



BEST PRACTICE

Managing Market Risk in Investment Portfolios (2007 and 2009) (TIM)

Background. Fixed-income securities are investment instruments that provide a stream of cash flows in the form of coupon and principal payments. Typically, they are issued with maturities ranging from one year to 30 years. A security's stated maturity is the date on which its final interest and principal payments are due. There are several general structures for fixed-income securities:

- **Bullet securities** – the principal amount will be paid in one payment at maturity. They are issued without any option that could cause redemption prior to the stated maturity;
- **Securities with options** – issued with either a call or put option that could change the stream of cash flows. Call options give the issuer the right to redeem bonds prior to maturity in accordance with the call schedule. Securities with call options have greater volatility than bullet securities. Issuers of callable securities typically call these when interest rates have fallen, causing investors to lose the higher interest rate in periods when such rates are hard to replace. Put options give the investor the right to submit a bond for redemption prior to maturity in accordance with the rules of the put. Buyers pay a premium for the put option. Typically, investors of puttable securities “put” these when interest rates have risen, gaining the opportunity to reinvest their principal at the then prevailing higher market rates; and
- **Amortizing securities** – pay a portion of the principal with each interest payment throughout the life of the bond (e.g. – mortgage securities, asset-backed securities). They have a stated final maturity and an average maturity, and can also have early redemption options.

Market risk refers to the effect that changing interest rates have on the present value of a fixed-income security, and can also be referred to as interest rate risk. There is an inverse relationship between interest rates and price. As interest rates rise, the value of a security falls. The reverse is true as interest rates fall. The extent of price change is a function of the length of term to maturity, the structure of the security (type of embedded options), the level of interest rates, and the size of the coupon.

Of these factors, the most important are the length of term to maturity and the structure. Generally, the longer the maturity of a security, the greater its market risk as measured by price volatility. Longer maturities have greater volatility because as the time to maturity increases, each change in interest rates has a greater impact on the present value of a security.

The size of a security's coupon also affects price volatility. When analyzing securities with the same maturity, securities with low coupons will have greater price volatility than securities with high coupons. The security with the greatest price volatility for any given maturity is a zero coupon security.

Many government investors employ a buy-and-hold approach, so that changes in a security's market value are never realized and the full face value of the security is received upon maturity. Despite this, market value must be managed for three reasons:

1. The total return of the portfolio is computed and compared to the total return of the portfolio's benchmark to evaluate portfolio performance.
2. The market value of an entity's investments must be disclosed in its annual financial report. Often an entity will include it in more frequent reports to the governing body and public. Accordingly, an entity must be able to understand and explain changes in the market value of its portfolio.

3. Circumstances may arise in which an entity is forced to sell a security before its maturity. In such instances, a government entity may have to accept a loss on a security that it had never planned to sell. Market risk is a critical risk for a government investor. Therefore, it is necessary to understand fully the maturity structure of securities before investing. To ensure appropriate liquidity and to reduce interest rate risk in operating portfolios, most state and local governments:
 - a. Limit the maximum maturity for securities they purchase;
 - b. Ensure that funds are available for scheduled disbursement by developing cash flow projections and properly structuring the maturities in a portfolio according to the expected cash flows;
 - c. Ensure that a reasonable liquidity buffer is maintained to meet unexpected disbursements; and
 - d. Ensure that a security can be sold with ease and minimal cost (price disruption) to the investor by investing in high grade, actively traded fixed-income securities.

Maximum maturity and weighted average maturity limits relate directly to an entity's statute and policy constraints, investment objectives and cash flow projections. Although setting maximum maturity constraints may help limit the market risk in a portfolio, it is not generally considered to be the most effective way for managing market risk and understanding the potential price volatility of either an individual security or an entire portfolio. Maximum maturities allow the portfolio to take advantage of longer securities and the weighted average maturity protects against over-extension of the portfolio in those longer maturities.

A widely used measure of market risk in the investment industry is *modified duration*. Durations can be obtained from professional market resources such as Bloomberg. For governments without access to these resources, broker-dealers may send documentation of the durations. Duration is more comprehensive and accurate in measuring market risk than the maturity of a security for two important reasons. First, duration takes into consideration all cash flows (interest and principal payments) of a fixed-income security using their present values. Maturity as a market risk measure only considers the principal payment of a security using its future value.

Second, modified duration is a multiplier that measures the approximate percentage change in the value of a security or portfolio given a 1% (100 basis points) move in interest rates. For example, if a security has a modified duration of 1.74 and interest rates rose by 50 basis points, the security would experience approximately a -0.87% change in value.

Formula and calculation:

$$\% \text{ change in market value} = (-1) * (\text{modified duration}) * \left(\frac{\text{basis points change in yield}}{100} \right)$$

$$-0.87\% = (-1) * (1.74) * \left(\frac{+50}{100} \right)$$

* multiplied by -1 because of inverse relationship between price and interest rates

With this type of price volatility analysis, a government investor can determine more accurately the amount of market risk in a security or portfolio.

Weighted average maturity and weighted average duration in a portfolio are calculated using the maturity and duration values of all the securities in a portfolio. Weighted average maturity allows a government to verify compliance with investment constraints since most investment policies and state statutes have maximum weighted average maturity limitations. Weighted average duration is considered industry wide as an acceptable measure of market risk in a portfolio. As such, it can provide the government investor with valuable information for managing the market risk in a portfolio.

The Governmental Accounting Standards Board (GASB) in GASB Statement No. 40 requires a disclosure of all risks associated with a government entity's portfolio, including market risk, including market rate or interest rate risk. Weighted average maturity and weighted average duration are two of five accepted methods for disclosing a

portfolio's market risk. (A description of the other three is beyond the scope of this Best Practice.) In accordance with the GASB fair market value reporting requirements in GASB Statement No. 31, a government entity's portfolio could show unrealized losses or gains for any reporting period.

Recommendation. State and local governments should comply with state statutes pertaining to investing public funds along with all investment policy parameters. Fixed income investing involves a certain level of market risk. Investors should be aware of their risk tolerance and confirm that the market risk they assume is within this tolerance level.

The Government Finance Officers Association (GFOA) makes the following recommendations to government investors with respect to managing market risk:

1. Develop and update cash flow projections to determine: a) the dollar amount of the portfolio that needs to remain liquid (liquidity buffer) to meet disbursement obligations within a six-month period (short-term), b) what dollar amount is required within the next 6 – 12 month period, and c) whether there is a 'core' of funds available for longer-term investing.
2. Structure the portfolio to provide sufficient liquidity for anticipated cash flow requirements by continuously investing a portion of the portfolio in money market type investments such as local government investment pools, money market mutual funds, overnight repurchase agreements and money market securities.
3. Understand fully the maturity structure of a security. Prior to purchase, the government should confirm compliance with its investment constraints and overall investment strategy. If a security has options associated with it such as call options, the structure of the option should be analyzed to determine its potential impact on market risk through an analysis such as option adjusted spread (OAS) analysis. The stated maturity date should always be used to determine compliance with maximum maturity constraints, not any potential call dates unless an official announcement of a call has been released.
4. Adopt weighted average maturity limitations and/or weighted average duration targets, consistent with the government's investment objectives, constraints, cash flow needs and risk tolerances. The weighted average maturity limitations is used to *limit* the liquidity and market risk in a portfolio consistent with the constraints in the governing state statutes and the investment policy. The weighted average duration targets can be used to *manage* market risk in a portfolio.
5. Do not directly invest in securities with maturities greater than the limits imposed by investment policy. In general, the maturities in a portfolio should coincide as nearly as practicable with the expected use of funds. Securities with maturities greater than five years should be matched to a specific cash requirement. The government should include in its investment policy a process for authorizing longer-term investments and for providing disclosures..

References.

- *Investing Public Funds*, Second Edition, Girard Miller with M. Corinne Larson and W. Paul Zorn, GFOA, 1998.
- GFOA Sample Investment Policy, 2003.
- GASB Statement No. 31 and Statement No. 40, www.GASB.org

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