Y

Yield: is the return on the amount invested in a security or a bond expressed as annualized percentage; for example, yield on a bond in its simplest form is the income on the bond over the holding period divided by the average amount invested based on the purchase price of the bond paid and its redemption value. Hence, yield on a bond is not the same as the coupon rate, because a bond is traded in the market at a price usually different from the par value of the bond. The yield on a loan is the actual amount of interest earned on an annual basis and expressed as a percentage; yield on a deposit is the interest income earned divided by the deposit balance over a defined period; this is because unlike a bond, a loan or a deposit is not actively traded in the market and does not have a market price like the price of a bond. The yield of a security or a bond is based on the amount invested, the maturity date, the time period of the investment, the number of periodic payments received per year as interest income, together with any reinvestment income on the amount of interest received, the redemption value of the security or the bond, adjusted for any capital gain or loss at the time of redemption. *(see Bond Yield)*

There are several types of yield as below.

- ***Coupon Yield:*** or the *nominal yield* is the contractual rate of interest, the coupon rate of the bond, fixed at the time of bond issue, provided the bond is purchased at par; for example, a bond of Rs1000 purchased at its par value with a coupon rate of 8 percent, payable once at the end of the year, will have interest income of Rs80 for the year, and since it was purchased at Rs1000, its coupon yield or nominal yield is also 8 percent, calculated by dividing the interest income for the year by the purchase price paid by the bond holder.

- ***Actual Yield:*** is the rate of return based on the purchase price of the bond and is obtained by dividing the interest income on the bond with the bond price; for example, a Rs 1000 bond paying 8 percent interest rate, if purchased below par at a discount for Rs 800, its bond yield is 10 percent, calculated by dividing bond income of Rs80 with the bond price of Rs800, and expressed as percentage; or the same bond if purchased above par at a premium for Rs1200, then its yield is 6.7 percent, calculated by dividing bond income of Rs80 with the bond price of Rs1200, and expressed as percentage. Thus, actual bond yield will be higher than the coupon yield if the bond is purchased below par; actual yield will be below coupon yield if bond is purchased above par; the reason is the underlying amount invested for the bond purchase.

- ***Current Yield:*** also called *market yield*, is the rate of return on the bond if purchased at prevailing market price different from its par value; current yield is calculated in the same manner as actual yield. If market price of a bond is the same as its par value, then current yield, market yield, actual yield and coupon yield, all are the same for the bond.

- ***Yield-to-Call (YTC):*** if the bond is callable and is actually called in by the issuer, then yield is calculated for the period bond is held until the time it is called, in the same manner as yield to maturity is calculated substituting par value of the bond with call price of the bond.

- ***Yield-to-Maturity (YTM):*** is the rate of return on a bond if it is held to maturity, and is based on the maturity period, the price of the bond paid at the time of purchase, the interest income on the bond during the maturity period, the redemption value of the bond on the maturity date, and any capital gain or loss based on appreciation or reduction in the bond price at the time of redemption. It is calculated through the method of averages, the simplest method, or through the method of interpolation involving discounted stream of the cash flow of coupon income as outlined below. If the bond is purchased at par value and if held upto its maturity date, then yield to maturity is the same as the interest rate on the bond, the coupon rate, the coupon yield; but YTM varies from the coupon yield if the bond is purchased at a discount or a premium. Note that the interest income in the calculations of the yield has two components; one component is the straightforward cash flow received as coupon interest based on the number of periodic payments and the coupon rate, and the other component is the interest received on the reinvestments of coupon income, the compounded interest of the coupon cash flow.

The Simple Method: gives a measure of YTM as the ratio of *average income* to *average investment* calculated as:

$$y = [(n \cdot cF + Vr - P) / n] / [(P + Vr) / 2]$$

where
y is the yield to maturity
n is the number of periodic payments
cF is the amount of cash flow per period
Vr is the redemption value of the bond
P is the price of the bond
Vp is the par value of the bond.

Suppose a bond of Rs1000 at par value, ***Vp,*** issued on January 15, 1998 for a maturity of 10 years, has a coupon interest rate, ***i***, of 12 percent, with ***n*** = 20 in semi-annual coupon payments; its redemption value, ***Vr***, on the redemption date of January 15, 2008, is Rs1000. Two years later, on January 15, 2000, the bond is selling at a discount and is quoted in the market at 94 7/8; hence, the purchase price of the bond, ***P***, will be Rs 948.75 = (94.875 x 10) paid by the purchaser; and the cash flow of coupon income, ***cF***, per period to the bond purchaser will be Rs 60 = (Rs1000 x 12 percent / 2) for 16 payments over the 8 years of remaining maturity period of the bond. On this basis, the average income for n = 16 periods, will be

$$= [(16 \times 60 + 1000 - 948.75) / 16] = \text{Rs } 63.20$$

while the average investment will be = [(948.75 + 1000) / 2] = Rs 974.37
and yield to maturity, y, will be $y = (63.20 / 974.37) \times 2 = 12.97\ \%$

The Discount Method: is a bit more complicated but more accurate as it uses the discount factor, where the discount rate is the yield rate, y, itself. Conceptually, this discount rate is such that it equalizes the price of the bond with the sum of the discounted value of the cash flow of the bond and the discounted redemption value of the bond as given in the formula below using same notations as above.

$$P = [(\text{sum } t = 1 \ldots n)\ cF / (1 + y)^{t}] + Vr\ (1 + y)^{-n}$$

There are two elements on the right side of the above equation. The first element is the discounted value of the cash flow *per period*, and the second element is the redemption value of the bond, discounted for the *last* payment period, n. Since the coupon rate is fixed, the cash flow amount, cF, is the same every period of interest payment. The discount rate in this equation is the yield to maturity, y, itself, and it can be determined given that this is the

only unknown variable in the equation; all others are pre-defined. However, y can be calculated only by a financial calculator by entering the appropriate values of the remaining variables, P, coupon rate, dates of purchase and maturity, n. In the above example, using the discount method, the yield is 6.84 per cent per period, and since it is the semi-annual rate, the annual yield is 13.68 percent, slightly higher than the yield obtained from the simple method. The discount method, therefore, is more accurate and is widely used.

- ***Yield- to-Worst:*** is used in the pricing of a callable bond by comparing its YTC and YTM and taking the lower of the two, the worst, to price the bond. Suppose a bond is callable, and its YTC is lower than the YTM, then the yield-to-worst of this bond will be its YTC, because the market would consider the YTC as the most likely outcome of the return on this bond and would use the YTC to price the bond.

Yield Curve: a curve obtained by plotting yield rate of securities of the same class on the vertical axis and the respective maturities on the horizontal axis. The yield curve enables a comparative analysis of the yield rate on short-term and long-term securities. If the yield curve slopes upward to the right it is called a positive yield curve, meaning that short-term interest rates are lower than those on long-term. Conversely, a downward or negatively sloped yield curve, or an inverted yield curve shows that short-term rates are higher than long-term rates. If there is little or no difference between short-term and long-term rate, the yield curve is flat. The positively sloped yield curve is also referred to as the normal yield curve, since it is widely believed that this is the normal shape of the curve given the rational expectations of short term interest rates being higher than the long term rates, and given the positive relation between yield and interest rates; that is, higher the interest rate higher the yield; in contrast to the inverse relation between the price of the bond and its yield, that is, higher the price, lower the yield; and conversely. *(see Inverted Yield Curve)*