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# Security Analysis

## Bond Valuation

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INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

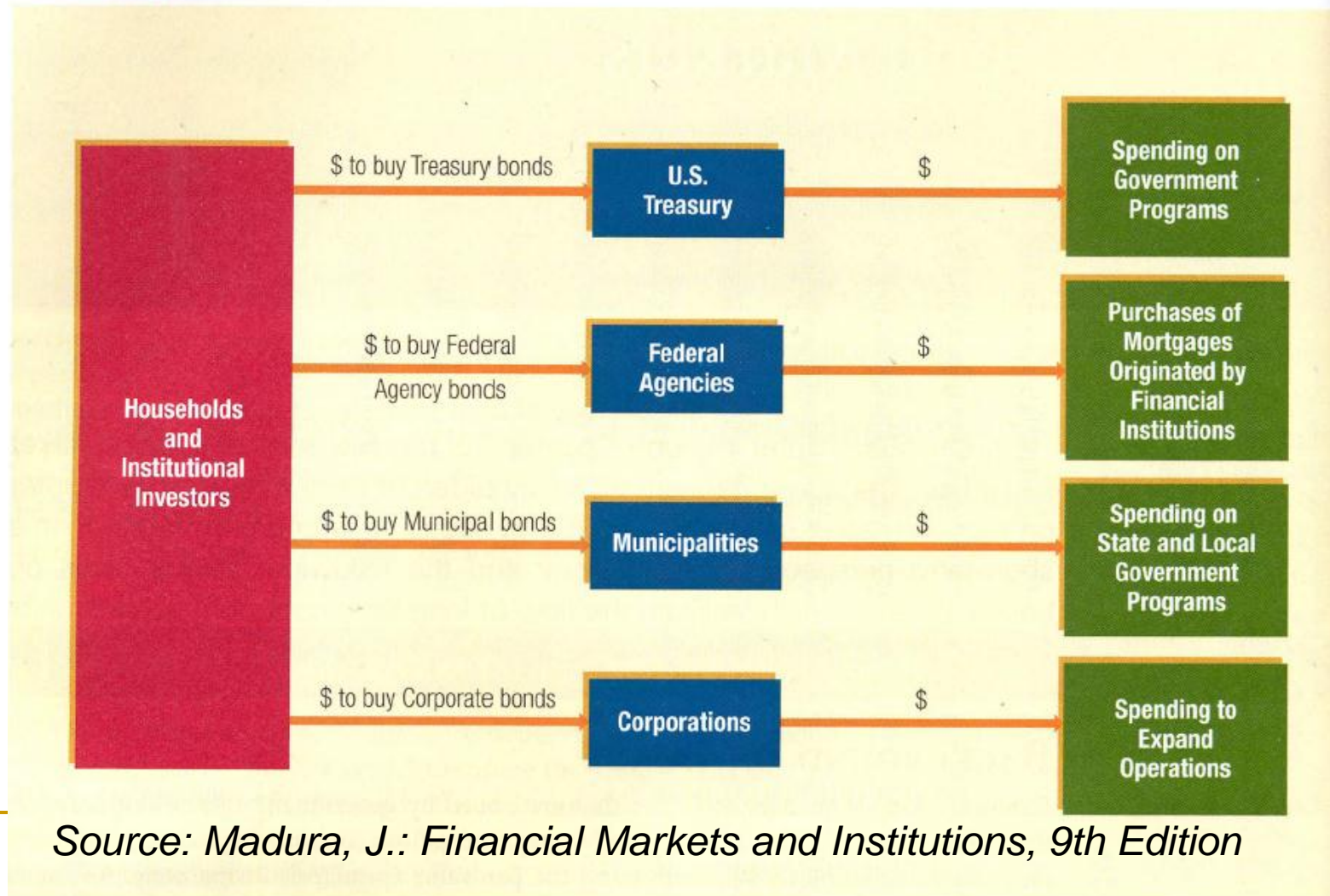
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# Background on Bonds

- Bonds represent long-term debt securities
    - Contractual
    - Promise to pay future cash flows to investors
  - The issuer of the bond is obligated to pay:
    - Interest (or coupon) payments periodically usually semiannually
    - Par or face value (principal) at maturity
  - According to ownership structure:
    - Bearer bonds
    - Registered bonds
-

# How Bond Markets Facilitate the Flow of Funds

**Exhibit 7.1** How Bond Markets Facilitate the Flow of Funds



FINANCIAL INSTITUTION	PARTICIPATION IN BOND MARKETS
Commercial banks and savings and loan associations (S&Ls)	<ul style="list-style-type: none"> <li>• Purchase bonds for their asset portfolio.</li> <li>• Sometimes place municipal bonds for municipalities.</li> <li>• Sometimes issue bonds as a source of secondary capital.</li> </ul>
Finance companies	<ul style="list-style-type: none"> <li>• Commonly issue bonds as a source of long-term funds.</li> </ul>
Mutual funds	<ul style="list-style-type: none"> <li>• Use funds received from the sale of shares to purchase bonds. Some bond mutual funds specialize in particular types of bonds, while others invest in all types.</li> </ul>
Brokerage firms	<ul style="list-style-type: none"> <li>• Facilitate bond trading by matching up buyers and sellers of bonds in the secondary market.</li> </ul>
Investment banking firms	<ul style="list-style-type: none"> <li>• Place newly issued bonds for governments and corporations. They may place the bonds and assume the risk of market price uncertainty or place the bonds on a best-efforts basis in which they do not guarantee a price for the issuer.</li> </ul>
Insurance companies	<ul style="list-style-type: none"> <li>• Purchase bonds for their asset portfolio.</li> </ul>
Pension funds	<ul style="list-style-type: none"> <li>• Purchase bonds for their asset portfolio.</li> </ul>

*Source: Madura, J.: Financial Markets and Institutions, 9th Edition*

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# Bond Yields

- Yield from the Issuer's Perspective
    - Cost of financing
      - Yield to maturity
        - annualized yield that is paid by the issuer over the life of bond
        - Annualized discount rate that equates the future coupon and principal payments
        - Based on assumption that coupon can be reinvested at the same yield
-

# Bond Yields

An investor can purchase a ten-year, \$1000 par value bond with an 8 percent annualized coupon rate for \$936. Determine the yield to maturity for this bond.

N	I	PV	PMT	FV
10		-936	80	1000

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# Bond Yield

- Yield from the Investor's Perspective
    - Investor holds it until maturity
      - Yield to maturity
    - Investor does not hold until maturity
      - Holding period return HPR
        - Less than one year –  $HPR = \text{coupons} + \text{difference between selling and purchasing price}$
        - Over one year –  $HPR = \text{annualized discount rate that equates payments received to the initial investments}$
        - Selling price of the bond is uncertain if the bond is not hold to maturity
        - An investment on bond is subject to the risk that the holding period return will be less than expected
-

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# U. S. Treasury Bonds

- Issued by the U.S. Treasury to finance federal government expenditures
  - Maturity
    - Notes, < 10 Years
    - Bonds, > 10 to 30 Years
  - Active OTC Secondary Market
  - Semiannual Interest Payments
  - Benchmark Debt Security for Any Maturity
-



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# Kinds of Treasury Bonds

- Coupon Bonds
    - Interest paid semiannually
    - To registered bondholders
  
  - Stripped Treasury Bonds
    - Zero-coupon securities are sold with claims on U. S. Treasury bonds held in a trust
      - One security represents the principal payment ( $np$ ) at maturity
      - Other securities represents the interest payments ( $ci$ ) at interest paying dates
  
  - Inflation-Indexed Treasury Bonds
    - Intended for investors who seek inflation protection with their investments
    - Coupon rates less than other Treasuries
    - Principal value adjusted for the U.S. inflation rate (CPI) every 6 months
    - Coupon income increases with inflation
-

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# Municipal Bonds

- State and local government obligations
  - Revenue bonds vs. general obligation Bonds
  - Investor interest income exempt from federal income tax
  - Tax Reform Act of 1986 placed limitations on tax-exempt bond issuance for private purposes
-

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# Corporate Bonds

- When corporations want to borrow for long-term periods they issue corporate bonds
    - Usually pay semiannual interest
    - Most have maturities between 10-30 years
    - Public offering vs. private placement
    - Limited exchange, larger OTC secondary market
    - Investors seek safety of principal and steady income
-

<HELP> for explanation.  
 Enter values and hit <Go>, <Menu> to Return

Capital Structure: Senior Unsecured Bonds

Issue --/--/-- - --/--/-- Mty --/--/-- - --/--/-- Curr Min Amt (M) S&P Moody's

1) CAST View 2) Covenants & Pricing

Apple Inc 6 Results

Company Name	Ticker	Coupon ↑	Maturity	Curr	Collateral	Amount(M)	S&P	Moody's
3) Apple Inc	AAPL	3.850	05/04/43	USD	SR UNSECURED	3,000,000	AA+	Aa1
4) Apple Inc	AAPL	2.400	05/03/23	USD	SR UNSECURED	5,500,000	AA+	Aa1
5) Apple Inc	AAPL	1.000	05/03/18	USD	SR UNSECURED	4,000,000	AA+	Aa1
6) Apple Inc	AAPL	.450	05/03/16	USD	SR UNSECURED	1,500,000	AA+	Aa1
7) Apple Inc	AAPL	FLOAT	05/03/16	USD	SR UNSECURED	1,000,000	AA+	Aa1
8) Apple Inc	AAPL	FLOAT	05/03/18	USD	SR UNSECURED	2,000,000	AA+	Aa1

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# Corporate Bond Offerings

- Public Offering
    - Investment bank to underwrite the bonds
      - Syndicate of investment banks
      - Determine selling price
      - Prospectus of bond issuance+
    - Registration of SEC
    - Used by institutional investors
  - Private Placement
    - Not registered by SEC
    - For small amounts of funds (\$30 million) easy to find an institutional investor
    - Disclosure of financial data
    - Security firms
    - No active secondary market
      - Institutional investor can trade bonds with each other
-

DES

APPLE INC

AAPL 3.85 05/43

85.338/85.338

(4.788/4.788) TRAC

AAPL 3.85 05/04/43 Corp

Page 1/11

Description: Bond

94) Notes

95) Buy

96) Sell

97) Settings

21) Bond Description

22) Issuer Description

Pages

- 1) Bond Info
- 2) Addtl Info
- 3) Covenants
- 4) Guarantors
- 5) Bond Ratings
- 6) Identifiers
- 7) Exchanges
- 8) Inv Parties
- 9) Fees, Restrict
- 10) Schedules
- 11) Coupons

Quick Links

- 32) ALLQ Pricing
- 33) QRD Quote Reqa
- 34) TDH Trade Hist
- 35) CAC Corp Action
- 36) CF Prospectus
- 37) CN Sec News
- 38) HDS Holders
- 39) VPR Underly Inf

66) Send Bond

Issuer Information

**Name** APPLE INC  
**Industry** Communications Equipment

Security Information

**Mkt of Issue** Global  
**Country** US **Currency** USD  
**Rank** Sr Unsecured **Series**  
**Coupon** 3.85 **Type** Fixed  
**Cpn Freq** S/A  
**Day Cnt** 30/360 **Iss Price** 99.41800  
**Maturity** 05/04/2043

**MAKE WHOLE @15 until 05/04/43/BULLET**  
**Issue Spread** 100.00bp vs T 2 3/4 11/15/42

**Calc Type** (1)STREET CONVENTION

**Announcement Date** 04/30/2013  
**Interest Accrual Date** 05/03/2013  
**1st Settle Date** 05/03/2013  
**1st Coupon Date** 11/04/2013

Identifiers

**ID Number** EJ6592533  
**CUSIP** 037833AL4  
**ISIN** US037833AL42

Bond Ratings

**Moody's** Aa1  
**S&P** AA+  
**Composite** AA+

Issuance & Trading

Amt Issued/Outstanding

USD 3,000,000.00 (M) /  
 USD 3,000,000.00 (M)

Min Piece/Increment

2,000.00 / 1,000.00  
**Par Amount** 1,000.00  
**Book Runner** DB,GS  
**Reporting** TRACE

AAPL 3.85 05/04/43 Corp

Page 5/11

Description: Bond

94) Notes

95) Buy

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66) Send Bond

## Bond Ratings

Agency/Type	Bond Ratings	Effective Date
<b>MOODY'S</b>		
Bond Rating	Aa1	04/30/2013
<b>STANDARD &amp; POOR'S</b>		
Bond Rating	AA+	04/30/2013
<b>BLOOMBERG COMPOSITE</b>		
Bond Composite	AA+	04/30/2013

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# Corporate Bond Terminology

- Indenture
    - Legal document specifying rights and obligations of issuer and bondholder
  - Trustee
    - Represents bondholders to assure compliance with indenture
  - Sinking Fund Provision
    - Requirement that the firm retire a certain amount or number of bonds each year
    - Protects investors with principal reduction
  - Protective Covenants
    - Places restrictions on the firm to protect bondholders
    - Examples: limits dividends and officer salaries, restricts additional debt
-



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# Corporate Bond Terminology

- Call provisions: Ability to pay bonds off early
    - Call premium
    - Advantage to issuers; disadvantage to investor
  - Bond collateral
    - Usually consists of a mortgage on real property
    - Unsecured bonds are called debentures and are backed only by the general credit of the issuing firm
-

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# Corporate Bond Terminology

- Low-coupon and zero-coupon bonds
    - Provide investors known rate of return
    - Imputed interest income taxed if not in tax-sheltered investment plan
    - Attractive to pension funds with expected payouts
  - Variable-rate bonds
  - Convertible bonds
  - Junk bonds
-

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# Junk Bonds

## ■ Junk Bonds

- ❑ Junk bonds are also called high-yield bonds or noninvestment rated bonds
  - ❑ Popularized in the direct finance boom of the 1980s
  - ❑ The risk premium is between three and seven percent above Treasury bonds and susceptible to contagion effects
  - ❑ Secondary market supported by dealer market
-

<HELP> for explanation.

1) Historical Charts ▾ 2) Export to Excel TRACE data generated from previous day's close US Distressed Debt

165 bonds found for 127 issuers

Amount 88.56BLN

■ Newly added bonds only

Issuer	Coupon	Maturity	Price	Yield↑	Spread	Amt Out
3) THORNBURG MTGE INC	18.000	03/31/15	.125	10091.100	1009080.0	17MM
4) ATP OIL & GAS CORPORATIO	11.875	05/01/15	.350	3095.630	309526.0	1MMM
5) NISKA GAS STORAGE US/CAN	8.875	03/15/18	99.750	845.059	84501.1	644MM
6) TEXAS COMPETITIVE/TCEH	10.250	11/01/15	3.510	459.983	45965.2	1MMM
7) TEXAS COMPETITIVE/TCEH	10.250	11/01/15	4.700	397.557	39718.6	2MMM
8) ADVANTA CAPITAL TRUST I	8.990	12/17/26	3.750	383.564	38099.0	89MM
9) FEDERAL HOME LOAN BANK	3.500	12/14/27	96.775	300.938	29815.1	15MM
10) OCEANOGRAFIA SA DE CV	11.250	07/15/15	18.000	232.878	23253.9	335MM
11) DESARROLLADORA HOMEX SA	7.500	09/28/15	12.100	230.515	23014.3	250MM
12) OGX AUSTRIA GMBH	8.500	06/01/18	6.375	133.023	13139.6	3MMM
13) ARALCO FINANCE SA	10.125	05/07/20	8.000	125.883	12424.7	250MM
14) OGX AUSTRIA GMBH	8.375	04/01/22	6.375	123.338	12066.8	1MMM
15) ENERGY FUTURE COMP HLDS	8.175	01/30/37	9.400	85.836	8212.6	8MM
16) DESARROLLADORA HOMEX SA	9.750	03/25/20	12.350	85.203	8363.0	400MM
17) DESARROLLADORA HOMEX SA	9.500	12/11/19	11.250	83.146	8151.2	250MM
18) URBI DESARROLLOS URBANOS	9.500	01/21/20	11.125	79.114	7761.5	300MM
19) CORPORACION GEO SA DE CV	8.875	03/27/22	13.000	70.197	6746.8	400MM
20) URBI DESARROLLOS URBANOS	9.750	02/03/22	11.750	69.897	6720.4	500MM
21) MOMENTIVE PERFORMANCE	11.500	12/01/16	35.000	65.527	6515.5	382MM
22) JAMES RIVER COAL CO	7.875	04/01/19	18.469	61.687	6012.4	270MM
23) NEWLAND INT PROP CORP	9.500	07/03/17	49.750	54.846	5415.0	228MM
24) TEXAS COMPETITIVE/TCEH	15.000	04/01/21	29.356	54.664	5186.8	1MMM
25) REDE ENERGIA SA	11.125		20.000	54.005	5034.2	497MM
26) ALLIANCE BANK JSC	10.500	03/25/17	43.250	53.309	5300.2	615MM

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000  
 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2014 Bloomberg Finance L.P.  
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DEFAULTED

94 Notes

95 Buy

96 Sell

97 Settings

21) Bond Description

22) Issuer Description

Pages	Issuer Information	Identifiers
1) Bond Info	<b>Name</b> THORNBURG MTGE INC	<b>ID Number</b> EH5133002
2) Addtl Info	<b>Industry</b> Consumer Finance	<b>CUSIP</b> 885218AG2
3) Covenants	<b>Security Information</b>	<b>ISIN</b> US885218AG20
4) Guarantors	<b>Mkt of Issue</b> Global	<b>Bond Ratings</b>
5) Bond Ratings	<b>Country</b> US <b>Currency</b> USD	<b>Moody's</b> NA
6) Identifiers	<b>Rank</b> 2nd lien <b>Series</b>	<b>Fitch</b> WD
7) Exchanges	<b>Coupon</b> 18 <b>Type</b> Defaulted	<b>Composite</b> NR
8) Inv Parties	<b>Cpn Freq</b> S/A	<b>Issuance &amp; Trading</b>
9) Fees, Restrict	<b>Day Cnt</b> 30/360 <b>Iss Price</b>	<b>Aggregated Amount Issued/Out</b>
10) Schedules	<b>Maturity</b> 03/31/2015	USD 1,150,000.00 (M) /
11) Coupons	<b>BULLET</b>	USD 16,819.00 (M)
<b>Quick Links</b>	<b>Issue Spread</b>	<b>Min Piece/Increment</b>
32) ALLQ Pricing	<b>Calc Type</b> (130)** IN DEFAULT **	1,000.00 / 1,000.00
33) QRD Quote Reca	<b>Announcement Date</b> 07/30/2008	<b>Par Amount</b> 1,000.00
34) TDH Trade Hist	<b>Bankruptcy Date</b> 05/01/2009	<b>Book Runner</b>
35) CAC Corp Action		<b>Reporting</b> TRACE
36) CF Prospectus		
37) CN Sec News		
38) HDS Holders		
39) VPR Underly Inf		
66) Send Bond	REG'D SEC; FOR 144A SEE CUSIP 885218AE7. POISON PUT @ 101%.	

<HELP> for explanation.

1<Go> to save current criteria as your default

Corporate Ratings Credit Ratings Trends

Criteria

Agencies: S&P

Region/Country: Western Europe

Rating Type: All

Industry: All

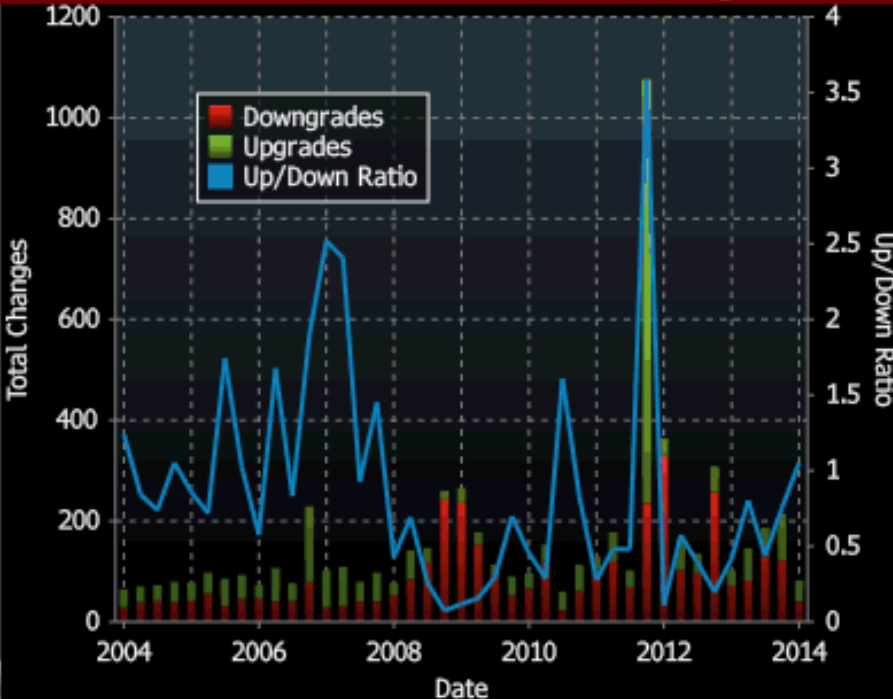
Credit Watch: Exclude

Rating Criteria: All

Results for the selected period

Period: YTD

	Upgrades	Downgrades
Total	42	40
Investment Grade	20	6
High Yield	18	30
Fallen Angels	0	0
Rising Stars	2	0



Historical Rating Actions Up/Down Ratio

	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004
Q1	1.05	.42	.11	.28	.45	.12	.43	2.52	.57	.86	1.24
Q2		.80	.57	.48	.29	.16	.69	2.41	1.68	.72	.84
Q3	N/A	.44	.39	.48	1.61	.30	.26	.93	.83	1.74	.74
Q4	N/A	.75	.20	3.58	.82	.70	.07	1.45	1.90	1.02	1.05
Total	1.05	.60	.23	1.83	.56	.22	.26	1.73	1.34	1.01	.95

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000  
 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000  
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<HELP> for explanation.

40 Total Downgrades

	Company Name	Effective Date ↓
1)	Lecta SA	01/14/2014
2)	URENCO Ltd	01/15/2014
3)	Orange SA	01/20/2014
4)	Basellandschaftliche Kantonalbank	01/20/2014
5)	Parpublica - Participacoes Publicas SGPS SA	01/21/2014
6)	Banco Portugues de Investimento SA	01/22/2014
7)	Caixa Geral de Depositos SA	01/22/2014
8)	Banco Santander Totta SA	01/22/2014
9)	Banco BPI SA	01/22/2014
10)	Banco Espirito Santo de Investimento SA	01/22/2014
11)	Banco Espirito Santo SA	01/22/2014
12)	Banco Comercial Portugues SA	01/22/2014
13)	Ocidental-Cia Portuguesa de Seguros de Vida SA	01/24/2014
14)	New World Resources NV	01/29/2014
15)	Missouri TopCo Ltd	01/31/2014
16)	Portugal Treasury Bill	02/05/2014
17)	Portugal Government International Bond	02/05/2014
18)	Portugal Obrigacoes do Tesouro OT	02/05/2014
19)	Portuguese Republic	02/05/2014
20)	Norske Skogindustrier ASA	02/06/2014
21)	Energie AG Oberoesterreich	02/07/2014

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Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2014 Bloomberg Finance L.P.  
SN 541209 CET GMT+1:00 H438-2454-0 10-Mar-2014 09:07:18

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# Other Types of Long-Term Debt Securities

- Structured notes
  - Exchange Traded Notes
  - Auction-Rate Securities
-



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# Bond Valuation and Risk

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# Bond Valuation and Risk

- Bonds are debt obligations with long-term maturities issued by governments or corporations to obtain long-term funds
  - Commonly purchased by financial institutions that wish to invest funds for long-term periods
  - Bond price (value) = present value of cash flows to be generated by the bond
-

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# Impact of the Discount Rate on Bond Valuation

- Critical for accurate valuation
  - The appropriate discount rate
    - Yield that could be earned on alternative investments with similar risk and maturity
    - Higher return on riskier securities -> higher discount rates
    - A high-risk securities have a lower value than a low risk securities even though both have the same expected cash flow
-

# Bond Risks and Prices

- Higher risk
- Higher discount rates
- Lower bond prices

- Lower risk
- Lower discount rates
- Higher bond prices

Note Inverse Relationship  
Between Risk, required returns  
and Bond Prices

# Bond Valuation Process

$$PV \text{ of bond} = \frac{C}{(1+k)^1} + \frac{C}{(1+k)^2} + \dots + \frac{C + \text{Par}}{(1+k)^n}$$

where

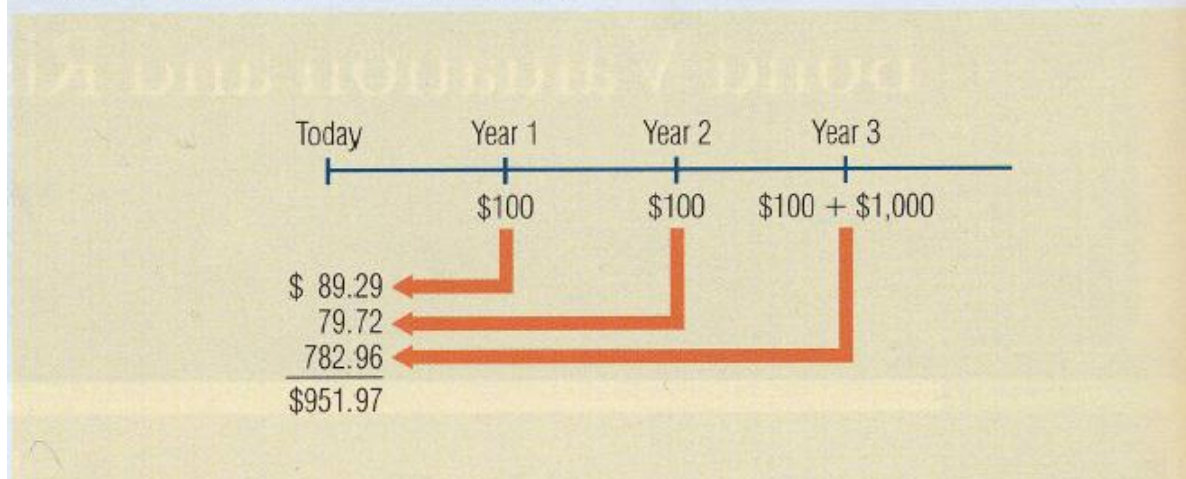
$C$  = coupon payment provided in each period

Par = par value

$k$  = required rate of return per period used to discount the bond

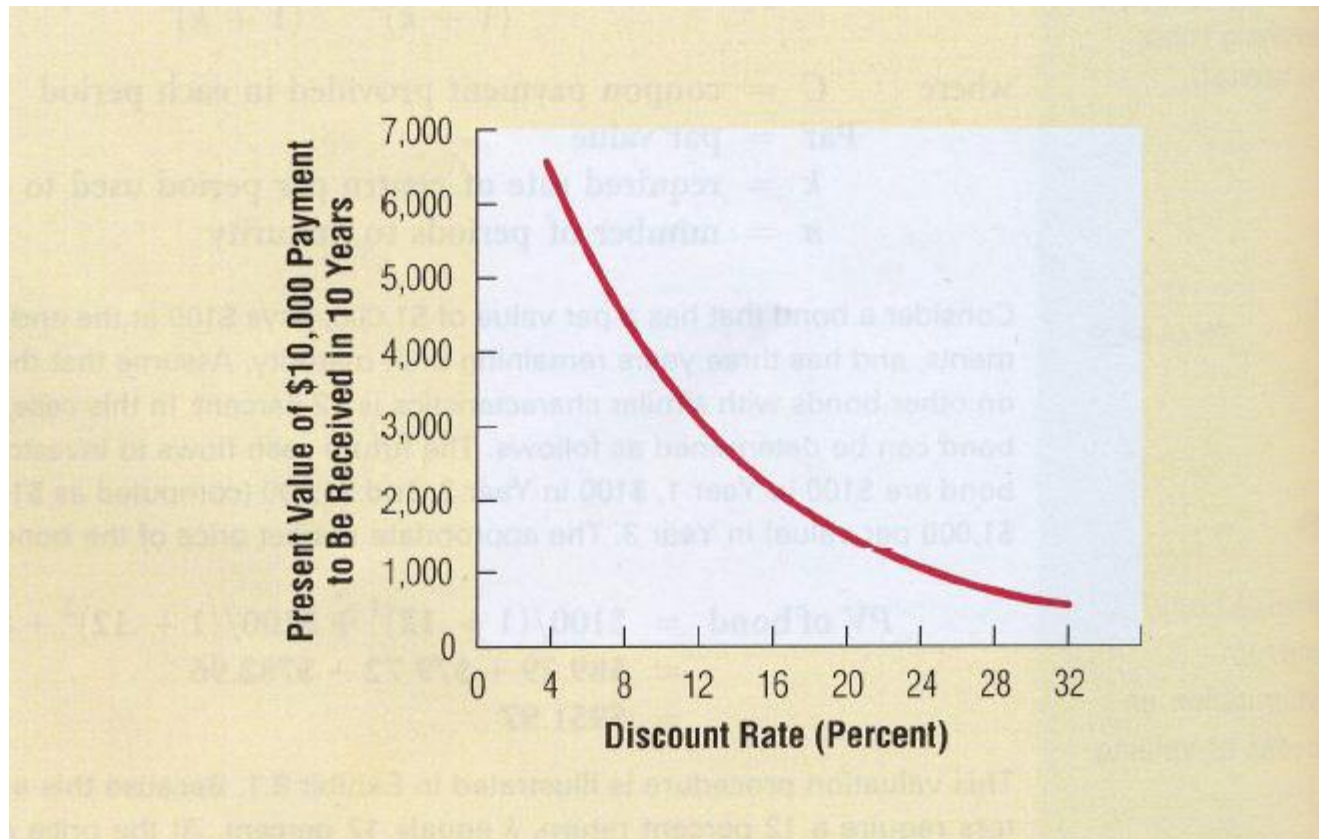
$n$  = number of periods to maturity

**Exhibit 8.1** Valuation of a Three-Year Bond



Source: Madura, J.: *Financial Markets and Institutions*, 9th Edition

# Relation between Discount Rate and Present Value of Payment



Source: Madura, J.: *Financial Markets and Institutions*, 9th Edition

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# Impact of the Timing of Payments on Bond Valuation

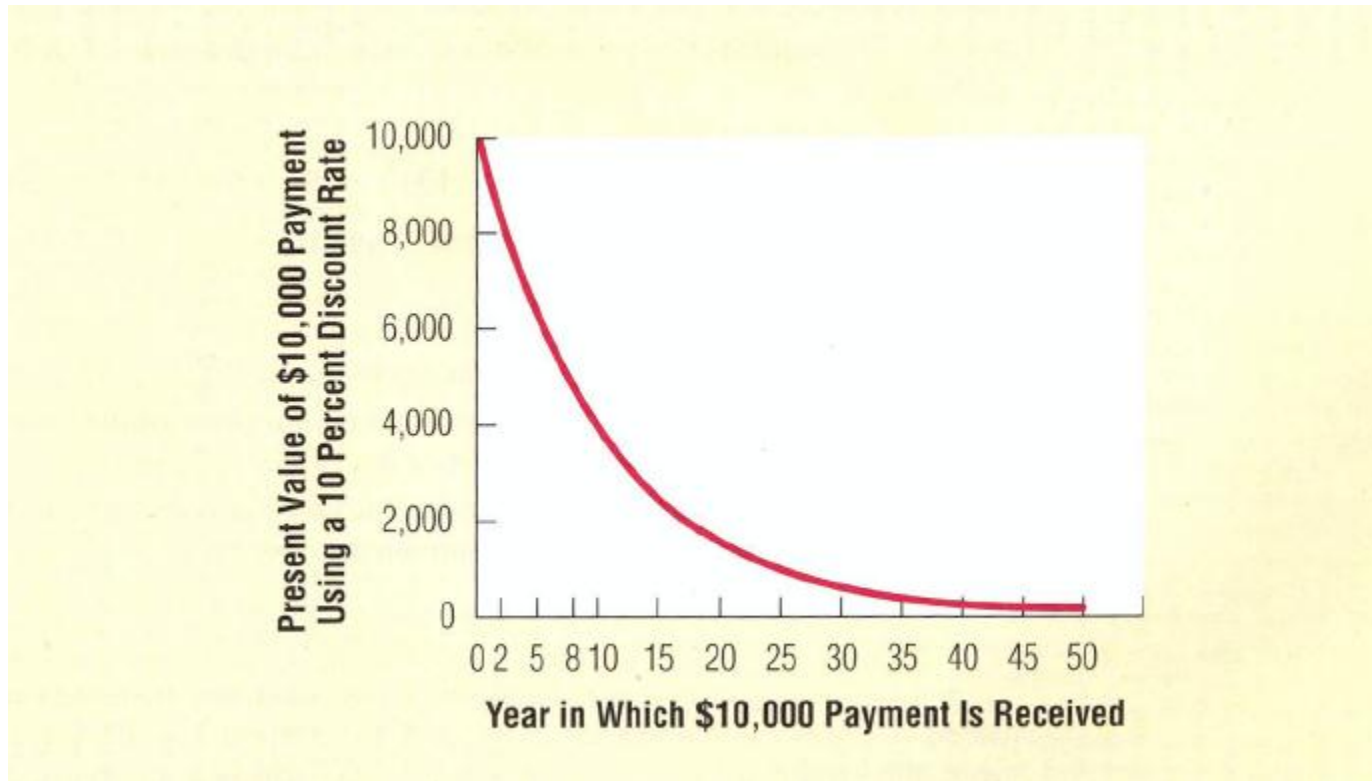
- The market price is affected by the timing of the payments made to bondholders
    - Sooner can be reinvested to earn additional returns
    - Dollar received sooner has a higher present value than one to be received later
-

# Valuation of Bonds with Semiannual Payments

$$\text{PV of bond with semiannual payments} = \frac{C/2}{[1 + (k/2)]^1} + \frac{C/2}{[1 + (k/2)]^2} + \dots + \frac{C/2 + \text{Par}}{[1 + (k/2)]^{2n}}$$



# Relation between Time of Payment and Present Value of Payment

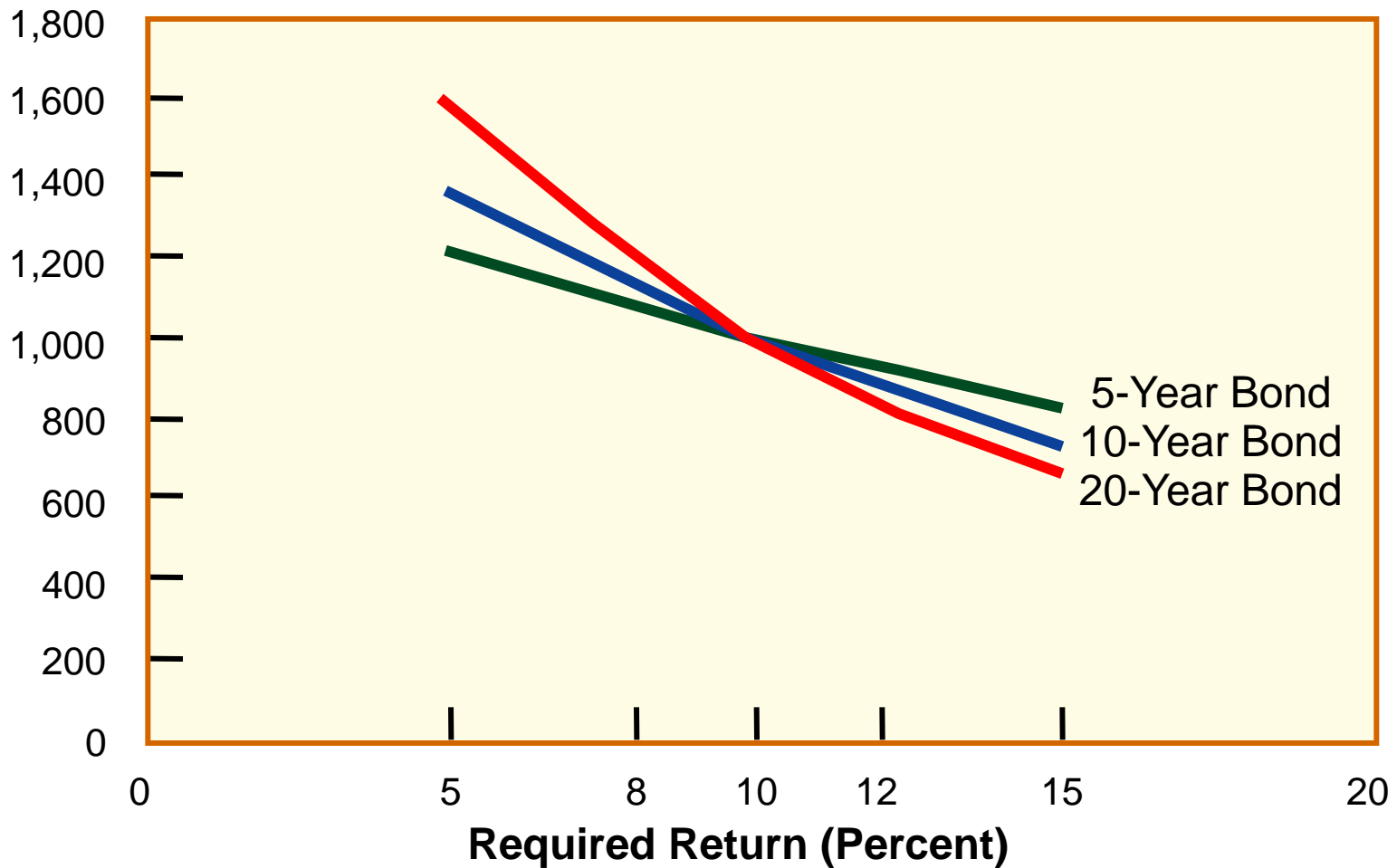


Source: Madura, J.: *Financial Markets and Institutions, 9th Edition*

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# Relations between Coupon Rate, Required Return and Bond Price

- Discount bonds
    - Larger required rate of return = the larger discount
  - 1. coupon rate  $<$  required rate of return (market value)
    - PV below its par value
  - 2. coupon rate = required rate of return (market value)
    - PV equals its par value
  - 3. coupon rate  $>$  required rate of return (market value)
    - PV above its par value
-



- ❑ Low coupon bond prices more sensitive to change in interest rates
- ❑ PV of face value at maturity a major proportion of the price

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# Explaining Bond Price Movements

- The price of a bond should reflect the present value of future cash flows discounted at a required rate of return
  - The required return on a bond is primarily determined by
    - Prevailing risk-free rate
    - Risk premium
-

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# Factors that affect the risk-free rate

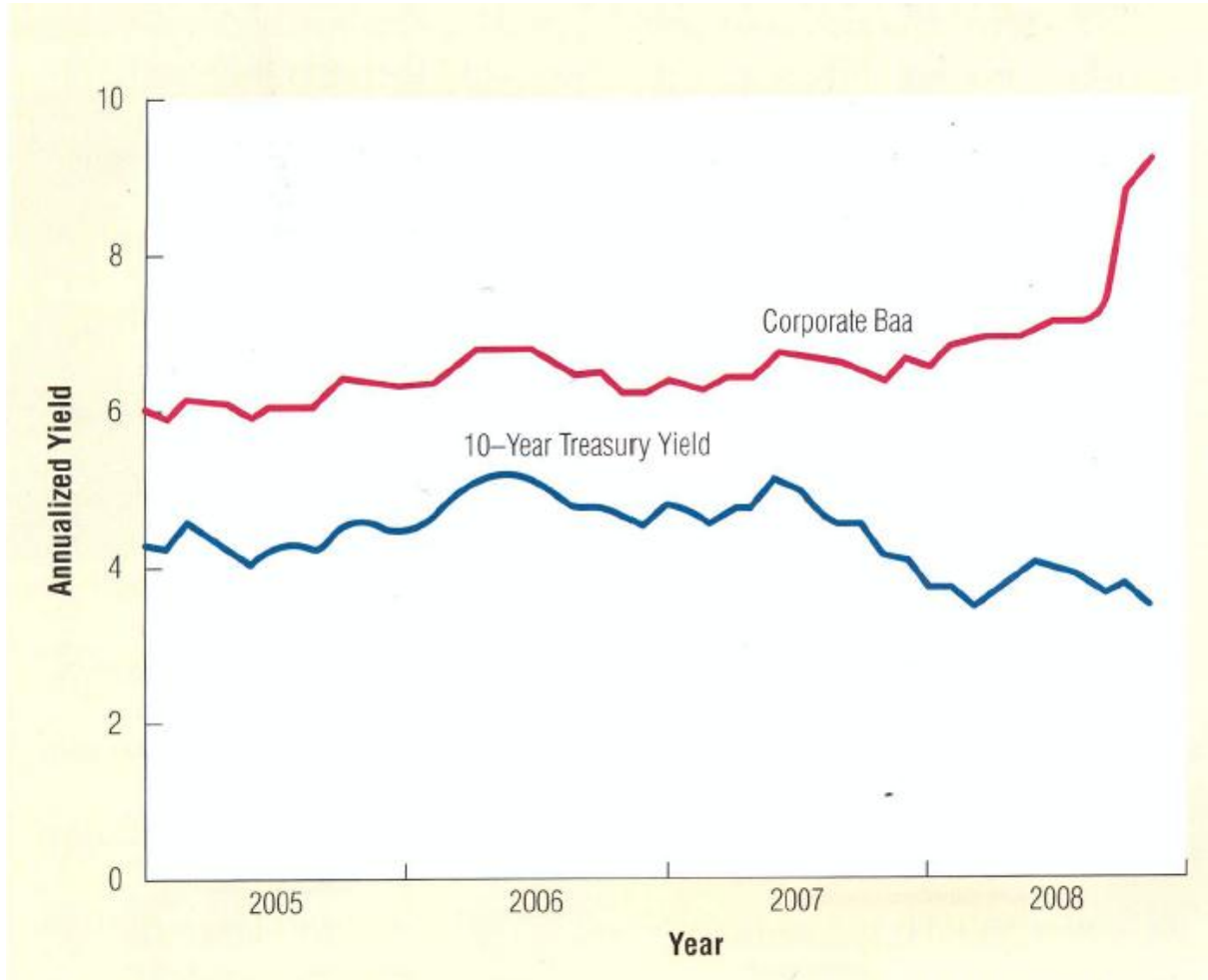
- Changes in returns on real investment
    - Financial investment an alternative to real investment
    - Opportunity cost of financial investment is the returns available from real investment
    - Federal Government deficits/surplus position
  - Inflationary expectations
    - Consumer price index
    - Federal Reserve monetary policy position
    - Oil prices and other commodity prices
    - Exchange rate movements
-

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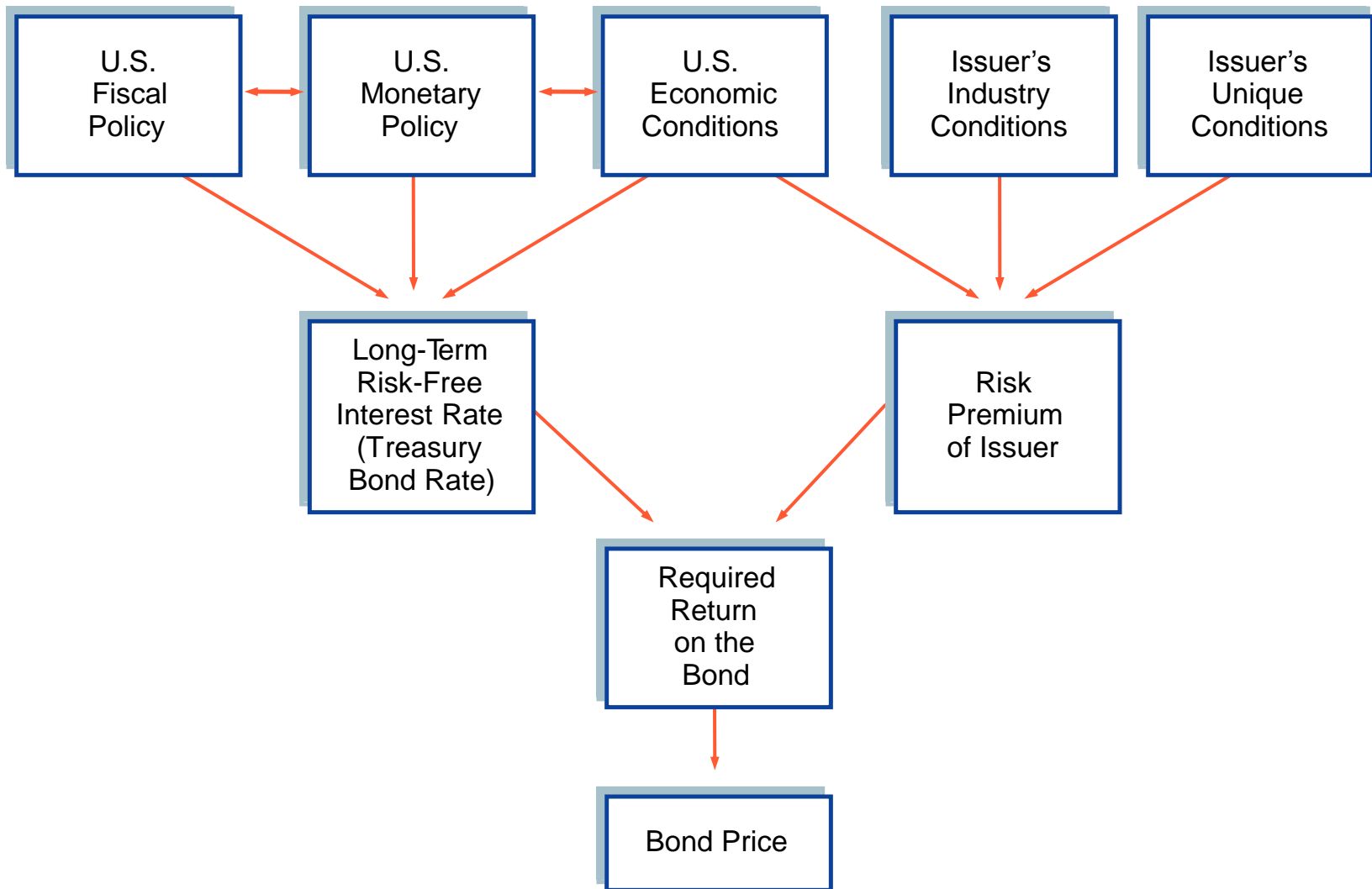
# Factors that affect the credit or default risk premium

- ❑ Strong economic growth
    - High level of cash flows
    - Investors bid up bond prices; lower default premium
  - ❑ Weak economic growth
    - Lower profits and cash flows
    - Impact on specific industries varied
    - Investors flee from risky bonds to Treasury bonds
    - Bond prices fall; default premiums increase
-

# Comparison of Bond Yields



Source: Madura, J.: *Financial Markets and Institutions, 9th Edition*



*Source: Madura, J.: Financial Markets and Institutions, 7th Edition*



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# Sensitivity of Bond Prices to Interest Rate Movements

- Depends on the bond's characteristics
  - Indicates the potential damage to bond holdings in response to and increase in interest rates
    - BOND PRICE ELASTICITY
    - DURATION
-

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# Bond Price Elasticity

- Bond Price Elasticity = Bond price sensitivity for any % change in market interest rates
  - Bond Price Elasticity =  
 $(\% \text{ Change In Price}) / (\% \text{ Change In Interest Rates})$
  - Increased elasticity means greater price risk
-

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# Bond Price Elasticity

## ■ Price-Sensitive Bonds

- ❑ Longer maturity—more price variation for a change in interest rates
  - ❑ Lower coupon rate bonds are more price sensitive (the PV is a greater % of current value)
  - ❑ Zero-coupon bonds most sensitive, approaching –1 price elasticity
  - ❑ Greater for declining rates than for increasing rates
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# Sensitivity of Bonds with Different Coupon Rates to Interest Rate Changes

EFFECTS OF A DECLINE IN THE REQUIRED RATE OF RETURN					
(1) BONDS WITH A COUPON RATE OF:	(2) INITIAL PRICE OF BONDS WHEN $k = 10\%$	(3) PRICE OF BONDS WHEN $k = 8\%$	(4) = [(3) - (2)]/(2) PERCENTAGE CHANGE IN BOND PRICE	(5) PERCENTAGE CHANGE IN $k$	(6) = (4)/(5) BOND PRICE ELASTICITY ( $P^e$ )
0%	\$ 386	\$ 463	+19.9%	-20.0%	-995
5	693	799	+15.3	-20.0	-765
10	1,000	1,134	+13.4	-20.0	-670
15	1,307	1,470	+12.5	-20.0	-625

EFFECTS OF AN INCREASE IN THE REQUIRED RATE OF RETURN					
(1) BONDS WITH A COUPON RATE OF:	(2) INITIAL PRICE OF BONDS WHEN $k = 10\%$	(3) PRICE OF BONDS WHEN $k = 12\%$	(4) = [(3) - (2)]/(2) PERCENTAGE CHANGE IN BOND PRICE	(5) PERCENTAGE CHANGE IN $k$	(6) = (4)/(5) BOND PRICE ELASTICITY ( $P^e$ )
0%	\$ 386	\$ 322	-16.6%	+20.0%	-830
5	693	605	-12.7	+20.0	-635
10	1,000	887	-11.3	+20.0	-565
15	1,307	1,170	-10.5	+20.0	-525

Source: Madura, J.: *Financial Markets and Institutions, 9th Edition*

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# Duration

- ❑ Measure of bond price sensitivity
  - ❑ Measures the life of bond on a PV basis
  - ❑ Duration = Sum of discounted, time-weighted cash flows divided by price
  - ❑ The longer a bond's duration, the greater its sensitivity to interest rate changes
  - ❑ The duration of a zero-coupon bond = bond's term to maturity
  - ❑ The duration of any coupon bond is always less than the bond's term to maturity
-

# Duration

$$\text{DUR} = \frac{\sum_{t=1}^n \frac{C_t(t)}{(1+k)^t}}{\sum_{t=1}^n \frac{C_t}{(1+k)^t}}$$

where

$C_t$  = coupon or principal payment generated by the bond

$t$  = time at which the payments are provided

$k$  = bond's yield to maturity, which reflects the required rate of return by investors

Source: Madura, J.: *Financial Markets and Institutions, 9th Edition*

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# Modified duration

- Modified duration is an easily calculated approximate of the duration measure
- $DUR^* = DUR / (1+k)$



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# Bond Investment Strategies

- Matching Strategy
    - Create bond portfolio that will generate income that will match their expected periodic expenses
    - Used to provide retirement income from savings accumulation
    - Estimate cash flow needs then select bond portfolio that will generate needed income
  - Laddered Strategy
    - Funds are allocated evenly to bonds in several different maturity classes
    - Example:  $\frac{1}{4}$  funds invested in bonds with 5 years until maturity,  $\frac{1}{4}$  in 10-year bonds,  $\frac{1}{4}$  in 15-year bonds, and  $\frac{1}{4}$  in 20-year bonds
    - Investor receives average return of yield curve over time as maturing bonds are reinvested
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# Bond Investment Strategies

## ■ Barbell Strategy

- Allocated funds to short-term bonds and long-term bonds
- Short-term bonds provide liquidity from maturity
- Long-term bonds provide higher yield

## ■ Interest Rate Strategy

- Funds are allocated in a manner that capitalizes on interest rate forecasts
  - Example: if rates are expected to decline, move into longer-term bonds
  - Problems:
    - High transaction costs because of higher trading
    - Difficulty in forecasting interest rates
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