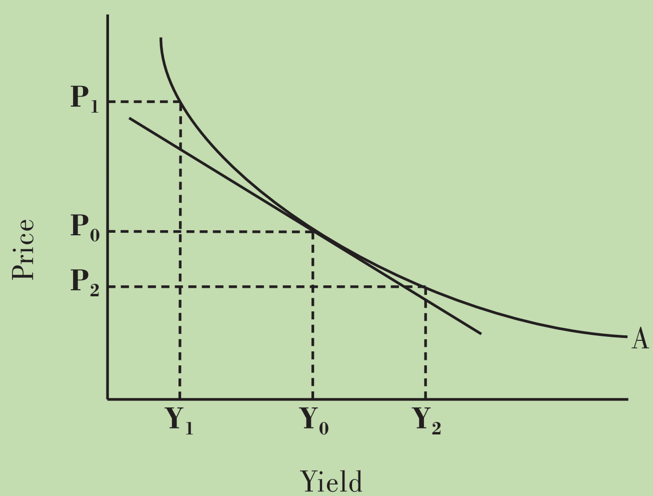
Merganser Investment Memorandum

Duration, Convexity and Bond Price Volatility

With the federal funds rate at record lows and the yield curve steep by historical standards, there is concern in the marketplace that interest rates will rise sharply in the near term. To take maximum advantage of the potential return from fixed income securities, total return investors will need to be cognizant of the impact of changes in interest rates on bond prices. The purpose of this memorandum is to briefly review duration and convexity, two measurements most commonly used by fixed income investors to understand the price volatility of fixed income securities.

Duration, in its many forms, is one of the most commonly used tools for measuring price volatility of fixed income securities. Modified duration provides a linear approximation of the percentage price change of a bond for a 100 basis points change in yield. For example, the price change for an option-free bond (such as a non-callable corporate or U.S. Treasury security) with a modified duration of ten years will be 10% for a 100 basis points change in yield. Modified duration does a good job of estimating price sensitivity for small changes in interest rates but is inadequate for estimating price sensitivity for large changes in rates. Since the price/yield relationship for fixed income securities is not linear, we need to consider convexity as an additional measure of bond price volatility.

Price/Yield Relationship of an Option-Free Bond



Merganser Welcomes New Research Analyst

We are pleased to introduce **Nik Vasilakos, CFA, Research Analyst**, as the newest member of Merganser's Investment Team. Nik brings 12 years of financial experience, most recently as a credit analyst at Eaton Vance Management. Prior to this, he worked at Wells Fargo Bank in the Leveraged Finance area. Nik holds an M.B.A. in finance and statistics from Carnegie Mellon University and a B.S. from Boston College. He enjoys golf and is an expert cook.

Convexity measures the rate of change of a bond's price sensitivity to changes in interest rates. It is the rate of change in a bond's duration. The graph shows a plot of the price/yield relationship (curve A), of an option-free bond and reveals a convex shape.

The line drawn tangent to the price/yield curve represents the duration of the hypothetical bond at a particular yield. The slope of the tangent line represents the modified duration of the security, with a steeper slope being a longer modified duration. The tangent line can be used to estimate the new price of the bond given a change in yield. Thus, for a change in yield from $\mathbf{Y_0}$ to $\mathbf{Y_1}$, modified duration estimates the new price at $\mathbf{P_1}$. From the graph, you can see that the actual price (from the curve) was higher than the price estimated by the tangent line using duration. This difference is largely attributable to convexity. The accuracy of the price estimate from modified duration is dependent on the convexity of the price/yield relationship. Note that the vertical line from the horizontal axis to the tangent line represents the price estimate using modified duration starting with an initial yield of $\mathbf{Y_0}$. The graph clearly shows that modified duration is a good measure of interest rate risk for small changes in yield, but does a poor job of estimating price for large changes in yield. We can also see that price change from ($\mathbf{P_0}$ to $\mathbf{P_1}$) is greater than the price change from ($\mathbf{P_0}$ to $\mathbf{P_2}$), which is an important property of convexity.

A security exhibits positive convexity when its price rises more for a downward move in yield than its price declines for an equal upward move in yield. Importantly, all option-free bonds exhibit positive convexity. This is because the duration of an option-free bond will increase as interest rates fall and decrease when interest rates rise. From the graph, it is clear that positive convexity will dampen the decrease in price when interest rates rise and enhance the increase in price when

Merganser Capital Management LP

99 High Street, Boston, MA 02110-2320 tel: (617) 494-1000 fax: (617) 528-4899

interest rates fall. This is because (P_1-P_0) is greater than (P_0-P_2). Thus, positive convexity is a desirable characteristic in both a rising and falling interest rate environment.

Negative convexity means that the price decrease will be greater than the price increase for large equal changes in yield. Bonds with embedded calls are commonly referred to as having negative convexity. These include callable agency and callable corporate issues as well as residential mortgage-backed securities. For bonds with embedded calls, such as callable corporates and agencies, as interest rates fall, the duration of the security decreases as the embedded call option becomes more exercisable ("in-the-money"). As the yield continues to fall, the price of the bond becomes more and more compressed around the call price. Thus, the call price becomes a ceiling on the bond. Conversely, as interest rates rise, and the call becomes less and less exercisable ("out-of-the-money"), the bond becomes more like an option-free security. While these securities may trade at higher yields than option-free securities, they may experience unfavorable changes in duration and price performance as yields change.

Residential mortgage pools commonly exhibit negative convexity because when interest rates are low, homeowners can easily refinance their outstanding mortgage debt, resulting in an early retirement of the mortgage at par. As these prepayments accelerate and more borrowers take advantage of lower rates, the duration of a pool backed by these mortgages shortens, compressing the price of the pass-through. The duration shortening and price compression is exactly what you don't want in a falling rate environment since these characteristics will limit performance. There is one important caveat about bonds with embedded call options: at high yield levels, callable bonds exhibit the same price/yield relationship as option-free bonds while at lower yield levels they retain their negatively convex characteristics.

There are several important properties relating to convexity. First, there is an inverse relationship between coupon and convexity (i.e., lower coupon bonds have higher convexity). Second, there is a direct relationship between maturity and convexity (i.e., convexity increases as maturity increases). Third, there is an inverse relationship between yield and convexity (i.e., the lower the yield, the higher the convexity). Finally, since a barbell structure is the combination of a shorter security and a longer security, a barbell structure will have better convexity than a bullet structure. Combining modified duration and convexity significantly improves the estimate of the price volatility of a bond as interest rates change.

Conclusion

Some final thoughts on duration and convexity. First, since we can't predict the timing and magnitude of interest rate changes, Merganser employs a duration-neutral strategy across all of our investment products (i.e., we strive to keep the durations of our portfolios close to their respective benchmarks). We believe that the value added comes from our bottom-up sector/security selection rather than market timing. We have avoided securities with high negative convexity because the expected reward does not adequately compensate the investor for the call risk. However, as interest rates rise, these securities may become more attractive. In the residential mortgage sector, we favor seasoned mortgage pools and well-structured CMOs that exhibit a lower prepayment sensitivity to changes in interest rates, and thus are less negatively convex than the mortgage universe. We are active in the asset-backed sector where prepayments are not highly correlated with interest rates. While much of the price change of a bond is driven by duration, convexity is still very important for managing interest rate risk particularly in intermediate and core portfolios. It is important to understand the convexity characteristics of fixed income securities and to what degree the market is efficiently pricing convexity. The premium for positive convexity is largely driven by expectations regarding interest rate volatility. While we don't try to predict interest rates, we strive to add value by investing in securities with favorable convexity characteristics.

Pete

Peter S. Kaplan, CFA
Winter 2004

Merganser

For additional information contact:
John C. Clavin, *Director of Marketing*
(617) 528-4861
jcc@merganser.com