financial Options

#### SOLUTIONS

1. The annual volatility of the return of company CJRD's stock is 45%. Currently CJRD's stock price is €3.75. The risk-free interest rate is 1.5% *per annum* (continuous).

(a) Compute the risk neutral probability of the scenario "up" in the context of the binomial model (1 year time step).

(b)

Stock	
Sigma	0,45
S	3,75

Interest Rate	
Rf	1,5%

u	1,568312185
d	0,637628152
p	0,405599429

(c) What is the value of a European call option on a share of company CJRD, with a strike price of €4.25 and time to maturity of 1 year? Use the binomial model (1 year time step).

<b>Call</b>	
K	4,25
T	1

<b>Stock Tree</b>	Year	0	1
		3,75	5,881170696
			2,391105569

<b>Call Tree</b>	Year	0	1
		0,651751934	1,631170696
			0

(d) Estimate the value of a put option on a share of company CJ, with expiry date in 3 years' time and an exercise price of €4.50 (use the binomial model, with time steps of length dt=1 year).

K	4,5
T	3

<b>Stock Tree</b>	Year	0	1	2	3
		3,75	5,881170696	9,223511667	14,46534574
			2,391105569	3,75	5,881170696
				1,524636224	2,391105569
					0,972150977

Put Tree	Year	0	1	2	3
		1,575018593	0,723076823	0	0
			2,196401667	1,234865452	0
				2,908367504	2,108894431
					3,527849023

2. The shares of firm MC have an annual volatility of 35% and are currently priced at \$40. There is no expectation of a dividend in the coming year. The riskless annual interest rate is 1.5% (continuous).

(a) What is the value (BS) of a call option on share of firm MC, for a maturity of 18 months and an exercise price of \$45?

Stock	
Sigma	35%
S	40

Interest Rate	
Rf	1,5%

Call	
T	1,5 year
K	45

### Using Black-Scholes

d1	0,007950427
d2	0,436611132

N(d1)	0,496828272
N(d2)	0,331196694

Call	5,300871896
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(b) What is the value (BS) of a European put option on a share of Firm MC, with expiry date in 3 years' time, and with an exercise price of \$45?

<b>Put</b>	
T	3,00
K	45

d1	0,183048019
d2	-
	0,423169763

N(d1)	0,572619829
N(d2)	0,336085703

<b>Call</b>	8,45
<b>Put</b>	11,47

3. Consider again the data of problem 1, regarding company CJRD: The annual stock volatility is 45% and the stock price is currently €3.75. No dividend is expected for the coming year. The riskless annual interest rate is 1.5% (continuous).

Re-compute the value of a call option with maturity of 1 year, with an exercise price of €4.25, based on the binomial model, considering time intervals of 1 month (each branch is 1 month long).

