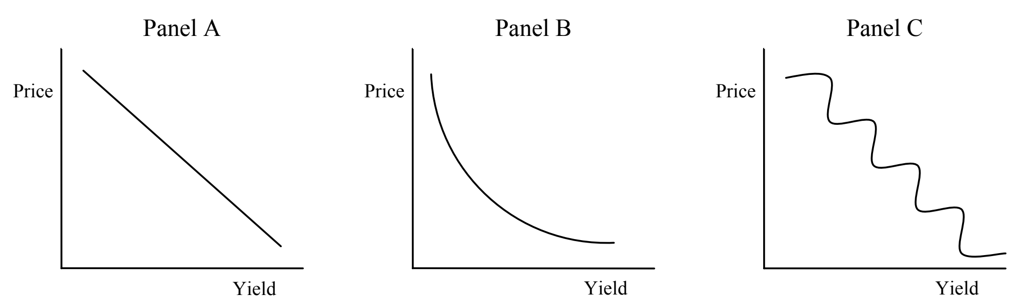
Ambassador Financial Group, Inc.

Have You Optimized Your Portfolio's Convexity?

Where did you go on vacation this summer? August 2007 will be remembered as the month when financial markets once again showed just how volatile they can be. A financial commentator said that many of the big investors are on vacation and that their absence helps explain the turmoil in the markets. I feel that the subprime debt market was a ticking time bomb that was going to detonate one way or the other, regardless of who was taking a vacation. Eventually the concerns over the credit crunch will subside; but don't be surprised to see continued volatility in interest rates. Interest-rate volatility is not the exception; it's the norm. In an environment of volatile rates, it's a mistake to neglect the convexity of your bond portfolio. While duration is the primary measure of interest-rate risk, the impact of convexity increases as rate volatility rises and should not be ignored.

Figure 1: Relationship between a bond's price and yield



Recall the cliché that becomes a joke when the man says, "I have good news and bad news. Which do you want to hear first?" Then the joke follows. Well, I can offer a banker some good news and some bad news regarding his investment portfolio. First, the bad news: if interest rates go up, the value of his portfolio will go down. But now the good news: if rates go down, the value of his portfolio will go up. My guess is that anyone managing investments already knows this basic concept regarding fixed-income securities. However, if you were asked to explain this correlation to your board of directors, how would you draw this inverse relationship on the blackboard? Close your eyes and think about that for a moment.

When I give my students a quiz, I show them panels A, B and C (see Figure 1). Each panel shows an inverse relationship between price and yield, but which is correct? Because I make sure to teach my students about duration *and* convexity, most correctly select panel B. While nearly all portfolio managers at banks would also select panel B as the correct answer, many act and make decisions as though panel A is how their bonds behave. What explains this paradox? It comes down to an understanding of convexity.

The better-known concept of duration trains us to estimate the percentage change in price by assuming a straight line. For example, if a bond's duration is five, we estimate that the bond's price will fluctuate by 5 percent if rates rise or fall by 100 basis points. If a 200-basis-point rate shock is considered, we extrapolate the duration figure in a linear fashion to estimate a ±10 percent price fluctuation. It is important to never forget that *duration is an approximation*. Sometimes an approximation is alright; but sometime greater accuracy is needed. That's when convexity is needed.

Figure 2 is from Frank J. Fabozzi's book titled *Fixed Income Mathematics*. (Fabozzi is one of the most prolific writers and editors of literature on fixed income in our profession.) The figure shows a bond that is priced at p^* and a yield of y^*. If there is a small movement in market yields—either up or down—to y_2 or y_3, the duration (represented by the tangent line) and the actual price (represented by the curved line) are nearly identical. Conversely, if yields shift in a more pronounced direction, as shown by y_1 or y_4 at either end of the x-axis, then there are significant errors between the duration-based price estimates and the true prices. These errors are labeled in Figure 2. The gap between the tangent line and curved line is convexity.

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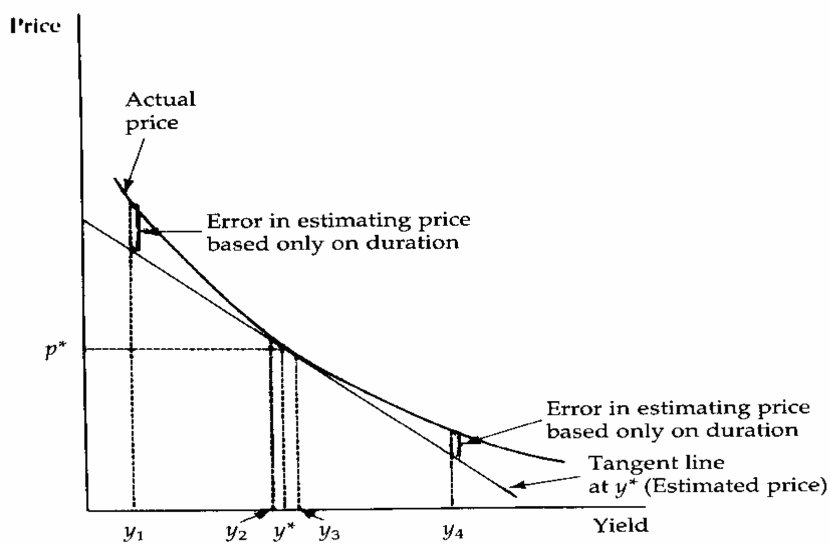
There are two important conclusions to draw. First, *convexity becomes more important as interest rate volatility increases*. As yields in the market shift farther from today's yields, convexity becomes a larger factor in the accurate pricing of a bond. This can be seen graphically in Figure 2 as an increasing gap between the straight line (duration) and the curved line (actual price). If you expect to hold a bond for more than a few months, it is exposed to ever greater potential volatility. In those cases when a bond or block of bonds is exposed potentially to a high dose of volatility, it is prudent to use duration *plus* convexity to forecast price changes.

Figure 2: Relationship between a bond's price and yield



Source: Fabozzi's Fixed Income Mathematics, 1993

The second conclusion is more subtle and requires a careful reexamination of Figure 2. Except for the point at (p^*, y^*), the true pricing of the bond shown by the convex line *is always higher than the duration line*. Moreover, the price advantage increases as the curved line becomes more convex. What does that mean for an investor? It means that (positive) convexity enhances value. It will protect the portfolio from price loss when rates rise and it will improve price gains when rates fall. We can go one step further by stating that, in general, positive convexity improves price performance when markets become volatile.

Not all convexity is a good thing. Some bonds exhibit what is termed "negative convexity." Examples include callable bonds and loosely structured securities. We are not recommending that a bank maximize its convexity, but instead try to *optimize* it. If a bank were to shy away entirely from bonds with negative or minimal convexity in an attempt to maximize convexity, then it would run the risk of losing diversification in the portfolio. For example, if a bank decided to avoid mortgage-backed securities in order to sidestep negative convexity, it would lose the unique diversification and other benefits gained from this particular asset class. Banks need to balance the positive attributes and risks of each asset class as it manages the portfolio to meet the stated objectives.

In summary, the objective of this article is to remind our readers that good (positive) convexity is valuable to the portfolio. Regardless of whether we are in a period of wide, narrow or modest spreads, it is always beneficial to take steps to optimize your portfolio's convexity. Bankers will typically concern themselves with coupons, yield-to-maturity, call options, credit quality and other key characteristics of a fixed-income investment. While these, of course, are very important attributes, don't forget about convexity.

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