Summary of Chapter 4

This chapter gives a introductory discussion about the use of Black-Scholes model in actual trading.

1 Use of the formula

As we notice from the Black-Scholes formula for standard European call/put options, there are several variables/parameters in the formula and some are assumed to vary in the formulation, such as the time t and the stock price S_t, while others are merely parameters that are assumed to be given constants. However, in actual trading it is found that people do not stick to the same parameters in general. In particular, the volatility used in trading can be hard to follow, even at the same time for different contracts. The concept of implied volatility is a very important indicator for the underlying stock market, which basically measures how volatile the underlying is for different time horizons, and the relative cheapness of different option contracts on the same underlying. This chapter explains how to watch for the market conditions beyond the underlying price in trading options.

- As in stock trading, the "buy low, and sell high" principle is also valid for trading volatilities. Since option prices are increasing functions of the volatility, you would like to buy an option when the volatility of the underlying is low, and sell it when the volatility is high.

- Implied volatility smile/skew: the observed implied volatilities turn out to be different for different contracts (different K and different T). Knowing about the shape of the smile/skew is essential in forming option portfolios.

- The dependence of the option price on other variables/parameters can be easily computed via partial differentiation of the option price. However, it should be stressed that these first-order approximations based on Taylor expansion are valid only when the corresponding changes in the variables/parameters are small.

- Hedging against a particular variable/parameter: we can pick a portfolio with chosen compositions so that a Greek of the portfolio (a linear combination of the Greeks of individual assets) becomes zero, in this case we say the portfolio is neutral with respect to this particular variable/parameter.

- The shortcomings of the Black-Scholes model are quite obvious and there are more advanced models to address various issues and the following is a partial list.

  1. jumps in underlying prices
  2. volatility by itself is stochastic
  3. transaction costs

4. dependent underlying price returns
5. incomplete markets