READING

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Performance Evaluation: Rate-of-Return Measurement
(an excerpt)

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2.1.3 *Bonds*

The return calculations given thus far have been illustrated using common shares. There are important distinctions between the income on common shares (dividends) and the income on bonds (interest). A common stock investor receives a declared dividend if he or she appears as the owner of record on a stated date (the so-called record date for receipt of the dividend); otherwise, whatever the length of time the investor held the shares, no part of the declared dividend is received. In contrast, when a bond is sold, the seller receives the price quoted in the transaction plus a share of the upcoming interest payment, known as **accrued interest** (AI), which is proportional to the fraction of days between interest payments that the bond has been held by the seller.[3] For example, if a $1,000 face value bond with $20 semi-annual interest payments is sold for $960 exactly halfway between interest payment dates, the seller would receive $960 + (1/2)$20 = $970. The $10 difference is accrued interest: interest that has been earned by the bond seller (but not yet paid by the bond issuer) since the last interest payment. Conventional price quotes exclude the value of coupon interest accrued to the date of the quote. The price without accrued interest is called the **clean price**; here, the clean price is $960. The price with accrued interest, here $970, is sometimes called the **dirty price**. The dirty price represents the value at which the asset can be exchanged for other assets in the market.

The price with accrued interest is the relevant one for calculating the rate of return on a bond using Equation 1. Adapted to bonds and, for simplicity, limiting ourselves to the case in which the bond is purchased and sold within a single period between interest payments, we obtain[4]

$$\text{Return relative} = \frac{V_1}{V_0} \qquad \textbf{(6a)}$$

where

Change in AI = Ending AI – Beginning AI[5]

$$R = \frac{V_1}{V_0} - 1 = \frac{V_1 - V_0}{V_0} \quad \textbf{(6b)}$$

$$R = \frac{V_1 - V_0}{V_0} = \frac{£10{,}200 - £10{,}000}{£10{,}000} = \frac{£200}{£10{,}000} = 0.02 \text{ or } 2.00\% \quad \textbf{(6c)}$$

Assume the bond just described is purchased halfway between interest payments for $970 (including accrued interest). The bond is sold three-fourths of the way into the six-month period for $950 plus accrued interest of (3/4)($20) = $15. The amount realized on the sale is $950 + $15 = $965.

The holding period return for the period beginning with the date the bond was purchased at a cost of $970 and ending on the date it was sold for total proceeds of $965 is

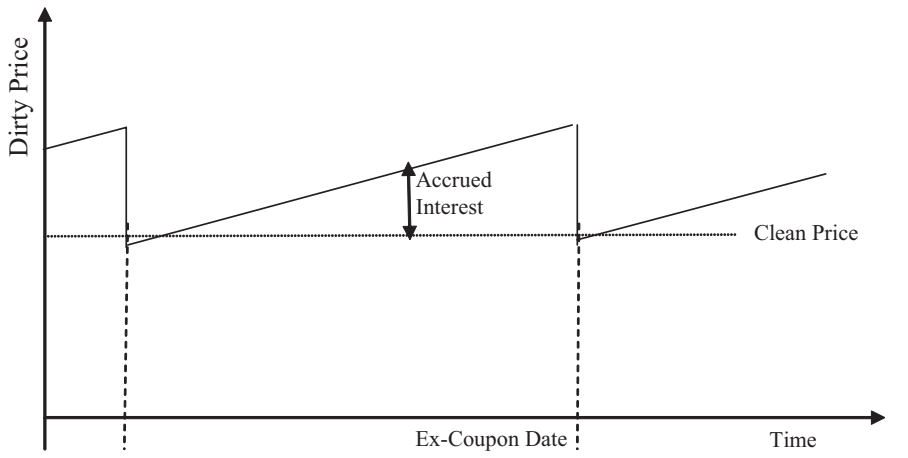
($965 – $970)/$970 = –0.52%

The price return is ($950 – $960)/$970 = –1.03 percent. Based on a change of accrued interest of $15 – $10 = $5, the income return is $5/$970 = 0.52 percent. The two return components sum to –0.52 percent (apart from rounding error).

Bonds, like common shares, can be thought of as having an "ex-date," or **ex-coupon date**: The entire coupon will be paid to the investor owning the bond on the day before the ex-coupon date. However, whereas for common shares the record date and the ex-dividend date are typically somewhat arbitrary,[6] for specific types of bonds the ex-coupon date is often set predictably in relation to trade settlement periods. For example, US corporate bond trades typically settle in three business days (e.g., on Thursday if the trade is on Monday, assuming Monday through Thursday are all days that are open for trading). If that Thursday is the coupon payment date, the Monday is effectively the ex-coupon date because a buyer on Monday does not receive the upcoming interest payment and the transaction is without accrued interest.[7]

Exhibit 1 shows the relationship between clean and dirty prices and accrued interest over time assuming the clean price remains constant over the period.

Exhibit 1 Relationship between Price and Accrued Interest for a Bond



EXAMPLE 6

Calculation of Holding Period Return for a Bond

A $1,000 face value, 4 percent coupon, semi-annual pay bond is issued on 1 January and purchased at par. The first coupon will be paid on 1 July. The bond is quoted at a clean price of $1,020 on 31 January.

1 Calculate the rate of return on the bond for January.
2 Calculate the price return on the bond for January.
3 Calculate the income return on the bond for January.

Solution to 1:

Because the bond was held for one month, 1/6 of the semi-annual coupon payment needs to be accrued.

Semi-annual coupon = $1,000 × 4% × 0.5 = $20

Accrued interest = $20 × (1/6) = $3.33

Using Equation 6a,

$$\text{Total return} = \text{Holding period return } R = \frac{V_1 - V_0}{V_0} = \frac{€1{,}149{,}910.72 - €1{,}081{,}312.35}{€1{,}081{,}312.35}$$
$$= 0.0634 = 6.34\%$$

Solution to 2:

Using Equation 6b,

$$\text{Price return} = \text{Holding period return } R = \frac{V_1 - V_0}{V_0} = \frac{£8{,}632.50 - £9{,}351.00}{£9{,}351.00}$$
$$= -0.0768 = -7.68\%$$

Note that the dirty and clean prices are the same on 1 January because there is no accrued interest.

Solution to 3:

The income return accounts for the portion of the coupon payment that has been earned but not yet received. Using Equation 6c,

$$\text{Income return} = \text{Holding period return } R = \frac{V_1}{V_0} - 1 = \frac{£5.755}{£6.234} - 1$$
$$= -0.0768 = -7.68\%$$

EXAMPLE 7

Calculation of Income Return, Price Return, and Total Return for a Bond

A $1,000 face value, 4 percent coupon, semi-annual pay bond is issued on 1 January and purchased at par. The first coupon will be paid on 1 July. The bond is quoted on each of the following dates at the clean prices noted:

31 March at $1,040

31 May at $1,055

Calculate the holding period return for the bond including the price and income return components for the period 31 March to 31 May.

Solution:

Accrued interest to 31 March = \$20 × (3/6) = \$10.00

Accrued interest to 31 May = \$20 × (5/6) = \$16.67

Change in accrued interest: \$6.67

Dirty price on 31 March = \$1,040 + \$10 = \$1,050 = V_0

$$\text{Total return} = R = \frac{V_1 - V_0 + D}{V_0} = \frac{V_1 - V_0}{V_0} + \frac{D}{V_0}$$

$$\text{Price return} = \frac{V_1 - V_0}{V_0} = \frac{\$106 - \$100}{\$100} = 0.06 = 6.00\%$$

$$\text{Income return} = \frac{D}{V_0} = \frac{\$2}{\$100} = 0.02 = 2.00\%$$