CHARTA LEARNING · LESSON NOTES

Yield measures: fixed-rate, floating-rate and money market

CFA Level I · Fixed Income

You will learn: Calculate and compare current yield, yield to maturity, yield to call and yield to worst, restate yields to a common periodicity, and price floating-rate notes and money market instruments.

Running example: Worked examples follow one made-up issuer, Brightwell Utilities: a bond with par 100, 6% coupon paid twice a year (3 + 3), 10 years to maturity (20 payments), price today 90. Prices are per 100 of par.

1. Current yield and yield to maturity

- A yield is one number for the return on a bond; there are many yields, each answering a different question. The coupon rate is fixed forever; the price moves every day.
- Current yield asks how much coupon income you get in a year on the money you pay today. It divides by price, not par. It ignores the gain or loss at repayment and the timing of cash.
- Yield to maturity is the single discount rate that makes the present value of all remaining cash flows equal the price. With half-yearly coupons, find the rate per half-year (by trial and error) and double it.
- Ordering rule: at a discount, coupon rate < current yield < yield to maturity. At par all three are equal. At a premium the order reverses.

Current yield = annual coupon ÷ price; Price = C ÷ (1+y) + C ÷ (1+y)² + … + (C + R) ÷ (1+y)^N

BRIGHTWELL AT A PRICE OF 90

Annual coupon	3.00 + 3.00	**6.00**
Current yield	6.00 ÷ 90.00	**6.67% (coupon rate 6.00%)**
Try 6.00% / 8.00% / 7.00% / 7.50%	price too high / low / high / a little low	**100.00 / 86.41 / 92.89 / 89.58**
Yield to maturity	price = 90.00	**7.44%**
Premium (price 110): coupon, CY, YTM	6 ÷ 110	**6.00% > 5.45% > 4.73%**

Watch out: Dividing the coupon by par and calling it the current yield.

2. What yield to maturity assumes

- YTM is a promised return, not an expected one. It is earned only if three things hold: the bond is held to maturity, the issuer pays everything in full and on time, and every coupon is reinvested at the YTM itself.
- The reinvestment assumption is the one that quietly fails. The coupons are promised, but interest on interest depends on future rates. The longer the bond and the higher the coupon, the bigger that block.
- A zero-coupon bond has nothing to reinvest, so held to maturity it earns its yield exactly.

BOUGHT AT PAR (100), 6% COUPON, 20 HALF-YEARS

Coupons received	20 × 3.00	**60.00**
Coupons reinvested at 6%	grow to	**80.61 (interest on interest 20.61)**
Coupons reinvested at 2%	grow to	**66.06 (interest on interest 6.06)**
Realised yield, reinvesting at 6%		**6.00%**
Realised yield, reinvesting at 2%		**5.14%**

Watch out: Treating yield to maturity as an expected return.

3. Callable bonds: yield to call and yield to worst

- A callable bond lets the issuer repay early at a call price on set dates, so the issuer picks the ending. For each call date compute a yield to call: the horizon is the call date and the final payment is the call price, not par.
- Yield to worst is the lowest of all the yields to call and the yield to maturity. For a premium bond plan on the yield to worst: the issuer has every reason to call.
- For a discount bond being called at a higher price is a bonus, so the yield to call is higher and the worst is usually the yield to maturity.

Price = C ÷ (1+y) + … + (C + call price) ÷ (1+y)^(periods to call)

BRIGHTWELL CALLABLE: 6%, PRICE 106; CALL 102 IN YEAR 3, 101 IN YEAR 5

Yield to first call	6 half-years, 102	**4.47%**
Yield to second call	10 half-years, 101	**4.81%**
Yield to maturity	20 half-years, 100	**5.22%**
Yield to worst	the lowest	**4.47%**
Price 94: to first call; to maturity	worst is maturity	**8.92%; 6.84%**
Trap: call price taken as par, price 106		**3.86% (too low)**

Watch out: Moving the call date but keeping par as the repayment; quoting yield to maturity for a premium callable bond.

4. Restating yields to a common periodicity

- Periodicity is the number of compounding periods in a year. A stated yield means little until you know it. Six per cent paid twice a year beats 6% paid once, because interest earns interest.
- To restate: divide the stated yield by its periods, compound for a year (the effective annual yield), then reverse for the new periodicity. Both versions must give the same growth over a year.
- More frequent compounding gives a lower stated figure for the same economics. Restate to a common basis before comparing bonds from different markets, or convention will masquerade as a credit difference.

(1 + yield ÷ m)^m = (1 + yield ÷ n)^n

RESTATING YIELDS

6.00% semiannual: rate per half-year	6.00% ÷ 2	**3.00%**
Effective annual yield	$1.03^2 - 1$	**6.09%**
Quarterly-basis equivalent	$4 \times (1.0609^{1/4} - 1)$	**5.96%**
Effective annual at 6% stated: annual; semi; quarterly; monthly		**6.00%; 6.09%; 6.14%; 6.17%**
Annual bond 6.05% restated to semiannual	$2 \times (1.0605^{1/2} - 1)$	**5.96%**
True gap versus semiannual 6.00%	5.96% − 6.00%	**−0.04% (reversed)**

Watch out: Comparing two stated yields without checking their periodicity.

5. Floating-rate notes

- An FRN coupon resets to a market reference rate plus a fixed quoted margin, set at issue. The discount margin (required margin) is the spread the market currently demands, given credit risk and ease of trading.
- When the quoted margin equals the required margin, the note is worth par. If the discount margin is larger, the note is worth less than par; if smaller, more.
- The reference rate appears in both the coupon and the discount rate, so it nearly cancels. A floater is almost immune to changes in the reference rate but not to changes in credit.

Price = Σ (Index + QM) ÷ 2 ÷ (1 + (Index + DM) ÷ 2)^t + 100 ÷ (1 + (Index + DM) ÷ 2)^N

BRIGHTWELL 3-YEAR FRN, SEMIANNUAL; REFERENCE RATE 3.00%, QUOTED MARGIN 0.80%

Coupon each half-year	(3.00% + 0.80%) ÷ 2	**1.90**
Required margin 0.80%	discount at 3.80%	**100.00**
Required margin 1.10%	discount at 4.10%	**99.16**
Required margin 0.60%	discount at 3.60%	**100.56**

6. Money market quotes

- A bill pays no coupon: you buy below face value and receive face value, and the difference is the interest. Quotes differ in what they divide by (face value or price paid) and in year length (360 or 365 days).
- The discount rate divides by face value, so it understates the true return. The add-on yield (money market yield) divides by the price paid, on a 360-day year. The bond equivalent yield uses a 365-day year and is the larger.
- A longer year means a larger quoted number for the same economics. Ask what basis a quote is on before comparing.

Discount rate = (face − price) ÷ face × 360 ÷ days; Add-on yield = (face − price) ÷ price × 360 ÷ days; Bond equivalent = (face − price) ÷ price × 365 ÷ days

120-DAY BILL, FACE 100, QUOTED DISCOUNT RATE 4.50%; AND TWO DEPOSITS

Price	100 × (1 − 4.5% × 120/360)	**98.50**
Interest earned	100 − 98.50	**1.50**
Add-on yield	(1.50 ÷ 98.50) × 360/120	**4.57%**
Bond equivalent yield	(1.50 ÷ 98.50) × 365/120	**4.63%**
Bank A 3.60% (360-day) restated to 365-day	3.60% × 365/360	**3.65% (beats Bank B 3.64%)**

Key takeaways

- Current yield = annual coupon ÷ price; yield to maturity also counts the pull to par and timing.
- At a discount, coupon rate < current yield < YTM; at a premium the order reverses.
- YTM assumes holding to maturity, full payment and reinvestment at the YTM, so it is promised, not expected.
- Yield to worst is the lowest of the yields to call and the yield to maturity; yield to call uses the call price, not par.
- Restate yields to a common periodicity (and year length) before comparing.
- A floater prices off the gap between required and quoted margin; bills must be restated for basis and days.

Quick check

1. Coupon 4%, price 80 per 100. Current yield? YTM higher or lower?
   Answer: 4 ÷ 80 = 5.00%. Higher: discount bond.
2. YTM 5.0%, yield to first call 4.1%, to second call 4.6%. Yield to worst?
   Answer: 4.1%: the lowest of all the yields.
3. 180-day bill, face 100, price 97.50. Money market yield?
   Answer: 2.50 ÷ 97.50 × 360/180 = 5.13%.