# Advaned Macroeconomics

## Chapter 11: Financial markets

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February 1, 2011

# Overview

# Financial markets: Introduction

- Objective of financial markets:

  $\Longrightarrow$ Perform the essential function of channeling funds from economic players that have saved surplus funds to those that have a shortage of funds.

  $\Longrightarrow$ Promotes economic efficiency by producing an efficient allocation of capital, which increases production (they allow funds to flow to people with the best investment opportunities).

  $\Longrightarrow$ Directly improves the well-being of consumers by allowing them to time purchases better.

# Financial markets: Introduction

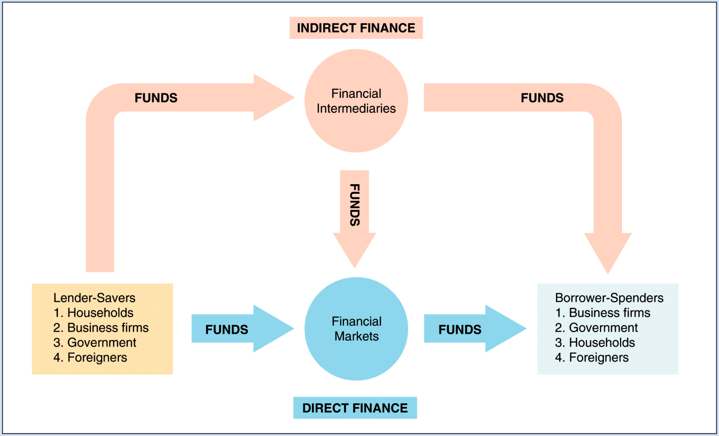


FIGURE 1 **Flows of Funds Through the Financial System**

Source: Mishkin (2009)

# Financial markets: Introduction

- Structure of financial markets (categorization based on essential features of individual markets):
  - Debt and equity markets
  - Primary and secondary markets
  - Money and capital markets
- Debt and equity markets:
  - Direct funding is possible in two ways: By issuing a debt instrument or equities.
  - Debt: Debt can be short-term (maturity is less than a year) or long-term (maturity is more than ten years).
  - Most common debt instruments:
    - Bonds
    - Mortgages.
  - Equity: In the broadest sense, equity means ownership.

# Financial markets: Introduction

- Structure of financial markets (continued):
  - Primary and secondary markets:
    - A primary market is a financial market in which new issues of a security are sold to initial buyers.
    - A secondary market is a financial market in which previously issued stocks are traded.
  - Money and capital markets:
    - Money markets deal in short-term debt instruments.
    - Capital markets deal in longer-term debt and equity instruments.

# Financial markets: Introduction

- Major money market instruments

| Type of Instrument | Amount Outstanding ($ billions, end of year) 1980 | 1990 | 2000 | 2008 |
|---|---|---|---|---|
| U.S. Treasury bills | 216 | 527 | 647 | 1060 |
| Negotiable bank certificates of deposit (large denominations) | 317 | 543 | 1053 | 2385 |
| Commercial paper | 122 | 557 | 1619 | 1732 |
| Federal funds and Security repurchase agreements | 64 | 387.9 | 768.2 | 2118.1 |

*Sources:* Federal Reserve Flow of Funds Accounts; Federal Reserve *Bulletin*; *Economic Report of the President.*

Source: Mishkin (2009)

# Financial markets: Introduction

- Major capital market instruments

| Type of Instrument | Amount Outstanding ($ billions, end of year) 1980 | 1990 | 2000 | 2008 |
|---|---|---|---|---|
| Corporate stocks (market value) | 1,601 | 4,146 | 17,627 | 19,648 |
| Residential mortgages | 1,106 | 2,886 | 5,463 | 12,033 |
| Corporate bonds | 366 | 1,008 | 2,230 | 3,703 |
| U.S. government securities (marketable long-term) | 407 | 1,653 | 2,184 | 3,621 |
| U.S. government agency securities | 193 | 435 | 1,616 | 8,073 |
| State and local government bonds | 310 | 870 | 1,192 | 2,225 |
| Bank commercial loans | 459 | 818 | 1,091 | 1,605 |
| Consumer loans | 355 | 813 | 536 | 871 |
| Commercial and farm mortgages | 352 | 829 | 1,214 | 2,526 |

*Sources:* Federal Reserve Flow of Funds Accounts; Federal Reserve *Bulletin*. 2008, 3rd Quarter.

Source: Mishkin (2009)

# The bond market: Introduction

- Credit market instruments:
  - Simple loans: Lender provides the borrower with an amount of funds, which must be repaid to the lender at the maturity date together with an interest rate payment.
  - Fixed payment loan: Lender provides the borrower with an amount of funds, which has to be repaid by making the same payment (interest and part of the principal) every period.
  - Coupon bond: Pays the owner a fixed interest payment (coupon payment) every year until the maturity date, when a specified final amount (face value) has to be repaid.
  - Discount bond (Zero-coupon bond): Bought at a price below its face value, at the maturity the face value is repaid.
- Yield to maturity: Interest rate that equates the present value of cash flow payments received from a debt instrument with its value today.

# The bond market: The term structure of interest rates

- Consider a coupon bond with the following characteristics:
  - $n$: Number of years until maturity.
  - $P_{n,t}$: Price of the coupon bond
  - c: Yearly coupon payment.
  - $F = 1$: Face value of the bond.

# The bond market: The term structure of interest rates

- The price of this coupon bond is given by:

$$
\begin{aligned}
P_{n,t} &= \frac{c}{1+R^c_{n,t}} + \frac{c}{\left(1+R^c_{n,t}\right)^2} + \ldots + \frac{1+c}{\left(1+R^c_{n,t}\right)^n} = \qquad (1) \\
&= c\sum_{i=1}^{n} \frac{1}{\left(1+R^c_{n,t}\right)^i} + \frac{1}{\left(1+R^c_{n,t}\right)^n} = \\
&= \frac{1}{1+R^c_{n,t}} c \sum_{i=0}^{n-1} \frac{1}{\left(1+R^c_{n,t}\right)^i} + \frac{1}{\left(1+R^c_{n,t}\right)^n} = \\
&= \frac{c}{1+R^c_{n,t}} \frac{1-\frac{1}{\left(1+R^c_{n,t}\right)^n}}{1-\frac{1}{\left(1+R^c_{n,t}\right)}} + \frac{1}{\left(1+R^c_{n,t}\right)^n} = \\
&= \frac{c}{R^c_{n,t}}\left(1-\frac{1}{\left(1+R^c_{n,t}\right)^n}\right) + \frac{1}{\left(1+R^c_{n,t}\right)^n}.
\end{aligned}
$$

# The bond market: The term structure of interest rates

- For a zero-coupon bond ($c = 0$) we obtain:

$$P_{n,t} = \frac{c}{R^c_{n,t}}\left(1 - \frac{1}{\left(1 + R^c_{n,t}\right)^n}\right) + \frac{1}{\left(1 + R^c_{n,t}\right)^n} = \tag{2}$$
$$= \frac{1}{\left(1 + R^c_{n,t}\right)^n} = \frac{1}{\left(1 + R^0_{n,t}\right)^n}.$$

- An n-period coupon bond can be considered as a collection of n-1 zero-coupon bonds (due in periods $1, 2, \ldots, n-1$) with face value $c$ and one zero-coupon bond with face value $1 + c$ (due in period $n$).

- Then, we can write:

$$P_{n,t} = \frac{c}{1 + R^0_{1,t}} + \frac{c}{\left(1 + R^0_{2,t}\right)^2} + \ldots + \frac{1 + c}{\left(1 + R^0_{n,t}\right)^n}. \tag{3}$$

# The bond market: The term structure of interest rates

- To compute the yields to maturities of the involved zero-coupon bonds (denoted by $R^0_{i,t}$, with $i = 1, 2, \ldots, n$) we proceed as follows:
  - If the holding period is only one period we have:

$$P_{1,t} = \frac{1+c}{1+R^0_{1,t}}. \tag{4}$$

$\Longrightarrow$ Equation determines $R^0_{1,t}$.

  - If the holding period is two periods we have:

$$P_{2,t} = \frac{c}{1+R^0_{1,t}} + \frac{1+c}{\left(1+R^0_{2,t}\right)^2}. \tag{5}$$

$\Longrightarrow$ Equation determines $R^0_{2,t}$.

  - Repeating this steps allows to solve for the remaining zero-coupon interest rates.

# The bond market: The term structure of interest rates

- If one buys a n-period bond today (t) and sells it in the next period (t+1) the rate of return is given by:

$$1 + h_{n,t+1} = \frac{P_{n-1,t+1}}{P_{n,t}} = \frac{\frac{1}{\left(1+R^0_{n-1,t+1}\right)^{n-1}}}{\frac{1}{\left(1+R^0_{n,t}\right)^{n}}} \qquad (6)$$

- Taking logs of this equation, observing that $\ln(1+a) \approx a$ (for small values of $a$) and using $p_{n,t} = \ln P_{n,t}$ one can write:

$$h_{n,t+1} \approx p_{n-1,t+1} - p_{n,t} = nR_{n,t} - (n-1)\, R_{n-1,t+1}. \qquad (7)$$

- Given that no-arbitrage opportunities exist the expected return $h_{n,t+1}$ must be equal to the interest rate on a risk-free bond $(s_t)$ plus a risk premium, $\pi_{n,t}$, i.e., we must have:

$$E_t h_{n,t+1} = s_t + \rho_{n,t}. \qquad (8)$$

# The bond market: The term structure of interest rates

- Combining the two expression for $h_{n,t+1}$ we can write:

$$h_{n,t+1} = nR_{n,t} - (n-1)\, E_t R_{n-1,t+1} = s_t + \rho_{n,t} \Longleftrightarrow \tag{9}$$
$$(n-1)\left(E_t R_{n-1,t+1} - R_{n,t}\right) = \left(R_{n,t} - s_t\right) + \rho_{n,t},$$

  where $(R_{n,t} - s_t)$ denotes the term spread.

- Solving this equation for $R_{n,t}$ yields:

$$R_{n,t} = \frac{n-1}{n} E_t R_{n-1,t+1} + \frac{1}{n}\left(s_t + \rho_{n,t}\right) \tag{10}$$

- For $R_{n-1,t+1}$ we obtain:

$$R_{n-1,t+1} = \frac{n-1}{n} E_{t+1} R_{n-2,t+2} + \frac{1}{n}\left(s_{t+1} + \rho_{n-1,t+1}\right) \tag{11}$$

# The bond market: The term structure of interest rates

- Plugging the so obtained expression for $R_{n-1,t+1}$ into the equation for $R_{n,t}$ and repeating these two steps for $R_{n-2,t+2}$, ... we obtain:

$$R_{n,t} = \frac{1}{n} \sum_{i=0}^{n-1} E_t \left( s_{t+i} + \rho_{n-i,t+i} \right). \tag{12}$$

$\Longrightarrow$ Interpretation?

- The nominal interest rate on the risk-free bond is given by:

$$s_t = r_t + E_t \pi_{t+1} \tag{13}$$

(Fisher equation).

- Plugging this expression into the just derived equation for $R_{n,t}$ yields:

$$R_{n,t} = \frac{1}{n} \sum_{i=0}^{n-1} E_t \left( r_{t+i} + E_t \pi_{t+i} + \rho_{n-i,t+i} \right). \tag{14}$$

# The bond market: The term structure of interest rates

- Yield curve: A plot of the yield on bonds with differing terms to maturity but the same risk, liquidity and tax considerations is called a yield curve.
- A yield curve can be
  - upward-sloping, i.e. long-term rates are above short-term rates.
  - flat, i.e. short- and long-term rates are the same
  - downward-sloping (inverted), i.e. long-term rates are below short-term rates or
  - shaped more complicated (very rare).