COURSE CODE: (FINC 406)

COURSE TITLE: (Financial Markets)

SESSION#: (9) – TITLE: (DETERMINATION AND TERM STRUCTURE OF INTEREST RATES)

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UNIVERSITY OF GHANA
College of Education
School of Continuing and Distance Education
## Course Information

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Session Overview

• This session seeks to discuss interest rate as a key economic factor that plays major roles in the diverse markets of the global economy.

• The theories behind the trends of interest rates and the factors that affect the behavior of interest rate are also discussed.

• The session concludes with discussions on security yields and term structure of interest rates with emphasis on the theories underpinning term structure of interest rates.
At the end of the session, the student will
1. Be able to explain what interest rate is and primary theories underlying interest rates.
2. Be able to explain the economic determinants of interest rates
3. Be able to explain security yields and the term structure of interest rates
4. Be able explain the theories underlying the term structure of interest rates, as well as the interrelationships among these theories.
DETERMINATION AND TERM STRUCTURE OF INTEREST RATES
• An *interest rate* is the price paid by a borrower to a lender for the use of resources that will be used during some time period then returned.
  – Real rate
  – Risk-free rate
  – Short-term rate
Interest Rates

- Real rate – rate that would prevail in the economy if the avg prices for goods and services were expected to remain constant during the loan’s life.

- Risk-free rate – rate on a loan whose borrower will not default on any obligation.

- Short-term rate - rate on a loan that has one year to maturity.
Theories of Interest Rates

- Fisher’s Classical Approach
- Loanable Funds Theory
- Keynes’ Liquidity Preference Theory
Fisher’s Classical Approach

• Proposed by Irving Fisher
• Irving Fisher analyses the determination of the level of interest rate in an economy by inquiring why people save and why others borrow
• No premium for default risk
Fisher’s Classical Approach

• Supply of Savings
  – Marginal rate of time preference (high time preference – want to consume more today – higher discount rate)
  – Income
  – Reward for saving

• Demand for Borrowed Resources
  – Marginal productivity of capital
  – Rate of interest

• Equilibrium Rate of Interest
Fisher’s Law

- Nominal Rate of Interest (i) – number of monetary units to be paid per unit borrowed
- Real Rate of Interest (r) – growth in the power to consume over the life of a loan.
- Premium for Expected Inflation (p)
- No inflation, $i = r$
- Fisher’s Law

\[
(1 + i) = (1 + r)(1 + p)
\]

- or
- $i = r + p$
The Loanable Funds Theory

- Fisher ignored power of govt, and investments in cash balances
- LFT - Proposes that the general level of interest rate is determined by the complex interaction of two forces:
  - Demand for and Supply of Funds by Firms, Governments, and Households
The Loanable Funds Theory

• Demand for and Supply of Funds by Firms, Governments, and Households
  – Changes in the money supply
  – Government deficits
  – Changes in preferences by households
  – New investment opportunities for firms

• Equilibrium Rate of Interest
The Liquidity Preference Theory

- Developed by John Keynes
- Analyses the equilibrium level of interest rate through the interaction of the supply of money and the public’s aggregate demand for holding money.
- Assumes people hold wealth in two forms:
  - money,
  - bonds
The Liquidity Preference Theory

• Demand for Money Balances
  – Transactions demand
  – Precautionary demand
  – Speculative demand

• Supply of Money – under the control of CB

• Equilibrium Rate of Interest
Changes in the Supply for Money and Interest Rates

• Liquidity Effect
  – Increase in money supply will lead to a decrease in interest rate.

• Income Effect
  – Increase in money supply is economically expansionary.

• Price Expectations Effect
  – Increase in money supply depending on the strength of the economy will lead to expectation of a rising level of prices. Increase in prices will lead to increased demand for money and consequently increase interest rates.

• Net Effect:
  – The interest rate may rise, fall, or remain unchanged depending on the net effect of changes in desired liquidity, income, and price expectations.
Determinants of the Structure of Interest Rates

• The Base Interest Rate
• Risk Premiums Are Determined By:
  – Issuer Type
  – Credit risk
  – Term to maturity
  – Embedded options
  – Taxability of interest
  – Liquidity
Factors Affecting Security Yields

- Risk-averse investors demand higher yields for added riskiness
- Risk is associated with variability of returns
- Increased riskiness generates lower security prices or higher investor required rates of return
Estimating the Appropriate Yield

- The appropriate yield to be offered on a debt security is based on the risk-free rate for the corresponding maturity plus adjustments to capture various security characteristics

\[ Y_n = R_{f,n} + DP + LP + TA + CALLP + COND \]
Estimating the Appropriate Yield

\[ Y_n = R_{f,n} + DP + LP + TA + CALLP + COND \]

Where:

- \( Y_n \) = yield of an \( n \)-day security
- \( R_{f,n} \) = yield on an \( n \)-day Treasury (risk-free) security
- \( DP \) = default premium (credit risk)
- \( LP \) = liquidity premium
- \( TA \) = adjustment for tax status
- \( CALLP \) = call feature premium
- \( COND \) = convertibility discount
Types of Issuers

• Treasury Market Sector
• Corporate Market Sector
  – Utilities
  – Industrials
  – Finance
  – Banks
• Intermarket and intramarket Sector
Default risk

• Benchmark—risk-free treasury securities for given maturity
• Default risk premium = risky security yield – treasury security yield of same maturity
• Default risk premium = market expected default loss rate
• Rating agencies set default risk ratings
• Anticipated or actual ratings changes impact security prices and yields
Default or Credit Risk

- Rating Companies
  - Moody’s, S&P, Fitch, Duff & Phelps
- Credit Ratings
  - Investment grade
  - Non-investment grade
- Credit Spread
Term to Maturity

- The volatility of a bond’s price is influenced by its maturity.
- The longer the maturity of a bond, the greater its price sensitivity to a change in market yields.
- Maturity spread or yield curve spread
Embedded Options

• Special Provisions
  – Call Feature: enables borrower to buy back the bonds before maturity at a specified price
    • Call features are exercised when interest rates have declined
    • Investors demand higher yield on callable bonds, especially when rates are expected to fall in the future
Embedded Options

- Special provisions
  - Convertible bonds
    - Convertibility feature allows investors to convert the bond into a specified number of common stock shares
    - Investors will accept a lower yield for convertible bonds because investor returns include expected return on equity participation
Embedded Options

• Call option
  – benefits issuer
  – increases required return on Treasuries

• Put Option
  – benefits bondholder

• Conversion option
  – benefits bondholder
  – reduces required return on bonds
Tax Status

• Tax status of income or gain on security impacts the security yield
• Investors concerned with after-tax return or yield
• Investors require higher yields for higher taxed securities
Tax Status

\[ Y_{at} = Y_{bt}(1 - T) \]

Where:

- \( Y_{at} \) = after-tax yield
- \( Y_{bt} \) = before-tax yield
- \( T \) = investor’s marginal tax rate
• Example: a taxable security that offers a before-tax yield of 14 percent. The investor’s tax rate is 20 percent. Calculate the after-tax yield.

\[ Y_{at} = 14\% (1 - 0.2) \]
\[ = 11.2\% \]

• The fully taxable pre-tax equivalent corporate bond for a 11.2% municipal bond is:

\[ Y_{bt} = 11.2\%/(1 - .2) = 14\% \]
Liquidity

• The greater the expected liquidity of a security issue, the lower the required yield.
• The size of the issue is an important factor that affects its liquidity.
Liquidity

• The Liquidity of a security affects the yield/price of the security
• A liquid investment is easily converted to cash at minimum transactions cost
• Investors pay more (lower yield) for liquid investment
• Liquidity is associated with short-term, low default risk, marketable securities
The Yield Curve

• Term to maturity
  – Interest rates typically vary by maturity.
  – The **term structure of interest rates** defines the relationship between maturity and yield.

• The Yield Curve is the plot of current interest yields versus time to maturity.
An upward-sloping yield curve indicates that Treasury Securities with longer maturities offer higher annual yields.
Yield Curve Shapes

- Normal
- Level or Flat
- Inverted
The Term Structure of Interest Rates

Theories Explaining Shape of Yield Curve

– Pure Expectations Theory
– Liquidity Premium Theory
– Segmented Markets Theory
The Term Structure of Interest Rates

• Pure Expectations Theory
  – Long-term rates are average of current short-term and expected future short-term rates
  – Yield curve slope reflects market expectations of future interest rates
  – Investors select maturity based on expectations
Pure Expectations Theory

- Assumes investor has no maturity preferences and transaction costs are low
- Long-term rates are averages of current short rates and expected short rates

- Forward rate: market’s forecast of the future interest rate
Assume that as of today, the annualized interest rate on a three-year security is 10 percent, while the annualized interest rate on a two-year security is 7 percent. Use only this information to estimate the one-year forward rate two years from now.

\[(1 + i_3)^3 = (1 + i_2)^2(1 + f^1_{t+2})\]

\[(1 + f^1_{t+2}) = \frac{(1 + i_3)^3}{(1 + i_2)^2}\]

\[f^1_{t+2} = \frac{(1 + i_3)^3}{(1 + i_2)^2} - 1\]

\[f^1_{t+2} = \frac{1.10^3}{1.07^2} - 1\]

1.35%
The Term Structure of Interest Rates

• Liquidity Premium Theory
  – Investors prefer short-term, more liquid, securities
  – Long-term securities and associated risks are desirable only with increased yields
  – Explains upward-sloping yield curve
  – When combined with the expectations theory, yield curves could still be used to interpret interest rate expectations
The Term Structure of Interest Rates

• Segmented Markets Theory
  – Choice of investment influenced by forecasted cash needs.
  – Theory explaining segmented, broken yield curves
  – Assumes investors have maturity preference boundaries, e.g., short-term vs. long-term maturities
  – Explains why rates and prices vary significantly between certain maturities
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