SUBMISSION 1 M3

Price a European Up-and-out Call Option

Submitted By

MScFE 630 Computational Finance (C21-S2) Group 18

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General: 4 points

1. What are the advantages and disadvantages of purchasing the up-and-out barrier call option, compared to the plain vanilla European call option? (2 pts)

The advantage of purchasing the up-and-out barrier call option is the call option price is cheaper than European call option. The disadvantage would be the capped profit due to the up-and-out option.

2. Would you expect to find this option on an exchange, or Over-The-Counter? (1 pt.)

We would expect to find it over-the-counter.

3. Is there a closed-form, analytical solution for pricing an up-and-out barrier call option?(1 pt.)

No, Mostly there is no closed form solution for this.

Pricing: 32 points

4. Price a European call option with the information provided. (2 pts)

Implemented on the ipynb file.

5. Price a European up-and-out barrier call option: Simulate paths for the underlying share and for the counterparty's firm value using sample sizes of 1000, 2000, …, 50000. Do monthly simulations for the lifetime of the option. (10 pts)

Implemented on the ipynb file.

6. Price a European up-and-in barrier call option. Hint: Use the 2 other option prices. (2 pts)

Implemented on the ipynb file.

7. Repeat Question 5 (Price up-and-out barrier call) 6 times, keeping all the data the same, but using a new strike level in each case: a) 85, b) 90, c) 95, d) 105, e) 110, f) 115. Produce a table of 7 rows that shows the strike, and the option price. (2 pts)

Implemented on the ipynb file.

8. Determine Monte Carlo estimates of both the default-free value of the option and the Credit Valuation Adjustment (CVA). You can take an initial firm value like of $200 for your calculations. (8 pts)

Implemented on the ipynb file.

9. Calculate the Monte Carlo estimates for the price of the option incorporating counterparty risk, given by the default-free price less the CVA. (8 pts)

Implemented on the ipynb file.

Discussing: 9 points

10. Write a 1-page non-technical document that explains the difference in the default-free value of the option, and the Credit Valuation Adjustment. (9 pts)

Default-free means an option with no default risk. To provide an option with no default risk the writer has to absorb the risk associated with the option. Hence, the option price needs to be higher than not default-free options to balance out option risks.

On the other hand, credit valuation adjustment means a change in the option price or any derivatives' value to hedge against counterparty risk. In this case, a credit valuation takes place against counterparty. If there is significant risk associated with counterparty then necessary price change takes place to balance out the risk among the buyer and writer.

Default free value generally focuses on the option buyer whereas cva method focuses on the counterparty's risk.

References

1. James Adams, Donald J Smith
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   Journal of Applied Corporate Finance, volume 25, issue 4
2. Gary L Gastineau, J Donald, Rebecca Smith, Todd
   Risk Management, Derivatives, and Financial Analysis Under SFAS, issue 133
3. Jon Gregory
   Counterparty Credit Risk