Bond Valuation

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Plan

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I. Bond Definition:

Bonds are a form of debt, and they are generally issued for longer than one year. Bonds are sold by national and local governments, municipalities, companies, and other institutions. When you buy a bond, you are lending money to the institution that is selling the bond. The seller of the bond agrees to repay the principal amount of the loan when the bond reaches maturity. For interest-bearing bonds, the seller also agrees to pay interest periodically, as specified in the loan contract

II. Bond Basics

Holder. The investor who owns the bond.

Issuer. The corporation or government agency that issues the bond.

Price. The price for which the bond could be sold.

Indenture. A document that outlines the terms of the loan agreement.

Par value. The face value of the bond, or the amount returned to the bond holder when the bond reaches maturity.

Coupon interest rate (interest rate). The percentage of the par value that is paid to the bond holder annually in the form of interest.

Call provision. A provision that allows the issuer to repurchase a bond before its maturity date. The price at which the bond may be repurchased is set in the indenture.

Deferred calls. A specification stating that call provisions cannot be exercised for a number of years. Deferred calls provide protection for the holder of the bond.

Redemption. The process of cashing in a bond.

Sinking fund. Money that is set aside annually by the issuer to pay off the issuer's bonds when they reach maturity.

Current yield. The total annual interest payment on a bond divided by the bond's current or market price.

Debt obligation. A term that is interchangeable with the term "bond."

III. Bond Maturity

Maturity date. The date on which the bond expires and the issuer must pay back the loan.

Short-term bond. A bond that matures in one year or less.

Intermediate-term bond. A bond that matures in 2 to 10 years.

Long-term bond. A bond that matures in 10 or more years.

IV. Types of Bonds

Asset-backed bond. A bond from an issuer whose bonds are backed or collateralized by

loans, leases, personal property, or receivables, but not real estate.

Bearer bond. A bond with an attached coupon that allows the bearer to claim interest payments upon surrender of the coupon.

Book-entry bond. A bond that is registered and stored electronically (similar to stocks).

Collateralized mortgage obligations (CMO). More complex, specialized versions of mortgage-backed bonds.

Debenture. A bond that is backed by the credit of the issuer and has no specific security or collateral.

Discount bond. A bond that is sold at less than its principal value or at a discount to its par value.

Junk bond (high-yield bond). A bond with a very low (or risky) bond rating, a higher interest rate, and a higher default rate. Junk bonds are almost always callable.

Mortgage-backed bond. A bond that is backed by a pool (portfolio) of mortgages that are carried by the issuer.

Zero-coupon bond. A discount bond that does not allow for a coupon payment and pays no interest until maturity.

Types of Bond

Government Bonds (Treasury Bonds)

Bonds issued by the federal government, also known as state bonds.

Municipal bonds or muni

Bonds issued by state and local governments.

Corporate Bonds

Bonds issued by companies.

Foreign Bonds

Bonds issued by foreign governments and foreign companies

V. Bonds with Conditions

Callable bond. A bond where the issuer can force the investor to redeem this type of bond before the bond's maturity date.

Convertible bond. A bond that gives the holder the option of converting the bond into company stock instead of obtaining cash repayment.

Floating-rate bond. A bond in which interest payments fluctuate according to a specific benchmark for interest rates and that varies with short-term interest rates.

Subordinated bond. A bond that will be paid only after the issuer's other loan obligations have been paid in the event of financial distress.

VI. Bond Ratings

Bond rating. A measure of the default risk associated with a company's bonds. Ratings are done by a bond-rating company and may range from AAA for the safest bonds to D for the riskiest bonds. In general, the better the bond rating, the lower the interest rate the company will have to pay on its bonds.

Default risk. The risk that a company will be unable to repay a bond.

Bond-rating company. A private-sector company that evaluates the financial condition of a company that issues bonds—factors include the company's revenues, profits, and debts. Bond-rating companies usually rate only issues of companies and sovereign issuers that offer corporate and municipal bonds.

Downgrade. A situation in which a bond-rating company reduces the bond rating of a particular issue, usually because of a company's deteriorating financial condition. If a bond rating is downgraded, it is likely that investors who own the company's bonds will have to reduce the price of their bonds (resulting in a lower return for the holder and a higher yield for the issuer) to make up for the increased risk if the investor wants to sell.

Upgrade. A situation in which a bond-rating company improves the bond rating of a particular bond, usually because of a bond-issuing company's improving financial condition.

VII. Bond Valuation

Bond valuation is a way of determining the fair value of a bond. Bond valuation involves calculating the present value of the bond's future coupon payments, its cash flow, and the bond's value at maturity (or par value), to determine its current fair value or price. The price of a bond is what investors are willing to pay for it on the secondary market.

When an investor buys a bond from the issuing company or institution, they typically buy it at its face value. But when an investor purchases a bond on the open market, they need to know its current value. Because a bond's face value and interest payments are fixed, the valuation process helps investors decide what rate of return would make that bond worth the cost.

The present value of a bond, expected to mature in N time periods, with coupons every period can be calculated.

$$\text{PV of Bond} = \sum_{t=1}^{t=N} \frac{\text{Coupon}_t}{(1+r)^t} + \frac{\text{Face Value}}{(1+r)^N}$$

where,

Coupon_t = Coupon expected in period t

Face Value = Face value of the bond

r = Discount rate for the cash flows

The discount rate used to calculate the present value of the bond will vary from bond to bond depending upon default risk, with higher rates used for riskier bonds and lower rates for safer ones.

If the bond is traded, and a market price is therefore available for it, the internal rate of return can be computed for the bond, i.e., the discount rate at which the present value of the coupons and the face value is equal to the market price. This internal rate of return is called the yield to maturity on the bond.

There are several details, relating to both the magnitude and timing of cash flows, that can affect the value of a bond and its yield to maturity. First, the coupon payment on a bond may be semi-annual, in which case the discounting has to allow for the semi-annual cash flows. (The first coupon will be discounted back half a year, the second one year, the third a year and a half and so on.) Second, once a bond has been issued, it accrues coupon interest between coupon payments and this accrued interest has to be added on to the price of the bond, when valuing the bond.

a. The Current Yield:

The simplest measure of the yield on a bond is the current yield, also known as the flat yield, interest yield or running yield. The running yield is given:

$$rc = \frac{C}{P} \times 100$$

where:

C is the bond coupon;
rc is the current yield;
P is the clean price of the bond.

Current yield ignores any capital gain or loss that might arise from holding and trading a bond and does not consider the time value of money. It essentially calculates the bond coupon income as a proportion of the price paid for the bond, and to be accurate would have to assume that the bond was more like an annuity rather than a fixed-term instrument. It is not really an “interest rate”, though.

b. The simple yield to maturity:

The simple yield to maturity makes up for some of the shortcomings of the current yield measure by taking into account capital gains or losses. The assumption made is that the capital gain or loss occurs evenly over the remaining life of the bond. The resulting formula is:

$$rs = \frac{C}{P} + \frac{100 - P}{nP}$$

where:

P is the clean price;
rs is the simple yield to maturity;
n is the number of years to maturity.

For a bond with a 6% coupon and with a price of 97.89, and also assuming $n = 5$ years:

$$rs = \frac{6.00}{97.89} + \frac{100 - 97.89}{5 \times 97.89} = 0.06129 + 0.00431 = 6.560\%$$

The simple yield measure is useful for rough-and-ready calculations. However, its main drawback is that it does not take into account compound interest or the time value of money. Any capital gain or loss resulting is amortised equally over the remaining years to maturity. In reality, as bond coupons are paid they can be reinvested, and hence interest can be earned. This increases the overall return from holding the bond.

c. The yield to maturity (YTM):

The yield to maturity (YTM) or gross redemption yield is the most frequently used measure of return from holding a bond.1 Yield to maturity takes into account the pattern of coupon payments, the bond's term to maturity, and the capital gain (or loss) arising over the remaining life of the bond. These elements are all related and are important components determining a bond's price. If we set the IRR for a set of cash flows to be the rate that applies from a start-date to an end-date we can assume the IRR to be the YTM for those cash flows. The YTM therefore is equivalent to the internal rate of return on the bond, the rate that equates the value of the discounted cash flows on the bond to its current price. The calculation assumes that the bond is held until maturity and therefore it is the cash flows to maturity that are discounted in the calculation. It also employs the concept of the time value of money.

$$P_d = \frac{C}{(1+rm)^1} + \frac{C}{(1+rm)^2} + \frac{C}{(1+rm)^3} + \cdots + \frac{C}{(1+rm)^n} + \frac{M}{(1+rm)^n}$$

where:

P_d	is the bond dirty price;
M	is the par or redemption payment (100);
n	is the number of interest periods;
C	is the coupon rate;
rm	is the annual yield to maturity (the YTM).

$$P_d = \sum_{n=1}^{N} \frac{C}{(1+rm)^n} + \frac{M}{(1+rm)^N}$$

For YTM for a semi-annual coupon bond, we have to adjust the formula to allow for the semi-annual payments. The previous equation is modified as bellow, again assuming there are precisely six months to the next coupon payment:

$$P_d = \sum_{n=1}^{N} \frac{C/2}{\left(1+\frac{1}{2}rm\right)^n} + \frac{M}{\left(1+\frac{1}{2}rm\right)^N}$$

Yield to Maturity (YTM): the rate of return received on a bond if the bond is held to maturity. In other words, it is the internal rate of return (IRR) of an investment in a bond if the investor holds the bond until maturity, with all payments made as scheduled and reinvested at the same rate.

$$YTM = \frac{Coupon\ Payment + \frac{Face\ Value - Market\ Price}{N}}{\frac{Par\ Value + Market\ Price}{2}}$$

N = Number of years to maturity
Face Value = Bond's Maturity Value or Par Value
Market Price = The bond's Price Today

d. Yield to Call (YTC):

The rate of return received on a bond if the bond is redeemed before its maturity date.

$$YTC = \frac{Coupon\ Payment + \frac{Call\ Price - Market\ Price}{N}}{\frac{Call\ Price + Market\ Price}{2}}$$

N = the number of years remaining until the call date

Market Price = current market price of a bond