

Calculate the Total Return of a Bond - given only the yield at beginning and end of year.

Valid benchmarks for Canadians' asset allocation to bonds are hard to find, and sometimes simply wrong. The most-often quoted benchmark is the universal market of Canadian debt that includes corporates, treasuries, mortgages, and also more exotic types of debt. But investors allocate to bonds mostly to benefit from bonds' predicted increase in value during any crisis that causes stock prices to tank. It is only treasury bonds that will do so. The solution is to calculate your own benchmark.

First decide whether you want to benchmark against long, short or medium term treasuries. This choice should stay constant over the business cycle so that any timing choices you make in your portfolio show up as deviations from the benchmark. Look up the year-end posted yield for this bond at <https://www.bankofcanada.ca/rates/interest-rates/canadian-bonds/>

Then use the math below to calculate the year's Total Return of that bond. An example of the whole calculation for an Excel spreadsheet is given at the end. It includes four pieces of a puzzle that fit together. The math following tackles the small pieces before putting them together.

Input assumptions

Principal at maturity = FV = \$1

Remaining term to maturity at year end = n = 20 years. This is always 1 year short of its maturity at the beginning of the year.

Market yield at beginning = %beg = 5%

Market yield at end = %end = 4%

Coupon = market yield at beginning = \$1 * 5% = \$0.05 (= %beg 5%)

Bond value at beginning = principal at maturity (because issued with coupon = market yield) = \$1

Logic

The present value (at year end) of the principal at maturity using the time value of money equation

$$= \frac{FV}{(1+\%end)^n} = \frac{\$1}{(1+4\%)^{20}} = .4564$$

The present value (at year end) of the coupon payments using the time value of money equation

$$\frac{Coupon}{\%end} \times \left(1 - \frac{1}{(1+\%end)^n} \right) = \frac{5\%}{4\%} \times \left(1 - \frac{1}{(1+4\%)^{20}} \right) = .6795$$

The bond's market value at year end = PV of principal at maturity + PV of coupon payments

$$0.4564 + 0.6795 = \$1.1359$$

Capital Gain % = (\$value at end / \$value at beginning) subtract 1

$$(1.1359 / 1) - 1 = 13.59 \%$$

Bond yields are quoted using simple interest half the yield is paid every six months. So the coupon return measured using compound interest is

$$\left(1 + \frac{\%beg}{2}\right)^2 - 1 = (1.025)^2 - 1 = 5.0625 \%$$

Total Return = capital gain plus coupon

$$13.59 \% \text{ plus } 5.0625 \% = \mathbf{18.65 \%}$$

Example of Microsoft Excel Calculation

Year	Year End Yield	Total Return
2001	5%	
2002	4%	18.65%