FIN221: Lecture 7 Notes

Chapters 8 and 9

Bond Yields and Prices

Chapter 8
Charles P. Jones, Investments: Analysis and Management,
Eighth Edition, John Wiley & Sons
Prepared by
G.D. Koppenhaver, Iowa State University

Interest Rates

- Rates and basis points
  - 100 basis points are equal to one percentage point
- Short-term riskless rate
  - Provides foundation for other rates
  - Approximated by rate on Treasury bills
  - Other rates differ because of
    - Maturity differentials
    - Security risk premiums

Interest Rates

- Maturity differentials
  - Term structure of interest rates
    - Accounts for the relationship between time and yield for bonds the same in every other respect
- Risk premium
  - Yield spread or yield differential
  - Associated with issuer's particular situation

Determinants of Interest Rates

- Real rate of interest
  - Rate that must be offered to persuade individuals to save rather than consume
  - Rate at which real capital physically reproduces itself
- Nominal interest rate
  - Function of the real rate of interest and expected inflation premium

Determinants of Interest Rates

- Market interest rates on riskless debt ≈ real rate +expected inflation
  - Fisher Hypothesis
- Real rate estimates obtained by subtracting the expected inflation rate from the observed nominal rate
- Real interest rate is an ex ante concept

Measuring Bond Yields

- Yield to maturity
  - Most commonly used
  - Promised compound rate of return received from a bond purchased at the current market price and held to maturity
  - Equates the present value of the expected future cash flows to the initial investment
    - Similar to internal rate of return

Yield to Maturity

- Solve for YTM:

$$P = \sum_{t=1}^{2n} \frac{C_t/2}{(1+\text{YTM}/2)^t} + \frac{MV}{(1+\text{YTM}/2)^{2n}}$$

  - For a zero coupon bond

$$\text{YTM} = 2 \times \{[MV/P]^{1/2n} - 1\}$$

- Investors earn the YTM if the bond is held to maturity and all coupons are reinvested at YTM

Yield to Call

- Yield based on the deferred call period
- Substitute number of periods until first call date for and call price for face value

$$\mathbf{P} = \sum_{t=1}^{2c} \frac{\mathbf{C_t/2}}{\mathbf{(1+YTC/2)^t}} + \frac{\mathbf{CP}}{\mathbf{(1+YTC/2)^{2c}}}$$

Realized Compound Yield

- Rate of return actually earned on a bond given the reinvestment of the coupons at varying rates

$$\mathbf{RCY} = \left[\frac{\mathbf{Total\ future\ dollars}}{\mathbf{Purchase\ price\ of\ bond}}\right]^{1/2n} \mathbf{- 1.0}$$

- Horizon return analysis
  - Bond returns based on assumptions about reinvestment rates

Bond Valuation Principle

- Intrinsic value
  - An estimated value
  - Present value of the expected cash flows
  - Required to compute intrinsic value
    - Expected cash flows
    - Timing of expected cash flows
    - Discount rate, or required rate of return by investors

Bond Valuation

- Value of a coupon bond:

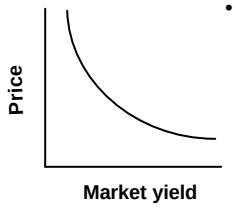
$$\mathbf{V} = \sum_{t=1}^{2n} \frac{\mathbf{C_t/2}}{\mathbf{(1+r/2)^t}} + \frac{\mathbf{MV}}{\mathbf{(1+r/2)^{2n}}}$$

- Biggest problem is determining the discount rate or required yield
- Required yield is the current market rate earned on comparable bonds with same maturity and credit risk

Bond Price Changes

- Over time, bond prices that differ from face value must change
- Bond prices move inversely to market yields
- The change in bond prices due to a yield change is directly related to time to maturity and indirectly related to coupon rate

Bond Price Changes



- Holding maturity constant, a rate decrease will raise prices a greater percent than a corresponding increase in rates will lower prices

Measuring Bond Price Volatility: Duration

- Important considerations
  - Different effects of yield changes on the prices and rates of return for different bonds
  - Maturity inadequate measure of volatility
  - May not have identical economic lifetime
  - A measure is needed that accounts for both size and timing of cash flows

Duration

- A measure of a bond's lifetime, stated in years, that accounts for the entire pattern (both size and timing) of the cash flows over the life of the bond
- The weighted average maturity of a bond's cash flows
  - Weights determined by present value of cash flows

Calculating Duration

- Need to time-weight present value of cash flows from bond

$$\mathbf{D} = \sum_{t=1}^{n} \frac{\mathbf{PV(CF}_t\mathbf{)}}{\mathbf{Market\ Price}} \times \mathbf{t}$$

- Duration depends on three factors
  - Maturity of the bond
  - Coupon payments
  - Yield to maturity

Duration Relationships

- Duration increases with time to maturity but at a decreasing rate
  - For coupon paying bonds, duration is always less than maturity
  - For zero coupon-bonds, duration equals time to maturity
- Duration increases with lower coupons
- Duration increases with lower yield to maturity

Why is Duration Important?

- Allows comparison of effective lives of bonds that differ in maturity, coupon
- Used in bond management strategies particularly immunization
- Measures bond price sensitivity to interest rate movements, which is very important in any bond analysis

Estimating Price Changes Using Duration

- Modified duration =D*=D/(1+r)
- D*can be used to calculate the bond's percentage price change for a given change in interest rates

$$\%\,\Delta \text{ in bond price} \approx \frac{-D}{(1+r)} \times \Delta r$$

Convexity

- Refers to the degree to which duration changes as the yield to maturity changes
  - Price-yield relationship is convex
- Duration equation assumes a linear relationship between price and yield
- Convexity largest for low coupon, long-maturity bonds, and low yield to maturity

Duration Conclusions

- To obtain maximum price volatility, investors should choose bonds with the longest duration
- Duration is additive
  - Portfolio duration is just a weighted average
- Duration measures volatility which isn't the only aspect of risk in bonds

Bonds: Analysis and Strategy

Chapter 9
Charles P. Jones, Investments: Analysis and Management, Eighth Edition, John Wiley & Sons
Prepared by
G. D. Koppenhaver, Iowa State University

Why Buy Bonds?

- Attractive to investors seeking steady income and aggressive investors seeking capital gains
- Promised yield to maturity is known at the time of purchase
- Can eliminate risk that a rise in rates decreases bond price by holding to maturity

The Case Against Buying Bonds

- Don't hold bonds unless investing strictly for income
  - Capital appreciation negative 1926-96
- Alternative: a combination of cash investments and stocks
- Investors should consider whether they could build better portfolios that do not include bonds

Rates of Return on Bonds and Bills

Series 1926-93	Geometric Mean (%)	Arithmetic Mean (%)	Standard Deviation (%)
Long-term corporate bonds	5.6	5.9	8.4
Long-term government bonds	5.0	5.4	8.7
Intermediate government bonds	5.3	5.4	5.6
U.S. Treasury bills	3.7	3.7	3.3
Inflation	3.1	3.2	4.6

Buying Foreign Bonds

- Why?
  - Foreign bonds may offer higher returns at a point in time than alternative domestic bonds
  - Diversification
- Can be costly and time-consuming
  - Illiquid markets
  - Transaction costs and exchange rate risk

Understanding the Bond Market

- Benefits from a weak economy
  - Interest rates decline and bond prices increase
- Important relationship is between bond yields and inflation rates
  - Investors react to expectations of future inflation rather than current actual inflation

The Term Structure of Interest Rates

- Term structure of interest rates
  - Relationship between time to maturity and yields
- Yield curves
  - Graphical depiction of the relationship between yields and time for bonds that are identical except for maturity
    - Default risk held constant

Term Structure of Interest Rates

- Upward-sloping yield curve
  - typical, interest rates rise with maturity
- Downward-sloping yield curves
  - Unusual, predictor of recession?
- Term structure theories
  - Explanations of the shape of the yield curve and why it changes shape over time

Pure Expectations Theory

- Long-term rates are an average of current short-term rates and those expected to prevail over the long-term period
  - Average is geometric rather than arithmetic
- If expectations otherwise, the shape of the yield curve will change

Liquidity Preference Theory

- Rates reflect current and expected short rates, plus liquidity risk premiums
- Liquidity premium to induce long term lending
  - Implies long-term bonds should offer higher yields
- Interest rate expectations are uncertain

Preferred Habitat Theory

- Investors have preferred maturities
  - Borrowers and lenders can be induced to shift maturities with appropriate risk premium compensation
  - Shape of yield curve reflects relative supplies of securities in each sector
- Most market observers are not firm believers in any one theory

Risk Structure of Rates

- Yield spreads
  - Relationship between yields and the particular features on various bonds
- Yield spreads are a result of
  - Differences in: quality, coupon rates, callability, marketability, tax treatments, issuing country

Passive Bond Strategies

- Investors do not actively seek out trading possibilities in an attempt to outperform the market
  - Bond prices fairly determined
  - Risk is the portfolio variable to control
- Investors do assess default and call risk
  - Diversify bond holdings to match preferences

Passive Bond Strategies

- Buy and hold
  - Choose most promising bonds that meet the investor's requirements
  - No attempt to trade in search of higher returns
- Indexing
  - Attempt to match performance of a well known bond index
  - Indexed bond mutual funds

Immunization

- Used to protect a bond portfolio against interest rate risk
  - Price risk and reinvestment risk cancel
- Price risk results from relationship between bond prices and rates
- Reinvestment risk results from uncertainty about the reinvestment rate for future coupon income

Immunization

- Risk components move in opposite directions
  - Favorable results on one side can be used to offset unfavorable results on the other
- Portfolio immunized if the duration of the portfolio is equal to investment horizon
  - Like owning zero-coupon bond

Active Bond Strategies

- Requires a forecast of changes in interest rates
  - Lengthen (shorten) maturity of bond portfolio when interest rates are expected to decline (rise)
- Horizon analysis
  - Projection of bond performance over investment horizon given reinvestment rates and future yield assumptions

Active Bond Strategies

- Identify mispricing among bonds then swap
  - Substitution swap, yield pickup swap, rate anticipation swap, sector swap
- Interest rate swaps
  - Exchange a series of cash flows
  - Convert from fixed- to floating-rate
  - Primarily used to hedge interest rate risk

Building a Fixed-Income Portfolio

- If conservative investor
  - View bonds as fixed-income securities that will pay them a steady stream of income with little risk
  - Buy and hold Treasury securities
- Conservative investor should consider:
  - Maturity, reinvestment risk, rate expectations, differences in coupons, indirect investing

Building a Fixed Income Portfolio

- If aggressive investor
  - View bonds as source of capital gains arising from changes in interest rates
  - Treasury bonds can be bought on margin to further magnify gains (or losses)
  - Seek the highest total return
- International bonds
  - Direct or indirect investment