



Problem Set 10: Solutions

Valuation of Warrants, Rights and Convertible Bonds

1. Firm RAP currently has 2 million shares outstanding, with a unit market price of €4.5. The firm announces an issue of 500,000 warrants at €5.5 each. Each warrant gives its holder the right to buy two new shares at a price of €4.0 in 3 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%.

Data:

N	2	million	Price	4,5
N*Price	9	million		
m	0,5	milion		
Unit Price Warrant	5,5			
r	2			
K	4			
T	3			
sigma	0,35			
Rf	3%			

- a. What is the market value of each warrant?

Lambda	0,333333333
d1	1,08568524
d2	0,479467457
N(d1)	0,861190864
N(d2)	0,684196943
Call	5,12
Warrants	1,705507087 million
Each warrant	3,411014174

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

Share Price 5,022246457

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

Solution 2,6
so that the price of the warrant equals its "fair price" of question a).

d. Going back to the initial data, re-compute the value of the warrants using the binomial model (building a tree with 3 periods).

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

Tree "V"				
t=0		1	2	3
	11,75	16,6740437	23,66159	33,5774
		8,280085054	11,75	16,67404
			5,834877	8,280085
				4,111769

Tree Call				
	5,010596254	9,139927427	15,89803	25,5774
		1,829574296	3,986436	8,674044
			0,123948	0,280085
				0

Warrants	1,670198751
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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 £2.0 million through a rights issue. OSO's share price immediately before the rights issue is £10. 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 £8 per share. The offering is underwritten by investment bank CLAC that charges an upfront fee of £750,000 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 40%. The annual riskless rate (continuous) is 3%.

Data:

N	1	million
mrK	2	million
Price	10	
m	1	million
r	?	
T	0,17	
K	8	
Fee Bank	0,75	million
sigma	0,4	
Rf	3%	

a. Into how many shares is each right convertible?

$mrK=2$ million

$1*r*8=2$

r	0,25
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b. At the time of the rights issue, at what price are they traded?

Lambda 0,2

d1 1,478738 considering fee fair-priced...

d2 1,315439

N(d1) 0,930395

N(d2) 0,905819

Call 2,09 million considering fee fair-priced

Rights 0,418708 million

Right 0,418708

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

Shares 9,581292 million considering fee fair-priced

Share 9,581292

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

Put 0,053640 million considering fee fair-priced

Fee 0,010728 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 3%, maturity in 4 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 €7.5 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 50%;
- The risk-free rate of interest is 2.5% (continuous, for 1 year);
- The yield of a "standard" bond – without convertibility – for a company in the same class of risk would be 5%.

Data:

Convertible Bond:	
Coupon	3%
T	4 years
par	
Face Value	6
m	1000000
K	7,5

Shares:	
N	40000000
Price	6
sigma	0,5

Market:	
Rf	2,50%
yield_standard	5%

(i) V(Straight Bond)

5548775,521

PV(Coupons) 636391,003

(ii) Warrant Component

Inputs:

Lambda ?

mrK=6*1000000

r	0,8
Lambda	0,01960784

V	245363609
F/Lambda	306000000
T	4
Rf	2,50%
sigma	0,5

d1	0,37915613
d2	0,62084387

N(d1)	0,64771404
N(d2)	0,26735118

Call	84901192,7
Warrants	1664729,27

(iii) Convertible Bonds

7213504,791