University of Lisbon

ISEG

GESTÃO FINANCEIRA II

Problem Set 4

Licenciatura – Undergraduate Course

1st Semester 2017 - 2018

GESTÃO FINANCEIRA II

PROBLEM SET 4 | Chapter 22 – Real Optioms

SUBMISSION DEADLINE: 15-12-2017, from 12:00H to 15:00H | Premises: Miguel Lupi's building at the reception desk

Your report must be written using a word processor as handwritten answers may not be considered. On Aquila you can find a template with the frontpage to answer the problem set. Its usage is mandatory.

1. You are a financial analyst at World Industries and are considering entering the baby wearing business. You believe that you have a very narrow window for entering this market. The time is right now, due to Christmas demand. For similar reasons, an alternative would be next year's Christmas. It is your deep conviction that there is no other opportunity will exist to break into this business. Entering the market has an estimated cost of €70 million. This is a very competitive market with several competitors. Some of them are public companies. Therefore, you can access sufficient information to create a perfectly comparable company.

   To help you deciding the best moment to enter the business, you conclude that using the Black-Scholes formula is the best option. A throughout analysis allowed you to estimate that the present value of an operating baby wearing company is €80 million. However, given the historical behavior of demand for such a product, your figures show that the company's value has a variability of 30% per year. The annual risk-free interest rate is 2%:

   a. When should you enter the baby wearing business?

   b. During your analysis, you wonder what would be the impact in your decision of paying dividend of 12% of the project's value. What have you concluded? Hint: In the context of Black-Scholes, the present value of the dividend is deducted to the current asset price.

   c. For the scenario in part b), plot the value of your investment opportunity as a function of the current value of your baby wearing project. Interpret it.

      a. S^x= *80*

         PV(*EX*) = 70 / (1.02) = 68.63

         T = 1

         σ = 0.30

         $$d_1 = \frac{\ln(P / PV(EX))}{\sigma\sqrt{T}} + \frac{\sigma\sqrt{T}}{2} = 0.6611$$

         $$d_2 = 0.3611$$

         $$C = PN(d_1) - PV(EX)N(d_2) = €15.67$$

         So the value of waiting is €15.67 million. The value of investing today is €80 – €70 = €10 million.

         So they should wait to enter the business now.

b. $S^x = S - PV(Div) = 80(1. - .12) = 80(0.88) = 70.4$

$PV(EX) = 70 / (1.02) = 68.63$

$T = 1$

$\sigma = 0.30$

$$d_1 = \frac{\ln(P / PV(EX)}{\sigma\sqrt{T}} + \frac{\sigma\sqrt{T}}{2} = 0.2350$$

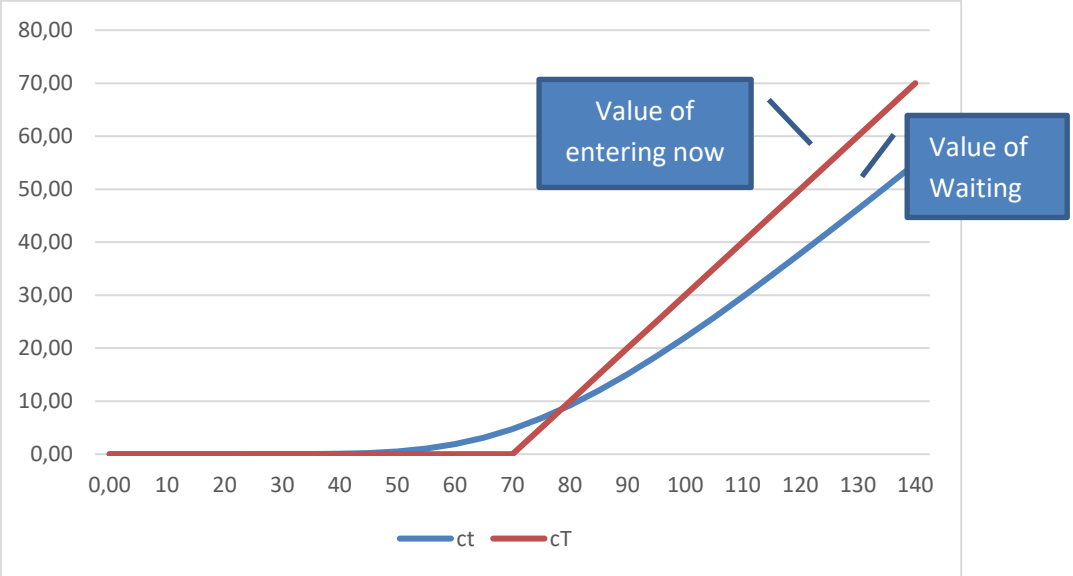
$$d_2 = -0.0650$$

$$C = PN(d_1) - PV(EX)N(d_2) = €9.20$$

So the value of waiting is €9.20 million. The value of investing today is €80 – €70 = $10 million.

So they should enter the business now.

c.

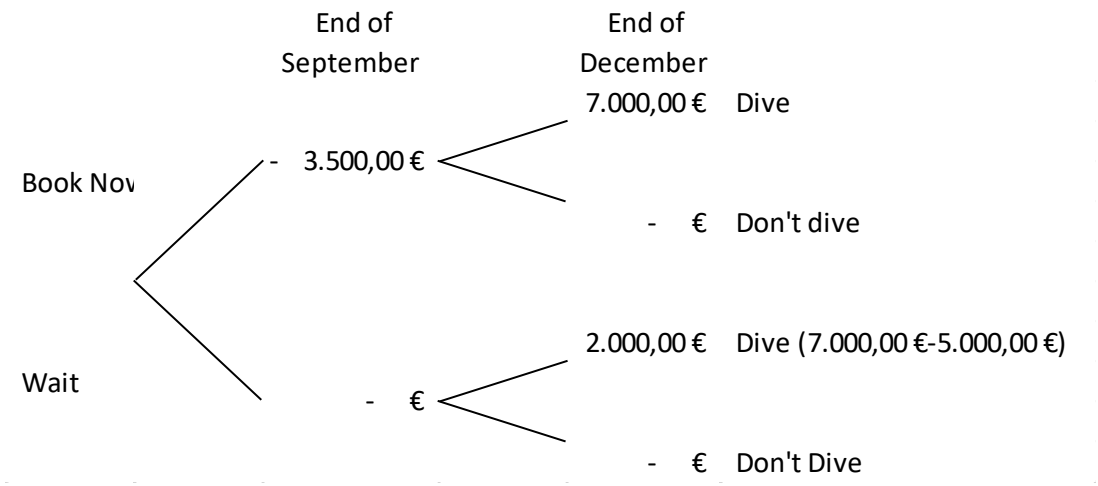


For project's value to the left of the intersection point it is preferable to wait. Otherwise it is preferable to enter now the business.

2. Imagine that you are a passionate diver. You have decided to travel the last week of December to the Red Sea to do deep-sea archeological diving. If you pay your journey now, it will cost you €3500. However, if the diving is canceled no matter the reason, you will not be refunded. Historical cancelation rates are around 30%. Nevertheless, you also have the possibility to do a last-minute booking. In this case it will cost you €5000. You are willing to pay at most €7000 for this journey as it represents the satisfaction you get in this activity. Assume you are in the last week of September and that your cost of capital is 10%.

   Should you wait or book immediately?

   Decision tree



If you book now, your expected benefit from diving in 3 months is:

$$7,000(0.70)+0(0.30)=€4,900$$

The NPV of booking today is therefore:

$$NPV=\frac{4,900}{1.1^{\frac{3}{12}}}-3,500=€1,284.63$$

If you wait to book the expected benefit in 3 months is:

$$2,000(0.70)+0(0.3)0=€1,400$$

The PV of this today is

$$\frac{\$1,400}{1.10^{\frac{3}{12}}}=\$1,367.04$$

So you should wait.

3. You are the owner of a spatial exploration startup. Unexpectedly, Starfleet, a big player in the industry, has recently offer you an offer to buy your firm. Under its terms, you will receive 50 million shares of Starfleet. Its stock is currently traded for €40 per share. The offer allows you to sell immediately the stock or, alternatively, to resell the shares to Starfleet in one year time for €40 per share. Consider an one-year risk free interest rate of 2%. Starfleet has a volatility of 25% and will not pay dividends in the foreseeable future.

   a. Is the value of this offer higher than € 2.000 million? Explain.

   b. How much is the value of this offer?

      a. The offer is worth more than $25 million because of the put option.

      b. The value of the offer is the current value of the shares plus the value of the put option.

         To calculate the value of the put, we first calculate the value of the call and then use the Put-Call parity to find the value of the put.

         S = 40 x 50 = 2000

         EX = 40 x 50 = 2000

         PV(*EX*) = 2000 / (1.02) = 1961

$T = 1$

$\sigma = 0.25$

$$d_1 = \frac{\ln(P / PV(EX)}{\sigma\sqrt{T}} + \frac{\sigma\sqrt{T}}{2} = 0.2042$$

$$d_2 = -0.0458$$

$$C = PN(d_1) - PV(EX)N(d_2) = €217$$

$$p = c + PV(EX) - S_0 = 217 + 1961 - 200 = €178$$

So, the value of the offer is 2.000 + 178 = €2.178 million.