Review and Summary of Debt

Chris Lamoureux, November 22, 2018

Notes:

1. A bill is a debt instrument with a term of one year or less that does not pay a coupon.
2. The terms *note* and *bond* are now used virtually interchangeably, although the US Treasury refers to its 30-year coupon securities as Treasury Bonds and coupon-paying securities of original ten-year terms or less are called notes.
3. It is convenient and precise to refer to interest rates in terms of basis points. 1% is 100 basis points.

Summary

4. The yield to maturity on US Treasury securities is the cost of time in our economy.
    a. We refer to the yields on 0-coupon Treasury securities as spot rates.
    b. A graph of spot rates against term is the yield curve. As a snapshot of the cost of time, as a function of borrowing term, the yield curve is a useful economic summary and indicator. As an example, recessions are often preceded by a downward-sloping (or ``inverted'') yield curve. (Although this is not to say that all inverted yield curves precede recessions.)
    c. Because the US Treasury is a risk-free borrower, a Treasury security's yield to maturity is the Treasury's cost of borrowing. A Treasury security's yield to maturity is the investor's expected return on the security (– if held to maturity).
5. Catastrophe (or Cat) bonds are debt securities linked to a catastrophe, and are part of the market known as Insurance Linked Securities. As a simplification if you buy a cat bond and the underlying catastrophe does not occur during the bond's life, then you will receive the promised interest and principal. But once the catastrophe occurs, the security becomes worthless.

   Provided the linked catastrophe is not correlated with the state of the economy (for example, named hurricane damage in Broward County), the cat bond has to compensate investors for the cost of time. Since there is a probability of loss, this means that the continuously compounded yield to maturity on a cat bond has to include the cost of time and the continuous hazard rate that describes the loss probability.

a. The expected return on a cat bond is the same as on a same-dated Treasury security. This is the cost of borrowing to the cat bond issuer and the investor's expected return on the security (– if held to maturity).
b. The yield to maturity on a cat bond is higher than the cost of time – we see that this is not the same as the investor's expected return on the security (– if held to maturity), since it includes the hazard rate. This is because the yield to maturity is simply that continuously compounded yield—which when used to discount all *promised* future cash flows—returns the security's market price (or value) as the present value.
c. Since the market is a complex algorithm that brings all information to bear in determining a security's price, we can read off the hazard rate that characterizes the underlying catastrophe as the difference between the cat bond's yield to maturity and the yield to maturity on a similarly-dated US Treasury security.

6. Corporate bonds are like cat bonds in the sense that they are also subject to default risk: If the issuer defaults (declares bankruptcy), the corporate bond will lose value. As with cat bonds for simplicity we will assume that when the borrower defaults, the bond becomes worthless. Unlike natural disaster–linked cat bonds corporate default probability is linked to the state of the economy. Since we value money more highly when things are bad, and vice-versa (i.e., we are risk averse), this means that the corporate borrower (bond issuer) must compensate the lender (bond holder) for this systematic risk. Therefore:
    a. The yield to maturity on a corporate bond has three components:
        i. Pure cost of time
        ii. Hazard rate
        iii. Risk premium
    b. The yield to maturity on corporate debt minus the yield to maturity on a similarly-termed US Treasury security is the security's credit spread.
    c. As a rule of thumb, we will treat the credit spread as being split equally between the hazard rate that defines bankruptcy and the risk premium.[1] So for example, if we observe that BBB-rated ITT Corp 7-year debt has a continuously compounded yield to maturity of 5%, while at the same time a 7-year US Treasury note is yielding 3% compounded continuously, then the credit spread on this ITT debt is 200 basis points. We say that its hazard rate is 100 basis points and the risk premium is 100 basis points. We can use the hazard rate to build the bankruptcy probability table over the bond's life. The expected return to the ITT bond's owner is 4% being the 3% cost of time plus the 1% risk premium. This is also the before-tax cost of this debt to ITT.

[1] This rule of thumb is based on empirical evidence that over a 150 year period the average credit spread on US corporate debt is about 150 basis points. Over the same period the average annual loss rate is about 75 basis points. See Geisecke, Longstaff, Schaefer, and Strebulaev, *Journal of Financial Economics*, 2011, ``Corporate Bond Default Risk: A 150-year Perspective.''

d. Under the current US Tax code the interest paid on debt is considered a business expense. Let τ be the company's marginal tax rate. Then the after tax cost of corporate debt is the (yield to maturity minus the hazard rate) times $(1 - \tau)$. Note that the hazard rate --- which is part of the yield to maturity-- is not part of the after-tax cost of debt, and does not benefit from the tax shield. Returning to ITT Corp, suppose that its marginal tax rate is 21%. In this case, its after tax cost of debt is: $(.05 - .01) \times .79 = .0316$ (or 3.16%).

A few words on Inflation. All of the debt instruments that I discuss above are contracted in nominal terms. Which is to say the promised cash flows are in US dollars. Inflation refers to depreciation of the purchasing power of a dollar. As such, if we expect that inflation will be 2% per year over the next five years, then lenders will require that borrowers compensate them for inflation – in addition to the passage of time. In addition, when there is inflation, it is often difficult to predict, so lenders may also require a risk premium to compensate for this risk. The US Treasury also issues inflation-indexed debt. This debt pays a real coupon, and the principal is indexed to the consumer price index. We can look at the real yield to maturity on these inflation-linked securities. If we subtract this from the nominal yield on standard Treasury securities we have a sense of expected inflation over the term plus the inflation risk premium.

Our focus in FIN 510 is exclusively on fixed-rate debt. Much corporate debt is floating-rate, and even the US Treasury now issues floating-rate debt. This debt pays a coupon that resets periodically to the current market rate. Thus floating rate debt does provide an inflation hedge.