

Differences between duration and maturity



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Introduction of duration

Duration is a significant measurement of how sensitivity the change in price of a bond in the change of interest rate. It is broadly linked to the length of time before the bond is mature. Duration assists investors during the investment decision making process by expressing the relation between interest rate and price variables of the bond. Therefore, duration is useful measurement for investors because it protects investment from interest rate risk. When the duration of bond is lower that means investors can obtain the cash earlier and reinvest it at prevailing interest rate. As a result, the lower the duration of a bond, the lesser sensitive changes in the interest rate.

Differences between duration and maturity

Majority of investors are familiar with maturity which is the point of time when investors get back the principal of bond. However, duration is defined as the length of time before the maturity of the bond. Therefore, the duration is always shorter than the maturity.

Besides that, there is mathematical formula for the duration calculation of a bond but maturity of a bond is non-calculated, it is quoted based on the bond's maturity. Duration is basically the weighted average amount of time for investors to be given back all the cash at the determined period whereas investors will be repaid the principal of bond at the end of bond life which known as maturity.

As a result, if the maturity of a bond is shorter, the shorter the duration of the bond. Duration is generally shorter for all bonds except zero coupon bonds which its duration is always equal to its maturity.

Duration calculations

There are three different duration calculations which consist of Macaulay's duration, Modified duration and Effective duration.

Macaulay's duration equals the weighted average of the times until cash flow received. The weight,, associated with the present value of the cash flow made at time (t) which refer to the length of time in the future until payment and receipt as:

The weights sum to 1 because the sum of the cash flows discounted at the yield to maturity equals the bond price. Macaulay's duration formula:

Modified duration is equal Macaulay's duration divided $(1+y)$. It indicated that how much a price of a bond will change in the percentage when there is change in interest rate.

Effective duration also called option-adjusted duration, it is used to estimate how price sensitive a bond when the bond contains embedded options.

Embedded option is sinking funds schedule or call options. It compares a bond's estimated price in falling rate environment with an estimated price in a rising rate environment relative to the initial price times the assumed rate differential.

Effective duration=

Uses of duration

Duration is useful for financial analysts, bond holders, and portfolio managers because duration is measurement of the price sensitivity of a bond. A longer duration has more price volatile than a bond with a shorter duration.

Furthermore, duration also used to measure the market potential risk of a bond to changes in its yield. It is an essential tool for either passive or active management. It used to protect the portfolios from fluctuations in interest rate which interest rate risk can be minimized. Therefore, duration is important for all treasury managers because they can adopt it to develop investment strategies in order to minimize the relevant risk levels in the changes of interest rate while maximize the profits.

Determination of Duration

There are several " rules" to determine duration. The first rule is the time to maturity is always similar with duration of a zero-coupon bond. Rule 2 is a bond's duration is lower when there is higher coupon rate which the holding maturity and YTM constant. Rule 3 is a bond's duration increase when the maturity increases while coupon rate is constant. Rule 4 is the duration of a coupon bond is increase while the yield to maturity decreases. Lastly, perpetual bonds' duration is count as $(1+Y/Y)$. Its duration is independent of coupons.

Immunization

Portfolio immunization is a strategy that insulates the portfolio from exposure to the interest rate risk which consists of price risk and reinvestment risk. Portfolio immunized enable the value of portfolio will not be influenced by the fluctuations of interest rate by adopting several strategies which including passive management strategies, active management strategies and contingent immunization.

Passive management strategy is used to adjust the risk performance of a portfolio. Duration matching adopted to reduce the duration GAP by matching the duration of assets equal to duration of liabilities in order to reduce the interest rate risk. Besides that, target date immunization used to equal the duration of bond same as investor's ideal holding period. Apart from that, cash flow matching and dedication strategy are another methods to immunize the portfolio from risks exposure. Cash flow matching is the firm expects the cash inflow match with cash outflow and it will not affect the payment obligation if there is a movement in interest rate whereas dedication strategy is a cash flow matching on a multi period basis. The advantage of dedication strategy is once the cash inflow match to cash outflow, rebalancing is unnecessary due to the elimination of interest rate risk occurred.

Active management is a strategy to foresee the movement of interest rate and analyze the market spread. Active bond portfolio management strategies comprise interest rate anticipation, valuation analysis, credit analysis, yield spread analysis and bond swap. Investor forecasts the future interest rate by using the interest rate anticipation. This strategy is useful to safeguard bond holders from encounter big losses when there is a sudden rise of interest rate. Investors able to alter the maturity and duration when they success to foresee the direction of interest rate. Bond with longer maturity and longer duration will benefit to bond holders when there is decrease of interest rate. On the other hand, they will shorten the duration of bond if the interest rate is expected to increase in future date. Besides that, portfolio manager can assess the value of bond, they can either look for undervalued bond or sell the overvalued bond based on the valuation analysis. Credit analysis is the judgment of default risk which the borrower fails to repay the debt obligation. Portfolio manager always keep track the credit analysis to verify the borrower will not default in their payment. Apart from that, to immunize the portfolio, portfolio manager should monitor the yield relationship between bonds through yield spread analysis. This analysis is pursued when bond holder believe that the yield spread between two sectors of the bond market is temporary outperform. If the yield spread is narrow, the particular bond is doing better than other bond and investor will consider replacing the bond by the particular bond. Furthermore, bond swap can be adopted when investor believe that the market has temporarily mispriced two bonds. Investor can substitutes the particular bond with another identical bond with the equal coupon, maturity, quality, call features and so on.

Contingent immunization is a technique that incorporates the passive and active management strategy. Active management is used as long as the return is above the minimum rate of return. If the return is below minimum rate, immunization strategy is commenced to reach the minimal acceptable performance.

Limitations of Duration and Immunization

Duration and immunization play important roles to help bond holders in solving potential risks especially interest rate risk. However, there are some limitations of using duration and immunization.

Firstly, if investors are not familiar with the calculation of duration, it is difficult to calculate the duration precisely.

Besides that, it only can be used to estimate the interest rate sensitivity when there is a change in interest rate that directs to a parallel shift in the yield curve. However, different maturities of bonds seldom have the same change of interest rate with the same shifting in the yield curve.

In fact, it is difficult to obtain a bond portfolio's duration equal to investor's desired holding period. The risk-free investors like shorten the holding period of bond rather than risk lovers tend to hold the long period of bond. In addition, immunization only can protect against term mismatch but not against other financial risk such as default risk.

Lastly, duration formula only shows the linear relationship between price and yield change in bonds. However, the relationship between price and yield of bond is convex, the curve line is indicated the change in price when there is change in yields. The straight line that tangent to curve line represent the expected change in price through the duration statistic.

Conclusion

Duration and immunization bring useful concept for investors but there are also some of the limitations of its uses. Overall, it is an important model for bond holders to develop investment strategy and maximize their profit in order to minimize the risk level in interest rate movement.

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