Part 1

Yield is a very simple concept and therefore, like all very simple concepts, comes embedded within a host of assumptions. These assumptions, when applied rigorously, can sometimes lead to surprising results; sometimes the degree of validity of an assumption changes without affecting the reported results; sometimes these assumptions are demonstrably incorrect.

Yield is used to provide a forecast of future returns and, like all forecasts, is subject to changes in the investment environment that may alter the underlying assumptions and hence alter the return on the investment that will have been realized at the end of the forecasting period. Greek two-year bonds have been recently quoted[1] at a yield of 28.23%, but it will be very hard to find any investor who seriously believes that this is the investment return that will have been realized two years hence; it is much more likely that some kind of reorganization/forebearance/selective default will have occurred by then[2] which will almost certainly act to reduce this projected figure, perhaps to negative levels.

In this essay, I will discuss yield, some of the ways it is measured in my analytical software, HIMIPref™ , and in the wider world of fixed income analysis and, with luck, convey to readers some intuitive feel for various yield measures to enable them to look at yield figures with a jaundiced eye, understanding the limitations of the reported number and the circumstances in which it is misleading.

Current Yield

Current Yield (CY) is the simplest method of expressing yield: it is simply the annual income rate divided by the price of the instrument. In the preferred share universe, it is also the most widely reported, but its flaws make it useless as a predictor of future returns.

There are two reasons for this wide use; the first is simply that preferred shares trade on stock exchanges and the technology used to deliver yield information is the same as is used for equities. For an equity, it is a reasonable default assumption that a dividend-paying company will continue to pay its dividend forever without having an effect on the stock's price; indeed, this is the fundamental assumption behind the Zero Growth Dividend Discount Model.[3]

This assumption is most certainly not the case for preferred shares. Some issues are contractually bound to return their par value (or as much as the company has left in its treasury!) on a specific date in the future. At the very least, all issues of which I am aware have a call provision, whereby the issuer can cancel its obligations to the shareholders by returning a specific amount of money at some specified time.

Thus, if an issue is trading above par, there is a risk that the company will redeem the shares at a lower price than the current trading price, handing the holder a capital loss. Naturally, the severity of this loss will be dependent upon the degree to which the current price is above par and the amount of time until the redemption becomes effective.

An additional problem with CY is that it does not take into account the timing of the dividend. All else being equal, it should be clear that it is better to hold an instrument on which the dividend is earned tomorrow rather than one in which the next dividend is earned three months hence – but the CY in the two cases will be the same. Mathematical expressions for determining the size of this error were derived in the June, 2010, edition of this newsletter.

An attempt is made to quantify the total effect of these adjustments by incorporating them into a more sophisticated model, Yield to Maturity.

Yield to Maturity

As noted above, Yield to Maturity (YTM) improves the approximation given by Current Yield by incorporating several elements not present in the expression for CY. These elements are:

- Amortization of the premium or discount from trade time to maturity date
- Specifying the length of time between the trade time and every cash flow that the instrument is presumed to provide
- Specifying a compounding period for which the YTM is quoted.

1 Paul Dobson, *Italian 10-Year Bond Yield Rises to 5%; Spanish, Greek 10-Year Debt Falls*, Bloomberg, 2011-6-27, available on-line at http://www.bloomberg.com/news/2011-06-27/italian-10-year-bond-yield-rises-to-5-spanish-and-greek-bonds-decline.html (accessed 2011-7-9)

2 Satyajit Das, *Bailing in to the Greek debt exchange plan*, Globe and Mail Blog 2011-7-7, available on-line at http://www.theglobeandmail.com/report-on-business/international-news/global-exchange/international-experts/bailing-in-to-the-greek-debt-exchange-plan/article2089862/ (accessed 2011-7-9)

3 See Ben McClure, *Digging Into the Dividend Discount Model*, Investopedia 2011-3-13, available on-line at http://www.investopedia.com/articles/fundamental/04/041404.asp#axzz1Rdpm2FNi (accessed 2011-7-9)

It is most convenient to perform the YTM calculation via an Internal Rate of Return calculation, as there is lots of software available for this. In such a calculation:

- The total cost of the instrument is listed, with the date (the Settlement Date) on which this amount must be paid (this will include the Accrued Interest payable on settlement, if the instrument is a bond. Preferred Shares do not trade with Accrued Interest, although the concept is useful when accounting for the proximity of the next ex-dividend date, as discussed in the June 2010 edition.)
- All cash flows expected from the bond are listed, together with the dates on which they are due. There will generally be two components to these cash flows: interim coupon payments and the return of capital on maturity.
- The time between each future cash flow and the Settlement Date is expressed in terms of years.
- The Present Value of each cash flow is then calculated for a trial rate of interest, the same rate for each cash flow.
- The trial rate is then adjusted until the Net Present Value of all cash flows (including the total cost) is zero. This value is then the Internal Rate of Return.
- The Internal Rate of Return is then adjusted to reflect the compounding period of the instrument.

The last specification, regarding the compounding period, is a relatively subtle point and often leads to eMails[4] ranging from the puzzled to the vitriolic. However, consider a one-year bond with a 10% coupon paid semi-annually, priced as a new issue at par. Since this is sold as a 10% bond, most new issue buyers would be very upset if they received a coupon of less than $5.00, but the $5.00 semi-annual coupon means that there is a compounding effect: the Internal Rate of Return is 1.05 * 1.05 – 1 = 10.25%.

Instead, yield calculations are thought of not as being calculated with Internal Rate of Return, as the fifth bullet above claims, but on a periodic return, as shown in Table 1.

Table A-1: Yield Calculation for a 1-Year, 10% Bond Priced at Par

Period	Cash Flow	Present Value (discounted at 5% per period)
0	-100	-100
1	5	4.7619
2	105	95.2381
Net Present Value		0.00

Thus, we find that the yield on the bond is 5% per period; by convention[5] we do not quote this as the compounded annual rate of return (which is 10.25%, as noted) but express this as an annual rate by multiplying the periodic return (5%) by the number of periods per year (2) to arrive at the quoted rate of 10%.

The reason for this has to do with ease of computation. Bonds, and the necessity of quoting their yields, have been around for a lot longer than pocket calculators!

Alert readers will have quickly realized other implications of this: a one year preferred share yielding 10% at par will (normally) pay 2.50 per quarter per $100 face value and therefore the Internal Rate of Return is (1.025)4 – 1 = 10.38%, which could result in an infuriating riddle: what yields more, a 10% bond or a 10% preferred share?

One problem with calculating YTM for preferred shares is the fact that most on-line yield calculators are designed for use with bonds and therefore automatically add Accrued Interest to the purchase price. Keith Betty published[6] an on-line calculator specifically for preferred shares which presents its results with quarterly compounding; I discussed the use of this calculator in a later article.[7]

There is one very important problem with YTM and that is that it requires that the computed yield to all cash flows be identical, or, as Dan Hallett has expressed it:[8] *The YTM formula assumes that all interest payments are fully reinvested (without cost) into the same bond at the YTM. This just isn't possible because yields and YTM levels aren't constant; and full reinvestment at no cost isn't possible.*

In a normal environment it is, of course, ludicrous to think that all discounting rates are identical regardless of their term: the coupon due in six months should be evaluated with a different yield than the last coupon, due in thirty years. The Bank of Canada publishes[9] estimates of these discounting rates, which must be extracted from prices of several bonds.[10]

4 For a very mild example, see http://www.prefblog.com/?p=1227. For a response to a condescending example (alas, the author did not respond to my request for permission to republish his efforts) see http://www.prefblog.com/?p=864

5 Investment Industry Association of Canada, *Canadian Conventions in Fixed Income Markets*, available on-line at http://www.iiac.ca/system/resources/267/original/canadian-conventions-in-fixed-income-markets-2007-01-01-2007.pdf?1302213592 (accessed 2011-7-9)

6 See http://www.telusplanet.net/public/kbetty/ytc.xls (accessed 2011-7-9)

7 See http://www.himivest.com/media/moneysaver_0607.pdf

8 Dan Hallett, *How rising rates may affect bond portfolios*, Globe & Mail, 2011-7-7, available on-line at http://www.theglobeandmail.com/globe-investor/investment-ideas/experts-podium/how-rising-rates-may-affect-bond-portfolios/article2089692/ (accessed 2011-7-9)

9 Bank of Canada, *Yield curves for zero-coupon bonds*, available on-line at http://www.bankofcanada.ca/rates/interest-rates/bond-yield-curves/ (accessed 2011-7-9)

10 David J. Bolder, Grahame Johnson, and Adam Metzler, *An Empirical Analysis of the Canadian Term Structure of Zero-Coupon Interest Rates*, Bank of Canada Working Paper 2004-48, December 2004, available on-line at http://www.bankofcanada.ca/wp-content/uploads/2010/02/wp04-48.pdf (accessed 2011-7-9)

Digression on Zero Coupon Curves

One may note that the Bank of Canada uses the function:

$$d(t) = \sum_{k=1}^{N} \zeta_k e^{-k\alpha t}.$$

HIMIPref™ uses the equation[11]

Y(t) = yieldCurveBaseRate
+yieldCurveShortTerm*exp(-t/yieldCurveDecayShort)
+yieldCurveLongTerm*exp(-t/yieldCurveDecayLong)

The HIMIPref™ implementation differs from the Bank of Canada implementation by:

- N is set equal to 3
- The BoC's constant α is replaced by α_k
- HIMIPref™ models yields, while the BoC models discounting factors. This was a deliberate design decision; modelling yields provides a more direct connection between the Portfolio Management way of thinking and the mathematics.

Of perhaps more interest to non-specialists is the implications of zero-coupon analysis on Strip Bond yields, which I discussed in an earlier article.[12] In a moderately upward sloping yield curve environment, it is possible to offer strips at yields which exceed the yields on bonds of the same term by about 25bp.

This is possible because comparing bonds with strips is an apples and oranges matter – a bond with a term of 10 years will have twenty coupons (and one principal repayment), each with a different term and, therefore, a potentially different yield. A thought experiment will assist understanding of the relationship between the yield curve (as derived from the YTM of normal bonds) and the zero-coupon curve.

We take a ten-year bond yielding 5% and strip it of its first coupon, which we sell at a yield of 1%. Since the yield of this first coupon is lower than the yield it was assigned in the valuation of the bond, it's price is higher. Hence, to maintain the price of the bond, each of its coupons must be priced lower and each of the corresponding yields must be higher.

As we repeat the process, stripping more bonds and selling them at the lower yields applicable to their shorter term, the yield on the coupons remaining in the bond will climb higher. In the article discussed, based on conditions at time of writing, this process eventually resulted in the principal portion of the bond being priced to yield about 25bp more than the original bond yield – while still providing a handsome profit for the stripping dealer.

A little more thought will lead to an understanding that the zero curve will always be steeper than the bond curve – which does not stop salesmen from calling their clients and excitedly informing them that the 'bond-coupon spread is higher than it has been in X years!', as if that means anything beyond 'the yield curve is steeper than it has been in X years.'

Yield to Worst (YTW)

A major problem with YTM with respect to preferred shares is, of course, the fact that most of them do not have a maturity date. Most issues are perpetual – remember that FixedResets are perpetual[13] – and therefore there will be a wide range scenarios according to which an issue could, possibly, mature.

A YTW analysis will look at all these scenarios and choose the scenario in which the issuer can force the lowest possible yield on the investor, barring default and, crucially, assuming that market conditions do not change.

Changing market conditions can affect the choice of YTW scenario, which will always be to the detriment of the investor – even if, for instance, the market goes up, the effect of a change in scenario will be that the issue he holds will go up by less than it would have had the issuer not been able to substitute the new scenario.

Many of these effects have been previously discussed in this newsletter. For example, a wide Issue Reset Spread on a bank FixedReset makes it seem overwhelmingly like that the issue will be called at the first opportunity – but if the spread that the bank would have to pay on a new issue should become greater than this amount, whether due to overall market conditions or credit problems at the bank, the issue is no longer likely to be called.

Similarly, PerpetualPremium preferred shares are generally likely to be called at par when this possibility becomes available to the issuers – but if overall market yields increase, or if there are credit problems, a call becomes much less likely.[14]

11 See http://www.prefshares.com/glossary.html#yieldCurve

12 *Yields of Bonds and Strips*, Canadian Moneysaver May 2009, available on-line at http://www.himivest.com/media/moneysaver_0905.pdf (accessed 2011-7-9)

13 See the *Taxonomy of Preferred Shares* at http://www.prefletter.com/taxonomy.pdf

14 See *Perpetual Hockey Sticks*, Canadian Moneysaver March/April 2007, on-line at http://www.himivest.com/media/moneysaver_0703.pdf

More insidious is the effect of a drop in the common shares on the effectiveness of a soft retraction option, in which the investor can exchange his preferred share holdings for common stock at a discounted price, which is generally assumed to cause the issuer to forestall the exchange with a redemption call. Most, if not all, such exchange options specify a minimum conversion price for the stock, generally $2 – if the market price of the common falls below this figure, the market value of common received on exchange may be much less than would otherwise be the case.

In short, although YTW is a powerful analytical tool, which has been shown[15] to be a far better predictor of future performance than CY, it has its limitations. Care should be taken when comparing YTWs of different issues to understand the assumptions underlying each calculation and the circumstances under which these assumptions may be no longer applicable.

Convexity

Convexity is a technical term from the bond world that describes how the duration of a bond[16] changes with the change in price. In the bond world, convexity works in favour of the investor: when yields rise, prices go down, but duration decreases – thus, while a further increase in yields will still hurt the investor, at least it will hurt less than the first increment.

However, in the presence of issuer options, convexity can be negative – and when the options are meaningful, convexity will almost certainly be negative.

Consider, for example, a Straight Perpetual trading above par shortly before a potential par call. Performing a standard YTW analysis – which assumes that market conditions will not change – might result in calculating a yield of 5% with a duration of 0.25 years, meaning, roughly, that one expects the issue to be called in three months, and that a 0.1% increase in market yields (to 5.1%) will result in a 0.025% decline in price (the duration multiplied by the presumed change in yield).

Should such an increase actually occur, the investor might well find that the issue is suddenly trading below par and a YTW calculation must assume that the issue will never be called and the duration has suddenly become about 19.6 (the Modified Duration of a perpetual annuity is the inverse of its yield[17]); the adverse effects of a further increase in yields haven't been slightly reduced, as would be the case with a bond, they've skyrocketed!

This illustrates the major problem with YTW as a tool for estimated the future total return of preferred shares: there are very strong edge effects. In a future edition of this newsletter I will discuss the various attempts I have made within HIMIPref™ to retain the power of YTW analysis while reducing the potential for large changes in calculated variables that may, in some cases, result from very minor changes in conditions; these analytical methodologies are termed Portfolio Yield, Cost Yield and Curve Yield.

15 See *A Call, too, Harms*, Advisors' Edge Report, June 2006, on-line at http://www.himivest.com/media/advisor_0606.pdf

16 See *Modified Duration*, Canadian Moneysaver, May 2007, on-line at http://www.himivest.com/media/moneysaver_0705.pdf

17 See http://www.prefblog.com/?p=2582