Duration (aka Macaulay Duration)

Duration measures the degree of interest rate risk in a bond. That is, it is an indicator of how much the bond's value will change with a change in its yield-to-maturity.

How does the duration of a bond change with a change in the:

1. coupon rate? As the coupon rate increases, the duration decreases.
2. initial yield-to-maturity? The lower the initial yield-to-maturity, the greater the sensitivity of the change in duration to a change in the yield-to-maturity.
3. time to maturity? In general, the longer the time to maturity, the greater the duration of a bond.

Modified Duration

Historically, modified duration has been used to estimate the change in the bond value due to a change in a bond’s yield-to-maturity.

The percentage change in price is estimated as:

Because of improvements in technology, the change in bond prices due to a change in yield-to-maturity can be easily and more precisely calculated directly. However, modified duration is considered a better measure of interest-rate risk than Macauley’s duration by some.

Convexity

Duration is the first-order approximation of the change in a bond’s value with respect to a change in the bond’s yield-to-maturity. Convexity is the second-order approximation of the change in a bond’s value with respect to a change in the bond’s yield-to-maturity.

Including the effect of convexity can improve the accuracy of the approximation of the change in the bond’s price due to the change in the bond’s yield-to-maturity. More importantly, the greater the convexity of a bond, the greater the increase in the bond’s value with a decrease in the yield-to-maturity and the less the decrease in the bond’s value with an increase in the yield-to-maturity.

The convexity adjustment to the bond value estimation is: