The Risk and Term Structure of Interest Rates

Prof. Irina A. Telyukova
UBC Economics 345
Fall 2008
Outline

- We have now figured out how interest rates are calculated (yield to maturity) and how they are determined (in the equilibrium of the bond market).

- But different bonds have different interest rates:
  - Bonds of the same term to maturity have differing interest rates because of risk, liquidity, taxes → risk and liquidity structure of interest rates.
  - Bonds of the same risk and liquidity characteristics but differing terms to maturity have differing returns → term structure of interest rates.
I. Risk Structure of Interest Rates

- The risk of default is an important determinant of the yield on a bond:
  - The Government of Canada is not likely to default on its debts - its bonds are default-free.
  - Corporations, on the other hand, could suffer losses and end up defaulting on their bonds - corporate bonds are more risky.
- Interest rates on these two bonds would be different; the difference amount is the risk premium
  - People have to be compensated for the additional risk
A bond with default risk will always have a positive risk premium; an increase in its default risk will raise the risk premium.
Importance of Risk

- The risk of default affects the interest rate on the bond through its risk premium

- In order to understand the bond’s default risk, investors turn to rating agencies:
  - BBB-AAA are investment-grade securities
  - BB or below are speculative-grade securities (junk bonds)

- Rating agencies employ models that assess the probability of default of the issuer organization
  - Sometimes they get it wrong: subprime-mortgage securities
Risk Premia over Time

Annual Yield (%)

- Canadas
- Provincials
- Corporates

Years:
- 1978
- 1980
- 1982
- 1984
- 1986
- 1988
- 1990
- 1992
- 1994
- 1996
- 1998
- 2000
- 2002
- 2004
- 2006
Risk Premia over Time

Corporates-Canada Spread

Risk Premium (%)

Not Just Risk: Liquidity and Taxes

- Canada bonds are more liquid than corporate bonds - easier to sell; fewer bonds for any given corporation are traded.
  - Relatively less liquid bonds will have lower demand/have higher interest rates
  - The spread in yields has full name of *risk and liquidity premium*.

- Income tax considerations
  - A bond with lower interest rate could yield higher final return if it is tax-exempt, relative to a higher-interest bond that is subject to taxation.
  - Effect of tax is different depending on tax bracket.
II. Term Structure of Interest Rates

- Bonds with identical risk/liquidity/tax characteristics but differing terms to maturity tend to have different interest rates.

- The yield curve plots yields of such bonds across maturity terms.
  - Upward-sloping, flat or inverted (downward-sloping)
Theories of the Term Structure

- Explain different possible shapes of yield curves

- Explain the following three data facts about term structure:
  - Interest rates on bonds of differing maturities tend to move together
  - When short-term interest rates are low, the yield curve tends to slope up. If short-term rates are high, the yield curve tends to slope down.
  - Yield curves mostly tend to slope up.
Four Theories

- **Expectations Theory**
  - Explains facts 1 and 2, but not 3

- **Segmented Markets Theory**
  - Explains fact 3, but not 1 and 2

- **Liquidity Premium Theory and Preferred Habitat Theory**
  - Combine expectations and segmented markets theories, explain all 3 facts
Expectations Theory

- The interest rate on a long-term bond will equal the average of short-term interest rates that people expect to occur over the life of the long-term bond.
  - Short-term interest rates are expected to change in the future, so long-term interest rates will be different from short-term ones.

- Thus, bonds of different maturities are *perfect substitutes*.
**Expectations Theory**

- To be indifferent between investing in 2 1-year bonds consecutively (interest rates $i_t$, $i_{t+1}^e$), and investing in a 2-year bond (interest rate $i_{2t}$), we need
  
  $i_{2t} = \frac{(i_t + i_{t+1}^e)}{2}$

- More generally, the return on a bond of n-year maturity must satisfy
  
  $i_{nt} = \frac{(i_t + i_{t+1}^e + ... + i_{t+n-1}^e)}{n}$
Expectations Theory

Shapes of the yield curve:

- If short-term interest rates are expected to rise in the future, the yield curve is upward-sloping
- If short-term interest rates are expected to fall in the future, the yield curve is downward-sloping
- If short-term interest rates are expected to stay constant in the future, the yield curve is flat

- A rise in short-term rates today will cause expectations of rising short-term rates in the future – all interest rates will move together (fact 1)
- When ST rates are low, they are expected to rise (upward-sloping yield curve); when they are high, expected to fall (downward-sloping yield curve). (fact 2)
- Fails on fact 3.
Segmented Markets

Markets for different bonds do not interact at all.

- The interest rates on each bond are determined by the individual demand and supply only.
- People have specific preferences for maturities, so that bonds of different maturities are not substitutes at all – returns on one bond do not influence returns on another.
- Preferences may be affected by the desired holding period (to minimize interest-rate risk, people will match holding period to maturity).
- More investors tend to prefer short-term bonds, so demand for them is higher → prices are higher → interest rates are lower.

→ Fact 3: typically upward-sloping yield curves. Fails on 1 and 2.
Liquidity Premium/
Preferred Habitat Theories

Interest rate on a long-term bond will equal an average of expected interest rates on short-term bonds plus a liquidity premium that responds to supply/demand conditions of the bond.

- Bonds of differing maturities are substitutes, but not perfect ones. Investors can favor some bonds over others: e.g. favor short-term bonds for reduced interest rate risk.

- To induce investors to hold long-term bonds, they have to be compensated – by liquidity premium that grows with bond’s maturity.

\[ i_{nt} = (i_t + i_{t+1}^e + \ldots + i_{t+n-1}^e)/n + l_t(n) \]
Liquidity Premium/
Preferred Habitat Theories

Preferred habitat theory says the same thing, except it assumes that investors simply prefer some bonds over others for reasons other than interest-rate risk (their preferred habitat).

- To hold other bonds, investors need to be compensated – by a term premium, which acts the same way as liquidity premium.

- Either of these theories accounts for all 3 facts.
Implied Yield Curves

Interest Rate, $i_{nt}$

Liquidity Premium and Preferred Habitat Theories Yield Curve

Liquidity Premium, $I_{nt}$

Expectations Theory Yield Curve

Years to Maturity, $n$
Yield Curve as Forecasting Tool

The yield curve has relevance not only for assessing investment opportunities, but for policy-makers who are trying to predict conditions in the macroeconomy.

- Recall that rising interest rates are associated with expansions, and falling rates with recessions.
  - If the yield curve is flat or negatively-sloped, indicating expectations of falling short-term rates, it may be a predictor of a recession.

- Recall that a rise in expected inflation causes interest rates to rise.
  - A steep yield curve is a predictor of a rise in inflation, while a flat or down-sloping curve predicts a fall in inflation.
  - Alternatively: steep curve indicates loose monetary policy, while a flat or down-sloping curve indicates tight policy.