Introduction to Corporate Finance

Chapter 1

Outline

1. Types of Firms
2. Definition of Corporate Finance
3. The Financial Manager
4. The Goal of Financial Management
5. The Agency Problem
6. Financial Markets

Forms of Business Organization

Forms of Business Organization

There are 3 major forms of business organization, each with its pros and cons.

1. Sole Proprietorship
2. Partnership
3. Corporation

Sole Proprietorship

A business owned by a single individual. In general, the business has no existence apart from its owner: its life is limited to the proprietor's own life span.

Sole Proprietorship

Pros:

- Easy to start & simple structure

Cons:

- Unlimited liability from creditors
- Equity raised is limited to the proprietor's personal wealth

Partnership

A business much like a sole proprietorship, but formed by two or more owners.

Partnership

Pros:

- Easy to start & simple structure

Cons:

- Unlimited liability from creditors for general partners
- Difficult to transfer ownership

Corporation

A business created as a distinct legal entity composed of one or more individuals or entities.

Corporation

Pros:

- Limited liability for owners
- Easy transfer of ownership and raising of equity financing
- Unlimited life

Cons:

- Double taxation
- Relatively more difficult to establish

Other Forms of Business Organization

We will focus on corporations, but other forms include:

S-corp

A corporation, but without double taxation, limited to about 100 shareholders

LLC

A limited liability corporation, operates as a sole proprietorship or partnership but retains limited liability and generally avoids double taxation

Start a Business!

To begin filing paperwork, visit the Kentucky Secretary of State's website.

Explore business listings as well.

To Summarize

The forms of business organization each have pros and cons. Unlimited liability to creditors can be a significant drawback for sole proprietorships and partnerships.

What is Corporate Finance?

Corporate Finance Answers 3 Questions

1. What long-term investments should the firm take on?
2. Where and how will the firm secure long-term financing?
3. How will the firm manage everyday financial activities?

Long-Term Investments

- The process of planning and managing a firm's long term investments is known as capital budgeting.
- The value of the cash flow generated by an investment should exceed its cost.

Investment Opportunities

Depend on the nature of the business:

- The Walt Disney Company expanding Disneyland Paris theme park or acquiring 20th Century Fox.
- Uber pulling out of south-east Asia.

Long-Term Financing

- Financing is needed to support long term investments
- The firm can borrow (debt) or use funds generated by selling ownership of the firm to investors (equity)

Long-Term Financing Examples

- Tesla raised $1.8 billion by promising to pay back funds in the future (debt)
- Snapchat raised $3.4 billion by selling ownership shares of the company (equity)

Capital Structure

The mixture of debt and equity that comprises the firm.

- If the firm is a pie, the *capital structure* is how it is sliced
- The optimal mix of debt and equity is based on the costs associated with each
- Sources and timing of long-term financing is important

Everyday Financial Activities

Working Capital refers to a firm's short-term (or current) assets and liabilities.

- How much cash should be kept on hand for a particular firm?
- How many days worth of inventory should that firm hold?
- Should that firm purchase on credit from suppliers or obtain financing and pay cash?

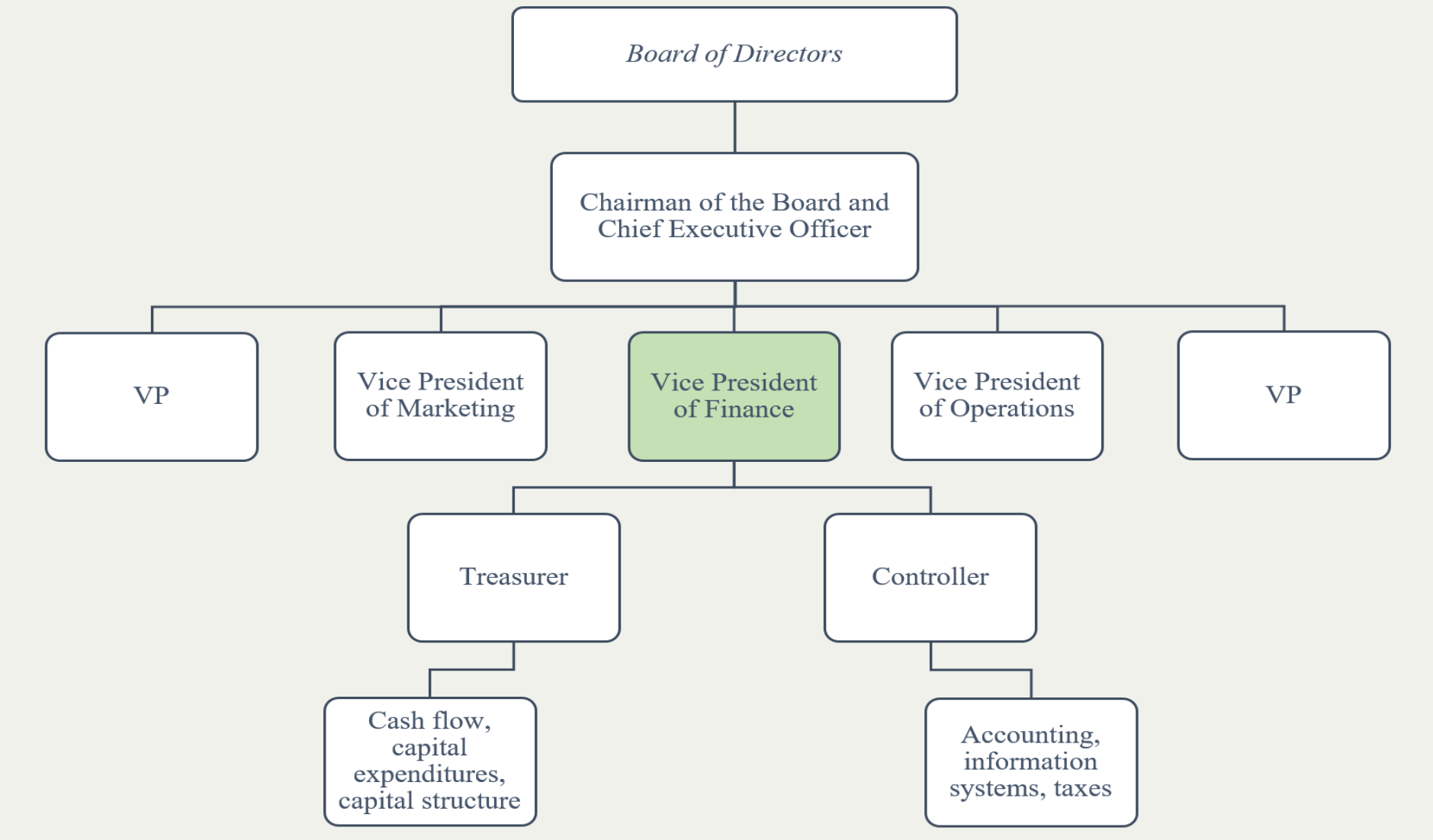
To Summarize

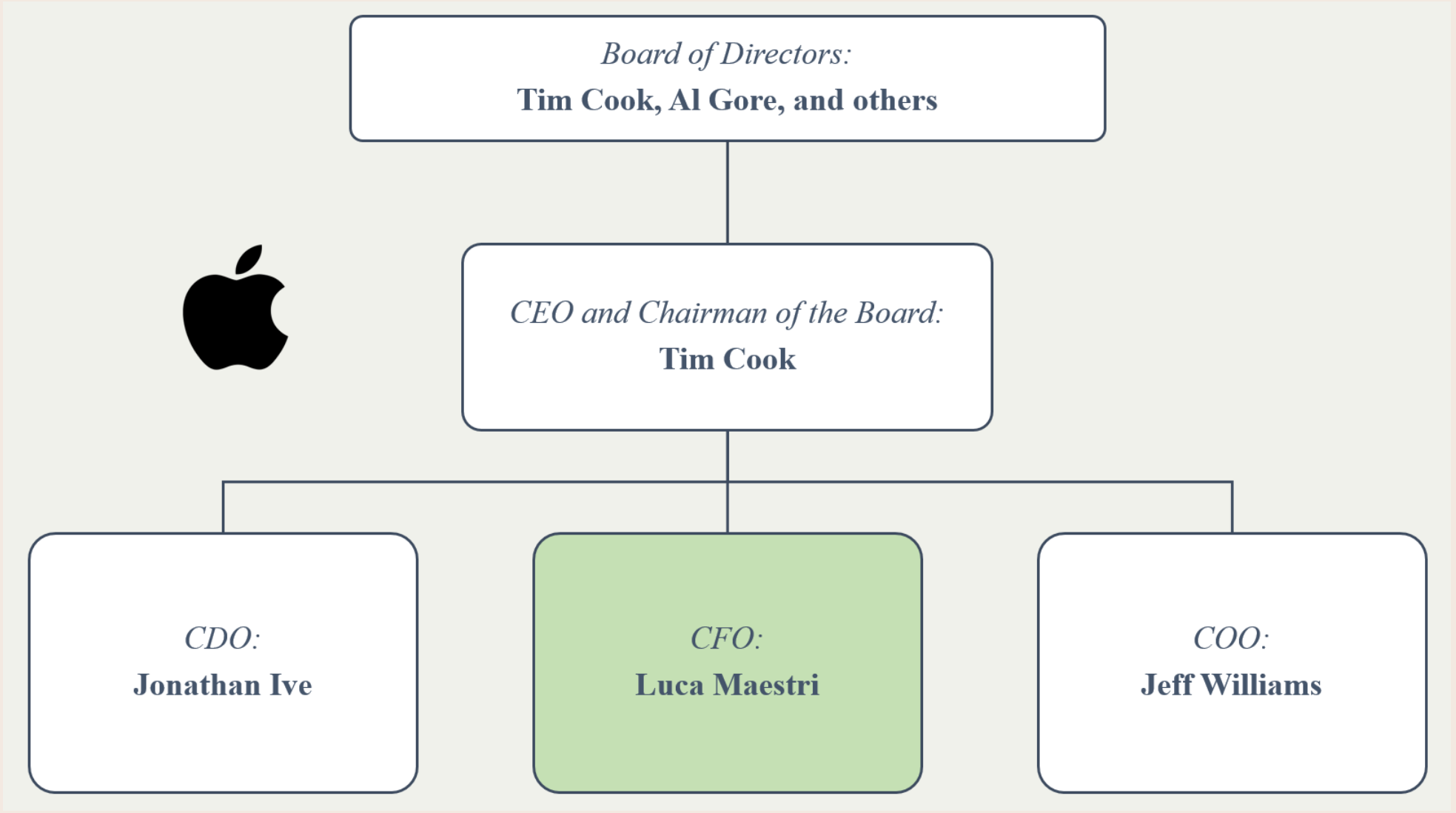
Corporate Finance seeks to answer questions regarding long-term investments, financing, and the capital structure of the firm.

The Financial Manager

The Financial Manager

In corporations, tasked with answering those three broad corporate finance questions we've discussed.


Board of Directors
Chairman of the Board and Chief Executive Officer
VP
Vice President of Marketing
Vice President of Finance
Vice President of Operations
VP
Treasurer
Controller
Cash flow, capital expenditures, capital structure
Accounting, information systems, taxes


Board of Directors:
Tim Cook, Al Gore, and others
CEO and Chairman of the Board:
Tim Cook
CDO:
Jonathan Ive
CFO:
Luca Maestri
COO:
Jeff Williams

The Goal of Financial Management

Possible Goals of the Financial Manager

Maximize Sales?

But we can incur costs to the point where we make no profits.

Maximize Profits?

When? Now? Is this at the expense of the future?

Survive?

This could lead to less risk-taking and lower profits.

The Goal of Financial Management

To maximize the current value per share of existing stock.

The Agency Problem

Separation of Ownership and Management

The financial manager should seek to maximize value for the shareholders, not pursue their individual interests at the shareholders' expense.

The Agency Problem

The possibility of conflict between the owners (stockholders) of a firm and the management of a firm.

Examples:

- An investment isn't pursued because failure would cost the manager their job
- A manager only pursues certain investments so that they control more (empire building)

Potential Solutions

1. Tie manager performance to the performance of the firm (stock options)
2. Shareholder monitoring through voting at company elections

To Summarize

The separation of owner and manager leads to the rise of the agency problem, but there are ways to minimize this issue.

Financial Markets & The Corporation

Financial Markets

Allow for the raising of capital or exchange of ownership.

Primary & Secondary Markets

1. *Primary Markets*: raise capital through public offerings or private placements (i.e., Snapchat's IPO)

2. *Secondary Markets*: trading ownership of a corporation; these transactions help to establish the value of the firm (i.e., buying and selling stock)

Why Managers Care About the Stock Price

A public company doesn't profit or lose money when its share price fluctuates in the secondary market. But the price matters for a number of reasons:

1. Compensation
2. Raising capital in the future
3. Creditors
4. Takeover target
5. Use of shares to acquire other firms

To Summarize

Financial markets matter for raising capital and assessing the health of the firm.

Takeaways

Takeaways

1. Three main forms of business organization, each with pros and cons.
2. Limited liability is an important feature of corporations and LLCs, encouraging entrepreneurship.
3. Corporate finance seeks to answer 3 main questions regarding investing, financing, and daily activities.
4. The financial manager deals with these questions and seeks to maximize the value of the firm.
5. But agency problems exist.
6. Financial markets allow for raising of capital and exchange of ownership, and managers care about the secondary markets.

End.

Financial Statements, Taxes, and Cash Flow

Chapter 2

Outline

1. The Balance Sheet & Income Statement
2. Corporate Tax Rates (and the new law)
3. Cash Flow from Assets

Financial Statements

Financial Statements

Reports that provide information on the firm's conditions and activities.

1. Balance Sheet
2. Income Statement
3. Statement of Cash Flows (a later chapter)

Where to Find Financial Statements

Financial Statements for public companies are included in the annual 10-K filing, available on the company's or SEC's website.

The Balance Sheet

The Balance Sheet

Summarizes what a firm owns (its assets), what a firm owes (its liabilities) and the difference between the two (the firm's equity).

U.S. CORPORATION
2014 and 2015 Balance Sheets
($ in millions)

Assets	2014	2015	Liabilities and Owners' Equity	2014	2015
Current assets			Current liabilities		
Cash	$ 104	$ 160	Accounts payable	$ 232	$ 266
Accounts receivable	455	688	Notes payable	196	123
Inventory	553	555	Total	$ 428	$ 389
Total	$1,112	$1,403			
Fixed assets					
Net plant and equipment	$1,644	$1,709	Long-term debt	$ 408	$ 454
			Owners' equity		
			Common stock and paid-in surplus	600	640
			Retained earnings	1,320	1,629
			Total	$1,920	$2,269
Total assets	$2,756	$3,112	Total liabilities and owners' equity	$2,756	$3,112

The Balance Sheet Identity

The balance sheet must satisfy the *balance sheet identity*:

Assets = Liabilities + Shareholders' Equity

Shareholders' Equity

Let's rearrange the Balance sheet identity:

Shareholders' Equity = Assets – Liabilities

What this tells us is that shareholders are entitled to what remains of the firm after debt holders are paid.

Thus, shareholders' equity is the *residual value*, and shareholders are the *residual claimants.*

U.S. CORPORATION
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($ in millions)

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If this firm ceases to exist, the $3,112 in total assets will be sold off to pay the liabilities of $843. The difference $3,112 – 843 = $2,269 would be split among the shareholders.

Net Working Capital

Net Working Capital is the difference between current assets and current liabilities.

NWC = Current Assets - Current Liabilities

For healthy firms, this is usually positive, indicating that *liquid* assets in the short term can pay accounts due within the short term.

Liquidity

The ability to convert an asset to cash quickly without a significant loss in value.

Current assets are *liquid* because they can be easily sold.

Is Liquidity Good?

Liquid firms are less likely to experience distress, but generally less profitable.

Real-World Example

Using Harley-Davidson's balance sheet on the next slide, do the following for 2017:

1. Verify the balance sheet identity.
2. Calculate the net working capital. What does this mean?
3. Find the residual value of the firm. What does this mean?

HARLEY-DAVIDSON, INC.
CONSOLIDATED BALANCE SHEETS
December 31, 2017 and 2016
(In thousands, except share amounts)

	2017	2016
ASSETS		
Current assets:		
Cash and cash equivalents	$ 687,521	$ 759,984
Marketable securities	—	5,519
Accounts receivable, net	329,986	285,106
Finance receivables, net	2,105,662	2,076,261
Inventories	538,202	499,917
Restricted cash	47,518	52,574
Other current assets	175,853	174,491
Total current assets	3,884,742	3,853,852
Finance receivables, net	4,859,424	4,759,197
Property, plant and equipment, net	967,781	981,593
Prepaid pension costs	19,816	—
Goodwill	55,947	53,391
Deferred income taxes	109,073	167,729
Other long-term assets	75,889	74,478
	$ 9,972,672	$ 9,890,240
LIABILITIES AND SHAREHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 227,597	$ 235,318
Accrued liabilities	529,822	486,652
Short-term debt	1,273,482	1,055,708
Current portion of long-term debt, net	1,127,269	1,084,884
Total current liabilities	3,158,170	2,862,562
Long-term debt, net	4,587,258	4,666,975
Pension liability	54,606	84,442
Postretirement healthcare liability	118,753	173,267
Other long-term liabilities	209,608	182,836
Commitments and contingencies (Note 14)		
Shareholders' equity:		
Preferred stock, none issued	—	—
Common stock, 181,286,547 and 180,595,054 shares issued, respectively	1,813	1,806
Additional paid-in-capital	1,422,808	1,381,862
Retained earnings	1,607,570	1,337,673
Accumulated other comprehensive loss	(500,049)	(565,381)
Treasury stock (13,195,731 and 4,647,345 shares, respectively), at cost	(687,865)	(235,802)
Total shareholders' equity	1,844,277	1,920,158
	$ 9,972,672	$ 9,890,240

Market Value vs. Book Value

It's important to know that financial statements present *book* values.

- *Book value* -- what the firm originally paid for its assets (less depreciation), or the original face value of its debt.
- *Market value* -- the price at which assets, liabilities, or equity can be bought or sold.

The *market values* are more important to the decision making process of managers because those values are more reflective of the cash flows that would occur today.

A Note about Equity Value

Because equity on the balance sheet is the *book* value of equity:

Shareholders' Equity ≠ Value of the Firm

To Summarize

The Balance Sheet provides a snapshot of the firm, summarizing what the firm owns and owes. Equity is what is left after subtracting liabilities from assets.

The Income Statement

The Income Statement

Measures the performance over a period of time, recording the revenues and expenses of the firm.

U.S. CORPORATION 2015 Income Statement ($ in millions)		
Net sales		$1,509
Cost of goods sold		750
Depreciation		65
Earnings before interest and taxes		$ 694
Interest paid		70
Taxable income		$ 624
Taxes (34%)		212
Net income		$ 412
Dividends	$103	
Addition to retained earnings	309	

The Income Statement Equation

Net Income = Revenues - Expenses

A Caveat

Net income is *not* cash flow, because it includes non-cash expenses such as depreciation and amortization. These are expenses that the company isn't "paying out" with cash.

HARLEY-DAVIDSON, INC.
CONSOLIDATED STATEMENTS OF INCOME
Years ended December 31, 2017, 2016 and 2015
(In thousands, except per share amounts)

	2017	2016	2015
Revenue:			
Motorcycles and Related Products	$ 4,915,027	$ 5,271,376	$ 5,308,744
Financial Services	732,197	725,082	686,658
Total revenue	5,647,224	5,996,458	5,995,402
Costs and expenses:			
Motorcycles and Related Products cost of goods sold	3,261,683	3,419,710	3,356,284
Financial Services interest expense	180,193	173,756	161,983
Financial Services provision for credit losses	132,444	136,617	101,345
Selling, administrative and engineering expense	1,181,641	1,217,439	1,220,095
Total costs and expenses	4,755,961	4,947,522	4,839,707
Operating income	891,263	1,048,936	1,155,695
Investment income	3,580	4,645	6,585
Interest expense	31,004	29,670	12,117
Income before provision for income taxes	863,839	1,023,911	1,150,163
Provision for income taxes	342,080	331,747	397,956
Net income	$ 521,759	$ 692,164	$ 752,207
Earnings per common share:			
Basic	$ 3.03	$ 3.85	$ 3.71
Diluted	$ 3.02	$ 3.83	$ 3.69
Cash dividends per common share	$ 1.46	$ 1.40	$ 1.24

To Summarize

The income statement equation is straightforward, but it can include non-cash expenses. Net income is not to be confused for cash the firm made in a time period.

Taxes

The Tax Code

Complex and frequently changing. We take a simplified approach.

Marginal vs. Average Tax Rates

The *marginal rate* is the % paid on the next dollar earned.

The *average rate* is the total tax bill divided by the taxable income.

TAX FOUNDATION

Table 1. Tax Brackets and Rates, 2018

Rate	For Unmarried Individuals, Taxable Income Over	For Married Individuals Filing Joint Returns, Taxable Income Over	For Heads of Households, Taxable Income Over
10%	$0	$0	$0
12%	$9,525	$19,050	$13,600
22%	$38,700	$77,400	$51,800
24%	$82,500	$165,000	$82,500
32%	$157,500	$315,000	$157,500
35%	$200,000	$400,000	$200,000
37%	$500,000	$600,000	$500,000

Marginal and Average Tax Rate Example

Using the table of marginal rates on the previous slide:

1. Calculate the tax bill for married individuals filing joint returns with a taxable income of $174,000 in 2018.
2. Find the average tax rate for this married couple.

Marginal and Average Tax Rate Example

$$
\begin{aligned}
Tax\ Bill = {} & 0.10(\$19,050) + \\
& 0.12(\$77,400 - \$19,050) + \\
& 0.22(\$165,000 - \$77,400) + \\
& 0.24(\$174,000 - \$165,000) \\
= {} & \$30,339
\end{aligned}
$$

Marginal and Average Tax Rate Example

$$
\begin{aligned}
Average\ Tax\ Rate &= \frac{Tax\ Bill}{Taxable\ Income} \\
&= \frac{\$30,339}{\$174,000} \\
&= 17.44\%
\end{aligned}
$$

Corporate Taxes

The corporate tax bill was similarly calculated, but the new tax law created a 21% flat rate.

THE WALL STREET JOURNAL.

Trump Signs Sweeping Tax Overhaul Into Law

President also approves bill keeping government funded until mid-January

Corporate Taxes

The US had the highest tax rate among developed nations, but firms generally paid much less than the highest U.S. federal corporate income tax rate of 35%.

Look up what firms pay here.

Debt and Taxes

A benefit of a firm using debt in their *capital structure* is that interest expense is *pre-tax*, resulting in a lower tax bill and more cash available to the firm and to shareholders.

Pre-Tax Debt Example

You are a shareholder of a corporation entitled to a dividend that is 20% of Net Income. You pay a 15% tax on the dividend. The firm has to pay $150 in interest, and the corporate tax rate is 21%.

	Pre-tax Interest	*After-tax Interest*
Revenue	1,000	1,000
COGS	(600)	(600)
Depreciation	(80)	(80)
EBIT	320	320
Interest	(150)	--
Taxable Income	170	320
Taxes (21%)	(35.7)	(67.2)
		252.8
Interest	--	(150.0)
Net Income	134.3	102.8
Dividends (20% of N.I.)	26.9	20.6
Tax on Dividends (15%)	(4.0)	(3.1)
Cash to you	**22.8**	**17.5**

To Summarize

Corporate taxes are complicated and can change (now a flat rate of 21% applies). The marginal tax rate is the percentage paid on the next dollar. In general, debt is favorably treated by tax law.

Cash Flow

Cash Flow

The difference between the number of dollars coming in and the number of dollars going out is the *cash flow* of the firm.

This is distinct from the *statement of cash flows* which we cover later.

Cash flow is perhaps a better metric for financial managers and investors than net income.

Cash Flow from Assets

Total cash flow to creditors and stock holders.

$$\begin{aligned} CFFA = & \ Operating\ Cash\ Flow \\ & - \ Net\ Capital\ Spending \\ & - \Delta\ in\ NWC \end{aligned}$$

Cash Flow from Assets

where…

$$\begin{aligned} Operating\ Cash\ Flow = {} & Earnings\ Before\ Interest\ \&\ Taxes \\ & + \ Depreciation \\ & - Taxes \end{aligned}$$

$$\begin{aligned} Net\ Capital\ Spending = {} & Ending\ Net\ Fixed\ Assets \\ & - \ Beginning\ Net\ Fixed\ Assets \\ & + Depreciation \end{aligned}$$

$$\begin{aligned} \Delta\ in\ NWC = {} & Ending\ Net\ Working\ Capital \\ & - \ Beginning\ Net\ Working\ Capital \end{aligned}$$

Example- Find the Operating Cash Flow

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OCF = $694 + $65 - $212 = $547

Example- Find the Net Capital Spending

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($ in millions)

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Total assets	$2,756	$3,112	Total liabilities and owners' equity	$2,756	$3,112

NCS = $1,709 - $1,644 + $65 = $130

EXAMPLE- FIND THE Δ IN NWC

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$$\Delta \text{ in NWC} = (\$1{,}403 - \$389) - (\$1{,}112 - \$428) = \$330$$

Example- Determine the CFFA

$$CFFA = Operating\ Cash\ Flow - Net\ Capital\ Spending - \Delta\ in\ NWC$$

CFFA= $547 - $130 - $330 = $87

Another CFFA Expression

$$Cash\ Flow\ from\ Assets\ (CFFA) = Cash\ Flow\ to\ Creditors + Cash\ Flow\ to\ Stock\ Holders$$

Cash Flow from Assets

And…

$$\begin{aligned} \text{Cash Flow to Creditors} &= \text{Interest Paid} \\ &\quad - \text{Net New Borrowing} \end{aligned}$$

$$\begin{aligned} \text{Cash Flow to Shareholders} &= \text{Dividends Paid} \\ &\quad - \text{Net New Equity Issued} \end{aligned}$$

$$\begin{aligned} \text{Net New Borrowing} &= \text{New Long Term Debt} \\ &\quad - \text{Old Long Term Debt} \end{aligned}$$

$$\begin{aligned} \text{Net Equity Issued} &= \text{New Common Equity} \\ &\quad - \text{Old Common Equity} \end{aligned}$$

Example- Find the CFFA

A firm paid $705 in interest and $1,080 in dividends in 2017. From 2016 to 2017, long term debt increased from $3,900 to $4,890 while equity issued fell from $5,800 to $4,870.

$$CFFA = \$705 - (\$4{,}890 - \$3{,}900) + \$1{,}080 - (\$4{,}870 - \$5{,}800) = \underline{\$1{,}725}$$

To Summarize

Cash Flow is important: we need to know how much firms make (in *cash*) and where it is going.

I. The cash flow identity

Cash flow from assets = Cash flow to creditors (bondholders)
+ Cash flow to stockholders (owners)

II. Cash flow from assets

Cash flow from assets = Operating cash flow
− Net capital spending
− Change in net working capital (NWC)

where:

Operating cash flow = Earnings before interest and taxes (EBIT)
+ Depreciation − Taxes

Net capital spending = Ending net fixed assets − Beginning net fixed assets
+ Depreciation

Change in NWC = Ending NWC − Beginning NWC

III. Cash flow to creditors (bondholders)

Cash flow to creditors = Interest paid − Net new borrowing

IV. Cash flow to stockholders (owners)

Cash flow to stockholders = Dividends paid − Net new equity raised

Takeaways

Takeaways

1. Market value matters more than book value when making decisions.
2. Net income includes non-cash expenses, making cash flow a better metric for understanding value to shareholders.
3. The marginal tax rate is the tax you pay on the next dollar.
4. The average tax rate is the total tax bill divided by taxable income.
5. The pre-tax nature of interest is a benefit of debt.
6. Cash Flow from Assets is the cash flow to stock holders and debt holders and can be calculated using income statement and balance sheet items.

End.

Working with Financial Statements

Chapter 3

Outline

1. Cash Flows: A Closer Look
    A. Sources and Uses of Cash
    B. The Statement of Cash Flow
2. Standardized Financial Statements
3. Ratio Analysis
4. The DuPont Identity

Cash Flows: A Closer Look

Sources and Uses of Cash

Firms generate cash by selling goods or products and use cash by paying for inputs and labor.

These activities are known as *sources* and *uses* of cash.

Sources and Uses of Cash

J. Alfred Prufrock Corporation
Balance Sheet
($ in millions)

Assets			
Current Assets	2016	2017	Change
Cash	$ 84	$ 98	14
Accounts Receivable	165	188	23
Inventory	393	422	29
Total	$ 642	$ 708	66
Fixed Assets			
Net Plant and Equipment	$ 2731	$ 2880	149
Total Assets	$ 3373	$ 3588	215

Liabilities and Owners' Equity			
Current Liabilities			
Accounts Payable	$ 312	$ 344	32
Notes Payable	231	196	(35)
Total	$ 543	$ 540	(3)
Long-term Debt	$ 531	$ 457	(74)
Owners' Equity			
Commons Stock and Paid-In Surplus	$ 500	$ 550	50
Retained Earnings	1799	2041	242
Total	$ 2299	$ 2591	292
Total Liabilities and Owners' Equity	$ 3373	$ 3588	215

An increase in non-cash assets ⟶ A use of cash. (Buying more inventory, building more factories.)

An increase in liabilities ⟶ A source of cash. (Money coming in through borrowing.)

Sources and Uses of Cash

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A decrease in non-cash assets ⟶ A source of cash. (Selling inventory, borrowers paying off their accounts which decreases A/R.)

A decrease in liabilities ⟶ A use of cash. (Paying off your accounts and notes payable)

The Statement of Cash Flows

Summarizes a firm's uses and sources of cash over a period.

1. Operating
2. Investing
3. Financing

The Statement of Cash Flows

J. Alfred Prufrock Corporation 2017 Statement of Cash Flows ($ in millions)		
Cash, beginning of year	$	84
Operating Activity		
Net Income		363
Plus:		
Depreciation		276
Increase in Accounts Payable		32
Less:		
Increase in Accounts Receivable		-23
Increase in Inventory		-29
Net cash from Operating Activity		619
Investment Activity		
Fixed Asset Acquisitions		-425
Net Cash for Investment Activity		-425
Financing Activity		
Decrease in Notes Payable		-35
Decrease in Long Term Debt		-74
Dividends Paid		-121
Increase in Common Stock		50
Net Cash from Financing Activity		-180
Net Increase in Cash		14
Cash, end of year	$	98

Notice that the net increase in cash on this statement is the same as the change in cash on the balance sheet.

Real-World Example: Royal Caribbean

1. What is the largest single source and use of cash?
2. Why is depreciation and amortization added back to net income?
3. Where are most of the cash flows coming from (operating, investing, or financing activities)?

CONSOLIDATED STATEMENTS OF CASH FLOWS

	Year Ended December 31,		
	2017	2016	2015
	(in thousands)		
Operating Activities			
Net income	$ 1,625,133	$ 1,283,388	$ 665,783
Adjustments:			
Depreciation and amortization	951,194	894,915	827,008
Impairment of Pullmantur related assets	—	—	411,267
Net deferred income tax expense (benefit)	1,730	2,608	(10,001)
Share-based compensation expense	69,459	32,659	36,073
Equity investment income	(156,247)	(128,350)	(81,026)
Amortization of debt issuance costs	45,943	52,795	52,153
Gain on sale of property and equipment	(30,902)	—	—
(Gain) loss on derivative instruments not designated as hedges	(61,704)	45,670	59,162
Changes in operating assets and liabilities:			
(Increase) decrease in trade and other receivables, net	(32,043)	4,759	63,102
Decrease (increase) in inventories	2,424	(1,679)	1,197
Decrease (increase) in prepaid expenses and other assets	20,859	11,519	(2,262)
Increase (decrease) in accounts payable	36,780	29,564	(25,278)
Increase (decrease) in accrued interest	1,303	7,841	(10,749)
Increase in accrued expenses and other liabilities	34,215	20,718	33,859
Increase (decrease) in customer deposits	274,705	188,632	(92,849)
Dividends received from unconsolidated affiliates	109,677	75,942	33,338
Other, net	(17,960)	(4,291)	(14,411)
Net cash provided by operating activities	2,874,566	2,516,690	1,946,366
Investing Activities			
Purchases of property and equipment	(564,138)	(2,494,363)	(1,613,340)
Cash received (paid) on settlement of derivative financial instruments	63,224	(213,202)	(178,597)
Investments in and loans to unconsolidated affiliates	(10,396)	(9,155)	(56,163)
Cash received on loans to unconsolidated affiliates	62,303	38,213	124,253
Proceeds from sale of property and equipment	230,000	—	—
Other, net [1]	5,415	(46,385)	(19,128)
Net cash used in investing activities	(213,592)	(2,724,892)	(1,742,975)
Financing Activities			
Debt proceeds	5,866,966	7,338,560	4,399,501
Debt issuance costs	(51,590)	(88,241)	(68,020)
Repayments of debt	(7,835,087)	(6,365,570)	(4,118,553)
Purchase of treasury stock	(224,998)	(299,960)	(200,000)
Dividends paid	(437,455)	(346,487)	(280,212)
Proceeds from exercise of common stock options	2,525	2,258	11,252
Other, net	3,843	3,249	2,520
Net cash (used in) provided by financing activities	(2,675,796)	243,809	(253,512)
Effect of exchange rate changes on cash	2,331	(24,569)	(17,555)
Net (decrease) increase in cash and cash equivalents	(12,491)	11,038	(67,676)

To Summarize

At the most fundamental level, firms generate and spend cash. The Statement of Cash Flows presents the sources and uses of cash.

Standardized Financial Statements

Common Size Statements

These statements present items in percentage terms, allowing for comparison to firms of different sizes or to the past.

The Common Size Balance Sheet

J. Alfred Prufrock Corporation
Balance Sheet
($ in millions)

Assets						
Current Assets	2016		2017			Change
Cash	$ 84	*2.5%*	$ 98	*2.7%*		0.2%
Accounts Receivable	165	*4.9*	188	*5.2*		.3
Inventory	393	*11.7*	422	*11.8*		.1
Total	$ 642	*19.0*	$ 708	*19.7*		.7
Fixed Assets						
Net Plant and Equipment	$ 2731	*81.0*	$ 2880	*80.3*		(0.7)
Total Assets	$ 3373	*100.0*	$ 3588	*100.0*		.0
Liabilities and Owners' Equity						
Current Liabilities						
Accounts Payable	$ 312	*9.2%*	$ 344	*9.6%*		0.3%
Notes Payable	231	*6.8*	196	*5.5*		(1.4)
Total	$ 543	*16.1*	$ 540	*15.1*		(1.0)
Long-term Debt	$ 531	*15.7*	$ 457	*12.7*		(3.0)
Owners' Equity				*.0*		
Commons Stock and Paid-In Surplus	$ 500	*14.8*	$ 550	*15.3*		.5
Retained Earnings	1799	*53.3*	2041	*56.9*		3.5
Total	$ 2299	*68.2*	$ 2591	*72.2*		4.1
Total Liabilities and Owners' Equity	$ 3373	*100.0*	$ 3588	*100.0*		.0

Presented as a % of total assets.

Notice that *Net Plant and Equipment* increased from 2016 to 2017, but that it fell as a percentage of assets.

The Common Size Income Statement

J. Alfred Prufrock Corporation
2017 Income Statement

Sales	*100.0%*
Cost of Goods Sold	*58.2*
Depreciation	*11.9*
Earnings before interest and taxes (EBIT)	*29.9*
Interest paid	*6.1*
Taxable income	*23.8*
Taxes (34%)	*8.1*
Net Income	*15.7%*
Dividends	*5.2%*
Addition to retained earnings	*10.5%*

Presented as a % of Sales.

For every $1 of sales, $0.58 goes to paying for inputs. $0.15 is profit (net income).

Common Size Statements Example

Walgreen's had $118.21B in sales in 2017. It's cost of goods sold was $90.71B. CVS had $184.77B in sales in 2017. It's cost of goods sold was $156.22B. Which firm is better at keeping costs down?

Walgreens: COGS/Sales = 76.7%

CVS: COGS/Sales = 84.5%

Walgreens costs are lower as a percentage of sales.

To Summarize

Common size statements put the value of financial statement items into perspective, relative to past years or other firms.

Ratio Analysis

Financial Ratios

Relationships used for assessing the health of the firm and comparative standing of the firm.

There are many ratios. We focus on a few more important ones here that fit into these categories:

- Short Term Solvency & Liquidity
- Leverage & Long Term Solvency
- Turnover
- Market Value
- Profitability

Short Term Solvency & Liquidity

Measures of short term liquidity. Generally, the higher the better for short term creditors.

$$Current = \frac{Current\ Assets}{Current\ Liabilities}$$

$$Quick = \frac{Current\ Assets - Inventory}{Current\ Liabilities}$$

Short Term Solvency & Liquidity Example

Interpret J. Alfred Prufrock's 2017 (1) Current Ratio of 1.31 and (2) Quick Ratio of 0.53.

1. The firm has $1.31 of current assets for every $1 in current liabilities, or the firm covered its current liabilities 1.31 over with current assets.
2. Net of inventory, which may be difficult to sell off immediately, it can only cover 53% of its current liabilities with current assets.

Leverage & Long Term Solvency

Address a firm's long-term ability to meet its obligations. Shows the *financial leverage* – the use of debt – of the firm.

$$Total\ Debt = \frac{Total\ Assets - Total\ Equity}{Total\ Assets}$$

$$Debt\ to\ Equity = \frac{Debt}{Total\ Equity}$$

Leverage & Long Term Solvency

$$Equity\ Multiplier = \frac{Total\ Assets}{Total\ Equity} = 1 + \frac{Debt}{Total\ Equity}$$

$$Cash\ Coverage = \frac{EBIT + Depreciation}{Interest\ Expense}$$

Leverage & Long Term Solvency Example

Interpret J. Alfred Prufrock's 2017 (1) Total Debt Ratio of 0.28, (2) Debt to Equity Ratio of 0.38, (3) Equity Multiplier of 1.38, and (4) Cash Coverage Ratio of 6.9.

1. The firm uses 28% debt (and thus 1 - 0.28 = 72% equity).
2. Debt is 38% of equity. Look to the industry to determine if this is high or low.
3. The equity multiplier is 1 + the Debt to Equity Ratio. The company's assets are worth 1.38 times its equity, highlighting the use of leverage.
4. Cash earnings before interest and taxes can pay the interest expense 6.9 times over.

Turnover

Measures asset utilization, or how efficiently or intensively a firm uses its assets to generate sales.

$$Inventory\ Turnover = \frac{COGS}{Inventory}$$

$$Total\ Asset\ Turnover = \frac{Sales}{Total\ Assets}$$

Turnover Example

Interpret J. Alfred Prufrock's 2017 (1) Inventory Turnover Ratio of 3.2 and (2) Total Asset Turnover of 0.64.

1. The firm “sold through” its inventory 3.2 times.
2. For every dollar in assets, the firm generated $0.64 in sales.

Market Value

Calculated for publicly-traded firms only, these ratios can tell the relative value of a share or how attractive the firms is as an investment.

$$Earnings\ per\ Share = \frac{Net\ Income}{Shares\ Outstanding}$$

$$Price\ to\ Earnings = \frac{Price\ per\ Share}{Earnings\ per\ Share}$$

$$Tobin's\ Q = \frac{Market\ Value\ of\ Assets}{Replacement\ Cost\ of\ Assets}$$

Market Value Example

Interpret J. Alfred Prufrock's 2017 (1) Earnings per Share of 11, (2) Price to Earnings Ratio of 8, and (3) Tobin's Q of 1.08.

1. Net income amounts to $11 per share.
2. Each of the firm's shares trades for 8 times more than the earnings associated with it, indicating potential for future growth opportunities.
3. A Q above 1 indicates that the assets of the firm are worth more than what it would take to replace them; therefore, it is likely the firm has attractive investment opportunities.

Profitability

Measures how efficiently a firm uses its assets and manages operations.

$$Profit\ Margin = \frac{Net\ Income}{Sales}$$

$$Return\ on\ Assets = \frac{Net\ Income}{Total\ Assets}$$

$$Return\ on\ Equity = \frac{Net\ Income}{Total\ Equity}$$

Profitability Example

Interpret J. Alfred Prufrock's 2017 (1) Profit Margin of 15.71%, (2) ROA of 10.12%, and (3) ROE of 14.01%.

1. The firm generates a little less than $0.16 in profit for every dollar in sales.
2. The firm generates $0.10 for every dollar of (book) assets.
3. The firm generates $0.14 for every dollar of (book) equity. This is important given that the goal is to maximize the value of the firm per share for shareholders.

Using Ratios and Financial Statements

Ratios and financial statements are used *internally* for performance evaluation and planning/budgeting and *externally* by creditors, suppliers, investors, customers, and stockholders.

Benchmarking

Firms can be compared to *the past* by benchmarking against its past ratios and to *peers* within the same SIC or NAICS code.

But these SIC and NAICS groupings are not perfect.

Other Issues

- Conglomerates are hard to classify
- Differences in accounting measures for multinational firms
- Seasonality and timing of fiscal years can present issues

To Summarize

Ratios are useful tools for internal and external parties to determine performance, efficiency, and profitability of a firm relative to its past or other similar firms.

DuPont Analysis

The Dupont Identity

An expression that shows the Return on Equity (ROE) can be represented as the product of the Profit Margin, the Total Asset Turnover, and the Equity Multiplier.

Thus, the ROE can be decomposed into Operating Efficiency (controlling costs), Asset Use Efficiency (managing productive resources) , and Leverage (use of debt financing).

The Dupont Identity

$$ROE = \frac{Net\ Income}{Equity}$$

$$ROE = \frac{Net\ Income}{Sales} \times \frac{Sales}{Assets} \times \frac{Assets}{Equity}$$

$$ROE = \frac{Net\ Income}{\cancel{Sales}} \times \frac{\cancel{Sales}}{\cancel{Assets}} \times \frac{\cancel{Assets}}{Equity} = \frac{Net\ Income}{Equity}$$

The Dupont Identity

$$ROE = \frac{Net\ Income}{Sales} \times \frac{Sales}{Assets} \times \frac{Assets}{Equity}$$

$$ROE = Profit\ Margin \times Total\ Asset\ Turnover \times Equity\ Multiplier$$

$$ROE = Operating\ Efficiency \times Asset\ Use\ Efficiency \times Leverage$$

Example: Vera Bradley Inc.

Obtain Vera Bradley's Financial Statements and find the ROE by calculating the profit margin, total asset turnover, and equity multiplier for 2018. Compare to 2017 and discuss where the difference is.

Example: Vera Bradley Inc.

2018: Net Income=7.02M, Sales=454.65M, Assets= 350.67M
Equity=285.28M

$$ROE = \frac{Net\ Income}{Sales} \times \frac{Sales}{Assets} \times \frac{Assets}{Equity}$$

$$ROE_{2018} = 0.015 \times 1.30 \times 1.23 = 0.024$$

Example: Vera Bradley Inc.

2017: Net Income=19.76M, Sales=485.94M, Assets= 373.51, Equity=283.79M

$$ROE = \frac{Net\ Income}{Sales} \times \frac{Sales}{Assets} \times \frac{Assets}{Equity}$$

$$ROE_{2017} = 0.04 \times 1.30 \times 1.32 = 0.07$$

Example: Vera Bradley Inc.

$$ROE_{2017} = 0.04 \times 1.30 \times 1.32 = 0.07$$

$$ROE_{2018} = 0.015 \times 1.30 \times 1.23 = 0.024$$

Profit margin fell most substantially. Vera Bradley is less *operationally efficient* than it was in 2017.

To Summarize

By breaking down the ROE into its component parts, we can see what specifically contributes to satisfactory or unsatisfactory levels of return on equity.

	ROE		Profit margin		Total asset turnover		Equity multiplier
Yahoo!							
2013	10.4%	=	29.2%	×	.279	×	1.29
2012	8.0	=	23.4	×	.292	×	1.17
2011	8.4	=	21.0	×	.368	×	1.18
Google							
2013	14.8%	=	21.6%	×	.539	×	1.27
2012	15.0	=	21.5	×	.535	×	1.31
2011	16.7	=	25.7	×	.522	×	1.25

Takeaways

Takeaways

1. Firms generate and use cash, and the sources and uses of cash are important to identify.
2. The Statement of Cash Flow identifies where cash is coming from and where it is going.
3. As a measure of performance, cash flow may be better than net income because it doesn't include non-cash expenses such as depreciation and amortization.
4. Standardized financial statements and ratios help us to compare a firm to its past self or to peer firms.
5. The DuPont Identity allows us to decompose ROE into operating efficiency, asset use efficiency, and financial leverage.

End.

The Time Value of Money

Chapter 5

Outline

1. The Time Value of Money
2. Future Value and Compounding
3. Present Value and Discounting
4. Applications

The Time Value of Money

The Time Value of Money

In general, a dollar today is worth more than a dollar in the future.

A Simple Example

You win a raffle for $1,000. You can either pick up the money today or in one year. A local bank pays 5% interest per year. Does it matter when you collect the prize money?

If you collect today, it is worth $1,000 plus 5% of $1,000 ⟶ $1,050 after one year.

If you collect in one year, it is still worth $1,000 when you pick it up.

Obviously, take the money now!

How Important is This?

This is the *single most important* concept in this course, and a central theme in finance.

Finance applications:

- Stock valuation
- Bond valuation
- Project valuation
- Company valuation

Other applications:

- Buying a house
- Saving for retirement
- Pursuing an advanced degree

To Summarize

A dollar today is worth more than a dollar in the future!

Future Value and Compounding

Future Value

The amount an investment is worth after one or more periods.

Raffle Example Revisited

You win a raffle for $1,000. A local bank pays 5% interest per year. You collect the money today and keep it at the bank for 1 year.

What do think the Future Value (FV) is?

$$\begin{aligned} FV &= \$1,000 \ + \ \$1,000 \times (0.05) \\ &= \$1,000 \times (1 + 0.05) \\ &= \$1,000 \times (1.05) \\ &= \$1,050 \end{aligned}$$

The future value of $1,000 invested for one year at 5% is $1,050.

Raffle Example Revisited

What if you collect the money and decide to keep it at the bank for *two* years?

What do think the Future Value (FV) is?

$$\begin{aligned} FV_{One\ Year} &= \$1,000 + \$1,000 \times (0.05) \\ &= \$1,000 \times (1 + 0.05) \\ &= \$1,000 \times (1.05) \\ &= \$1,050 \end{aligned}$$

$$\begin{aligned} FV_{Two\ Years} &= \$1,050 + \$1,050 \times (0.05) \\ &= \$1,050 \times (1 + 0.05) \\ &= FV_{One\ Year} \times (1 + 0.05) \\ &= \$1,000 \times (1.05) \times (1.05) \\ &= \$1,102.50 \end{aligned}$$

The future value of $1,000 invested for two years at 5% is $1,102.50.

Compound Interest

We see from the example that we earn *interest on our interest* as well as interest on the original investment, the *principal*.

This is known as *compound interest*.

Compounding Over Many Periods

What if you collect the $1,000 and decide to keep it at the bank for 10 years?

$$FV_{One\ Year} = \$1,000 \times (1.05)$$
$$FV_{Two\ Years} = \$1,000 \times (1.05) \times (1.05)$$
$$FV_{Three\ Years} = \$1,000 \times (1.05) \times (1.05) \times (1.05)$$
$$\dots$$
$$FV_{Ten\ Years} = \$1,000 \times (1.05)^{10} = \$1,628.89$$

Calculating the Future Value

$$FV = PV(1 + r)^t$$

The future value of a sum is equal to the value of the sum today (the present value or principal, *PV*) times 1 plus the interest rate *r* raised to the number of compounding periods *t*. The expression $(1 + r)^t$ is known as the *future value interest factor*.

Practice Problem: Vacation

You've just earned a bonus of $2,000. You'd like to eventually take a nice vacation, and the total cost of the trip you want is $3,200. The travel agency guarantees that price won't increase for the next 5 years. You found an investment that returns 9% per year. Will you be able to afford the trip with your bonus money before the price goes up?

$$FV = \$2,000(1 + 0.09)^5 = \$3,077.25$$

You can't afford the vacation!

Practice Problem: Biology

You've engineered a mutant gene that increases in size by 40% every month. It currently has a diameter of 2 nm. How big will the gene be after 8 months?

$$FV = 2\ nm(1\ +\ 0.40)^8 = 29.52\ nm$$

Important: Notice that the rate and the compounding periods are the same unit - months.

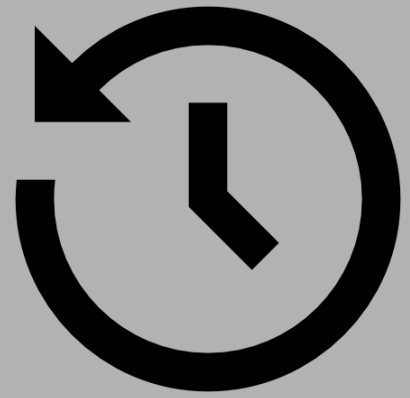
Simple Interest

If we do not allow interest to compound, the future value of our investment is much less, particularly for long periods.

Year	Beginning Amount	Simple Interest	Compound Interest	Total Interest Earned	Ending Amount
1	$100.00	$10	$.00	$10.00	$110.00
2	110.00	10	1.00	11.00	121.00
3	121.00	10	2.10	12.10	133.10
4	133.10	10	3.31	13.31	146.41
5	146.41	10	4.64	14.64	161.05
Total		$50	$11.05	$61.05	

To Summarize

We calculate the *future value* of the *principal* by multiplying *1 + the growth rate* raised to the number of compounding periods.



Present Value and Discounting

The Present Value

The current value of future cash flows *discounted* at the appropriate *discount* rate.

Vacation Example Revisited

You know you can invest your vacation money and earn 9% per year. How much money do you need to put into your investment today in order to have $3,200 in 5 years?

$$FV = PV(1 + r)^t$$

$$\$3,200 = PV(1 + 0.09)^5$$

$$PV = \frac{\$3,200}{(1 + 0.09)^5}$$

$$PV = \$2,079.78$$

Thus, the present value of $3,200 discounted back 5 years at 9% per year is $2,079.78. Save this amount to afford your vacation.

Discounting

To *discount* is to calculate the value today of some future amount. The *discount rate* is the rate you used to calculate the present value.

Think of this as the opposite of *compounding*.

Calculating the Present Value

$$PV = \frac{FV}{(1 + r)^t}$$

The present value of a sum is equal to the value of a sum in the future (the lump sum or future value, *FV*) divided by 1 plus the discount rate *r* raised to the number of discounting periods *t*. The expression $1/(1 + r)^t$ is known as the *present value interest factor*.

Practice Problem: Funding Retirement Bonuses

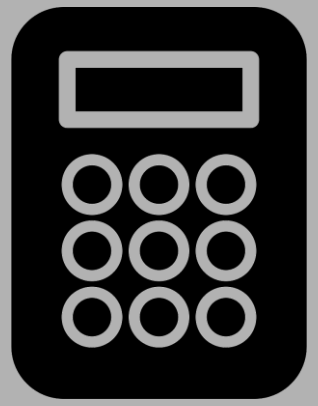
The board of directors of the company you work for approaches you with a problem. They estimate 17 employees will be retiring in exactly 8 years, and that each is due a retirement bonus of $1,000 at that time. The board has a safe investment account where they can earn 4% per year. How much do they need to put into this account to be able to pay those retirement bonuses?

$$PV = \frac{FV}{(1 + r)^t}$$

$$PV = \frac{17 \times \$1,000}{(1 + 0.04)^8} = \$12,421.73$$

To Summarize

The present value is the *discounted* value of some future sum, which we find by dividing that value by *1 + the discount rate* raised to the number of discounting periods.



Applications

Using a Financial Calculator: The TI BA II Plus

1. Display the maximum number of decimal places:
   2^{ND} ⟶ FORMAT ⟶ use arrows to navigate to DEC ⟶ 9 ⟶ ENTER

2. For now, make sure there is no "BGN" above your zero on your screen:
   2^{ND} ⟶ BGN ⟶ 2^{ND} ⟶ SET

3. Before *each* TVM problem, clear your work:
   2^{ND} ⟶ CLR TVM

4. Always remember to put a negative sign in front of cash outflows.

Practice Problem: Lawsuit

You've been sued! You have to pay the $10,000 settlement in 3 years. How much do you have to put away today if you can earn 3% at the bank per year?

This is a PV problem.

2ND → CLR TVM
N = 3 → the number of years
I/Y = 3 → the interest rate
FV = -10000 → the future value, a cash outflow
CPT PV = 9151.41

You should put away at least $9,151.41.

Practice Problem: Buying a Motorcycle

The Scout FTR 1200 is being released in 4 years and will cost $13,000. You put $11,000 in an investment that yields 8% annually. Will you be able to afford it when it's released?

This is a FV problem.

2ND → CLR TVM
N = 4 → the number of years
I/Y = 8 → the interest rate
PV = -11000 → the future value, a cash outflow
CPT FV = 14965.38

You'll have $14,965.38, which is enough to pay for the $11,000 bike.

Practice Problem: Saving for College

When you have your first child, you will put away $30,000 to save for their college which you estimate will cost $100,000 in 18 years. What annual rate of interest do you need to earn in order to be able to afford tuition at that time?

Here, find the interest rate.

2ND ⟶ CLR TVM
N = 18 ⟶ the number of years
PV= -30000 ⟶ the present value, a cash *outflow* (giving money to the bank)
FV = 100000 ⟶ the future value, a cash *inflow* (getting money from the bank)
CPT I/Y = 6.92

You'll need to save at an annual rate of 6.92%.

Practice Problem: Tricky Timelines

How much do you need to invest in 3 years if you plan on having $30,000 in 10 years? You'll invest at 12% per year.

This is a PV problem.

2ND → CLR TVM
N = 10 – 3 = 7
I/Y = 12
FV = 30000 → a cash inflow
CPT PV = -13,570.48 → a cash *outflow* that you are depositing in an investment account.

You'll need to put away $13,570.48 in 3 years to have $30,000 in 10 years.

Practice Problem: A Signing Bonus

In 2 years, you will graduate and your employer will give you a signing bonus of 10% of your $48,000 salary. At that time, you plan on investing it at 4% per year until you have $12,000, enough for you to take a 3 year backpacking trip. In how many years from now will you be able to afford this trip?

Here, find the number of years plus 2, the number of years until you get your signing bonus.

2ND → CLR TVM
PV = -48000 * 10% = -4800 → a cash *outflow*
I/Y = 4
FV = 12000 → a cash *inflow*
CPT N = 23.36

You'll need to leave this in your account for 23.36 years, but you won't get your bonus for 2 more years. You can afford the trip in 25.36 years.

Takeaways

Takeaways

1. A dollar today is worth more than a dollar in the future.
2. The future value is a function of the present value, the interest rate, and the number of compounding periods.
3. The present value is a function of the future value, the discount rate, and the number of discounting periods.
4. Applications extend beyond just finance.

End.

Discounted Cash Flow Valuation

Chapter 6

Outline

1. FV of Multiple Cash Flows
2. PV of Multiple Cash Flows
3. Annuities and Perpetuities
4. Interest Rates
5. Types of Loans

FV of Multiple Cash Flows

FV and PV Review

In the previous section, we've calculated the FV and PV for *one* lump sum using the following formulas:

$$FV = PV(1 + r)^t$$

$$PV = \frac{FV}{(1 + r)^t}$$

But many investments have multiple cash flows:

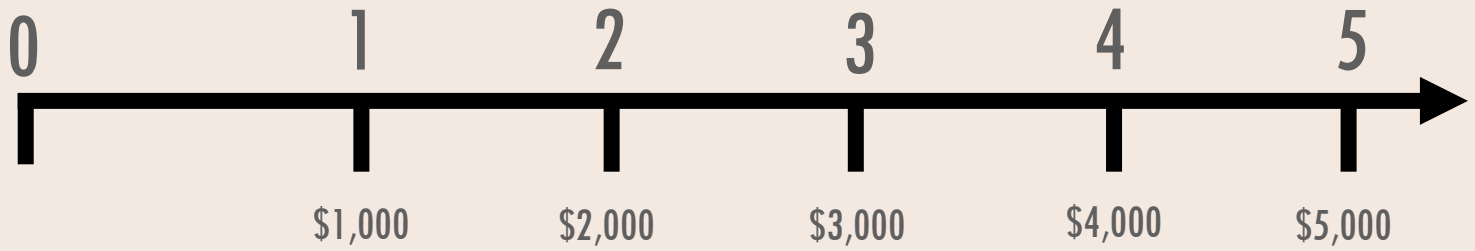
- Example: Costco builds a new store that results in sales each year for many years.

FV of Multiple Cash Flows

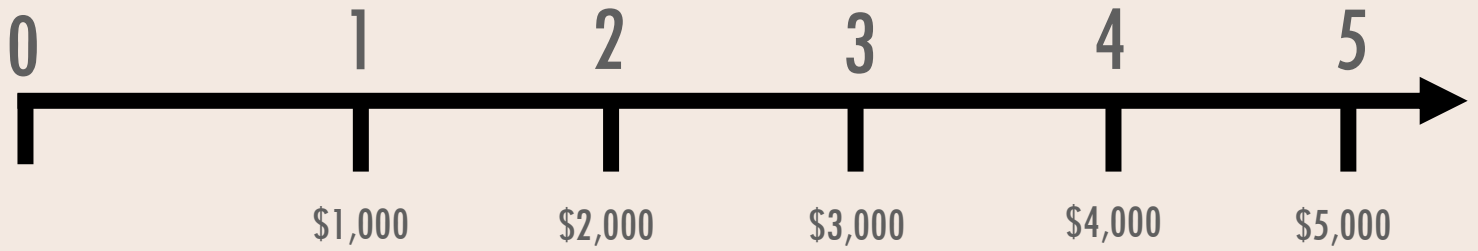
To find the FV of multiple sums over time, find the sum of the individual future values.

FV of Multiple Cash Flows: First Payment Later

What is the value in 5 years of a series of 5 payments to a bank account earning 10% annually, assuming the payments start at $1,000 and increase by $1,000 each year? You make your first payment at the end of this year.



FV of Multiple Cash Flows: First Payment Later



$1,000 X 1.1^4 = $1,464.10

$2,000 X 1.1^3 = $2,662.00

$3,000 X 1.1^2 = $3,630.00

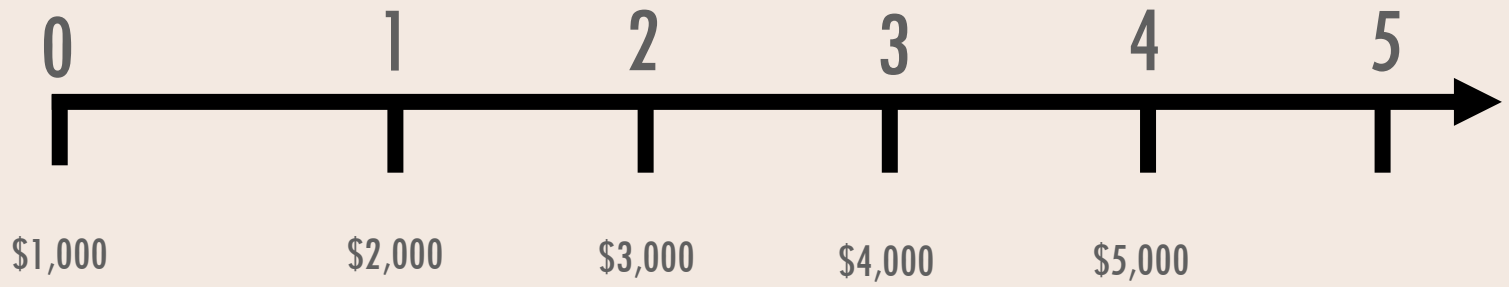
$4,000 X 1.1^1 = $4,400.00

$5,000 = $5,000.00

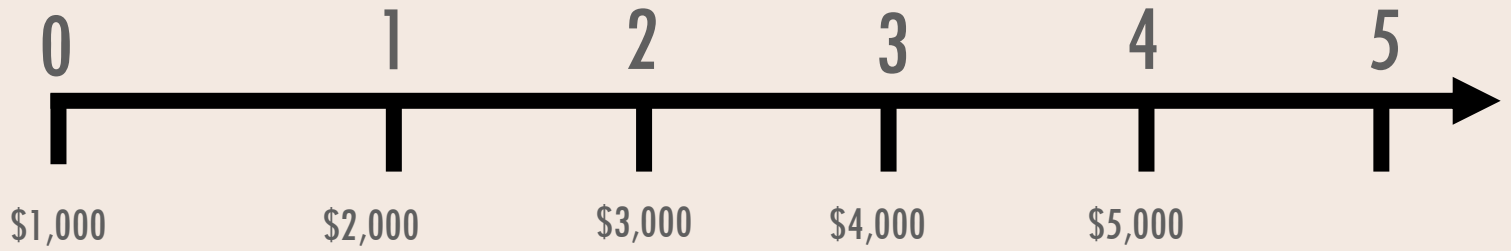
$17,156.10

FV of Multiple Cash Flows: First Payment Today

What is the value in 5 years of a series of 5 payments to a bank account earning 10% annually assuming the payments start at $1,000 and increase by $1,000 each year? You make your first payment at the beginning of this year.



FV of Multiple Cash Flows: First Payment Today



$1,000 X 1.1^5 = $1,610.51

$2,000 X 1.1^4 = $2,928.20

$3,000 X 1.1^3 = $3993.00

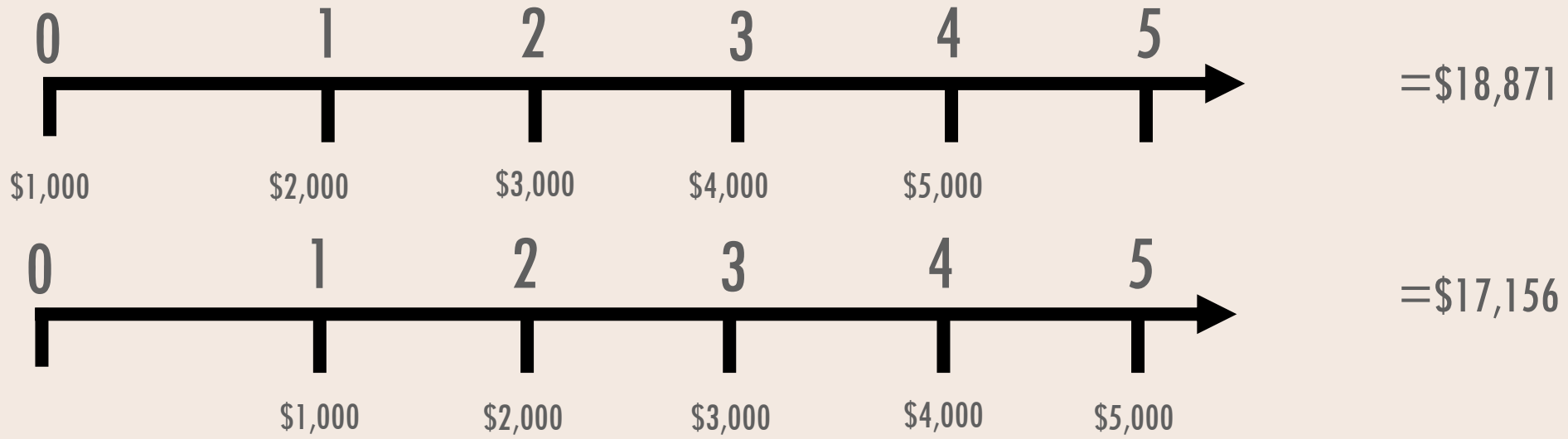
$4,000 X 1.1^2 = $4,840.00

$5,000 X 1.1^1 = $5,500.00

$18,871.71

Timing of Payment Matters!

In the two previous examples, the only thing that changed was the timing, and we had quite different results.



To Summarize

The future value of a series of amounts is the sum of each amount's future value.

PV of Multiple Cash Flows

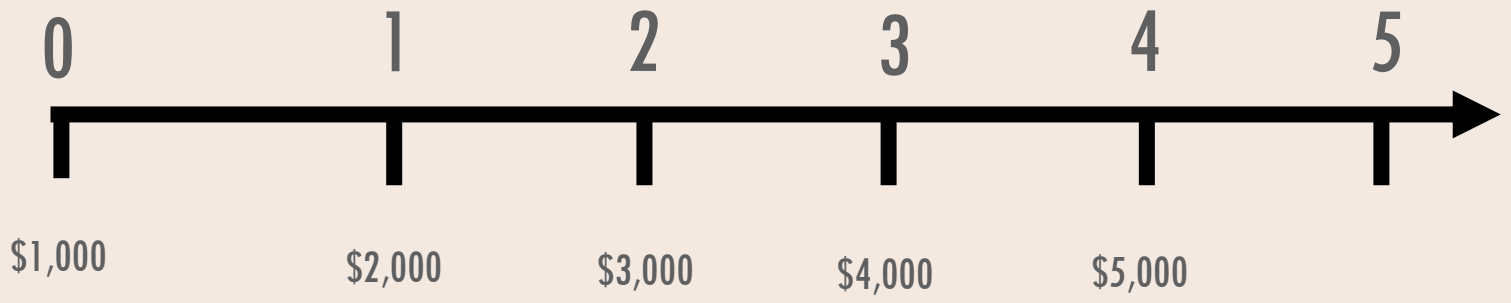
PV of Multiple Cash Flows

To find the PV of multiple sums over time, find the sum of the individual present values.

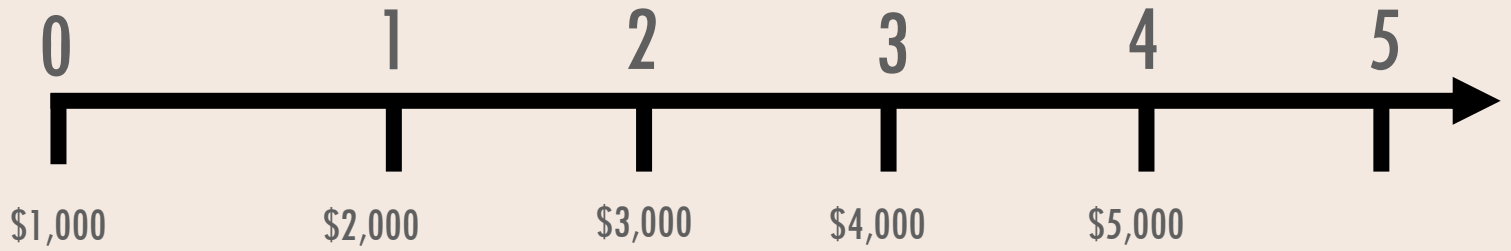
$$PV = \frac{FV}{(1 + r)^t}$$

PV of Multiple Cash Flows: First Payment Today

What is the value today of a series of 5 payments made to a bank account earning 10% annually assuming the payments start at $1,000 and increase by $1,000 each year? The first payment is at the beginning of this year.



PV of Multiple Cash Flows: First Payment Today



$1,000 / 1.1^0 = $1,000.00

$2,000 / 1.1^1 = $1,818.18

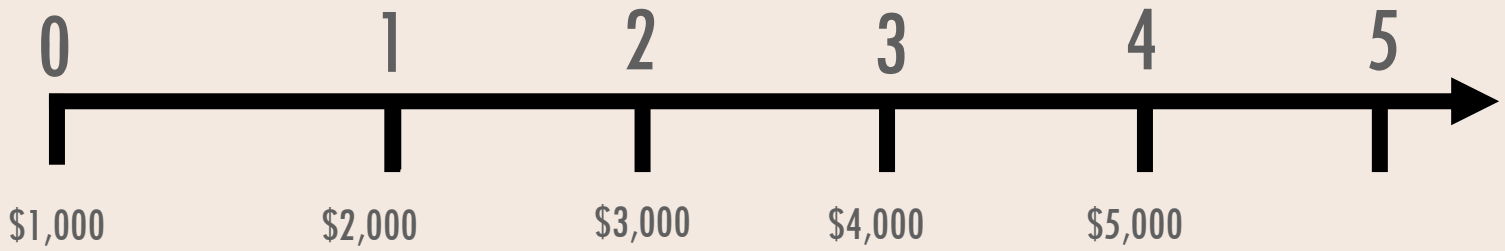
$3,000 / 1.1^2 = $2,479.34

$4,000 / 1.1^3 = $3,005.26

$5,000 / 1.1^4 = $3,415.07

$11,717.85

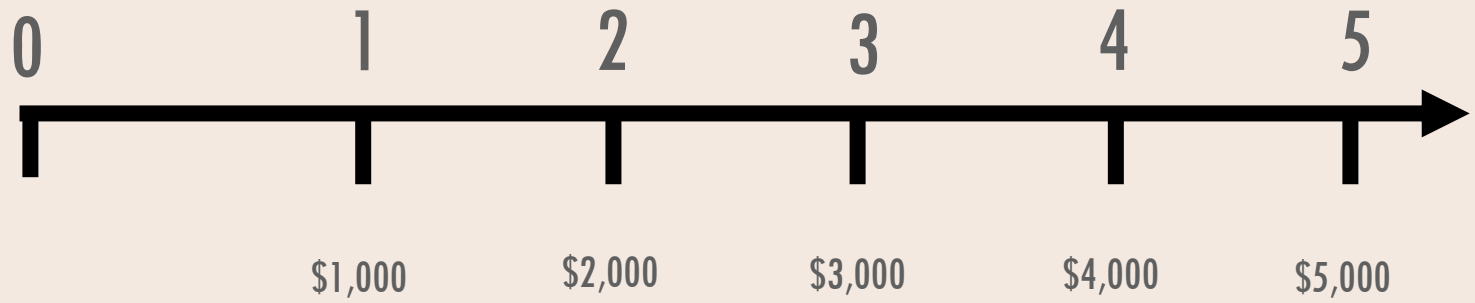
PV of Multiple Cash Flows: Calculator



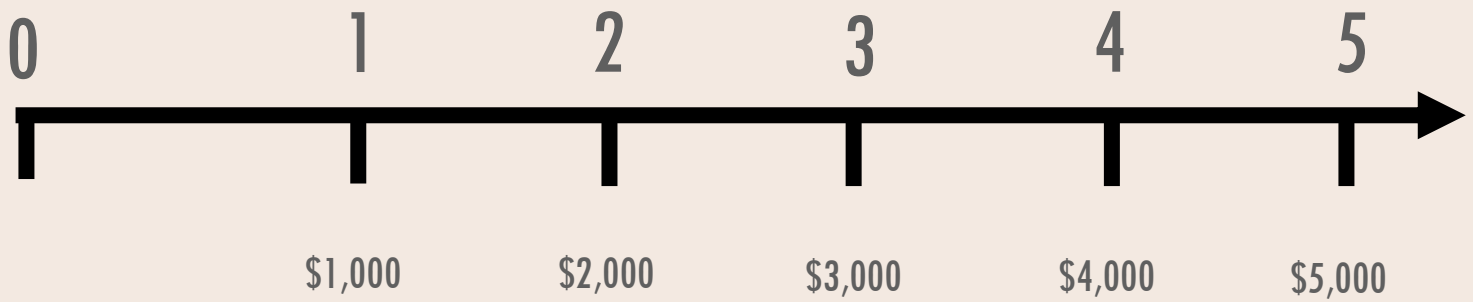
CF
2ND CLR WORK
2ND CLR TVM
CFo = 1000, CO1 = 2000, FO1 = 1, CO2 = 3000, FO2 = 1, . . ., CO4 = 5000, FO4 = 1
NPV
I = 10
CPT NPV = **11,717.85**

PV of Multiple Cash Flows: First Payment Later

What is the value today of a series of 5 payments made to a bank account earning 10% annually assuming the payments start at $1,000 and increase by $1,000 each year? You make your first payment at the beginning of next year.



PV of Multiple Cash Flows: First Payment Today



$1,000 / 1.1^1 = $909.09

$2,000 / 1.1^2 = $1,652.89

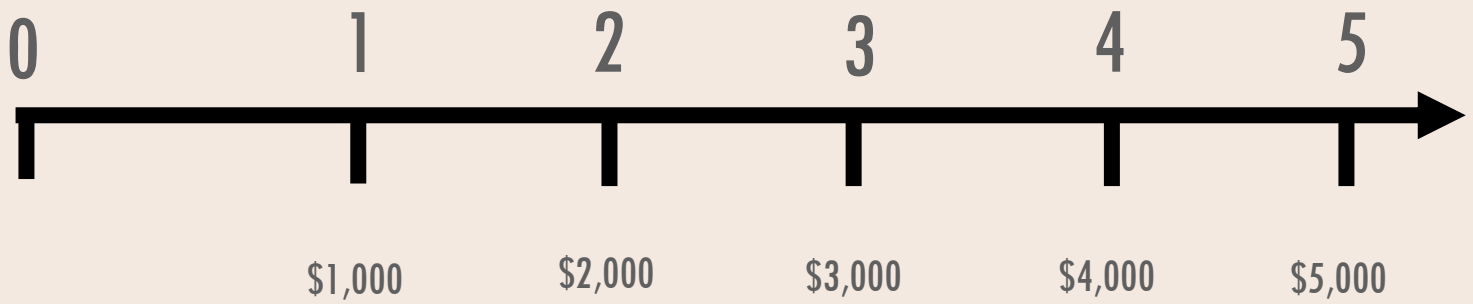
$3,000 / 1.1^3 = $2,253.94

$4,000 / 1.1^4 = $2,732.05

$5,000 / 1.1^5 = $3,104.61

$10,652.58

PV of Multiple Cash Flows: Calculator



CF
2ND CLR WORK
2ND CLR TVM
CFo = 0, CO1 = 1000, FO1 = 1, CO2 = 2000, FO2 = 1, . . ., CO5 = 5000, FO5 = 1
NPV
I = 10
CPT NPV = **10,652.58**

To Summarize

We find the present value of multiple future cash flows by discounting each of these cash flows to the present and summing them.

Annuities and Perpetuities

Steady Stream of Cash Flows

In the previous examples, the future cash flows could vary in size. We now look at streams of cash flow where the cash flows for each period are the same, or grow by the same amount, each period.

Annuities

A level stream of cash flows over a period of time that either doesn't change or grows at the same rate each period.

Ordinary Annuity: cash flows at the end of each period

Annuity Due: cash flows at the beginning of each period

Ordinary Annuity Example

There is an investment opportunity that promises to pay $500 at the end of each of the next three years. If you want to earn 10%, what's the most you should pay for this investment?

Using the same method we've just learned:

$$PV = (\$500/1.1^1)+(\$500/1.1^2)+(\$500/1.1^3) = \$1{,}243.43$$

Ordinary Annuity Example

Because the payments are the same each year, we can use a formula:

$$Ordinary\ Annuity\ PV = C \times \frac{1 - [1/(1+r)^t]}{r}$$

Where C is the payment amount.

Ordinary Annuity Example

Plugging in the values:

$$Ordinary\ Annuity\ PV = C \times \frac{1 - [1/(1+r)^t]}{r}$$

$$= 500 \times \frac{1 - [1/(1+0.10)^3]}{0.10}$$

$$= \$1,243.43$$

Ordinary Annuity Example

We can also calculate the PV of these cash flows in our calculator using the PMT key:

N=3

I/Y=10

PMT =500

CPT PV= -$1,243.43

Ordinary Annuity Example 2

You want to purchase the new 256 GB Apple iPhone X that costs $1,149. Assume that you put this on your Chase Freedom credit card, and you can only make the minimum monthly payment of $20. This credit card charges 1.5% a month. How long until you pay off this phone?

PV=1149

I/Y=1.5

PMT=-20

CPT N = 133 months ≈ 11 years!

Ordinary Annuity Example 3

Instead of buying that new iPhone, let's invest the $20 a month in the stock market. You expect to earn about 1% a month. How much will you have after 11 years?

We can use the *FV of an Annuity* formula:

$$Ordinary\ Annuity\ FV = C \times \frac{(1+r)^t - 1}{r}$$

$$= 20 \times \frac{(1+0.01)^{11*12} - 1}{0.01} = 5,438$$

Verify in your calculator.

Annuities Due

Here, the first cash flow happens immediately and not at the end of the period.

There's a simple correction:

(1) Calculate the PV or FV as an ordinary annuity

(2) Multiply that PV or FV by (1+r)

In a calculator, switch the mode to BGN.

Annuities Due Example

You want to save up for backstage passes for Beyoncé's upcoming concert. You'll deposit $50 a month starting today. The concert is in 12 months, and you can save at 2% per month. Will you be able to afford the $680 passes?

N=12

PMT=-50

I/Y=2%

CPT FV = 670.60

Then, 670.60 x (1+0.02) = $684.02

Perpetuities

An annuity in which the cash flows continue forever.

$$PV\ of\ a\ Perpetuity = \frac{C}{r}$$

Perpetuities Example

You are interested in buying preferred stock in a company that pays a $3 dividend every quarter. Other companies similar to this one return about 2% every quarter. How much should you pay for the preferred stock?

$$PV\ of\ the\ Perpetuity = \frac{3}{0.02} = \$150$$

PV of Growing Annuities and Perpetuities

You win a lottery that pays you $200,000 at the end of this year. The amount paid each year increases by 5%, so in the 2nd year, you are paid $210,000. In the 3rd year you are paid $220,500, and so on for 20 years. What is the present value if we discount by 11%?

Use the formula:

$$Growing\ annuity\ present\ value = C \times \frac{1 - (\frac{1+g}{1+r})^t}{r - g}$$

PV of Growing Annuities and Perpetuities

$$Growing\ annuity\ present\ value = C \times \frac{1 - (\frac{1+g}{1+r})^t}{r - g}$$

$$= 200000 \times \frac{1 - (\frac{1+0.05}{1+0.11})^{20}}{0.11 - 0.05}$$

$$= 2{,}236{,}337.06$$

Growing Perpetuities

$$Growing\ perpetuity\ present\ value = \frac{C}{r - g}$$

Growing Perpetuities Example

You have a structured settlement, but you need cash now. You call J.G. Wentworth, 877-CASH-NOW. You explain that you will receive $1,000 in the first year, which grows by 2% per year forever. J. G. Wentworth discounts these cash flows at 4%. How much cash will they give you now?

$$Growing\ perpetuity\ present\ value = \frac{C}{r-g}$$

$$= \frac{\$1,000}{0.04 - 0.02} = \$50,000$$

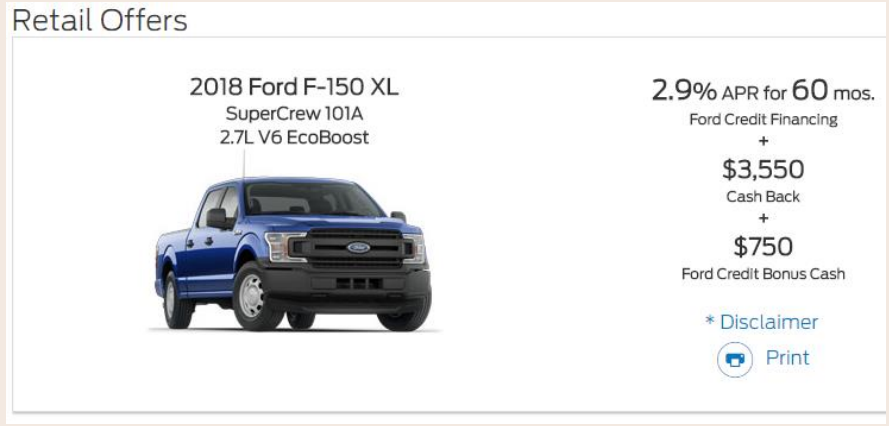
To Summarize

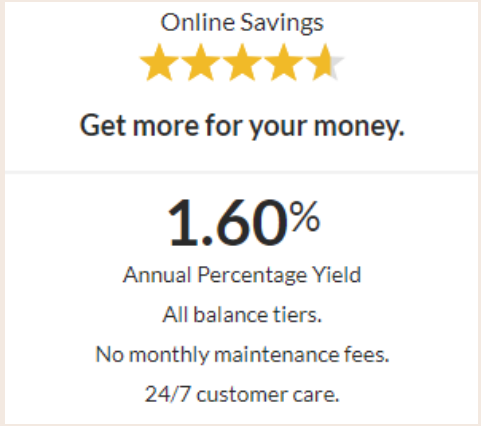
Annuities and perpetuities involve steady cash flows over a period of time or cash flows that grow at a constant rate over time.

Interest Rates

Interest Rates and Compounding

The *quoted* interest rate we see in car and mortgage commercials or on bank websites is generally expressed as an annual rate.





But how often the interest is *compounded* matters substantially.

Interest Rates and Compounding

Example: You see your local bank is quoting a 10% return on an account that *compounds semiannually*. You put $100 in this account. How much interest will you have earned (in percent) by the end of the year?

Because we have 2 six-month periods, the interest rate is $10/2 = 5\%$ for each period

For the first period: $\$100 \times 1.05 = \$105$
For the second period: $\$105 \times 1.05 = \$110.25$

The future value is $110.25 which grew from $100. This is a 10.25% increase, not a 10% increase!

APR, EAR, AND APY

The *annual percentage rate* (APR) is the quoted annual rate, or the interest rate charged per period times the number of periods over which it compounds.

The *effective annual rate* (EAR), or the *annual percentage yield* (APY) is the rate you actually pay or earn based on the compounding.

In the previous example, APR = 10% and EAR = APY = 10.25%.

APR, EAR, and APY Example

You bank offers to pay you 12% compounded quarterly. What is the APR? What is the EAR? What is the APY?

APR = 12%

For the first period:	$100 x 1.03 = 103
For the second period:	$103 x 1.03 = 106.09
For the third period:	$106.09 x 1.03 = 109.2727
For the fourth period:	$109.2727 x 1.03 = 112.55088

Thus, the EAR = APY = 12.55%

APR, EAR, and APY Example (Calculator)

You bank offers to pay you 12% compounded quarterly. What is the APR? What is the EAR? What is the APY?

APR = 12%

In your calculator:
N = 4, I/Y = 12/4 = 3, PV = -100, CPT FV = 112.55088

Thus, the EAR = APY = 12.55%

APR, EAR, and APY Example 2

You bank offers to pay you 7% compounded daily on a loan that requires a minimum deposit of $6,000. You put in exactly the minimum deposit. What is the APR? What is the EAR? What is the APY? What will be in the account after 2 years?

APR and EAR/APY

APR = 7%

N = 365, I/Y = 7/365 = 0.019178082, PV = -100, CPT FV = 107.2501

EAR = APY = 7.25%

Future Value

N = 365 x 2 = 730, I/Y = 7/365 = 0.019178082, PV = -6000, CPT FV = **$6,901.55**

APR and EAR Conversion

To directly convert a quoted APR to an EAR or APY:

$$EAR = [1 + \frac{APR}{m}]^m - 1$$

Where *m* is the number of compounding periods.
For *continuous* compounding:

$$EAR = e^{APR} - 1$$

Conversion Examples

Convert a quoted rate of 8% compounded weekly to an EAR.

$$EAR = [1 + \frac{APR}{m}]^m - 1$$

$$EAR = [1 + \frac{0.08}{52}]^{52} - 1 = 8.32\%$$

Convert a continuously compounded quoted rate of 14% to an EAR.

$$EAR = e^{APR} - 1$$

$$EAR = e^{0.14} - 1 = 15.03\%$$

Real World Example

You want to purchase a new Porsche for $74,500 and the finance office at the dealership quoted you an APR of 5.6% for a 48 month loan to buy the car. What will your monthly payments be? What is the EAR?

Monthly Payments

N = 48, I/Y = 5.6/12 = 0.466667, PV = 74500, CPT PMT = **-1,736.00**

EAR

$EAR = [1 + (.056 / 12)]^{12} - 1 = 5.75\%$

To Summarize

Interest rates are quoted in annual terms, often as an APR. Understanding the number of compounding periods is important for knowing the actual rate we save or borrow at, the EAR or APY.

Types of Loans

Pure Discount Loans

The simplest type of loan- you receive money today and pay back a lump sum in the appropriate number of periods.

Suppose you will receive a bonus of $25,000 in five years, but you want money now. The bank charges 12% on loans. How much will they lend you today if you will pay back in five years the full $25,000?

$$PV = \$25{,}000 / (1.12^5) = \mathbf{\$14{,}186}$$

Interest-Only Loans

Here, the borrower pays interest each period then the entire loan amount or principal in the future.

We will cover this when we get to *bond valuation* in the next chapter.

Amortized Loans

In an amortized loan, a portion of each payment includes interest and a principal reduction.

Mortgages, student loans, credit cards, and car notes are generally amortized loans.

Mortgage Example

You want to obtain a $400,000 loan to purchase a new home. As with most mortgages, the term is 30 years but payments (and compounding) is monthly. The interest rate the bank quotes you is 4.3% per year (the APR). What are your payments?

N = 30 x 12 = 360, I/Y = 4.3/12= 0.35833333, PV = 400000, CPT PMT = -1979.49

You will pay **$1,979.49** a month.

Amortization schedule creator.

Takeaways

Takeaways

1. We obtain the PV or FV of multiple cash flows by summing the PV or FV of each cash flow overtime.
2. The timing of the first payment in a series of cash flows matters.
3. Annuities have constant or constant growth payments overtime.
4. Perpetuities have a steady stream of payments forever.
5. The quoted return and the effective return are different due to compounding.

End.

Interest Rates and Bond Valuation

Chapter 7

Outline

1. Introduction to Bonds and Bond Valuation
2. Bond Features and Definitions
3. Bond Markets, Inflation, and Interest Rates

Introduction to Bonds and Bond Valuation

Bonds

A debt instrument issued by corporations or governments to borrow money for investments.

Generally an *interest-only* loan, with regular interest payments (called coupons) and the principal payment at the end.

An Example of A Corporate Bond

The CFO of Coca-Cola would like to raise $1,000,000 in debt financing to be repaid in 10 years. They will borrow at a rate of 8%. They'll sell 1,000 total bonds, so that each has a face value of $1,000.

An Example of A Corporate Bond

Year	0	1	2	3	4	5	6	7	8	9	10
Coupon		$80	$80	$80	$80	$80	$80	$80	$80	$80	$80
Face Value											$1,000
Payment		$80	$80	$80	$80	$80	$80	$80	$80	$80	$1,080

Coupon: 8% x $1,000 = $80 paid to the bond holder each year, where 8% is the *coupon rate*

Face Value, Principal, or Par = $1000, or the amount borrowed and paid back in the final year for each bond.

How Much Would You Pay for the Bond?

We can determine the value of the bond by combining:

1. The Present Value of the Coupons
2. The Present Value of the Principal

$$Bond\ Value = [C \times \frac{1 - \frac{1}{(1+r)^t}}{r}] + \frac{FV}{(1+r)^t}$$

But what is the discount rate? The coupon rate stays the same, but the interest rates in the market change.

Yield to Maturity

The YTM is the rate required in the market on a bond, also called the *yield.*

The coupon rate is often different from the yield. When the value = principal, however, the coupon rate equals the yield.

The YTM can be thought of as the EAR.

An Example of A Corporate Bond

What is the value of this bond *today* given that the prevailing interest rate in the market is 8%?

Year	0	1	2	3	4	5	6	7	8	9	10
Coupon		$80	$80	$80	$80	$80	$80	$80	$80	$80	$80
Face Value											$1,000
Payment		$80	$80	$80	$80	$80	$80	$80	$80	$80	$1,080

PV of the Coupons:

N = 10, PMT = 80, I/Y = YTM = 8, CPT PV = -536.81

PV of the Face Value:

N = 10, FV = 1000, I/Y = YTM = 8, CPT PV = -463.19

Value of the Bond:

536.81 + 463.19 = $1,000 or N=10, FV =1000, I/Y=YTM=8, PMT=80, CPT PV = -$1,000

An Example of A Corporate Bond

Now assume one year has passed. Investors now demand a 10% yield for Coca-Cola bonds. What is the value of the bond now?

Year	0	1	2	3	4	5	6	7	8	9	10
Coupon		$80	$80	$80	$80	$80	$80	$80	$80	$80	$80
Face Value											$1,000
Payment		$80	$80	$80	$80	$80	$80	$80	$80	$80	$1,080

PV of the Coupons:

N = 9, PMT = 80, I/Y = YTM = 10, CPT PV = -460.72

PV of the Face Value:

N = 9, FV = 1000, I/Y = YTM = 10, CPT PV = -424.10

Value of the Bond:

460.72 + 424.10 = $884.82 or N=9, PMT=80, FV=1000, I/Y=YTM=10, CPT PV = -$884.82

Premium and Discount Bonds

Discount Bonds sell for less than face value, or

D: Price < Par
and
D: Coupon % < YTM %

Premium Bonds sell for more than face value, or

P: Price > Par
and
P: Coupon % > YTM %

Semiannual Coupons

In practice, coupons are paid twice a year.

Pepsi raised $1,000,000 in debt financing, and 7 years are left on this debt issue. The YTM on these bond are 16% and the coupon rate is 14%. 1,000 bonds were sold, so that each has a face value of $1,000. Payments are made semiannually. What is the value today for these bonds?

Semiannual Coupons

The coupon rate is like an APR- a bond holder will receive 14%/2 = 7% (or $1000 x 0.07 = $70) each period. There are 2 x 7 = 14 periods. The discount rate is the YTM/2 = 16%/2 = 8%

Year	0	1	2	3	.....	12	13	14
Coupon		$70	$70	$70		$70	$70	$70
Face Value					.....			$1,000
Payment		$70	$70	$70		$70	$70	$1,070

PV of the Coupons
N = 14, PMT = 70, I/Y = 8, CPT PV = -577.10

PV of the Face Value
N = 14, FV = 1000, I/Y = 8, CPT PV = -340.46

Value of the Bond
577.10 + 340.46 = $917.56

Price and Yields

Bond price and yield (or interest rates) always move in *opposite* directions.

As YTM increases, bond price falls.
As YTM decreases, bond price rises.

Finding a Bond Yield

To find a bond yield given the other characteristics of the bond, we have to rely on trial and error.

Finding a Bond Yield

Example: Suppose you are quoted $955.14 for a 6 year, 8% annual coupon bond. To determine the YTM, plug in C = 80, t=6, FV = 1000, and Bond Value= 955.14 into the equation below. Then plug in guesses for r until both sides equate.

$$Bond\ Value = [C \times \frac{1 - \frac{1}{(1+r)^t}}{r}] + \frac{FV}{(1+r)^t}$$

Because this is a discount bond, your guess should start above 8%. This one is just under 9%).

You can also use the yield on similar bonds as a starting point.

Current Yield

The annual coupon divided by the current bond price. This is the effective rate of interest for a bond at its current price. This is the actual income rate of return as opposed to the coupon rate or YTM.

$$Current\ Yield = \frac{Annual\ Coupon}{Bond\ Price}$$

Current Yield Example

Assume you buy that Coca-Cola bond for $955.14. The coupons are $80. What is the income rate of return (that is, what is the coupon relative to the bond price)?

Current Yield = 80/955.14 = 8.38%

Notice that the current yield doesn't take into account if the bond is selling at a discount or premium.

To Summarize

Bonds are debt instruments. We value bonds by using present value techniques, discounting at the YTM.

Bond Features and Definitions

Review of Securities

Corporations issue both *equity* and *debt* securities

> **Equity**: represent ownership interest with a residual claim
> **Debt**: represent something that must be repaid

These are stock (equity) and bonds (debt).

Corporations issuing bonds are borrowing and are called **DEBTORS**. Those that hold the bond and are getting repaid are **CREDITORS** or lenders.

Example of Securities

TJX Companies (TJX): TJ Maxx, HomeGoods, Marshalls

Visit finra-markets.morningstar.com to see at what price the *equity* shares are trading and to explore the *debt* offerings (the bonds).

Debt vs. Equity

1. Debt is not ownership interest in the firm. Creditors only get back money according to the terms of the lending agreement.
2. Interest payments are tax deductible (unlike dividends) because it is a cost of doing business.
3. Unpaid debt is a liability to the firm. Equity is not a liability and unpaid dividends do not need to be paid.

Debt vs. Equity Example

Let's look at TJX's income statement and balance sheet.

1. Where is the interest expense on the income statement? The dividends?
2. Where is debt on the balance sheet?

Debt vs. Equity Example

The TJX Companies, Inc.

CONSOLIDATED STATEMENTS OF INCOME

Amounts in thousands except per share amounts	Fiscal Year Ended February 3, 2018 (53 weeks)	January 28, 2017	January 30, 2016
Net sales	**$35,864,664**	$33,183,744	$30,944,938
Cost of sales, including buying and occupancy costs	**25,502,167**	23,565,754	22,034,523
Selling, general and administrative expenses	**6,375,071**	5,768,467	5,205,715
Impairment of goodwill and other long-lived assets, related to Sierra Trading Post ("STP")	**99,250**	—	—
Loss on early extinguishment of debt	**—**	51,773	—
Pension settlement charge	**—**	31,173	—
Interest expense, net	**31,588**	43,534	46,400
Income before provision for income taxes	**3,856,588**	3,723,043	3,658,300
Provision for income taxes	**1,248,640**	1,424,809	1,380,642
Net income	**$ 2,607,948**	$ 2,298,234	$ 2,277,658
Basic earnings per share:			
Net income	**$ 4.10**	$ 3.51	$ 3.38
Weighted average common shares – basic	**636,827**	655,647	673,484
Diluted earnings per share:			
Net income	**$ 4.04**	$ 3.46	$ 3.33
Weighted average common shares – diluted	**646,105**	664,432	683,251
Cash dividends declared per share	**$ 1.25**	$ 1.04	$ 0.84

Debt vs. Equity Example

The TJX Companies, Inc.

CONSOLIDATED BALANCE SHEETS

Amounts in thousands except share amounts	Fiscal Year Ended February 3, 2018	Fiscal Year Ended January 28, 2017
ASSETS		
Current assets:		
Cash and cash equivalents	**$ 2,758,477**	$ 2,929,849
Short-term investments	**506,165**	543,242
Accounts receivable, net	**327,166**	258,831
Merchandise inventories	**4,187,243**	3,644,959
Prepaid expenses and other current assets	**706,676**	373,893
Total current assets	**8,485,727**	7,750,774
Net property at cost	**5,006,053**	4,532,894
Non-current deferred income taxes, net	**6,558**	6,193
Goodwill	**100,069**	195,871
Other assets	**459,608**	398,076
TOTAL ASSETS	**$ 14,058,015**	$ 12,883,808
LIABILITIES		
Current liabilities:		
Accounts payable	**$ 2,488,373**	$ 2,230,904
Accrued expenses and other current liabilities	**2,522,961**	2,320,464
Federal, state and foreign income taxes payable	**114,203**	206,288
Total current liabilities	**5,125,537**	4,757,656
Other long-term liabilities	**1,320,505**	1,073,954
Non-current deferred income taxes, net	**233,057**	314,000
Long-term debt	**2,230,607**	2,227,599
Commitments and contingencies (See Note L and Note N)		
SHAREHOLDERS' EQUITY		
Preferred stock, authorized 5,000,000 shares, par value $1, no shares issued	**—**	—
Common stock, authorized 1,200,000,000 shares, par value $1, issued and outstanding 628,009,022 and 646,319,046, respectively	**628,009**	646,319
Additional paid-in capital	**—**	—
Accumulated other comprehensive income (loss)	**(441,859)**	(694,226)
Retained earnings	**4,962,159**	4,558,506
Total shareholders' equity	**5,148,309**	4,510,599
TOTAL LIABILITIES AND SHAREHOLDERS' EQUITY	**$ 14,058,015**	$ 12,883,808

Long-Term Debt

Debt securities with maturities greater than one year.

Typically, debt with maturities less than 10 years are called **NOTES** while debt with maturities longer than 10 years are called **BONDS**.

Long term debt can be **PRIVATELY PLACED** (not offered to the public) and **PUBLIC-ISSUED** (offered to the public).

The Indenture

The written agreement between the corporation and the lender that details the terms.

A legal document that includes:

- General terms of the bond
- The amount issued
- Description of property used as collateral (what the lenders get if the borrowers default- your house if you have a mortgage!)
- Repayment arrangements

General Terms of the Bond

Registered (payment made to the registered holder) or **Bearer** (payment made to the holder-can be easily stolen).

Debenture (unsecured debt with a claim only on property not pledged elsewhere) or **Collateralized** (backed by property).

Seniority (if you hold *subordinated* debt, the *senior* debt gets paid back first in the event of a default)

Sinking Funds (a fund established by the borrower with the **trustee**, a bank or intermediary that handles the account, to retire debt that it doesn't need to issue)

General Terms of the Bond Cont.

Call Provisions: allow the borrower to pay a set price for a bond, often higher than the face value, the call premium, in order to recall your bond and no longer make payments.

Protective Covenants: rules for borrower, such as limiting dividends, maintaining a certain level of working capital, restrictions for issuance of more debt, etc.

Bond Ratings

Moody's, Fitch, and Standard & Poor's (S&P) rate bonds based on their probability of default.

Lenders generally require that bonds with low ratings pay higher yields.

Investment grade bonds are higher quality than **Speculative grade (junk) bonds**

Moody's		S&P		Fitch		Rating description	
Long-term	Short-term	Long-term	Short-term	Long-term	Short-term		
Aaa	P-1	AAA	A-1+	AAA	F1+	Prime	Investment-grade
Aa1		AA+		AA+		High grade	
Aa2		AA		AA			
Aa3		AA−		AA−			
A1		A+	A-1	A+	F1	Upper medium grade	
A2		A		A			
A3	P-2	A−	A-2	A−	F2		
Baa1		BBB+		BBB+		Lower medium grade	
Baa2	P-3	BBB	A-3	BBB	F3		
Baa3		BBB−		BBB−			
Ba1	Not prime	BB+	B	BB+	B	Non-investment grade speculative	Non-investment grade AKA high-yield bonds AKA junk bonds
Ba2		BB		BB			
Ba3		BB−		BB−			
B1		B+		B+		Highly speculative	
B2		B		B			
B3		B−		B−			
Caa1		CCC+	C	CCC	C	Substantial risks	
Caa2		CCC				Extremely speculative	
Caa3		CCC−				Default imminent with little prospect for recovery	
Ca		CC					
		C					
C		D	/	DDD	/	In default	
/				DD			
				D			

US Government Bonds

Issued by the US government, the largest borrower in the world.

Treasury Bills (called **T-Bills**) have a maturity of less than a year.

Treasury Notes have maturities between 1 and 10 years.

Treasury Bonds have maturities greater than 10 years.

Assumed that there is no default risk- they print money.

Municipal Bonds

Issued by state and local governments, but *can* default.

The coupon payments made to lenders are exempt from federal income taxes, making it an attractive investment for high-tax bracket investors.

Zero Coupon Bonds

Don't make coupon payments: simply sell for a discount and are paid back in full at the maturity.

You still pay taxes as if you were receiving coupons.

To Summarize

Bonds are debt securities. The bond holder is the lender. The indenture provides terms and provisions for the bond. Rating agencies evaluate default risk. The federal and local governments also borrow money through bonds.

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Bond Markets, Inflation, and Interest Rates

Bond Markets

Bonds are traded *over the counter* (OTC), meaning that *dealers* buy and sell bonds from various parties.

Bid- the price the dealer will pay you for a bond

Ask- the price at which the dealer will sell you a bond

Bid-Ask Spread- the positive difference between the bid and ask prices

U.S. Treasury Quotes

U.S. Treasury Quotes

TREASURY NOTES & BONDS

GO TO: Bills

Monday, June 11, 2018 Find Historical Data | WHAT'S THIS?

Treasury note and bond data are representative over-the-counter quotations as of 3pm Eastern time. For notes and bonds callable prior to maturity, yields are computed to the earliest call date for issues quoted above par and to the maturity date for issues below par.

Maturity	Coupon	Bid	Asked	Chg	Asked yield
11/15/2020	1.750	97.9922	98.0078	-0.0938	2.603
11/15/2020	2.625	100.0078	100.0234	-0.1016	2.615
11/30/2020	1.625	97.6328	97.6484	-0.0859	2.615
11/30/2020	2.000	98.5391	98.5547	-0.0703	2.609
12/15/2020	1.875	98.2188	98.2344	-0.0703	2.607
12/31/2020	1.750	97.8594	97.8750	-0.0703	2.617
12/31/2020	2.375	99.3828	99.3984	-0.0781	2.620
1/15/2021	2.000	98.4297	98.4453	-0.0703	2.624
1/31/2021	1.375	96.8047	96.8203	-0.0859	2.631

http://www.wsj.com/mdc/public/page/2_3020-treasury.html

Looking at the first row:

Maturity = 11/15/2020

Coupon Rate = 1.750%, but semiannual payments of 1.750/2 = 0.875%

Bid = the dealer will pay you is 97.99% of par

Asked = you'll have to pay the dealer 98.0078% of par to purchase

Chg = this bond's ask price fell 0.0938% from yesterday

Asked yield = the YTM based on Asked price

Real and Nominal Interest Rates

Nominal Interest rates have not been adjusted for inflation.

Real Interest rate *have* been adjusted for inflation.

Real and Nominal Rates Example

You are throwing a Super Bowl party in exactly one year. You plan on buying several Little Caesar's Hot -N- Ready Pizzas for $5 each. You put exactly $100 in an investment today that returns 15.5% annually.

How many pizzas can you afford for the Super Bowl? Assume an inflation rate of 5%.

If we purchased pizzas today, it would be 20 pizzas.
Investment growth: $100 x 1.155 = $115.50
Pizza price: $5 x 1.05 = $5.25
Pizza purchase: $115.50 / $5.25 = 22 pizzas

We could have bought 23 pizzas if no inflation.

Real and Nominal Rates Example

So, even though our investment grew at 15.5%, our purchasing power only grew by:

$$\frac{22\ pizzas - 20\ pizzas}{20\ pizzas} = 10\%$$

Thus, the **REAL RATE** of return on my investment is 10%, whereas the **NOMINAL RATE** is 15.5%.

Put another way:
The **NOMINAL RATE** on an investment is the % change in dollars you have.
The **REAL RATE** on an investment is the % change in how much you can buy.

Real and Nominal Rates Example

To determine the purchasing power of our investment, we can *deflate* our future investment value by dividing it by (1 + Inflation):

$$\$115.50 / 1.05 = \mathbf{\$110}$$

This means our purchasing power in one year will actually be **$110** in today's dollar terms.

$$\$110 \text{ in today's terms} / \$5 \text{ cost in today's terms} = 22 \text{ pizzas}$$

The Fisher Effect

Named after the economist Irving Fisher, a relationship between nominal rates (R), real rates (r), and the inflation rate (h).

$$1 + R = (1 + r) \times (1 + h)$$

$$R \approx r + h$$

The Fisher Effect Example

You want to withdraw $25,000 of *purchasing power* each year for the next 3 years to finance your child's college tuition. How much do you need to invest today in an account earning 10% to be able to do this? Assume inflation of 4% per year.

1. We can discount *nominal* cash flows at the *nominal* rate.
2. We can discount *real* cash flows at the *real* rate.
3. (1) and (2) above will be equal.

(1) Nominal Cash Flows at the Nominal Rate

We want $25,000 in purchasing power, so the nominal withdrawals should be:

$$C_1 = \$25{,}000 \times 1.04^1 = \$26{,}000$$
$$C_2 = \$25{,}000 \times 1.04^2 = \$27{,}040$$
$$C_3 = \$25{,}000 \times 1.04^3 = \$28{,}121.60$$

And the PV at the nominal rate of 10% is:

$$PV = 26000/1.10^1 + 27040/1.10^2 + 28121.60/1.10^3 = \$67{,}112$$

(2) Real Cash Flows at the Real Rate

First find the real rate:

$$1 + R = (1 + r) \times (1 + h)$$
$$1 + 0.10 = (1 + r)(1 + 0.04)$$
$$r = 0.0577$$

Now, find the PV at this rate.

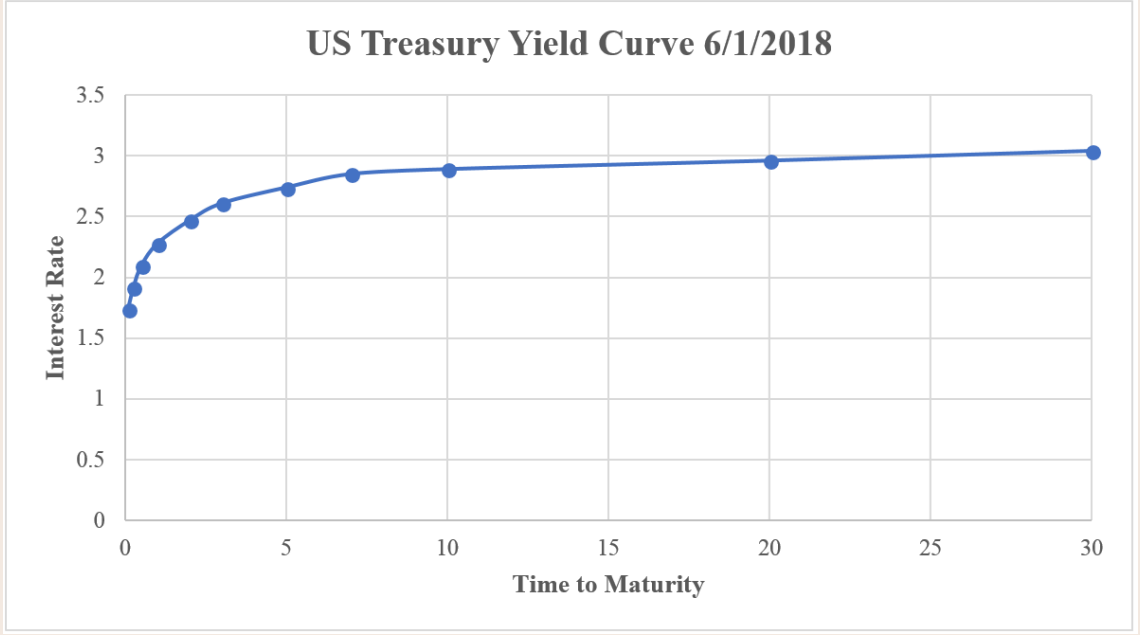
N = 3, I/Y =5.76923, PMT = 25000, CPT PV = $67,112

As expected, the two methods yield the same result.

The Term Structure of Interest Rates

The relationship between interest rates and time to maturities.

Date	1 Mo	3 Mo	6 Mo	1 Yr	2 Yr	3 Yr	5 Yr	7 Yr	10 Yr	20 Yr	30 Yr
6/1/2018	1.74	1.92	2.1	2.28	2.47	2.61	2.74	2.85	2.89	2.96	3.04



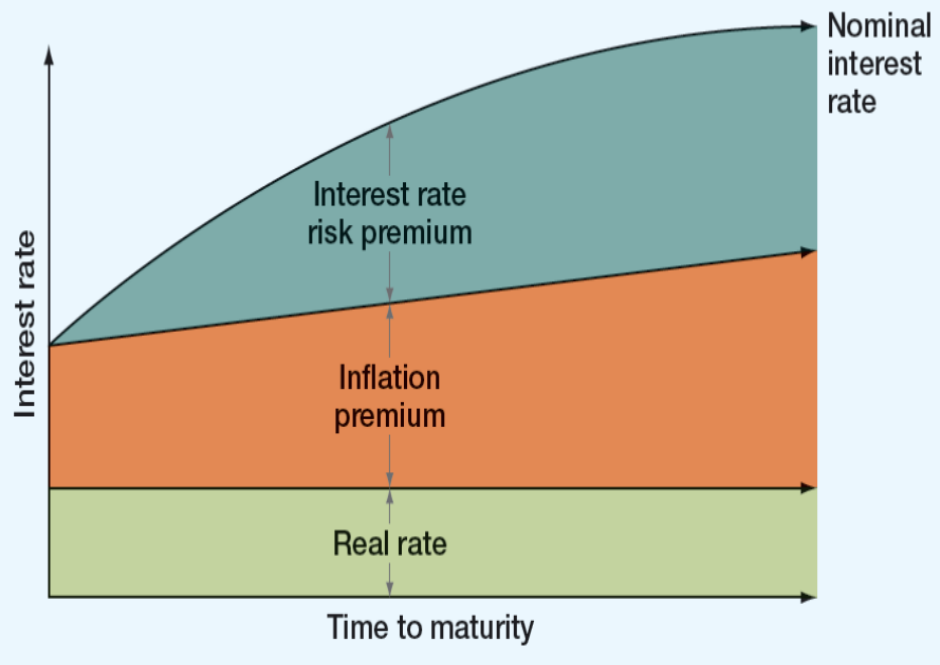
Components of The Term Structure

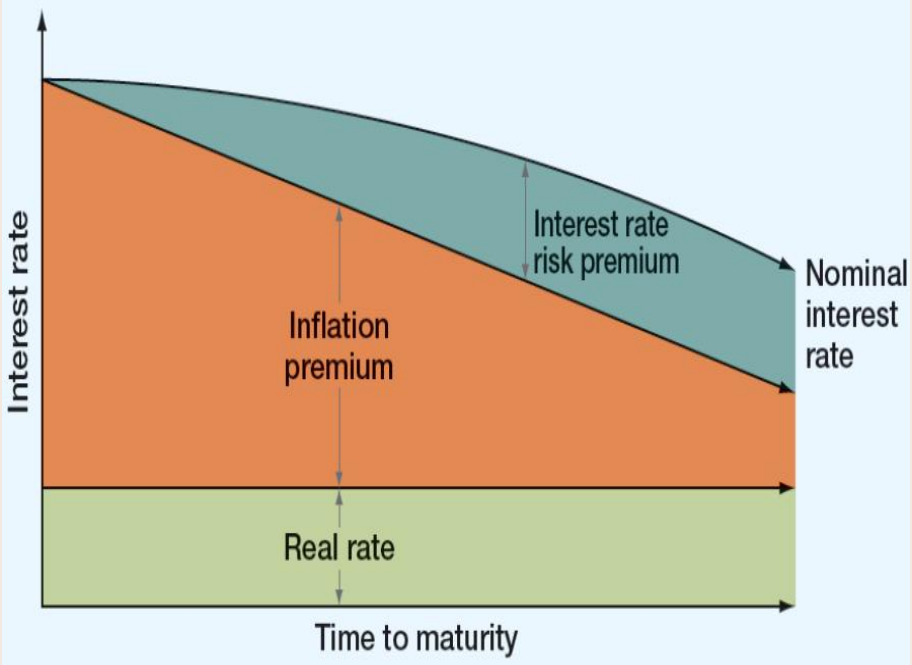
There are three components of the term structure:

1. **Real Rate of Interest**- what investors require for forgoing the use of their money.
2. **Inflation Premium**- compensation for the loss of purchasing power.
3. **Interest Rate Risk Premium**- compensation for holding long-term bonds and bearing the risk of loss resulting from a change in interest rates.

The term structure can be upward or downward sloping (perhaps due to beliefs that inflation is falling).

Components of The Term Structure





To Summarize

Bonds are traded over the counter. Real Rates consider *purchasing power* whereas Nominal Rates consider the growth in *dollars*. The term structure of interest rates is comprised of the real rate of interest, the inflation premium, and the interest rate risk premium.

Takeaways

Takeaways

1. Bonds are debt instruments issued to raise money for projects.
2. The value of a bond is found by finding the present value of the coupons and adding it to the present value of the lump sum payment at the end.
3. The Yield to Maturity is the rate required in the market on a bond.
4. The indenture includes many bond terms, including who is paid first and restrictions on borrowing.
5. Real rates are found by removing the affects of inflation from the interest rate.

End.

Stock Valuation

Chapter 8

Outline

1. Common & Preferred Stock
    A. Rights
    B. The Annual Meeting & Voting
    C. Dividends
2. Stock Valuation
    A. Zero Growth Dividends
    B. Constant Growth Dividends
    C. Non-constant Growth Dividends
    D. Benchmarking
3. The Stock Market

Common Stock & Preferred Stock

Common Stock

Common Stock is a unit of ownership in a public corporation; therefore, Stockholders or Shareholders are owners of the firm.

These shares are units of *equity* without priority for dividends or a payout during bankruptcy.

Common Stock Holders' Rights

As owners, stockholders are generally entitled to:

1. Voting rights at the firm's Annual Meeting
2. Dividends, *if they are paid*
3. Assets after liabilities are paid in the event of liquidation (residual claimant)
4. Preemptive rights in some cases to share proportionally in any new stock issuance

The Annual Meeting & Voting

Voting for directors happens at a firm's annual meeting, where investors gather to cast their votes, ask questions, and hear management discuss the outlook of the firm.

Alphabet

Let's look at Google's parent company, Alphabet.

Voting Rights

Votes are generally *one share, one vote*, so larger shareholders can exert more influence. Some DUAL-CLASS SHARE structures offer shares with more than one vote per share, possibly to preserve power for founders.

Voting for Directors:

STRAIGHT VOTING is when a shareholder cannot cast more than one vote per share per director.

CUMULATIVE VOTING is when a shareholder may cast all their votes for a director giving smaller shareholders more power.

Voting Rights- Director Example

You own 500 shares and there are 4 directors up for election. With straight voting (the norm), you get can vote up to 500 times for each director. With cumulative, you could vote up to 500 x 4 = 2000 for one candidate (forfeiting votes for other candidates), or divide up your vote anyway you'd like.

Other Vote Items

Approving executive compensation (an advisory vote)

Frequency of executive compensation vote

Approving new stock issuance

Auditor approval

Voting Definitions and Features

Proxy: granting the authority to another to vote your shares if you can't make it to the meeting (most voting done this way).

Proxy Fight: outside shareholders try to obtain votes via proxy to vote against management.

Dual Class Shares: Some firms offer multiple classes, with voting power concentrated to a certain class.

Alphabet's Proxy Statement

Dividends

Dividends are payments made by a corporation to shareholders, either in cash or more stock.

1. Not a liability (can't go bankrupt for not paying)
2. Not a business expense (and thus not tax deductible)
3. Taxable income to shareholders (even though taxes already paid at the corporate level)

The Dividend Decision

Some firms pay dividends; others don't.

1. Retaining earnings can be used to finance growth.
2. Dividends are taxable; capital gains aren't unless realized.

Why would you hold a stock that doesn't pay dividends?

Preferred Stock

Preferred Shares are equity shares with dividend priority over common stock, sometimes without voting rights, and commonly with cumulative dividends.

> Cumulative Dividends require that unpaid dividends be carried forward and paid first to preferred stock holders before any common share dividends are paid. Not a liability.

To Summarize

Common stock represents ownership in a firm. Rights include a residual claim to assets and voting ability at annual meetings. Dividends need not be paid and are not a liability, even for preferred shares.

Stock Valuation

Common Stock Valuation

Valuation for common stock can be challenging for three reasons:

1. Cash flows for stocks (the dividends) are not promised like cash flows for bonds (coupons)
2. There is no maturity
3. No easy way to determine the rate of return for discounting

Another issue: we can't always predict what the "future value" will be.

Common Stock Valuation Example

You are considering buying one share of Nike. You forecast that you will be able to sell that share for $70 in one year's time. Further, Nike is expected to pay a $10 dividend at the end of the year. You think that the company is relatively risky, so you require a 25% return on this investment.

What is the value of 1 share of Nike?

Common Stock Valuation Example

$$PV = \frac{FV}{(1+r)^t} = \frac{10+70}{(1+0.25)^1} = 64$$

With a calculator:

N = 1, FV = 10 + 70, I/Y = 25, CPT PV = -64

Therefore, you should pay no more than $64.

Valuing Stock Cash Flows- 1 Period

We can rewrite the calculation we've done as:

$$P_0 = \frac{(D_1 + P_1)}{(1 + R)}$$

P_0 is the price now, D_1 is the dividend in 1 year, P_1 is the price in 1 year, R is the required return.

$$P_0 = \frac{(D_1 + P_1)}{(1 + R)} = \frac{(10 + 70)}{(1 + 0.25)} = 64$$

Valuing Stock Cash Flows- 2 Periods

What if we want to sell after 2 years?

$$P_0 = \frac{D_1 + P_1}{1+R} = \frac{D_1 + \frac{D_2+P_2}{1+R}}{1+R}$$

Because…

$$P_1 = \frac{D_2 + P_2}{1+R}$$

Valuing Stock Cash Flows- 2 Periods

And…

$$P_0 = \frac{D_1 + P_1}{1+R} = \frac{D_1 + \frac{D_2+P_2}{1+R}}{1+R} = \frac{D_1}{(1+R)^1} + \frac{D_2}{(1+R)^2} + \frac{P_2}{(1+R)^2}$$

$$P_0 = \frac{D_1}{(1+R)^1} + \frac{D_2}{(1+R)^2} + \frac{P_2}{(1+R)^2}$$

Valuing Stock Cash Flows- Many Periods

Continue to add dividends for each period, pushing back the predicted stock price so far that it hardly has an impact on P_0.

$$P_0 = \frac{D_1}{(1+R)^1} + \frac{D_2}{(1+R)^2} + \ldots + \frac{D_t}{(1+R)^t} + \frac{P_t}{(1+R)^t}$$

$$P_0 = \frac{D_1}{(1+R)^1} + \frac{D_2}{(1+R)^2} + \frac{D_3}{(1+R)^3} + \frac{D_4}{(1+R)^4} \ldots$$

$$P_0 = \sum_{t=1}^{n} \frac{D_t}{(1+R)^t}$$

Therefore, the price of a stock today is equal to the present value of all future dividends.

Valuing Stock Cash Flows- Many Periods Example

What is the value of one share of Adidas, given it pays an annual dividend of $10 and the required return is 15%? Assume Adidas will (1) cease to exist in 30 years, (2) 40 years, (3) 100 years

$$P_0 = \sum_{t=1}^{n} \frac{D_t}{(1+R)^t}$$

(1) PMT= 10, I/Y = 15%, N = 30, CPT PV = $65.67

(2) PMT= 10, I/Y = 15%, N = 40, CPT PV = $66.42

(3) PMT= 10, I/Y = 15%, N = 100, CPT PV = $66.66

What About Companies that Don't Pay Dividends?

From Ross, Westerfield, and Jordan (11th ed, pg. 241):

> "When we say that the value of the stock is equal to the present value of the future dividends, we don't rule out the possibility that some number of those dividends are zero. They just can't *all* be zero."

Special Cases of Stock Valuation

We have some special cases where we can directly solve for the value of the shares (though, unfortunately, these cases are rare in practice):

1. Dividends are always the same forever (zero growth rate)
2. Dividends grow at a constant rate.
3. Dividends growth is not constant originally, but after some periods becomes constant.

Case 1: Dividends with Zero Growth

In this case, the dividends are the same in each period, effectively making the stock a *perpetuity.*

$$P_0 = \frac{D}{R}$$

which is analogous to…

$$PV\ of\ a\ Perpetuity = \frac{C}{r}$$

Case 1 Example

Starrbuxx Koffee has a policy of paying a $10 per share dividend every year. If this will continue forever, what is the value of a share assuming you require a return of 20%?

$$P_0 = \frac{D}{R} = \frac{\$10}{0.20} = \$50$$

Case 2: Constant Growth

In this case, the dividends are expected to grow at a constant rate forever.

Using the future value formula, we can find the dividends in each period:

$$D_1 = D_0(1+g)^1$$
$$D_2 = D_0(1+g)^2$$

. . . and so on.

Case 2: Constant Growth

We can plug in these values of D_1 and D_2 into:

$$P_0 = \frac{D_1}{(1+R)^1} + \frac{D_2}{(1+R)^2} + \frac{D_3}{(1+R)^3} + \frac{D_4}{(1+R)^4} \cdots$$

$$P_0 = \frac{D_0(1+g)^1}{(1+R)^1} + \frac{D_0(1+g)^2}{(1+R)^2} + \frac{D_0(1+g)^3}{(1+R)^3} + \frac{D_0(1+g)^4}{(1+R)^4} \cdots$$

which simplifies to…

$$P_t = \frac{D_{t+1}}{R-g}$$

Case 2: Constant Growth

This is called the dividend growth model.

$$P_t = \frac{D_{t+1}}{R - g}$$

Note that R must be greater than g. The rate of return you require must be greater than the rate at which the dividends grow.

Case 2 Example

Amuhzahn Inc. just paid a dividend of $2.30. Management believes the company is doing well, so they announce they will pay dividends annually, growing 5% per year indefinitely. Currently, the shares sell at $36. The required return is 13%. Would you buy these shares?

$$P_t = \frac{D_{t+1}}{R - g}$$

$$P_0 = \frac{D_1}{R - g} = \frac{2.30 \times 1.05}{0.13 - 0.05} = \$30.19$$

You would not buy these shares, because $\$30.19 < \$36$.

Case 2 Example Continued

Suppose we want to determine what the price for Amuhzahn shares will be in 5 years.

$$P_t = \frac{D_{t+1}}{R - g}$$

$$P_5 = \frac{D_6}{R - g} = \frac{2.30 \times (1.05)^6}{0.13 - 0.05} = \$38.53$$

Case 3: Nonconstant Growth

An example of nonconstant growth would be a firm that is paying no dividends for a period then begins paying at a constant growth rate.

Here, we first calculate the value of the constant growth portion, then discount that value to the present.

Case 3 Example

Faysbuk is a newer company that isn't quite ready to pay dividends. However, in 5 years, you think the company will be confident enough to pay a dividend of $0.50 per share to grow at 10% indefinitely. What should the price of that share be today? The required return is 20%.

Step 1: Constant growth formula:

$$P_4 = \frac{D_5}{R - g} = \frac{0.50}{0.20 - 0.10} = \$5$$

Step 2: Discount to present:

$$P_0 = \frac{FV}{(1 + r)^t} = \frac{\$5}{1.20^4} = \$2.41$$

Case 3 Example (2)

Hahrlee-Dayvidsin Moeturs will pay a dividend of $1, then $2, then $2.50 for the next three years. At that point, dividends will grow at 5% per year. The required returns is 10%. What is the value of the stock today?

Step 1: Constant growth formula:

$$P_3 = \frac{D_4}{R - g} = \frac{\$2.50 \times 1.05}{0.10 - 0.05} = \$52.50$$

Step 2: Discount to present:

$$P_0 = \frac{D_1}{(1+R)^1} + \frac{D_2}{(1+R)^2} + \frac{D_3}{(1+R)^3} + \frac{P_3}{(1+R)^3}$$

$$P_0 = \frac{\$1}{(1+0.10)^1} + \frac{\$2}{(1+0.10)^2} + \frac{\$2.50}{(1+0.10)^3} + \frac{\$52.50}{(1+0.10)^3} = \$43.88$$

The Required Return

What about growth in the value of the shares?

The Required Return is the return investors demand to receive before they will commit money to an investment given a level or risk.

A formulaic definition can be found by using the equation of P_0 and solving for the required return:

$$P_0 = \frac{D_1}{R - g} \rightarrow R = \frac{D_1}{P_0} + g$$

D_1/P_0 is the Dividend Yield

g is the Capital Gains Yield

The Required Return

Thus, the required return consists of the stock's dividend portion and the rate at which the value of the shares are expected to rise.

$$R = \frac{D_1}{P_0} + g$$

Using EPS when No Dividends

If the company doesn't pay dividends, we can also consider multiplying some Benchmark PE ratio by the Earnings Per Share of the company.

$$P_t = Benchmark\ PE\ Ratio \times EPS_t$$

Benchmark Example

Jinrel Elektrik doesn't pay dividends. It operates in an industry with a median PE ratio of 29x's. Last year, its net income was $1,240,000 and there were 500,000 shares outstanding. What is your estimate price per share for this company?

$$P_t = Benchmark\ PE\ Ratio \times EPS_t$$

$$P_t = 29 \times \frac{1,240,000}{500,000} = \$71.92$$

Therefore, you may want to buy this share if it is selling in the market for less than $71.92

To Summarize

We consider the value of a share to be the present value of future dividends. Special cases we can calculate include when dividends stay the same, grow at a constant rate, or begin growing at a constant rate in the future. The required return for these calculations includes a dividend and capital gains portion. Finally, we can use benchmarking when dividends are not paid.

The Stock Market

Basic Terminology

Primary Markets: Where companies sell equity shares to raise money.

Secondary Markets: Where shares are traded among investors.

Dealer: An agent who buys and sells securities from an inventory.

Broker: An agent who arranges transactions between buyers and sellers and does not hold an inventory.

Example

To understand what dealers do, think of a campus bookstore:

- If they sell you a new book, this is a *primary* market transaction.
- If you buy a used book, this is a *secondary* market transaction, and you pay the store's *ask* price.
- If you sell a used book to them, this is a *secondary* market transaction, and you receive the store's *bid* price.
- The store makes money by charging more than cost for new books and on the bid-ask spread for used books.

Stock Markets: NYSE and NASDAQ

NYSE

Designated Market Makers (dealers) hold certain stocks and remain at their post auctioning off shares to brokers and maintaining order.

Floor Brokers get a call from the brokerage company (say Merrill-Lynch) to buy a certain number of shares of a company on behalf of a client.

Stock Markets: NYSE and NASDAQ

NASDAQ

National Association of Securities Dealers Automated Quotations System.

Purely electronic market with no physical location.

A dealer market, where bid and ask prices are posted.

Stock Market Indices

The Dow Jones Industrial Average and the S&P 500 are popular examples of stock market indices.

These are groups of popular companies, and the performance of the stocks in each INDEX can give us an idea of how the stock market is performing overall.

When the stock market is “up” or “down”, it usually means that the DJIA or the S&P 500 has gone “up” or “down”.

https://markets.wsj.com/us

To Summarize

The NYSE and NASDAQ are secondary markets where trading of shares takes place. Dealers have an inventory of stocks whereas brokers match buyers and sellers.

Takeaways

Takeaways

1. Common stock is an ownership interest in a company that generally comes with voting rights and a residual claim.
2. Dividends don't need to be paid and are not a liability nor tax deductible as interest expense is.
3. Preferred stock has dividend priority over common stock.
4. We determine the value of a share by finding the present value of dividends.
5. The required return has both a dividend yield and capital gains component.
6. The stock market is a secondary market where owners exchange shares.

End.

Net Present Value and Other Investment Criteria

Chapter 9

Outline

1. Capital Budgeting
2. Evaluating Investments and Investing Criteria
    1. Net Present Value (NPV)
    2. Internal Rate of Return (IRR)
    3. Payback Rule
    4. Discounted Payback Rule
3. Advantages and Disadvantages of Investing Criteria
4. The Practice of Capital Budgeting

Capital Budgeting

The Capital Budgeting Decision

Recall that Capital Budgeting is the process of planning and managing a firm's long-term investments.

Investments are acquisition of fixed assets, properties, or cash flow rights, spending on research and development, expanding factories, launching and marketing new products.

Examples of Capital Budgeting

Tesla building a factory in China.

Disney expanding theme parks in Paris.

Microsoft acquiring Minecraft.

With all decisions, the goal of the manager is to maximize value per share.

Capital Budgeting Considerations

Regardless of the nature of the investment opportunity, financial managers need to understand the

- Size
- Timing
- Risk

of the future cash flows.

Note that these correspond to inputs of the PV calculation.

Evaluating Investments

Given that firms have a large number of opportunities for investing, they need tools for evaluating these possibilities.

The NPV, IRR, Payback Rule, and Discounted Payback Rule are ways firms evaluate investments.

The Net Present Value

Net Present Value Example

You want to start a grass cutting business in Lexington to make some money during the 4 years you attend UK. It costs $3,000 to buy all the equipment you need, which you will buy today. You estimate that you will be able to make $2,000 a year for each of the next 4 years (starting in one year), but buying gas and maintaining your equipment costs $800 a year. At the end of 4 years you will graduate and sell your equipment for an estimated $1,000. You think your discount rate should be around 15% because there are other investment opportunities that could yield similar returns at a similar level of risk. Should you start this business?

NPV Example

To determine if it is a good idea to start this business, we should calculate the PV of the future cash flows. Let's start by organizing the information we have.

Initial Cost = $3,000

Time Periods = 4

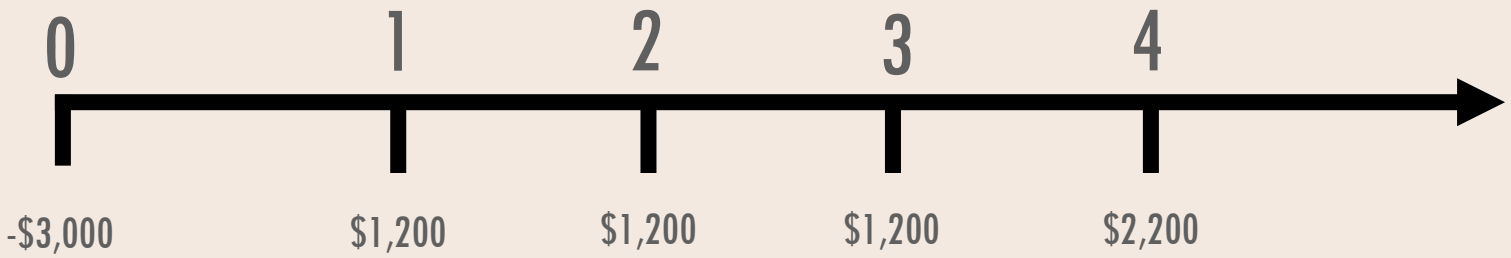
Cash Flow Years 1 through 3 = $2,000 revenue - $800 costs = $1,200

Cash Flow in Year 4= $2,000 revenue - $800 costs + $1,000 equipment = $2,200

Discount Rate = 15%

NPV Example

Now, draw a timeline



CF0=-3000, CF1=1200, F01=1, . . . , CF3=1200, F03=1, CF4=2200, F04=1

(or CF0=-3000, CF1=1200, F01=3, CF2=2200, F02 =1)

I=15, CPT NPV = **$997.73**

NPV

Net Present Value: the difference between an investment's market value and its cost. A measure of how much value is created or destroyed, taking into account cash inflows and outflows.

Here, the positive/negative sign is *very* important, but it is much clearer as to whether cash is an outflow or inflow.

> Based on the NPV Rule, An investment should be accepted if the NPV is positive and rejected if it is negative.

Note: the NPV is only an estimate and quite sensitive to the discount rate!

Back to the Example

The Net Present Value is the measure of how much value is created or destroyed, taking into account cash inflows and outflows.

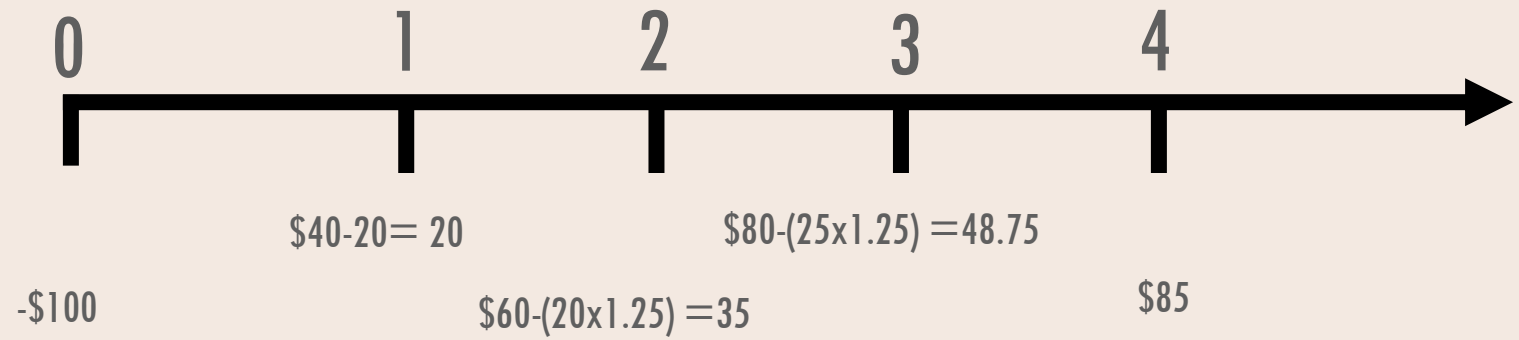
Here, the NPV is +**$997.73**, therefore, your net worth increases by +**$997.73** for investing in the lawn care business. You should make this investment!

NPV Example 2

Snapchat is interested in developing its own phone to sell to consumers that focuses on photos and filters but doesn't make calls. The cost of development will be $100 million. Sales in the first year 3 years are expected to be $40 million, $60 million, and $80 million while costs are expected to be $20 million in the first year and grow annually at 25%. One year after achieving $80 million in sales, Snapchat expects to sell off its phone business for $85 million. What is the NPV and should Snapchat pursue this project assuming the discount rate is 28% annually?

NPV Example 2

First, draw a timeline:



CF0=-100, CF1=20, F01=1, . . ., CF4=85, F04=1

I=28, CPT NPV = **-$8.10 million.**

Snapchat should not pursue this project.

To Summarize

We calculate the NPV by considering the PV of future cash flows with the cost of an investment. We should accept investments with a positive NPV and reject investments with a negative NPV. The NPV is only an estimate.

The Internal Rate of Return

Internal Rate of Return Example

American Airlines wants to update an old fleet of airplanes it no longer uses and sell them to other airlines. The cost to do so is $435.44 million, and they project they can earn $100 million in the first year, $200 million in the second year and $300 million in the third year by selling the updated fleet. Given the riskiness of this investment, AA requires a return of 18%. What is the IRR? Should AA undertake this investment?

In your calculator:

Cfo = -435.44, CF1= 100, F01= 1, . . ., CF3 = 300, F03 = 1

IRR CPR = 15.00%

IRR < Required Return, therefore AA should *not* undertake this investment.

The Internal Rate of Return (IRR)

IRR: The discount rate that makes the NPV of an investment zero. This rate is "internal" in that it depends only on the cash flows of the project, not on opportunity costs.

Based on the IRR Rule An investment should be accepted if the IRR is greater than the required return

Internal Rate of Return Example Revisted

American Airlines wants to update an old fleet of airplanes and sell them to other airlines. The cost to do so is $435.44 million, and they project they can earn $100 million in the first year, $200 million in the second year and $300 million in the third year y selling the updated fleet. What is the NPV of this project given a discount rate of 15%? (Note that 15% = IRR from before).

In your calculator:

Cfo = -435.44, CF1= 100, F01= 1, . . ., CF3 = 300, F03 = 1

NPV → I= 15.00%

CPT NPV = 0.000

IRR AND NPV

IRR is useful because we don't need to think about a discount rate, only a rate we require.

Using the IRR and NPV Rule always results in the same accept/reject decision *unless*:

(1) The project's cash flows are *unconventional*

(2) The projects are *mutually exclusive*, whereby undertaking one project means you cannot undertake the other.

(1) Unconventional Cash Flows

This generally exists when you have positive and negative cash flows over time.

> Example: Mining gold requires an initial investment of $60 million to set up the site. This yields cash flows of $100 million then $200 million over the next two years, but then another $40 million investment is required to restore the mine.

There can be multiple IRRs in this case, and your calculator may just pick one, which isn't suitable.

Fortunately, the NPV method still works.

(2) Mutually Exclusive Projects

Two projects are mutually exclusive if taking one means you can't take the other.

Example: JCPenney's has a plot of land that they can either build a store or distribution center on, but not both.

We *cannot* use the IRR to compare two mutually exclusive projects: accept the one with the highest NPV.

This is in part due to the *timing* of the cash flows as well as the chosen *discount rates*.

(2) Mutually Exclusive Projects Example

The Ford Motor Company must decide which of their classic cars, the Model T or the Model A, to reintroduce to its lineup. Whichever it chooses, it will be for a limited time only (4 years). The table of the investment and expected sales (net of expenses) are presented below. Calculate the IRR for each investment.

Year	Model T	Model A
0	-$100 M	-$100 M
1	50 M	20 M
2	40 M	40 M
3	40 M	50 M
4	30 M	60 M

(2) Mutually Exclusive Projects Example

Year	Model T	Model A
0	-$100 M	-$100 M
1	50 M	20 M
2	40 M	40 M
3	40 M	50 M
4	30 M	60 M

For the Model T:

Cfo= -100, CF1= 50, FO1=1, . . ., CF4=30, FO4=1 → CPT IRR = 24.00%

For the Model A:

Cfo= -100, CF1= 20, FO1=1, . . ., CF4=60, FO4=1 → CPT IRR = 21.03%

(2) Mutually Exclusive Projects Example

Year	Model T	Model A
0	-$100 M	-$100 M
1	50 M	20 M
2	40 M	40 M
3	40 M	50 M
4	30 M	60 M

Does this mean Ford should produce the Model T? What's the NPV of both projects assuming a discount rate of 5%?

For the Model T:

Cfo= -100, CF1= 50, FO1=1, . . ., CF4=30, FO4=1 → I = 5, CPT NPV=43.13

For the Model A:

Cfo= -100, CF1= 20, FO1=1, . . ., CF4=60, FO4=1 → I = 5, CPT NPV=47.88

(2) Mutually Exclusive Projects Example

Year	Model T	Model A
0	-$100 M	-$100 M
1	50 M	20 M
2	40 M	40 M
3	40 M	50 M
4	30 M	60 M

What's the NPV of both projects assuming a discount rate of 15%?

For the Model T:

Cfo= -100, CF1= 50, F01=1, . . ., CF4=30, F04=1 → I = 15, CPT NPV=17.18

For the Model A:

Cfo= -100, CF1= 20, F01=1, . . ., CF4=60, F04=1 → I = 15, CPT NPV=14.82

Mutually Exclusive Projects

Never rank mutually exclusive projects on their returns. Think of it this way:

> You have two investments. One has a 10% return and makes you $1,000 richer immediately. The other has a 20% return and makes you $500 richer immediately. You'd rather be $1,000 richer regardless of return.

Use NPVs when comparing mutually exclusive projects.

Independent projects are those that can be pursued at the same time.

Conflicts Between IRR and NPV

Due to the unreliable nature of IRR when it comes to unconventional cash flows and mutually exclusive projects, *always go with the NPV if there is a conflict with IRR.*

To Summarize

The IRR is the rate at which the NPV is zero. If you calculate an IRR for a project that is greater than your required return, you should accept the project. Be mindful of mutually exclusive projects and projects with unconventional cash flows.

The Payback Rule

Payback Rule Example

Cedar Fair Entertainment Company is interested in building a new theme park in Lexington, KY. The cost of the park will be $1.3 billion. Cash flows net of costs will be $250 million, $275 million, $400 million, $550 million, and $600 million for the next 5 years, consisting of ticket and merchandise sales. How much time is needed until the original investment is paid off? Should they pursue this project if the Board of Directors wants it to be paid back within 5 years?

Year 1: 250	Not yet
Year 2: $250 + 275 = 525$	Not yet
Year 3: $250 + 275 + 400 = 925$	Not yet
Year 4: $250 + 275 + 400 + 550 = 1{,}475$	Paid back!

In the 4th year, you only need 1,300-925=375 to be paid back. With 550 in total cash flow projected for year 4, we are paid back 68% of the way through the 4th year: $375/550 = 0.68$

This project pays back in $3 + 0.68 = 3.68$ years.

Payback Rule

The Payback Period is the amount of time required for an investment to generate cash flows sufficient to cover its costs. Generally used for smaller projects.

> Based on the Payback Rule, an investment is acceptable if its calculated payback period is less than some prespecified period of time.

This is a type of "break even" measure, and time value of money is ignored.

Payback Rule Example (2)

Bass Pro Shops is interested in building a store Lexington, KY. The cost of the store will be $65 million. Cash flows net of costs will be $25 million, $50 million, $70 million, and -$12.65 trillion, for the next 4 years. Should they pursue this project if the Board of Directors wants it to be paid back within 3 years?

Year 1: 25	Not yet
Year 2: $25 + 50 = 75$	Paid back!

In the 2nd year, you only need 65-25=40 to be paid back. With 50 in total cash flow projected for year 2, we are paid back 80% of the way through the 2nd year, or $40/50 = 0.80$

This project pays back in $1 + 0.80 = 1.8$ years, which is less than 3 years.
Should they undertake this investment?

To Summarize

The Payback Rule determines if an investment will be offset by future cash flows within a set number of periods.

The Discounted Payback Rule

The Discounted Payback Rule

Here, we determine the Payback Period as in the Payback Rule Method, only now we consider the Time Value of Money.

> Based on the Discounted Payback Rule, An investment is acceptable if its calculated payback period is less than some prespecified period of time.

Not much simpler than just finding the NPV…

Discounted Payback Rule Example

Let's revisit the Cedar Fair Entertainment Company example. Assume now a discount rate of 12%. The cost of the park will be $1.3 billion. Cash flows net of costs will be $250 million, $275 million, $400 million, $550 million, and $600 million for the next 5 years. Should they pursue this project if the Board of Directors wants it to be paid back within 3 years?

Year 1: $250/(1.12)^1 = 223$	Not yet
Year 2: $275/(1.12)^2 = 219$ and $223 + 219 = 442$	Not yet
Year 3: $400/(1.12)^3 = 285$ and $223 + 219 + 285 = 727$	Not yet

No, this project does not pay back the original investment within 3 years assuming a discount rate of 12%.

To Summarize

The Discounted Payback Rule determines if an investment will be offset by the present value of future cash flows within a set number of periods.

Advantages and Disadvantages of Investing Criteria

Pros and Cons of NPV

The NPV is the preferred method of evaluating a project.

No major flaws, but it is important to note:

(1) The NPV is only an estimate

(2) The NPV is sensitive to the discount rate

Pros and Cons of IRR

Pros:

Easy to understand an communicate. A manager can say “this project would yield a return of 15%” where 15% is the IRR.

Cons:

Cannot be used to compare mutually exclusive projects

Cannot be used when there are unconventional cash flows

Pros and Cons of the Payback Rule

Pros:

Easy to calculate and has a straightforward interpretation

Cons:

Doesn't determine if value is created for the shareholders

Ignores risks and time value of money

Ignores cash flows after the payback period

The choice of payback period can be arbitrary

Pros and Cons of the Discounted Payback Rule

Pros:

Easy to calculate and has a straightforward interpretation

Cons:

Doesn't determine if value is created for the shareholders

No simpler to calculate than the NPV

Ignores cash flows after the payback period

The choice of payback period can be arbitrary

To Summarize

Each of the methods we've covered has pros and cons. The NPV method is generally preferred.

The Practice of Capital Investments

What Do Managers Do?

In practice, CFOs use a mix of the techniques we've discussed (and a few that we didn't).

Percentage of CFOs who Always or Almost Always use a Given Technique (1999):

Capital Budgeting Technique	Percentage Always or Almost Always Using	Average Score [Scale is 4 (always) to 0 (never)]		
		Overall	Large Firms	Small Firms
Internal rate of return	76%	3.09	3.41	2.87
Net present value	75	3.08	3.42	2.83
Payback period	57	2.53	2.25	2.72
Discounted payback period	29	1.56	1.55	1.58
Accounting rate of return	20	1.34	1.25	1.41
Profitability index	12	.83	.75	.88

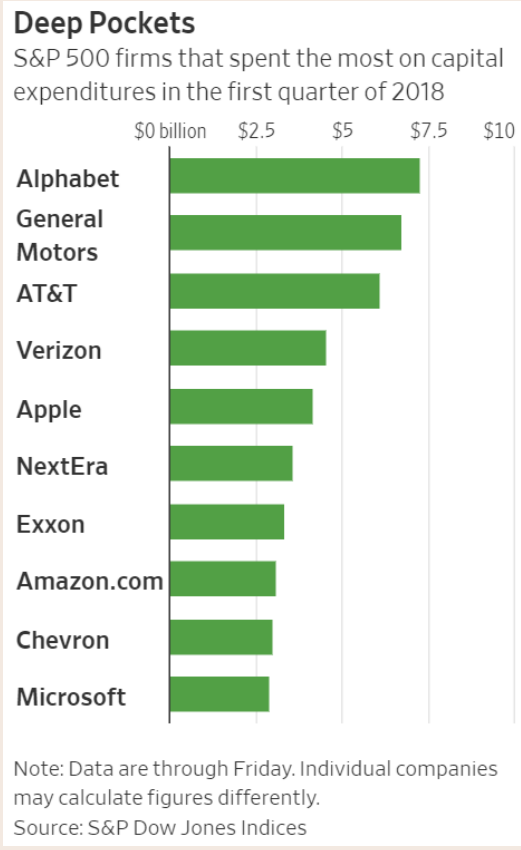
What Should Managers Do?

Managers and CFOs should be focused on maximizing the value per share to existing shareholders. This is done by undertaking positive NPV projects and rejecting negative NPV projects.

Investing and Capital Expenditures

Investments and projects are generally called Capital Expenditures in financial statements and in the financial press.

[WSJ Capital Spending Boom]



Investing and Capital Expenditures: ExxonMobil

CONSOLIDATED STATEMENT OF CASH FLOWS

	Note Reference Number	2017	2016	2015
			(millions of dollars)	
Cash flows from operating activities				
Net income including noncontrolling interests		19,848	8,375	16,551
Adjustments for noncash transactions				
Depreciation and depletion	9	19,893	22,308	18,048
Deferred income tax charges/(credits)		(8,577)	(4,386)	(1,832)
Postretirement benefits expense in excess of/(less than) net payments		1,135	(329)	2,153
Other long-term obligation provisions in excess of/(less than) payments		(610)	(19)	(380)
Dividends received greater than/(less than) equity in current earnings of equity companies		131	(579)	(691)
Changes in operational working capital, excluding cash and debt				
Reduction/(increase) - Notes and accounts receivable		(3,954)	(2,090)	4,692
- Inventories		(1,682)	(388)	(379)
- Other current assets		(117)	171	45
Increase/(reduction) - Accounts and other payables		5,104	915	(7,471)
Net (gain) on asset sales	5	(334)	(1,682)	(226)
All other items - net	5	(771)	(214)	(166)
Net cash provided by operating activities		30,066	22,082	30,344
Cash flows from investing activities				
Additions to property, plant and equipment	5	(15,402)	(16,163)	(26,490)
Proceeds associated with sales of subsidiaries, property, plant and equipment, and sales and returns of investments	5	3,103	4,275	2,389
Decrease/(increase) in restricted cash and cash equivalents		-	-	42
Additional investments and advances		(5,507)	(1,417)	(607)
Other investing activities including collection of advances		2,076	902	842
Net cash used in investing activities		(15,730)	(12,403)	(23,824)

Takeaways

Takeaways

1. Capital Budgeting is the process of planning and managing a firm's long-term investments.
2. There are several ways managers evaluate projects, including the NPV, IRR, Payback Period, and Discounted Payback Period.
3. The NPV compares the present value of an investment's future cash flows to the cost of the investment.
4. The IRR can be calculated for a project and compared to a required rate of return.
5. Ultimately, the goal of the financial manager is to maximize the value pre share for existing shareholders, which is done by selecting value-enhancing (positive NPV) projects.

End.

Making Capital Investment Decisions

Chapter 10

Outline

1. Relevant Cash Flows
    A. Opportunity Costs
    B. Side Effects
    C. Net Working Capital
    D. Taxes
2. Pro Forma Financial Statements and OCF

Relevant Cash Flows

Capital Budgeting Decisions and Cash Flows

The NPV and IRR are frequently used to evaluate investments and make capital budgeting decisions.

These methods consider the cost of an investment and the cash flows that result from undertaking a project.

We now consider which cash flows should be included in capital budgeting analysis.

Capital Budgeting Decisions Example

Amazon is interested in building a new distribution center in Baton Rouge, LA. They estimate that 30,000 new people will enroll in Prime as a result and make Amazon their first stop for shopping. Below is Amazon's cash flows with and without the project. How would you calculate the NPV of the distribution center?

Amazon	**2019**	**2020**	**2021**	**…**
Cash Flows without New Center	$143 M	$156 M	$175 M	…
Cash Flows of the New Center	($30 M)	$15 M	$17 M	…
Total	$113 M	$171 M	$192 M	…

Discount the *Cash Flows of the New Center* after 2019 and subtract the initial cost of the investment to find the NPV.

Relevant Cash Flows for Capital Budgeting

The relevant cash flows are a firm's future cash flows that come about as a direct consequence of the project.

Incremental Cash Flows are this difference between a firm's future cash flows with a project and those without a project and should be used in the capital budgeting decision.

Cash flows that would exist without the investment should not be considered.

Capital Budgeting Decisions Example

What are the incremental cash flows? Which cash flows should not be considered when evaluating this project?

Amazon	2019	2020	2021	…
Cash Flows without New Center	$143 M	$156 M	$175 M	…
Cash Flows of the New Center	($30 M)	$15 M	$17 M	…
Total	$113 M	$171 M	$192 M	…

This is the Standalone Principle, whereby we assume that the project is separate from the firm and is evaluated on its own merits in isolation from other activities or projects.

Identifying Relevant Cash Flows

It's not always easy to determine if a cash flow should be included in the capital budgeting decision. Examples of costs and cash flows we need to think about carefully are:

- Sunk Costs
- Opportunity Costs
- Side Effects
- Net Working Capital
- Financing Costs
- Taxes

Sunk Costs

A Sunk Cost is a cost that has been incurred, cannot be removed, and therefore should *not* be considered in an investment decision.

Sunk Costs Example

MGM Resorts International hires a consultant to evaluate whether they should build a new casino on the Las Vegas strip. Should the fee for the consultant be included in the NPV calculation with the “initial investment”?

NO. The fee needs to be paid regardless of whether or not MGM undertakes the investment.

Opportunity Costs

An Opportunity Cost is the most valuable alternative that is given up if a particular investment is accepted. These *should* be considered in the capital budgeting decision.

Opportunity Cost Example

MGM Resorts owns a large parking garage a few blocks down the Vegas strip from its current location. It acquired this structure a decade ago for $30 million. Today, MGM can sell the garage for $100 million. They decide to build a new casino at that location. Should we include this in the capital budgeting decision?

YES. We would include the $100 million that we *could* have gotten for the garage as an opportunity cost when evaluating this project. The $30 million, however, is a sunk cost.

Side Effects

A Side Effect is a way a project can impact other projects at the firm. Side effects should be included in the capital budgeting analysis.

Erosion is a side effect whereby a new project negatively impacts cash flows of your current investments.

Side Effects Example

MGM Resorts builds the new casino on the strip, but in doing so pulls customers from its existing casino, the MGM Grand. Should we consider this in the NPV calculation?

YES. We should subtract the cash flows generated by customers moving from the old casino to the new one before we calculate the NPV of the new casino's cash flows.

Net Working Capital

Recall Net Working Capital is the difference between current assets and current liabilities.

We include *investments in net working capital* when evaluating a project. This includes purchasing of inventories, increases in accounts payable, and increases in cash.

As projects wind down, inventories are sold and accounts are paid off; therefore, the change in NWC is reversed in the final investment period.

Net Working Capital Example

MGM Resorts acquires new slot machines from suppliers on credit for the new casino. As a result, its accounts payable increases. Should this be included when evaluating a project?

YES. The increase in current liabilities affects net working capital.

Financing Costs

Financing Costs such as interest expense on debt used to finance the project are *not* included. This is because firms generally raise money for multiple projects, not just one.

Financing Costs Example

MGM Resorts issued bonds (raised debt) for this new casino project, as well as for other projects it is implementing in the US and globally. Should the coupon payments to bond holders be deducted from the cash flows the new casino generates?

NO. We don't include financing costs.

Taxes

All cash Flows should be considered after taxes have been paid.

Taxes Example

MGM Resorts generates cash flows of $100 M per year from the new casino. It pays $20 M of these cash flows in taxes. Should we use $100- $20 = $80 M as the cash flows when computing the NPV?

YES. We always assume the incremental cash flows are after tax. Be sure to only pay the portion that the *individual project* contributes to the tax bill.

To Summarize

We consider *after-tax incremental cash flows* when evaluating a project. Sunk costs and financing costs shouldn't be included in the analysis while opportunity costs, side effects, changes in net working capital, and taxes should be.

Pro Forma Statements and Project Cash Flows

Pro Forma Financial Statements

Pro Forma is Latin for "as a matter of form."

Pro Forma Statements are financial statements, particularly the income statement, that project future years' performance and standing.

We can use these statements to project cash flows of an investment opportunity.

Example: Whole Foods

Whole Foods is thinking about developing a new diet drink that has all the nutrients needed for daily life. It expects that it can sell 50,000 cans per year at $4 each. The cost will be about $2.50 each. Health fads usually come and go quickly, so this project has a 3 year useful life. A production facility will need to be rented at $12,000 per year, and $90,000 of manufacturing equipment (also with a life of 3 years) will be purchased. An investment of $20,000 of net working capital is required, and the tax rate is 34%. They require a 20% return on this project. Should Whole Foods pursue this project?

Example: Whole Foods

Summarize a year's information in a pro forma income statement:

Sales (50,000 units at $4/unit)	$	200,000
Variable costs ($2.50/unit)		125,000
Fixed costs		12,000
Depreciation ($90,000/3)		30,000
EBIT	$	33,000
Taxes (34%)		11,220
Net income	$	21,780

Example: Whole Foods

To obtain the project cash flows, we use the following formula:

$$Cash\ Flow_p = OCF_p - \Delta NWC_p - Capital\ Spending_p$$

where

$$OCF_p = EBIT_p + Depreciation_p - Taxes_p$$

Example: Whole Foods

What's the project's OCF?

Sales (50,000 units at $4/unit)	$	200,000
Variable costs ($2.50/unit)		125,000
Fixed costs		12,000
Depreciation ($90,000/3)		30,000
EBIT	$	33,000
Taxes (34%)		11,220
Net income	$	21,780

$$OCF = 33{,}000 + 30{,}000 - 11{,}220 = 51{,}780$$

Example: Whole Foods

Now, we can build a timeline using the OCF, ΔNWC, and capital spending information from the problem:

	Year			
	0	1	2	3
Operating cash flow		$ 51,780	$ 51,780	$ 51,780
Changes in NWC	$ (20,000)			$ 20,000
Capital spending	(90,000)			
Total project cash flow	$ (110,000)	$ 51,780	$ 51,780	$ 71,780

Notice that the NWC is recovered at the end of the project. The capital spending is on manufacturing equipment (the depreciable asset).

Example: Whole Foods

Using the Total Project Cash Flow, calculate the NPV and IRR.

	Year			
	0	1	2	3
Operating cash flow		$ 51,780	$ 51,780	$ 51,780
Changes in NWC	$ (20,000)			$ 20,000
Capital spending	(90,000)			
Total project cash flow	$ (110,000)	$ 51,780	$ 51,780	$ 71,780

NPV = $10,647.69

IRR = 25.76%

Whole Foods should accept the project.

Depreciation

Why do we subtract depreciation when calculating EBIT, only to add it right back in the OCF formula?

Income tax is calculated on the income *after* we deduct depreciation. The higher our depreciation expense, the lower our tax bill (all else equal).

Depreciation therefore has cash flow implications.

Depreciation Tax Shield

The Depreciation Tax Shield is simply the depreciation expense times the tax rate.

This is the increase to OCF by being able to "expense" depreciation.

Depreciation Tax Shield Example

Sales (50,000 units at $4/unit)	$	200,000
Variable costs ($2.50/unit)		125,000
Fixed costs		12,000
Depreciation ($90,000/3)		30,000
EBIT	$	33,000
Taxes (34%)		11,220
Net income	$	21,780

Sales (50,000 units at $4/unit)	$	200,000
Variable costs ($2.50/unit)		125,000
Fixed costs		12,000
Depreciation		0
EBIT	$	63,000
Taxes (34%)		21,420
Net income	$	41,580

$OCF = 33{,}000 + 30{,}000 - 11{,}220 = 51{,}780$

$OCF = 63{,}000 + 0 - 21{,}420 = 41{,}580$

$51{,}780 - 41{,}580 = 10{,}200$

Depreciation Tax Shield $= 0.34 \times 30{,}000 = 10{,}200$

Example 2: McDonald's

McDonald's is considering the development of a "Hoof & Bone" Burger, made of all the parts of the cow that doesn't go into the Big Mac. They plan on offering this sandwich as a limited-time 3 year engagement. A new factory will cost $2.97 million, which will depreciate by the same amount each year to zero. They estimate that they will sell $2,170,000 worth of burgers each of the year while incurring annual costs of $865,000. Assuming a tax rate of 35% and a required return of 9%, should McD's undertake this project? Use both the NPV and IRR method.

Example 2: McDonald's

Summarize information in a pro forma income statement.

Sales	$	2,170,000
COGS		865,000
Depreciation ($2.97M/3)		990,000
EBIT	$	315,000
Taxes (35%)		110,250
Net income	$	204,750

Example 2: McDonald's

Find the OCF.

Sales	$	2,170,000
COGS		865,000
Depreciation ($2.97M/3)		990,000
EBIT	$	315,000
Taxes (35%)		110,250
Net income	$	204,750

$$OCF = EBIT + DEP - TAXES = 315{,}000 + 990{,}000 - 110{,}250 = 1{,}194{,}750$$

Example 2: McDonald's

Present the Total Project Cash Flow and find the NPV and IRR.

	Year			
	0	1	2	3
Operating cash flow		$ 1,194,750	$ 1,194,750	$ 1,194,750
Changes in NWC	$ -			$ -
Capital spending	(2,970,000)			
Total project cash flow	$ (2,970,000)	$ 1,194,750	$ 1,194,750	$ 1,194,750

NPV = $54,264.30

IRR = 10.02%

McD's should develop the Hoof & Bone Burger.

Salvage Value

What if the equipment has a Salvage Value of $360,000 in the final year, and it can be sold for that amount?

	Year			
	0	1	2	3
Operating cash flow		$ 1,194,750	$ 1,194,750	$ 1,194,750
Changes in NWC	$ -			$ -
Salvage Value				$ 360,000
Capital spending	(2,970,000)			
Total project cash flow	$ (2,970,000)	$ 1,194,750	$ 1,194,750	$ 1,554,750

NPV = $332,250.35

IRR = 14.89%

McD's should develop the Hoof & Bone Burger.

To Summarize

Once we understand the relevant cash flows, we can develop pro forma statements for the life of the project and calculate the NPV and IRR.

Takeaways

Takeaways

1. We need to be sure to only include relevant cash flows when considering a project.
2. Relevant cash flows include opportunity costs, side effects, net working capital, and taxes.
3. Pro forma statements present projections for the cash flows that an investment opportunity yields.
4. Operating cash flow is calculated using the EBIT, adding depreciation, and subtracting taxes.

End.

Some Lessons from Capital Market History

Chapter 12

Outline

1. Returns
2. History
3. Average Returns: The First Lesson
4. Variability of Returns: The Second Lesson
5. Arithmetic & Geometric Averages
6. Capital Market Efficiency

Returns

Perspective

Roughly 90 years ago, your great-grandmother opened 4 “managed” accounts and put $100 (~$1400 in today’s dollars) in each for your just-born grandfather. These accounts were investments in:

(1) Treasury Bills
(2) Long-term Government Bonds
(3) Stocks of Large Companies
(4) Stocks of Small Companies

Your grandfather has forgotten about those accounts until today. How much do you think would be in each?

PERSPECTIVE

(1) Treasury Bills: A $100 investment in 1925 is now worth

$2,058.00

(2) Long Term Government Bonds: A $100 investment in 1925 is now worth

$10,914.00

Perspective

(3) Large Company Stocks: A $100 investment in 1925 is now worth

$467,688.00

(4) Small Company Stocks: A $100 investment in 1925 is now worth

$2,664,117.00

Returns

Your Return on Investment is your gain (or loss) from holding some financial asset.

Generally, we think in terms of

(1) Dollar Returns

(2) Percentage Returns

(1) Dollar Returns

Dollar Returns are how much more or less cash you have for holding an asset for a period of time. It consists of two components:

(1) Income Component: dividends & interest

(2) Capital Gain (or Loss) Component: change in value from beginning period to ending period

(1) Dollar Returns Example

Given the information from *finance.yahoo.com* on the next slide, what is your dollar return assuming you purchased 100 Coca-Cola shares at the Close Price on January 1, 2018 and sold 100 Coca-Cola shares at the Close Price on April 1, 2018?

(1) Dollar Returns Example

The Coca-Cola Company (KO) ☆ Add to watchlist

NYSE - Nasdaq Real Time Price. Currency in USD

43.59 +0.34 (+0.79%) Buy Sell

As of 3:37PM EDT. Market open.

Date	Open	High	Low	Close*	Adj Close**	Volume
Apr 01, 2018	43.440	45.030	41.910	43.210	42.829	256,838,800
Mar 14, 2018				**0.39** Dividend		
Mar 01, 2018	43.100	45.090	42.250	43.430	42.670	278,776,900
Feb 01, 2018	47.410	47.730	42.190	43.220	42.464	292,809,500
Jan 01, 2018	45.910	48.620	45.340	47.590	46.757	256,362,300

Income Component: Dividend x Shares = 0.39 x 100 = $39

Capital Gain (Loss) Component: (End – Beginning) x Shares = ($43.210 - $47.590) x 100 = -$438

Total Dollar Return = Income + Capital Gain (Loss) = $39 + ($438) = -$399

(2) Percentage Returns

The Percentage Return tells us how much we get for each $1 invested.

As we've seen before, the percentage return consists of:

(1) Dividend Yield

(2) Capital Gains Yield

(2) Percentage Returns

The dividend yield expresses the dividend as a percentage of the beginning stock price.

$$Dividend\ Yield = \frac{D_{t+1}}{P_t}$$

(2) Percentage Returns

The capital gains yield is the percent change in price.

$$Capital\ Gains\ Yield = \frac{P_{t+1} - P_t}{P_t}$$

(2) Percentage Returns Example

Suppose you pay $37 for a share of Pfizer. This firm pays a dividend of $1.85. At the end of the year, you sell this share for $40.33. What's the percent return?

Dividend Yield

$= 1.85 / 37 = 0.05 = 5\%$

Capital Gains Yield

$= (40.33 - 37) / 37 = 0.09 = 9\%$

(2) Percentage Returns Example, Cont.

Now we can find the total return:

$$Total\ Percent\ Return = Dividend\ Yield + Capital\ Gains\ Yield$$

$= 5\% + 9\%$

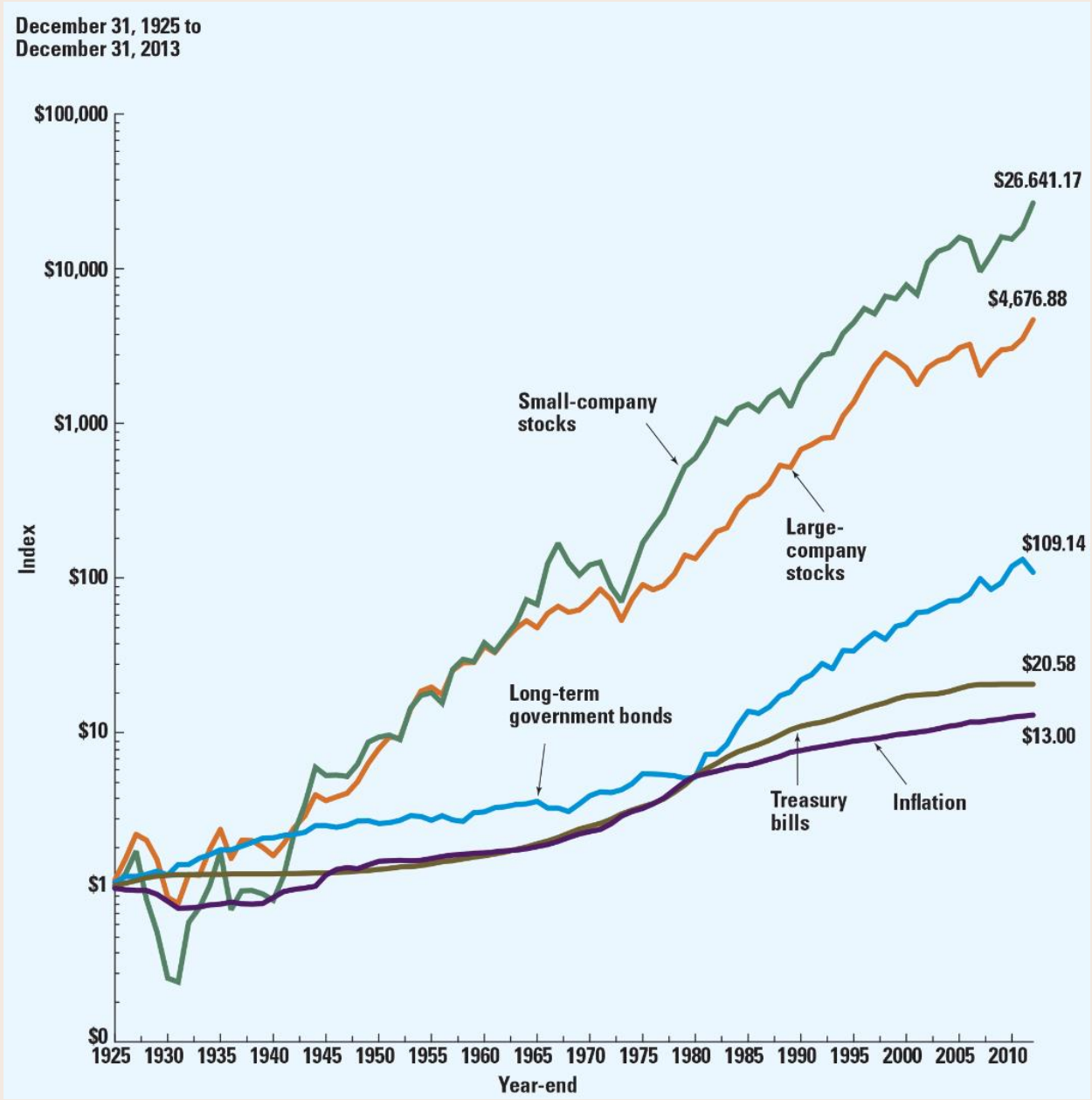
$= 14\%$

Our percentage return is 14%, or 14 cents per dollar invested.

To Summarize

Our return on investment can be presented in dollar terms or percentage returns. Both have a type of income and capital gains (loss) component.

History



SMALL STOCKS: smallest 20% of companies on the NYSE.

LARGE STOCKS: the S&P 500

LONG-TERM US GOVERNMENT BONDS: 20 year maturity

U.S. TREASURY BILLS: 1 month maturity

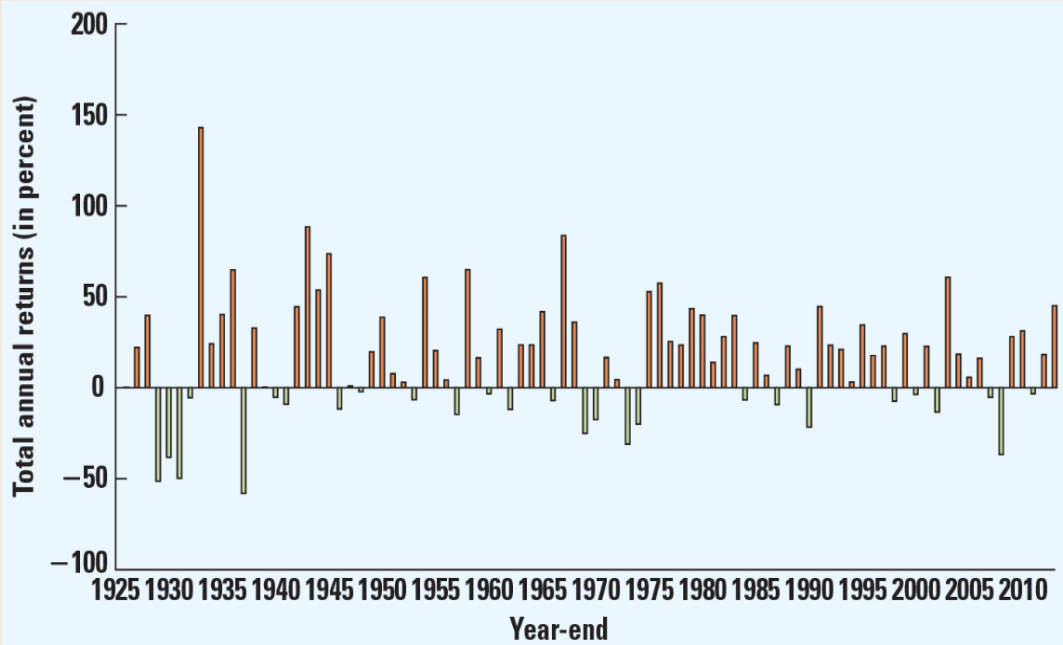
Historical Returns

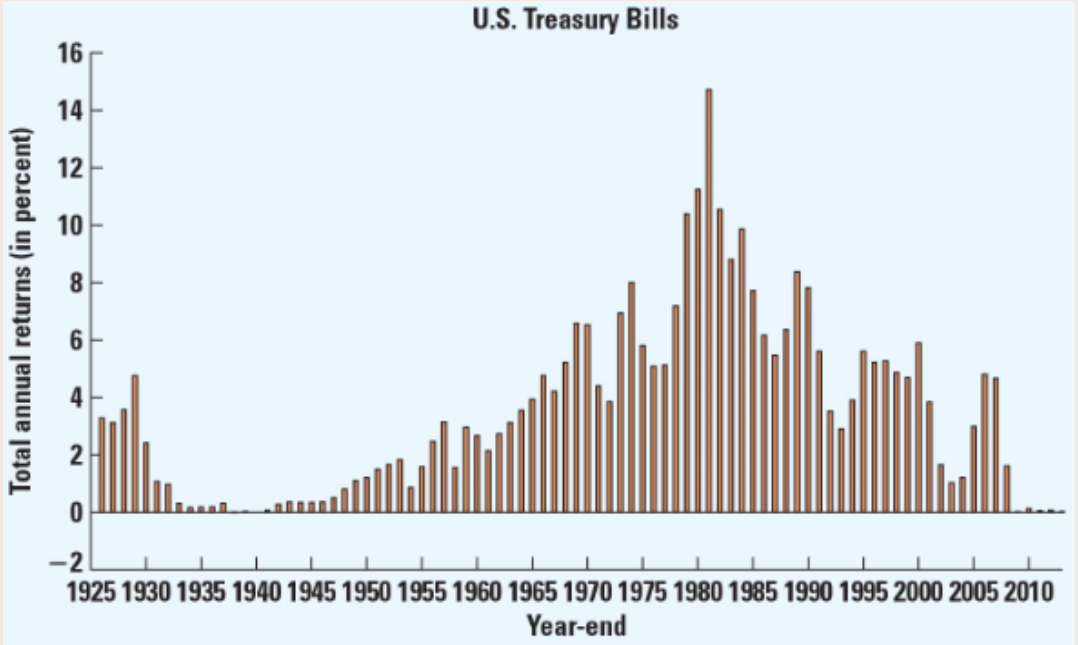
Why not just hold the small stocks?

Why would anyone hold T-bills?

Do all investors buy these investments and hold for 90+ years?

Historical Returns- Small Stocks vs. T-Bills





Historical Returns- Various Investments

Year	Large-Company Stocks	Long-Term Government Bonds	U.S. Treasury Bills	Consumer Price Index
2000	−9.10	17.22	5.98	3.39
2001	−11.89	5.51	3.33	1.55
2002	−22.10	15.15	1.61	2.38
2003	28.89	2.01	.94	1.88
2004	10.88	8.12	1.14	3.26
2005	4.91	6.89	2.79	3.42
2006	15.79	.28	4.97	2.54
2007	5.49	10.85	4.52	4.08
2008	−37.00	41.78	1.24	.09
2009	26.46	−25.61	.15	2.72
2010	15.06	7.73	.14	1.50
2011	2.11	35.75	.06	2.96
2012	16.00	1.80	.08	1.74
2013	32.39	−14.69	.05	1.50

To Summarize

Riskier assets tend to provide higher returns. Risky small stocks have had annual returns as good as 143% and as bad as -53%. Safe T-bills have never had a negative return, but have never returned more than 15%.

Average Returns: The First Lesson

Average Returns by Investment Type

Investment	Average Return
Large-company stocks	12.1%
Small-company stocks	16.9
Long-term corporate bonds	6.3
Long-term government bonds	5.9
U.S. Treasury bills	3.5
Inflation	3.0

Risk Premium

The Risk Premium is the *excess return* required from an investment in a risky asset over that required from a risk-free investment. It's found by subtracting the risk free rate from the average return.

Investment	Average Return	Risk Premium
Large-company stocks	12.1%	8.6%
Small-company stocks	16.9	13.4
Long-term corporate bonds	6.3	2.8
Long-term government bonds	5.9	2.4
U.S. Treasury bills	3.5	.0

The First Lesson

Risky assets, on average, earn a Risk Premium

Investment	Average Return	Risk Premium
Large-company stocks	12.1%	8.6%
Small-company stocks	16.9	13.4
Long-term corporate bonds	6.3	2.8
Long-term government bonds	5.9	2.4
U.S. Treasury bills	3.5	.0

Variability of Returns: The Second Lesson

Variability of Returns

In order to determine a level of risk, we need to understand the spread of an asset's returns overtime. This is known as the Variability of Returns.

We use the Variance and Standard Deviation of returns as measures of Volatility, or risk.

VARIANCE

The VARIANCE is the average squared difference between the actual return and the average return. A higher variance indicates that returns are more spread out from the mean.

$$Var(R) = \sigma^2 = \frac{1}{T-1}[(R_1 - \bar{R})^2 + ... + (R_T - \bar{R})^2]$$

R is the return of an asset.

R-bar is the average return of the asset.

T represents the number of returns.

Variance Example: Kroger

Suppose Kroger stock has returned the following over the past 4 years: 10%, 12%, 3%, -9%. What is the VARIANCE of returns over this time period?

Variance Example: Kroger

Returns: 10%, 12%, 3%, -9%.

$$Var(R) = \sigma^2 = \frac{1}{T-1}[(R_1 - \bar{R})^2 + ... + (R_T - \bar{R})^2]$$

(1) Calculate the average (R-bar) first

$$(0.10 + 0.12 + 0.03 + (-0.09)) / 4 = 0.04 = 4\%$$

Variance Example: Kroger

$$Var(R) = \sigma^2 = \frac{1}{T-1}[(R_1 - \bar{R})^2 + ... + (R_T - \bar{R})^2]$$

(2) Find the difference (or *deviation*) between each return and the average:

(1) Actual Return	(2) Average Return	(3) Deviation 1 - 2
0.10	0.04	0.06
0.12	0.04	0.08
0.03	0.04	-0.01
-0.09	0.04	-0.13
Total: 0.16		0.00

Variance Example: Kroger

$$Var(R) = \sigma^2 = \frac{1}{T-1}[(R_1 - \bar{R})^2 + ... + (R_T - \bar{R})^2]$$

(3) Obtain the sum of the squared deviations (note that the sum is *always* 0):

(1) Actual Return	(2) Average Return	(3) Deviation 1 - 2	(4) Squared Deviation
0.10	0.04	0.06	0.0036
0.12	0.04	0.08	0.0064
0.03	0.04	-0.01	0.0001
-0.09	0.04	-0.13	0.0169
Total: 0.16		0.00	0.0270

Variance Example: Kroger

$$Var(R) = \sigma^2 = \frac{1}{T-1}[(R_1 - \bar{R})^2 + ... + (R_T - \bar{R})^2]$$

(4) Divide the sum of the squared deviations by T-1:

$$\text{VAR(R)} = \sigma^2 = 0.0270 / (4 - 1) = 0.009$$

Variance Example: Kroger

Thus, the variance is 0.009.

The unit is “squared” percentages, which is difficult to interpret, so we generally use the Standard Deviation to measure volatility of returns.

Standard Deviation

The Standard Deviation is the positive square root of the variance.

$$SD(R) = \sigma = \sqrt{\sigma^2} = \sqrt{Var(R)}$$

The units are in percent.

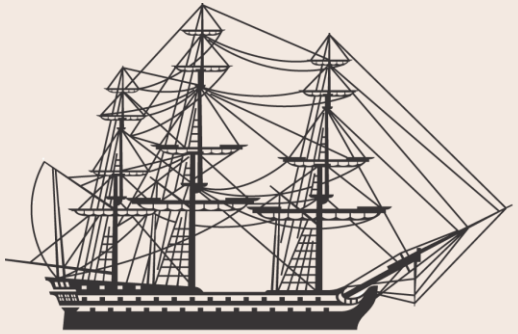
Standard Deviation Example: Kroger

$$SD(R) = \sigma = \sqrt{\sigma^2} = \sqrt{Var(R)}$$

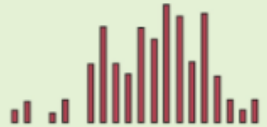
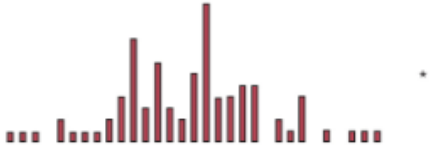
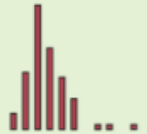
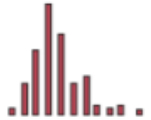
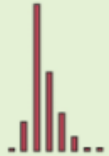
The standard deviation of the Kroger returns is the square root of 0.009, which is $0.09486833 = 9.49\%$.

Real-World Example: VFINX

We can obtain the standard deviation of returns for the Vanguard VFINX S&P 500 Index Fund on Morningstar's website here.



Vanguard®

Series	Average Return	Standard Deviation	Frequency Distribution
Large-company stocks	12.1%	20.2%	
Small-company stocks	16.9	32.3	
Long-term corporate bonds	6.3	8.4	
Long-term government bonds	5.9	9.8	
Intermediate-term government bonds	5.4	5.7	
U.S. Treasury bills	3.5	3.1	
Inflation	3.0	4.1	

The Second Lesson

The greater the risk, the greater the potential reward.

Risk Premium and the Required Return

Now that we understand some of the risks and rewards of investing in financial markets, we can think about what return we should require on certain investments.

An estimate of the return we should require would be the risk free rate plus the historical risk premium, using the U.S. T-bills as the risk free rate.

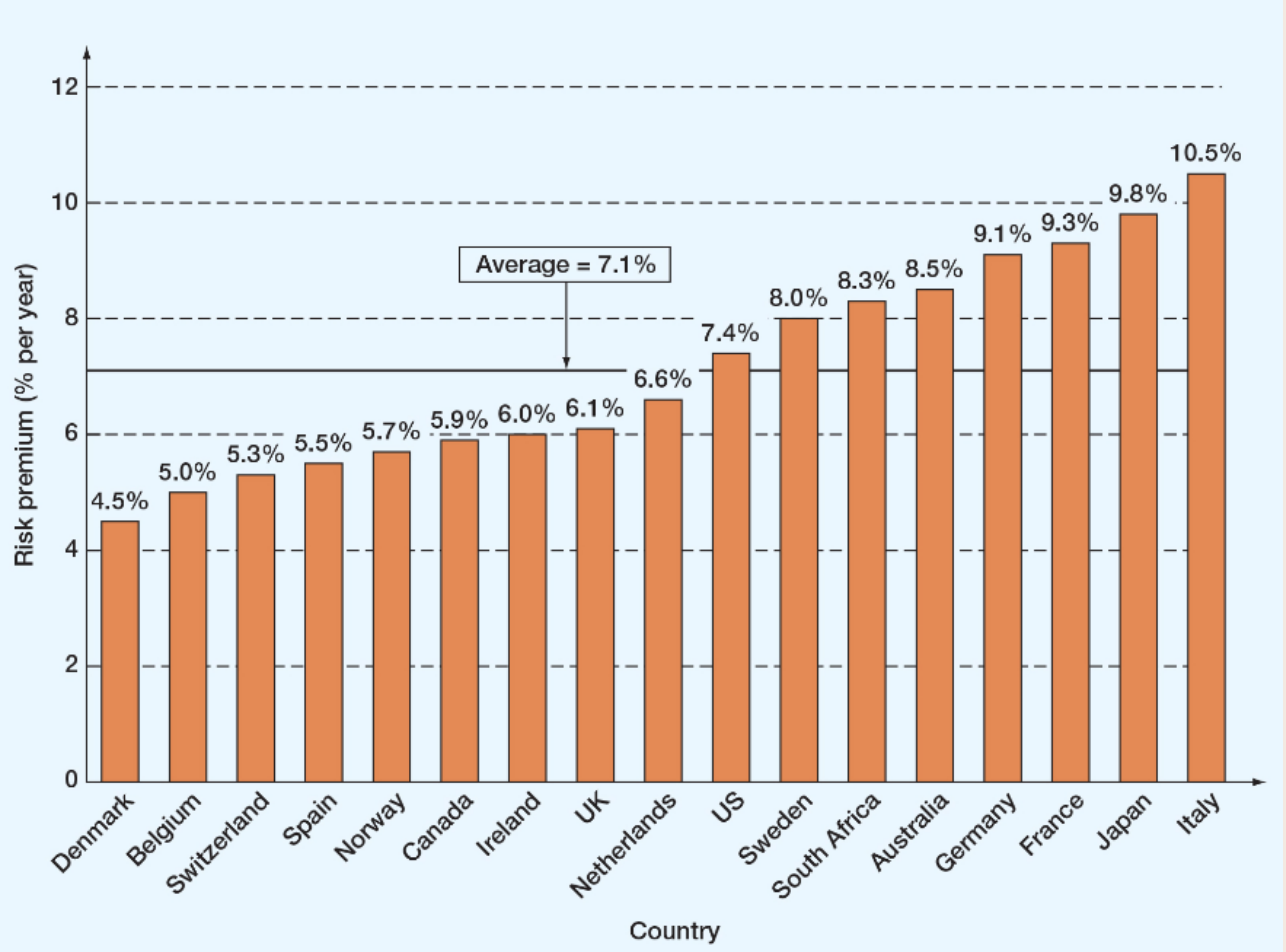
Real World Example: Risk Premium & Required Return

You have a portfolio of small company stocks. What would be a reasonable required return given a current T-Bill yield of 1.80% (as of 6/25/2018)?

Investment	Average Return	Risk Premium
Large-company stocks	12.1%	8.6%
Small-company stocks	16.9	13.4
Long-term corporate bonds	6.3	2.8
Long-term government bonds	5.9	2.4
U.S. Treasury bills	3.5	.0

Required Return = 13.4% + 1.80% = 15.2%

The Stock Market Risk Premium (1900-2005)



To Summarize: The Lessons from Capital Market History

(1) Risky assets, on average, earn a risk premium.

(2) The greater the risk, the greater the potential reward.

Arithmetic and Geometric Averages

Arithmetic Averages

Thus far, we've looked at simple Arithmetic Averages. But consider the following example:

You buy a $100 share which falls to $50 in the first year. This is a negative 50% return. In the second year, it rises back to $100. This is a positive 100% return ($50 doubling to $100). What is your average return?

(100% + -50%) / 2 = 25%.

Arithmetic Averages

Your average return on this investment over two years is 25% even though your stock is worth the same as before!

Geometric Averages

We can also compute the Geometric Average.

$$Geometric\ Average\ Return = [(1 + R_1) \times (1 + R_2) \times ... \times (1 + R_T)]^{1/T} - 1$$

Revisiting the example:

$(1+(-0.50)) \times (1+1.00))^{(1/2)}-1 = (1)^{(1/2)}-1 = 0$

Geometric Average: Example

Find the Geometric Average for these 5 annual returns of the S&P 500:

13.75%, 35.70%, 45.08%, -8.80%, and -25.13%

$$Geometric\ Average\ Return = [(1 + R_1) \times (1 + R_2) \times ... \times (1 + R_T)]^{1/T} - 1$$

Returns	Product
13.75	1.1375
35.70	x 1.3570
45.08	x 1.4508
-8.80	x 0.9120
-25.13	x 0.7487
	1.5291

$$\Rightarrow 1.5291^{(1/5)} - 1$$
$$= 0.0887$$
$$= 8.87\%$$

Arithmetic vs. Geometric Average Return

The geometric average tells you what you *actually earned* per time period on average, *including compounding effects*. The arithmetic mean tells you what you earned in a typical time period.

	Average Return	
Series	**Geometric**	**Arithmetic**
Large-company stocks	10.1%	12.1%
Small-company stocks	12.3	16.9
Long-term corporate bonds	6.0	6.3
Long-term government bonds	5.5	5.9
Intermediate-term government bonds	5.3	5.4
U.S. Treasury bills	3.5	3.5
Inflation	3.0	3.0

Unless otherwise stated, "average" means "arithmetic average."

To Summarize

The arithmetic average of returns presents what you earn in a typical year while the geometric average presents what you actually earned per year, on average, including compounding.

Capital Market Efficiency

Fluctuation of Market Values

Why do stock and bond prices fluctuate?

Prices change, in part, because new information arrives and investors reassess asset values based on that information.

Efficient Markets

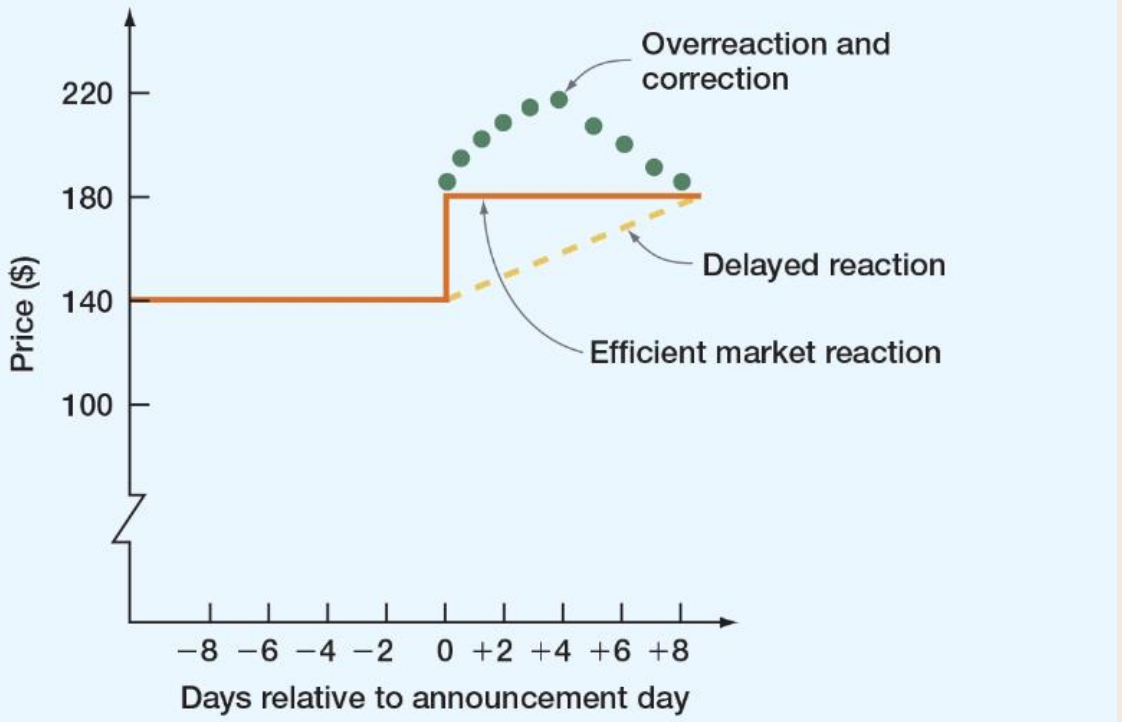
An Efficient Capital Market is a market in which security prices reflect available information.

The Efficient Market Hypothesis states that *actual* capital markets are efficient.

Efficient Markets Example

AstraZeneca has, through years of secret R&D, developed a cure for cancer. They predict this is a highly positive NPV project. They will make an announcement about this discovery on day 0. Today, on day -1, the stock price only reflects what is *publicly* known about AstraZeneca's future projects. Tomorrow, when the announcement is made, the stock price will shoot up and quickly settle as investors buy and sell shares to adjust to the news.

Efficient Markets Example



Efficient market reaction: The price instantaneously adjusts to and fully reflects new information; there is no tendency for subsequent increases and decreases to occur.
Delayed reaction: The price partially adjusts to the new information; eight days elapse before the price completely reflects the new information.
Overreaction: The price overadjusts to the new information; it overshoots the new price and subsequently corrects.

Efficient Markets Consequences

If asset prices fully reflect available information, you cannot make money by trading based on past information (earnings, ROA, past stock returns). And making money on just-released news is difficult as the prices quickly adjust.

Some disagree… and how efficient markets are is a matter of debate.

To Summarize

In efficient markets, prices adjust quickly and correctly to new information.

Takeaways

Takeaways

1. We learn two important lessons from capital market history: risky assets on average earn a risk premium, and the greater the risk, the greater the potential reward.
2. The standard deviation gives us a measure of risk by looking at the variability of returns.
3. The arithmetic average presents the returns you'd achieve in a typical period while the geometric average presents the returns you'd actually achieve on average over a period.
4. Efficient markets suggest that asset prices in the market reflect all publicly available information.

End.

Return, Risk, and the Security Market Line

Chapter 13

Outline

1. Expected Returns and Variances
2. Portfolios
3. Risk, Diversification, and Portfolio Risk
4. Beta and the Security Market Line

Expected Returns and Variances

Expected Return

The Expected Return is the return a risky asset is expected to yield in the future.

While we estimated average returns and variances using historical data in the previous chapter, we now do so based on projections of the future.

Risk & Return Example

To illustrate this concept, assume we hold two stocks for one year.

- Stock L is expected to be down 20% during a recession and up 70% during a boom
- Stock U is expected to be up 30% during a recession and up 10% during a boom

Let's find the variance and standard deviation for each stock.

Risk & Return Example

Assume there's a 50% chance that either a recession or boom occurs next year.

State of Economy	Probability of State	Rate of Return L	Rate of Return U
Recession	0.5	-20%	30%
Boom	0.5	70%	10%
	1.00		

$$E(R_L) = -0.2(0.5) + 0.7(0.5) = 0.25 = 25\%$$

$$E(R_U) = 0.3(0.5) + 0.1(0.5) = 0.20 = 20\%$$

Risk & Return Example

We can find the variance and standard deviation as well. Note here, instead of dividing by (T-1), we multiply by the probabilities:

State of Economy	Probability of State	Rate of Return L	Rate of Return U
Recession	0.5	-20%	30%
Boom	0.5	70%	10%
	1.00	E(R) = 25%	E(R) = 20%

$$Var(R_L) = 0.5(-0.20-0.25)^2 + 0.5(0.7-0.25)^2 = 0.2025 \text{ and } SD = 45\%$$

$$Var(R_U) = 0.5(0.30-0.20)^2 + 0.5(0.10-0.20)^2 = 0.01 \text{ and } SD = 10\%$$

Risk & Return Example

Summarizing what we've found:

	Stock L	Stock U
E(R)	25%	20%
Var	0.2025	0.0100
SD	45%	10%

To Summarize

The expected return can be found by summing the probabilities multiplied by returns across states. The variance is found by summing the probabilities multiplied by the squared deviations across states.

Now that we can do this for individual assets, we can think about *portfolios*.

Portfolios

Portfolio of Assets

We've calculated the return and risk for single assets in the previous section, but investors rarely hold just one asset.

We can use similar methods for a Portfolio, or a collection of assets, to see how an investor's investments do overall.

Portfolio Example

Find the portfolio expected return, variance, and standard deviation given the following information, assuming you hold each share in equal proportions.

State of Economy	Probability of State	IBM	Microsoft	Apple
Boom	0.4	10%	15%	20%
Bust	0.6	8%	4%	0%
	1.00			

Portfolio Example: E(R)

State of Economy	Probability of State	IBM	Microsoft	Apple
Boom	0.4	10%	15%	20%
Bust	0.6	8%	4%	0%

$$E(R)_{IBM} = 0.4(0.10) + 0.6(0.08) = 8.8\%$$
$$E(R)_{Microsoft} = 0.4(0.15) + 0.6(0.04) = 8.4\%$$
$$E(R)_{Apple} = 0.4(0.2) + 0.6(0.0) = 8.0\%$$

$$E(R)_{Portfolio} = (1/3)(8.8\%) + (1/3)(8.4\%) + (1/3)(8.0\%) = 8.4\%$$

Portfolio Example: Variance & Standard Deviation

State of Economy	Probability of State	IBM	Microsoft	Apple
Boom	0.4	10%	15%	20%
Bust	0.6	8%	4%	0%

$$E(R)_{Boom} = (1/3)(10\%) + (1/3)(15\%) + (1/3)(20\%) = 15\%$$
$$E(R)_{Bust} = (1/3)(8\%) + (1/3)(4\%) + (1/3)(0\%) = 4\%$$

$$VAR_{Portfolio} = 0.4(15\% - 8.4\%)^2 + 0.6(4\% - 8.4\%)^2 = 0.002904$$
$$SD_{Portfolio} = \sqrt{0.002904} = 5.39\%$$

Portfolio Example: Summary

We've found the following:

$$E(R)_{Portfolio} = 8.4\%$$

$$VAR_{Portfolio} = 0.002904$$

$$SD_{Portfolio} = 5.39\%$$

To Summarize

We can find the expected return of a portfolio by considering the assets' weighting and return in each state. To find the variance and standard deviation, we use the expected return and returns in each state of the entire portfolio.

We can now learn about the benefits of *diversification*.

Risk and Diversification

Returns

Returns consist of an expected and unexpected portion. Let's consider an example.

Expected and Unexpected Returns: Generic Co.

What will determine the price of Generic Co.'s shares in one year? The *expected* portion is what investors generally believe based on their own forecasts or the company's forecasts. The *unexpected* portion is due to surprises in the news that has an affect on Generic Co.'s future viability, cash flows, and value.

$$Total\ Return = R = E(R) + U$$

Unexpected Return

The unexpected portion of the return is the true risk of the investment. If we receive *exactly* what we expect, then the asset is risk-free.

Furthermore, there are two components to this "surprise" component of the return: systematic and unsystematic risk.

(1) Systematic Risk

Systematic Risk affects many assets. These are surprises that influence the market overall.

Example: A news report that GDP is unexpectedly falling and unemployment is unexpectedly rising hurts Generic Co. and just about all other companies nation-wide.

(2) Unsystematic Risk

Unsystematic Risk affects, at most, a small number of assets. These surprises are sometimes called *unique* or *firm-specific* risk.

Example: Assume Generic Co. is an oil refinery company and they unexpectedly strike a massive oil reserve on their land. This wouldn't necessarily echo across the country, but would be quite good for Generic Co.

Systematic and Unsystematic Returns

We can now rewrite the surprise component of returns:

$$R = E(R) + U$$
$$R = E(R) + Systematic\ Portion + Unsystematic\ Portion$$
$$R = E(R) + m + \epsilon$$

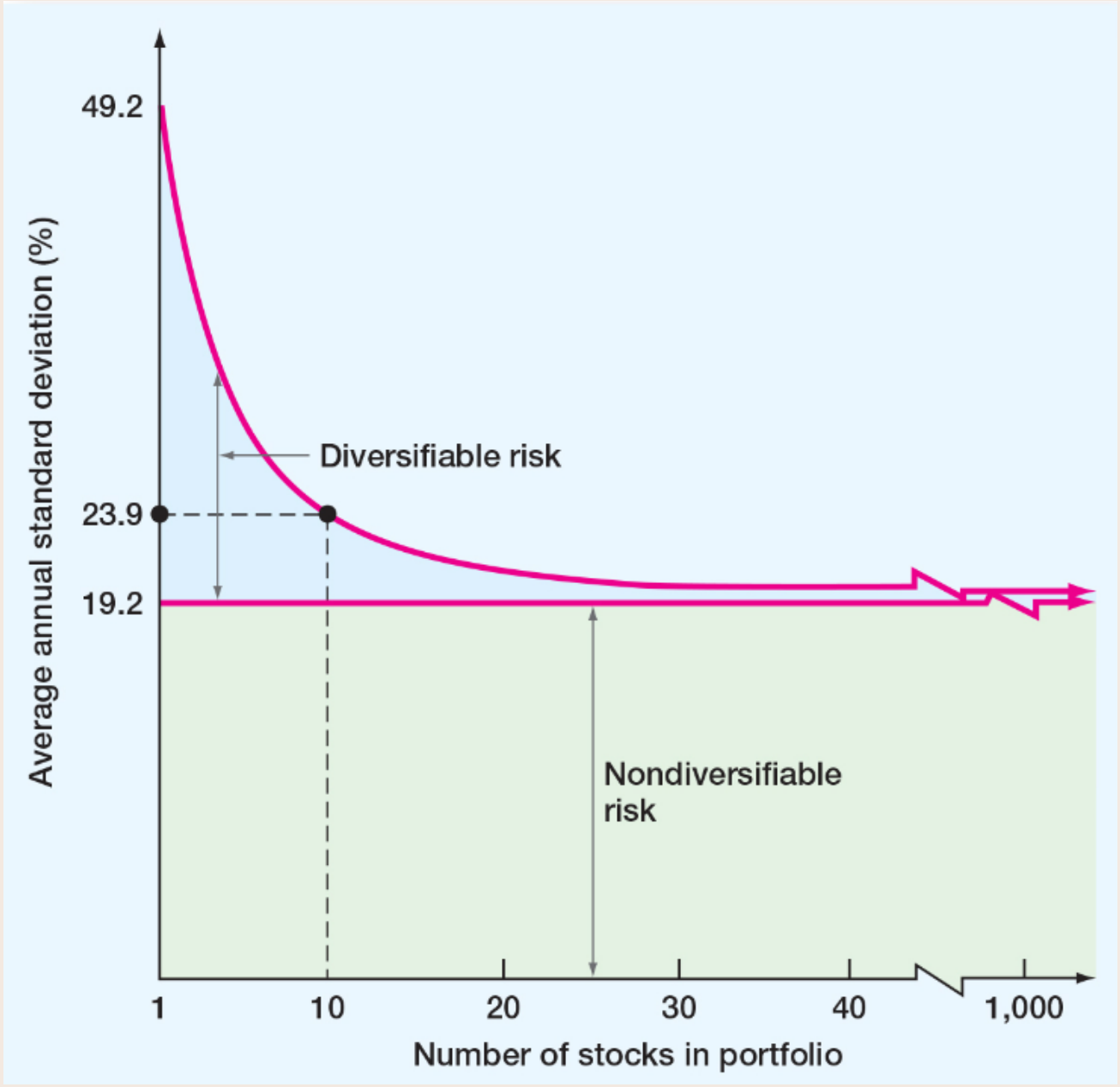
Now that we understand risk, what can we do to reduce it?

Diversification

Diversification involves spreading an investment across a number of assets. Doing so will eliminate some, but not all, risk.

Specifically, diversification helps to eliminate the unsystematic portion of risk.

(1) Number of Stocks in Portfolio	(2) Average Standard Deviation of Annual Portfolio Returns	(3) Ratio of Portfolio Standard Deviation to Standard Deviation of a Single Stock
1	49.24%	1.00
2	37.36	.76
4	29.69	.60
6	26.64	.54
8	24.98	.51
10	23.93	.49
20	21.68	.44
30	20.87	.42
40	20.46	.42
50	20.20	.41
100	19.69	.40
200	19.42	.39
300	19.34	.39
400	19.29	.39
500	19.27	.39
1,000	19.21	.39


49.2
23.9
19.2
Average annual standard deviation (%)
Diversifiable risk
Nondiversifiable risk
1
10
20
30
40
1,000
Number of stocks in portfolio

Diversification

Holding a portfolio of many assets effectively cancels out any firm specific risk.

Unsystematic risk is essentially eliminated by diversification, so a portfolio with many assets has almost no unsystematic risk.

To Summarize

The return of an asset has a systematic and unsystematic (or firm specific) portion. Diversification practically eliminates firm specific risk.

We now move on to quantifying risk with the understanding that firm specific risk can be eliminated.

Beta

Systematic Risk

The Systematic Risk Principle is the idea that the expected return on a risky asset depends only on that asset's systematic risk.

This is because unsystematic risk can be eliminated by diversifying. The market doesn't reward risks that are borne unnecessarily.

Beta

The Beta Coefficient measures the amount of systematic risk present in a particular asset relative to that in an average risky asset.

The average asset has a beta of 1.

Apple

Netflix

Disney

Coca-Cola

Portfolio Beta Example

What is the expected return and beta of this portfolio?

Security	Amount Invested	Expected Return	Beta
Stock A	$1,000	8%	0.8
Stock B	$2,000	12%	0.95
Stock C	$3,000	15%	1.10
Stock D	$4,000	18%	1.40

Portfolio Beta Example

Security	Amount Invested	Expected Return	Beta
Stock A	$1,000	8%	0.8
Stock B	$2,000	12%	0.95
Stock C	$3,000	15%	1.10
Stock D	$4,000	18%	1.40

We see that we stocks A, B, C, and D are 10%, 20%, 30%, and 40% of the portfolio.

$$E(R)_{Portfolio} = 0.1(8\%) + 0.2(12\%) + 0.3(15\%) + 0.4(18\%) = 14.9\%$$

$$E(\beta)_{Portfolio} = 0.1(0.8) + 0.2(0.95) + 0.3(1.10) + 0.4(1.40) = 1.16$$

This portfolio has greater systematic risk than the average asset.

To Summarize

The beta coefficient measures the amount of systematic risk a security or portfolio possesses.

With this understanding, we can now think about how risk is rewarded in the market place.

The Security Market Line

Beta and the Risk Premium Example

Assume you hold some risky asset, Asset A, with an expected return of 20% and beta of 1.6. You create a portfolio with 75% of your holdings in Asset A, and 25% in some risk free asset (say, T-bills) that returns 8%. Find the expected return and beta of this portfolio.

Beta and the Risk Premium Example

$E(R)_{Portfolio} = 0.25(0.2) + 0.75(0.08) = 11\%$

$\beta_{Portfolio} = 0.25(1.6) + 0.75(0) = 0.40$

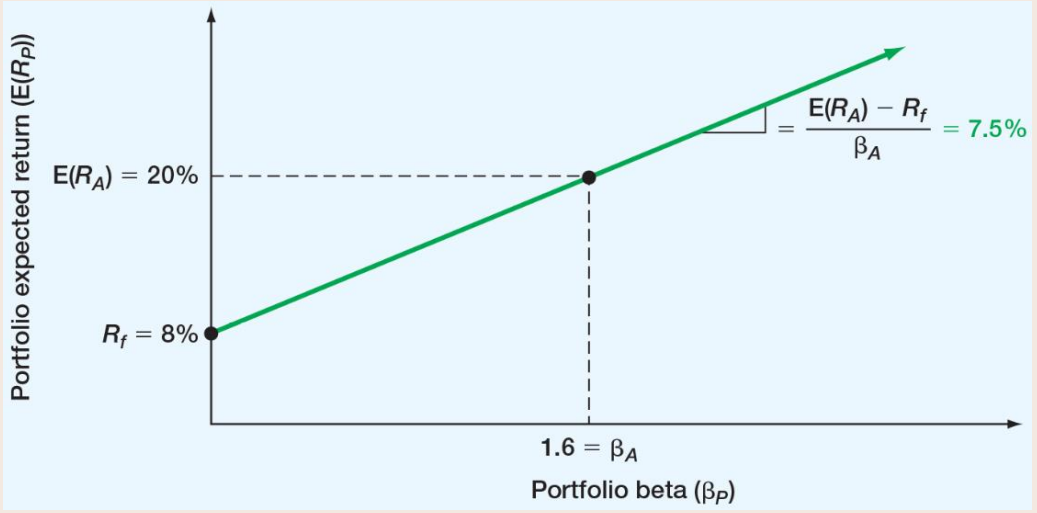
We can compute the expected return and beta for the portfolio at different weightings of Asset A and the Risk Free asset:

50% in A, 50% in Risk Free: $E(R)_{Portfolio} = 14\%$ and $\beta_{Portfolio} = 0.8$

75% in A, 25% in Risk Free: $E(R)_{Portfolio} = 17\%$ and $\beta_{Portfolio} = 1.2$

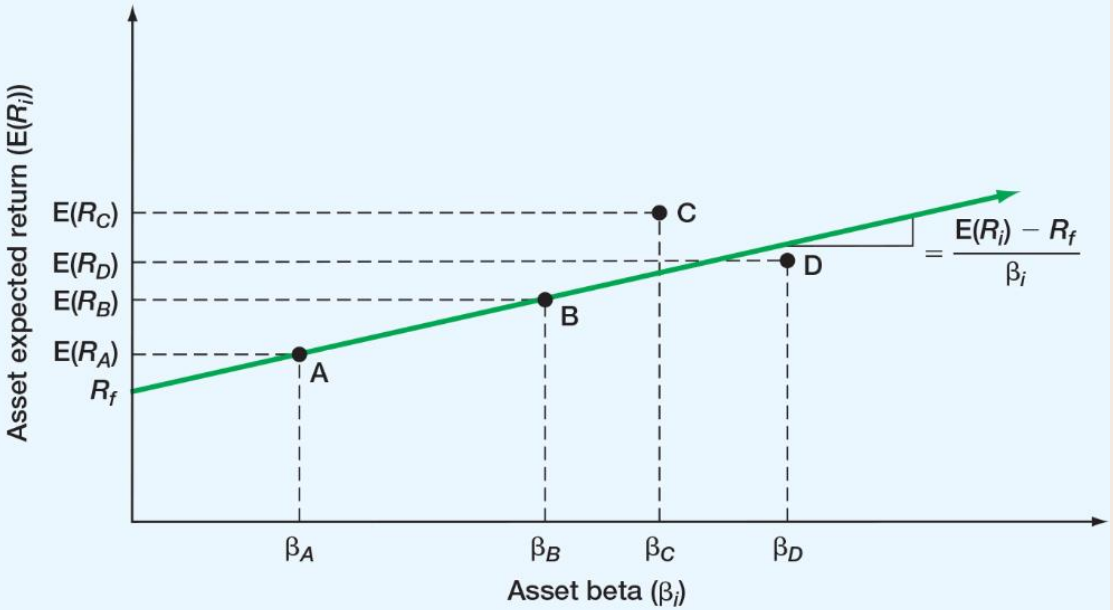
Beta and the Risk Premium Example

Let's plot all these different combinations on a plot with the y-axis the portfolio expected returns and the x-axis the portfolio betas. The slope is the "rise over run" also known as the Reward to Risk Ratio.



Beta and the Risk Premium Example

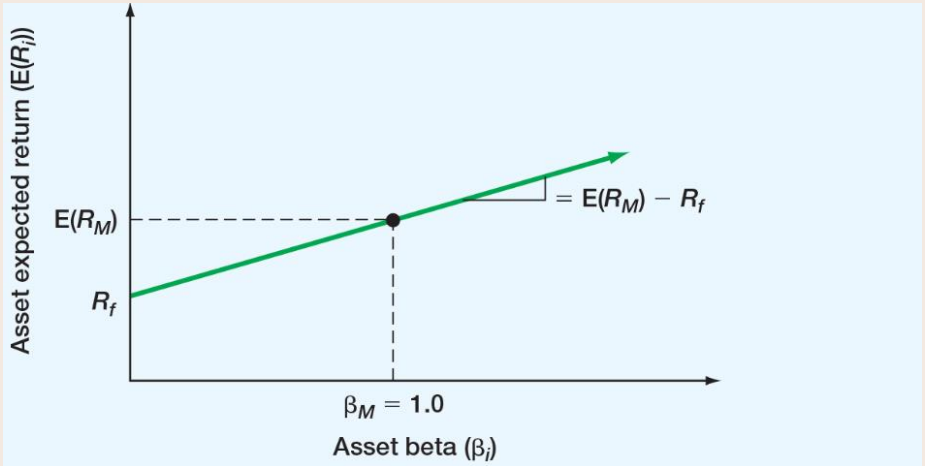
We can include any number of assets on this line. **All reward-to-risk ratios must be the same for all assets**, otherwise investors would "buy up" undervalued assets until they were properly priced.



The fundamental relationship between beta and expected return is that all assets must have the same reward-to-risk ratio, $[E(R_i) - R_f]/\beta_i$. This means that they would all plot on the same straight line. Assets A and B are examples of this behavior. Asset C's expected return is too high; asset D's is too low.

The Security Market Line (SML)

The Security Market Line is the positively sloped straight line displaying this relationship between expected return and beta.



The slope of the security market line is equal to the market risk premium—that is, the reward for bearing an average amount of systematic risk. The equation describing the SML can be written:

$$E(R_i) = R_f + [E(R_M) - R_f] \times \beta_i$$

which is the capital asset pricing model (CAPM).

The Security Market Line (SML)

For the market portfolio, we know beta is equal to 1 because it must have the average systematic risk.

$$SML\ Slope = \frac{E(R_M) - R_f}{\beta_M} = \frac{E(R_M) - R_f}{1} = E(R_M) - R_f$$

The expected market return minus the risk free rate is the Market Risk Premium.

The Capital Asset Pricing Model

We know that all assets must plot on the SML, or their reward to risk ratio must be equal to the slope of the SML. Therefore we have:

$$\frac{E(R_i) - R_f}{\beta_i} = E(R_M) - R_f$$

Which rearranges to:

$$E(R_i) = R_f + \beta_i(E(R_M) - R_f)$$

The Capital Asset Pricing Model

$$E(R_i) = R_f + \beta_i(E(R_M) - R_f)$$

The CAPM shows that the expected return depends on

(1) Pure time value of money through the risk free rate

(2) The reward for bearing systematic risk (the market risk premium)

(3) The amount of systematic risk (β)

The Capital Asset Pricing Model: Example

$$E(R_i) = R_f + \beta_i(E(R_M) - R_f)$$

Assume the risk free rate is 4%, the market risk premium is 8.6%, and a particular stock has a beta of 1.3. What is the expected return on this stock?

$$E(R_i) = 0.04 + 1.3\,(0.086) = 15.18\%$$

To Summarize

The SML shows the relationship between expected return and beta. These concepts of risk and return will be used in the next chapter to determine the value of a company overall.

Takeaways

Takeaways

1. Investors are only rewarded for taking systematic, or non-diversifiable, risk.
2. Beta measures the amount of systematic risk in an asset relative to the average risky asset.
3. The SML displays the relationship between expected return and beta. All risky assets should lie on this line.
4. The CAPM comes from the understanding that the reward to risk ratio for all assets should equal the slope of the SML.
5. Understanding these relationships between risk and return will allow us to set suitable discount rates for valuing a company.

End.

The Cost of Capital

Chapter 14

Outline

1. The Cost of Capital
2. Cost of Equity
3. Cost of Debt
4. The Weighted Average Cost of Capital

The Cost of Capital

What We've Learned So Far

When valuing an investment, we *discount* the cash flows to the present by using a *discount rate*.

Similarly, when finding the NPV of a project, we *discount* the incremental and relevant cash flows to the present.

Required Returns

When we say the required return on an investment is 10%, we usually mean that the investment will have a positive NPV only if its returns exceed 10%.

The firm must return 10% on the investment to compensate investors for the use of the capital needed to finance the project.

10%, in this case, would be the Cost of Capital.

The Cost of Capital

The Cost of Capital is the minimum required return associated with a project.

The return an investor in a security receives is the cost of that security to the company that issued it. Therefore, the Cost of Capital to a firm is a required return to an investor.

The Cost of Equity and The Cost of Debt

A firm has both equity holders and debt holders, and each have a required return.

We will calculate the Weighted Average Cost of Capital (WACC) which includes both the Cost of Equity and the Cost of Debt.

The Cost of Equity (Debt) is the return that equity (debt) holders require on their investment in the firm.

The Cost of Equity

The Cost of Equity

The Cost of Equity is the required return to shareholders of a stock.

We can use either the Dividend Growth Model or the Capital Asset Pricing Model to find this required return, both of which we've seen before.

The Cost of Equity: Dividend Growth Model

Kramerica Industries paid a $4 dividend last year. The stock currently sells for $60 per share. The dividend is expected to grow steadily at 6% per year. What is the cost of equity?

$$R_E = \frac{D_1}{P_0} + g$$

$$R_E = \frac{\$4 \times (1.06)}{60} + 0.06 = 13.07\%$$

The Cost of Equity: CAPM

Kramerica Industries has a beta of 1.85. Last year, the S&P 500 returned 7.1%. The return on T-bills is 0.10%. What is the cost of equity?

$$R_E = R_f + \beta_E(R_M - R_f)$$

$$R_E = 0.001 + 1.85(0.071 - 0.001) = 13.05\%$$

To Summarize

To find the Cost of Equity, which is the return that equity holders require, we can use either the dividend growth model or the CAPM.

The Cost of Debt

The Cost of Debt

The Cost of Debt is the return that a firm's creditors require on new borrowing.

This is the yield to maturity.

The Cost of Debt

Kramerica Industries issued a 30 year, 7% (annual coupon) bond 8 years ago. Today, the bond sells for 96% of its face value, or $960. What is the cost of debt?

Find the YTM: N = 30, PMT = 70, FV = 1000, PV = -960

CPT I/Y = 7.33%

The Cost of Debt is 7.33%. This is *not* the coupon rate, because this is not a new debt issue.

To Summarize

The Cost of Debt is the yield to maturity or the cost of new borrowing

The Weighted Average Cost of Capital

Debt and Equity

The firm finances capital budgeting activities through debt and equity, the costs of which we've just found.

The value of the firm, therefore, is the *market* value of debt and the *market* value of the equity.

$$V = E + D$$

Capital Structure Weights

The Capital Structure Weights are the percentage of debt and equity that comprise the firm.

Example: If the total market value of the firm's equity is $200 million and the total market value of the firm's debt is $500 million, then
E/V= 200/(200+500)= 28.6% and D/V= 500/(200+500)=71.4%

The Weighted Average Cost of Capital

To determine the overall cost of capital, multiply the weights of debt and equity by their costs in the WACC formula:

$$WACC = \frac{E}{V}R_E + (1 - T_C)\frac{D}{V}R_D$$

Recall that interest payments are tax deductible. Multiply the return on debt by 1 minus the tax rate to arrive at our after-tax cost of debt.

WACC Example

Tech Enterprises has 1.4 million shares outstanding, and the stock sells for $20 per share. The firm's debt has a total face value of $5 million, is priced to yield 11%, and was recently quoted at 93% of par. The rate on T-Bills is 8%, the market risk premium is 7%, and the beta is 0.74. Assuming a corporate tax rate of 34%, what is the WACC?

WACC Example

Step 1: Cost of Equity

$$R_E = R_f + \beta_E(R_M - R_f)$$

$R_E = 0.08 + 0.74(0.07) = 13.18\%$

Step 2: Cost of Debt

From the problem, the debt is priced to yield 11%.

WACC Example

Step 3: Market Value of Equity

1.4 million shares x $20 = $28,000,000

Step 4: Market Value of Debt

0.93 x $5,000,000 = $4,650,000

WACC Example

Step 5: Capital Weights

$E/V = 28M / (28M + 4.65M) = 0.8576$

$D/V = 4.65M / (28M + 4.65M) = 0.1424$

WACC Example

Step 6: WACC

$$WACC = \frac{E}{V} R_E + (1 - T_C) \frac{D}{V} R_D$$

WACC = 0.8576(0.1318) + (1-0.34)(0.1424)(0.11) = 12.34%

The overall cost of capital is 12.34%

Using the WACC

Now that we know how to calculate the WACC, we can use it to find the present value of future cash flows .

Using the WACC: Example

A firm is considering a project that will result in initial after-tax cash savings of $5,000,000 at the end of the first year. These savings will grow at a rate of 5% per year. The firm is comprised of 2/3 Equity and 1/3 Debt, has a cost of equity of 29.2%, a cost of debt of 10%, and a tax rate of 34%. Assuming the project costs $15 million, should the firm accept?

Using the WACC: Example

WACC = (2/3) x 0.292 + (1/3) x 0.1 x (1-0.34) = 21.67%

Then, we plug in the WACC as our required return in the present value of a growing perpetuity formula:

$$P_0 = \frac{D_1}{R - g}$$

And $P_0 = 5 / (0.2167 - 0.05) = \$30$ million, accept.

To Summarize

The WACC provides the overall cost of capital for a firm, using the cost of equity, debt, their weights, and the tax rate. We can use the WACC to discount future cash flows.

Takeaways

Takeaways

1. The firm's cost of capital consists of the cost of equity and the cost of debt.
2. The cost of equity can be found using the dividend growth model or the CAPM.
3. The cost of debt is the YTM.
4. The WACC is the overall cost of equity considering the weights of equity and debt.
5. The WACC can be used when discounting future cash flows to value a capital budgeting activity.

End.