Part III - VALUING YOUR BOND POSITION

Welcome back to Banfield on Bonds. In the first issue, we discussed some of the various products available for constructing your fixed interest portfolio.

The second issue then looked at the basic premise surrounding fixed interest investing and the risks involved. In this issue – Part III we will cover the basics of valuing any fixed interest investment.

Hopefully you are now aware that money has an ability to generate a return (interest in the most basic sense). As we have also shown in Part II, this return is dependent on the level of risk and the time period of the investment.

The previous issue showed the level of return you could expect on one investment relative to another. In this issue we will arm you with a basic ability to price any fixed interest investment based on the expected return.

To value a fixed interest investment we first need to understand the concept of 'Time Value of Money'. Those familiar with the concept, may have also heard the terms 'Present Value' (PV) – the value now – and 'Future Value' (FV) – the value at a future point in time – both of which are a function of current market interest rates and time.

Most people would instinctively choose to receive $1000 today over $1000 at a certain point in the future. At the most basic level, this is because $1000 today has more value than $1000 tomorrow due to the interest that can be earned.

Let's look at this idea another way. If you decide to invest in a fixed interest instrument that will give you $1000 in *x* years, to calculate how much you should be willing to pay for this return we apply the 'Time Value of Money' concept.

Put simply we want to work out the dollar value we are willing to pay for a particular investment now, based on the current market interest rate.

To do this, we need to know how to apply the PV and FV concepts. The formulas that follow are the mathematical representation of these two concepts.

FV = PV*(1+r)^n or conversely
PV = FV/(1+r)^n
PV = Present Value
FV = Future Value
r = Discount Rate
n = Number of Periods

In other words, **the Present Value is simply the Future Value <u>less</u> the potential interest earned at a defined rate for the defined period.** Conversely, **the Future Value is the Present Value <u>plus</u> the potential interest earned at a defined rate for the defined period.**

Let's use this formula to work out how much we should be willing to pay today to receive our $1000 in one year's time, assuming the current one year market rate (which we will use as the discount rate) is 7%p.a.[1] This gives:

FV = $1000
r = 7%
n = 1.

Substituting our numbers into the PV formula:

PV = FV/(1+r)^n

PV = $1000/(1+0.07)^1
= 1000/(1.07)
= $934.58

This tells us that based on a market interest rate of 7%, and all other things remaining equal, $65.42 is the difference between receiving $1000 today and $1000 one year in the future. To some this may not seem like a very big deal. However, if you had the option of $1 million today or $1 million in one year's time (at the same market rates), the difference suddenly becomes more significant - $65,420.56 more significant. This shows why the concept of Time Value of Money should not be ignored.

Some readers may have realised that the above example is remarkably similar to an instrument mentioned in Part I of this series; **A Zero Coupon Bond**. In the market, this type of instrument is commonly referred to as a 'discount instrument'[2] and as discussed briefly in that issue, has no cash flows beyond the repayment of the principal upon maturity.[3]

The next step is to apply what we have covered so far to an investment that pays interest throughout its life, - described as a **'Vanilla Bond'** in Part I. To achieve this we simply apply the same PV formula to each of the individual cash flows and face value.[4]

"the value of any fixed interest investment is the present value of all future cash flows"

First though, let's ensure everyone is familiar with how **interest rates**, **yield** and **coupon** fit together. As mentioned in the previous newsletter, the **coupon rate** is the annual interest rate applied to a bond's face value.[3] The coupon rate is generally set upon issue of the instrument and will reflect the current market **interest rate** for that investment at the time it is set.

Yield, or yield-to-maturity as it is sometimes known, is the return the investment will generate over its life. For example, an instrument issued with a coupon of 8%, issued at par[5] and held to maturity will generate a yield of 8%. On the other hand, by discounting all the future cash flows at 8%, the PV will be equal to par.

Let's continue the valuation of our 'Vanilla Bond'. Perhaps the easiest way to show the process is via *fig. 1*. In our example we assume a four year investment term, a coupon rate of 8%p.a. and a current four year interest rate of 8%p.a. and a face value of $1000.[6]

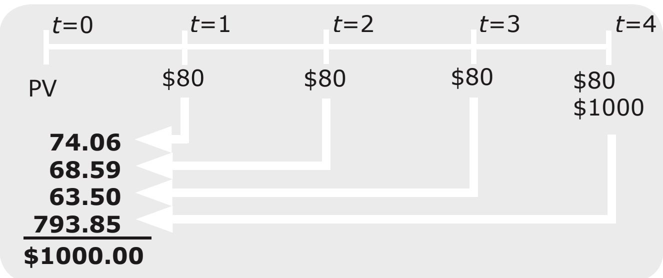

fig 1. Graphic depiction of a bond valuation

Fig. 1 shows the bond broken down into principal (the $1000 face value of the investment) and coupon (the $80 periodic cash flows).

The discount formula (PV= FV/(1+r)^n) is then applied to each individual cash flow to give a value today. The sum of all the individual discounted cash flows gives the value of this investment today, that is $1000.

Try it for yourself to see if you can get the same result. This example reinforces the concept that the value of any fixed interest investment is the present value of all future cash flows it is expected to provide over the relevant time period.

What we have covered so far really starts to become useful when market interest rates move. What if market interest rates had increased? As an investor, let's say an equivalent investment would now produce 9%p.a. It now wouldn't make good financial sense to invest $1000 in the investment depicted above at 8%p.a. (refer to the risk reward frontier discussed in Part II).

As an investor, the only reason you would invest in the investment depicted in *fig. 1* is if at the end of the investment period, it yielded 9%p.a. By using 9% as the discount rate in our calculation above, we are able to create a new value for that bond today of $967.60 in this instance (shown below in *fig. 2*) - try it out yourself.

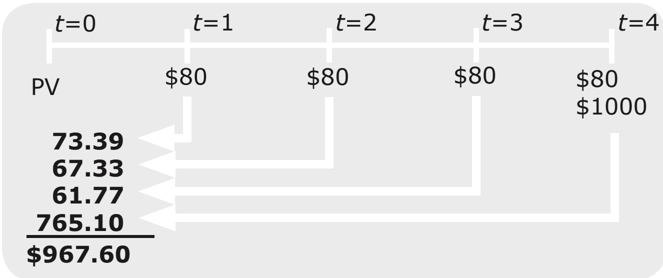

fig 2. Graphic depiction of a bond valuation

As you work through this example, it will become clear that as the discount rate (yield) increases, the value of the bond today decreases and as the discount rate (yield) decreases, the price increases. This inverse relationship between price and yield is one of the most commonly misunderstood concepts in fixed interest investing.

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We have shown so far how the price can fluctuate over the life of a fixed interest investment depending on the current market yield. Because all the instruments discussed in the previous articles are traded on the secondary market, as an investor, this allows you to capitalise on any of these fluctuations in price.

This ability to be traded easily prior to maturity in the secondary market is what separates these sorts of instruments from that of term deposits or debentures. Importantly though, in the same manner that profits can be realised, so too can losses.

However, if held to maturity the investment will return the purchase yield regardless of how the capital price has behaved over its life. (Provided the issuer encounters no financial difficulty.)

An area of the valuation that we have not had to address because of the assumption that the valuation is taking place at the beginning of the coupon period[7] in our worked example is that of accrued interest.

In the majority of interest bearing investments, interest will accrue on a daily basis. This means that even though the interest may be paid quarterly or semi-annually, the price of the bond at any point should reflect the current amount of accrued interest.

"Swap rates are the various rates at which banks or, other large institutions, are willing to swap a fixed rate obligation for a floating rate obligation for a given maturity."

So, if you held an investment then sold one day prior to the coupon payment date, the price you received would include the interest accrued for the period you held the investment.

For those who are mathematically minded, I have included in Appendix 1 a copy of the official bond formula. See if you can apply it to the worked example.

Although we have discussed how the valuation of a fixed interest security relies on the current market yield or rate for that investment, we have not discussed where this rate comes from. This brings us to the topic of the **NZ Swap Curve.**

The swap market and swap curve construction has been the topic of many publications and we could easily spend all four issues on this alone. However, for the most part, it is enough to know what the swap market is and its role in fixed interest valuations.

Swap rates are the various rates at which banks or, other large institutions, are willing to swap a fixed rate obligation for a floating rate obligation for a given maturity.

This is a supply and demand driven market and has lately, become the benchmark for the pricing of the majority of fixed interest investments with a maturity of between one and five years. It is the most efficient and liquid indicator of current market interest rates.

By plotting the various swap rates against the various maturities, we can see a curve taking shape as seen in *Fig 3.*

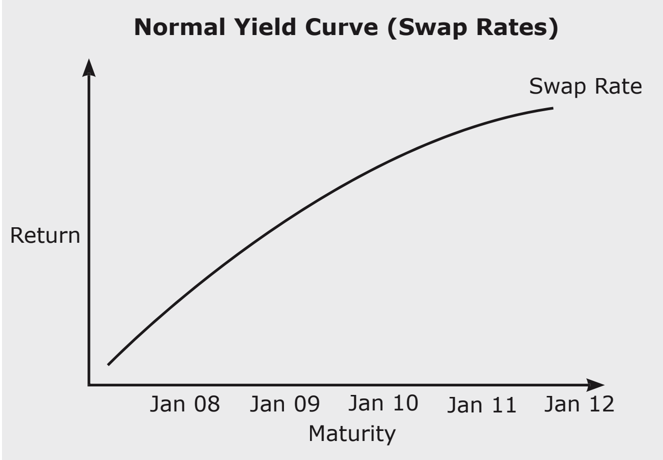

fig 3. Normal Yield Curve (Swap Rates)

Because swap rates are such a good reflection of the current market rate or yield for a particular maturity, we can use these rates to value the cash flows of our current investment.

If you had a bond maturing in January 2010, paying an 8%p.a. coupon, a face value of $1000 and the current 2010 market swap rate was 7%, you would discount those $80 (8%*1000) coupons and the FV at 7% to give you the PV of the bond.

Some of you may be thinking back to my earlier comment about finding a market rate for the equivalent investment and you might be thinking "how can one 'swap curve' be used as the market proxy for all these bonds issued by various issuers with different ratings?"

"Common practice is for a margin or spread to be added to or subtracted from this swap rate."

The short answer is it can't. Common practice is for a margin or spread to be added to or subtracted from this swap rate. This margin or spread, commonly referred to as the **"spread to swap" will depend on a number of factors including the credit risk of the investment relative to that of the swap market.** In other words, because swap rates are effectively determined by the major banks, we can assume these rates carry the same AA- rating[8] as the banks determining them.

For any issuer of debt with a lower rating than AA-, we would expect a higher yield and so would add a margin to the swap rate for valuation purposes.

As one would expect, we would subtract a margin from the swap rate for any issuer with a higher credit rating than AA-.

Below fig. 4 shows the relationship of these various curves and the 'spread to swap' we have mentioned.

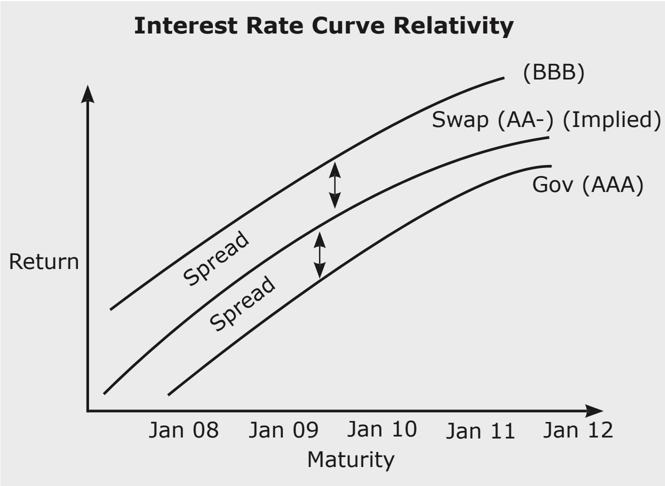

fig 4. Interest Rate Curve Relativity

The margins over and under the swap curve reflect both the credit worthiness of the issuer and liquidity.

The spread to swap for a particular issuer or issue may not stay constant over its life. It may narrow and widen as different market forces come into play.

These forces could be acting on the general market (macro) or specific to the individual issuer (micro).

Hopefully you now understand the basic process of valuing a fixed interest investment by applying the 'Time Value of Money' concept. You should also be able to approximate the market interest rate for a particular investment. Although we have kept things to a reasonably simple level, the principles remain the same. If you understand these principles, you should be able to apply them to any investment.

A note to make about valuing any investment is that a theoretical value could be placed on anything. However, it is still reliant on someone willing to pay or receive that value. This idea of liquidity is often overlooked when analysing an investment. If there are no buyers or sellers in the market, in the short term it may not matter what the theoretical yield or price is - you are at the mercy of market forces.

Coming up in the next and final issue, we will put everything we have covered together and show you the basics of constructing a portfolio of fixed interest investments and how to optimise your portfolio performance based on your view of the future of interest rates.

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[1] This example assumes interest is paid at the end of the investment period.
[2] Referred to as a discount instrument as the purchase price will always be at a discount to face value due to the zero coupon structure.
[3] The repayment of principal on maturity will occur provided no financial distress is encountered by the issuer.
[4] Face Value is defined as The nominal value or dollar value of a security stated by the issuer. It is the amount paid to the holder at maturity (generally $1,000). Also known as 'par value' or simply 'par'.
[5] Issued at 'par' indicates the price being equal to the face value. In other words the yield is equal to the coupon rate.
[6] The payment of annual rather than semi-annual bond interest is assumed throughout the following discussion. This assumption simplifies the calculations involved while maintaining the conceptual accuracy of the valuation procedures presented. Cash flows occur at the end of each period. This example also ignores any tax implications for simplicity.
The bond value in this example is assumed to be calculated at the beginning of the interest period thereby avoiding the need to consider accrued interest.
[7] The bond value in this example is assumed to be calculated at the beginning of the interest period thereby avoiding the need to consider accrued interest.
[8] Throughout this article, any reference to a rating refers to a rating by Standard & Poors rating agency.

Appendix 1

Official Bond Formula:
The settlement price per N dollars of Principal shall be calculated on the basis of the following formula:

SETTLEMENT PRICE PER $N PRINCIPAL =

$$\left\{ \frac{\dfrac{1}{(1+i)^n} + r\left[c + \dfrac{1 - \dfrac{1}{(1+i)^n}}{i}\right]}{(1+i)^{\frac{a}{b}}} \right\} N$$

Where	**N** =	the principal of the bond ($)
	r =	the annual Coupon Interest Rate divided by two hundred, i.e.: the semi-annual Coupon Interest Rate (%)
	i =	the Yield divided by two hundred, i.e.: the semi-annual yield (%)
	c =	where the Settlement Date is after the Record date and up to, but not including, the next Coupon Interest Payment date “c” has a value of 0, otherwise “c” has a value of 1
	n =	the number of full half years between the next Coupon Interest Payment Date and the Maturity Date
	a =	the number of days from the Settlement Date to the next Coupon Interest Payment Date
	b =	the number of days in the half year ending on the next Coupon Interest Payment Date

Provided by the New Zealand Debt Management Office - www.nzdmo.govt.nz