THE COST OF MONEY (INTEREST RATES) [*Chapter 5*]

- Cost of Money—interest rate associated with borrowing funds.
- Realized Rates of Return—returns include two components: (1) income paid by the issuer, and (2) capital gains realized from market price changes

$$\begin{aligned}\text{Dollar return} &= \text{Dollar income} + \text{Capital gains}\\ &= \text{Dollar income} + (\text{Ending value} - \text{Beginning value})\end{aligned}$$

$$\text{Yield} = \frac{\text{Dollar return}}{\text{Beginning value}} = \frac{\text{Dollar income + Capital gains}}{\text{Beginning value}}$$

Suppose that on January 2 you purchased 100 shares of Dell Inc. common stock for $25 per share. It is now December 31, and the Dell stock that you purchased at the beginning of the year is selling for $26. If Dell paid a dividend equal to $1.50 per share during the year, what is the annual yield that you earned?

$$\text{Yield} = \frac{100(\$1.50) + 100(\$26 - \$25)}{100(\$25)} = \frac{\$150 + \$100}{\$2{,}500} = 0.10 = 10.0\%$$

- Factors That Affect the Cost of Money—factors that determine interest rates are those that affect the supply of, and the demand for, funds.
  - Production Opportunities—greater production opportunities should create opportunities for greater returns on investments, thus the ability to pay higher interest rates (greater demand for funds).
  - Time Preference for Consumption—the greater the need for current consumption, the less willing individuals are to save, thus lend funds, which means interest rates will be higher (less supply of funds).
  - Risk—investors demand higher returns for riskier investments; if the expected returns were the same for all investments, regardless of risk, investors generally would not invest in higher risk investments because they would perceive greater uncertainty about whether they would be repaid than for lower risk investments.
  - Inflation—investors save to increase their ability to purchase in the future; thus, if the prices of goods and services are expected to increase, investors must demand a return greater than the expected price increases to be able to purchase greater amounts of the same products in the future.

- Interest Rate Levels—interest rates fluctuate continuously, increasing when money is “tight” (often during very fast-growing economies) and decreasing when the demand for money declines (generally during business recessions).

- <u>The Determinants of Market Interest Rates</u>—the following equation provides an over-simplified expression of the relationship between the quoted, or nominal, interest rate and factors that influence interest:

$$\text{Rate of return (interest)} = r = \text{Risk-free rate} + \text{Risk premium} = r_{RF} + RP$$

Risk premium = RP = payment for additional risk investors take when purchasing risky investments

$$\text{Quoted interest rate} = r = r_{RF} + RP = [r^* + IP] + [DRP + LP + MRP]$$

where

r	=	quoted, or *nominal*, interest rate.
r*	=	*real* risk-free interest rate; rate that would exist if an investment promises you a perfectly certain (risk-free) payoff and inflation is expected to be zero during the investment period.
IP	=	inflation premium; the expected average rate of inflation during the investment period; the *nominal* (including inflation) risk-free rate, r_{RF}, includes the real risk-free rate and an adjustment for expected inflation such that $r_{RF} = r^* + IP$.
DRP	=	default risk premium; all else equal, the greater the chance that the borrower might not meet the terms of the loan, the greater the default risk premium; generally U.S. government securities are considered to have zero default risk.
LP	=	liquidity premium; if an asset can be converted into cash on short notice without significant loss of principal, it is considered liquid; all else equal, investors generally demand a higher return—that is, a premium—for investing in less liquid investments.
MRP	=	maturity risk premium; longer-term bonds are exposed to greater risk that changes in interest rates will adversely affect their prices (called interest rate risk) than are shorter-term bonds; all else equal, long-term bonds generally have higher interest rates than short-term bonds due to maturity risk.

- <u>The Term Structure of Interest Rates</u>—relationship between the yields and the maturities of bonds. The yield curve graphically shows the relationship of yields for bonds with different maturities. A "normal" ("inverted") yield curve is upward (downward)-sloping, meaning long-term rates are greater (less) than short-term rates. The three basic explanations for the shape of the yield curve are:
  - Expectations Theory—the shape of the yield curve is based on expectations about inflation in the future; if inflation is expected to increase, the yield curve will be upward-sloping, and vice versa. For example, if the inflation rates for the next three years are forecasted to be:

Year: Months	Expected Inflation Rate for the Year	***Average*** of the Expected Inflation Rates for This Year and the Previous Years, IP_t
Year 1: Months 1-12 (current year)	1%	1%/1 = 1.0%
Year 2: Months 13 – 24	5%	(1% + 5%)/2 = 3.0%
Year 3: Months 25 – 36	6%	(1% + 5% + 6%)/3 = 4.0%

If the real risk-free rate, r*, is 3 percent, then the yields (interest rates) on 1-year, 2-year, and 3-year bonds should be:

Bond Type	Maturity	Real Rate r*		Inflation Premium; IP_t from Above		Nominal Risk-Free Rate, r_{RF}
1-year bond	12 months	3.0%	+	1.0%	=	4.0%
2-year bond	24 months	3.0%	+	3.0%	=	6.0%
3-year bond	36 months	3.0%	+	4.0%	=	7.0%

- Liquidity Preference Theory—long-term bonds are considered less liquid than short-term bonds; therefore, all else equal, long-term bonds must have higher yields to attract investors; if interest rates for long-term bonds and short-term bonds were equal, investors would prefer to hold only short-term bonds.

- Market Segmentation Theory—there is a belief that borrowers and lenders prefer bonds with particular maturities; if true, when the supply/demand relationship in a particular maturity "segment" changes, so will interest rates in that segment.

- <u>Using Current Interest Rates to Forecast Future Rates</u>—under very restrictive assumptions, current interest rates can be used to get an idea as to what future rates will be. Suppose that the following rates currently exist in the financial markets:

Type of Bond	Maturity in Years	Yield to Maturity
1-year	1	5.0%
2-year	2	5.5
3-year	3	5.8
10-year	10	6.0
11-year	11	6.2

The type of bond often refers to the number of years remaining until maturity; thus, a 2-year bond has two years remaining until it matures. A bond's yield represents the average of the rates for each individual year that remains to the maturity of the bond. For example, the 3-year bond matures in three years, and it has a YTM equal to 5.8 percent. Thus, the rates that are expected to exist for the next three years—that is, Year 1, Year 2, and Year 3—average 5.8 percent. It is possible that none of the three years individually has a 12-month rate equal to 5.8 percent.

Can we determine what the 12-month (annual) rate is for Year 3? If we *assume* that interest does not compound every year and that the expectations theory is the only explanation for the shape of the yield curve, then we can conclude the following:

Type of Bond	Yield to Maturity	Sum of the Rates Each Year Until Maturity				
1-year	5.0%	$\Sigma\ (R_1)$			=	5.0%
2-year	5.5	$\Sigma\ (R_1 + R_2)$	=	2(5.5%)	=	11.0%
3-year	5.8	$\Sigma\ (R_1 + R_2 + R_3)$	=	3(5.8%)	=	17.4%
10-year	6.0	$\Sigma\ (R_1 + R_2 + \ldots + R_{10})$	=	10(6.0%)	=	60.0%
11-year	6.2	$\Sigma\ (R_1 + R_2 + \ldots + R_{10} + R_{11})$	=	11(6.2%)	=	68.2%

Because we are assuming that interest does not compound from year to year, it is easy to determine what the cumulative interest rate must be for the bond's YTM to equal its particular value, which is an average of all of the individual year rates. For example, because the 11-year bond has a YTM equal to 6.2 percent, the sum total of the interest rates for each of the 11 years that remain until maturity must equal 68.2%—that is, 6.2% = 68.2%/11.

Using the information provided in the previous table, we can determine the 1-year rates for Year 1, Year 2, Year 3, and Year 11. Note that in each case, we know the YTM for bonds that mature in at least two consecutive years. This situation must exist so that we can observe by what amount the sum of the interest rates changes from one year to the next. For example, the cumulative total of the annual interest rates for 10 years is 60.0 percent, and it is 68.2 percent for 11 years. As a result, the interest rate in Year 11 must be 8.2% = 68.2% - 60.0%, because the cumulative amount increased by 8.2 percent when Year 11 was included. Using this same logic, we can construct the following table:

Year	Sum of the Rates Each Year Until Maturity			1-Year Rate		
1	$\Sigma\ (R_1)$	=	5.0%	5.0 – 0.0	=	5.0%
2	$\Sigma\ (R_1 + R_2)$	=	11.0%	11.0 – 5.0	=	6.0%
3	$\Sigma\ (R_1 + R_2 + R_3)$	=	17.4%	17.4 – 11.0	=	6.4%
10	$\Sigma\ (R_1 + R_2 + \ldots + R_{10})$	=	60.0%	60.0 – ?	=	?
11	$\Sigma\ (R_1 + R_2 + \ldots + R_{10} + R_{11})$	=	68.2%	68.2 – 60.0	=	8.2%

According to this table, the rate for the next 12 months (Year 1) is expected to be 5 percent, and the rate for the following 12 months (Year 2) is expected to be 6 percent. If these are the actual rates in the financial market during the next two years, then investors who buy 2-year bonds should earn 5 percent next year and then 6 percent the following year, or an average rate that equals 5.5% = (5% + 6%)/2, which is the YTM on a 2-year bond.

Note that we cannot compute the expected interest in Year 10 because we do not know the cumulative total of the rates for Year 1 through Year 9. But, we can compute the rate that is expected in Year 11, because we do know the cumulative total of the rates for Year 1 through Year 10 as well as the cumulative total for Year 1 through Year 11. Because the cumulative total increased by 8.2 percent when Year 11 was added, the expected rate for Year 11 must 8.2 percent.

- Other Factors that Influence Interest Rates
  - Federal Reserve Policy—the Fed controls the supply of money in the United States; when the Fed wants to increase interest rates, it will decrease the money supply, and vice versa.
  - Federal Deficits—when the federal government spends more than it collects, a deficit exists that must be financed; greater financing for higher deficits generally puts upward pressure on interest rates.
  - International Business (Foreign Trade Balance)—when goods imported into the United States exceed goods exported, a trade deficit exists; the deficit must be financed, which generally puts upward pressure on interest rates.
  - Business Activity—business activity has a significant impact on the supply/demand relationship of the funds that are available in the financial markets; in boom periods, the demand for money increases, which causes upward pressure on interest rates, and vice versa.

- Interest Rate Levels and Stock Prices—interest is a cost to businesses, so interest-rate changes have a direct impact on business profits—all else equal, higher interest rates lower a firm's income; interest rates also affect investment behavior—when rates on bonds increase, there is a tendency to take money out of the stock markets to invest in the bond markets, which pushes the general prices of stocks down (returns ultimately increase) and the prices of bonds up (rates ultimately decrease), and vice versa.

- Interest Rates and Business Decisions—a firm's decisions concerning what types of financing should be used for investments in assets is based on forecasts of future interest rates; if interest rates are expected to decrease over the next few years, the firm would have a tendency to borrow short-term and wait to "lock into" lower, long-term rates when (if) the rates fall.

- The Cost of Money as a Determinant of Value—the value of an asset is based on (1) the future cash flows the asset is expected to generate, (2) the timings of the expected cash flow, and (3) the opportunity cost of investors, which is represented by prevailing rates in the financial markets. We compute value by solving the following equation:

$$\text{Value} = \frac{\hat{CF}_1}{(1+r)^1} + \frac{\hat{CF}_2}{(1+r)^2} + \cdots + \frac{\hat{CF}_n}{(1+r)^n}$$

  Here, $\hat{CF}_t$ represents the cash flow that the asset is expected to generate in Period t, and r is the cost of funds, or investors' opportunity cost. Thus, you can see that value changes as r changes (in an opposite direction).

- Chapter 5 Summary Questions—You should answer these questions as a summary for the chapter and to help you study for the exam.
  - How are interest rates determined?
  - What factors affect interest rates?

- What is the term structure of interest rates? What are the theories that have been developed that help explain the shape of the yield curve?
- Describe how interest rates can be forecasted.