Consider that a 1-percent rise in interest rates can cause a 12-percent decline in the capital value of a 30-year Treasury bond portfolio. Proportionally, this equates to a nearly 1,500-point drop in the Dow at current levels above 12,000. Even with shorter-term maturities (say, five years), investors could expect a 4-percent drop in the market price of AAA bonds.

Most investors generally understand that volatility in bond prices coincides with changes in prevailing market interest rates. A smaller number recognize that the amount of price fluctuation can be magnified significantly in longer maturities. However, a deeper understanding of investment principals often is required of those responsible for investing other people’s money.

This article reviews bond duration as a means to assess price sensitivity. It is geared to help the fiduciary, trustee, or third-party adviser understand, select, and monitor fixed income investments.

Higher Standard of Care for Fiduciaries

Fiduciaries generally are required to fulfill their duties with a higher standard of care than the general public. The actual standard, however, can depend upon the nature of the fiduciary relationship and, in some cases, the acumen, experience, and facilities of the fiduciary. For example, perhaps the highest standard is that of the “prudent expert” required by the Employee Retirement Income Security Act of 1974 (ERISA). ERISA Section 404(a)(1)(B) provides that fiduciaries must act “with the care, skill, prudence and diligence under the circumstances then prevailing that a prudent person acting in a like capacity and familiar with such matters would use in the conduct of an enterprise of a like character with like aims.” Case law has widely held this to mean that ERISA fiduciaries must function at or near the level of an experienced investment adviser.

While the courts have applied this rigorous standard in non-ERISA fiduciary cases, it is not mirrored in the Illinois Trusts and Trustees Act, effective since 1997 (760 ILCS 5/) and used as the model for the Uniform Prudent Investor Act (UPIA) now adopted in most states. The prudent investor rule requires only “reasonable care, skill, and caution” and the legislative notes indicate the intent to allow individuals of ordinary intelligence to serve as trustees.

Nonetheless, and as is characteristic in other areas of tort law, trustees possessing greater skill than individuals of ordinary intelligence, are held to that higher skill level. As a result, if a trustee solicits employment by representing that it has greater ability than that of a merely prudent investor, the trustee must make reasonably diligent use of such ability.

Third-party advisers, properly selected and responsibly monitored, can help fiduciaries meet required levels of “care, skill, prudence, and diligence.” Still the bottom line in many cases is that a fiduciary responsible for day-to-day decisions likely will need and certainly want to be familiar with investment theory and practice beyond that of the average person.

The Restatement (Third) of Trusts contemplates that certain duties might require “knowledge and experience greater than that of an individual of ordinary intelligence, depending on the investment strategy to be employed.” The Restatement explicitly states that these circumstances do not prevent an individual of ordinary intelligence from serving but warns that these circumstances might impose a duty to obtain sufficient assistance.

A ‘Test’ Every Investor Should Pass

Given a change in market interest rates, which bond will exhibit the most price sensitivity assuming a 6-percent discount rate: a 20-year bond at 4 percent or a 25-year bond at 6 percent?

If you chose the longer maturity, take your phone off the hook and read on.

Weighted Average Term—Some Math

At first glance, the price sensitivity or volatility of a bond appears directly correlated to its maturity date. Accordingly, a longer-term bond seems to imply greater price sensitiv-
duration. However, coupon payments, prevailing market rates, assumed reinvestment rates for coupon payments, and acquisition costs (premium or discount) also play an important role in accounting for and predicting bond price volatility. Recognition of the interrelationship among these various factors is critical to predicting the impact of interest rate changes on bonds and bond portfolios.

In 1938, Frederick Macaulay created a formula, which he termed duration, to assess the degree and impact of interest rate volatility in bond prices. His formula was based upon the weighted average term-to-maturity (WAT) of the bond’s cash flow. Using the present value of each cash flow receipt as a percentage of the present value of total cash flows, he created a weighting system that provided a result expressed in terms of years.

By comparing the WAT of one bond versus another, an investor could assess relative price sensitivity to interest rate changes. Even better, by multiplying the WAT of a bond against a projected percentage change in interest rates, a rough figure of the expected percentage price change in a bond could be achieved. In more recent times, the Macaulay duration standard has been generally replaced by a more useful measure known as modified duration.

To understand the concept of modified duration, it is important to understand the foundation (and flaws) of Macaulay duration. The weighted average term-to-maturity of a bond or a portfolio reflects how soon an investor will recover his or her investment in the form of coupon and maturity payments. It specifically takes into consideration that a high coupon bond will provide a “faster” return than a low coupon bond.

Macaulay duration is calculated by dividing the present value PV of annual cash flow CF, including maturity payment, by the present value of the total cash flow (PVTFC).

\[ \text{Macaulay duration} = \frac{\text{PV} \times \text{CF}}{\text{PVTFC}} \]

In narrative, this formula becomes:

The Macaulay duration is the sum of one times the present value of cash flow from period one, two times the present value of cash flow from period two, three times the present value of cash flow from period three, etc., finishing with the number of years until maturity times the present value of cash flow from the year of maturity, all divided by the present value of the total cash flow, including the maturity payment.

Visualizing Duration

Interestingly enough, the modified duration product actually is the length of time that it will take an investor to recover one half of the present value of the initial investment. This can be illustrated visually by imagining a balance scale. On the right side of the scale is the entire amount of the bond’s remaining future payments (including maturity value) represented by a stack of dollar bills. On the left side of the scale are the dollar bills representing the payments received to date.

As the bond moves toward maturity, imagine that money is taken away from the right side and placed on the left side. The point at which the scale is balanced will be the modified duration value expressed in years. This, for example, helps conceptualize why zero-coupon bonds have a duration equal to their maturity date—they make no payments to the left side of the scale until they mature.

Practical Value

Fiduciaries can use these principles to control and monitor portfolio volatility. For example, all else being equal, higher coupon (stated interest rate) bonds will have a shorter duration and lower volatility than lower coupon bonds. A prudent investor therefore may wish to cushion bond portfolios against a significant slide in bond prices by including higher coupon or premium bonds. This technique can provide an especially important safeguard where zero-coupon bonds also are present in the portfolio. In fact, noncallable premium bonds (above par) can offer some of the best hidden values in the bond market, both for their yield to maturity and comparatively lower price volatility.

Rule of Thumb. Multiply duration by the change in market interest rates to determine the approximate change in market value. For more information about advanced bond portfolio construction methods, an Internet search using keywords such as “modified duration,” “bond portfolio immunization,” and “bond convexity” can help yield productive avenues for a starting point.

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