Bond Valuation Problems

1. The Par Value of the bond is Rs.1000 with coupon rate is 10% maturity of 8 yrs., YTM is 18% Find the Value of the bond and suggest if Investor can purchase it when the market price is Rs.874.75.
2. The Par Value of the bond is Rs.1000 with coupon rate is 10% maturity of 5 yrs, YTM is 8% Find the Value of the bond and suggest if Investor can purchase it when the market price is Rs.1035.66
3. The Par Value of the bond is Rs.1000 with coupon rate is 10% maturity of 5yrs, YTM is 15% Find the Value of the bond and suggest if Investor can purchase it when the market price is Rs.918.71

1.The Par Value of the bond is Rs.1000 with coupon rate is 10% maturity of 8 yrs., YTM is 18% Find the Value of the bond and suggest if Investor can purchase it when the market price is Rs.874.75

Solution 1

|  |  |  |  |
| --- | --- | --- | --- |
| Yrs | Int | YTM@18% PV @ 18% | PV |
| 1 | 100 | 0.8474 | 84.74 |
| 2 | 100 | 0.7181 | 71.81 |
| 3 | 100 | 0.6086 | 60.86 |
| 4 | 100 | 0.5157 | 51.57 |
| 5 | 100 | 0.4371 | 43.71 |
| 6 | 100 | 0.3704 | 37.04 |
| 7 | 100 | 0.3139 | 31.39 |
| 8 | 1100 | 0.2660 | 292.6 |
|  |  | Bond Value | 676.72 |

2. The Par Value of the bond is Rs.1000 with coupon rate is 10% maturity of 5 yrs, YTM is 8% Find the Value of the bond and suggest if Investor can purchase it when the market price is Rs.1035.66

|  |  |  |  |
| --- | --- | --- | --- |
| Yrs | Int | YTM@8% PV @ 8% | PV |
| 1 | 100 | 0.9259 | 92.59 |
| 2 | 100 | 0.8573 | 85.73 |
| 3 | 100 | 0.7938 | 79.38 |
| 4 | 100 | 0.7350 | 73.50 |
| 5 | 1100 | 0.6805 | 748.55 |
|  |  | Bond Value | 1079.75 |

3.The Par Value of the bond is Rs.1000 with coupon rate is 10% maturity of 5yrs, YTM is 15% Find the Value of the bond and suggest if Investor can purchase it when the market price is Rs.918.71

Bond value:- 832

Problems on YTM & AYTM

YTM= Yield to Maturity (rate of return)

YTC = Yield to Call

AYTM=Approx. Yield to Maturity

LR=Lower rate

PvLr=Present value of Lower rate

LVHR=Present value of higher rate

MP=Market price of share

I=Interest

RV=Redeemable Value

SV=Today MP

N=no of Yrs

1. A 4 yrs bond with coupon rate of 7% and the maturity value is 1000/- is currently selling at Rs 905. What is YTM?

I=70

RV=1000

SV=905

N=4

=9.84%

AYTM=9.84%

LR=7%

HR=12%

|  |  |  |  |
| --- | --- | --- | --- |
| Yrs | Int | PV @ 7% | PV |
| 1 | 70 | 0.9345 | 65.41 |
| 2 | 70 | 0.8734 | 61.13 |
| 3 | 70 | 0.8162 | 57.13 |
| 4 | 1070 | 0.7628 | 816.19 |
|  |  |  |  |
|  |  | PVLR | 999.856 |

|  |  |  |  |
| --- | --- | --- | --- |
| Yrs | Int | PV @ 12% | PV |
| 1 | 70 | 0.8928 | 62.49 |
| 2 | 70 | 0.7971 | 55.79 |
| 3 | 70 | 0.7117 | 49.81 |
| 4 | 1070 | 0.6355 | 679.98 |
|  |  |  |  |
|  |  | PVHR | 848.07 |

|  |  |
| --- | --- |
| PV LR = | 999.86 |
| PV HR | 848.07 |

YTM=7+3.125=10.125%

YTM=10.13%

1. A Bond with the face value of Rs.1000 pays a coupon rate of 9%. The maturity period is 9 yrs. selling value is RS.920 Find a) AYTM & b)YTM.

Sol:-

AYTM=10.3%

YTM=

|  |  |
| --- | --- |
| PVLR | 1062.38 |
| PVHR | 840.1 |

YTM=10.5%

A Bond of Rs. 1000 face Value bearing coupon rate of 12% will mature in 7 yrs and company as call back the bond in 4 yrs. Calculate YTC.

Sol:-

Calculate AYTM

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 10% |  |  |  | 14% |  | [PV@ 14%](mailto:PV@%2014%25) |  |
| Yrs | Int | [PV@10%](mailto:PV@10%25) | PV | Yrs | Int |  | PV |
| 1 | 120 | 0.909 | 109.08 | 1 | 120 | 0.877 | 105.24 |
| 2 | 120 | 0.8264 | 99.168 | 2 | 120 | 0.769 | 92.28 |
| 3 | 120 | 0.7513 | 90.156 | 3 | 120 | 0.674 | 80.88 |
| 4 | 1120 | 0.683 | 764.96 | 4 | 1120 | 0.592 | 663.04 |
|  |  |  |  |  |  |  |  |
|  |  | PV LR | 1063.364 |  |  | PV HR | 941.44 |

LR=10%

HR=14%

Calculate YTC

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PVLR | 1063.36 |  |  |  | PVHR | 941.61 |

YTC=12.09%

Duration: it is the measure of Time Structure and Interest rate risk

1.Determine MD of a bond that has a face value of Rs.1000 with 10% Coupon rate and 3 yrs to mature. YTM is 12%.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| yrs | Int | PV @12% | PV | W | WPV |
| 1 | 100 | 0.8928 | 89.28 | 1 | 89.28 |
| 2 | 100 | 0.7971 | 79.71 | 2 | 159.4 |
| 3 | 1100 | 0.7117 | 782.9 | 3 | 2349 |
|  |  | PV | 951.9 |  | 2597 |

|  |  |
| --- | --- |
| 951.8 | 2597.21 |

Modified Macaulay’s Duration (MMD)

2.Calculate Duration for Bond A & B with 7 % and 8 % Coupon rate having maturity of 4 yrs. The face value of the bond is Rs.1000. Both the bonds have the YTM of 6%.

Sol:-

MD

Bond A =3.63yrs

Bond B=3.59 Yrs

MMD

Bond A =

Bond B=

Modified Macaulay’s Duration

P= No of times interest is paid=1

3.Arun buys a bond with 4 yrs. Maturity. The bond has a coupon rate of 9 % and face value is Rs.100 with YTM of 12 %. Calculate MD, MMD when Interest is paid Semi Annually.

Sol:-

No of yrs = 4\*2=8

Coupon rate and YTM will be Divided by 2

Int=9/2=4.5%

YTM=12/2=6%

|  |  |
| --- | --- |
| 90.68 | 619.14 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Yr | INT | PV@ 6% | PV | W | WPV |
| 1 | 4.5 | 0.9433 | 4.24485 | 1 | 4.24485 |
| 2 | 4.5 | 0.8899 | 4.00455 | 2 | 8.0091 |
| 3 | 4.5 | 0.8396 | 3.7782 | 3 | 11.3346 |
| 4 | 4.5 | 0.7920 | 3.564 | 4 | 14.256 |
| 5 | 4.5 | 0.7471 | 3.36195 | 5 | 16.80975 |
| 6 | 4.5 | 0.7048 | 3.1716 | 6 | 19.0296 |
| 7 | 4.5 | 0.6649 | 2.99205 | 7 | 20.94435 |
| 8 | 104.5 | 0.6273 | 65.55285 | 8 | 524.4228 |

|  |  |  |
| --- | --- | --- |
| PV =90.67005 |  | WpV=619.0511 |

Holding period Returns

1. An Investor “A” Purchased a bond at a price of Rs 900 with Rs 100 as coupon payment and sold at Rs.1000. What is the holding period Return?

Sol:- Price at beginning=900

Int=100

Gain=1000-900=100

1. If a bond sold for Rs.750 after receiving coupon payment What is the holding period Return?

Sol:- Price at beginning=900

Int=100

Gain=750-900=-150

Current Yield

If the MP of the bond is Rs 80 and FV is 100 with coupon rate of 8%Calculate Current Yield.

Int= 8

Theorem 1

If the Market Price of the bond increases, the yield would Decline and vice Versa.

Theorem 2

If the bond YTM remains same over its Life the dis or Premium Depends on the Maturity Period, this means the bond with shorter term to mature sells at lower dis than the bond with longer time to mature.

**Theorem 3:**

The increase in the price of a bond when the interest rate goes down by a certain percentage is greater than the decrease in its price when the interest rate goes up by the same percentage.

In other words, given the same level of say 1 % change in interest rate, the price appreciation on account of interest rate going down by 1 % is greater than the price depreciation on account of interest rate going down by 1%..

**Theorem 4:**

Between two bonds of same maturity but different coupons, the bond with the lower coupon will experience more price sensitivity than the one with higher coupon.

**Theorem 5:**

Between two bonds of same coupon and same maturity but differing coupon payment intervals, the bond with higher frequency of coupon payment is less sensitive to price changes when market interest rate changes.

Bond convexity

In [finance](https://en.wikipedia.org/wiki/Finance), bond convexity is a measure of the non-linear relationship of bond prices to changes in [interest rates](https://en.wikipedia.org/wiki/Interest_rate), the [second derivative](https://en.wikipedia.org/wiki/Second_derivative) of the price of the bond with respect to interest rates ([duration](https://en.wikipedia.org/wiki/Bond_duration) is the first derivative).

In general, the higher the duration, the more sensitive the bond price is to the change in interest rates.

Bond convexity is one of the most basic and widely used forms of [convexity in finance](https://en.wikipedia.org/wiki/Convexity_(finance)). Convexity was based on the work of Hon-Fei Lai and popularized by Stanley Diller.

Bond immunization

Bond immunization is an investment strategy used to minimize the interest rate risk ofbond investments by adjusting the portfolio duration to match the investor's investment time horizon.

It does this by locking in a fixed rate of return during the amount of time an investor plans to keep the investment without cashing it in.

Immunization locks in a fixed rate of return during the amount of time an investor plans to keep the bond without cashing it in.

Normally, interest rates affect bond prices inversely. When interest rates go up, bond prices go down. But when a bond portfolio is immunized, the investor receives a specific rate of return over a given time period regardless of what happens to interest rates during that time. In other words, the bond is "immune" to fluctuating interest rates.

To immunize a bond portfolio, you need to know the duration of the bonds in the portfolio and adjust the portfolio so that the portfolio's duration equals the investment time horizon. For example, suppose you need to have $50,000 in five years for your child's education. You might decide to invest in bonds. You can immunize your bond portfolio by selecting bonds that will equal exactly $50,000 in five years regardless of interest rate changes. You can buy one zero-coupon bond that will mature in five years to equal $50,000, or several coupon bonds each with a five year duration, or several bonds that "average" a five-year duration.

Duration measures a bond's market risk and price volatility in response to a given change in interest rates. Duration is a weighted average of the bond's cash flows over its life. The weights are the present value of each interest payment as a percentage of the bond's full price. The longer the duration of a bond, the greater its price volatility. Duration is used to determine how a bond will react to changing interest rates. For example, if interest rates rise 1%, a bond with a two-year duration will fall about 2% in value.

You needn't worry about doing the calculations as you can obtain a bond's (or bond fund's) duration from a broker or advisor. Using bonds' durations, you can build a bond portfolio immune to interest rate risk.

## Passive Bond Management Strategy

The passive buy-and-hold investor is typically looking to maximize the income-generating properties of bonds. The premise of this strategy is that bonds are assumed to be safe, predictable sources of income. Buy and hold involves purchasing individual bonds and holding them to maturity. Cash flow from the bonds can be used to fund external income needs or can be reinvested in the portfolio into other bonds or other asset classes.

In a passive strategy, there are no assumptions made as to the direction of future interest rates and any changes in the current value of the bond due to shifts in the yield are not important. The bond may be originally purchased at a premium or a discount while assuming that full par will be received upon maturity. The only variation in total return from the actual coupon yield is the reinvestment of the coupons as they occur.

On the surface, this may appear to be a lazy style of investing, but in reality, passive bond portfolios provide stable anchors in rough financial storms. They minimize or eliminate [transaction costs](https://www.investopedia.com/terms/t/transactioncosts.asp), and if originally implemented during a period of relatively high interest rates, they have a decent chance of outperforming active strategies.

One of the main reasons for their stability is the fact that passive strategies work best with very high-quality, non-callable bonds like government or investment grade corporate or municipal bonds. These types of bonds are well suited for a buy-and-hold strategy as they minimize the risk associated with changes in the income stream due to embedded options, which are written into the bond's covenants at issue and stay with the bond for life. Like the stated coupon, call and put features embedded in a bond allow the issue to act on those options under specified market conditions.

## Indexing Bond Strategy

Indexing is considered to be quasi-passive by design. The main objective of indexing a bond portfolio is to provide a return and risk characteristic closely tied to the targeted index. While this strategy carries some of the same characteristics of the passive buy-and-hold, it has some flexibility. Just like tracking a specific stock market index, a bond portfolio can be structured to mimic any published bond index. One common index mimicked by portfolio managers is the Barclays U.S. Aggregate Bond Index.

Due to the size of this index, the strategy would work well with a large portfolio due to the number of bonds required to replicate the index. One also needs to consider the transaction costs associated with not only the original investment, but also the periodic [rebalancing](https://www.investopedia.com/terms/r/rebalancing.asp) of the portfolio to reflect changes in the index.

## Immunization Bond Strategy

This strategy has the characteristics of both active and passive strategies. By definition, pure immunization implies that a portfolio is invested for a defined return for a specific period of time regardless of any outside influences, such as changes in interest rates.

Similar to indexing, the opportunity cost of using the immunization strategy is potentially giving up the upside potential of an active strategy for the assurance that the portfolio will achieve the intended desired return. As in the buy-and-hold strategy, by design, the instruments best suited for this strategy are high-grade bonds with remote possibilities of default.

In fact, the purest form of immunization would be to invest in a [zero-coupon bond](https://www.investopedia.com/terms/z/zero-couponbond.asp) and match the maturity of the bond to the date on which the cash flow is expected to be needed. This eliminates any variability of return, positive or negative, associated with the reinvestment of cash flows.

Duration, or the average life of a bond, is commonly used in immunization. It is a much more accurate predictive measure of a bond's volatility than maturity. A duration strategy is commonly used in the institutional investment environment by insurance companies, pension funds, and banks to match the time horizon of their future liabilities with structured cash flows. It is one of the soundest strategies and can be used successfully by individuals.

For example, just like a pension fund would use an immunization to plan for cash flows upon an individual's retirement, that same individual could build a dedicated portfolio for their own retirement plan.

## Active Bond Strategy

The goal of [active management](https://www.investopedia.com/terms/a/activemanagement.asp) is maximizing total return. Along with the enhanced opportunity for returns obviously comes increased risk. Some examples of active styles include interest rate anticipation, timing, valuation, and spread exploitation, and multiple interest rate scenarios. The basic premise of all active strategies is that the investor is willing to make bets on the future rather than settle with the potentially lower returns a passive strategy can offer.