

Lecture 3

Bond Valuation

FINA 614

Bond Definitions

- Bond
- Par value (face value)
- Coupon rate
- Coupon payment
- Maturity date
- Yield or Yield to maturity

Valuing a Discount Bond with Annual Coupons

- Consider a bond with a coupon rate of 10% and coupons paid annually. The par value is \$1000 and the bond has 5 years to maturity. The yield to maturity is 11%. What is the value of the bond?
 - Using the formula:
 - $B = \text{PV of annuity} + \text{PV of lump sum}$
 - $B = 100[1 - 1/(1.11)^5] / .11 + 1000 / (1.11)^5$
 - $B = 369.59 + 593.45 = 963.04$
 - Using the calculator:
 - $N = 5; I/Y = 11; PMT = 100; FV = 1000$
 - $\text{CPT PV} = -963.04$

The Bond-Pricing Equation

$$\text{Bond Value} = C \left[\frac{1 - \frac{1}{(1+r)^t}}{r} \right] + \frac{F}{(1+r)^t}$$

Example – Semiannual Coupons

- Most bonds in Canada make coupon payments semiannually.
- Suppose you have an 8% semiannual-pay bond with a face value of \$1,000 that matures in 7 years. If the yield is 10%, what is the price of this bond?
 - The bondholder receives a payment of \$40 every six months (a total of \$80 per year)
 - The market automatically assumes that the yield is compounded semiannually
 - The number of semiannual periods is 14

Example – Semiannual Coupons continued

$$\text{Bond Price} = 40 \times \frac{\left[1 - \frac{1}{1.05^{14}}\right]}{0.05} + \frac{1,000}{1.05^{14}} = 901.01$$

– Or PMT = 40; N = 14; I/Y = 5; FV = 1000; CPT PV = -901.01

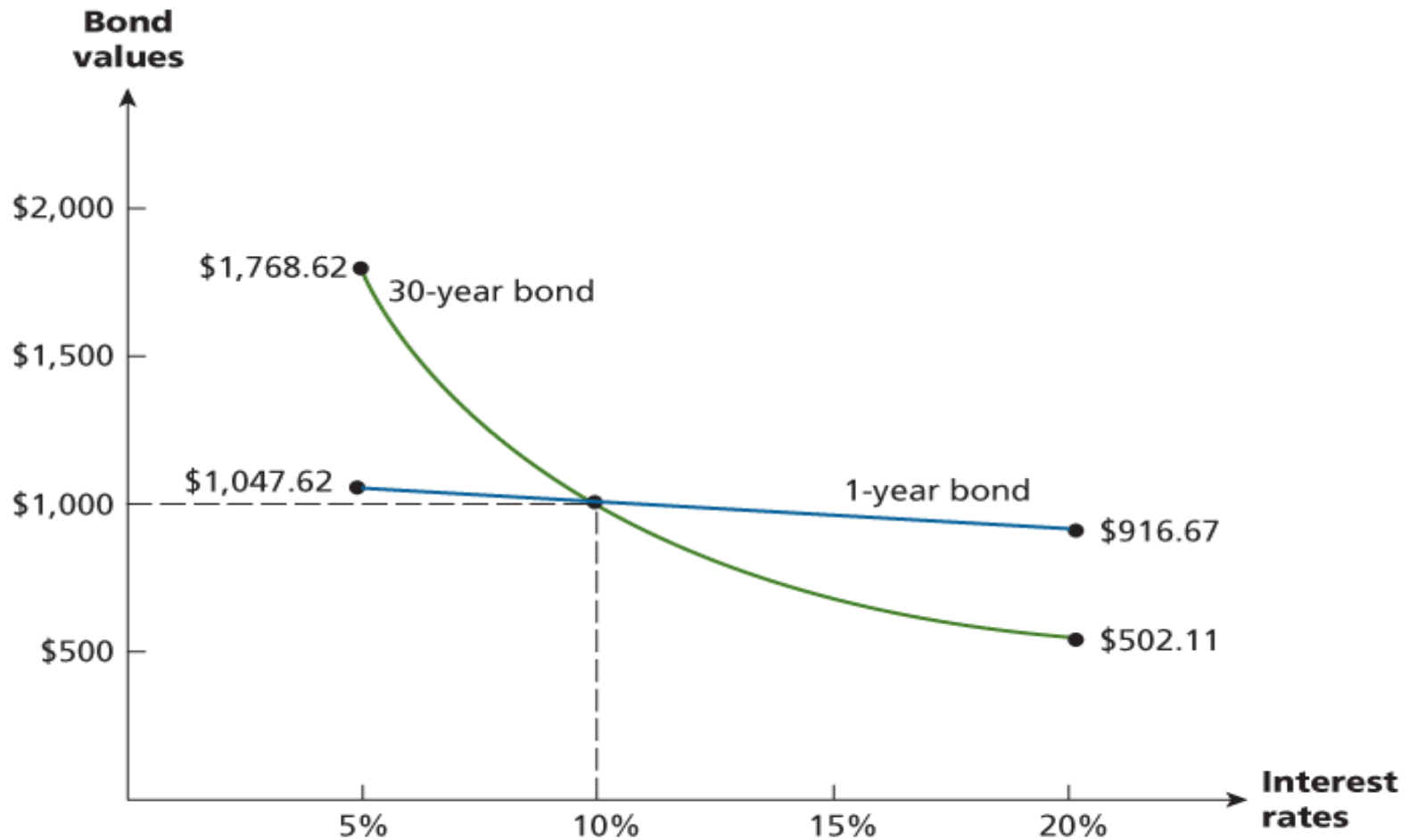
Bond Prices: Relationship Between Coupon and Yield

- If $YTM = \text{coupon rate}$, then $\text{par value} = \text{bond price}$
- If $YTM > \text{coupon rate}$, then $\text{par value} > \text{bond price}$
 - Why?
 - Selling at a discount, called a discount bond
- If $YTM < \text{coupon rate}$, then $\text{par value} < \text{bond price}$
 - Why?
 - Selling at a premium, called a premium bond

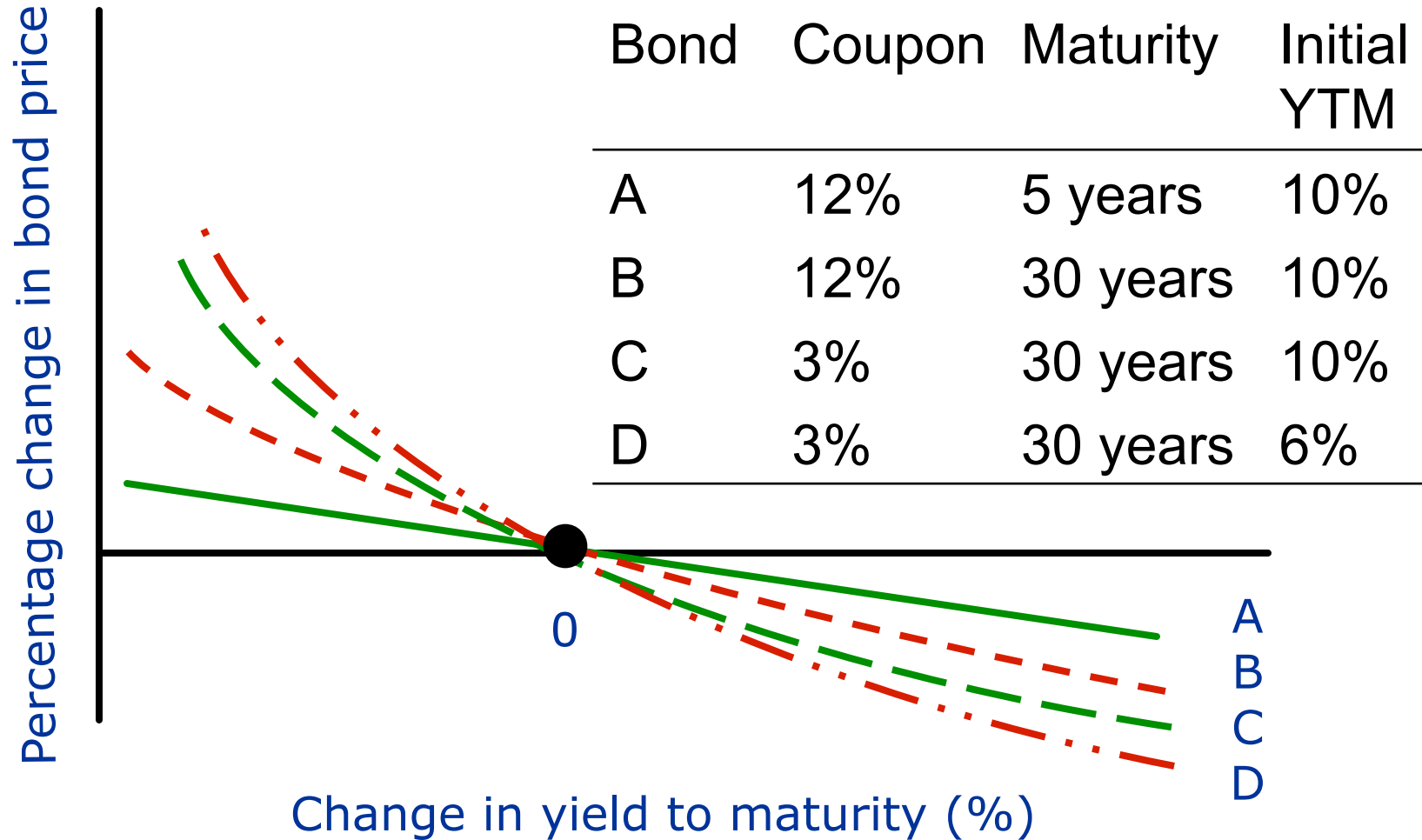
Interest Rate Risk

- Price Risk
 - Change in price due to changes in interest rates
 - Long-term bonds have more price risk than short-term bonds
- Reinvestment Rate Risk
 - Uncertainty concerning the interest rates at which cash flows can be reinvested
 - Short-term bonds have more reinvestment rate risk than long-term bonds

Interest Rate Risk and Time to Maturity



Interest Rate Sensitivity



Bond Pricing Theorems

- Bonds of similar risk (and maturity) will be priced to yield about the same return, regardless of the coupon rate
- If you know the price of one bond, you can estimate its YTM and use that to find the price of the second bond
- This is a useful concept that can be transferred to valuing assets other than bonds

Differences Between Debt and Equity Continued

- Equity
 - Ownership interest
 - Common shareholders vote for the board of directors and other issues
 - Dividends are not considered a cost of doing business and are not tax deductible
 - Dividends are not a liability of the firm and shareholders have no legal recourse if dividends are not paid
 - An all equity firm can not go bankrupt

The Bond Indenture

- Contract between the company and the bondholders; includes:
 - The basic terms of the bonds
 - The total amount of bonds issued
 - A description of property used as security, if applicable
 - Sinking fund provisions
 - Call provisions
 - Details of protective covenants

Bond Classifications

- Registered vs. Bearer Forms
- Security
 - Collateral – secured by financial securities
 - Mortgage – secured by real property, normally land or buildings
 - Debentures – unsecured debt with original maturity of 10 years or more
 - Notes – unsecured debt with original maturity less than 10 years
- Seniority
 - Sinking Fund – Account managed by the bond trustee for early bond redemption

Bond Classifications Continued

- Call Provision
 - Call premium
 - Deferred call
 - Call protected
 - Canada plus call
- Protective Covenants
 - Negative covenants
 - Positive covenants

Bond Characteristics and Required Returns

- The coupon rate depends on the risk characteristics of the bond when issued
- Which bonds will have the higher coupon, all else equal?
 - Secured debt versus a debenture
 - Subordinated debenture versus senior debt
 - A bond with a sinking fund versus one without
 - A callable bond versus a non-callable bond

Bond Ratings – Investment Quality

- High Grade
 - DBRS's AAA – capacity to pay is exceptionally strong
 - DBRS's AA – capacity to pay is very strong
- Medium Grade
 - DBRS's A – capacity to pay is strong, but more susceptible to changes in circumstances
 - DBRS's BBB – capacity to pay is adequate, adverse conditions will have more impact on the firm's ability to pay

Bond Ratings - Speculative

- Low Grade
 - DBRS's BB, B, CCC, CC
 - Considered speculative with respect to capacity to pay.
- Very Low Grade
 - DBRS's C – bonds are in immediate danger of default
 - DBRS's D – in default, with principal and/or interest in arrears

Stripped or Zero-Coupon Bonds

- Make no periodic interest payments (coupon rate = 0%)
- The entire yield-to-maturity comes from the difference between the purchase price and the par value
- Cannot sell for more than par value
- Sometimes called zeroes, or deep discount bonds
- Bondholder must pay taxes on accrued interest every year, even though no interest is received

Floating Rate Bonds

- Coupon rate floats depending on some index value
- There is less price risk with floating rate bonds
 - The coupon floats, so it is less likely to differ substantially from the yield-to-maturity
- Coupons may have a “collar” – the rate cannot go above a specified “ceiling” or below a specified “floor”

Other Bond Types

- Catastrophe bonds
- Income bonds
- Convertible bonds
- Put bond (retractable bond)
- There are many other types of provisions that can be added to a bond and many bonds have several provisions – it is important to recognize how these provisions affect required returns

Bond Markets

- Primarily over-the-counter transactions with dealers connected electronically
- Extremely large number of bond issues, but generally low daily volume in single issues
- Makes getting up-to-date prices difficult, particularly on small corporate issues
- Treasury securities are an exception

Bond Quotations

- From Figure 7.3

Canada 10.5 Mar 15/21 169.37 3.43

- Issue is a Government of Canada bond
- Coupon rate is 10.5% (assumed to be semiannual)
- Maturity date is March, 15, 2021
- Price that a bondholder can sell for is \$1,693.70
- Yield to maturity is 3.43% compounded semiannually

Inflation and Interest Rates

- Real rate of interest – compensation for change in purchasing power
- Nominal rate of interest – quoted rate of interest, includes compensation for change in purchasing power and inflation

The Fisher Effect

- The Fisher Effect defines the relationship between real rates, nominal rates and inflation
- Exact relationship is $(1 + R) = (1 + r)(1 + h)$, where:
 - R = nominal rate
 - r = real rate
 - h = expected inflation rate
- Approximation of the above relationship is:
 - $R = r + h$

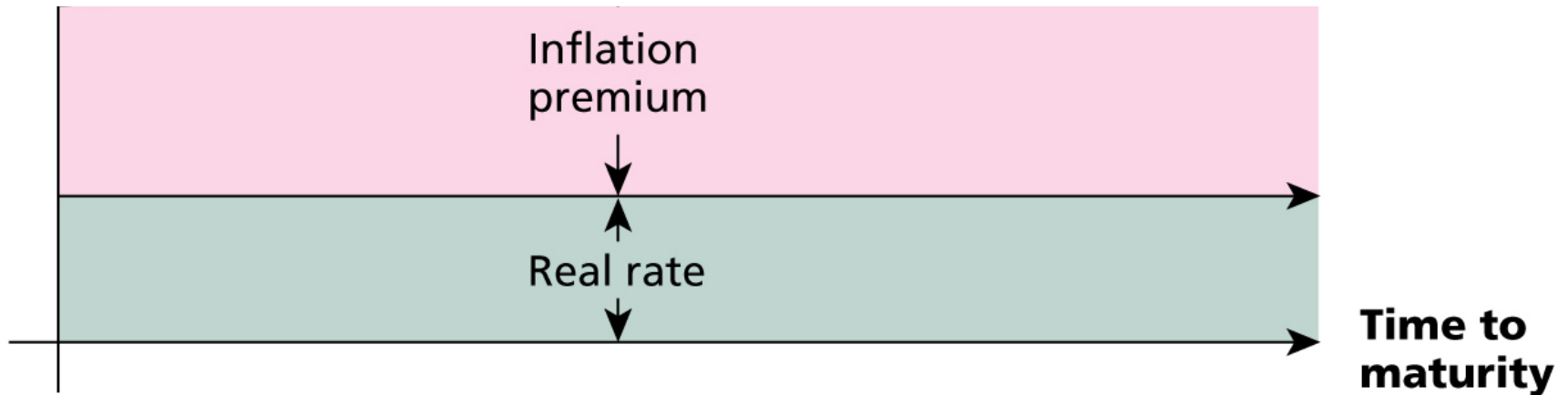
Example – Fisher Effect

- If we require a 10% real return and we expect inflation to be 8%, what is the nominal rate?
- $R = (1.1)(1.08) - 1 = .188 = 18.8\%$
- Approximation: $R = 10\% + 8\% = 18\%$
- Since the real return and expected inflation are relatively high, there is significant difference between the actual Fisher Effect and the approximation.

Term Structure of Interest Rates

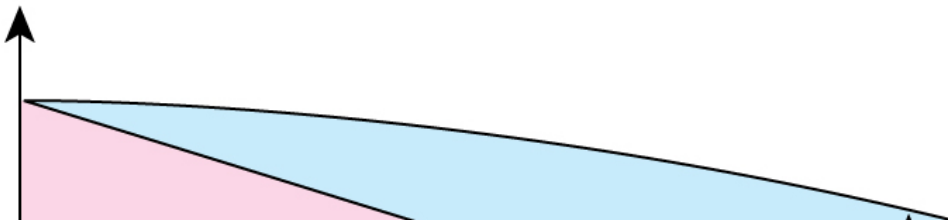
- Term structure is the relationship between time to maturity and yields, all else equal
- It is important to recognize that we pull out the effect of default risk, different coupons, etc.
- Yield curve – graphical representation of the term structure
 - Normal – upward-sloping, long-term yields are higher than short-term yields
 - Inverted – downward-sloping, long-term yields are lower than short-term yields

– Upward-Sloping Yield Curve



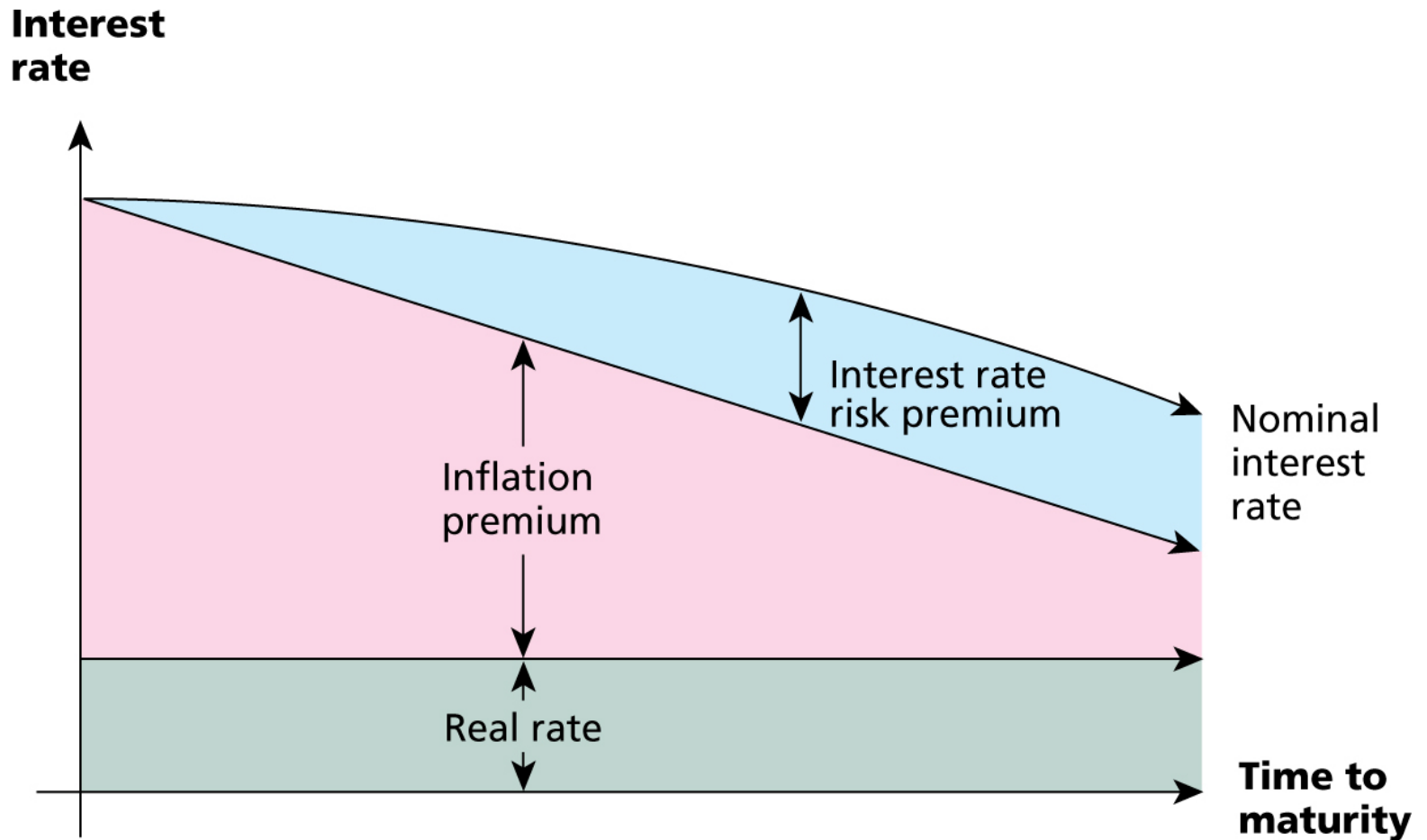
B. Downward-sloping term structure

Interest rate

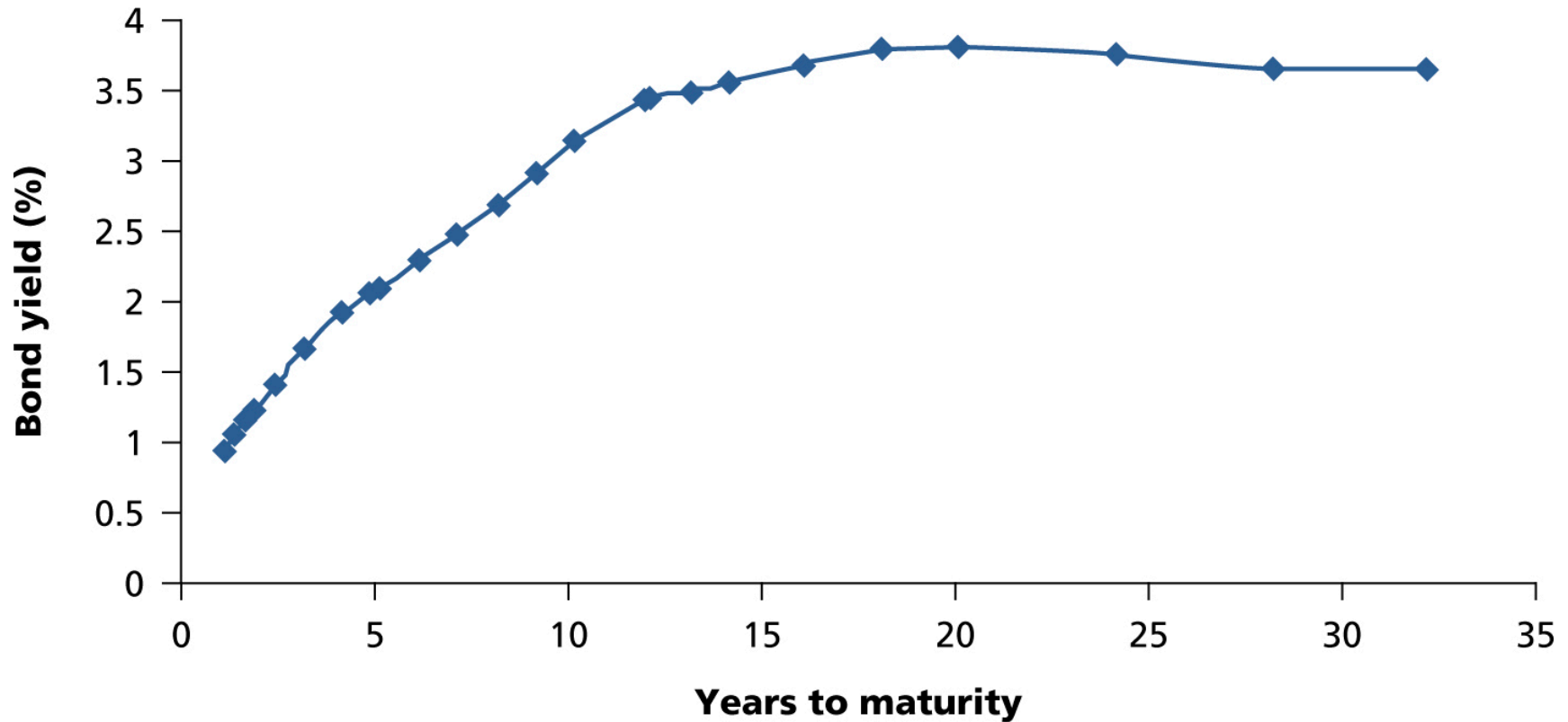


Downward-Sloping Yield Curve

B. Downward-sloping term structure



Government of Canada Yield Curve February 13, 2009



Factors Affecting Required Return

- Default risk premium – remember bond ratings
- Liquidity premium – bonds that have more frequent trading will generally have lower required returns
- Anything else that affects the risk of the cash flows to the bondholders, will affect the required returns