

Understanding Duration



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Duration is among the most important characteristics of a fixed income security. Still, the concept can be elusive. Many investors may have questions regarding the nature of duration as it relates to their fixed income investments.

BlackRock believes it is important for you to have a working understanding of duration, and how it can be used to help assess the appropriateness of a fixed income strategy.

The History of Duration

In 1938, economist Frederick Macaulay suggested duration as a way of determining the price volatility of bonds. 'Macaulay duration' is now the most common duration measure.

Until the 1970s, few people paid attention to duration due to the relative stability of interest rates. When interest rates began to rise dramatically, investors became very interested in a tool that would help them assess the price volatility of their fixed income investments. During this period, the concept of 'modified duration' was developed, which offered a more precise calculation of the change in bond prices given varying coupon payment schedules.

In the mid-1980s, as interest rates began to drop, several investment banks developed the concept of 'option-adjusted duration' (or 'effective duration'), which allowed for the calculation of price movements given the existence of call features.

Utilizing Duration

Duration can help predict the likely change in the price of a bond given a change in interest rates. As a general rule, for every 1% increase or decrease in interest rates, a bond's price will change approximately 1% in the opposite direction for every year of duration. For example, if a bond has a duration of 5 years, and interest rates increase by 1%, the bond's price will decline by approximately 5%. Conversely, if a bond has a duration of 5 years and interest rates fall by 1%, the bond's price will increase by approximately 5%.

Duration	Interest Rate Change	Approximate Bond Price Change
5 years	+1%	-5%
5 years	-1%	+5%

Calculating Duration

Duration is defined as the average time it takes to receive all the cash flows of a bond, weighted by the present value of each of the cash flows. Essentially, it is the payment-weighted point in time at which an investor can expect to recoup his or her original investment.

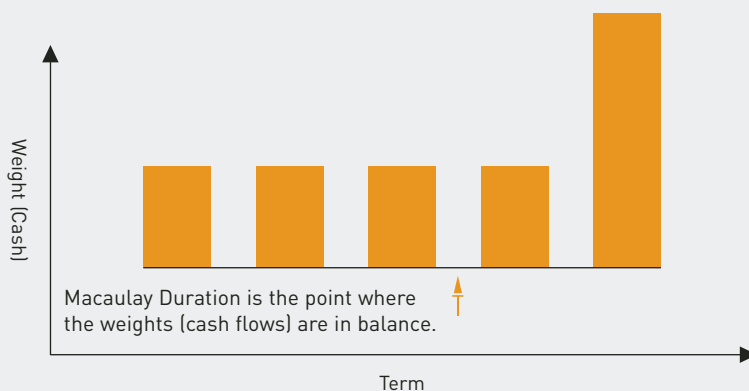
Given its relative ability to predict price changes based on changes in interest rates, duration allows for the effective comparison of bonds with different maturities and coupon rates. For example, a 5-year zero coupon bond may be more sensitive to interest rate changes than a 7-year bond with a 6% coupon. By comparing the bonds' durations, you may be able to anticipate the degree of price change in each bond assuming a given change in interest rates. Accordingly, duration calculations may help you more precisely structure your portfolios against the backdrop of their overall investment objectives and risk tolerance.

For example, for a two-year bond with a \$1000 face value and one coupon payment every six months of \$50, the duration (calculated in years) is:

$$0.5y \left(\frac{50}{1200} \right) + 1y \left(\frac{50}{1200} \right) + 1.5y \left(\frac{50}{1200} \right) + 2y \left(\frac{50}{1200} \right) + 2y \left(\frac{1000}{1200} \right) = 1.87 \text{ years}$$

Where: y = Years
 50 = Interest paid every six months
 1000 = Principal payment
 1200 = Total of all payments received, including principal

As illustrated below, duration can be intuitively understood as the point along a time spectrum at which a bond's total payments roughly balance:



Rules of Duration

When thinking about duration, a few general rules apply. With everything else being equal:

- The duration of any bond that pays a coupon will be less than its maturity, because some amount of coupon payments will be received before the maturity date.
- The lower a bond's coupon, the longer its duration, because proportionately less payment is received before final maturity. The higher a bond's coupon, the shorter its duration, because proportionately more payment is received before final maturity.
- Because zero coupon bonds make no coupon payments, a zero coupon bond's duration will be equal to its maturity.
- The longer a bond's maturity, the longer its duration, because it takes more time to receive full payment. The shorter a bond's maturity, the shorter its duration, because it takes less time to receive full payment.

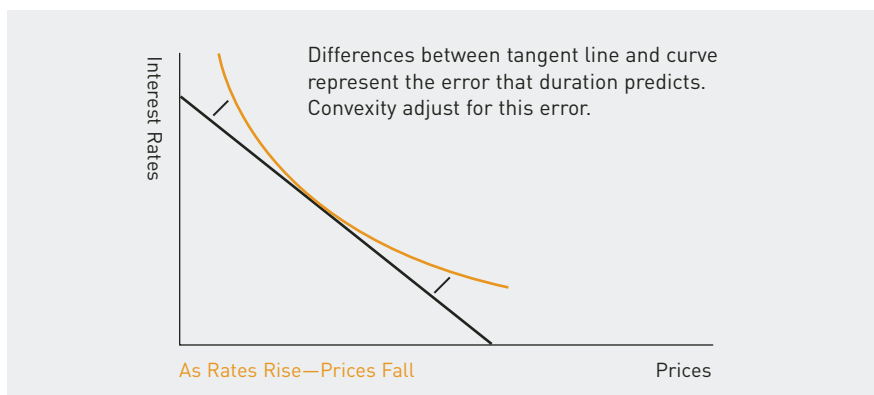
Considering Duration and Convexity

Duration assumes a linear relationship between bond prices and changes in interest rates.



In actuality, however, prices fall at an increasing rate as interest rates rise; similarly, prices rise at an increasing rate as interest rates fall. This disparity implies that duration will consistently overestimate the amount of price decline associated with a large upward move in interest rates. Conversely, duration will consistently underestimate the amount of price increase associated with a large drop in interest rates.

In order to compensate for this disparity, the concept of 'convexity' was developed. Convexity corrects for the error that duration produces in anticipating price changes given large movements in interest rates. As such, convexity also measures the rate of change in duration, thereby fully accounting for the dynamic relationship between prices and rates.



Convexity can help you anticipate how quickly the prices of your bonds are likely to change given a change in interest rates. Everything else being equal, you may find issues with greater convexity more attractive, as greater convexity may translate into greater price gains as interest rates fall and lessened price declines as interest rates rise.

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BY UNDERSTANDING DURATION, you can more effectively structure the interest rate sensitivity of your portfolio as it relates to your overall investment objectives and risk tolerance. However, duration is only one factor among many to be considered in determining whether a given security is right for your portfolio. Duration is only meant to describe the interplay between a security's price and prevailing interest rates, and does not give any indication regarding an issuer's ability to make interest and principal payments in a timely fashion. A security's duration is only an estimate, and the change in price in response to an interest rate change may be more or less than indicated by the security's duration. As with any investment consideration, a security with a given duration may be appropriate for one investor but not another.

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