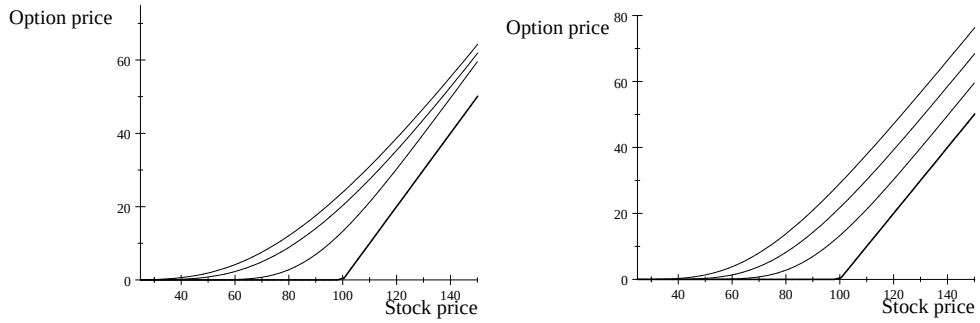
Chapter 8: Black and Scholes option pricing - part 2

Exercises

1. Explain why the value of a call increases with the risk free interest rate while the value of a put decreases.

2. Use the put-call parity to work out a relation between the Greek 'delta' of puts and calls.

3. The graphs below (copies from the main text) plot call option prices for different values of their determinants. All options have an exercise price of 100, a risk free interest rate of 10% and are written on a stock that pays no dividends. The graph on the left plots options with a time to maturity of 1 year and three different volatilities: $\sigma = .5$ (top), $.4$ and $.2$ (bottom). The graph on the right plots options with a volatility of .2 and three different maturities: $T = 3$ (top), 2 and 1 (bottom). Explain briefly why the options with different volatilities converge to a common value as the stock price increases and why the options with different maturities do not converge to a common value as the stock price increases.



4. The shares of ZX Co. currently trade at €100; their annual volatility is 35%. 3-months European put and call options on shares ZX Co. are also traded, the available exercise prices range from €80 to €120 in steps of €5. The risk free interest rate is 5% per year. Investor A has made a thorough study of ZX Co. and is convinced that, over the next 3 months, its share price will increase to at least €105 but no more than €110. Unfortunately, she has no money available for an investment that would allow her to profit from her insight, all her funds are tied up in a position that will expire 3 months from now. Design an option position that allows investor A to profit from her insight, that requires no net investment today and that has limit downside risk. Calculate the maximum and minimum profit at maturity.

5. Explain in general terms how the call option delta changes as the stock prices changes.

6. The following information on option prices, stock prices and interest rates was published in Finansavisen (a Norwegian financial newspaper) of 5 Sept. 2005.

Option price quotes

			call option		put option	
Ticker	T	X	bid	ask	bid	ask
NHY	nov.5	620	68.00	70.00	9.25	10.00
„	„	680	28.75	30.25	29.00	31.25
„	feb.6	620	82.00	83.75	19.00	20.75
„	„	680	44.00	47.00	41.50	44.25
ORK	jan.6	240	25.50	26.75	5.00	5.50
NSG	dec.5	100	10.00	11.00	2.85	3.35

Stock price quotes

	stock price	
Ticker	bid	ask
NHY	677.00	678.50
ORK	259.00	259.50
NSG	108.75	109.50

NIBOR rates

1 month	2.180
2 month	2.235
3 month	2.290
4 month	2.313
5 month	2.337

NIBOR is the Norwegian InterBank Offer Rate that can be used as the yearly risk free interest rate for the different maturities. Ask prices are prices at which a dealer is willing sell, bid prices at prices at which a dealer is willing to buy. The ticker marks are for Norsk Hydro (NHY), Orkla (ORK) and Norske Skog (NSG).

(a) Is there any sign of mispricing on the market? If so, how would you profit from it?

(b) Is there an alternative explanation for price differences, if you find any?