Corporate Finance, Module 21: "Option Valuation"

Corporate finance module 21: Readings for Tenth Edition

(The attached PDF file has better formatting.)

Updated: October 14, 2010

The page numbers here are for the *tenth* edition of Brealey and Myers. You may also use the seventh, eighth, or ninth editions of this text. The page numbers for earlier editions are in separate postings. The substantive changes in the textbook are slight among these editions, but the final exam problems are based on the tenth edition.

{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 525 has five bullet points that are tested on the final exam; be sure to know them.

Read section 21.1, "A Simple Option Valuation Model," on pages 525-529. 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 down by Z, and we look at the change in the option value divided by the change in the stock price.

Know the formula for the option delta on page 527 (repeated on page 529), and the formula for the risk-neutral probability of an increase in the stock price on page 528. The option delta is positive for a call option and negative for a put option; using a positive option delta for a put option leads to careless errors on final exam problems.

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 middle of page 527, the middle of page 528, and the middle of page 529. The textbook solves for option values several times, since readers don't always grasp the logic at first. The final section (bottom of page 529) shows that the call and put options satisfy the put call parity relation. The final exam gives a basic call or put option and asks for options deltas or risk-neutral probabilities of stock price increases.

Read section 21.2, "The Binomial Method for Valuing Options," on pages 530-533. Brealey and Myers use a two stage illustration. Some authors use a single stage example first, since the concepts are harder in the two stage model. The practice problems on the

discussion forum have several examples of calls and puts, with more explanation than in the textbook.

Read the sections "The General Binomial Method" on pages 533-534 and "The Binomial Method and Decision Trees" on page 534. Page 533 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 derivation is simple for actuarial candidates, 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 may ask: If the upside change is +25% and the downside change is –20% each quarter, what is the annual stock price volatility?

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.

You must know options pricing for the actuarial exams, and these pages from the Brealey and Myers text are a good introduction. Your study does double duty: for the VEE course and then for the actuarial exams.

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 mini-case on pages 549-550 and skip the appendix on dilution (pages 55–553).

Review problems 1, 4, and 5 on page 545; problems 9, 10, and 12 on page 546; and problems 15 and 16a on page 547.