Innealta CAPITAL

COMMENTARY: AUGUST 1, 2012

MEASURING INTEREST RATE RISK

- Perhaps even more than the 'ons' and 'offs' of the equity markets, the fixed income components of our portfolios remain of great interest to folks with whom we meet to discuss our strategies. That interest in mind, we thought it worth reviewing our approach to managing the various risks associated with the overall fixed income allocations.
- Much of what we'll review today (and likely in a few subsequent commentaries as well) is sourced from the past work of several members of our investment committee. Individually, Drs. Buetow, Hanke and Henderson might be considered experts in fixed income portfolio and risk management. Not only have they published widely in this field, they maintain collective experience as fixed income portfolio management practitioners that is measured in decades. This knowledge is the foundation of our approach.
- This commentary is part of an eventual series of missives we'll offer in response to the often requested, "what will we do in a rising interest rate environment?", which we can relate to the second-most-asked question: "What will you do if (variously: 'raging', 'rampant', 'onerous'...) inflation takes hold?"
- Readers should understand that the portfolio is managed for duration and yield. And know, too, that our options in the fixed income space are expanding such that a U.S.-only view is no longer so relevant. Gist is that the U.S.-view isn't the only one we'll have once rates start rising. Much of the world markets, we imagine, will be available to us—many already are—presenting many sorts of structure/duration/trend scenarios. It may matter much less, then, what rates are doing in the U.S.
- As we monitor the changing structure of global fixed income markets, we carefully, very regularly (daily) consider existing and substitute allocations for our fixed income portfolio. The list of potential exposures continues to expand, as do our efforts to compare and critique these exposures within the context of our investment framework. As always, we'll remain every bit as vigilant at managing the fixed income exposures as we are on the equity side.
- Core to the review of fixed income exposures is gauging the potential and consequence of various interest rate shifts here in the U.S. and abroad. While we must take some risk in order to implement our views on future interest rates, we must be sure that we are taking risks very selectively and that, where possible, we minimize or hedge any unrewarded risks. With this commentary, we would like to illustrate how we estimate the risk of a changing term structure on the value of our portfolios.

MEASURING INTEREST RATE RISK

Perhaps even more than the 'ons' and 'offs' of the equity markets, the fixed income components of our portfolios remain of great interest to folks with whom we meet to discuss our strategies. No wonder, given the breadth of the exposures in most of our portfolios, the Rotation strategies in particular. That interest in mind, we thought it worth reviewing our approach to managing the various risks associated with the overall fixed income allocations.

Much of what we'll review today (and likely in a few subsequent commentaries as well) is sourced from the past work of several members of our investment committee. Individually, Drs. Buetow, Hanke and Henderson might be considered experts in fixed income portfolio and risk management. Not only have they published widely in this field[1], they maintain collective experience as fixed income portfolio management practitioners that is measured in decades. This knowledge is the foundation of our approach.

For our fixed income portfolio allocation, the most significant source of bond price risk is the risk of changes in the *term structure of interest rates*. Put simply, the term structure of interest rates is the pattern of current interest rates at various points along the maturity spectrum. Any potential shifts both of and along this curve represent the primary risk to the fixed income portfolios we manage.

WHY READERS SHOULD CARE

When launching into a dense review such as the one to follow, an author does himself fine service by confirming in advance for readers why they should care to proceed with the effort. In this particular case, we're responding to the often requested, "what will we do in a rising interest rate environment?", which we can relate to the second-most-asked question: "What will you do if (variously: 'raging', 'rampant', 'onerous'...) inflation takes hold?" The questions are similar not because they might occur at the same time (they could, and likely would, though), but because the response is similar.

The quick answer to each is that we'll cross that bridge when we come to it. "Trust us" rarely actually engenders trust, however. So, we'll add that those bridges are nowhere in our sights, and, meantime, we like to think that we've got the binoculars to see what's ahead far enough in advance. And, just as importantly, the portfolios—which make asset allocation decisions at the asset-class level via ETFs, instead of via individual securities—by design can swiftly alter exposures in order to deal with or even take advantage of any such scenarios as they arise.

Readers should understand that the portfolio is managed for duration and yield. And know, too, that our options in the fixed income space are expanding such that a U.S.-only view is no longer so relevant. Gist is that the U.S.-view isn't the only one we'll have once rates start rising. Much of the world markets, we imagine, will be available to us—many already are—presenting many sorts of structure/duration/trend scenarios. It may matter much less, then, what rates are doing in the U.S.

Note that the duration coming from abroad can be derivative of a wholly different term structure (e.g. the emerging market debt), in which case the impending structure shifts could be entirely different, presenting various opportunities. Further, on the home front, spreads on various non-Treasury fixed income sectors might be such that we may still be able to find commensurate reward from those allocations all along the duration and risk spectra.

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[1] Please see the list of references at the end of this commentary for a selection of past work.

A scenario could come to pass…highly suppositional here…that we could see some regions where we now have light exposures raising rates earlier upon some sort of recovery. Once those trends have more or less stabilized, we might actually swap/add some duration to the portfolio—likely in return for the yield pickup—in non-U.S.-specific exposures.

Most importantly, readers should understand that we are looking beyond the U.S. market for our fixed income exposures and that we continue to express great desires to the ETF providers that we'll want broader and more granular regional exposures at some point in the not-so-distant future in no small part to be able to manage around any deleterious shifts in the U.S.

As we monitor the changing structure of global fixed income markets, we carefully, very regularly (daily) consider existing and substitute allocations for our fixed income portfolio. The list of potential exposures continues to expand, as do our efforts to compare and critique these exposures within the context of our investment framework. As always, we'll remain every bit as vigilant at managing the fixed income exposures as we are on the equity side.

Core to the review of fixed income exposures is gauging the potential and consequence of various interest rate shifts here in the U.S. and abroad. While we must take some risk in order to implement our views on future interest rates, we must be sure that we are taking risks very selectively and that, where possible, we minimize or hedge any unrewarded risks. With this commentary, we would like to illustrate how we estimate the risk of a changing term structure on the value of our portfolios.

Sure, it's a more academic commentary. But, as we noted above, since "Trust us" rarely actually gains trust, we believe commentaries like these serve to burnish our credentials as a manager of multi-asset-class portfolios, and can bolster the confidence in our work of those who have entrusted us with their monies.

FIXED INCOME RISK METRICS

Various risk metrics have been used by fixed income professionals to measure portfolio risk. Not all such measures are suitable for our purposes. The main two approaches to interest rate risk measurement are the *full valuation approach* and the *standard modified duration/convexity approach*. Widely used metrics such as effective duration, effective convexity and key rate durations are special cases of the full valuation approach, which will be the focus of subsequent sections.

The most obvious way to measure the interest rate risk exposure of a bond position or a portfolio of bonds is to revalue it under scenarios that involve changes in interest rates. At Innealta we make extensive use of scenario analysis to examine the impact of various economic environments on our fixed income allocations. One such review might involve an expected increase in the rate of inflation that causes the Federal Reserve to raise interest rates in response. To be properly prepared for this scenario, we should like to model the price/value impact of an increase of, say, 25 basis points (a quarter of a percent) on our fixed income allocation. A broad increase in interest rates could result in a decrease in the value of some of our fixed income holdings. The question is: by how much?

There are various ways to answer this question. The approaches differ in both the complexity of the analyses and the dependability and applicability of its results. We'll discuss two approaches this month: *Modified Duration/Convexity* and *Full Valuation*. What the former offers in simplicity, the latter achieves in applicability. Both are put to use in our work, depending on the nature of the question.

Modified Duration/Convexity Approach

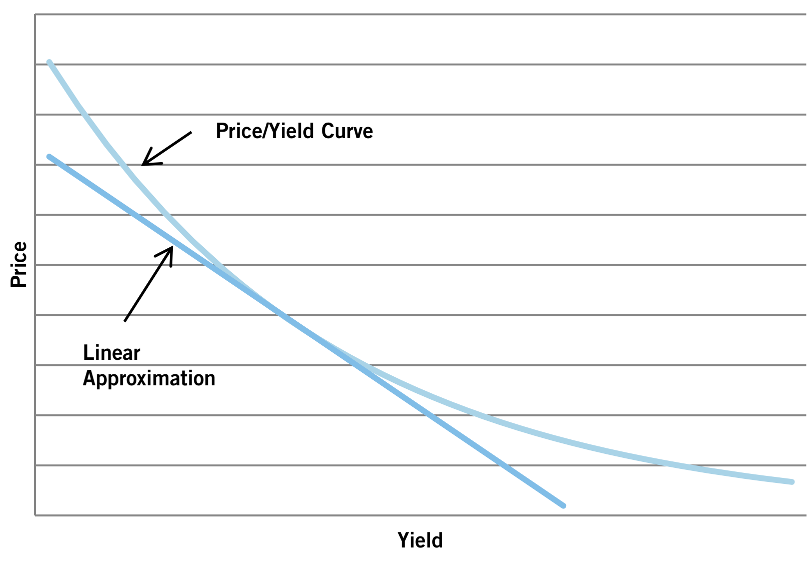
First up, the modified duration/convexity approach. *Modified duration* (MD) is a measure of the approximate sensitivity of a bond's value to changes in its yield to maturity. More specifically, it is the approximate percentage change in value when yields change by a very small amount. Modified duration can be computed as follows using an analytic formula:

$$MD = \frac{1}{1+y}\sum_{i=1}^{n}\frac{t_i}{P}\frac{CF_i}{(1+y)^{t_i}} = -\frac{1}{P}\frac{\Delta P}{\Delta y}$$

where y is the yield to maturity of the bond, t_i is the time (in years) from now, CF_i is the cash flow received at a given time (the coupon before maturity and the coupon plus the bond principal at maturity), P is the bond value and n is the number of coupon payments. Intuitively, modified duration measures the change in the bond value for a very small change in the yield to maturity of the bond relative to the bond's current value. Modified duration is expressed as a positive quantity; since the bond value moves in the opposite direction of the change in the yield to maturity, the expression must be sign-flipped.[2]

We'll see below that duration is the first approximation of the percentage price change to changes in the yield-to-maturity. To improve the estimate provided by duration, we can utilize a measure called *convexity*. The relationship between interest rate changes and bond price changes is not linear, but is curved, as we show in Exhibit 1. Convexity measures the curvature in this relationship. Hence, we can combine duration with convexity to estimate the percentage price change of a bond to changes in yields; this is the basis of the modified duration/convexity approach.

Exhibit 1: Bond Price/Yield Relationship



SOURCE: Innealta Capital

In general, *effective duration* can be computed using any sensible parallel shift in the term structure of interest rates (meaning each point in the term structure changes by the same absolute amount) that the user specifies. To compute the effective duration, the term structure is shifted up by a certain amount, say 100 basis points, and down by the same amount. The duration is then computed as a price elasticity, which is the difference

[2] Modified convexity can be expressed similarly. A note for the mathematically inclined, modified duration and modified convexity are the first two moments of a Taylor series expansion.

between the bond price under the low rate environment and the high rate environment, divided by the total amount of the term structure shift multiplied by the starting bond value (under the original term structure of interest rates). Readers should note that, as opposed to modified duration, to compute the effective duration, we shift the entire term structure of interest rates in a parallel manner, rather than shifting the yield to maturity.

Full Valuation Approach

Importantly, while modified duration and modified convexity can be computed using an analytic formula, they can only be used for option-free or so-called ‘straight’ bonds. They cannot be used to value bonds containing what are known as *embedded options*. The most common embedded option is a call option which gives the bond issuer the right to redeem a bond before its maturity at a certain call price that is specified in the bond prospectus. As opposed to Treasury bonds, corporate bonds are often callable by the issuer before maturity. Other bonds might be putable, meaning they contain an embedded put option that gives the bond holder the right to force the issuer to redeem the bond prior to its maturity at a predetermined put price. Mortgage-backed securities (MBS) and credit default swaps (CDS) have embedded options as well.

The valuation of bonds with embedded options requires the use of an interest rate model, as a single formula cannot capture the different impacts various shifts in interest rates might have on the value of such a bond. Interest rate models are components of a more intensive approach to measure interest rate risk: the full valuation approach of effective duration/convexity.

The interest rate model required for the valuation of bonds with embedded options is a probabilistic description of how interest rates can change over the life of a bond, making certain assumptions about interest rate behavior. So-called *binomial interest rate trees*, commonly used for this purpose, model the evolution of short-term rates over time. Given a starting interest rate (the short-term rate currently observed in the market), as well as an interest rate volatility estimate, the binomial model breaks up the time to maturity of a bond into shorter time intervals (such as one year or one-half year). The process thus allows the practitioner to model interest rate behavior over the life of a bond. Term structure modeling will be the topic of a future commentary, but Exhibit 2 is an example of such an interest rate tree based on a term structure model:[3]

Exhibit 2: Interest Rate Tree Based on a Term Structure Model

			2.70%
		1.82%	
	1.08%		1.93%
0.50%		1.26%	
	0.72%		1.38%
		0.87%	
			0.99%
Time in Years	1	2	3

SOURCE: Innealta

If the steps are annual, this interest rate tree could be used to value a bond with a 4-year maturity and annual coupon payments. Here the current one-year spot rate is 0.5% and according to the interest rate model used to construct the tree in this example, the one-year rate could either increase to 1.08% or to 0.72% over the next year (both these rates are one-year forward rates starting one year from now), and so on. Again, the values in the tree are based on the current term structure of interest rates as well as estimated interest rate volatility.

[3] We use the Black-Derman-Toy (BDT) term structure model to generate the interest rate tree. We will discuss term structure models in more detail in a future commentary.

Once one generates an interest rate tree, the next step is to construct a bond price tree using the interest rate tree. One constructs a bond price tree by successively discounting the bond's par value (usually $100) and coupon payments using the rates from the interest rate tree and allowing for any potential embedded options. Exhibit 3 is an example of a bond price tree. It is based on the above interest rate tree (Exhibit 2) and is for an option-free bond with four years remaining to maturity and a 1% coupon rate.

Exhibit 3: Bond Price Tree

				$100.00
			$98.34	
		$97.93		$100.00
	$98.46		$99.08	
$99.63		$99.10		$100.00
	$99.80		$99.62	
		$99.94		$100.00
			$100.01	
				$100.00
Time in Years	1	2	3	4

SOURCE: Innealta

As described above, to estimate the bond price sensitivity to interest rate changes under the full valuation approach, the term structure of interest rates is shifted by a certain amount and bonds are subsequently revalued under these different scenarios to come up with an effective duration estimate. Hence, effective duration can be computed as follows:

$$\text{effective duration} = \frac{V^- - V^+}{2V^0 \Delta ts}$$

where V^+= bond value if the term structure is increased by Δts
V^-= bond value if the term structure is decreased by Δts
V^0= original bond value
Δts = term structure shift

As a result, computing the effective duration of a bond requires the following steps:

1. Using an interest rate model based on a term structure of interest rates obtained from government securities, one obtains the estimated bond value. Then one compares the estimated bond value to its market price and determines the spread that must be added to each spot rate in the interest rate tree so that the estimated bond value equals its market price (V^0).
2. In turn, one shifts the term structure up and down by the desired amount (e.g. 50 basis points) and uses the resulting shifted term structure to reconstruct a binomial interest rate tree, which then is used to revalue the bond under each scenario to obtain V^+ and V^-.

As mentioned above, the bond has to be revalued for each term structure shift. The moniker, "full valuation approach," reflects the fact that there is no shortcut to this requirement.

Ease-of-use, versus Breadth of Applicability

As one can see, modified duration can be computed using an analytic formula only, as opposed to the need to value the bond multiple times, as is the case under the full valuation approach. Thus, the multi-step requirements may appear to be a disadvantage of the full valuation approach. However, in practice this approach turns out to be more flexible than modified duration, as it can be applied to many different types of fixed income securities: option-free bonds, callable bonds, putable bonds, different types of mortgage structures, etc. In contrast, modified duration cannot be used for security types with cash flows that change depending on the level of interest rates.

For example, consider a callable bond with a 3% coupon and a call price of $101. The issuer of the bond has an incentive to redeem or call the bond if interest rates decrease enough so that the bond price increases above its call price (the $101). Under this scenario the bond issuer will benefit from refinancing at a lower interest rate. Once the existing bond is called, its owner will obviously not receive any further coupon payments.

Therefore, we can describe a callable bond from the investor's point of view as:

$$\text{Callable bond} = \text{non-callable bond} - \text{call option value}$$

Hence, the bond's cash flows and the timing of its cash flows depend on the level of future interest rates and the probability of different interest rate scenarios which is driven by volatility assumptions.

While modified duration is very similar to effective duration for option-free bonds (especially if they have a relatively short maturity), modified duration cannot deal with options and would therefore give unreasonable values if applied to bonds with embedded options.

To see this, let's take a look at the following example:

Bond Coupon	$3.00
Bond Maturity (in years)	10
Call Price	$101.00
Callability Start (years from now)	3

The last input means that the embedded call option starts three years from now. That is, the issuer won't be able to call/redeem the bond within the next three years.

Let's assume interest rates and their associated volatilities are as follows:

Maturity	Spot Rates	Volatilities
1	0.50%	20%
2	0.70%	19%
3	0.90%	18%
4	1.10%	17%
5	1.30%	16%
6	1.50%	15%
7	1.70%	14%
8	1.90%	13%
9	2.10%	12%
10	2.30%	

Note that the option-free bond value will not be affected by the interest rate volatilities, only the callable bond. Its embedded call option is going to be more valuable to the bond issuer (as opposed to the bondholder) the more volatile interest rates are because more volatile interest rates increase the chance that the call option has a positive payoff for the bond issuer. As a result, the callable bond value will be lower. In other words, what is good for the bond issuer is bad for bondholders who are on the other side.

Using the inputs above, the following effective duration/convexity values result:

		Down	Up	Total	Modified Duration
Effective Duration (ED)	Option-Free	8.70	8.52	8.61	8.56
	Callable	6.91	7.90	7.40	
Effective Convexity	Option-Free			44.22	
	Callable			-248.54	

For now, let's just compare the last two values in the first numerical row. The effective duration for the option-free bond is 8.61, while its modified duration is 8.56, a relatively small difference, which simply comes from the fact that modified duration assumes a very small change in a bond's yield to maturity and effective duration was computed using a 20 basis point parallel up and down shift in the term structure of interest rates.

As one can see from the last value in the second numerical row above, the effective duration of the callable bond is smaller, at 7.40. This is because the issuer will have an incentive to call the bond (and refinance his liabilities at lower rates) once interest rates have decreased sufficiently to push the price of the bond above the call price of $101. Further decreases in interest rates will not affect the bond price any more, since it will have been called and redeemed by that time. As a result, the callable bond's effective duration or interest rate sensitivity is lower. In general, the higher the coupon and the lower interest rates are, the higher the likelihood that the callable bond is called and redeemed by the issuer. This, again, is due to the fact that the issuer has an incentive to refinance at a more attractive rate. This call is not desirable for the bond holder since they are forced to reinvest the call proceeds at the lower prevailing rates.

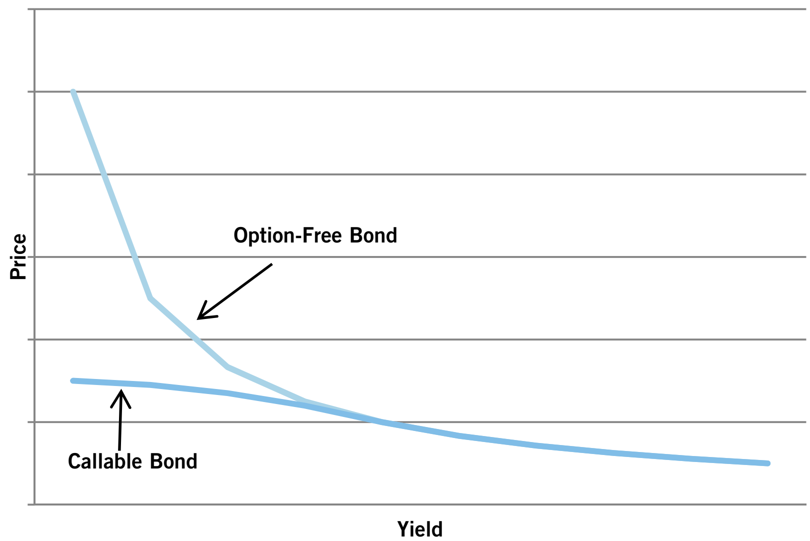
Taking the callability into account is crucial for our corporate bond allocation as corporate bonds are often callable. This means that these bonds' interest rate sensitivity is lower than for otherwise equivalent option-free bonds. Hence we need to adjust our portfolios accordingly if we have a particular effective portfolio duration target which may or may not be based on our fixed income benchmark's effective duration.

Accounting for embedded options is also of critical importance should we extend the portfolios to include mortgage backed securities (MBS). Embedded option features influence the values of MBS heavily. To explain, should interest rates decline, homeowners have strong incentive to refinance their mortgages at more favorable rates, resulting in prepayments which act as "calls," resulting in early retirement of the bonds. Thus, MBS exhibit negative convexity in many cases, truncating the usual large price gains bond investors enjoy when interest rates fall to low levels.

The first two numerical columns in the above results labeled "Down" and "Up" show the down and up effective durations or elasticities. The down-elasticity is computed as the difference between the bond price when the yield curve is shifted down (and the bond price goes up) and the original bond price divided by the original bond price times the rate difference. The same is true for the down elasticity.

As you can see the down and up elasticities are different. Why is that the case? The reason is *convexity*. As expressed earlier in Exhibit 1, convexity arises as the relationship between interest rates and bond prices is not linear. Convexity measures the curvature of this relationship. Exhibit 4 shows the bond/yield relationship for an option-free bond and a callable bond.

Exhibit 4: Bond Price/Yield Relationship (Option-Free and Callable Bonds)



SOURCE: Innealta

As Exhibit 4 and our earlier calculated example illustrate, option-free bonds tend to increase more in price for a given interest rate decrease than they fall for the equivalent interest rate increase. This results from positive convexity, which is a desirable property for investors. For interest rate increases and decreases of the same amount, say 50 basis points, investors lose less from the rate increase than they gain from the same rate decrease. This is reflected in the down-elasticity (8.70) being larger than the up-elasticity (8.52), a convexity of 44.22 that is shown in the third numerical row.

The value of convexity comes into play if the term structure of interest rates is not constant, but changes over time in level and shape. The higher the interest rate volatility, the higher the value of (positive) convexity will be for an option-free bond. An investor with a long position in an option-free bond always benefits from positive convexity. If a bond has positive convexity, then the bond price will increase more if interest rates decrease and it will decrease less if interest rates increase than for a theoretical bond with zero convexity.

The opposite can be true for callable bonds. As you will remember from above, callable bonds will be called if interest rates decrease below a level that causes the bond value to exceed the call price. Therefore, if interest rates decrease, the callable bond price will not increase as much as the option-free bond price as it is bounded above by the call price ($101 in our example), resulting in a lower down-elasticity. This feature can be seen in Exhibit 4: the down-elasticity (6.91) of the callable bond is lower than for the option-free bond and it is smaller than the callable bond's up elasticity of 7.90. Hence the effective convexity of the callable bond is negative (in this case, -248.54).

In general, the full valuation approach can generate an *elasticity* for any projected yield curve shift. Effective duration and effective convexity are just special cases of elasticities that can be obtained using the full valuation approach. Both are obtained by projecting parallel shifts to the yield curve. Again, effective duration measures the relative bond price change for a parallel term structure shift and effective convexity measures the curvature in the price/yield relationship, i.e. it measures how much the effective duration changes between an up-shift and a down-shift in the term structure.

The important take-away of this analysis is that *effective* measures (which are computed using the full valuation approach) account for changing cash flows to the bondholder as a result of changing interest rates and modified measures (modified duration and modified convexity) do not. The differences between the two approaches are very significant whenever a bond has embedded options and its cash flows can therefore be greatly affected by the level of interest rates. However, to properly compute the effective measures both an interest rate model and a valuation model are required as illustrated above. Consequently they are more computationally intensive than the traditional measures.

Effective Duration in our Work

At Innealta we incorporate effective duration into our analyses for various investment strategies. For example, if we have a view on the shape of the yield curve but not its level, we may take a bond position that matches the effective duration of our fixed income benchmark (the Barclays Aggregate), but that offers a maturity structure different from that of the benchmark. As a result, if the level of interest rates changed (e.g. the same change at each point of the yield curve), our bond position would change approximately in line with the benchmark as the effective durations are matched. If the shape of the yield curve changed, however, then the return on our portfolio would differ from the benchmark return.

KEY RATE DURATIONS

As we discussed above, effective duration is a bond's price sensitivity to parallel shifts in the term structure. Although rate changes across different points of the term structure tend to be highly positively correlated, they will generally not all be the same. Hence, the term structure is unlikely to shift exactly in a parallel manner.

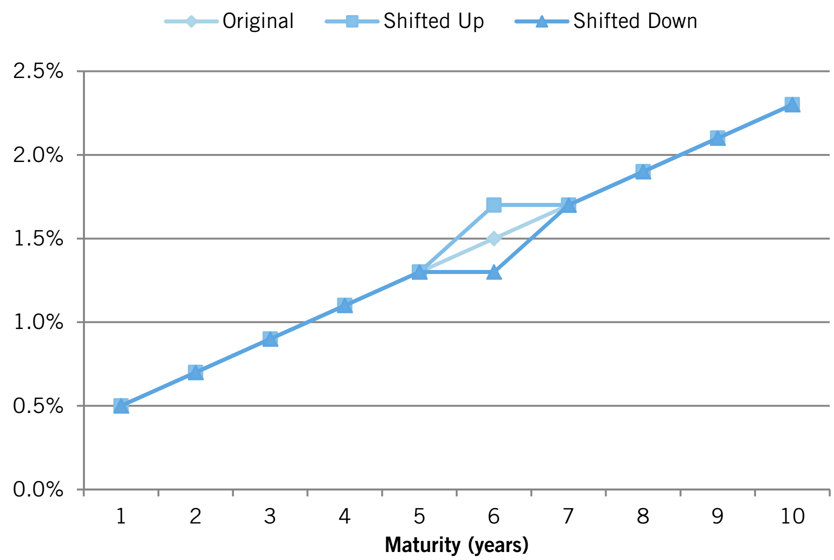
In a bond portfolio, a particular portfolio duration can be achieved using various sensitivities to the short, medium and long end of the term structure. To effectively manage a portfolio's interest rate risk, we need to be able to measure the portfolio's sensitivity to non-parallel shifts in the term structure. This is usually done using *key rate durations* (KRD).

KRDs measure a bond's (or a portfolio's) price sensitivity to an interest rate shift at one particular point on the term structure examined in isolation. A KRD is computed by shifting a specified key spot rate by a certain amount (for example, 50 basis points) while leaving all other spot rates unchanged. Hence the steps to compute a KRD are exactly the same as for effective duration, the only difference being that the term structure is not shifted in a parallel manner. As KRDs are computed by revaluing bonds under different interest rate scenarios they are special cases of the full valuation approach as well.

Though only one key rate is shifted at a time to compute a KRD, it can easily be shown that the sum of these "partial" durations must equal a bond's effective duration. As a result, KRDs decompose a bond's effective duration into its component parts thereby providing the portfolio manager a more detailed picture of portfolio interest rate sensitivity to non-parallel term structure shifts.

Let's look at a KRD example to gain some intuition. We will shift the six-year spot rate up and down by 20 basis points and leave the remaining spot rates unchanged. Exhibit 5 shows the rate shift that we have specified:

Exhibit 5: Spot Rate Term Structure



SOURCE: Innealta Capital

The KRD results are as follows:

		Down	Up	Total
Key Rate Duration (KRD)	Option-Free	0.15	0.15	0.15
	Callable	0.14	0.26	0.20

As you can see in the column labeled "Total", the KRD is 0.15 for the option-free bond and 0.20 for the callable bond. This is the relative price sensitivity of each of the two bond types to a 20 basis point change in the six-year spot rate. As all other maturity segments of the term structure are assumed to remain unchanged, the KRD is considerably smaller than the effective duration we computed above and may be interpreted as a "partial" duration.

In general, KRDs are particularly informative for bonds with embedded options. Consider the callable bond we have been looking at so far. The callable bond has a 10-year maturity but it will be callable at a call price of $101 starting three years from now. The bond's price will be particularly sensitive to a shift in the yield curve at the 3-year and the 10-year points. The change in the 3-year rate will greatly affect the likelihood of the bond being called/redeemed by the issuer long before its maturity and a shift in the 10-year rate will affect the present value of the principal payment expected at the final maturity date. While we know that the bond's effective duration will be somewhere between 3 years (the call start date) and 10 years (the final maturity), examining the 3-year and 10-year KRDs sheds additional light on the price sensitivities to shifts in particular key term structure segments.

KRDs in our Work

At Innealta we use key rate durations in various ways in our portfolio management process. While it is unlikely that only certain key rates change and all other spot rates remain exactly the same, comparing KRDs between our portfolios and their benchmarks helps us find maturity sectors where duration mismatches exist, which we can subsequently address by restructuring our portfolio. This helps us take only the types of risks for which we expect to be compensated and it helps mitigate unrewarded sources of risk.

For example, in certain cases we want to match our portfolio's effective duration with that of our benchmark (the Barclays Aggregate) to avoid being differentially exposed to interest rate changes from the benchmark. However, since matching effective durations only protects us against parallel term structure shifts and not against shifts that are different for different maturities, we may also analyze different KRDs in an attempt to uncover structural mismatches between our portfolio and the benchmark.

We also use KRDs to optimally construct yield curve trades. For example, suppose we expect the yield curve to steepen and we would like to adjust the weights of different bonds in our portfolio to be able to capitalize on this view. KRDs can help us find those bond issues with particularly high sensitivities to the desired segments of the yield curve maturity spectrum.

Similarly, if we expect the term structure to become more concave, this implies that medium-term interest rates increase relative to short-term and long-term interest rates. Examining KRDs at the short, medium and long end of the term structure allows us to estimate the impact of our interest rate view on our bond position. They also allow us to position ourselves in a way that we can profit if our rate view materializes.

In more general terms, we can use KRDs to capitalize on any non-symmetrical shift in the term structure of interest rates. In this sense, KRDs provide additional information beyond effective duration, which assumes a parallel shift in the term structure.

CONCLUSION

Interest rate risk measures are used in hedging applications, matching portfolio interest rate sensitivities to those of a benchmark and the construction of trading strategies used to exploit interest rate views that a portfolio manager may have. Two main approaches to interest rate risk measurement exist, the modified duration/convexity approach and the full valuation approach. While modified duration/convexity can be calculated more easily, it only can be used for option-free bonds with cash flows that are unaffected by changes in interest rates. The full valuation approach is much more flexible and can be used for any type of fixed income security.

Hence, the full valuation approach and its special cases, effective duration and effective convexity, should be the method of choice for fixed income professionals.

At Innealta we use the full valuation approach to examine different interest rate scenarios in order to make sure we are well-prepared for various economic environments and we are able to capitalize on our investment views in the most efficient manner without taking any unintended bets.

To wrap, we offer this review (and a few more upcoming) as an expression of the thought and process that result in the allocations to fixed income securities in each of our strategies. To bolster the continued trust our partners and clients maintain in our ability to defend and grow their wealth.

ENVIRONMENT AND POSITIONING

As we've moved through earnings season, we have not seen much in the way of changes in the trends of the fundamental series we track: Europe, broadly, remains in negative terrain, and we expect both equities and the euro to continue to weaken. Meantime, much of Asia and Latin America are offering at best neutral and in many cases decidedly bearish signals. This is true, even as monetary easing in parts of the developing world have provided a more favorable backdrop for comparisons. The action has been a bit more noticeable among U.S. sectors. Aside from the Industrials sector, though, for which the trends quickly turned south in the earlier part of last month, the shifts have been relatively minor (mostly to the bearish side of the ledger). Of notable exception still are the Energy and Russian markets, which remain our sole equity exposures in our Sector and Country Rotation portfolios, respectively. We remain underweight across all equity positions in our Risk-Based portfolios.

Again, no disconnects to find here in terms of our framework's ability to digest the current state of the investing environment. Fundamentals remain pressured by global deleveraging, along with multiple sources of risk that continue to gain in weight and impact; growing dysfunction and disabling inertia in Europe, weakening growth in the U.S. and emerging markets, and rising political uncertainty in the U.S. are only the most obvious in an environment that offers few reasons for executives and investors to make bold bets on the future. These forces also come through loud and clear in still hefty levels of market risk.

And so we remain defensively positioned across the board in our portfolios. The fixed income portfolio remains focused on the U.S. Corporate space, with approximately half of the portfolio exposed to investment grade debt, shifted to a moderately longer duration, a quarter in high yield, and the remainder divided among the U.S. fixed income aggregate and two individual local-currency-denominated emerging market debt.

On Knight Capital's Trading Error

Making news just as we were heading to press this month, Knight Capital disclosed that the, "installation of trading software…resulted in Knight sending numerous erroneous orders in NYSE-listed securities into the market." Knight so far has realized a loss of $440 million undoing those erroneous trades. That large of a hit has forced the company to pursue, "strategic and financing alternatives to strengthen its capital base."

As a matter of disclosure, we directly trade via Knight Capital on a regular basis; we know partners of our firm, to which we provide our model portfolios, also make use of Knight's trading expertise. We will remain very watchful as this scenario plays out on that firm.

Readers also should know that we have taken many steps to broaden our list of sources for trading liquidity, and we've done (and do) so both for ourselves and the partner firms with which we work. Knight is just one of many such providers of ETF liquidity, and they are not the only such provider with which we have worked. As necessary and prudent, we will direct flow elsewhere as the longer-term consequences of this error are more clearly understood.

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