Chapter 13: Fixed Income Securities

The lowest of these yields is called the **yield-to-worst**.

\[ YTW = \text{Min}[y_{t_1}, y_{t_2}, \ldots, y_{t_k}] = \text{Yield to worst, given } P \]

If the bond is not redeemed until maturity, then its yield is known as its **yield-to-maturity**:

\[ YTM = \text{Yield to maturity} = y_{t_k} \]

For a given yield \( y \), there are \( k \) possible prices, depending on when the bond is redeemed. Each of these prices is a price to redemption (PTR):

\[ PTR_{t_1}, PTR_{t_2}, \ldots, PTR_{t_k} \]

We call the minimum of these prices the **price-to-worst**, which is denoted by \( PTW \):

\[ PTW = \text{Min}[PTR_{t_1}, PTR_{t_2}, \ldots, PTR_{t_k}] = \text{Minimum price, given } y \]

If a \( YTW \) is used to calculate a \( PTW \), then the resulting price is the price that was originally used to calculate the \( YTW \). And if a \( PTW \) is used to calculate a \( YTW \), then the resulting yield is the yield that was originally used to calculate the \( PTW \).

**Example 13.07**

A 4-year bond makes annual coupon payments at an annual rate 10% per year. The par value is $100. The annual effective yield is 6.50% per year.

The bond is callable after 1 year for $110, after 2 years for $106, and after 3 years for $104. The redemption value after 4 years is $100.

Calculate the price-to-worst.

**Solution**

Let's use the BA II Plus to obtain the 4 possible prices to redemption.

1 \[ N \] 6.5 \[ I/Y \] 10 \[ PMT \] 110 \[ FV \] [CPT] [PV]

\[ \text{Result is } -112.68. \quad PTR_1 = 112.68 \]

2 \[ N \] 106 \[ FV \] [CPT] [PV]

\[ \text{Result is } -111.66. \quad PTR_2 = 111.66 \]

3 \[ N \] 104 \[ FV \] [CPT] [PV]

\[ \text{Result is } -112.58. \quad PTR_3 = 112.58 \]

4 \[ N \] 100 \[ FV \] [CPT] [PV]

\[ \text{Result is } -111.99. \quad PTR_4 = 111.99 \]

The price-to-worst is:

\[ PTW = \text{Min}[-112.68, 111.66, 112.58, 111.99] = 111.66 \]

In the next example, we use the same bond as in the example above, and we use the \( PTW \) to find the \( YTW \).

**Example 13.08**

A 4-year bond makes annual coupon payments at an annual rate 10% per year. The par value is $100. The price of the bond is $111.66.

The bond is callable after 1 year for $110, after 2 years for $106, and after 3 years for $104. The redemption value after 4 years is $100.

Calculate the yield-to-worst.

**Solution**

Let's use the BA II Plus to obtain the 4 possible yields.

1 \[ N \] -111.66 \[ PV \] 10 \[ PMT \] 110 \[ FV \]