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 10: Solutions

Valuation of Warrants, Rights and Convertible Bonds

HAND IN SOLUTIONS – CLASS OF DECEMBER 10TH, 2015

1. Firm RAP currently has 2 million shares outstanding, with a unit market price of €5. The firm announces an issue of 500,000 warrants at €6 each. Each warrant gives its holder the right to buy two new shares at a price of €4.5 in 4 years time. The volatility estimated for RAP's equity rate of return is 35% per year. The annual risk-free rate (in continuous time) is 3%.

N	2	million	Price	5
N*Price	10	million		
m	0,5	milion		
Unit Price Warrant	6			
r	2			
K	4,5			
T	4			
sigma	0,35			
Rf	3%			

a. What is the market value of each warrant?

Lambda	0,333333333	
d1	1,046749686	
d2	0,346749686	
N(d1)	0,852392479	
N(d2)	0,63561031	
Call	6,01	
Warrants	2,002493422	million
Each warrant	4,004986843	

b. What is the stock price once the warrants are issued?

Share Price	5,498753289

c. What would be the fair price of the warrants at the time of their issuance? Comment.

Ojective:B26=B6		
B26-B6	-1,995013157	"Tools"/"Goalseek"
Solution	3,24	

Explain.

d. Going back to the initial data, re-compute the value of the warrants using the binomial model (building a tree with 4 periods).

u	1,419067549
d	0,70468809
p	0,456013174

Tree "V"				
t=0	1	2	3	4
13	18,44787813	26,17879	37,14946	52,7176
	9,160945166	13	18,44788	26,17879
		6,455609	9,160945	13
			4,549191	6,455609
				3,205761

Tree Call				
6,130368921	10,59683425	17,7029	28,41545	43,7176
	2,729423511	5,233212	9,713868	17,17879
		0,783352	1,770144	4
			0	0
				0

Warrants	2,043456307	million
Each warrant	4,086912614	

2. Company OSO is all-equity financed with 1 million shares listed in the Stock Exchange. The Board of Directors decides to go the market to raise more equity in a seasoned offering. The aim is to raise £1.0 million through a rights issue. OSO's share price immediately before the rights issue is £8.0. The terms of the issue are as follows: Each old share is entitled to 1 right which can be converted into a fixed number of new shares at the end of 60 days, at a price of £6.5 per share. The offering is underwritten by investment bank CLAC that charges an upfront fee of £600,000 for the firm commitment service. Company OSO is not expected to pay dividends during the life of the rights. The annual volatility of OSO's asset rate of return is 30%. The annual riskless rate (continuous) is 3%.

N	1	million
mrK	1	million
Price	8	
m	1	million
r	?	
T	0,17	
K	6,5	
Fee Bank	0,6	million
sigma	0,3	

Rf	3%

a. Into how many shares is each right convertible?

mrK=1 million
1*r*6,5=1

r	0,153846

b. At the time of the rights issue, at what price are they traded?

Lambda	0,133333		
d1	1,79743	considering fee fair-priced…	
d2	1,674956		
N(d1)	0,963866		
N(d2)	0,953029		
Call	1,55	million	considering fee fair-priced
Rights	0,206285	million	
Right	0,206285		

c. What is the share price once the rights are issued?

Shares	7,793715	million	considering fee fair-priced
Share	7,793715		

d. How do you assess the investment bank's fee?

Put	0,014722	million	considering fee fair-priced
Fee	0,001963	million	THIS should be the fair price…

3. Compute the value of the following issue of convertible bonds by company RA, knowing that:

- RA is entirely equity financed;
- The company announces an issue of European convertible bonds, with annual coupons of 4%, maturity in 3 years, and placed at face value;
- The face value is €6.00 per bond;
- The number of bonds to issue is: 1,000,000;
- The conversion price of these bonds is €7 per share;
- The company currently has 40 million shares outstanding;
- RA's stock price, immediately before the bond issue announcement is €6.0;
- The annualized volatility predicted for RA's assets, after issuing the bonds, is 45%;
- The risk-free rate of interest is 3% (continuous, for 1 year);
- The yield of a "standard" bond – without convertibility – for a company in the same class of risk would be 4%.

Convertible Bond:	
Coupon	4%
T	3
par	
Face Value	6
m	1000000
K	7

years

Shares:	
N	40000000
Price	6
sigma	0,45

Market:	
Rf	3,00%
yield_standard	4%

(i) V(Straight Bond)

5986520,914

PV(Coupons) 664998,293

(ii) Warrant Component

Inputs:

Lambda ?

mrK=6*1000000

r	0,85714286
Lambda	0,02097902

V	245335002
F/Lambda	286000000
T	3
Rf	3,00%
sigma	0,45

d1	0,3084113
d2	-0,47101156

N(d1)	0,62111531
N(d2)	0,31881624

Call	69047759,6
Warrants	1448554,4

(iii) Convertible Bonds

7435075,312

Comment.