SESSION 4: Options (Financial and Real)

Q1: Option Valuation (European call, binomial tree).

Your boss has found the following data. He wants to value a European call on a share with a one year maturity and a 190€ strike price. The share is currently traded at 200€. He knows that the price of the share can either double (probability 70%) or be divided by two (probability 30%) during the next year. The linear risk free rate is worth 4%. On basis of these elements what is the risk neutral probability? And the value of the call (use a one year binomial tree)? How could one replicate the call? You have 200€ today how many shares could you buy and how many calls?

Q2: Option Valuation. (American put, binomial tree).

Impressed by your knowledge your boss wants to see you work in more complex material. He wonders whether you can help him with the following option. He has seen an American put option on a share which is currently traded at 100€ (this share is not expected to pay any dividend in the near future). Each month, the price of the share can either increase by 10% or go down by 9.1%. Your boss has several questions. He wants to know (without number crunching) if the European put on with the same features is worth more than the American one. He then would like to compute the value of a three months European put (strike price 100€) and a three months American put. The continuous risk free rate is worth 0.5% per month.

Q3: Option valuation (Arbitrage)

Your boss has called you for an urgent matter. You rush to his office to understand what he wants. He shows on his screen the following elements: A share of the Vinano Company is currently traded at 52$, a one year European call option on this share with a strike price of 45$ is traded for 53$. He believes there is a sure way to make money but doesn't see how. Could you help him construct an arbitrage?

Q4: Option valuation (Black and Scholes)

In view of your experience, you have been asked to move from the simple binomial setting to the continuous setting represented by the Black and Scholes formula. What would be the value of a call on the MekWhisky Cy knowing that the current share price is 120$, the strike price 100$, the maturity one year, the annual volatility of the share is 40% and the continuous risk free rate is worth 5%? Use first a one year binomial tree and then the Black and Scholes formula. How can you explain the difference? What would happen if you chose a binomial tree with 6 months steps (instead of one year)?

Q5: Real Options

Not so long ago, you performed a brilliant valuation analysis of Freshwater Corp. following their move to Bobland. The move to a country where corporate profits are taxed resulted in a lower market capitalisation (2,325,000 $). Following the move, the stock traded at 23.25 $. Taking into account the existing business cash-flows it seemed a fair value. However, soon after their move, Freshwater made a press release announcing the signature of a R&D partnership financing agreement with Bobland's main university Ewing State. The project related to the development of a new energy drink 'Spirit of Southfork'.

It had to go fast so Freshwater could gain a first entrant competitive advantage. The partnership was a 2 year agreement with the following features:

- Freshwater finances 100% of the partnership.
- Every year an interim report on the project is released and Freshwater can terminate the partnership if they wish.
- The initial investment to start the project is 25,000 $.
- If the company decides to pursue the project after 1 year it will have to invest, 75,000$.
- After 2 year, assuming the company goes ahead, the big launch costs is estimated to be 225,000 $.

Obviously given the importance of the market, Freshwater's marketing and financial experts had performed a very detailed market analysis and came up with the following figures for the new line of product's net profits (by a savvy

reorganisation of the production capacity, no extra investment was required, nor any increase in WCR was created !) :

Year 3 : 50

Year 4 : 55

Year 5 : 60

Year 6 → ∞ : +2% annually

The press release included the following information as well:

The project WACC is 17%

Freshwater WACC is 12%

The risk free rate is 2%

Freshwater capital structure will remain constant

The financial planning report also highlighted that the forecasts were very sensitive to a number of uncertain factors which would influence the energy drink market in Bobland and on which further information was to be available in the coming months, namely:

- a potential new law extending pub opening hours (decision expected in 1 year time)
- the creation of a free cab service for Bobland's discos clients (decision in 2 year from now)

The realisation of each of these elements could potentially impact the value of the future business. The volatility of the future business value is estimated to be 50%.

Just after the press release, the stock volatility shot up as the financial community was puzzled by Freshwater's strategy and struggled to figure out the impact for the company.

On that day trading session the stock finally lost 10% and closed down at 20.9$. The same evening John Ross III E. a well-known local investor and major Freshwater investor contacted you to know you what he should do with his participation.

Before leaving, John told you that he tried to compute the present value of the project but obtained a negative value….

You decide to first check if John's initial NPV assessment makes sense and then find an alternative approach to determine if this partnership has got any value for Freshwater.

Is the stock price slide justified?