Corporate Financial Decisions

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For His Glory and Mission

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Outline

Nature, Scope and Origin

1. Economics is the study of choice under scarcity. Finance is a subset of applied Economics that studies asset allocation and valuation.
   - Two themes in Economics: Resource Allocation and Income Distribution
   - Two decision variables in Economics: Price and Quantity in exchange
   - Two most essential variables in Finance: Return and Risk (R&R)
2. Corporate Finance studies financial decisions facing corporations, including
   - Financing: capital/financial structure (quantity, duration, and mixture)
   - Investing: capital budgeting (planning and managing long-term assets)
   - Operating: working capital management (short-term assets and liabilities)
   - Dividend: cash payout, stock buyback, stock splits, and retained earnings
3. Modigliani, Franco and Merton H. Miller. 1958. The Cost of Capital, Corporate Finance, and the Theory of Investment. American Economic Review. June 48:4, pp. 261-97.

Analytical Frameworks

Corporate governance provides the institutional foundation for corporate management. In financial markets, corporations finance their decisions via debt and equity instruments. The costs of capital and capital valuation are the determining factors in all corporate financial decisions.

1. Corporate governance vs corporate management
2. Financial statements: accounting data and rules
3. Financial markets: institutions and instruments
4. Financial assets performance: returns and risks
5. Corporate valuation: philosophy and techniques
6. Economic theories and models: CAPM and M-M

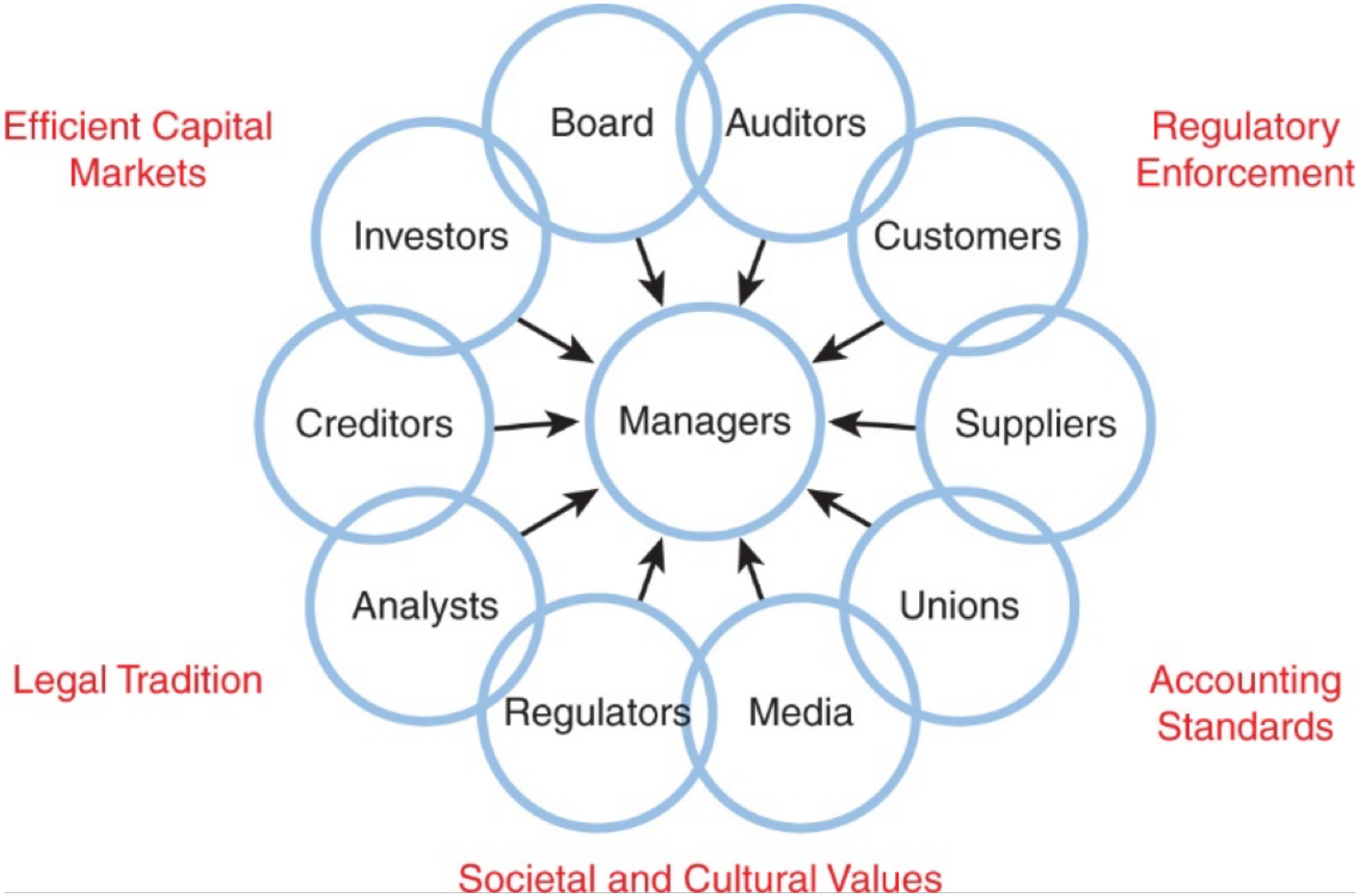
Capital value, costs of capital, and capital structure constitute the three pillars of corporate finance. Examinations on the relationships between the three give birth to the theory of corporate finance.

Corporate Governance

Corporate governance deals with the mechanisms for aligning the interests of managers with those of (controlling) shareholders while protecting the interests of stakeholders (minority shareholders, creditors, financial markets, employees, customers, supplier, and society at large). In short, good corporate governance prevents expropriation of outside investors.

1. Board of directors
2. CEO performance
3. Shareholder activism
4. Stakeholder activism
5. Financial reporting
6. External auditing
7. Corporate control
8. ESG initiatives

Corporate Governance System



Source: Larcker and Tayan (2021)

Corporation Organization Chart

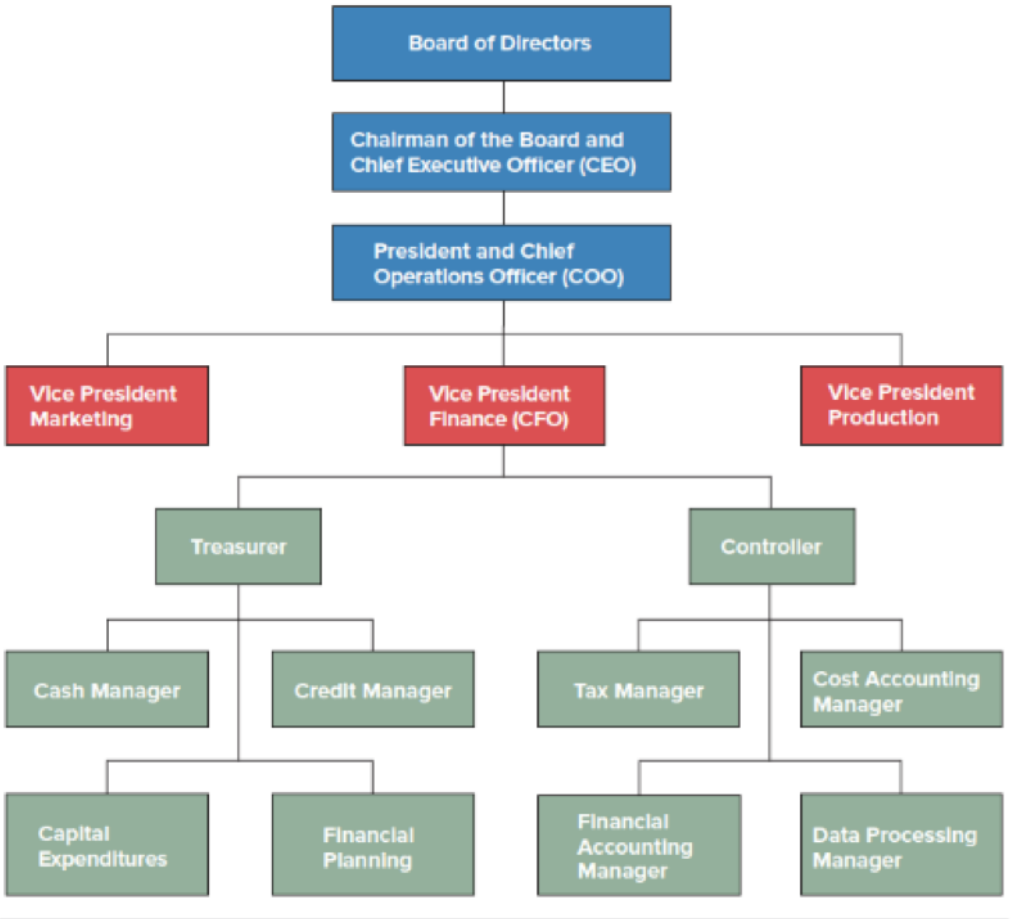


FIGURE 1.1

A simplified organizational chart

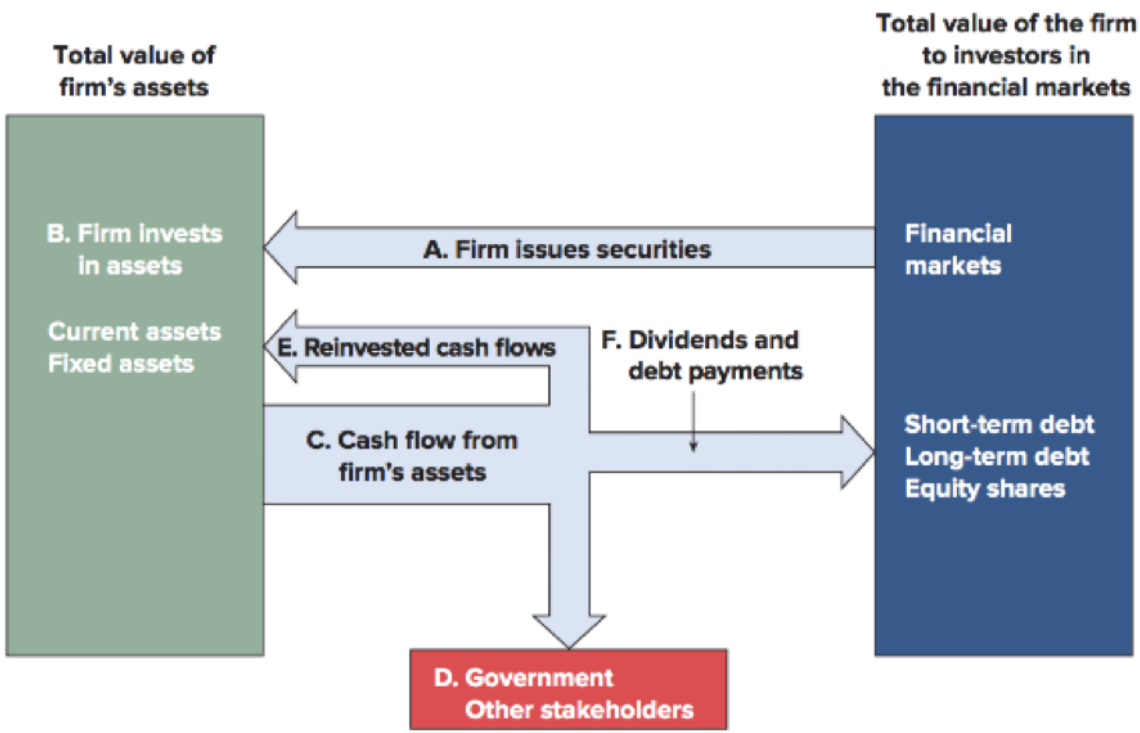
The exact titles and organization differ from company to company.

Source: Ross et. al. (2021).

Corporation in the Financial Markets

FIGURE 1.2

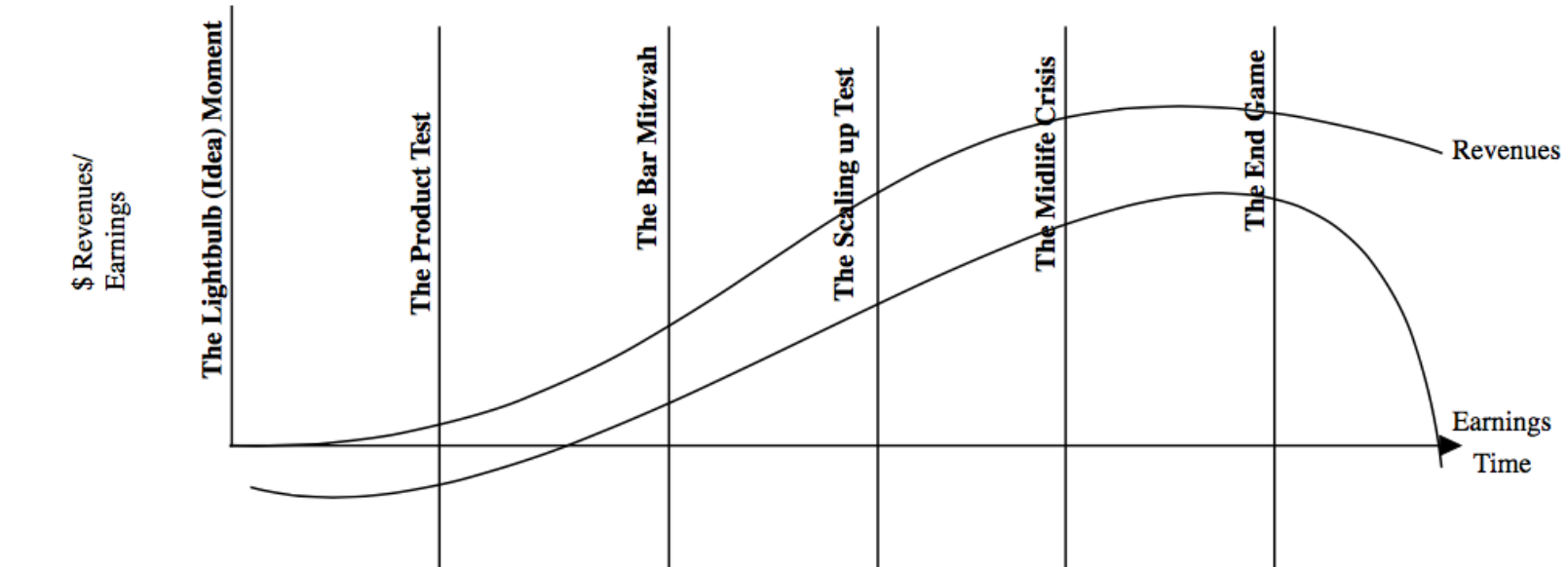
Cash flows between the firm and the financial markets



A. Firm issues securities to raise cash.
B. Firm invests in assets.
C. Firm's operations generate cash flow.
D. Cash is paid to government as taxes. Other stakeholders may receive cash.
E. Reinvested cash flows are plowed back into firm.
F. Cash is paid out to investors in the form of interest and dividends.

Source: Ross et. al. (2021).

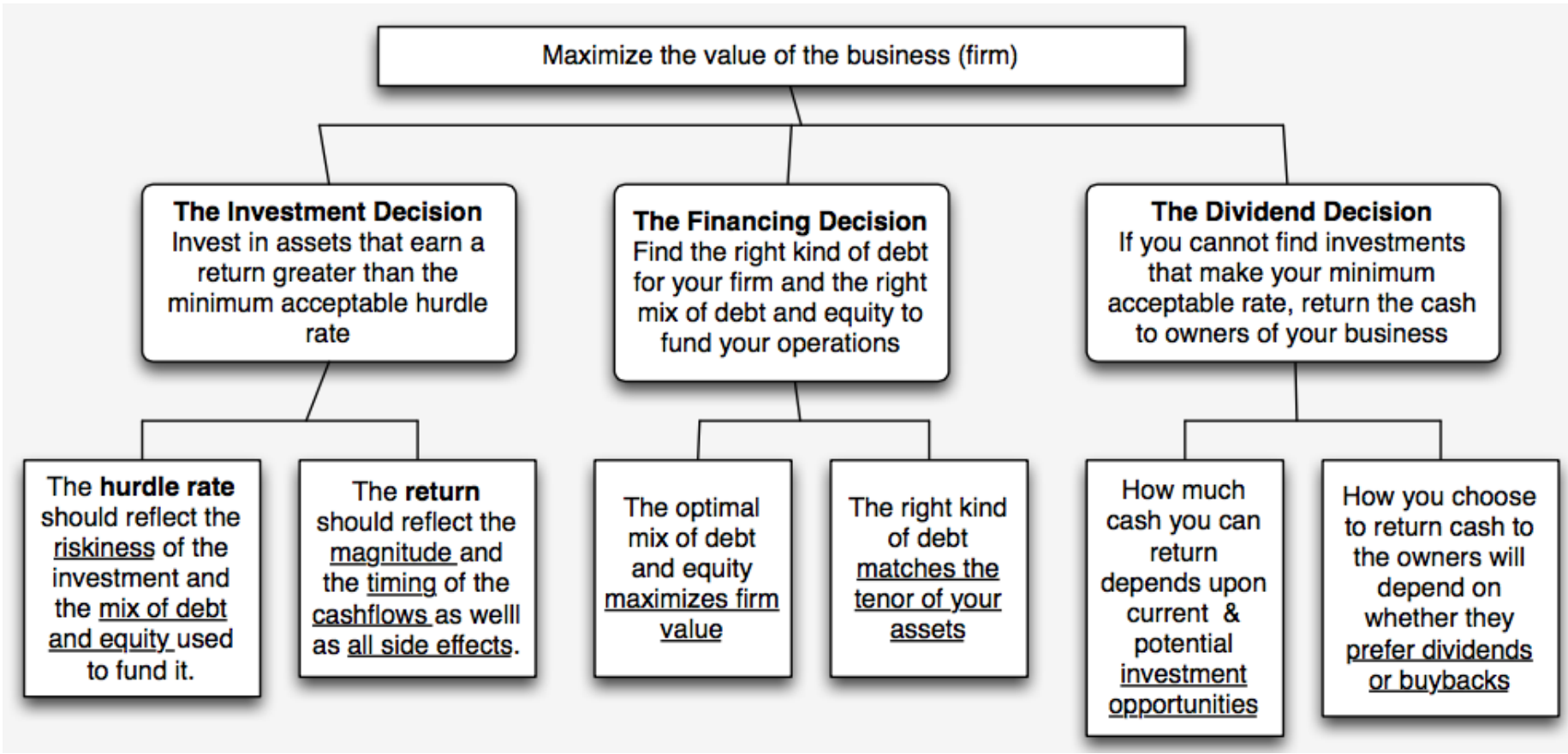
The Corporate Life Cycle



Growth stage	Stage 1 Start-up	Stage 2 Young Growth	Stage 3: High Growth	Stage 4 Mature Growth	Stage 5 Mature Stable	Stage 6 Decline
Description	Have an idea for a business that meets an unmet need in the market.	Create a business model that converts ideas into potential revenues & earnings	Build the business, converting potential into revenues.	Grow your business, shifting from losses to profits	Defend your business from new competitors & find new markets	Scale down your business as market shrinks.

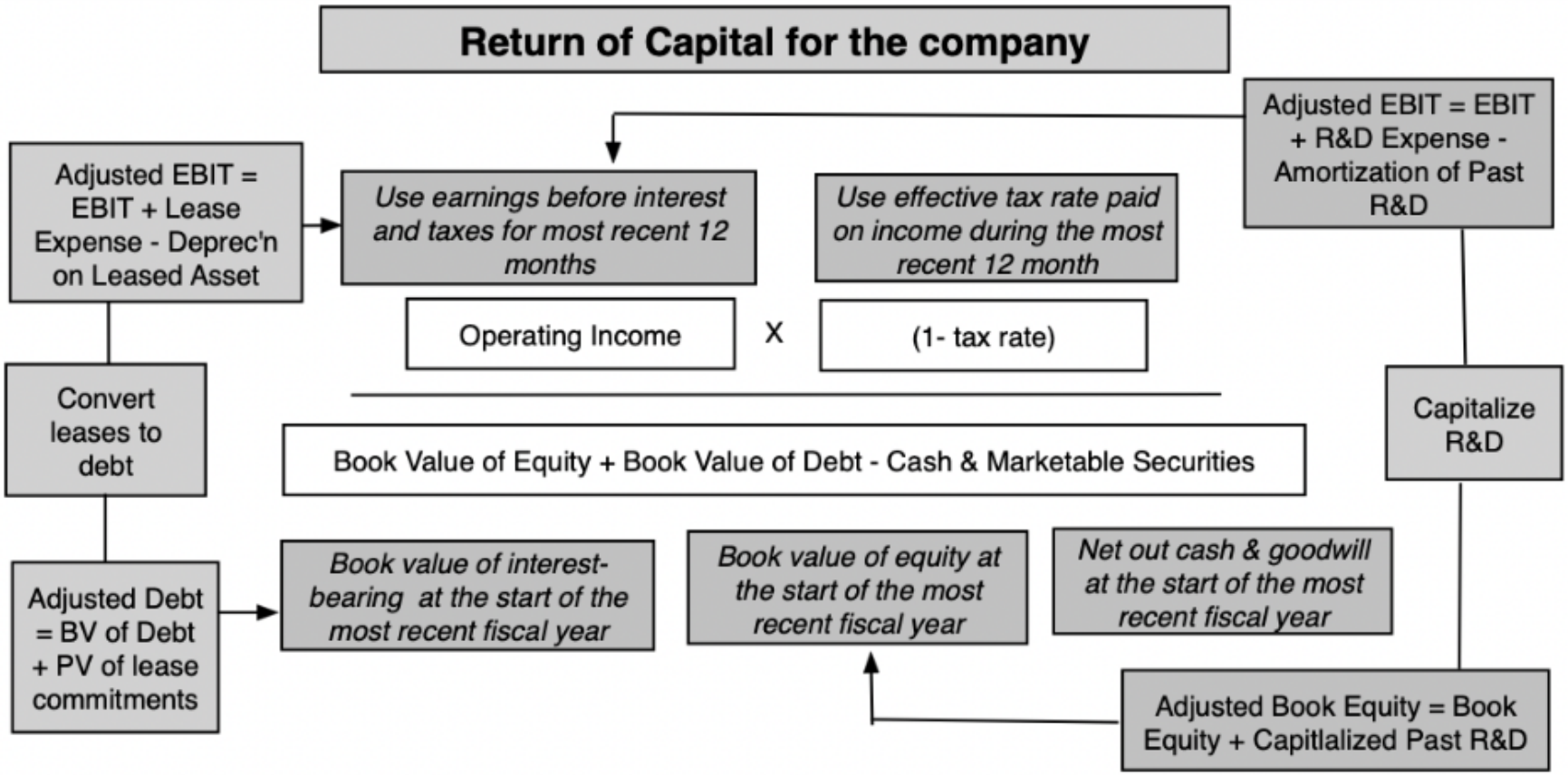
Source: Aswath Damodaran (2021).

Corporate Finance: Decision Rules



Source: Aswath Damodaran (2021).

Corporate Finance: Return of Capital



Source: Aswath Damodaran (2021).

Careers and Certifications

1. Financial Management
   - Accountants
   - Financial managers
2. Investment Banking
   - Securities underwriting
   - Merge and acquisition
3. Portfolio/Risk Management
4. Venture Capital/Private Equity
5. Budget/Credit/Financial Analyst
6. Consulting firms/business schools

Top Finance Certifications

1. Chartered Financial Analyst (CFA)
2. Certified Public Accountant (CPA)
3. Chartered Alternative Investment Analyst (CAIA)
4. Certified Financial Planner (CFP)
5. Financial Risk Manager (FRM)
6. Financial Modeling & Valuation Analyst (FMVA)

Finance Certifications and Exams (w)

	CFA	CPA	CAIA	CFP	FRM	FMVA
Number of Levels	3	1	2	2	2	1
Costs	$2,550 to $3,450	$1,000 to $3,000	$3,000	$2,000	$1,500	$497
Exam Pass Rate	30-50%	40-50%	70%	67%	40-50%	70%
Content Focus	Portfolio Management, Investments	Financial Reporting, Audit	Real Assets, Alternative Investments	Financial Planning	Financial Risk Management	Financial Modeling, Valuation
Career Application	All Encompassing	Accounting and Finance	Asset Management	Retail and Wealth Management	Risk Management	All Encompassing
Study Time (hrs)	300-350 per exam	Varies	200 per exam	Varies	200-300 per exam	120-200 total
Completion Time	3-5 years	2.5 - 5 years	1-2 years	4 years	<1 year	<1 year
Work Experience	4 years	1 year	1 year	3 years	2 years	None

Source: Corporate Finance Institute (2021).

Outline

Fundamentals of Accounting (w) (w)

ACCOUNTING is the procedure of data entry and recording, summarizing, analyzing, and then reporting the financial data.

Five Basic Accounting Principles

Revenue Recognition	Revenue to be recorded at transaction execution time.
Matching Principle	Assets to be recorded at its acquisition cost
Historical Cost	Income in current FY to be compared with CY Expense
Full Disclosure	Full disclosure of relevant info. should be made to users
Objectivity Principle	Information in books should be true, relevant & accurate.

Categories of Accounting

Assets	Tangible & Intangible items owned by entity
Liability	Amt. that entity owes to outsiders
Equity	Net Worth of Entity, Assets - Liabilities
Expense	Amt. paid for purchases made in biz.
Income	Amt. earned by entity from sale of goods

JOURNAL
Journal Entries consist of Debits & Credits, the totals of which should be equal

V/s

LEDGER
Journal are then transferred to appropriate Ledger Accounts.

FINANCIAL STATEMENTS
There are three main types of Fin. Stats.

- **Income and Expenditure Account** which shows profit or loss during the period.
- **Balance Sheet** denotes an entity's financial position at a particular point in time.
- **Statement of Cash Flow** shows inflow and outflow of cash & equivalent during period.

Double Entry System

- Each Accounting Entry will have two sides – Debit and Credit.
- The accounts used will be from any of above five categories.

Three Fields of Accounting

- **Financial Accounting** – This field is used for preparing the Financial Statements.
- **Managerial Accounting** – This field is useful to prepare reports for internal use
- **Cost Accounting** – It measure performance of production resources.

Types of Accounts

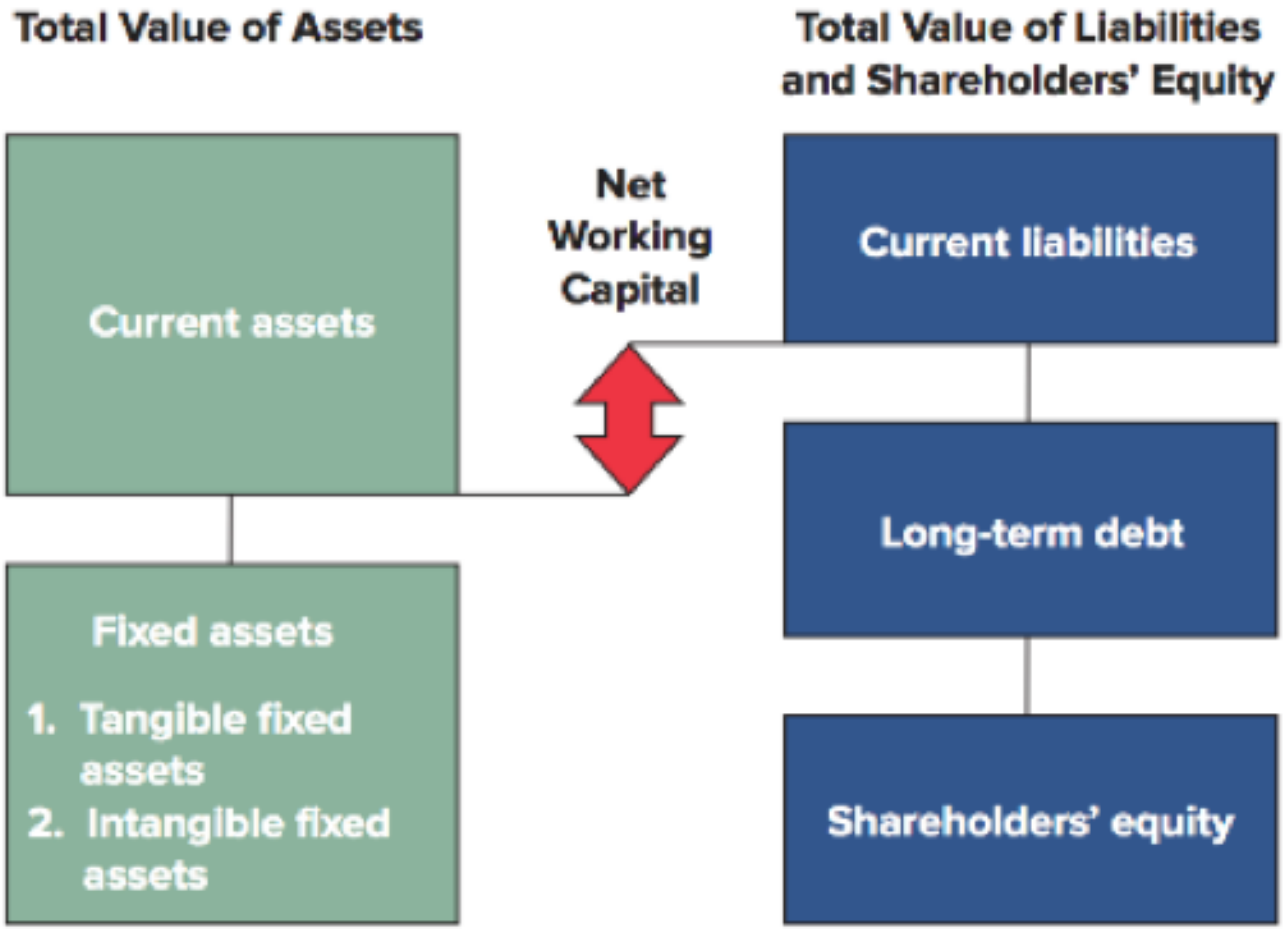
Real	Consists of tangible and intangible assets.
Personal	Accounts for individual, group, entity, bank etc.
Nominal	Accounts related to Gain, Loss, Expense & Income

Source: efinancemanagement.com

GAAP vs IFRS

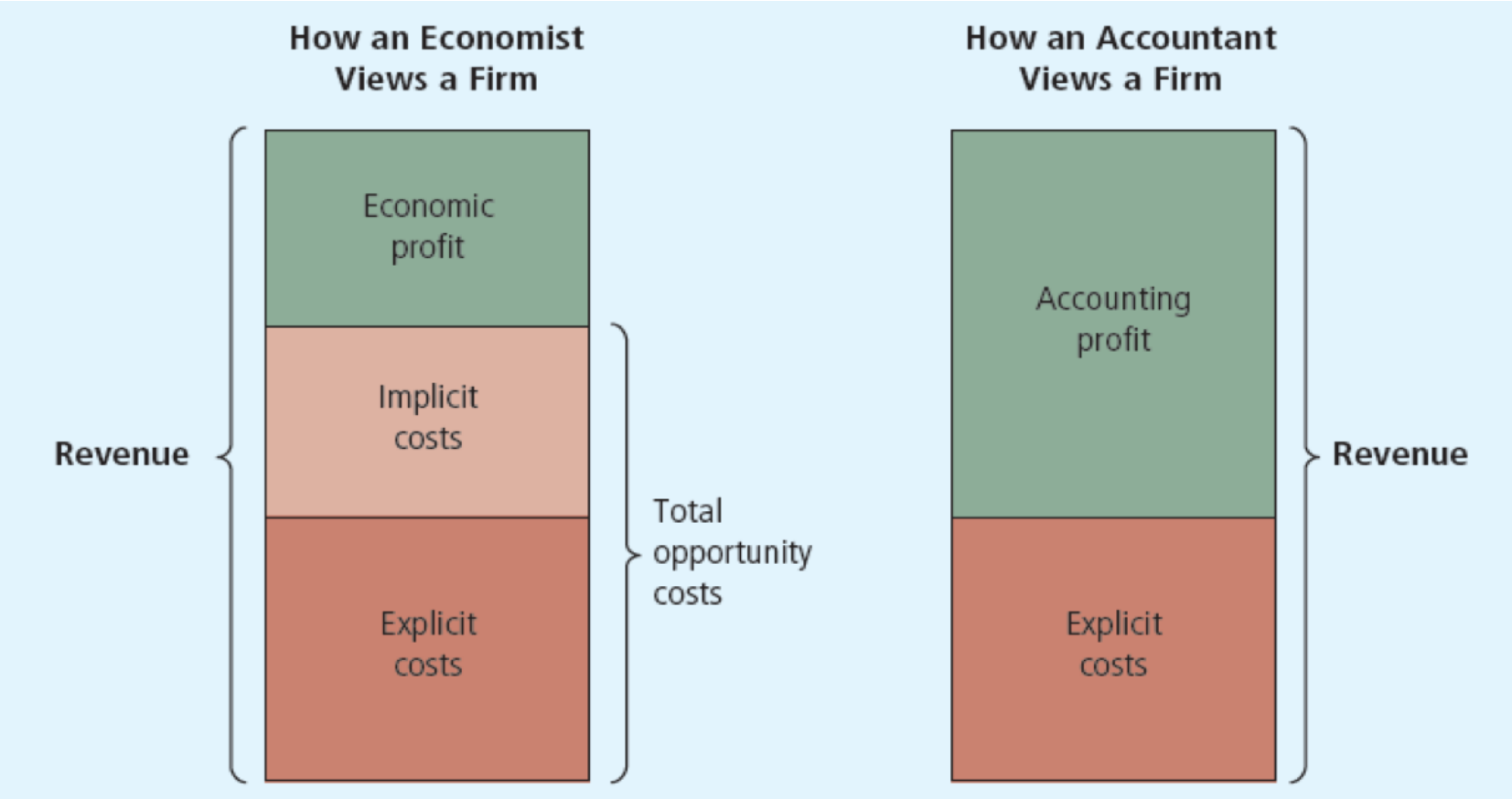
	GAAP	IFRS
BOARD GOVERNING	International Accounting Standard Board overseas GAAP.	Financial Accounting Standard Board overseas GAAP.
GLOBAL APPEAL	GAAP is primarily used US	IFRS is used by around 110 countries. Thus has global appeal.
PRINCIPLE vs RULE BASIS	GAAP is Rule Based and not principle based.	IFRS is principle based i.e. companies has some flexibility with disclosure.
INVENTORY METHOD	GAAP prefers LIFO method for valuation of inventory	IFRS does not recommend LIFO (as it reveals lower income)
FIXED ASSET VALUATION	Only cost model can be used for valuing Fixed Asset	IFRS also recognizes the Revaluation model in addition to cost model.
INTANGIBLE ASSET	Intangible assets are valued at Fair Value.	Intangible Assets are valued on the basis of future economic benefits.
EARNING PER SHARE	This averages the individual interim period	This does not averages the individual interim period.
EARNING PER SHARE	If Market Value increases, the company cannot reverse write down	Here, reversal of write down of inventory is possible / allowed.
DEVLOPMENT COST	All development costs are expensed out under GAAP.	Some development costs are expensed and other are capitalized & amortized.
LIABILITIES GROUPING	GAAP requires splitting of liabilities into current and non current.	IFRS does not make such classification.
INCOME STATEMENT	Extra Ordinary and unusual amount are shown below net income	Such items come under income statement.
PREPARATION OF CONS FS.	GAAP prefers a risks-and-rewards model	IFRS is in favor of a control model

Balance Sheet Structure



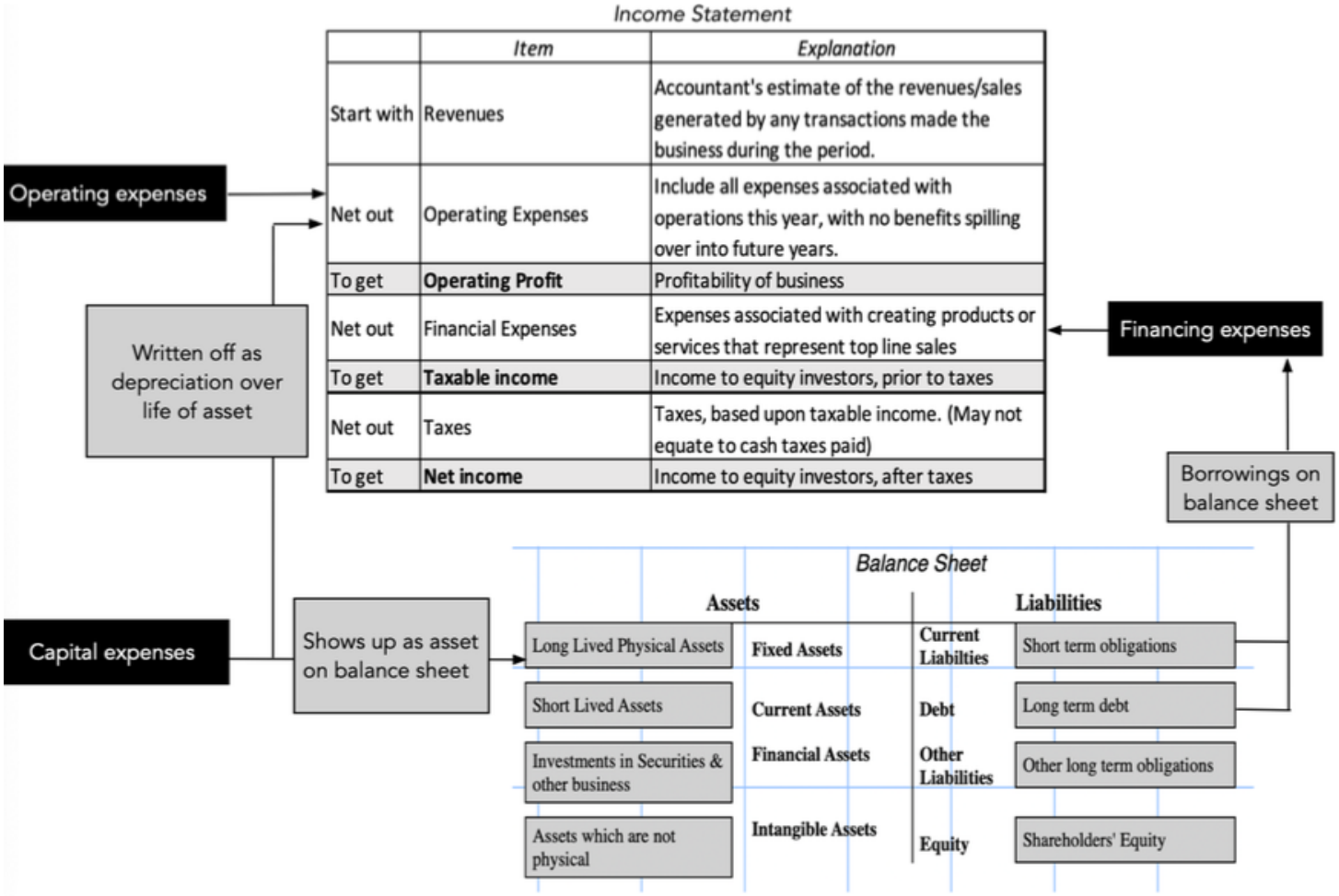
Source: Ross et al. (2021).

Accounting Profit vs Economic Profit



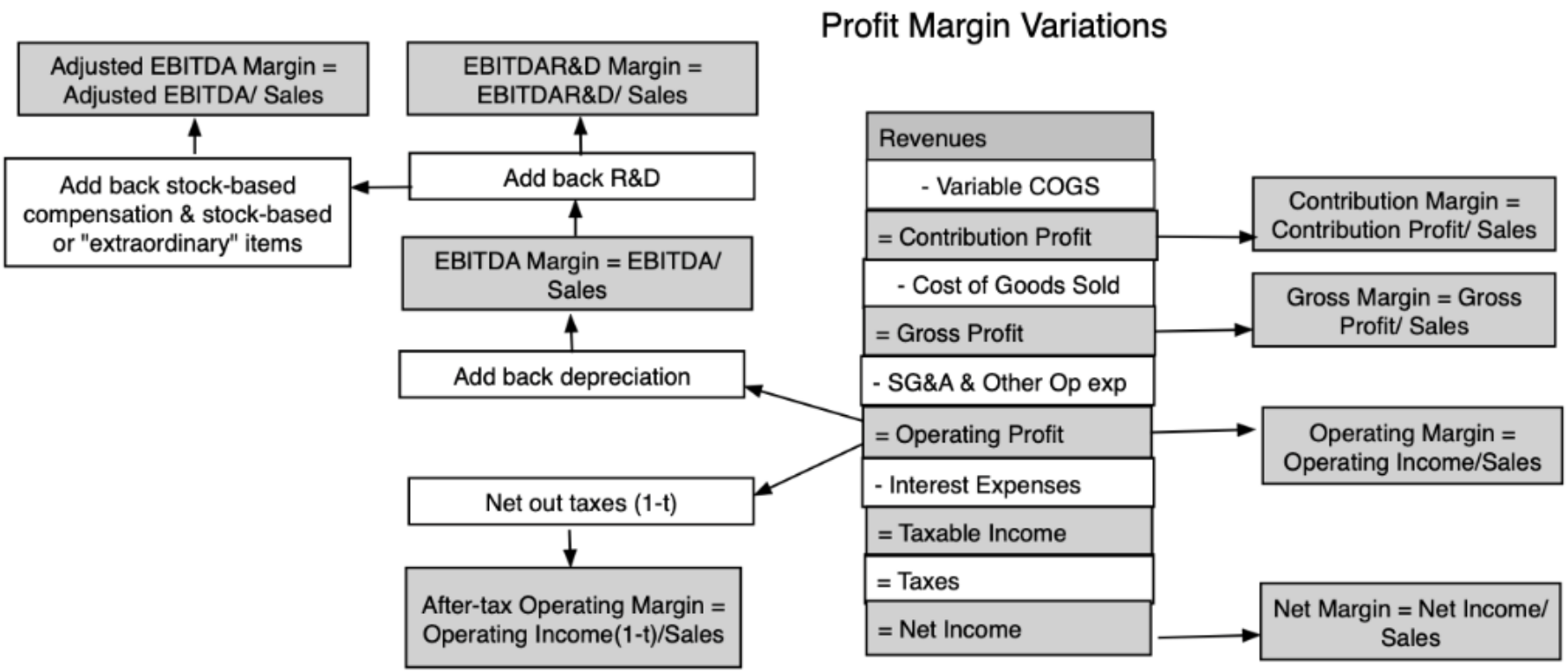
Source: Mankiw (2021).

Income Statement and Balance Sheet



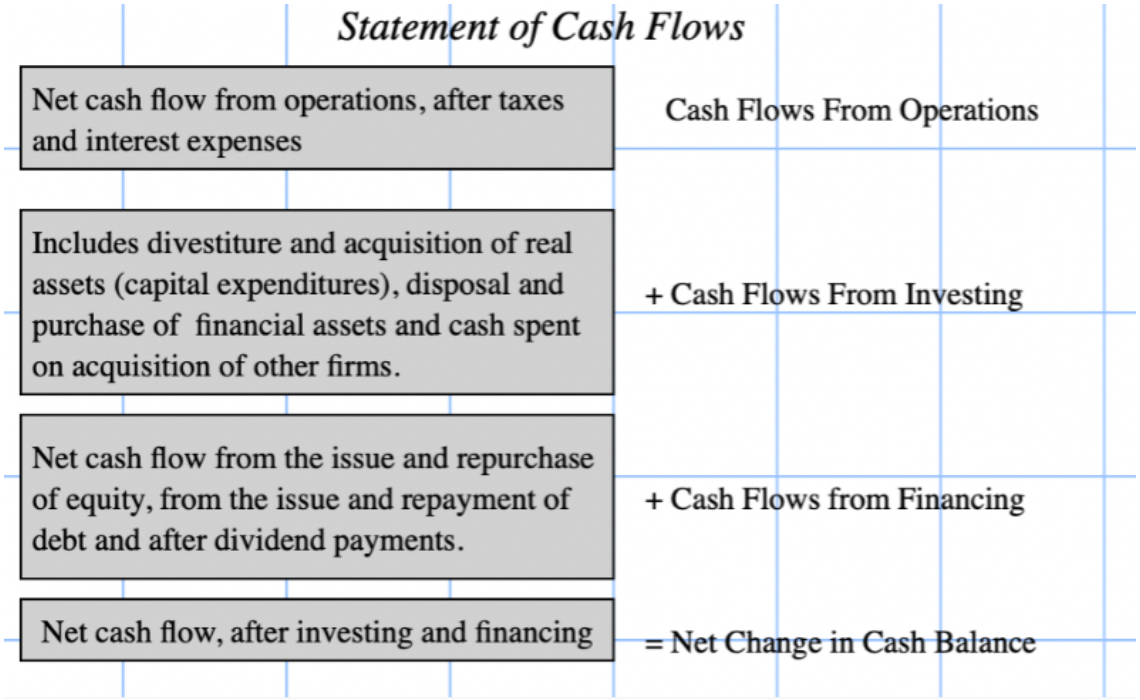
Source: Aswath Damodaran (2021).

Profit Margin Variations



Source: Aswath Damodaran (2021).

Cash Flow Statement



Cash Flow Effect	*Item*
Start with	Net Income
Plus	Depreciation and Amortization
Plus	Other non-cash Expenses
Plus or Minus	Change in Accounts Receivables
	Change in Inventory
	Change in Other Current Asset
	Change in Accounts Payable
	Change in Taxes Due
Equals	**Cash flow from Operations**
Minus	Capital Expenditures
Plus	Divestitures of assets
Minus	Cash Acquisitions
Equals	**FCFE before debt**
Plus	Debt Raised
Minus	Debt Repaid
Equals	**FCFE after Debt**

Source: Aswath Damodaran (2021)

Cash Flow Identities

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)

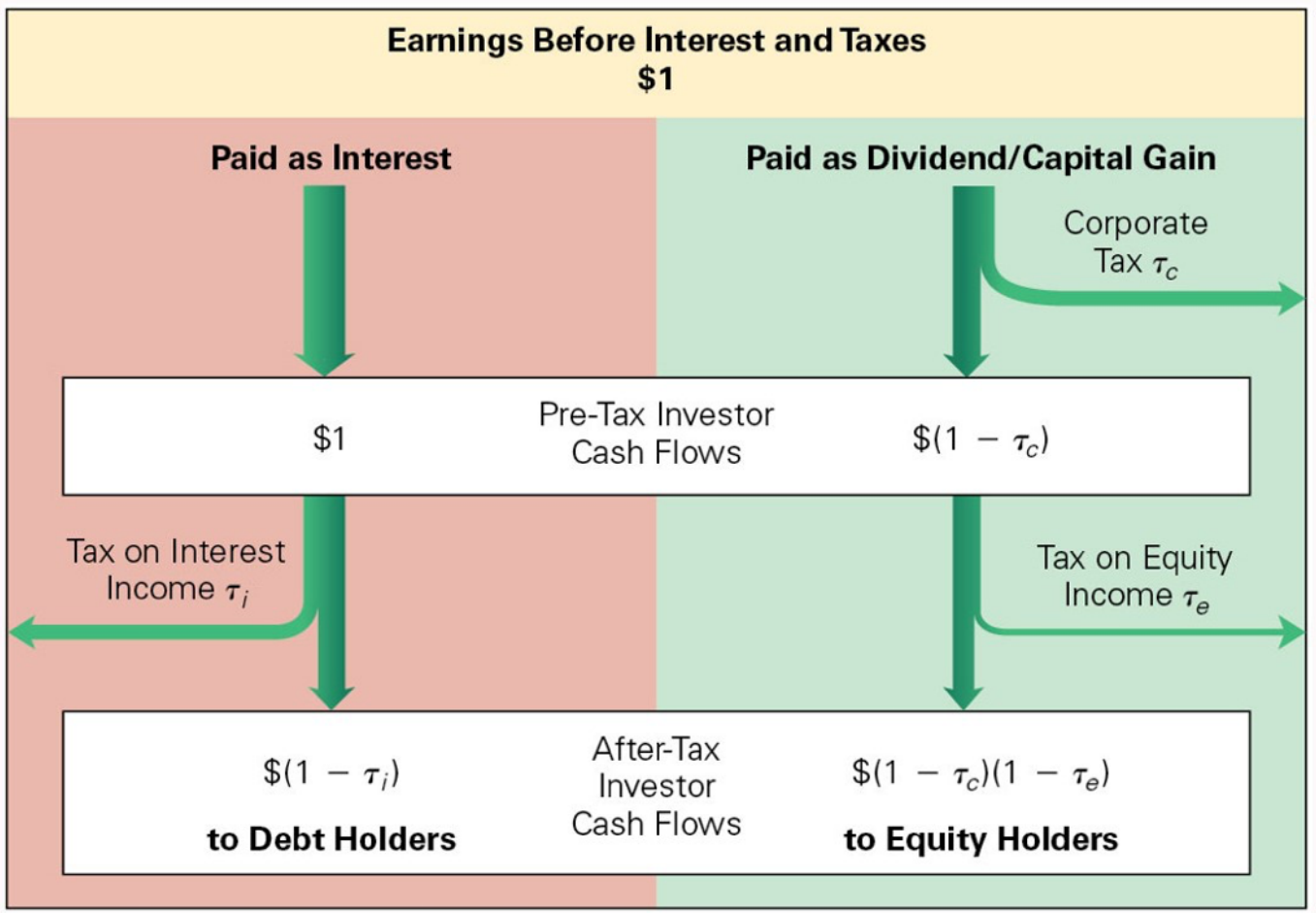
Cash flow to creditors = Interest paid − Net new borrowing

IV. Cash flow to stockholders (owners)

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

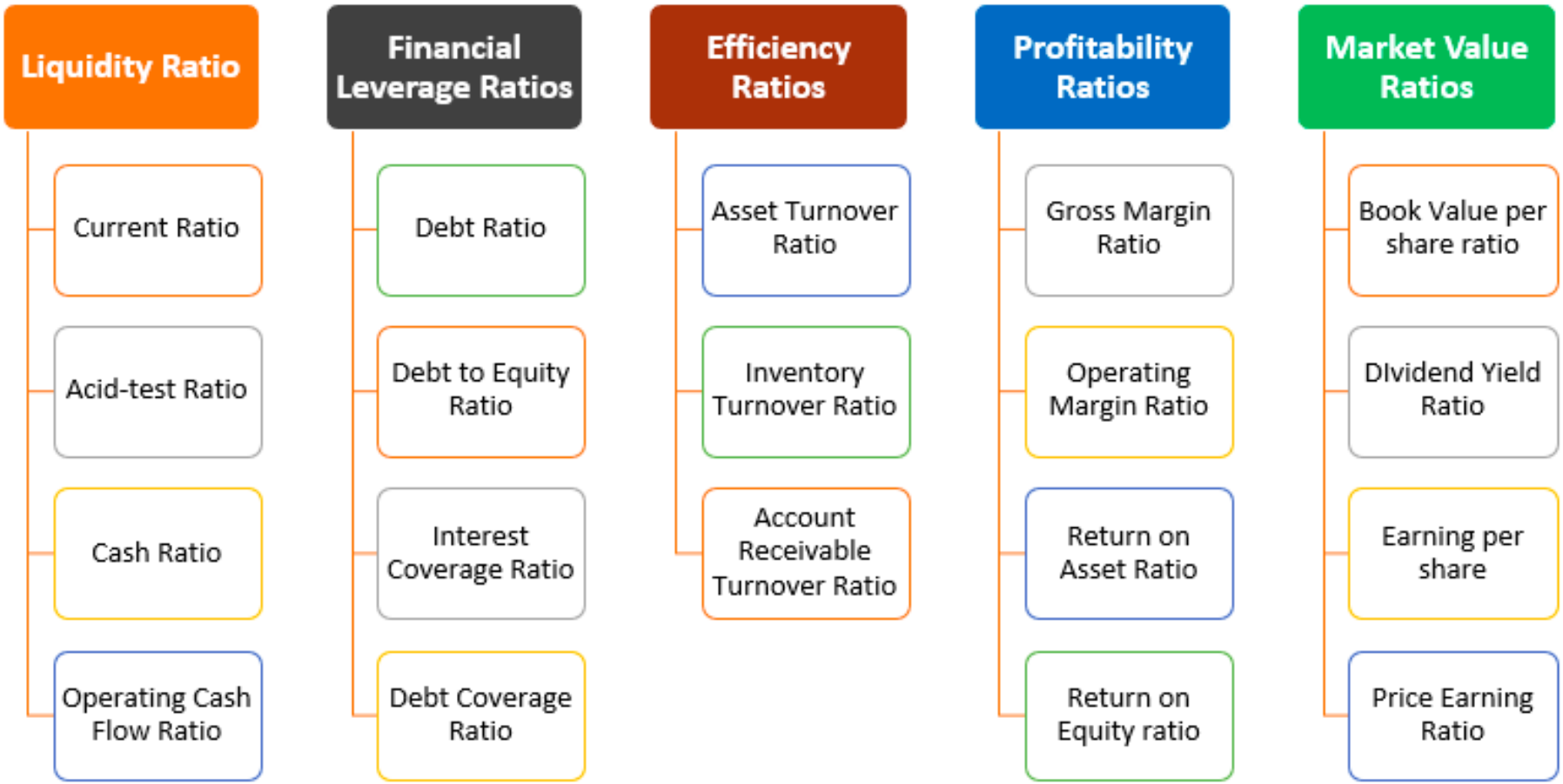
Source: Ross et al. (2021).

Corporate Tax and Cash Flows to Investors



Source: Berk & DeMarzo (2021)

Financial Ratios for Business Performance (w)



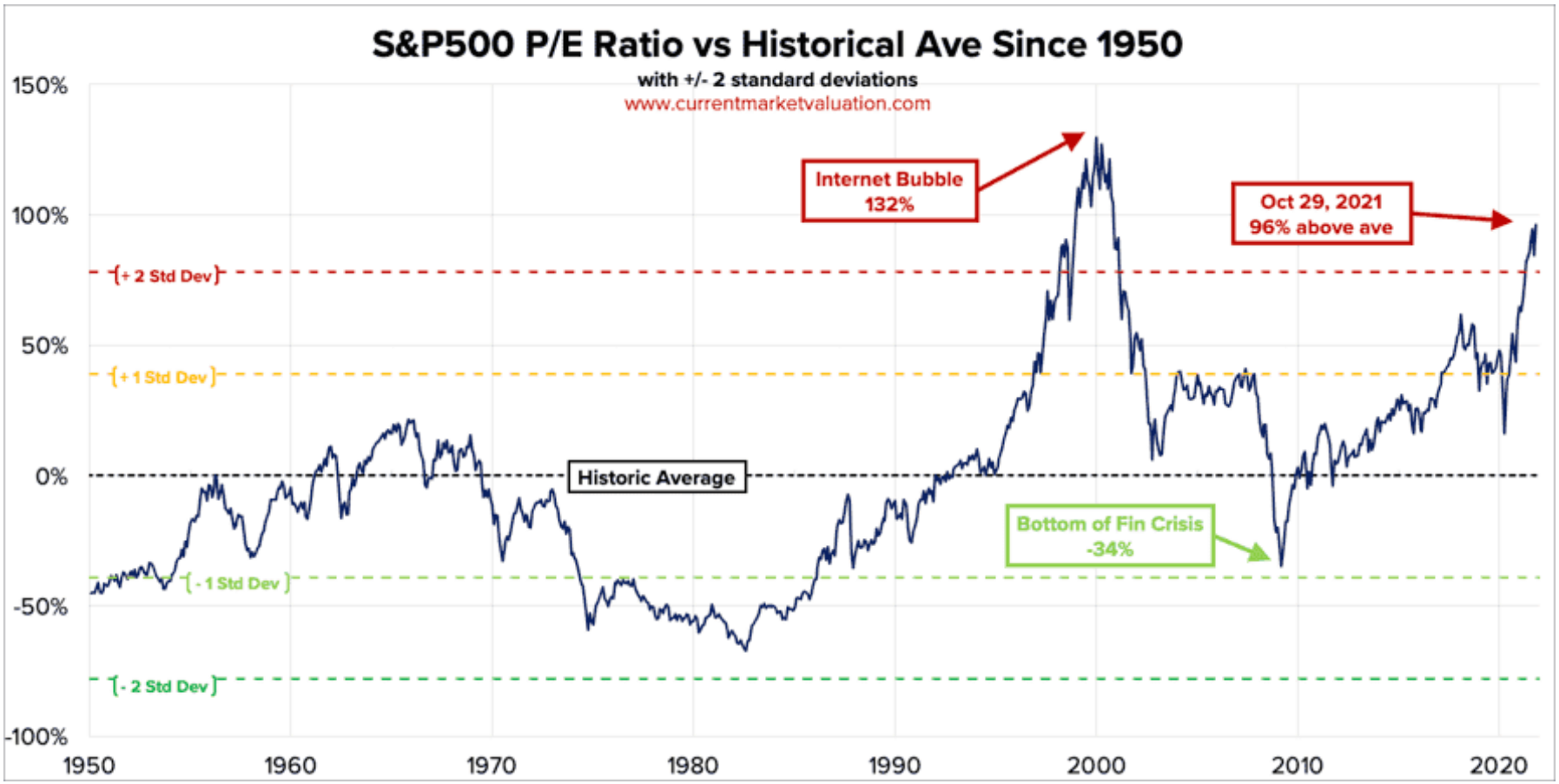
https://www.educba.com/importance-of-ratio-analysis/

Financial Ratios Formula

I. Short-term solvency, or liquidity, ratios	II. Long-term solvency, or financial leverage, ratios
Current ratio = $\frac{\text{Current assets}}{\text{Current liabilities}}$	Total debt ratio = $\frac{\text{Total assets} - \text{Total equity}}{\text{Total assets}}$
Quick ratio = $\frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}}$	Debt–equity ratio = Total debt/Total equity
Cash ratio = $\frac{\text{Cash}}{\text{Current liabilities}}$	Equity multiplier = Total assets/Total equity
Net working capital to total assets = $\frac{\text{Net working capital}}{\text{Total assets}}$	Long-term debt ratio = $\frac{\text{Long-term debt}}{\text{Long-term debt} + \text{Total equity}}$
Interval measure = $\frac{\text{Current assets}}{\text{Average daily operating costs}}$	Times interest earned ratio = $\frac{\text{EBIT}}{\text{Interest}}$
	Cash coverage ratio = $\frac{\text{EBIT} + \text{Depreciation}}{\text{Interest}}$
III. Asset management, or turnover, ratios	**IV. Profitability ratios**
Inventory turnover = $\frac{\text{Cost of goods sold}}{\text{Inventory}}$	Profit margin = $\frac{\text{Net income}}{\text{Sales}}$
Days' sales in inventory = $\frac{365 \text{ days}}{\text{Inventory turnover}}$	Return on assets (ROA) = $\frac{\text{Net income}}{\text{Total assets}}$
Receivables turnover = $\frac{\text{Sales}}{\text{Accounts receivable}}$	Return on equity (ROE) = $\frac{\text{Net income}}{\text{Total equity}}$
Days' sales in receivables = $\frac{365 \text{ days}}{\text{Receivables turnover}}$	ROE = $\frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}}$
NWC turnover = $\frac{\text{Sales}}{\text{NWC}}$	**V. Market value ratios**
Fixed asset turnover = $\frac{\text{Sales}}{\text{Net fixed assets}}$	Price–earnings ratio = $\frac{\text{Price per share}}{\text{Earnings per share}}$
Total asset turnover = $\frac{\text{Sales}}{\text{Total assets}}$	PEG ratio = $\frac{\text{Price–earnings ratio}}{\text{Earnings growth rate (\%)}}$
	Price–sales ratio = $\frac{\text{Price per share}}{\text{Sales per share}}$
	Market-to-book-ratio = $\frac{\text{Market value per share}}{\text{Book value per share}}$
	Tobin's Q ratio = $\frac{\text{Market value of assets}}{\text{Replacement cost of assets}}$
	Enterprise value–EBITDA ratio = $\frac{\text{Enterprise value}}{\text{EBITDA}}$

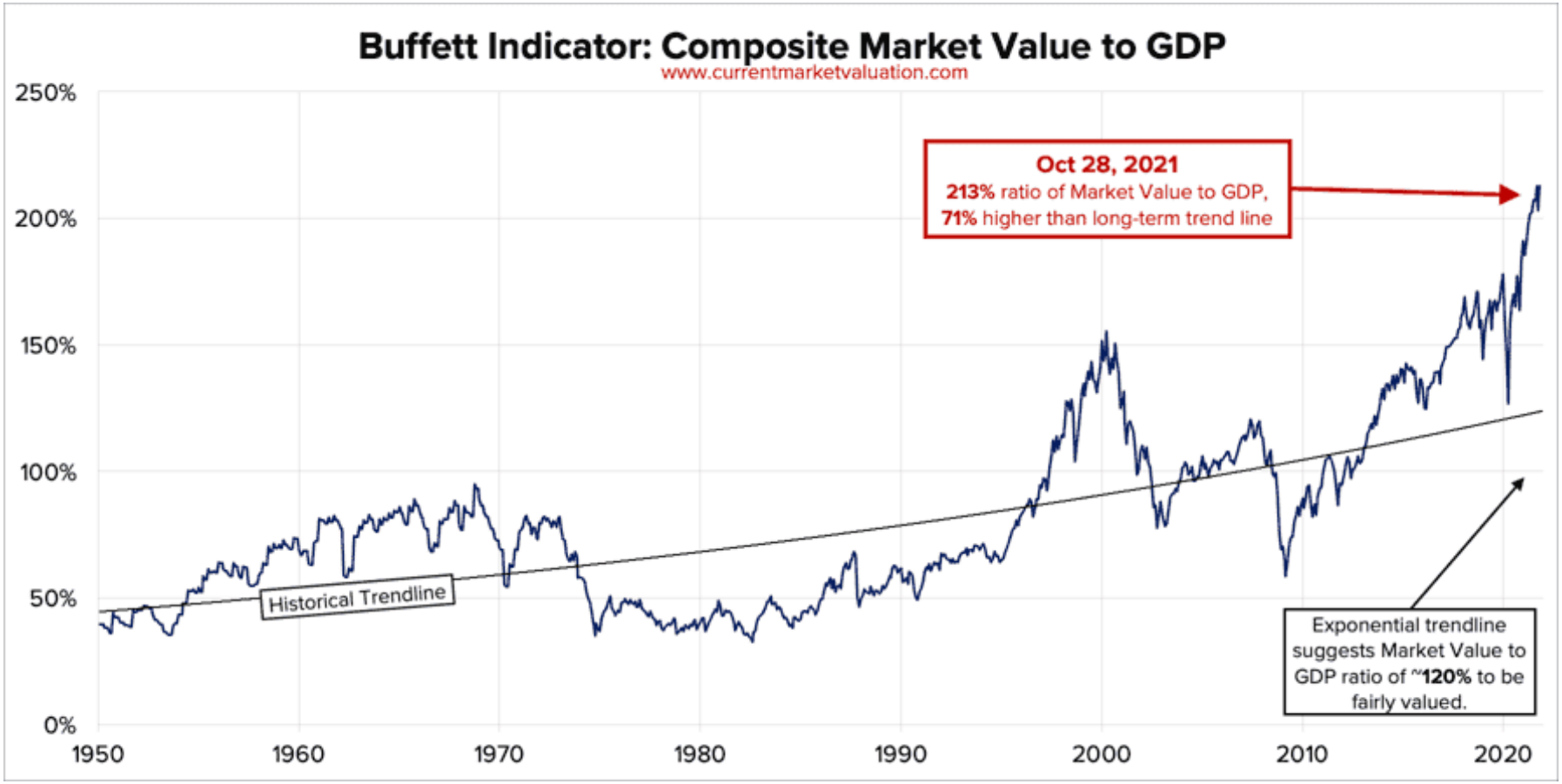
Source: Ross et al. (2021).

Price/Earnings Ratios in Valuation (w)



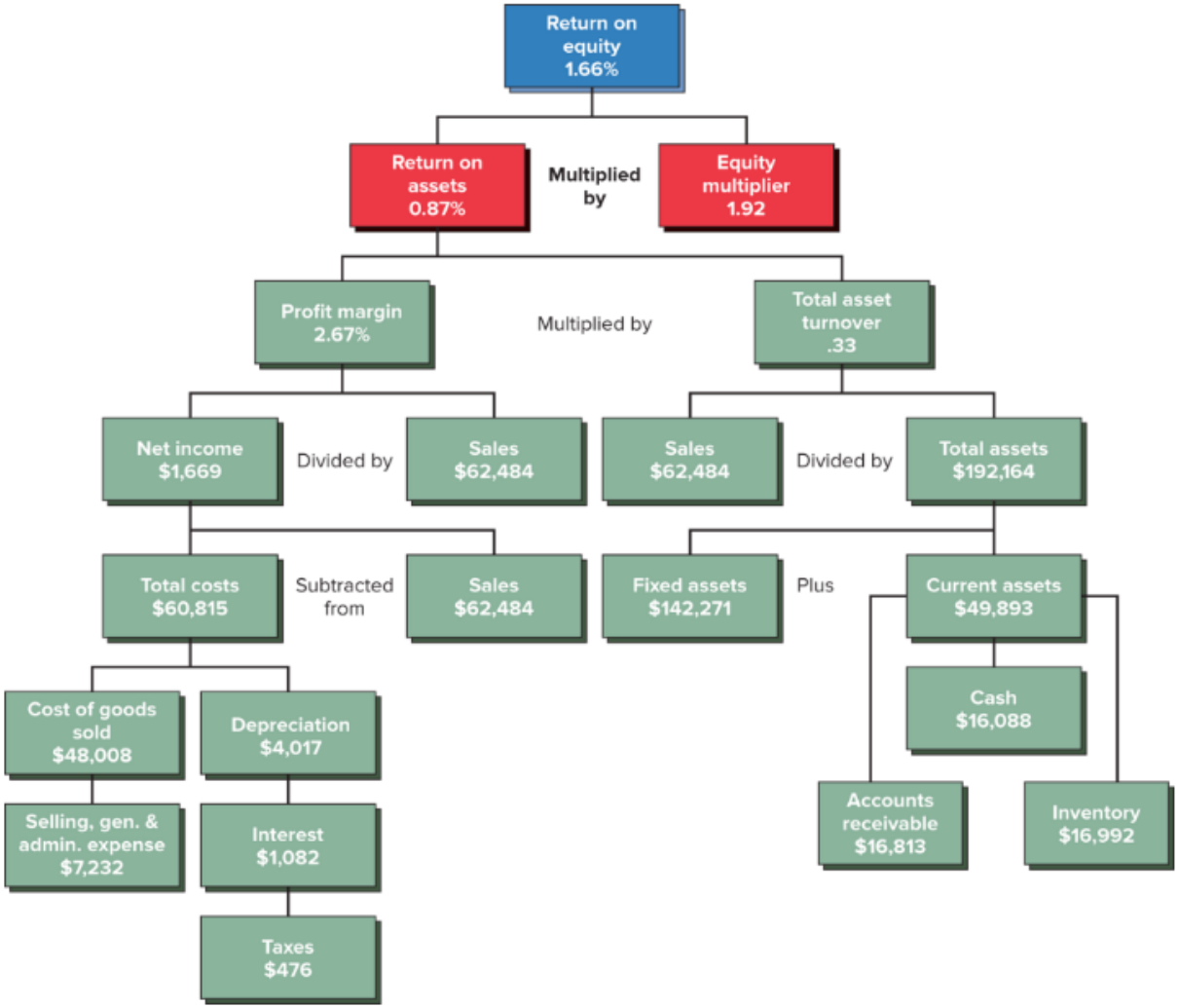
https://www.currentmarketvaluation.com/models/price-earnings.php.

Buffet Indicator in Valuation (w)



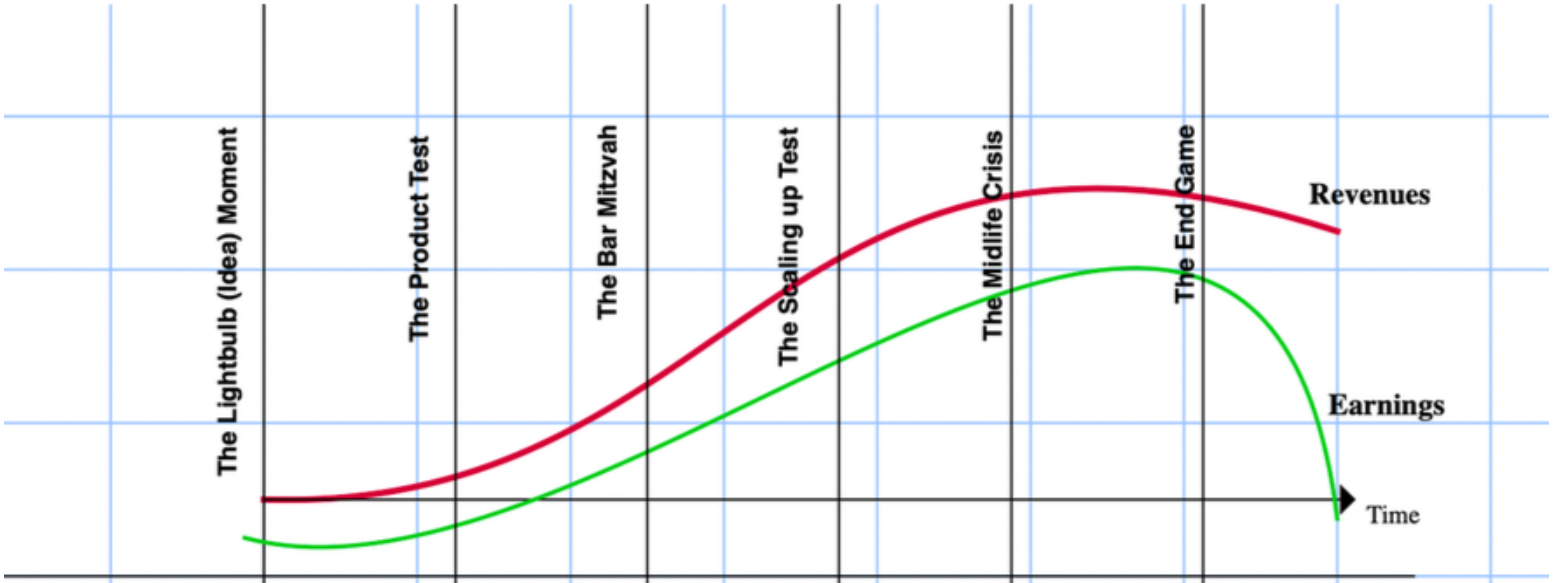
https://www.currentmarketvaluation.com/models/buffett-indicator.php

DuPont Analysis: $ROE = ROA \times EM$



Source: DowDuPont

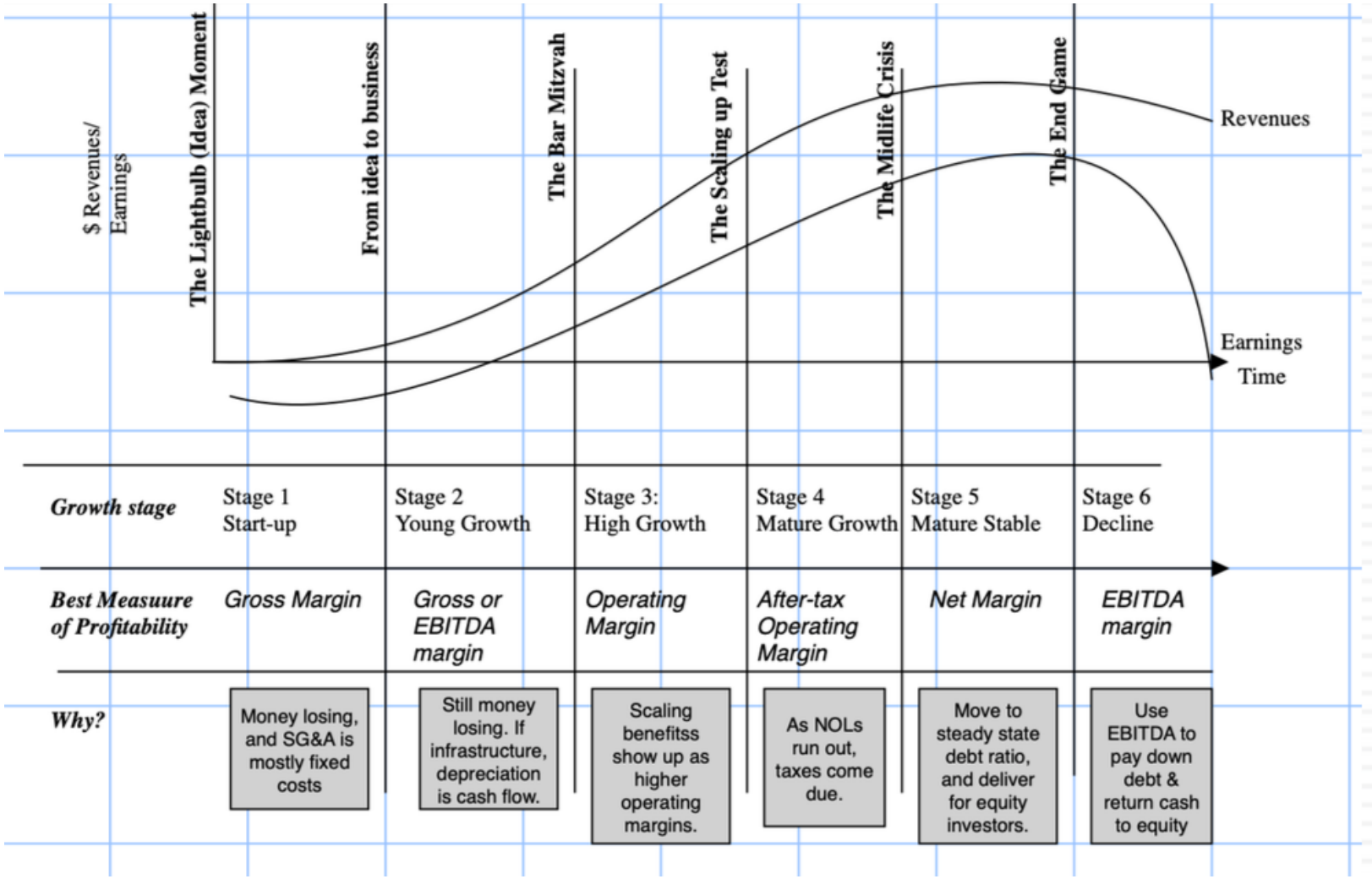
Corporate Life Cycle View: Revenue and Profit



Lifecycle stage	Start-up	Young Growth	High Growth	Mature Growth	Mature Stable	Decline
Revenue & Revenue Growth	Small, but high growth rate	Acquiriing Substance, with high growth	Large and still growing	Large, but growth rate drops off	Large, but stagnant	Revenues start dropping
Profit Patterns	Losses, as business is built up, but sales are in future.	Losses accelerate, as expenses grow faster than revenues.	Losses decline & profits emerge, as revenue grow faster than expenses.	Profits climb, as economies of scale kick in.	Profits level off, and grow with revenues.	Profits decline, often faster than revenues.

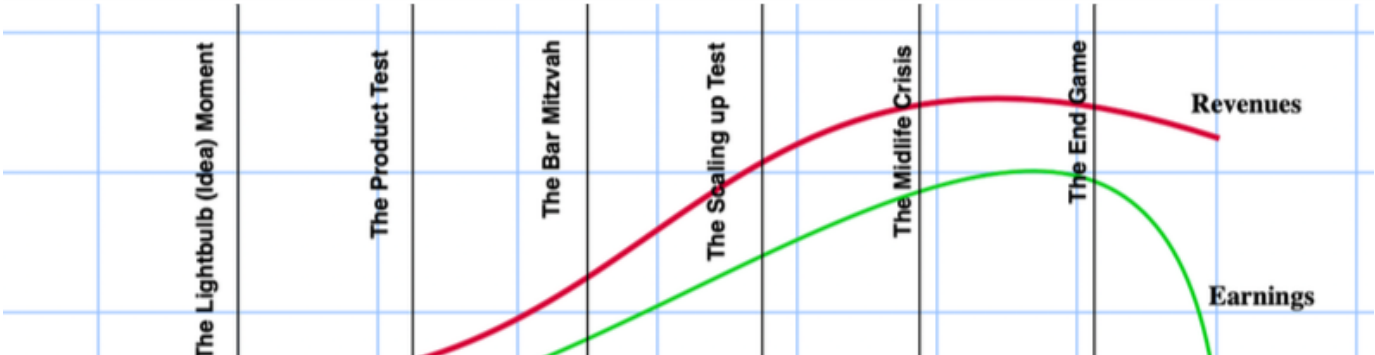
Source: Aswath Damodaran (2021).

Corporate Life Cycle View: Profit Margins



Source: Aswath Damodaran (2021).

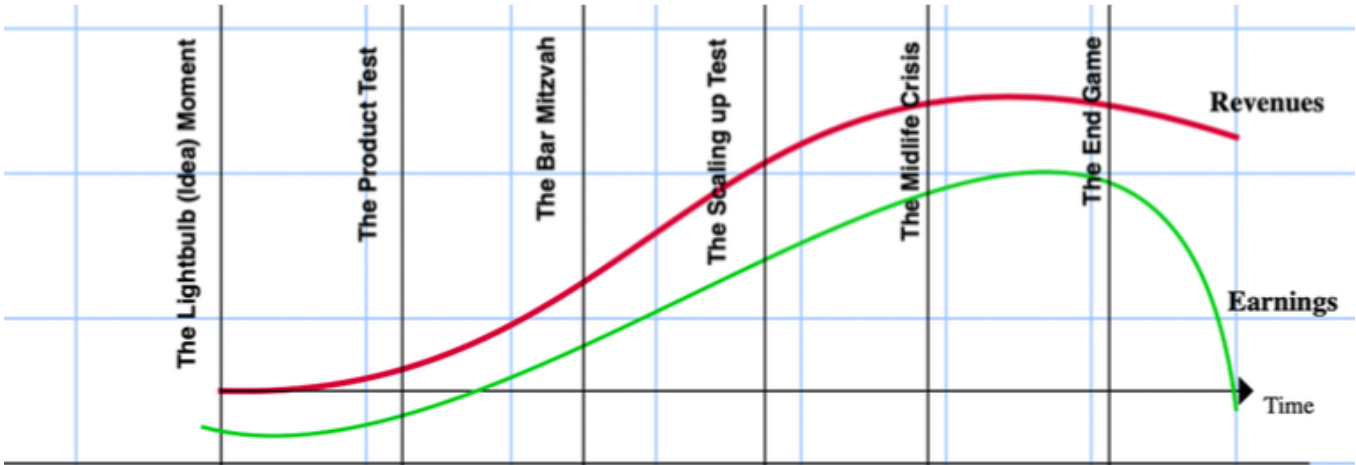
Corporate Life Cycle View: Balance Sheet



Lifecycle stage	Start-up	Young Growth	High Growth	Mature Growth	Mature Stable	Decline
Assets	Small asset base, if any	Asset base grows quickly	Asset base continues to grow, albeit at lower rate.	Asset base stabilizes & grows with earnings	Asset base stabilizes	Asset base declines
Debt	Only as a last resort	Low or non-existent	Stays low	Starts to grow	Large and often complex	Decline or in distress
Shareholder Equity	Often negative, reflecting continued losses	Turns positive, more because of capital infusions than retained earnings.	Consolidates and starts growth as retained earnings start accumulating.	Grows quickly, as earnings build, but cash return stays low.	Depends on how much cash the company chooses to return.	Declines, as losses & divestitures take their toll.

Source: Aswath Damodaran (2021).

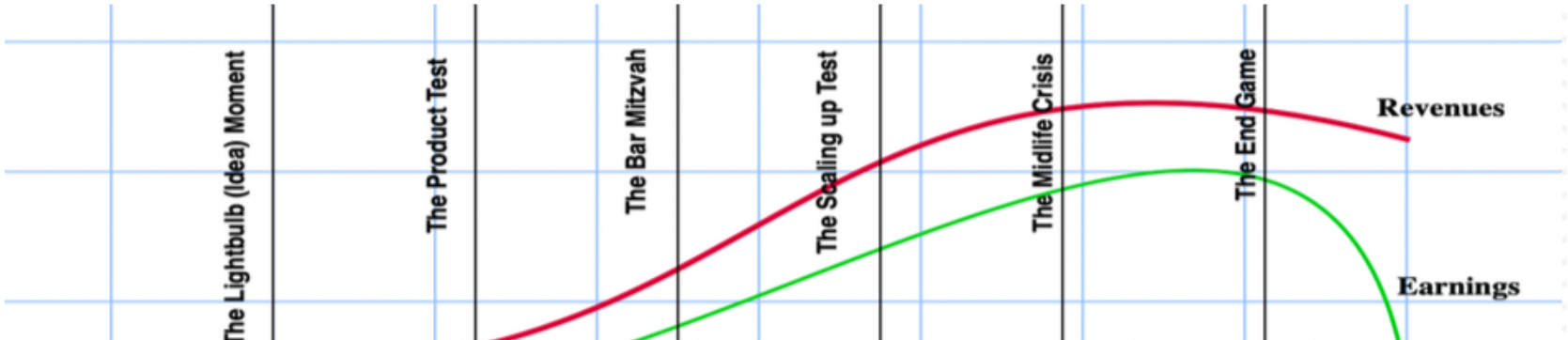
Corporate Life Cycle View: Cash Flows



Lifecycle stage	Start-up	Young Growth	High Growth	Mature Growth	Mature Stable	Decline
Operating Cash Flows	Negative, as it starts with losses	Continues to be negative, with working capital adding to losses.	Starts to turn positive, as company reports profits	Increasingly positive, driven by net income growth	Positive and stable	Declines with profits dropping
Investing Cash Flows	Large investing needs	Continued investing activity	Investing growth starts to slow	Investing stabilizes	Maintenance investing	Asset sales & divestitures
Financing Cash Flows	Cash inflows from new equity issuances	Continued cash inflows from new equity issuances	Not much activity	Start of inflows from debt financing & first outflows to equity	Regular debt issuances/ payments and significant cash return to equity	Debt repayments & equity cash return

Source: Aswath Damodaran (2021).

Corporate Life Cycle View: Margins and Debt Ratios



Lifecycle stage	Start-up	Young Growth	High Growth	Mature Growth	Mature Stable	Decline
Profit Margins	Very negative, sometimes NMF (pre-revenue)	Negative, as losses run ahead of revenues	Margins turn positive	Margins continue to grow	Margins stable	Margins declining
Accounting Returns	Very negative	Negative, but get less so over time	Turn positive, but may still be low	Improve, with economies of sale.	Stabilize	Decrease
Debt Ratios	Usually zero or very low	Stay low	Continue to be low	Start rising, as debt capacity is accessed	Debt ratios converge on steady state	Depends on whether debt repaid during decline

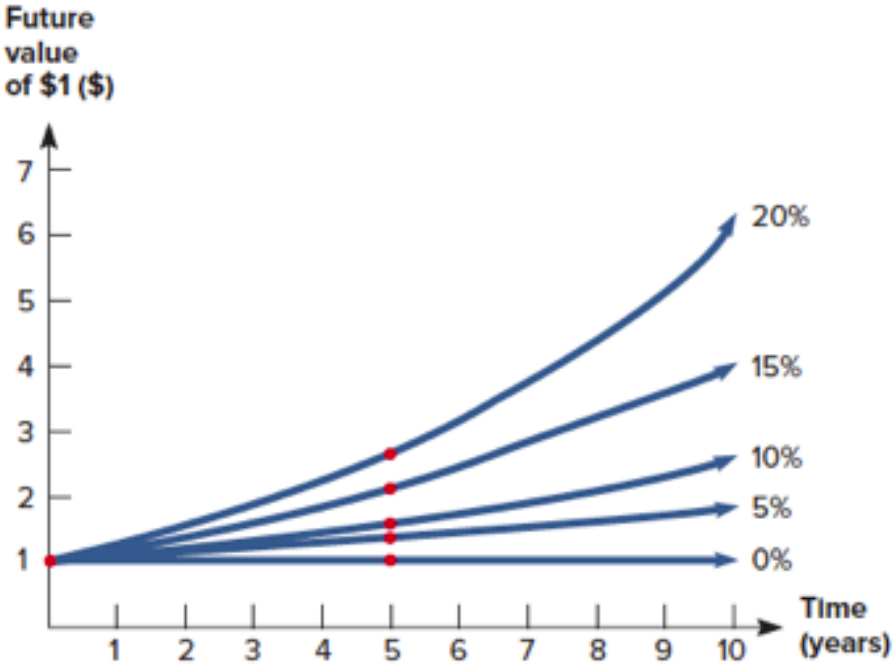
Source: Aswath Damodaran (2021).

Irving Fisher (1930) The Theory of Interest

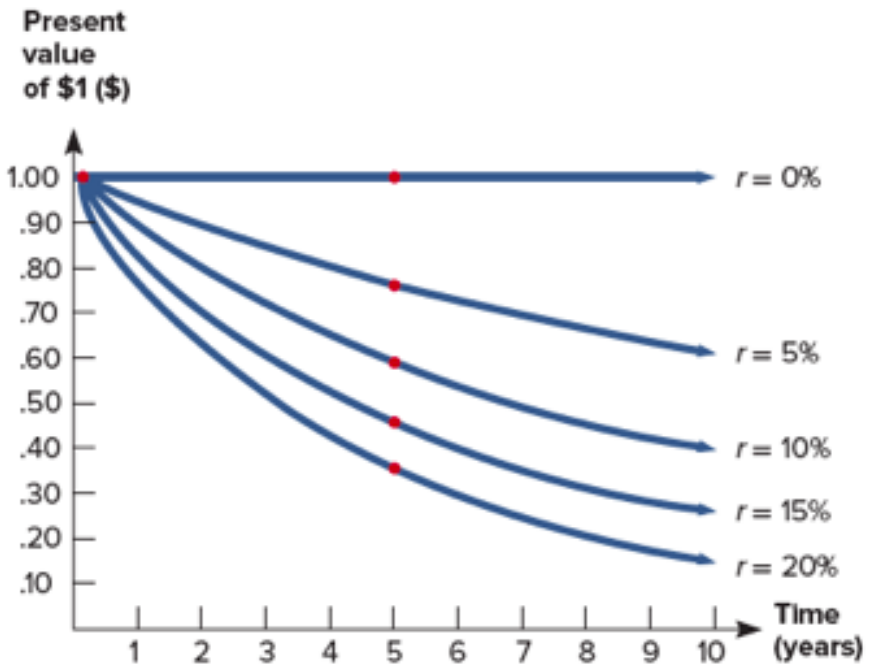
1. Income is the alpha and omega of economic life.
2. Investment is the balancing of consumption over time.
3. Capital generates income. Income is derived from capital.
4. The value of capital is derived from the value of income.
5. Interest is paid for immediate consumption at the cost of future consumption, the size of which is determined by consumption impatience and investment opportunity.
6. Interest (rate) is the cost of borrowing and return to lending.
7. Nominal interest rate equals real interest rate plus a risk premium.
8. The theoretical price, or the present value, of an asset is the discounted summation of all its expected future cash flows, after adjusting for risks.
9. Market interest rates and asset prices are ex-ante risk signals.

Future Value v.s. Present Value

$$FV = (1+i)^T$$

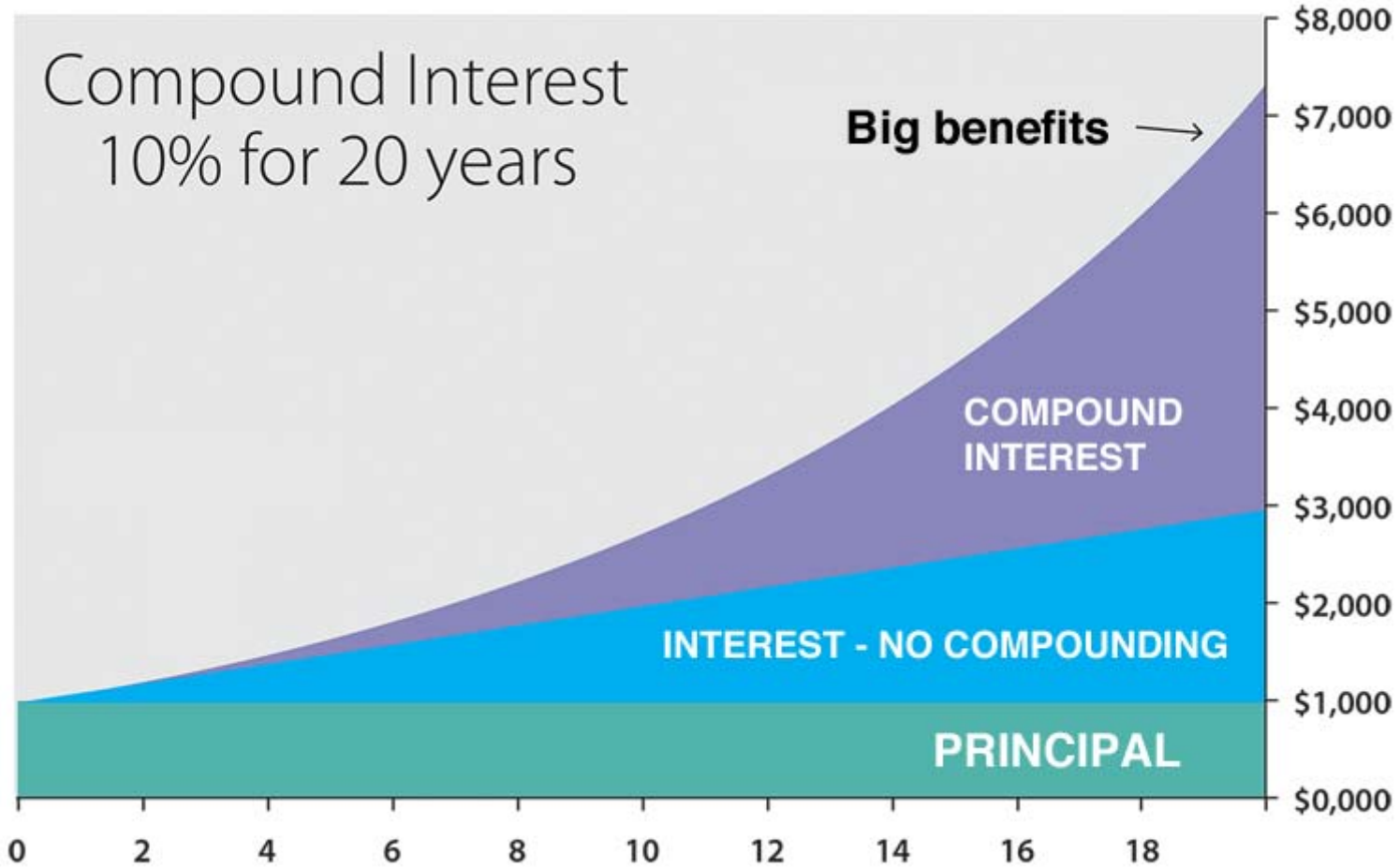


$$PV = (1+i)^{-T}$$



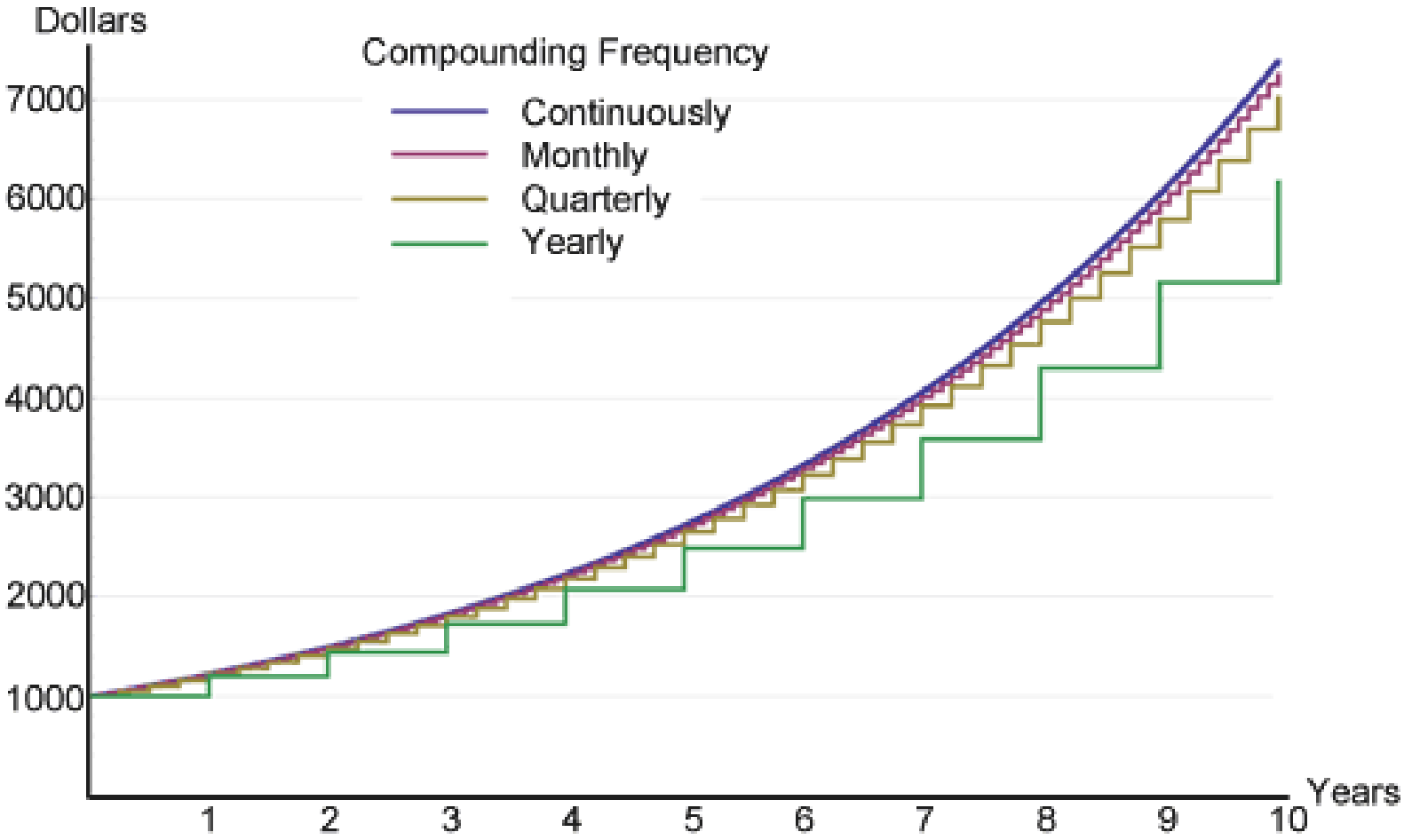
Source: Ross (2021). FV rises with the compound rate and the time horizon. For the same future value, PV falls with the discount rate and time horizon.

The Effect of Compounding (w)



https://www.thecalculatorsite.com/articles/finance/compound-interest-formula.php

The Effect of Compounding Frequency (w)



https://www.calculator.net/interest-calculator.html

Principles of Pricing Financial Assets

The fundamental principle of finance is that the theoretical price of an asset equals the present value of all cash flows that the owner of the asset expects to receive during its life.

$$PV = \frac{CF_1}{(1+i)} + \frac{CF_2}{(1+i)^2} + \ldots + \frac{CF_T}{(1+i)^T} = \sum_{t=1}^{T} \frac{CF_t}{(1+i)^t}$$

- PV is the present value (or intrinsic value) of the financial asset
- CF_t is the expected cash flow arriving in year t $(t = 1, 2, \ldots T)$
- T is the maturity of the financial asset (life expectancy)
- i is the appropriate interest rate for discounting

Philosophy of Asset Pricing Equation

$$PV = \frac{CF_1}{(1+i_1)} + \frac{CF_2}{(1+i_2)^2} + \ldots + \frac{CF_T}{(1+i_T)^T} = \sum_{t=1}^{T} \frac{CF_t}{(1+i_t)^t}$$

1. At $t = 0$, the expected cash flow CF_t is estimated for year t. The more sizable it is, the more valuable is the asset ($CF \uparrow \Rightarrow PV \downarrow$).
2. Future time horizon T: the longer the life of the asset, the more valuable ($T \uparrow \Rightarrow PV \uparrow$). However, the distant future income is less valuable than the near future income: $\frac{1}{(1+i)^T} < \frac{1}{(1+i)^{T-1}}$, due to impatience.
3. The discount rate(s) i shall match the timing of and reflect the nature of future CF_t. Adverse risks cause value reduction: $V(CF_t) \uparrow \Rightarrow i \uparrow \Rightarrow PV \downarrow$.
4. PV is the fundamental intrinsicmodel theoretical value of the asset, which is not equal to the market price. PV serves as valuation benchmark.

The Appropriate Discount Rate (ADR)

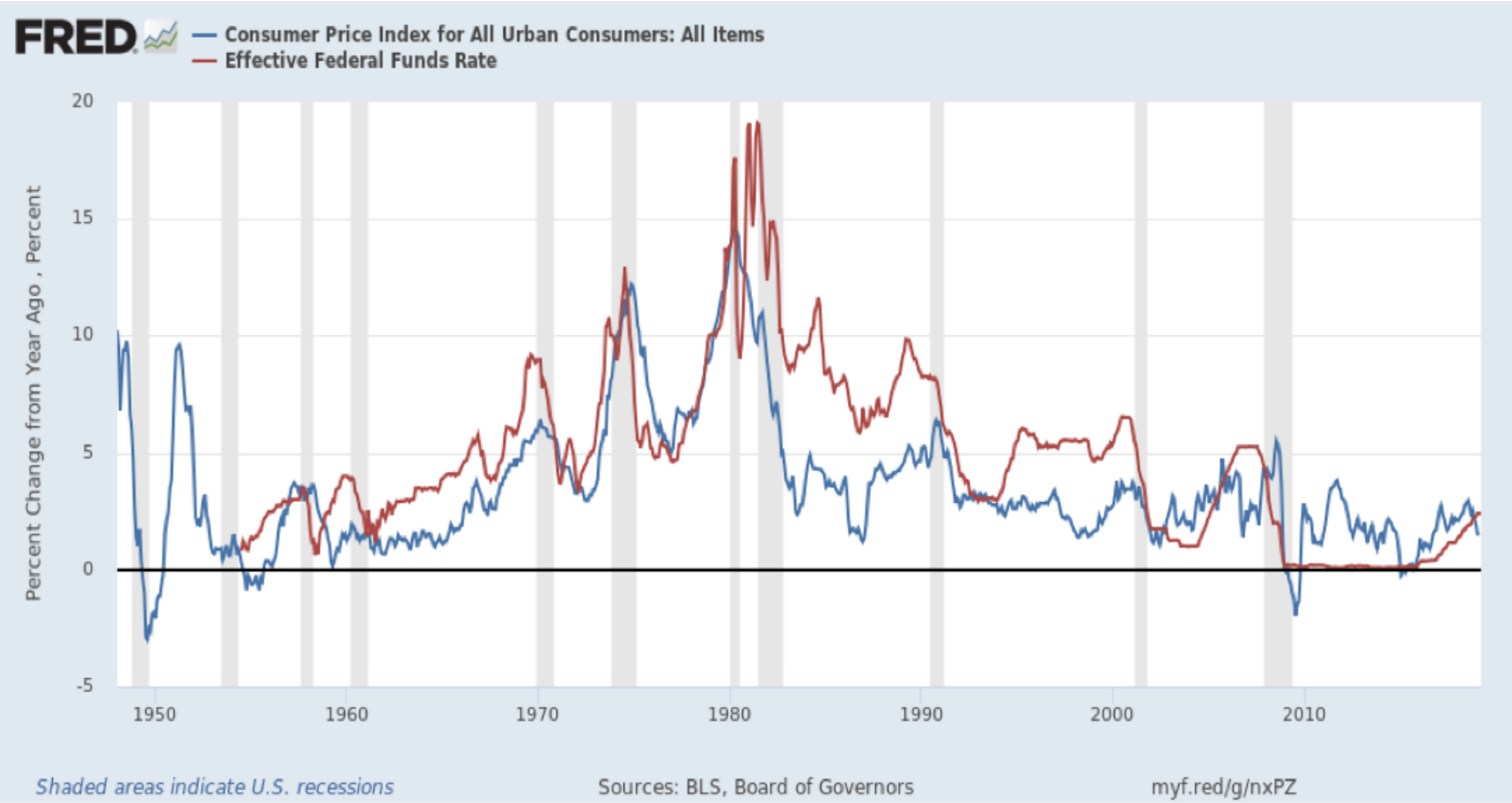
The appropriate discount rate ADR is the rate of return that the market or the consensus of investors requires on the asset, adjusting for risks.

$$\boxed{ADR = RR + IP + DP + MP + LP + CP}$$

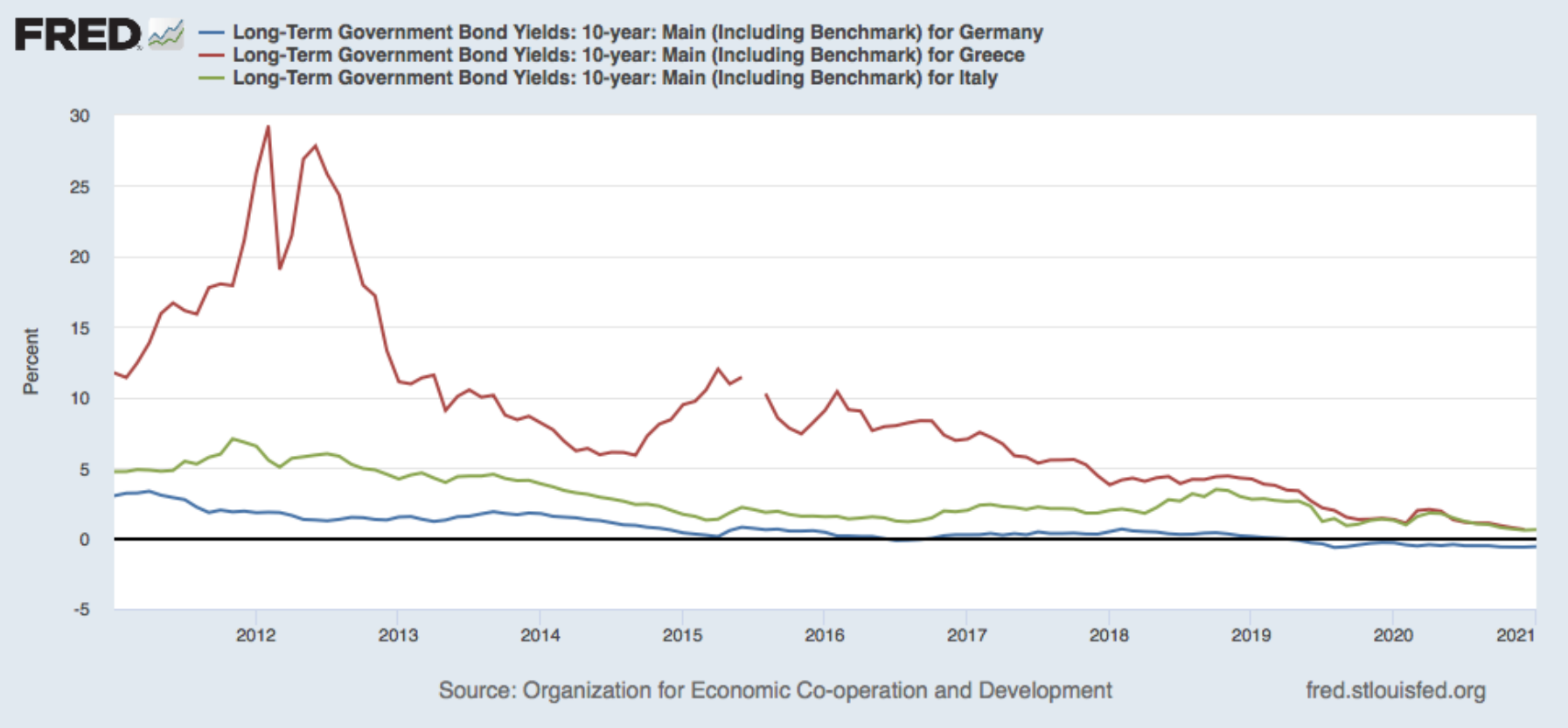
- RR the real rate of return
- IP the inflation premium
- DP the default premium
- MP the maturity premium
- LP the liquidity premium
- CP the currency premium

Discounted cash flow valuation adjusts expected cash flows for risks.

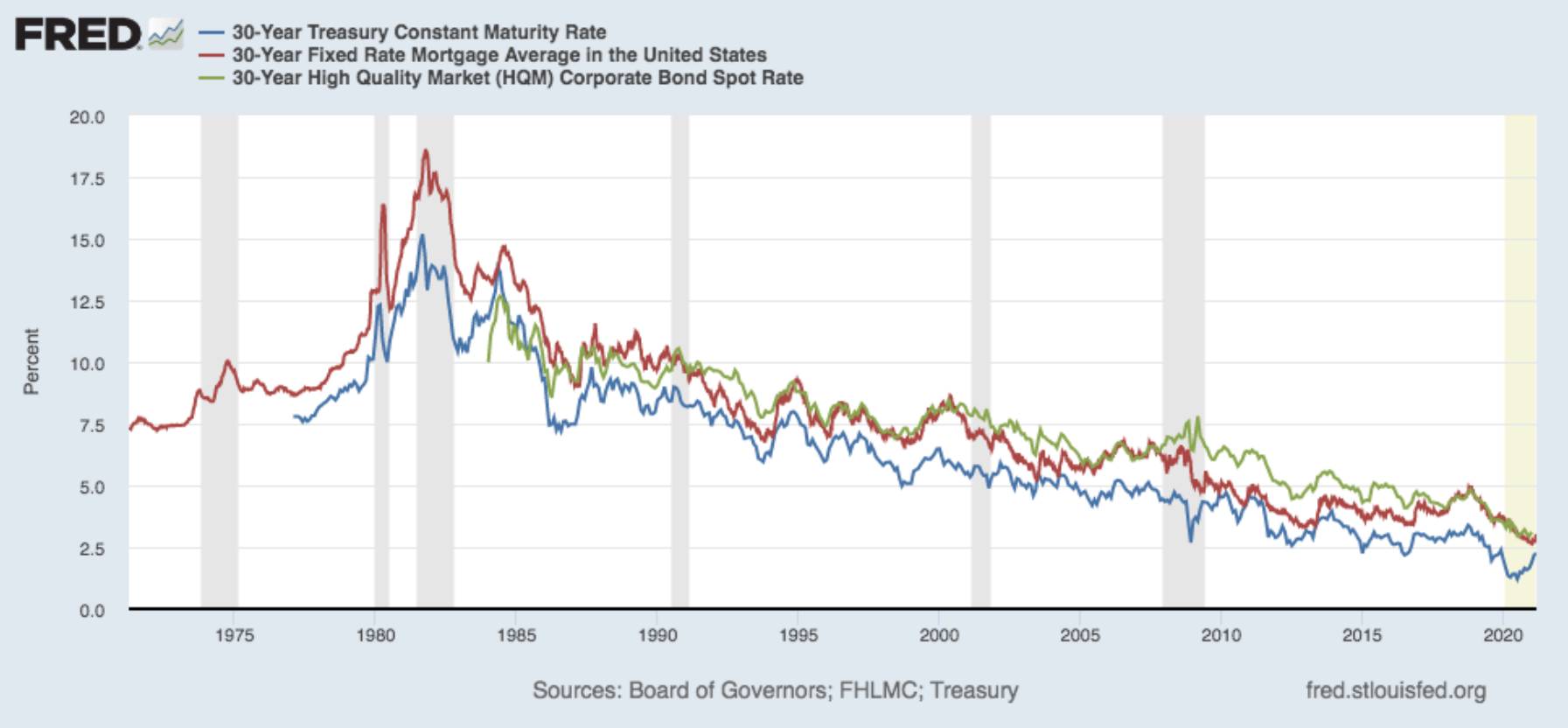
Interest Rate Inflation Risk



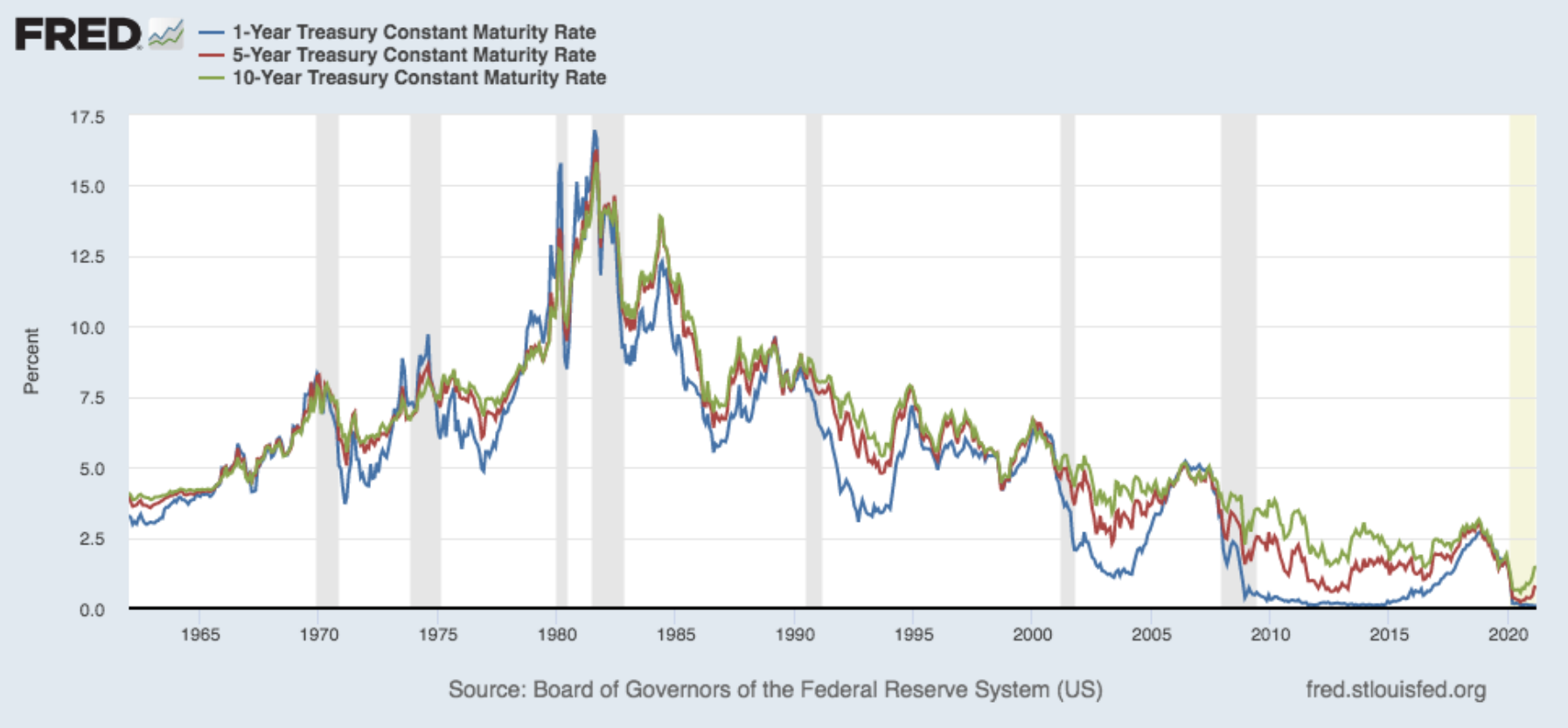
Interest Rate Sovereignty Risk



U.S. Interest Rate Credit Risk



U.S. Interest Rate Term Structure



Application: Perpetuity and Annuity

1. Perpetuity: $PV = \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \ldots \frac{C}{(1+i)^\infty} = \sum_{t=1}^{\infty} \frac{C}{(1+i)^t} = \frac{C}{i}$
2. Perpetuity due: $PV = C + \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \ldots \frac{C}{(1+i)^\infty} = \frac{C(1+i)}{i}$
3. Perpetuity in t years: $PV = \frac{C}{(1+i)^t} + \frac{C}{(1+i)^{t+1}} + \ldots \frac{C}{(1+i)^\infty} = \frac{C}{i(1+i)^t}$
4. Perpetuity: $FV = \frac{C(1+i)^t}{i}$ & Perpetuity due: $FV = \frac{C(1+i)(1+i)^t}{i}$
5. Annuity: $PV = \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \ldots + \frac{C}{(1+i)^T} = C[\frac{1}{i} - \frac{1}{i(1+i)^T}]$
6. Annuity due: $PV = C + \frac{C}{(1+i)} + \ldots + \frac{C}{(1+i)^T} = C(1+i)[\frac{1}{i} - \frac{1}{i(1+i)^T}]$
7. Annuity: $FV = C[\frac{(1+i)^T}{i} - \frac{1}{i}]$ & Annuity due: $FV = C(1+i)[\frac{(1+i)^T}{i} - \frac{1}{i}]$

Application: Bond Pricing

$$PV_B = \frac{C}{(1+Y_1)} + \ldots + \frac{C}{(1+Y_T)^T} + \frac{FV}{(1+Y_T)^T} = \sum_{t=1}^{T} \frac{C}{(1+Y_t)^t} + \frac{FV}{(1+Y_T)^T}$$

1. Coupon C is the periodic payment of the bond
2. Maturity T is the life length of the bond
3. Face value FV is the principal of the bond
4. Yield Y_t is the year t discount rate

Given the interest rate term structure, bond price is equal to its PV in theory. In practice, bond price is determined by market forces of demand and supply, and yield to maturity (YTM) is backed out from the zero coupon bond price.

Application: Bond Yields and Coupon Rates

$$\boxed{Zeros: \quad YTM_T = (FV/P_T)^{1/T} - 1}$$

$$\boxed{P_T = C[\frac{1}{Y_T} - \frac{1}{Y_T(1+Y_T)^T}] + \frac{FV}{(1+Y_T)^T}}$$

1. Zero-coupon bonds (zeros) make no coupon payments, so investors receive only the face value at maturity.
2. For coupon bonds, each coupon payment is computed as coupon rate times face value divided by the number of coupon payments per year.
3. Risk-free interest rate for an investment equals the yield of a default-free zero-coupon bond. Hence, zero-coupon yield curve (term structure).

Yield to maturity (YTM) is the rate of return to investors holding a bond till the end. It is considered as the internal rate of return or the discount rate that sets the present value of the bond payments equal to its current price.

Application: Stock Pricing

$$PV_S = \frac{D_1}{(1+R)} + \ldots + \frac{D_T}{(1+R)^T} + \frac{P_T}{(1+R)^T} = \sum_{t=1}^{T} \frac{D_t}{(1+R)^t} + \frac{P_T}{(1+R)^T}$$

1. Constant dividend zero growth: $PV_S = \frac{D}{R}$, where $D_1 = D_2 = \ldots = D$
2. Constant dividend growth: $PV_S = \frac{D_1}{R-g}$, where g is the growth rate
3. Non-constant dividend growth (or constant growth after t periods): $PV = \frac{D_1}{(1+R)} + \frac{D_2}{(1+R)^2} + \ldots + \frac{D_t}{(1+R)^t} + \frac{P_t}{(1+R)^t}$, where $P_t = \frac{D_t(1+g)}{(R-g)}$
4. Required rate of return (or the cost of equity): $R = \frac{D_1}{PV} + g$, where D/P is the dividend yield and g (dividend growth) is the capital gains yield.
5. No dividend: $PV = (P/E)^* \times EPS$, where EPS is earnings per share
6. No profit: $PV = (P/S)^* \times SPS$, where SPS is sales per share

Application: Capital Budgeting

$$NPV = PV_R - PV_C = (R_0 - C_0) + \frac{R_1 - C_1}{(1+IRR)} + \ldots + \frac{R_T - C_T}{(1+IRR)^T} = \sum_{t=0}^{T} \frac{R_t - C_t}{(1+IRR)^t} \geq 0$$

1. *NPV* criterion: choose the project with positive net present value.
2. *IRR* criterion: choose the project with an internal rate of return exceeding the hurdle rate (minimum required rate of return). Not always reliable!
3. *MIRR* criterion: choose the IRR^* after adjusting for all negative cash flows and reinvestment of all cash flows.
4. Payback criterion: choose the project with the length of time $T < T^*$ where the payback period T^* is the project with a length of time when the *NPV* turns positive.
5. Average accounting return = average earnings/average book value
6. Profitability index = present value of cash flows/initial investment cost

Valuation Factors in Warren Buffett's Toolkit (w)

Future Cash Flows	Probability*	Timing**	Amount**
Risk-Free Interest Rate	Yield on Long-Term U.S. Bonds		
****Clues to the Amount & Timing of Cash Flows***	Dividend Yield	Price to Earnings or to Book Value	Growth Rates
****Uncertainty***	New Businesses	Rapidly Changing Industries	
Growth	Growth is simply a component – usually a plus, sometimes a minus – in the value equation. Growth only adds value when ROIC > COC.		
Other	General Understanding of the Business Economics	Independent Thinking	Forever Changing
Tax Factors	Corporate Income Tax Rate		

https://www.oldschoolvalue.com/valuation-methods/warren-buffetts-formula-valuing-assets/

Top Financial Functions in Excel (w)

1. Future Value (FV) & FVSCHEDULE = (Principal, Schedule)
2. Present Value (PV) & Net Present Value (NPV) & XNPV
3. PMT & PPMT calcuates the periodic payment required
4. Internal Rate of Return (IRR) & Modified IRR & XIRR
5. NPER = (Rate, PMT, PV, [FV], [Type])
6. RATE = (NPER, PMT, PV, [FV], [Type], [Guess])
7. EFFECT = (Nominal Rate, NPERY)
8. NOMINAL = (Effective Rate, NPERY)
9. SLN (Cost, Salvage, Life) for depreciation via a straight-line method.

Outline

Metrics for Return and Risk

1. Period-to-period rate of return: $R_t = (P_t - P_{t-1})/P_{t-1} = (P_t/P_{t-1}) - 1$
2. Arithmetic average return: $E(R_t) = \sum_{t=1}^{T} R_t/T$ where R_t is the single period return calculate from percentage change in price.
3. Geometric average return: $(1+R_{GA})^T = (1+R_1)(1+R_2)...(1+R_T) = \prod_{t=1}^{T}(1+R_t)$
4. Aggregate return from : $(1+R_{0T}) = (1+R_{0,1})(1+R_{1,2})...(1+R_{T-1,T}) = \prod_{t=1}^{T}(1+R_{t-1,t})$
5. Continuous compounded rate of return: $R_t = Ln(P_t/P_{t-1})$ due to $\lim_{m\to\infty}(1+R/m)^m = e^{R_t} = P_t/P_{t-1}$ and $Ln(e_t^R) = R_t$
6. Weekday returns: Monday $R_1 = Ln(P_1/P_0)$, Tuesday $R_2 = Ln(P_2/P_1)$,..., Friday $R_5 = Ln(P_5/P_4)$ and the return over the week $R_{0,5} = Ln(P_5/P_0)$
7. Annualized returns: daily data $R \times 250$, weekly data $R \times 52$, monthly data $R \times 12$, quarterly data $R \times 4$, where R is the corresponding one-period return for the given data frequency.

Financial Markets: Return and Risk

1. Risk-free rate R_f: the default-free rate of interest in the debt market: T-bill, EFFR, Repos (collateralized), LIBOR (unsecured)
2. Yield to maturity YTM: the rate of return for holding the bond to expiration (annualized). Back out from the price.
3. Dividend yield D/P: dividend per share over stock price per share
4. Excess return: $R - R_f$ or $R - E(R)$, which is also unconditional
5. Abnormal return: $R - E(R|X)$, where $E(R|X)$ is conditional on X
6. Risk premium: $E(R) - R_f$ or $E(R|X) - R_f$ (bond/equity/forex)
7. Volatility risk: 1) V(R), SD, MAD; 2) Option VIX; 3) GARCH
8. Liquidity risk: Credit spread $R - R_f$ (TED: LIBOR-T-bill)
9. Inflation & recession risk: Yield/term spread $(Y_l - Y_s)$
10. Total risk=systematic/market risk+unsystematic/individual risk
11. Higher return must compensate investors for bearing higher risk

Statistical Approach to Return and Risk

1. Historical return (unconditional expectation): $E(R_t) = \sum_{t=1}^{T} R_t / T$
2. Historical risk (unconditional variance): $V(R_t) = \frac{1}{T-1} \sum_{t=1}^{T} [R_t - E(R_t)]^2$
3. Conditional return: $E(R|X) = \sum_{i=1}^{N} P_i R_i$ where $P_i = Prob(R_i|X = i)$
4. Conditional risk: $V(R|X) = \sum_{i=1}^{N} P_i [R_t - E(R_t)]^2$ where $\sum_{i=1}^{N} P_i = 1$
5. Covariance (comovement) between two asset returns (1 and 2):
   $Cov(R_1, R_2) = \frac{1}{T-1} \sum_{t=1}^{T-1} [R_{1,t} - E(R_1)][R_{2,t} - E(R_2)]$
6. Correlation coefficient between two asset returns: $\rho_{1,2} = \frac{Cov(R_1,R_2)}{\sigma_{R_1} \times \sigma_{R_2}}$,
   where $\sigma_{R_i} = \sqrt{V(R_i)}$ is the standard deviation of the asset return.
7. Variance of the summation of two asset returns:
   $V(R_1 + R_2) = V(R_1) + V(R_2) + 2Cov(R_1, R_2)$
   $V(R_1 - R_2) = V(R_1) + V(R_2) - 2Cov(R_1, R_2)$

Portfolio Construction Theory

Two-asset portfolio case: $R_P = w_1 R_1 + w_2 R_2$, where $w_1 + w_2 = 1$ are the portfolio weights (proportions) invested in asset one and asset two.

$E(R_P) = w_1 E(R_1) + w_2 E(R_2)$, $V(w_1 R_1) = w_1^2 \sigma_1^2$, $V(w_2 R_2) = w_2^2 \sigma_2^2$
$V(R_P) = w_1^2 V(R_1) + w_2^2 V(R_2) + 2 w_1 w_2 Cov(R_1, R_2)$
$V(R_P) = w_1^2 \sigma_1^2 + w_2 \sigma_2^2 + 2 w_1 w_2 \rho_{1,2} \sigma_1 \sigma_2 = \sigma_P^2$

1. When $\rho = +1, \sigma_P = w_1 \sigma_1 + w_2 \sigma_2$ (weighted average of individuals)
2. When $\rho = 0, \sigma_P = (w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2)^{1/2} < w_1 \sigma_1 + w_2 \sigma_2$ (risk reduction)
3. When $\rho = -1, \sigma_P = |w_1 \sigma_1 - w_2 \sigma_2| \Rightarrow w_1 / w_2 = \sigma_2 / \sigma_1$ for $\sigma_P = 0$ (Risk elimination to zero for perfectly negatively correlated assets.)
4. When $-1 < \rho < 1, |w_1 \sigma_1 - w_2 \sigma_2| < \sigma_R < w_1 \sigma_1 + w_2 \sigma_2$

N-asset portfolio case: $\sum_{i=1}^{N} w_i = 1$, $R_P = \sum_{i=1}^{N} w_i R_i$, $E(R_P) = \sum w_i E(R_i)$, $V(R_P) = \sum_{i=1}^{N} \sum_{j=1}^{N} w_i w_j Cov(R_i, R_j)$, where $Cov(R_i, R_i) = V(R_i) = \sigma_{R_i}^2$

Mean-Variance Efficient Frontier

Assumptions: 1) In investment decisions, all investors are only interested in the expected return and variances and covariances of the securities; 2) Transaction costs in financial markets are negligible.

- Efficient frontier: The points on the efficient frontier are the points that correspond to the highest mean for a given level of variance, as well as the points that correspond to the lowest variance for a given mean level.
- Minimum variance portfolio: The leftmost point on the curve of efficient frontier. It represents the portfolio that has the smallest possible variance.
- One-fund theorem: Any portfolio on the efficient frontier line can be obtained by trading in the fund and the risk-free asset.

Cvitanic and Zapatero (2004), CH5, Introduction to the Economics and Mathematics of Financial Markets. MIT Press.

Efficient Portfolio and Optimal Investment

1. Efficient portfolios offer investors the highest possible expected return for a given level of risk. The set of efficient portfolios is called the efficient frontier. As investors add stocks to a portfolio, the efficient portfolio improves.
   - An investor seeking high expected returns and low volatility should invest only in efficient portfolios.
   - Investors will choose from the set of efficient portfolios based on their risk preference (tolerance).
2. Investors may use short sales in their portfolios. A portfolio is short by borrowing stocks from a broker, constructing negative portfolio weights. Short selling extends the set of possible portfolios.

Berk and DeMarzo (2020), CH11, Corporate Finance, 5e. Pearson.

Efficient Portfolio and the Capital Market Line

- On the efficient frontier of risky investments, the tangent portfolio with the highest return over risk ratio is the most efficient investment decision.
- Investments on the tangent line connecting the risk-free asset and the tangent portfolio provides the best risk and return tradeoff among all available options to the investor.
- The capital market line (CML) depicts portfolios combining the risk-free investment and the efficient portfolio, and shows the highest expected return that the investor can attain for each level of volatility.
- According to the CAPM, the market portfolio is on the CML and all other stocks and portfolios contain diversifiable risk and lie to the right of (and below) the CML.

Berk and DeMarzo (2020), CH11, Corporate Finance, 5e. Pearson.

Capital Asset Pricing Model (CAPM)

Assumptions: 1) Investors hold homogeneous expectations regarding the means, variances, and covariances of the returns of securities; 2) Investors choose efficient portfolios in competitive capital markets.

$$\boxed{E(R_i) = R_f + \beta_i[E(R_M) - R_f]}$$

- The market portfolio is the efficient portfolio. Therefore, the highest expected return for any given level of volatility is obtained by a portfolio on the capital market line (CML), which combines the market portfolio with a risk-free asset.
- The risk premium for any investment is proportional to its beta with the market. Therefore, the relationship between expected return and risk is given by the security market line (SML).

Source: Berk and DeMarzo (2020), CH11, Corporate Finance, 5e. Pearson.

CAPM Regression and Test

In CAPM equilibrium, the expected return of a risky security depends only on its beta, and securities (portfolios) with a higher beta should offer a higher expected return. The CAPM regression model:

$$\boxed{R_i = R_f + \beta_i(R_M - R_f) + \varepsilon_i, where \;\; \varepsilon_i \sim N(0, \sigma^2_{\varepsilon_i})}$$

1. Excess rate of return of stock: $ER_i = R_i - R_f$ or security excess return
2. Excess rate of return of market: $ER_M = R_M - R_f$ or market excess return
3. Regression coefficients: $\hat{\beta}_i = Cov(R_i, R_M)/Var(R_M)$, $\hat{\alpha}_i = \overline{ER_i} - \hat{\beta}_i \overline{ER}_M$
4. CAPM hypothesis testing: $H_0 : \alpha_i = 0$ (abnormal return is zero) versus $H_1 : \alpha_i > 0$ (abnormal return is positive, relative to the market)

The Security Market Line

Securities Market Line (SML): Under the CAPM assumption, in equilibrium, the SML is the line along which all individual securities should lie when plotted according to their expected return and beta relationship.

$$\boxed{E(R_i) = R_f + [E(R_M) - R_f]\beta_i}$$

- The slope of the SML is $E(R_M) - R_f$ and the intercept is R_f.
- Market $\beta_M = 1$, by definition and equality of CAPM equation.
- The beta of a security measures the amount of the security's risk that is common to the market portfolio or market risk.
- The higher the beta, the riskier is the security relative to the market, thus a higher expected return relative to the market.

Source: Berk and DeMarzo (2020), CH11, Corporate Finance, 5e. Pearson.

CAPM Risk Decomposition

$$CAPM\ coefficient: \hat{\beta}_i = \frac{Cov(R_i, R_M)}{Var(R_M)} = \frac{\rho_{i,M}\sigma_{R_i}\sigma_{R_M}}{\sigma_M^2} = \frac{\rho\sigma_{R_i}}{\sigma_M}$$

$$CAPM\ regression: R_i = R_f + \beta_i(R_M - R_f) + \varepsilon_i, where \varepsilon_i \sim N(0, \sigma_{\varepsilon_i}^2)$$

$$CAPM\ variance: V(R_i) = V(R_f) + V[\beta_i(R_M - R_f)] + V(\varepsilon_i) = \beta_i^2\sigma_M^2 + \sigma_{\varepsilon_i}^2$$

- The beta of a security measures its volatility due to market risk relative to the market, and thus captures the security's sensitivity to market risk.
- Total risk = market risk + specific risk = $\beta_i^2\sigma_M^2 + \sigma_{\varepsilon_i}^2 = \sigma_i^2$
- Diversification via portfolio optimization can eliminate idiosyncratic risk
- Market risk is systematic whereas specific risk is individual and nonsystematic (idiosyncratic).

CAPM Market Practice

1. Jensen index: α-Alpha (or its estimates). A positive alpha means that a security is performing better than CAMP prediction and may be underpriced. Weakness: lack of indication of risk level.
2. Treynor index: $[E(R_i) - R_f]/\beta_i$, if the index of a security is greater than $E(R_M) - R_f$ then the security is performing better than it should according to the CAPM
3. Sharpe index: $[E(R_i) - R_f]/\sigma_i$, the higher the index of a security, the better the security, in the M-V sense. In the CAPM, optimal investment is bet on the CML, which corresponds to the Sharpe index of the market portfolio $[E(R_M) - R_f]/\sigma_M$

Cvitanic and Zapatero (2004) Introduction to the Economics and Mathematics of Financial Markets. MIT Press.

The Costs of Equity R_E: Estimation

1. CAPM-SML Approach: $E(R_i) = R_f + \beta[E(R_M) - R_f]$
   - Risk-free rate: R_f shall match the term structure of the equity
   - Stock beta: β_i is the coefficient from a time series regression
   - Market risk premium: $E(R_M) - R_f$
2. Stock dividend growth model: $R_E = D_1/P_0 + g$ where $D_1 = D_0(1+g)$ and g is the expected growth rate of the dividend.
3. The cost of a prefer stock: $R = D/P$
4. Market proxy or industry average

The Cost of Debt R_D: Estimation

1. Investment grade debts: $R_D = YTM$ (yield-to-maturity)
2. High yield debts: $R_D = YTM - P(Default) - E(LR)$ where default probability and expected loss rate are factored in pricing.
3. Bond portfolio: $R_{WACD} = \sum_i^N w_i R_{Di}$ where $w_i = MV_i / \sum MV_i$
4. CAPM-debt beta approach and debt rating adjustment.
5. Effective tax-shield debt cost $= R_D(1-\tau)$, where R_D is the interest rate on debt and τ is the corporate tax rate.

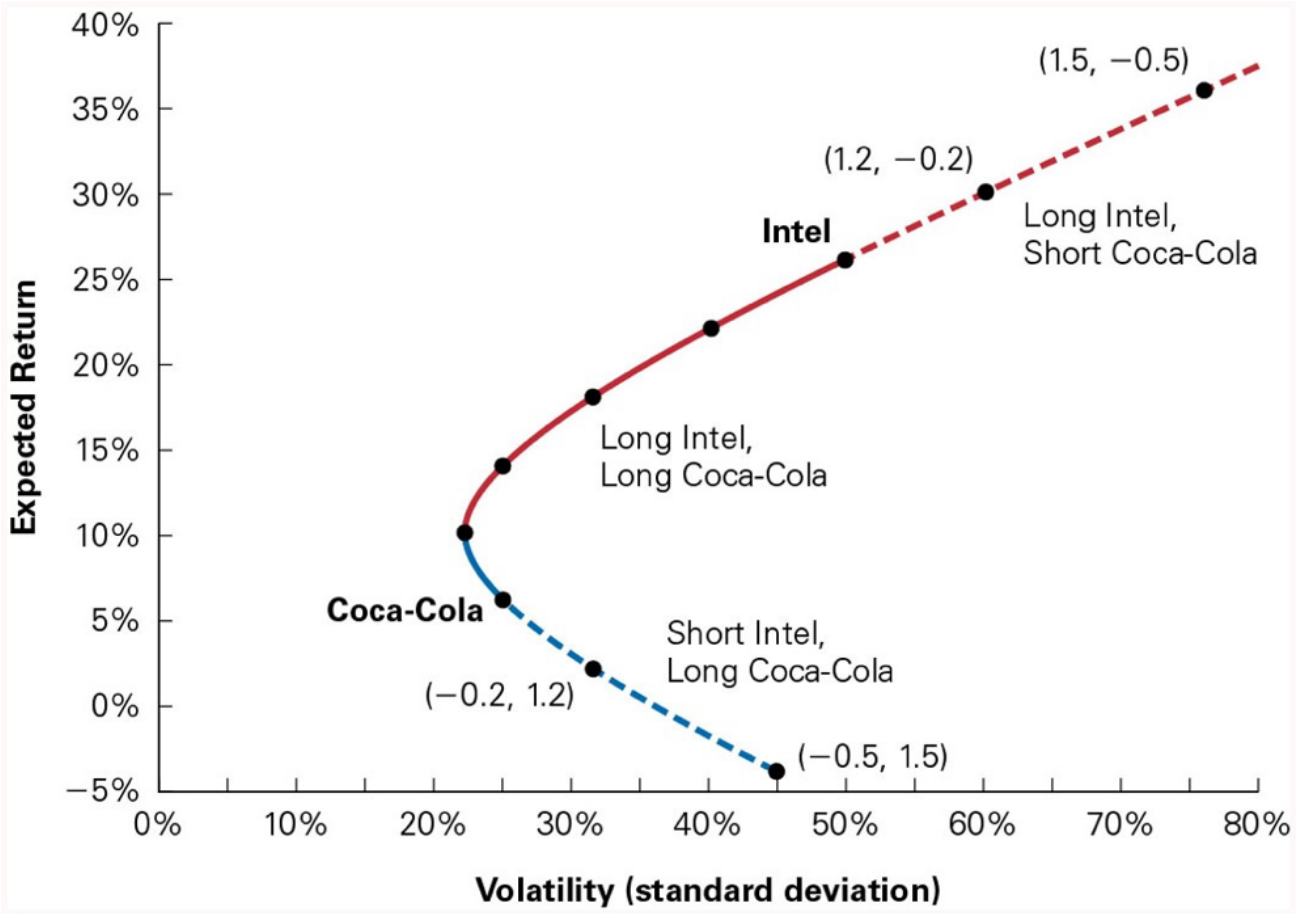
The Weighted Average Cost of Capital (WACC)

The weighted average cost of capital is the effective after-tax cost of capital.

$$R_{WACC} = \frac{E}{E+D}R_E + \frac{D}{D+E}R_D(1-\tau) = R_U - \frac{D}{D+E}\tau R_D$$

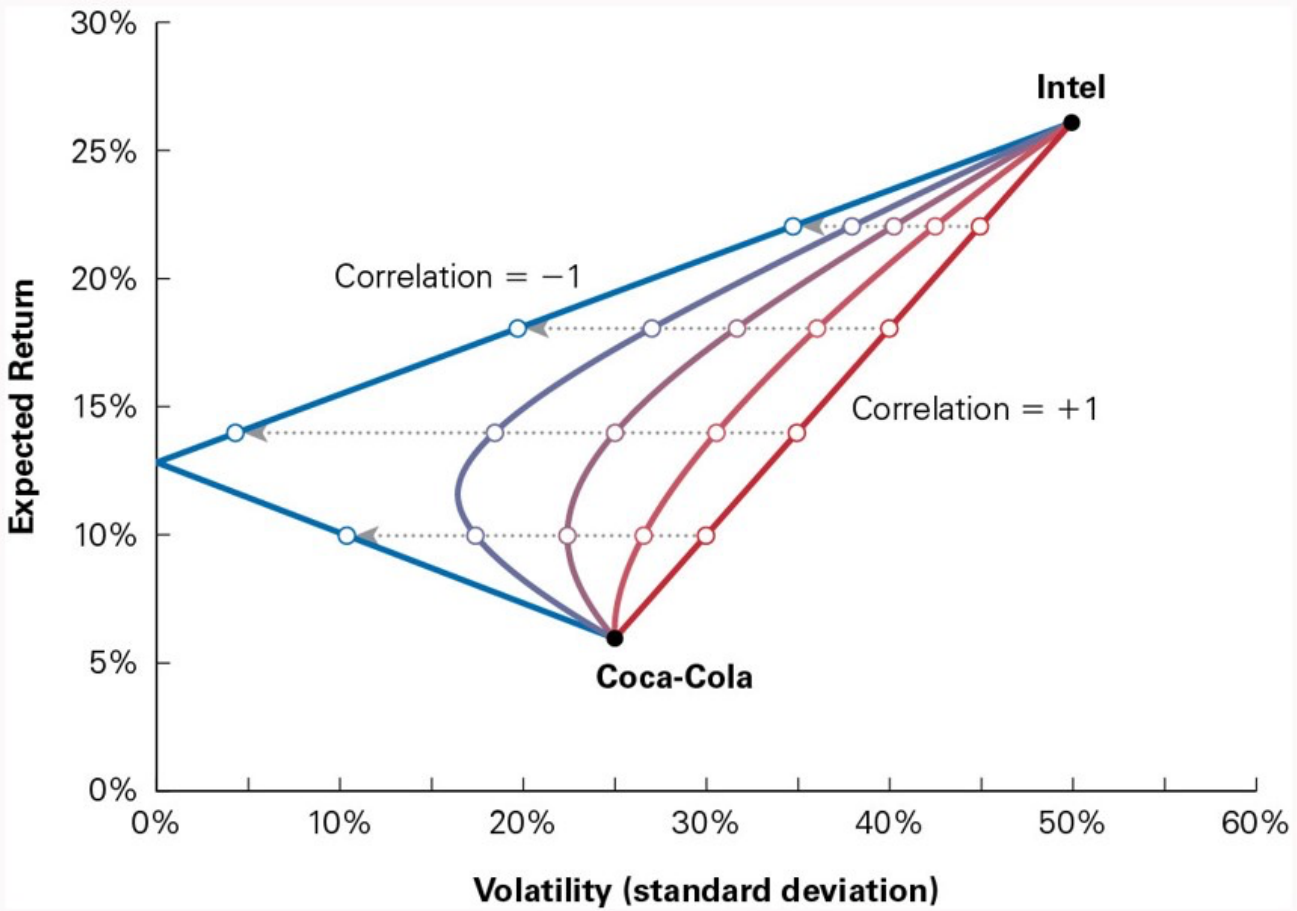
- Capital Value = Debt Value + Equity Value or $V = D + E$
- Capital structure weights: $w_D = D/V$, $w_E = E/V$, $D + E = V$
- Weight average cost of capital (pre-tax): $R_U = (D/V)R_D + (E/V)R_E$
- WACC including preferred stocks: $V = D + P + E$, $w_E + w_P + w_D = 1$
  $WACC = w_E R_E + w_P R_P + w_D R_D = (E/V)R_E + (P/V)R_P + (D/V)R_D$
- Debt tax shield effect: $WACC = (E/V)R_E + (1-\tau)(D/V)R_D$ where τ is the corporate tax rate

Portfolio Construction: Two-Asset Case



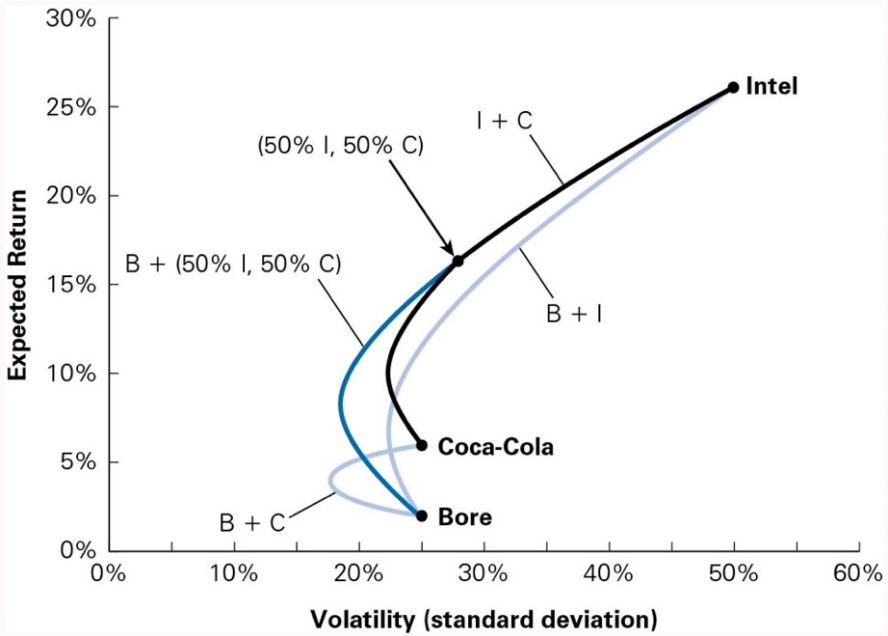
Source: Berk & DeMarzo (2020). Mean-variance portfolio construction.

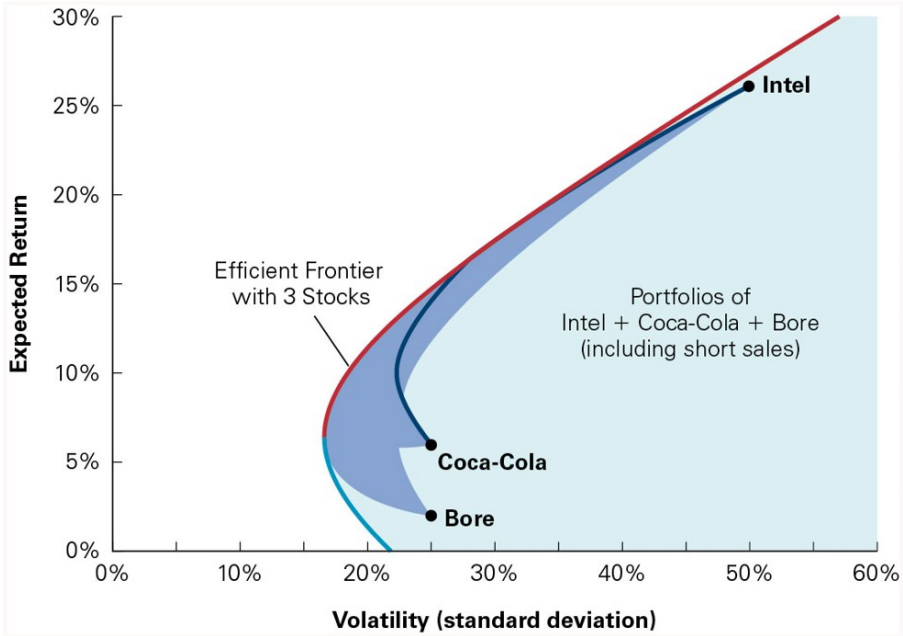
Portfolio Construction: Envelopes



Source: Berk & DeMarzo (2020)

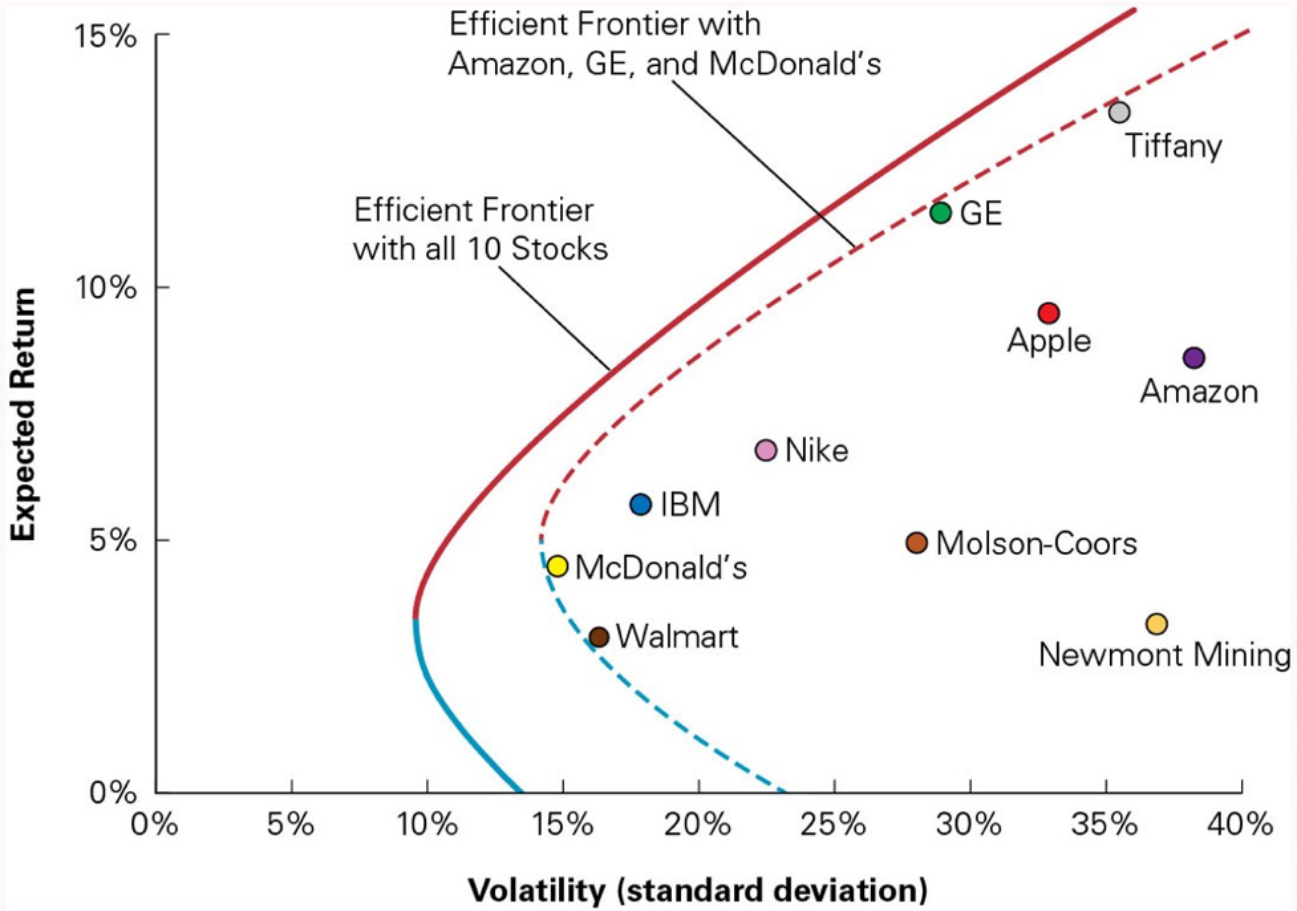
Portfolio Construction: Efficient Frontier





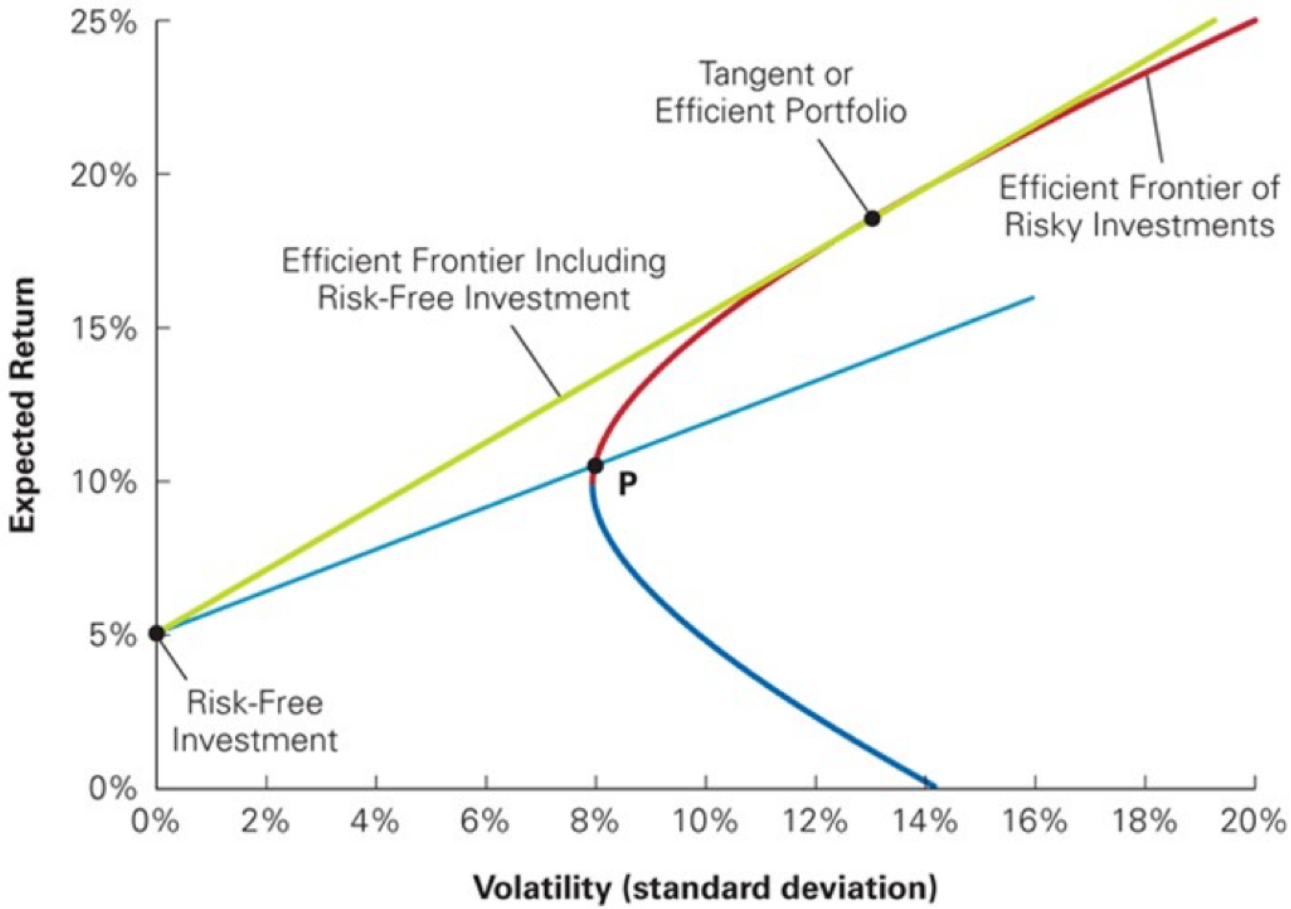
Source: Berk & DeMarzo (2020). The best return-risk combinations are on the efficient frontier, which improves when investors move from two to three stocks, generating a higher return at each given level of risk.

Efficient Portfolio Frontiers: Three vs Ten Stocks



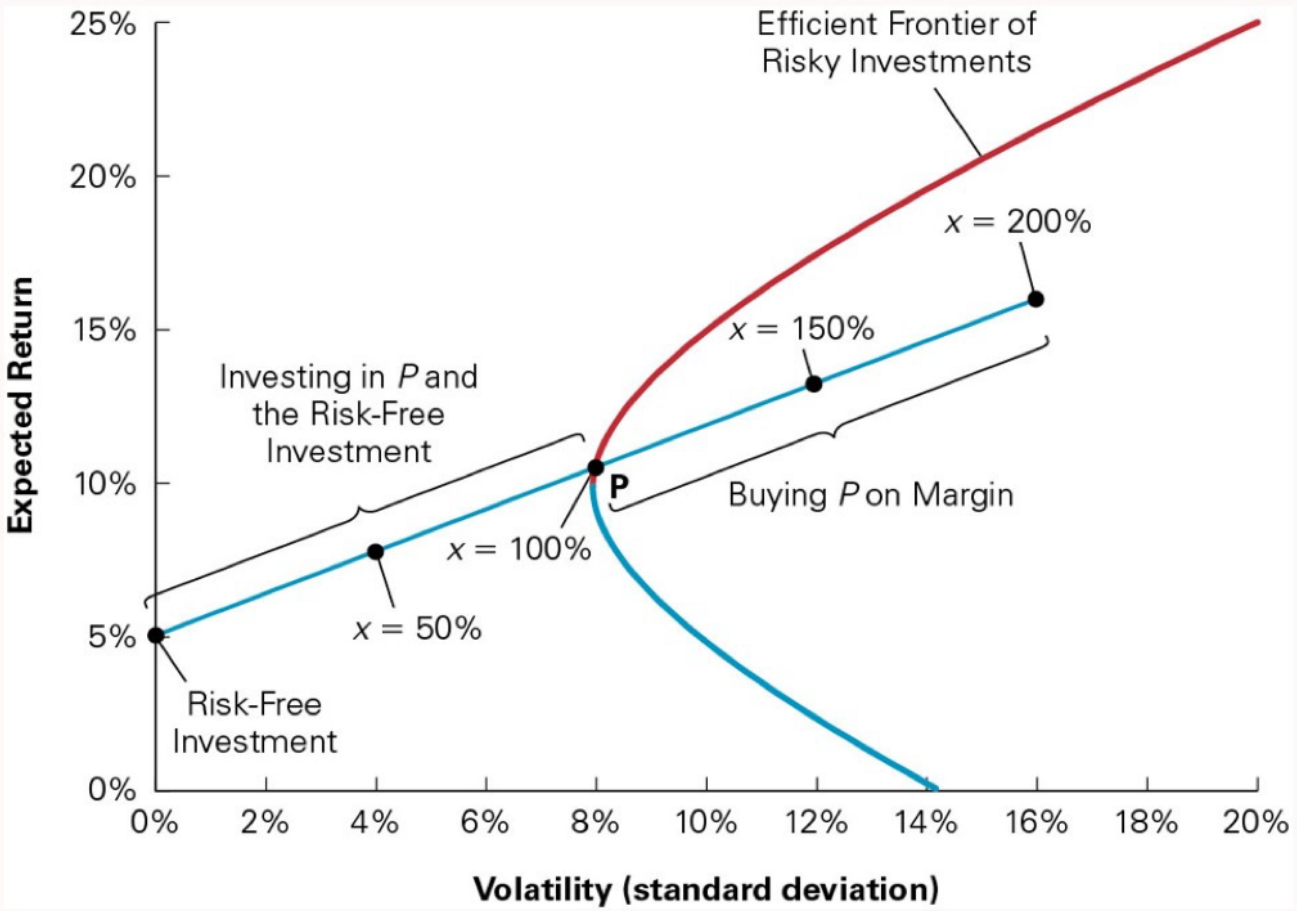
Source: Berk & DeMarzo (2020)

Efficient Frontier with a Risk-Free Asset



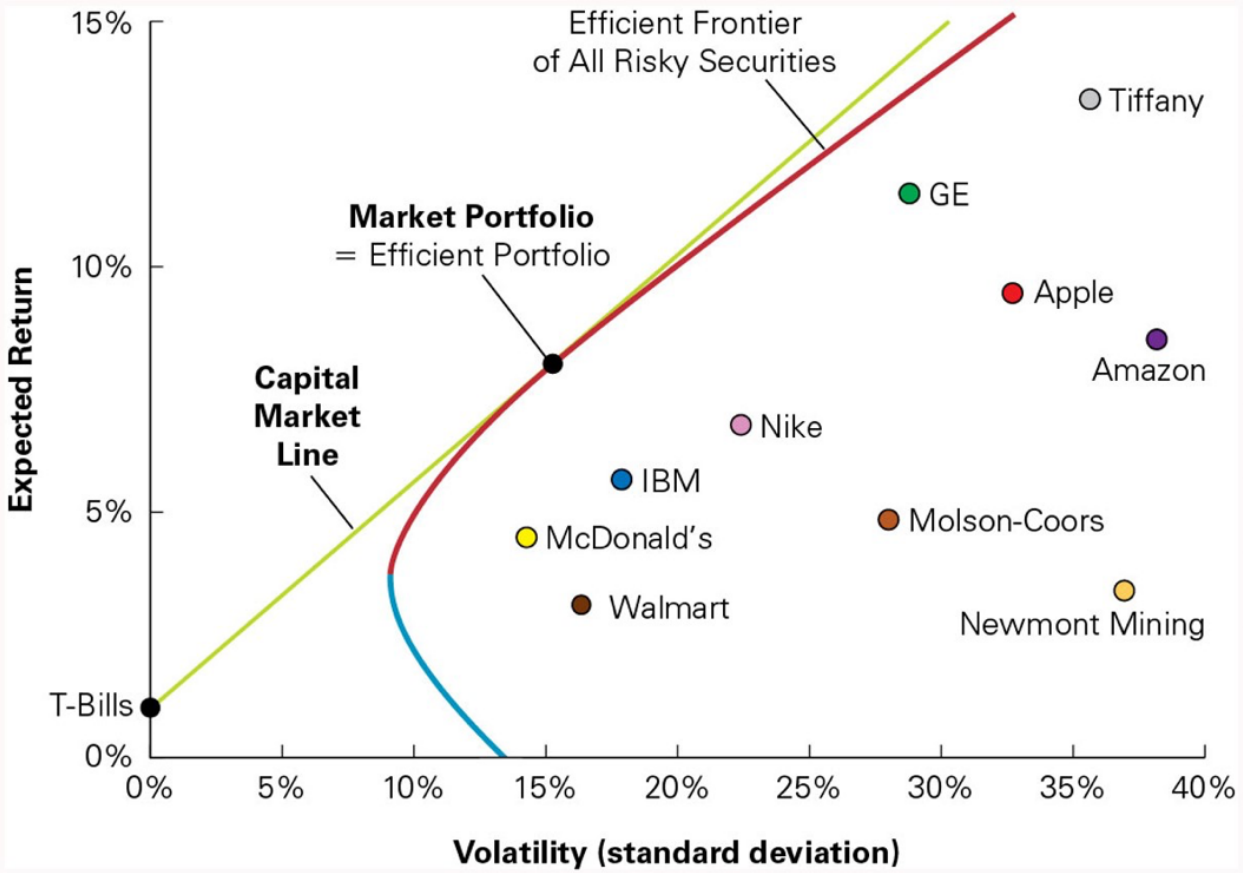
Source: Berk & DeMarzo (2020)

Efficient Frontier with Short Positions



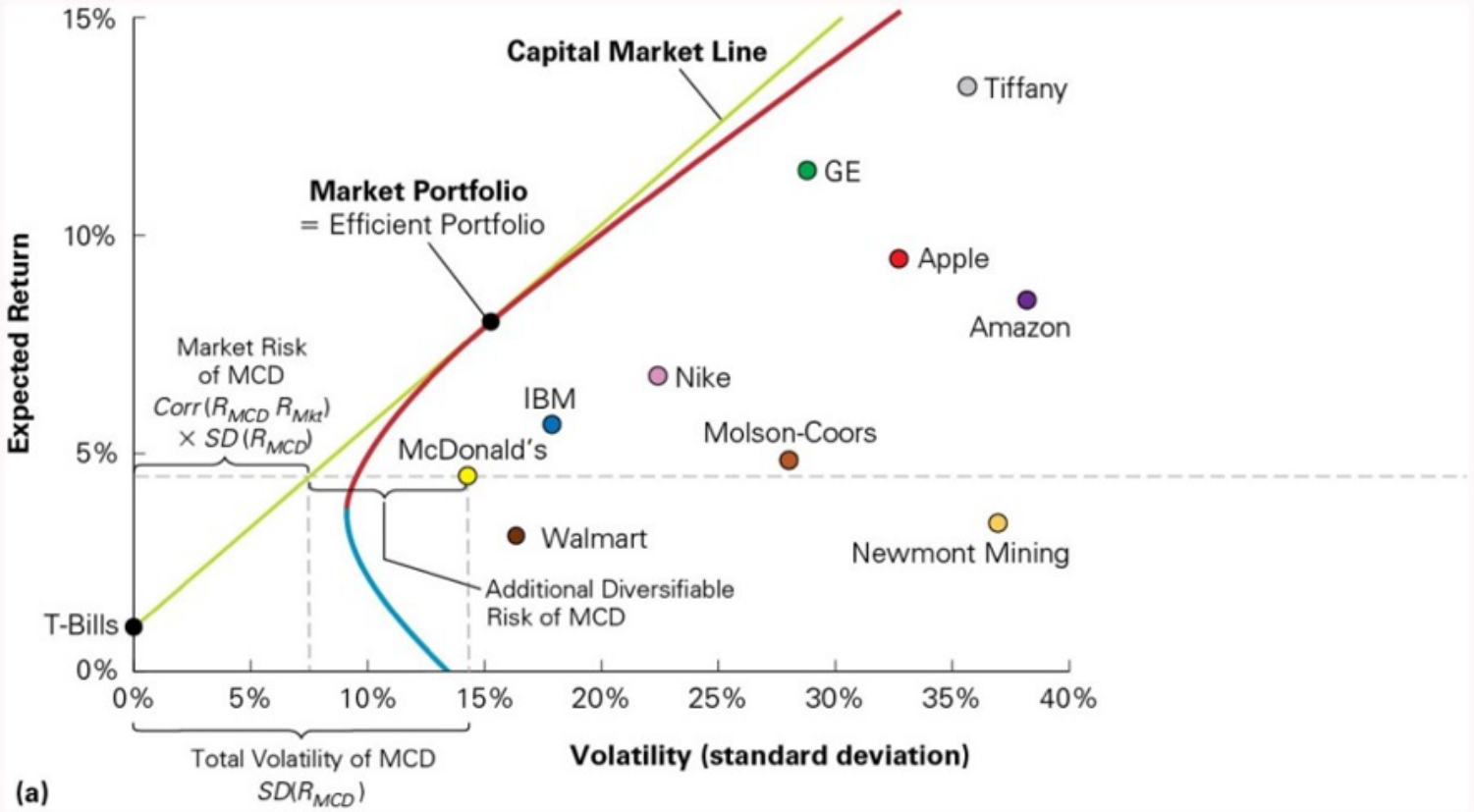
Source: Berk & DeMarzo (2020)

Market Portfolio and Capital Market Line



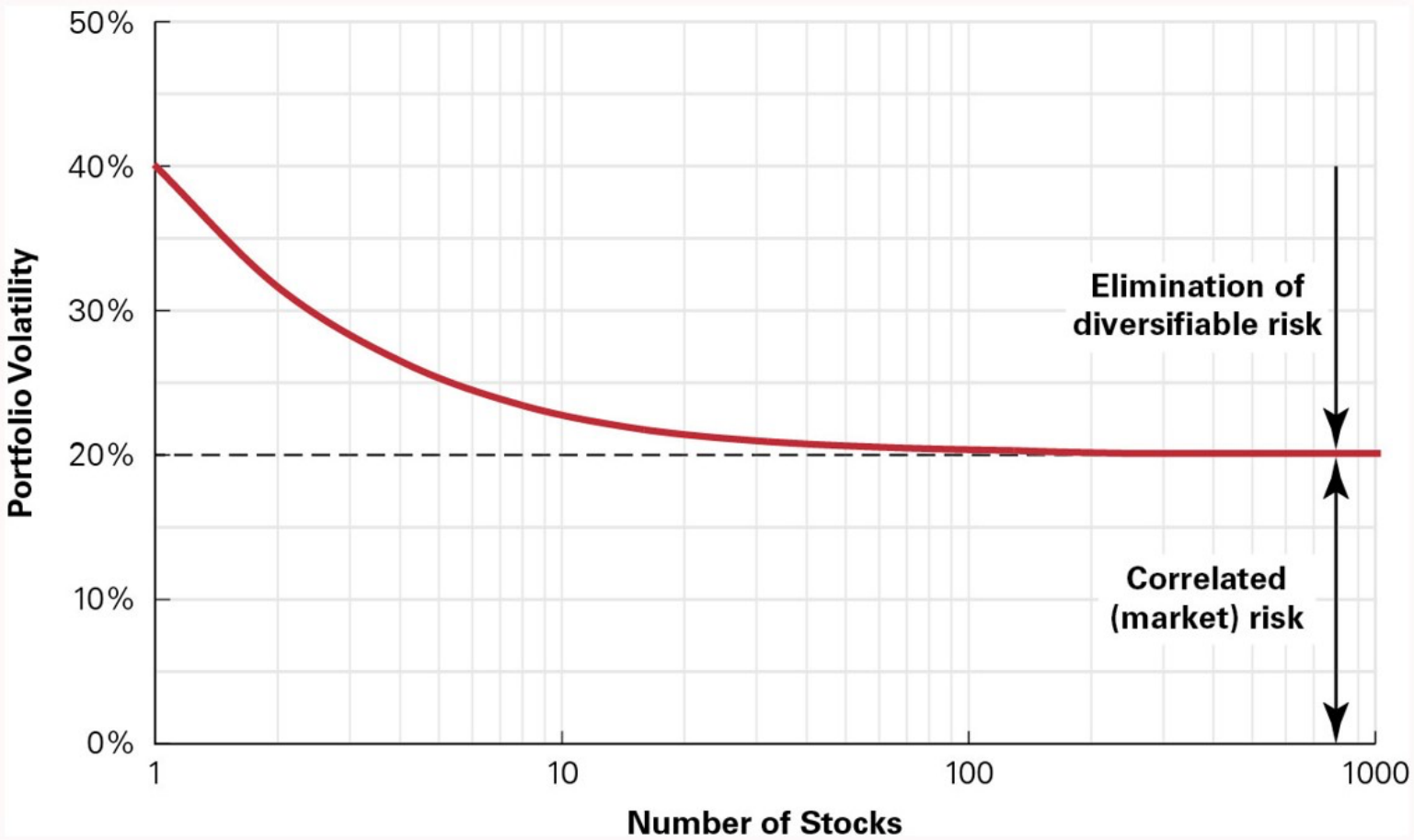
Source: Berk & DeMarzo (2020). The CML depicts portfolios combining the risk-free investment and the efficient portfolio, and shows the highest expected return that investors can attain for each level of volatility.

CAPM Risk Decomposition



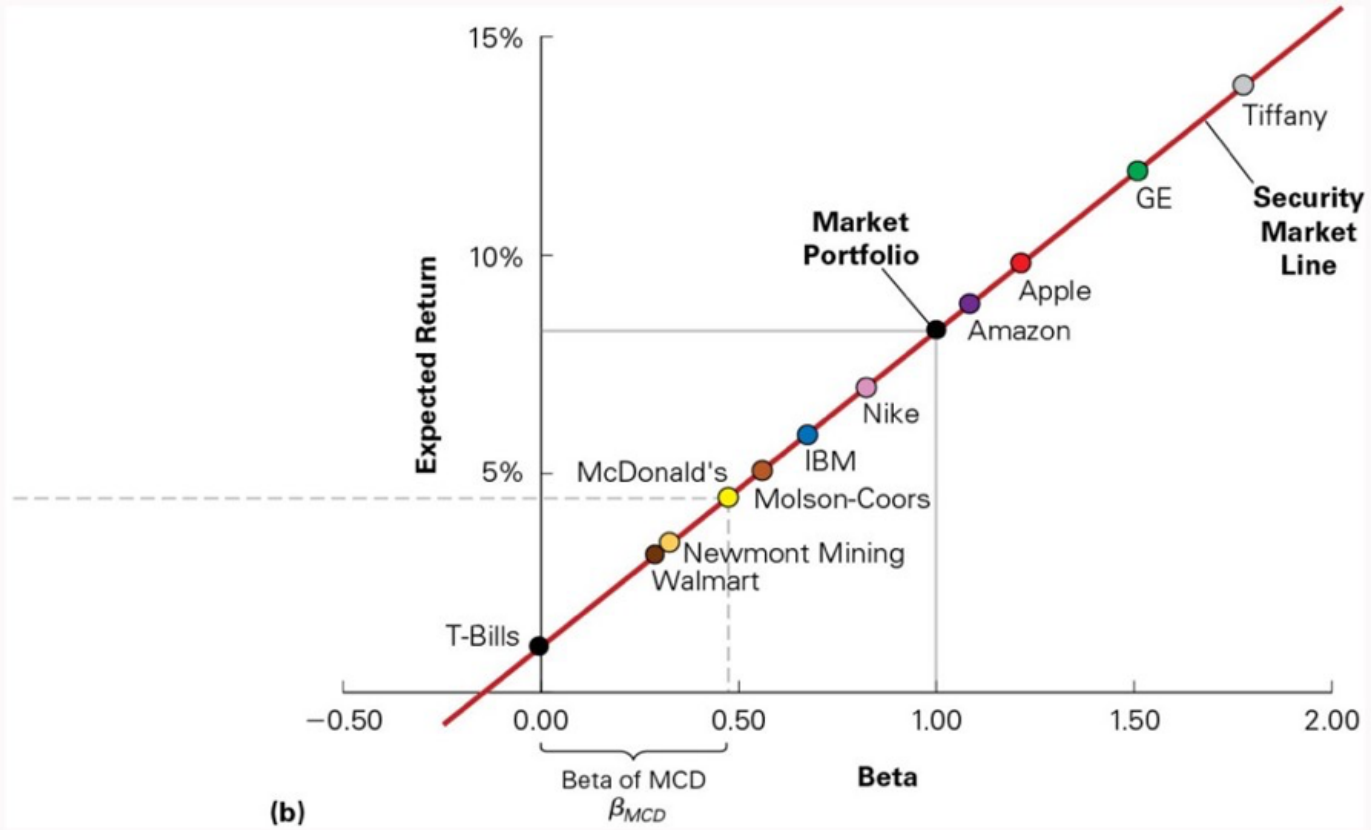
Source: Berk & DeMarzo (2020). According to the CAPM, the market portfolio is on the CML and all other stocks and portfolios contain diversifiable risk and lie to the right of the CML.

Portfolio Risk Diversification



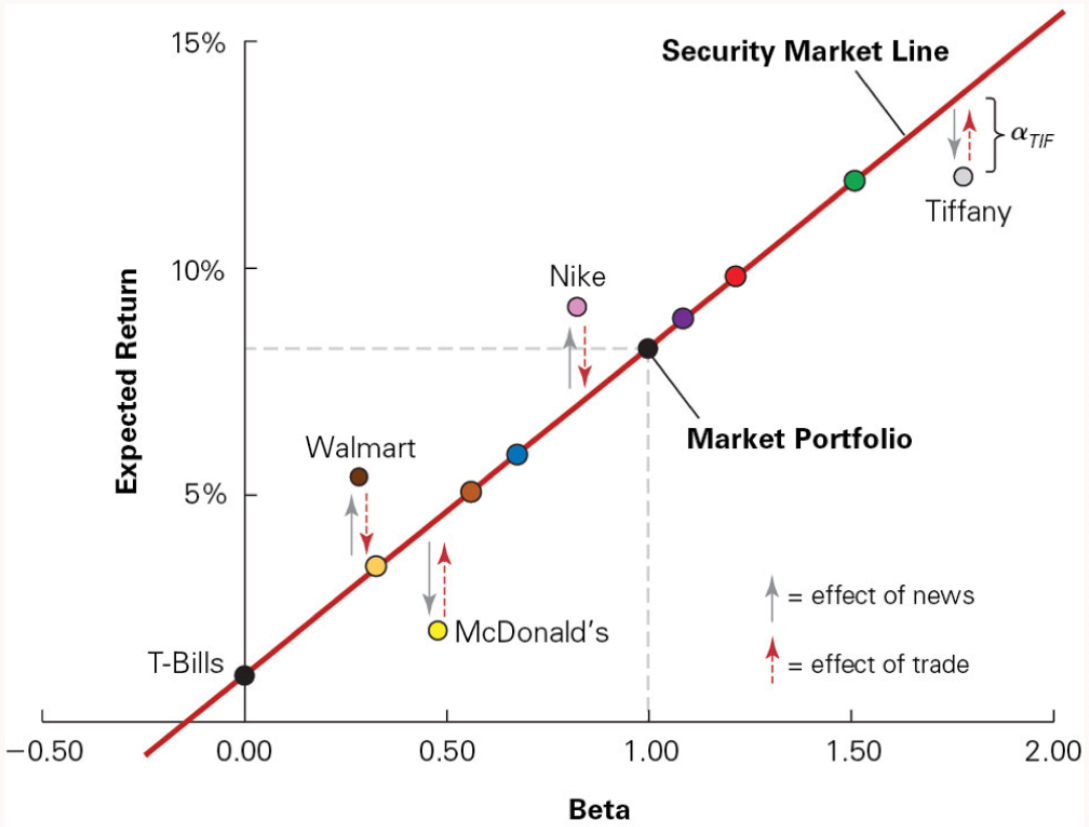
Source: Berk & DeMarzo (2020).

CAPM and Security Market Line



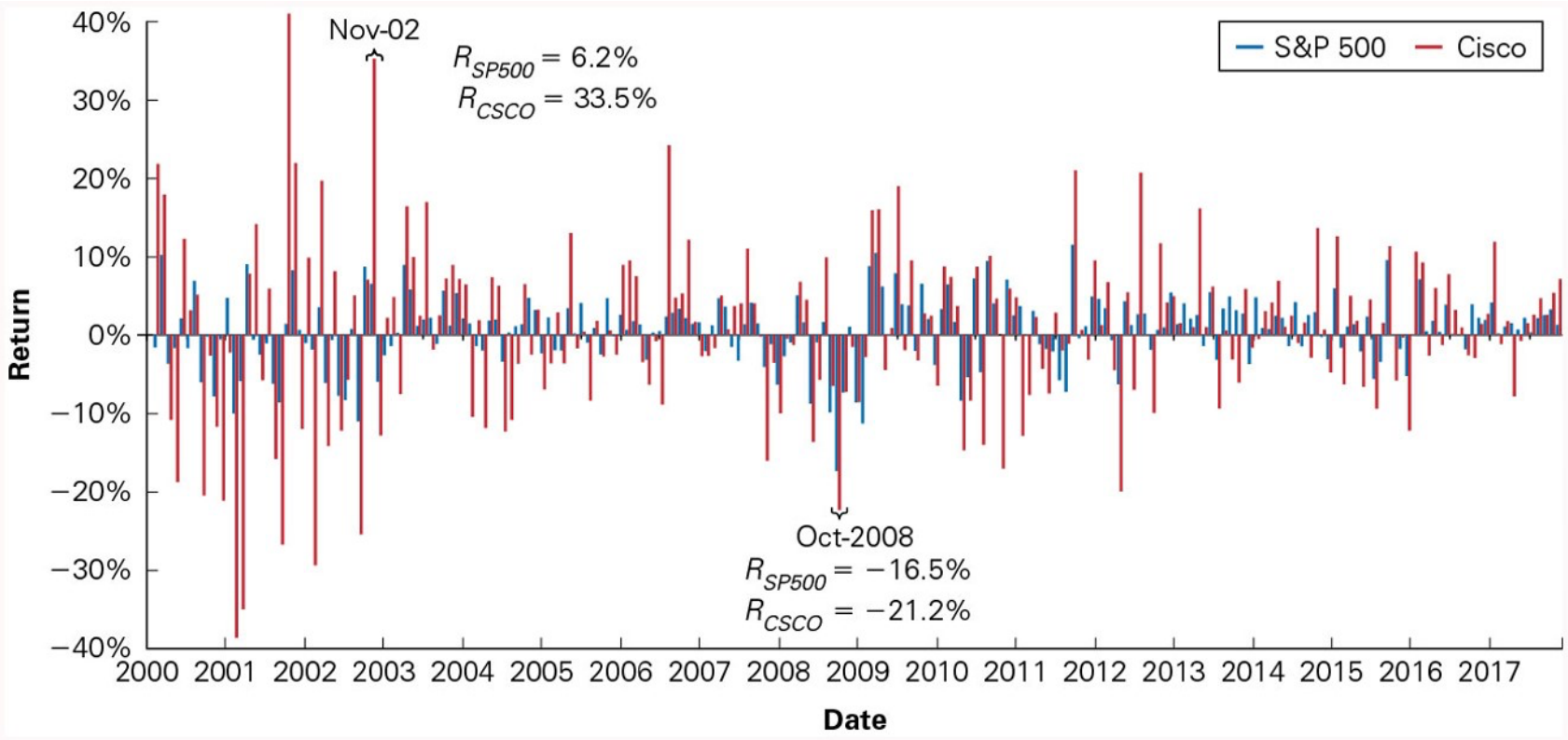
Source: Berk & DeMarzo (2020). According to CAPM, the market portfolio is efficient, so all stocks and portfolios should lie on the SML, which shows the $E(R_i)$ for a security as a function of its beta with the market.

Security Market Line and Deviations



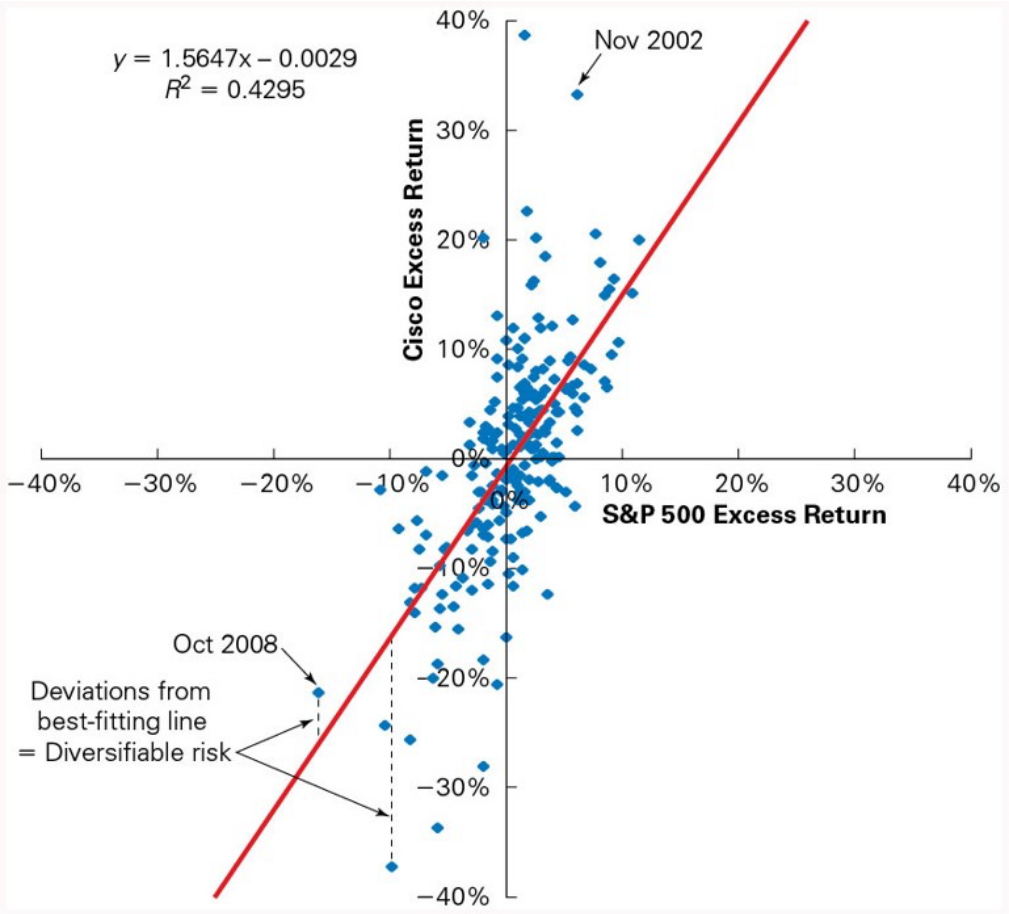
Source: Berk & DeMarzo (2020). If capital market is not efficient or transaction costs are present, then stocks will not all lie on the SML. The distance of a stock above or below the SML is the stock's alpha.

S&P500 v.s. Cisco Monthly Returns, 2000 to 2018



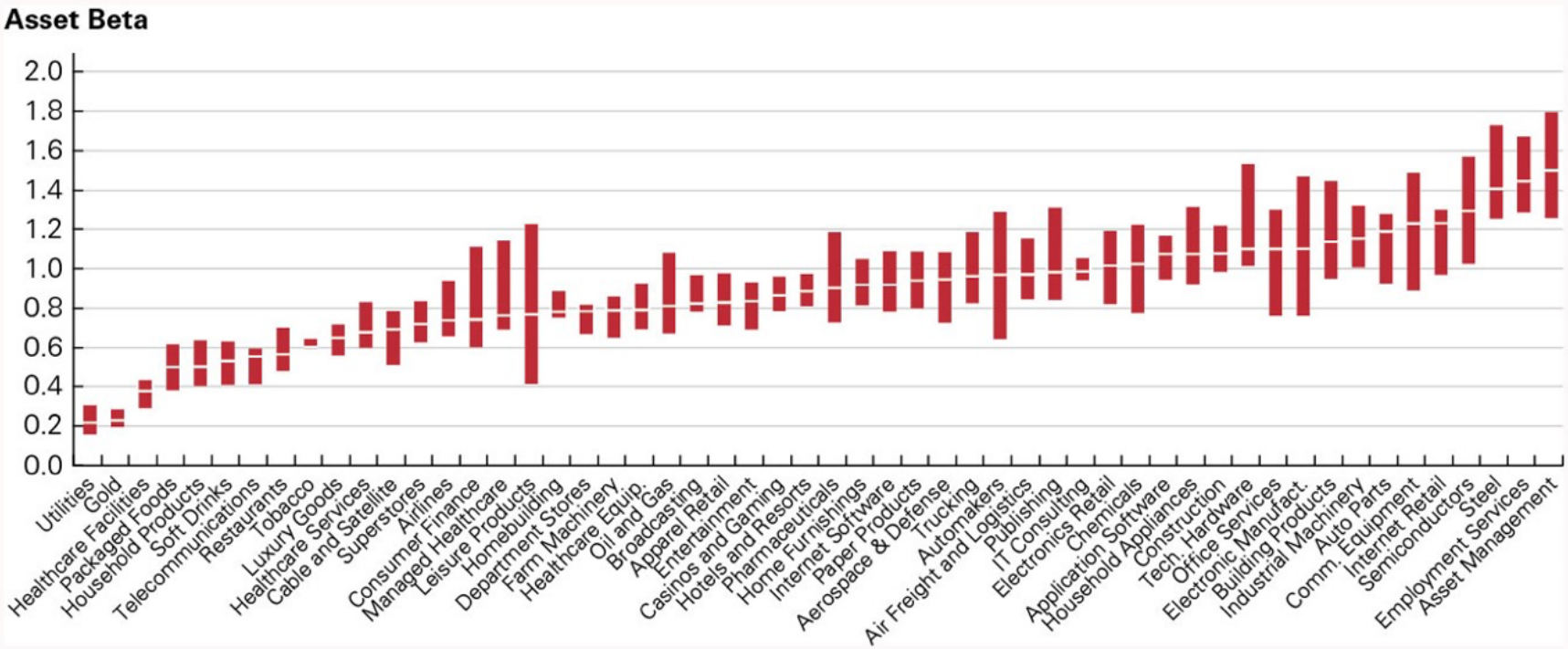
Source: Berk & DeMarzo (2020)

CAPM Regression Line



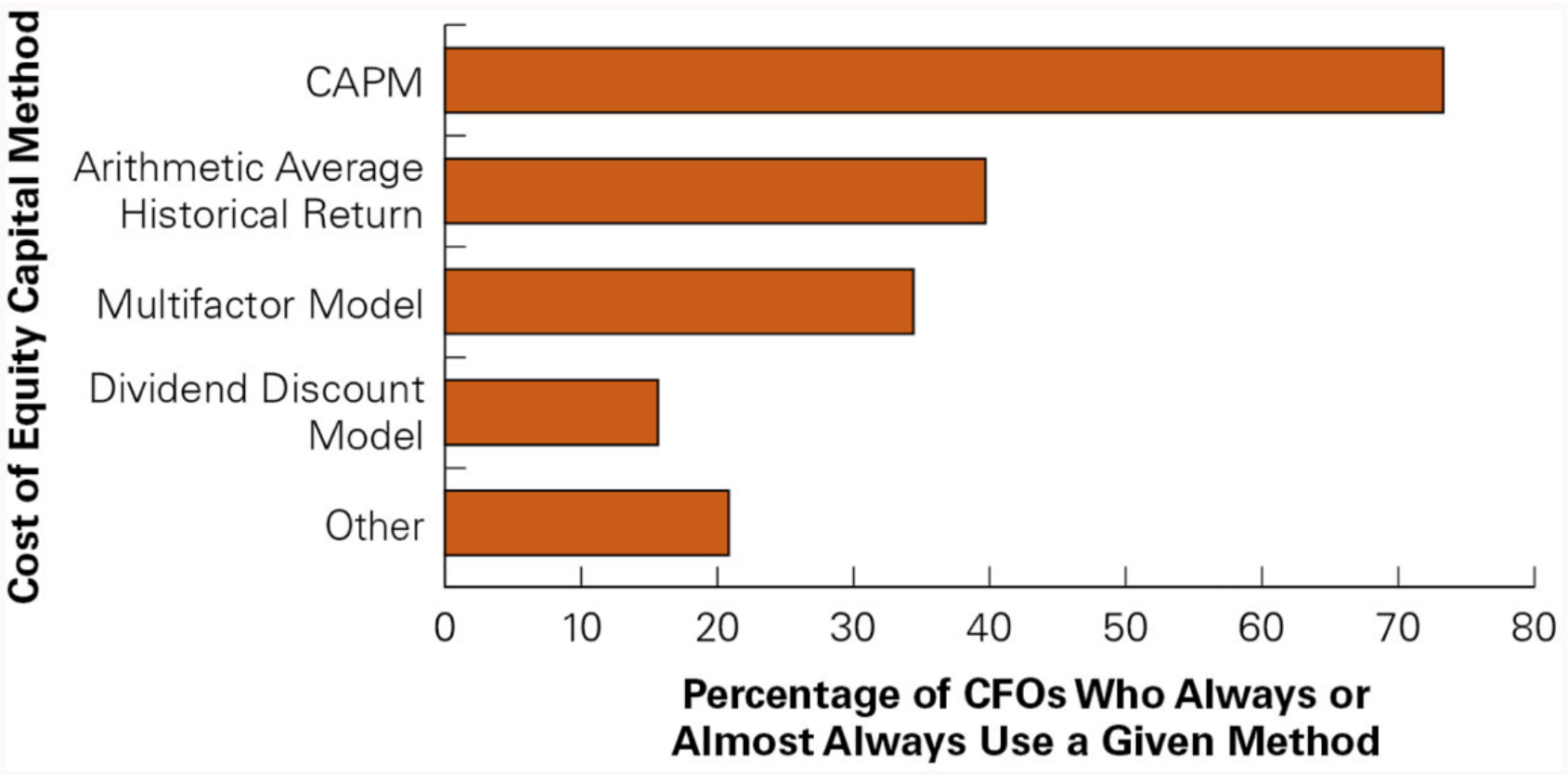
Source: Berk & DeMarzo (2020)

Stock Betas by Sector



Source: Berk & DeMarzo (2020)

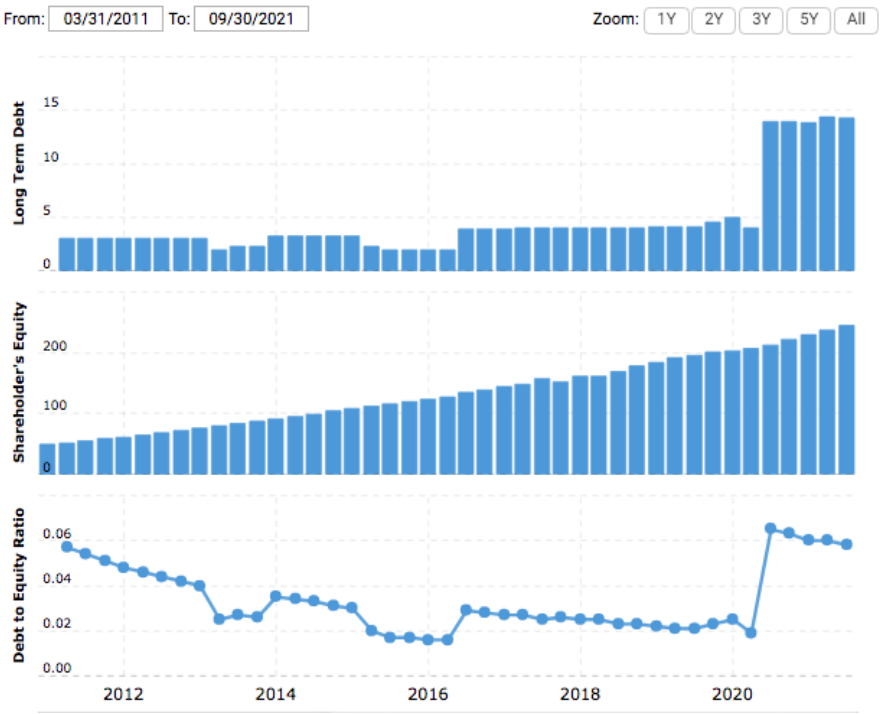
What Methods do CFOs Prefer?

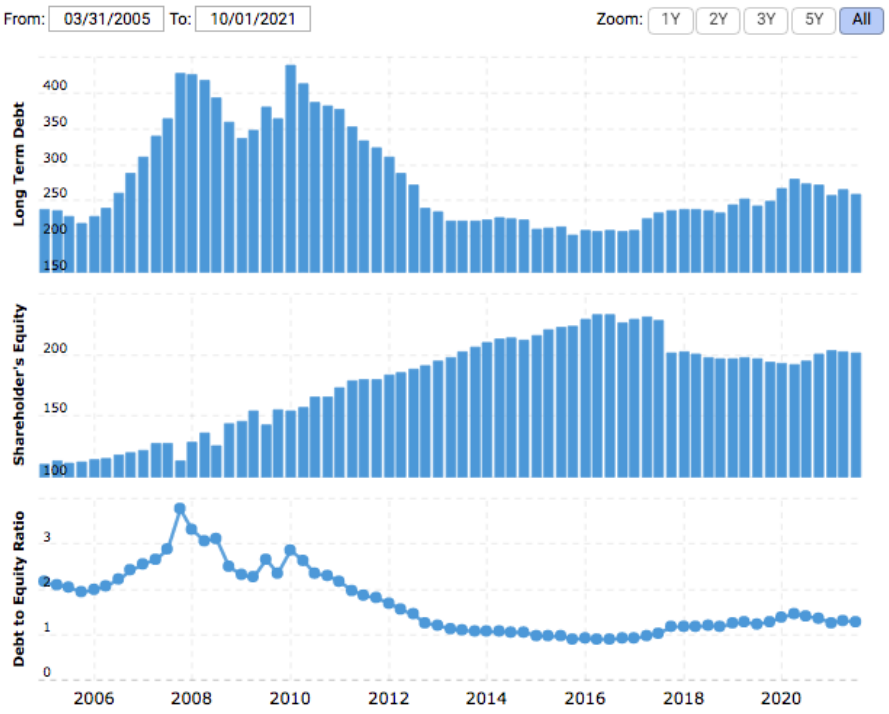


Source: Berk & DeMarzo (2020)

Outline

Debt to Equity Ratio: Alphabet vs Citigroup (w)





Note: The debt/equity ratio can be defined as a measure of a company's financial leverage calculated by dividing its long-term debt by stockholders' equity.

`https://www.macrotrends.net/stocks/charts`

Debt to Equity Ratio: Industry Ranking (w)

Debt to Equity Ratio Best performing Industry Ranking

Industry	Ranking	Industries Ranking	Within the Sector	Ratio
Industry Screening • Debt to Equity Ratio • Includes every company within the Industry. • also displays industry ranking within it's sector	1	Consumer Electronics	1	0.00
	2	Consulting Services	2	0.07
	3	Internet Services & Social Media	3	0.09
	4	Audio & Video Equipment	4	0.11
	5	Property & Casualty Insurance	5	0.11
	6	In Vitro & In Vivo Diagnostic Substances	6	0.17
	7	Laboratory Analytical Instruments	7	0.22
	8	Agricultural Production	8	0.22
	9	Computer Networks	9	0.23
	10	Life Insurance	10	0.25

Debt to Equity Ratio worst performing Industry Ranking

Industry	Ranking	Industries Ranking	Within the Sector	Ratio
Industry Screening • Debt to Equity Ratio • Includes every company within the Industry. • also displays industry ranking within it's sector	1	Restaurants	1	11.21
	2	Airline	2	5.20
	3	Miscellaneous Financial Services	3	5.01
	4	Movies and Entertainment	4	4.90
	5	Home Improvement	5	4.14
	6	Aerospace & Defense	6	3.60
	7	Security & Armored Car Services	7	3.57
	8	Auto & Truck Manufacturers	8	3.29
	9	Cruise and Vacation	9	2.66
	10	Hotels & Tourism	10	2.41

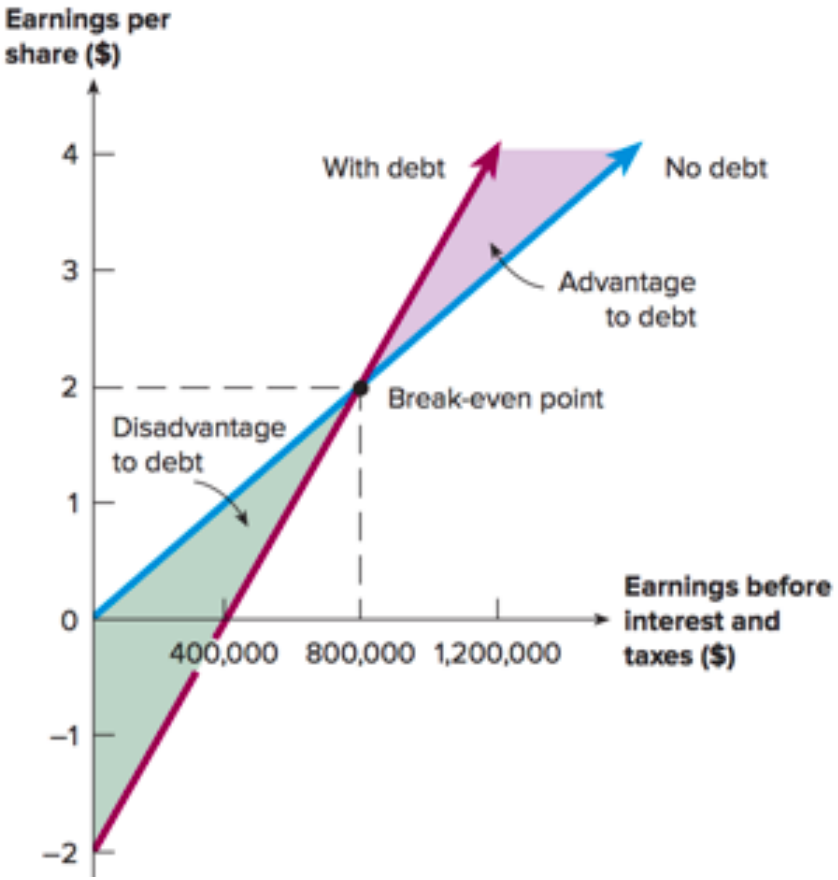
Note: Debt to Equity Ratio Screening as of Q3 of 2021.

`https://csimarket.com/screening/index.php`

Capital Structure in Corporate Finance

- The primary goal of financial managers: Maximize stockholder wealth.
- Maximizing shareholder wealth requires maximizing firm value and minimizing WACC.
- The relative proportion of debt, equity, and other securities that a firm has outstanding constitute its capital structure.
- If capital structure decisions can affect investment return, risk, and corporate valuation, then the objective for the corporation would be: Choose the capital structure that will minimize WACC and maximize stockholder wealth.
- Financial leverage implies the use of debt in corporate financing decision. What are the effects of leverage on corporate valuation and costs of capital?

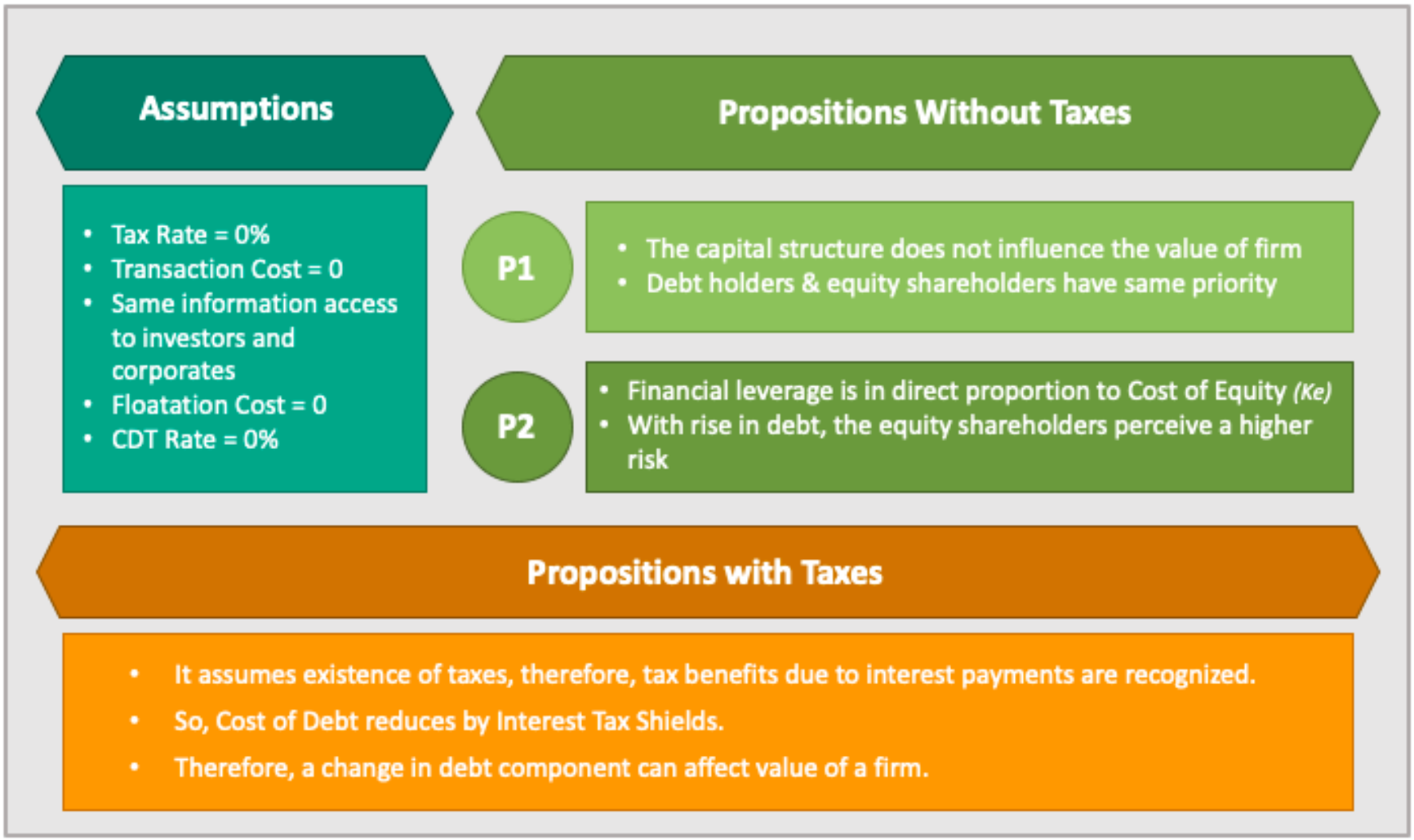
Financial Leverage: EPS and EBIT



Source: Ross et al. (2021).

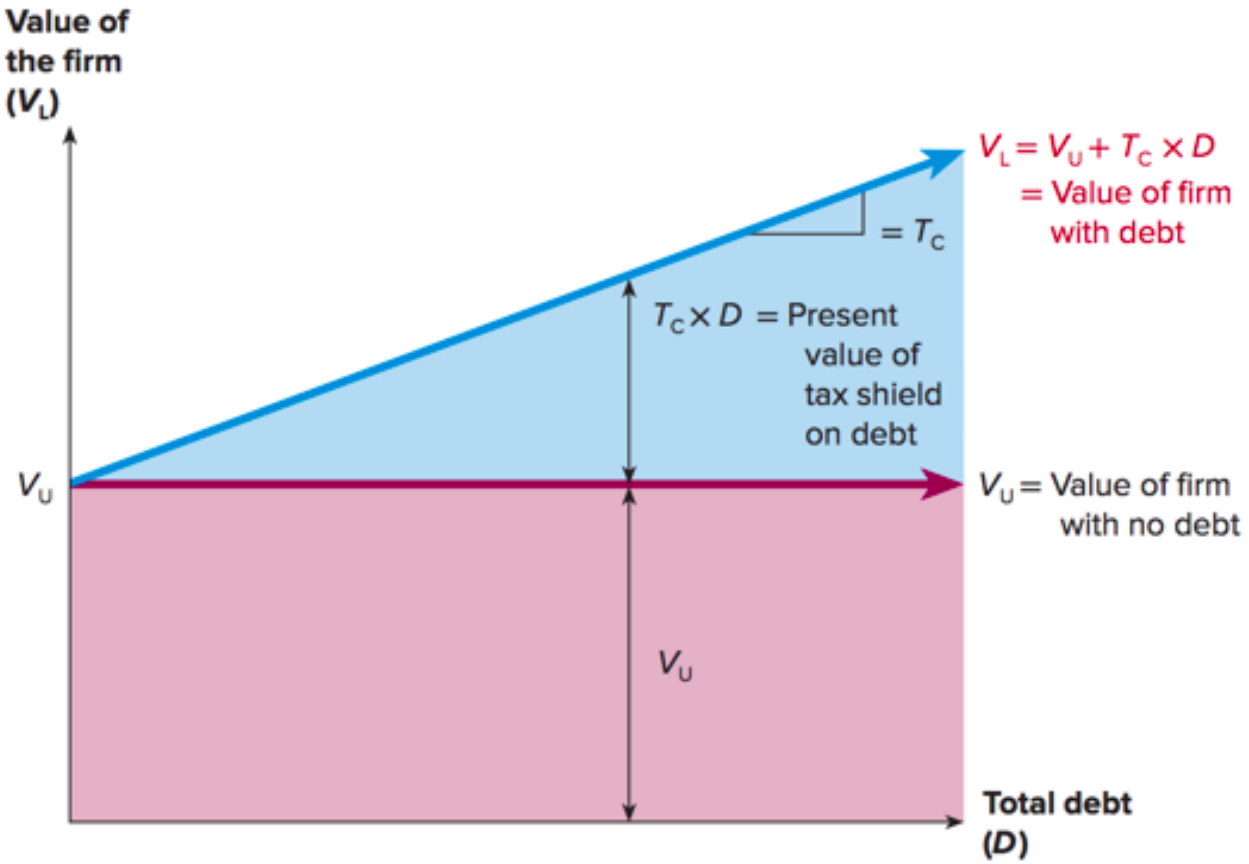
- The sensitivity of EPS and EBIT is higher for a levered firm than for an unlevered firm. Thus, given assets with the same risk, the EPS of a levered firm is more volatile.
- If investors expect EBIT to be greater than the break-even point, then leverage is beneficial to our stockholders.
- If investors expect EBIT to be less than the break-even point, then leverage is detrimental to our stockholders.

Modigliani-Miller Theorem (w)



https://www.sketchbubble.com/en/presentation-capital-structure-theory.html

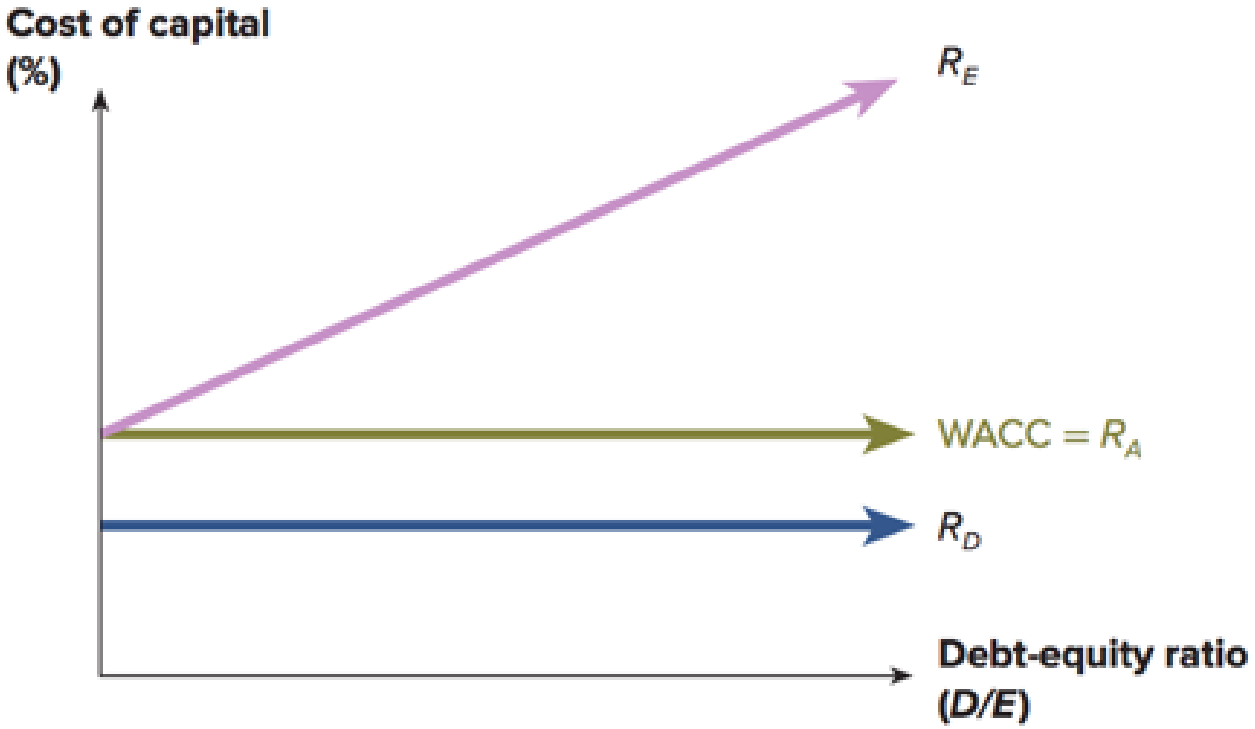
M&M I: Capital Structure and Value (Taxes)



The value of the firm increases as total debt increases because of the interest tax shield. This is the basis of M&M Proposition I with taxes.

Source: Ross et al. (2021).

M&M II: Capital Structure and Costs (no Taxes)



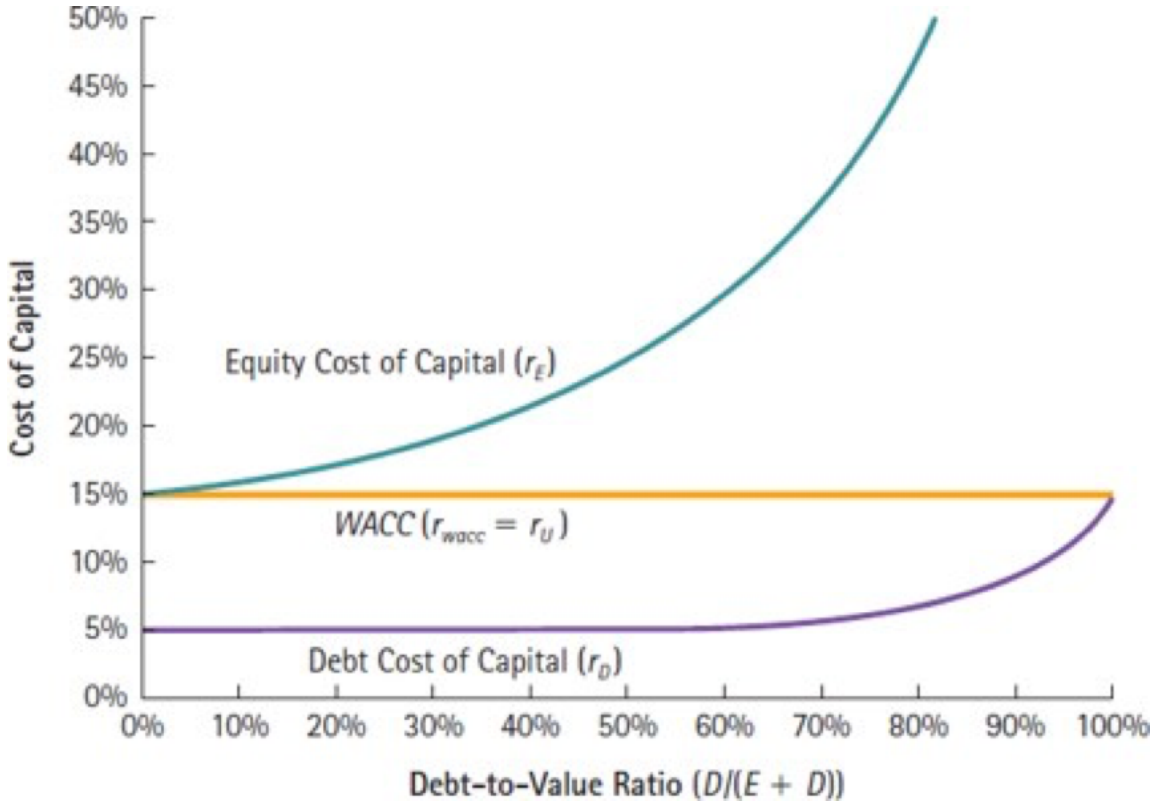
$R_E = R_A + (R_A - R_D) \times (D/E)$ by M&M Proposition II

$R_A = \text{WACC} = (E/V) \times R_E + (D/V) \times R_D$

where $V = D + E$

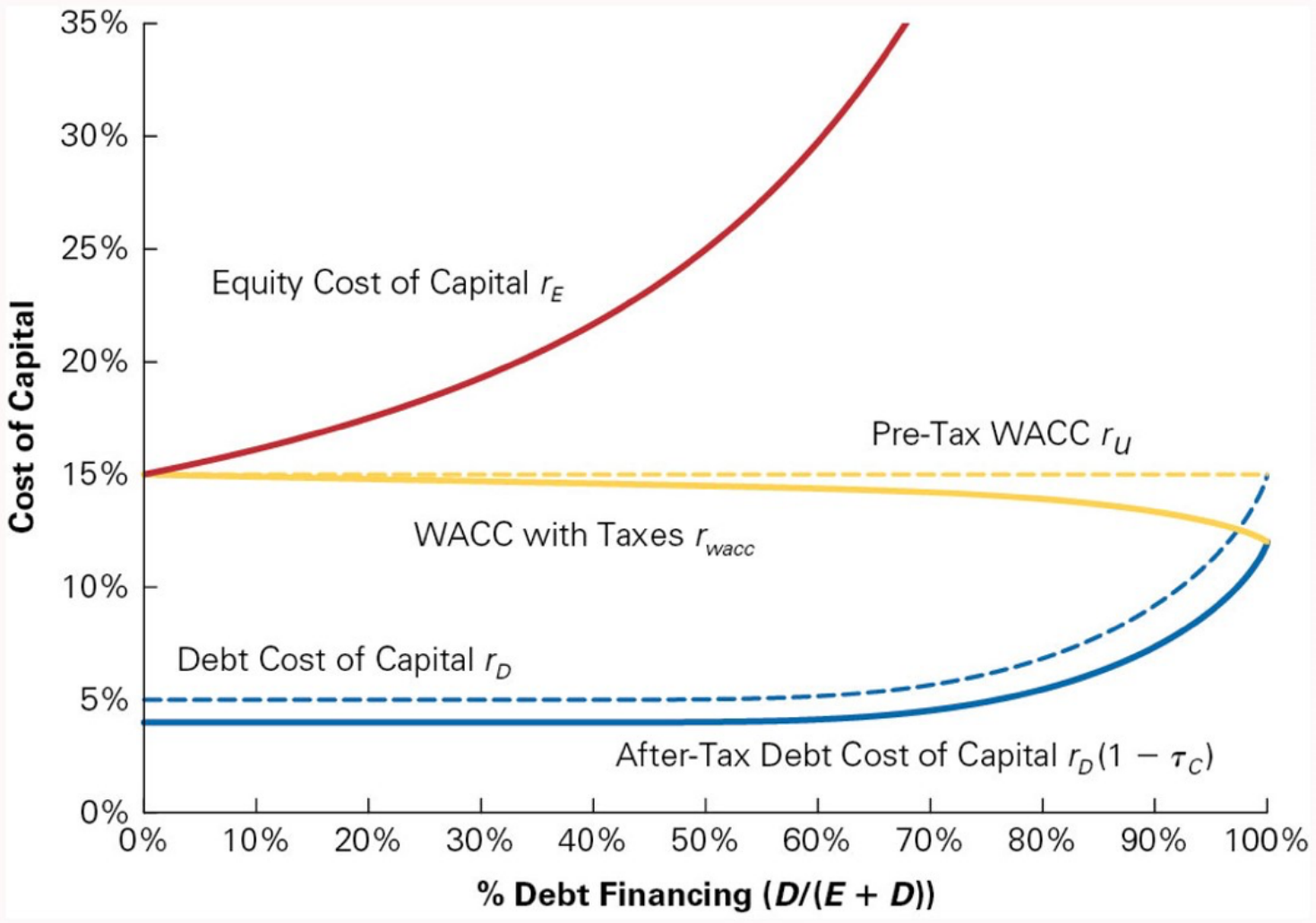
Source: Ross et al. (2021). The change in the capital structure weights (E/V&D/V) is exactly offset by the change in the cost of equity (R_E), so the WACC stays the same.

M&M II: Capital Structure and Costs (no Taxes)



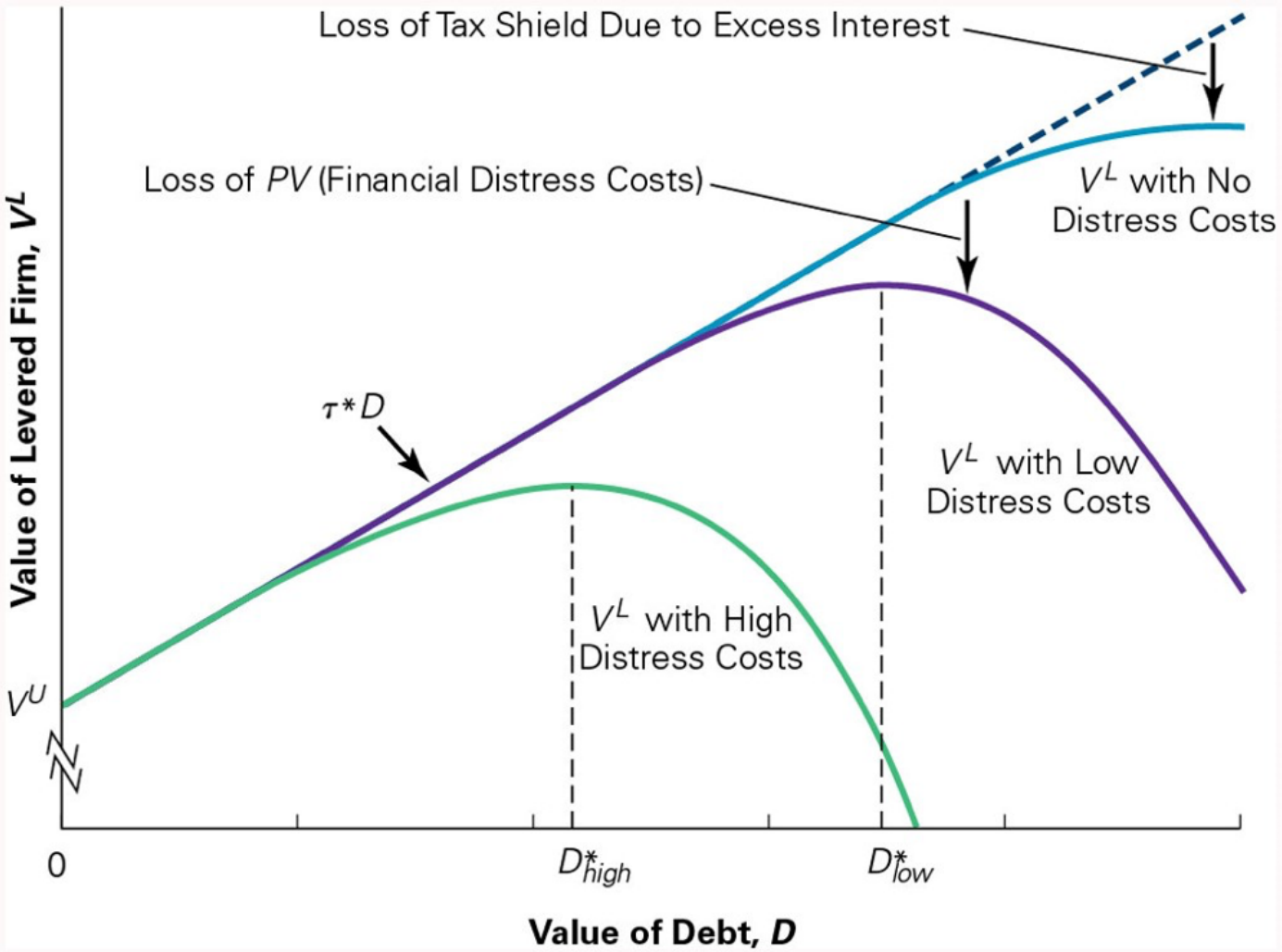
E	D	r_E	r_D	$r_E \frac{E}{E+D} + r_D \frac{D}{E+D}$	$= r_{wacc}$
30,000	0	15.0%	5.0%	15.0% × 1.0 + 5.0% × 0.0	= 15%
24,000	6,000	17.5%	5.0%	17.5% × 0.8 + 5.0% × 0.2	= 15%
15,000	15,000	25.0%	5.0%	25.0% × 0.5 + 5.0% × 0.5	= 15%
3,000	27,000	75.0%	8.3%	75.0% × 0.1 + 8.3% × 0.9	= 15%

M&M II: Capital Structure and Costs (Taxes)



Source: Berk & DeMarzo (2021).

M&M I: Capital Structure and Value (Bankruptcy Costs)



Source: Berk & DeMarzo (2021).

Optimal Capital Structure

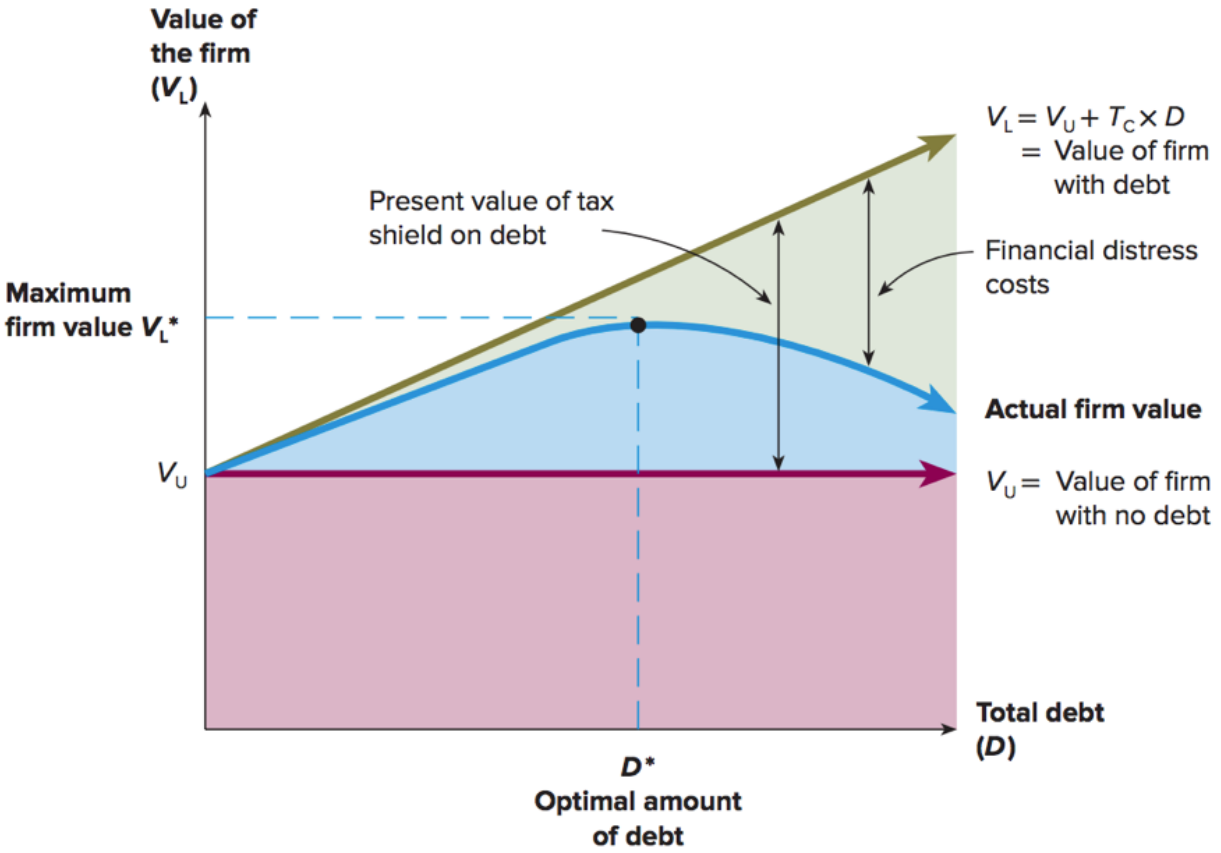


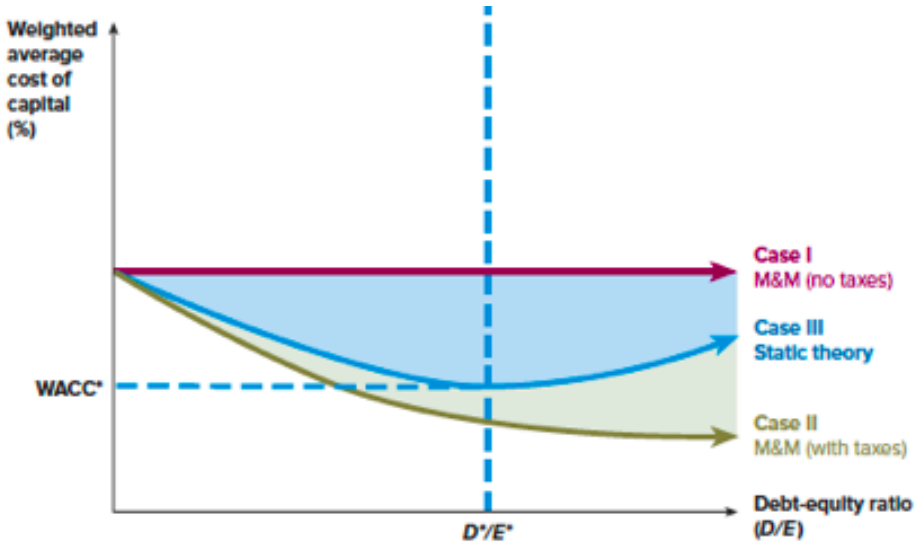
FIGURE 13.5

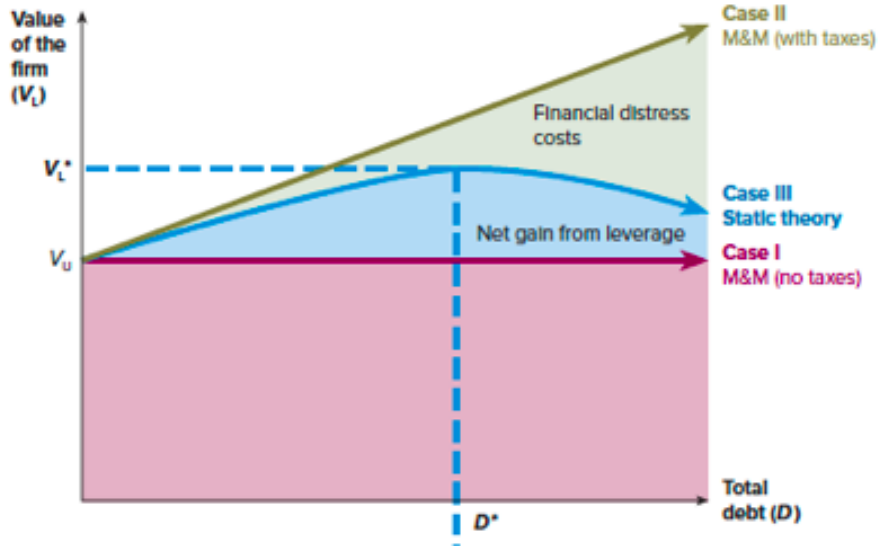
The static theory of capital structure: The optimal capital structure and the value of the firm

According to the static theory, the gain from the tax shield on debt is offset by financial distress costs. An optimal capital structure exists that balances the additional gain from leverage against the added financial distress costs.

Source: Ross et al. (2021).

Capital Structure: WACC & Valuation





Case I: With no taxes and bankruptcy costs, WACC and valuation are not affected by capital structure of the firm.
Case II: With corporate taxes, WACC falls and valuation rises as leverage increases.
Case III: With corporate taxes and bankruptcy costs, WACC is minimized and valuation maximized at D^*, the optimal amount of debt.

Source: Ross et al. (2021).

Modigliani and Miller Theorem: Summary

TABLE 13.4

Modigliani and Miller summary

I. **The no-tax case**

A. Proposition I: The value of the leveraged firm (V_L) is equal to the value of the unleveraged firm (V_U):

$$V_L = V_U$$

B. Implications of Proposition I:

1. A firm's capital structure is irrelevant.
2. A firm's weighted average cost of capital, WACC, is the same no matter what mixture of debt and equity is used to finance the firm.

C. Proposition II: The cost of equity, R_E, is:

$$R_E = R_A + (R_A - R_D) \times D/E$$

where R_A is the WACC, R_D is the cost of debt, and D/E is the debt-equity ratio.

D. Implications of Proposition II:

1. The cost of equity rises as the firm increases its use of debt financing.
2. The risk of the equity depends on two things: the riskiness of the firm's operations (*business risk*) and the degree of financial leverage (*financial risk*). Business risk determines R_A; financial risk is determined by D/E.

II. **The tax case**

A. Proposition I with taxes: The value of the leveraged firm (V_L) is equal to the value of the unleveraged firm (V_U) plus the present value of the interest tax shield:

$$V_L = V_U + T_C \times D$$

where T_C is the corporate tax rate and D is the amount of debt.

B. Implications of Proposition I with taxes:

1. Debt financing is highly advantageous, and, in the extreme, a firm's optimal capital structure is 100 percent debt.
2. A firm's weighted average cost of capital, WACC, decreases as the firm relies more heavily on debt financing.

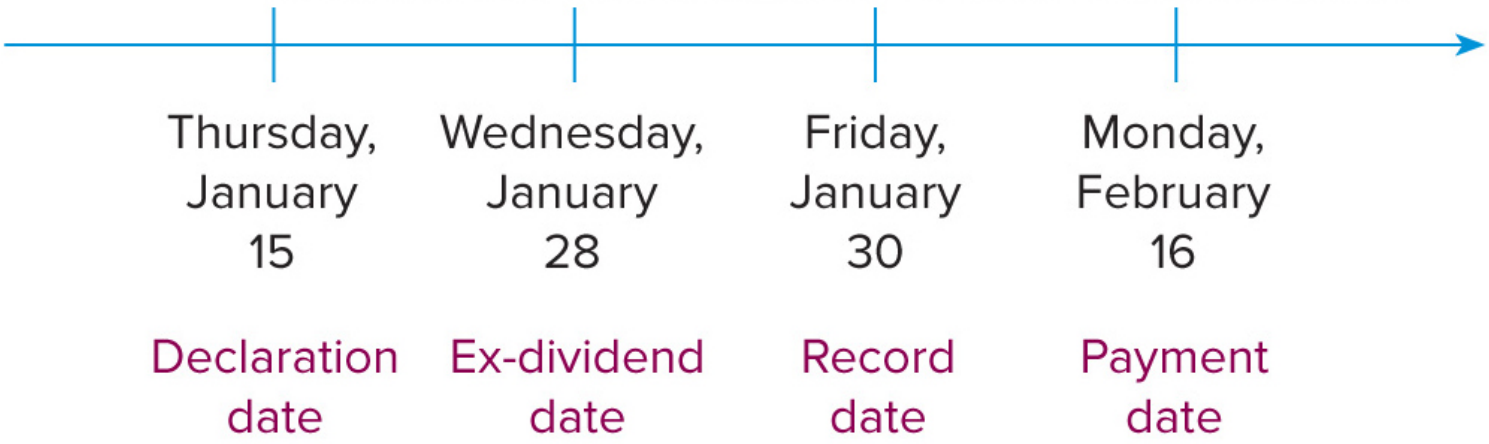
Source: Ross et al. (2021).

Outline

Dividend Policy Basics

- Dividends are payments made at the discretion of the corporation (board of directors) to its equity holders.
- Dividend = earnings (net income) – retained earnings (reinvestment)
- Dividend payout rate is the fraction of a firm's earnings that the firm pays as dividends each year.
- Dividend yield is the expected annual dividend of a stock divided by its current price. It is the percentage return an investor expects to earn from the dividend paid by the stock.
- Dividend category: cash dividend, stock repurchase, stock dividend (as a percentage of shares) or split (ratio)
- Dividend payment procedure: announcement/declaration, ex-dividend, record, payment date.

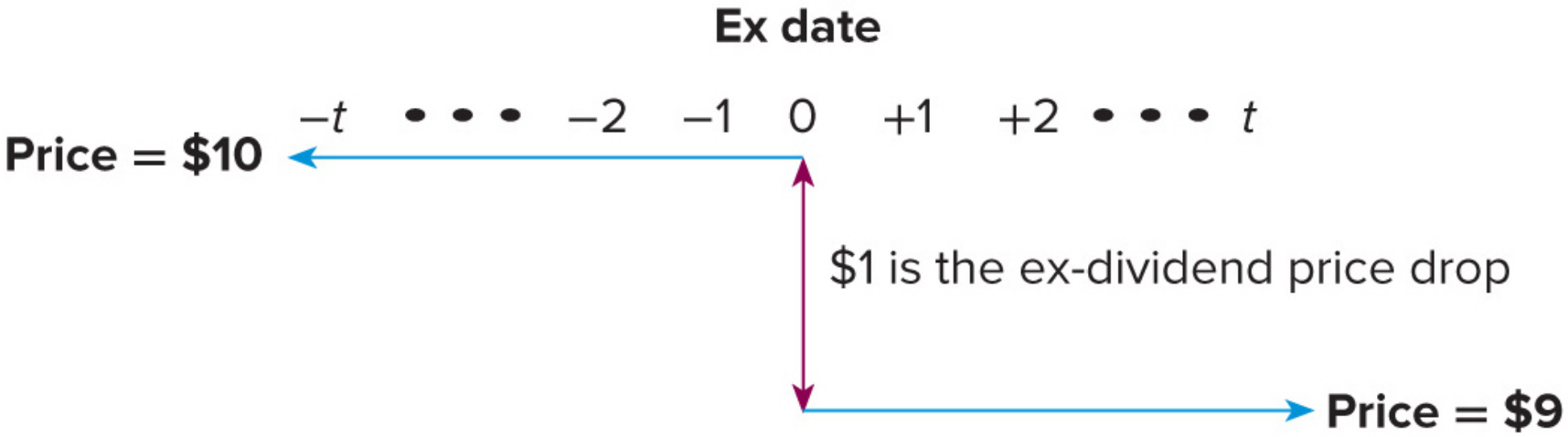
Dividend Payment Procedure: Example



1. *Declaration date:* The board of directors declares a payment of dividends.
2. *Ex-dividend date:* A share of stock goes ex dividend on the date the seller is entitled to keep the dividend; under NYSE rules, shares are traded ex dividend on and after the second business day before the record date.
3. *Record date:* The declared dividends are distributable to those who are shareholders of record as of this specific date.
4. *Payment date:* The dividend checks are mailed to shareholders of record.

Source: Ross et al. (2020).

Price Behavior at the Ex-Dividend Date: Example



The stock price will fall by the amount of the dividend on the ex date (Time 0). If the dividend is \$1 per share, the price will be equal to \$10 − 1 = \$9 on the ex date.

Before ex date (Time −1)	Dividend = \$0	Price = \$10
On ex date (Time 0)	Dividend = \$1	Price = \$ 9

Source: Ross et al. (2020).

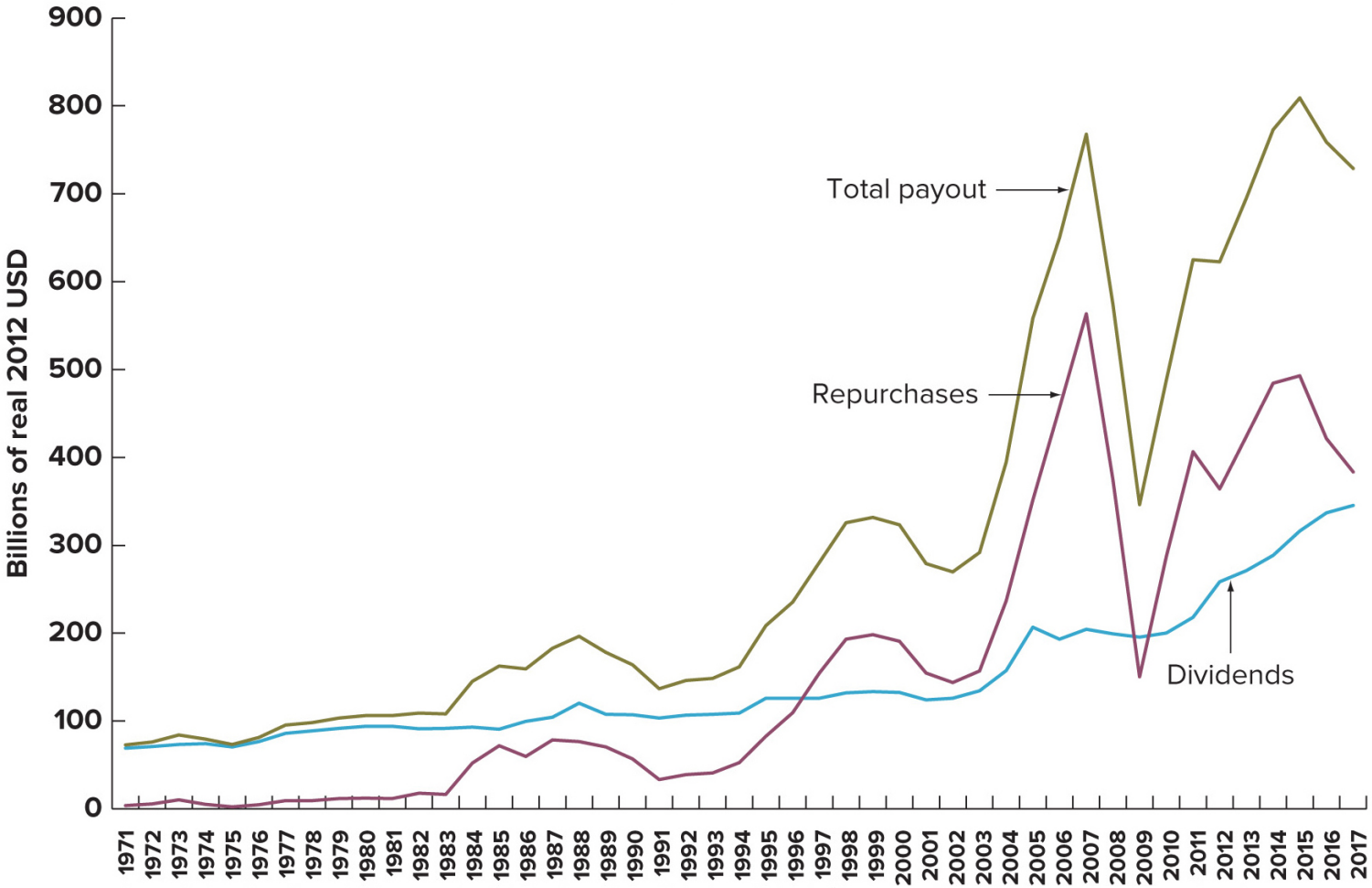
Dividend Policy and Valuation

M-M dividend irrelevance theorem: In perfect capital markets, holding fixed the investment policy of a firm, the firm's choice of dividend policy is irrelevant and does not affect the initial share price.

1. In a perfect capital market, when a dividend is paid, the share price drops by the amount of the dividend when the it begins to trade ex-dividend.
2. In perfect capital markets, an open market share repurchase has no effect on the stock price, and the stock price is the same as the cum-dividend price if a dividend were paid instead.
3. In perfect capital markets, investors are indifferent between the firm distributing funds via dividends or share repurchases. By reinvesting dividends or selling shares, they can replicate either payout method.

Optimal dividend policy: Dividend policy is irrelevant when there are no taxes or other imperfections. With taxes and new issue costs, the firm should pay out dividends only after all positive NPV projects have been fully financed.

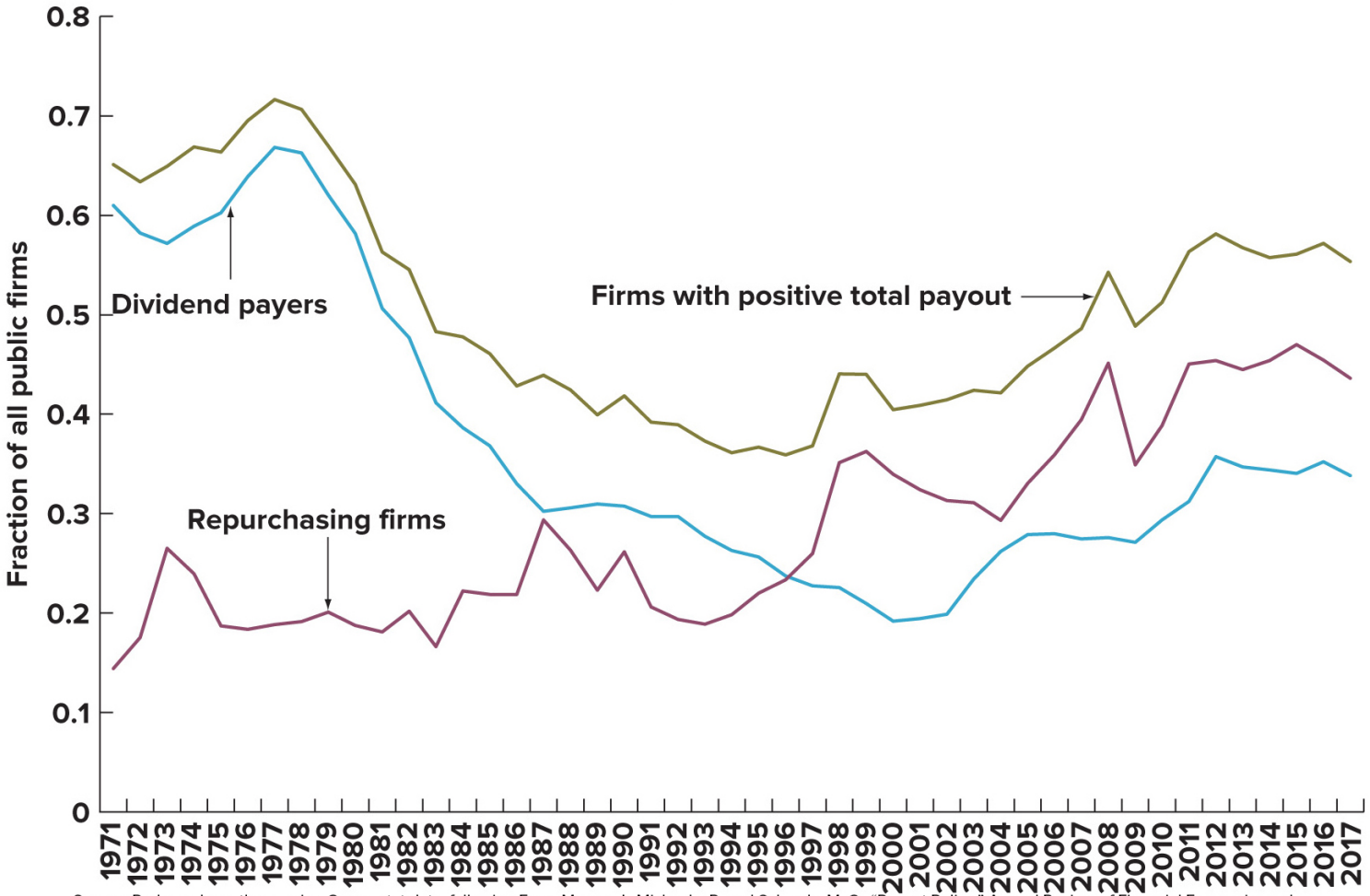
Dividend and Repurchase: U.S. Industrials



Source: Redrawn by authors using Compustat data, following Farre-Mensa, Michaely, and Schmalz, "Payout Policy," Annual Review of Financial Economics, vol. 6, 2014, 75–134. Updated by authors.

Source: Ross et al. (2020). Aggregate real dividends and stock repurchases by publicly held U.S. industrial firms.

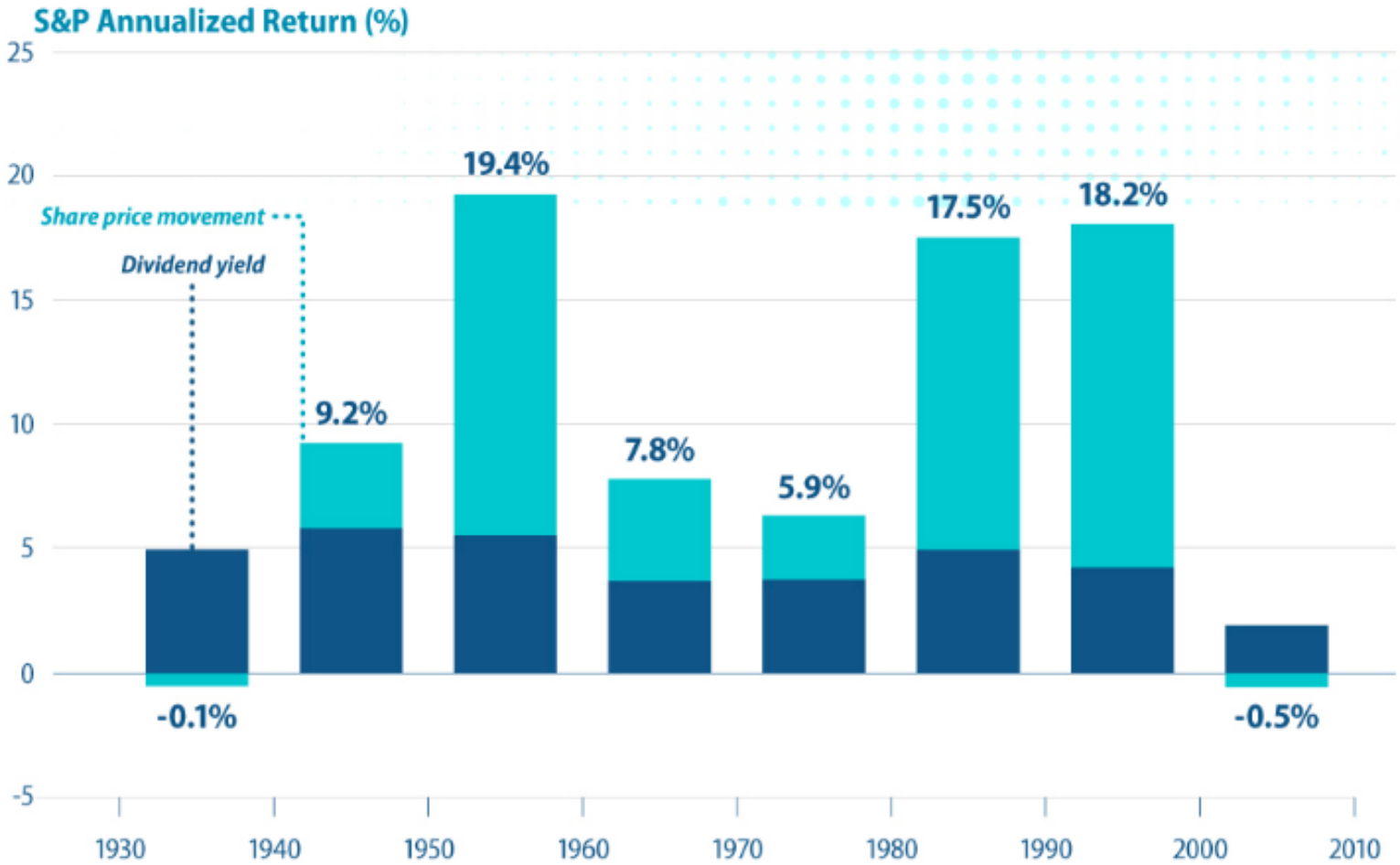
Dividend and Repurchase: U.S. Industrials



Source: Redrawn by authors, using Compustat data, following Farre-Mensa, J., Michaely, R. and Schmalz, M. C., "Payout Policy," Annual Review of Financial Economics, vol. 6, 2014, 75–134. Update by authors.

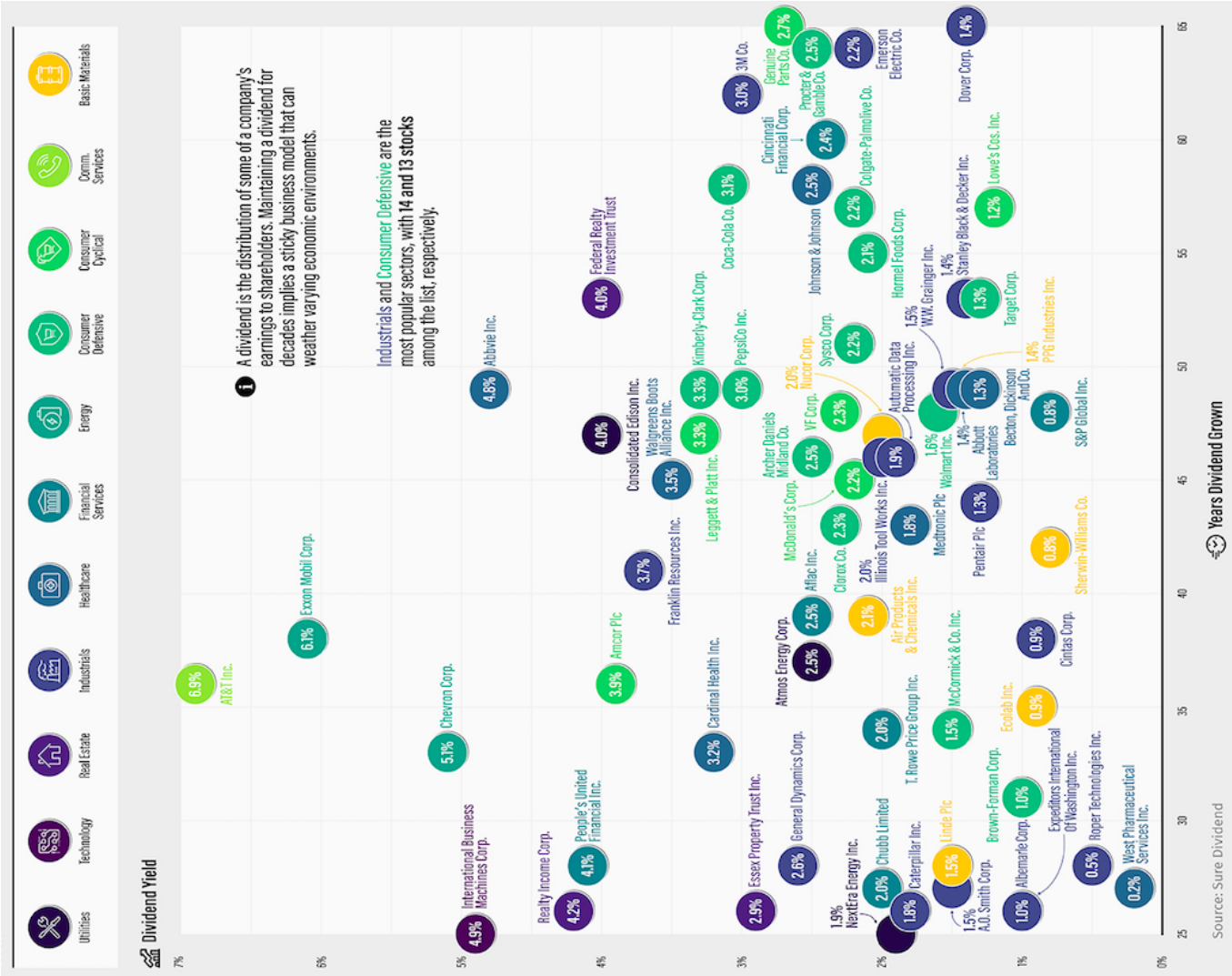
Source: Ross et al. (2020). Proportion of dividend/repurchase firms among all publicly held U.S. industrials.

S&P 500 Annualized Returns in Decades



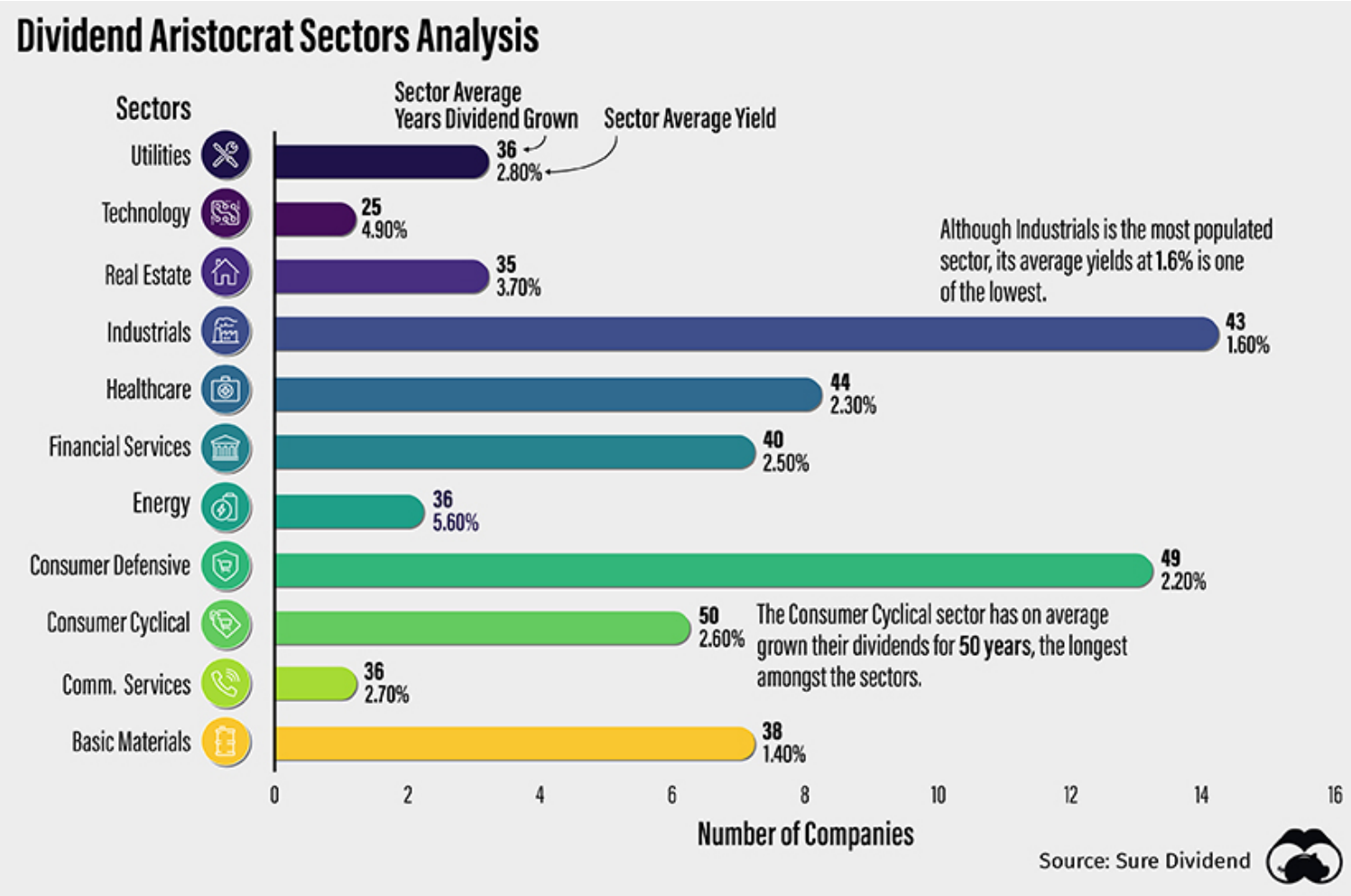
Source: Visual Capitalist. Report numbers are average years dividend grown and average yield, respectively.

S&P 500 Dividend Aristocrats 2021 (w)



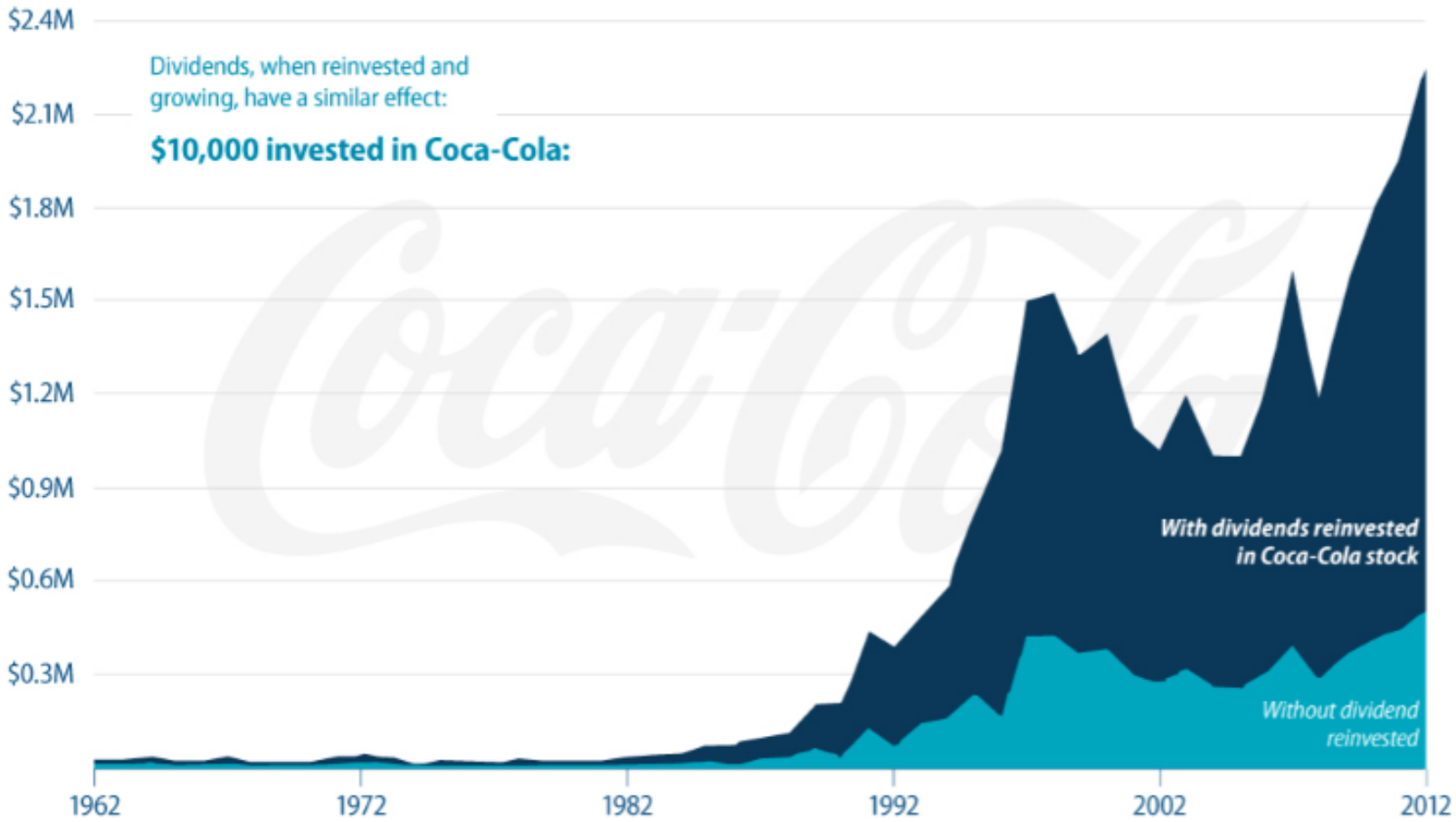
Source: Visual Capitalist.

S&P 500 Dividend Aristocrats 2021 (w)

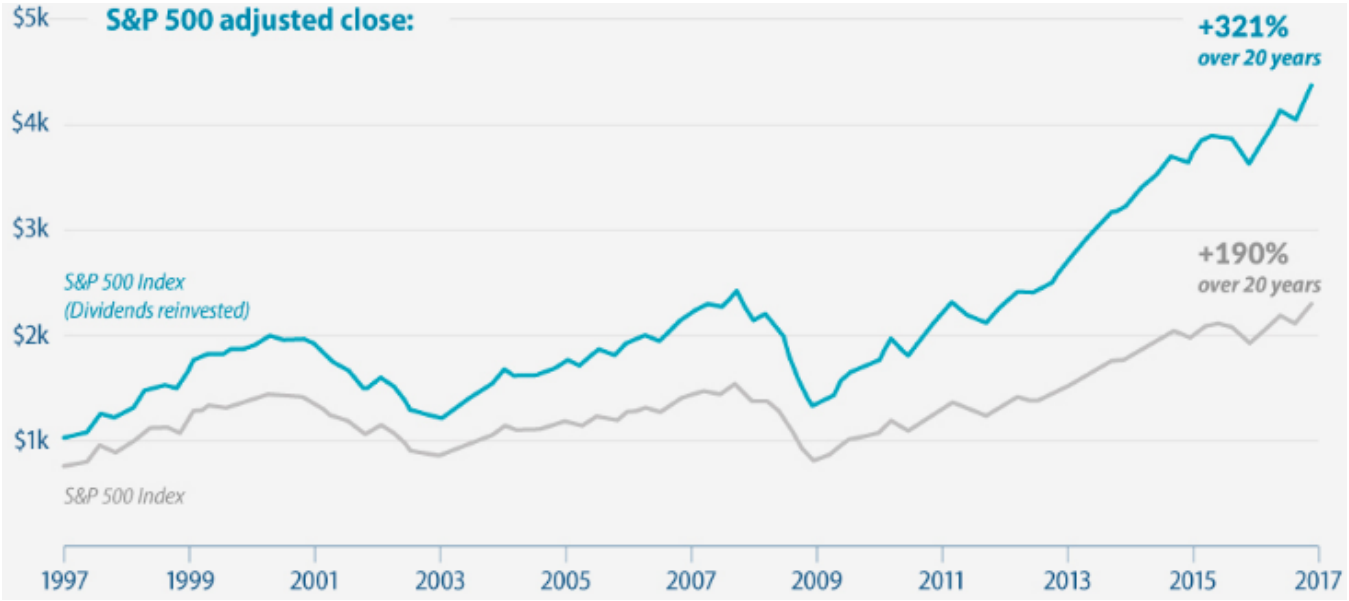


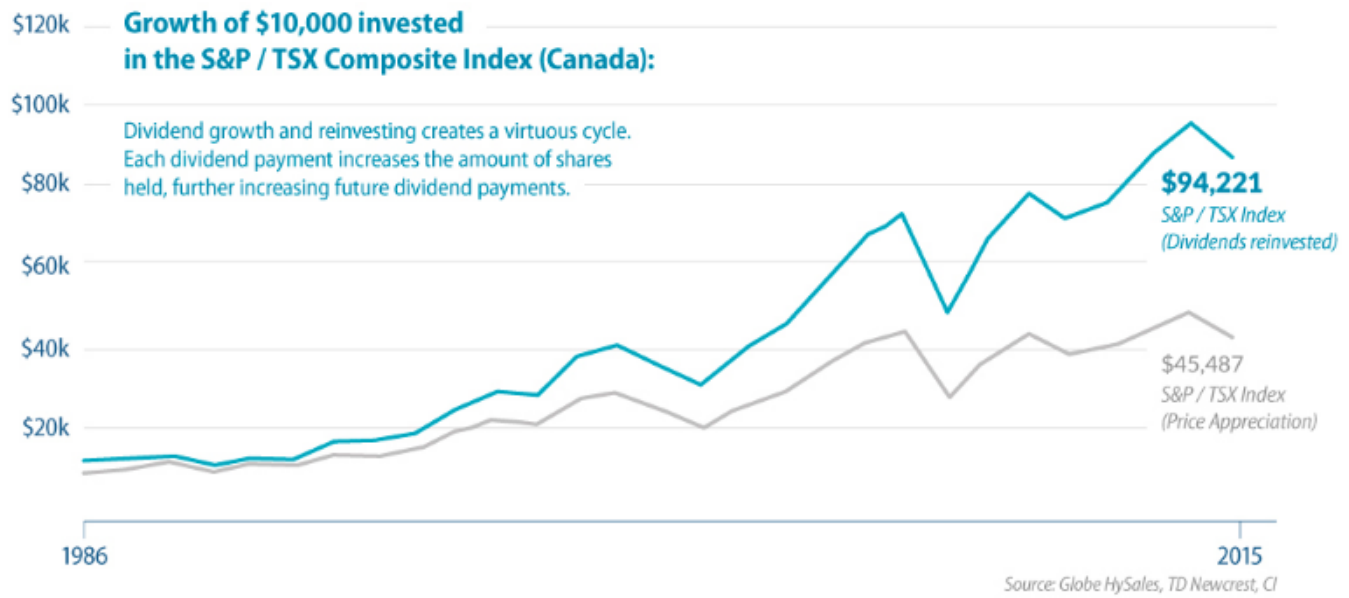
https://www.visualcapitalist.com/who-are-the-dividend-aristocrats-in-2021/

Dividend Reinvestment Effect: Coca-Cola (w)



https://www.visualcapitalist.com/power-dividend-investing/





https://www.visualcapitalist.com/power-dividend-investing/

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