Corporate Finance, Module 21: “Option Valuation”

Required reading, Eighth Edition:

(The attached PDF file has better formatting.)

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{The Brealey and Myers textbook is excellent. We say to read certain sections and to skip others. This does not mean that certain sections are better; it means that the homework assignments and exam problems are based on the sections that you must read for this course. Some of the skipped sections are fascinating, but they are not tested.}

The introduction on page 565 has five bullet points that you must know for Module 23; you might as well read them now.

Read section 21.1, “A Simple Option Valuation Model,” on pages 565-570. The option delta valuation method has two parts: (i) determining the option delta and (ii) using risk neutral valuation to price the option. The option delta is the partial derivative of the option price with respect to the stock price: *if the stock price increases by 1¢, what is the change to the option price?* We speak of this in a *two-state world*: the stock price either moves up by Y or moves down by Z, and we look at the change in the option value divided by the change in the stock price.

Using the option delta, we construct a risk-free portfolio, meaning that *whether the stock price moves up or moves down, the ending value of the risk-free portfolio is the same*. A risk-free portfolio earns the risk-free interest rate, and we solve for the value of the option. See the top half of page 567.

Read the Amgen example on pages 567-569 for the call and put options. The final section (top of page 570) shows that the call and put options satisfy the put call parity relation.

Read section 21.2, “The Binomial Method for Valuing Options,” on pages 570-575. To save space, Brealey and Myers use a two stage illustration. Most authors use a single stage example first, since the concepts are more complex in the two stage model. The practice problems have several single stage examples of both calls and puts, with more explanation than in the textbook.

Read the sections “The General Binomial Method” on pages 573-574 and “The Binomial Method and Decision Trees” on page 575. Page 574 gives a formula for the upside and downside changes in terms of the volatility of the stock price. The formula says that if these are the changes, the standard deviation for a period one year is the volatility. The proof is simple, but Brealey and Myers don’t show it, since most of their readers (first and second year college students) have little mathematics background. The final exam does not test the derivation, but the problems assume this relation: the upside change is $e^{\sigma\sqrt{h}}$ and the downside change is the reciprocal of this.

The option delta and binomial tree pricing methods are straight-forward, but they take a while to grasp. One moment they seem bizarre, but once you grasp the concept, they are simple, and you have trouble understand what was so hard. One way of grasping this material is to explain the procedure to another person. Study with a partner; take a problem from the Module 21 practice problems and explain the solution to your partner. After working through three or four problems, it makes sense.

The SOA places high value on option pricing, and the final exam for this course covers all three methods in the text (option delta, binomial tree, and Black-Scholes) for a variety of option types (calls, puts, one stage, two stage). Spend an hour or two explaining the methods to another candidate (or even explaining to the mirror). If you are feeling cruel, you might try explaining option pricing to your spouse.

We cover sections 21.3 and 21.4 in Module 23. The summary for this section does not review the text, so it is of little help to you. Skip the appendix on dilution (pages 585-588) and skip the mini-case on pages 593-594.

Review question 1 in the quiz on page 589. Review questions 4a, 4b, and 4c on page 591; then answer the same questions for a put option instead of a call option. Review questions 2 and 4 in the quiz on page 589 are harder, but they are worth reviewing.