

Introduction to Finance
Problems to prepare for Quiz 7

This material is structured around the concept of the expected return on a debt instrument – which is the pre-tax cost of the instrument from the issuer’s perspective.

A bond or note is a debt instrument that specifies promised future cash flows. In the event of a catastrophe—for a cat bond—or default—for a corporate bond—the promised flows will not be paid. This means that we can appeal to probability theory and historical data to come up with *expected* future cash flows. That rate that when used to discount expected cash flows gives the market price is the expected return on the bond. For any bonds except US Treasuries the expected return will be less than the bond’s yield to maturity.

The yield to maturity has 3 parts:

1. Compensation for time (risk-free rate);
2. Compensation for expected loss (hazard rate); and
3. Risk Premium – compensation for the fact that losses are more likely when the economy (and hence the rest of your wealth) is faring poorly.

If we work with continuously compounded yields, rates, and hazards, then these components are additive.

Note that since cat bonds’ catastrophes are not connected to the state of the economy, they have a 0-risk premium.

Note too that the second component – being compensation for expected loss– is the difference between the security’s yield to maturity and its expected return. So you can compute the note’s expected return by taking the yield to maturity minus the hazard rate. This will equal the sum of the risk-free rate and the risk premium.

From the borrower’s perspective (the borrower is the issuer of the bond or note), the pre-tax cost of debt equals the lender’s expected rate of return. This means that the hazard rate is not part of the cost of debt to the borrower. The reason is that in the event of default, the borrower pays nothing. We obtain the after-tax cost of debt by taking the pre-tax cost of debt $\times (1 - \tau)$, where τ is the borrower’s marginal income tax rate. If the firm has \$100 income before interest expense, and \$10 of interest expense, then its taxable income is \$90. If the firm pays a 30% income tax rate, then its tax expense is \$27. If it had paid no interest, then its tax expense would have been \$30. So the government effectively paid \$3 of the company’s \$10 interest expense.

Example of questions on expected returns:

1. Suppose that you buy \$1,000 par value of each of 15,000 different BBB-rated 6-year 0-coupon bonds that yield 8% (continuously compounded), when the 6-year US Treasury STRIPS sells for 71.89.
 - (a) What is the implied hazard rate on these BBB bonds?
 - (b) What is the value of your portfolio today?
 - (c) What is the expected value of your portfolio in 6 years, when these bonds mature?
 - (d) Using your answers to the previous 2 questions show your expected holding period return on a continuously compounded basis on this portfolio.
 - (e) Establish how you can identify this expected holding period return on the day you buy the portfolio.
 - (f) How does the expected return on this portfolio compare to the expected return from a portfolio of the same value of 6-year 0-coupon US Treasury STRIPS? Explain.
2. ITT Corp.’s marginal income tax rate is 19%. ITT just issued a 5-year, 0-coupon bond at a price of 70.46. A term-matched US Treasury STRIPS sells for 86.07.
 - (a) What is the credit spread on this ITT Corp. 0-coupon bond?
 - (b) What is the market-implied probability that ITT Corp. will default at some over the next 5 years?
 - (c) What is the expected return on these bonds?
 - (d) What is ITT Corp.’s after-tax cost of debt on these bonds?