

FINM3405 Derivatives and risk management

Some Final Exam practice questions

October 10, 2024

Question 1. Let the current stock price be $S = \$100$, the risk-free rate be $r = 5.5\%$, the stock's volatility be $\sigma = 27.5\%$, the time to expiry be $T = \frac{1}{4}$, and the dividend yield be $y = 7\%$. Also let $N = 3$, so monthly time steps.

1. Starting at $S = \$100$, create the 3-step binomial model asset price tree using your choice of either the CRR or JR schemes.
2. Calculate the binomial model prices of ATM European and American call and put options.
3. Also calculate the time $t = 0$ binomial model deltas of ATM European and American calls and puts.
4. Calculate the price of an ATM chooser option whose choice date is the end of month one.

Question 2. Using the same parameters as above, consider the following five simulated paths of geometric Brownian motion again with monthly time steps:

	0	1	2	3
0	100	102.822	99.7769	94.5728
1	100	109.582	108.033	130.956
2	100	99.477	115.124	103.019
3	100	88.5383	87.0328	85.0011
4	100	90.586	86.2677	88.965

Calculate the Monte Carlo prices of:

1. European call and put options.
2. ATM fixed-strike lookback call and put options.
3. Floating-strike lookback call and put options.
4. ATM fixed-strike arithmetic average Asian call and put options.
5. Arithmetic average-strike Asian call and put options.

Question 3. Consider these default and survival probabilities, and yield curve:

Quarter	Survival probability	Default probability	Risk-free rate
1	99.2528%	0.7472%	3.41%
2	98.5112%	0.7416%	3.30%
3	97.7751%	0.7361%	3.18%
4	97.0446%	0.7306%	3.03%
5	96.3194%	0.7251%	2.85%
6	95.5997%	0.7197%	2.64%

1. Calculate the breakeven CDS spread k on a 18-month CDS with quarterly coupon periods and recovery rate of $R = 40\%$.
2. Calculate the upfront payment if the CDS spread was fixed at $k = 1\%$ over a notional principal of $F = \$10\text{m}$
3. Explain in words how you'd use CDS indices to speculate on market-wide credit risk perceptions.
4. Suppose you bought protection over a notional principal of $F = \$10\text{m}$ at the above data and with a fixed CDS spread of $k = 1\%$, and during the first quarter there was a macroeconomic shock resulting in the following new survival and default probabilities, and yield curve:

Quarter	Survival probability	Default probability	Risk-free rate
2	98.5112%	1.4888%	3.07%
3	97.0446%	1.4666%	2.90%
4	95.5997%	1.4448%	2.70%
5	94.1765%	1.4233%	2.47%
6	92.7743%	1.4021%	2.19%

What is your profit if you were to close out your CDS position at the end of the first quarter?

5. Explain in words how a bank might use CDS to hedge against default by a large lending exposure on their balance sheet.
6. Provide an intuitive no-arbitrage argument for why the breakeven CDS spread should approximately equal the risk premium of the yield on the reference entity's debt over the risk-free rate.

Question 4. Consider the following Euribor yield curve:

Euribor 1 week	3.392 %
Euribor 1 month	3.272 %
Euribor 3 months	3.265 %
Euribor 6 months	3.058 %
Euribor 12 months	2.798 %

Let the 9-month Euribor rate be an average of the 6-month and 12-month rates.

1. What is the fixed rate k in a 1-year fixed-for-floating interest rate swap with quarterly interest periods and whose floating rate is Euribor?
2. Suppose you entered into the swap as the fixed rate receiver over a notional principal of $F = \$10\text{m}$, and the Euribor yield curve fell by 50 basis points during the first quarter. What would be your profit or loss if you closed out your position at the end of the first quarter? What would be your profit or loss if instead the Euribor yield curve went up by 50 basis points?
3. Explain in words how you would use interest rate swaps to speculate on shifts in the yield curve.
4. Explain in words how you would use interest rate swaps to hedge a floating interest rate borrowing exposure against an increase in interest rates.