A Brief Introduction to Bond Mathematics

Uur clients often ask about the relationship between bond prices and bond yields and why certain properties exist. This column will introduce some of these properties, explain why they exist and how they affect a portfolio. Future editions will expand on the subject as well. If you wish, the matter can also be discussed during private portfolio reviews with our Investment Specialists.

A FEW BASICS

I. Bond prices change in the opposite direction of yield change. A bond purchased last September at a "locked-in rate", when interest rates were higher, trades at a higher dollar price today. Why? Because the investor would part with that guaranteed higher rate of return (yield) only if the buyer offered a higher price.

Therefore, lower bond yields are reflected in higher bond prices and vice versa. The shape of the relationship between the yield and the dollar price of a bond is convex and it is this convex shape that creates "properties".

II. Price volatility is not the same for all bonds and it is not symmetric for large yield changes. If bond yields change by 2% (200 basis points), the percentage change in dollar price is not the same for a decrease in yield versus and increase in yield. In fact, price increases are greater than price decreases for an equal change in yield. Once again, this *"properly"* results from the convex shape of the price/yield relationship.

III. Generally, the lower a bond's coupon rate, the greater is the dollar price volatility. Given the same maturity and yield to maturity, a bond with a 2% coupon rate is more volatile than its counterpart sporting a 10% rate. Non-callable zero coupon bonds will increase in price most as yields decline. High coupon premium bonds will decline less in value as yields increase. **This** *is one of the reasons* **we prefer premium bonds for a conservatively managed portfolio.**

IV. Price volatility increases with maturity. The longer the maturity the greater the volatility factor.

V. The lack of credit quality and insufficient call protection greatly affect price volatility.

VI. Yield to maturity of a bond affects its price volatility. The higher the yield to maturity of a bond, the less volatile is its price. All other factors constant, the lower a bond's yield the greater is it's price volatility for a given yield change. Therefore, a **good quality non-rated** bond maturing in 10 years and yielding 5.25% may well experience **less** volatility than a 10- year AA rated issue yielding 5% at time of purchase! This is one of the several reasons we recommend solid quality, non-rated issues we know and follow. *There is a place for this type of bond for a portion of many of the portfolios we manage.*

VII. Lastly, the three factors of yield, maturity and coupon rate do not affect price volatility equally for any two bonds. Comparisons therefore become somewhat more complicated. We will leave this topic for a future quarterly letter. Perhaps this would be a good subject for your next portfolio review conference with your **Bernardi Securities, Inc.** *Investment Specialist.*

I hope these comments are helpful. Call us directly should you wish to have an in depth discussion about the *"mathematics of bonds and price volatility".*

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President