ECO359H1: Financial Economics II Corporate Finance Notes

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Contents

1 Basic corporation and financial markets

1.1 Three types of firms

There are three types of major firms in corporate finance, which are:

1. Sole proprietorship
2. Partnership
3. Corporation

1.1.1 Sole proprietorship

Definition 1.1: Sole proprietorship

A sole proprietorship is a business owned and run by one person. Sole proprietorship is relatively small in terms of revenues and profits produced and people employed.

Advantages	Disadvantages
Straightforward to set up.	No separation between the firm and the owner.
	Business income is taxed at a personal level.
	No ownership stake for people other than the owners, thus, ability to raise funds is l
	The life of the sole proprietorship is limited by the life of the owners.

Table 1: Advantages and disadvantages of sole proprietorship

Remark.

For most businesses, the disadvantages of a sole proprietorship outweigh the advantages.

1.1.2 Partnership

Definition 1.2: Partnership

A partnership is similar to a sole proprietorship but it has more than one owner.

It has the following features:

- Income is taxed at the personal level. The income is split among partners according to their ownership in the partnership.
- All partners have unlimited personal liability. This means all partners are responsible for any legal actions against the partnership. The partners are also fully liable for the debts of firm.
- The partnership ends on the death or withdrawal of any single partner. However, partners can avoid liquidation if the partnership agreement provides for alternatives such as a buyout of a deceased or withdrawn partner.

Some old and established businesses remain partnerships or sole proprietorships. Often these firms are the types of businesses in which the owners' personal reputations are the basis for the businesses. For example, law firms and accounting firms.

Definition 1.3: Limited partnership

A limited partnership is a partnership with two kinds of owners, general partners and limited partners.

- For general partners, they have the same rights and liabilities as partners in a regular partnership. They are typically responsible to run the firms on a day to day basis.
- For limited partners, they have a limited liability to their investments in the partnership. The death or withdrawal of a limited partner does not dissolve the partnership. The interest in the business by limited partners is transferable, and they have no management authority and cannot legally be involved in the managerial decision for the business.

Definition 1.4: limited liability partnership (LLP)

It is a special partnership in Canada in which a partner's personal assets are protected from the negligent actions of other partners. The partnership can be used in the legal and accounting professionals. All the owners have limited liability and they can run the business. A particular partner's own negligence or the negligence of those supervised by the particular partners, that partner has unlimited personal liability.

1.1.3 Corporations

Definition 1.5: Corporation

A legally defined, artificial being, separated from its owners. A corporation has many of the legal powers individuals have such as enter into contracts and acquire assets. The corporation is solely responsible for its own obligations. Its owners are not liable for any obligation the corporation enters into.

The formation of the corporation must be according to the law. The corporation files a charter with the state it wishes to incorporate in. The state then charters the corporations, formally giving its consent to the incorporation.

The ownership of a corporation is represented by shares of stock and different kinds of stocks. Owner of the stock is called shareholders, stockholders, or equity holder. And entitled to dividend payments. Equity is the sum of all ownership value. There is no limit to the number of shareholders, and thus the amount of funds a company can raise by selling stock. And there is no limit to who owns the stock. Shareholders are generally united with wealth maximization goal.

The shareholders of a corporation are under double taxation, which is corporate tax on corporate revenue, and shareholders personal income tax.

Example.

> You are a shareholder in a corporation. Some of your shares are held inside your tax-free savings account (TFSA) so any earnings there are not taxed; any income from shares held outside your TFSA is taxable. The corporation earns $\$5$ per share before taxes. After it has paid taxes, it will distribute the rest of its earnings to you as a dividend. The corporate tax rate is 25% and your tax rate on dividend income outside your TFSA is 36%. How much of the earnings remains after all taxes are paid (calculate this twice-for the shares in the TFSA and for the shares outside of the TFSA)?
> Since the shares are held inside a TFSA, there is no tax on the income from these shares. Therefore:
>
> - Earnings before corporate tax: $\$5$ per share.
> - Corporate $\text{tax}(25\%) : 5 \times 0.25 = 1.25$ per share.
> - Earnings after corporate tax: $5 - 1.25 = 3.75$ per share.

Since there is no tax on earnings inside the TFSA, the entire $\$3.75$ per share remains after taxes. For the shares held outside the TFSA, you need to account for both corporate tax and personal tax on the dividends:

- Earnings before corporate tax: $\$5$ per share.
- Corporate tax (25%) : $5 \times 0.25 = 1.25$ per share.
- Earnings after corporate tax: $5 - 1.25 = 3.75$ per share.
- Personal tax on dividends (36%): $3.75 \times 0.36 = 1.35$ per share.
- Earnings after all taxes: $3.75 - 1.35 = 2.40$ per share.

While the corporate organizational structure is subject to double taxation, Canada Revenue Agency allowed an exemption from double taxation for flow through entities, meaning they only apply personal tax.

Definition 1.6: Flow through entities

Business entities in which virtually all income produced by the business flows to the investors. They are called income trust. There are three forms of income trust:

- **Business income trust:** A flow through entity that holds all the debt and equity securities of a corporation in trust for the trust owners. This means the trust is responsible for managing and holding these securities, the underlying business payts interest to the trust, then the trust will passes the interest to the trust owners (unit holders) as income.
- **Energy trust:** A flow through entity that holds resource properties directly or holds all debt and equity securities of a resource corporation within the trust.
- **Real estate investment trust REIT:** A flow through entitiy that holds real estate properties directly or holds all the debt and equity securities of a corporation that owns real estate properties.

Definition 1.7: Trust unit

These are the investment units in a income trust, similar to shares in a corporation. When you own trust units, you have a claim on the income generated by the trust.

Definition 1.8: Non-taxable plans

They are special types of investment accounts or plans that offer tax advantages, such as Registered retirement savings plan (RRSP) allows individuals to save for retirement while deferring taxes on the investment earnings until retirement. Many investors held trust units in non-taxable plans like RRSPs.

Remark.

The Canadian government implemented new tax rules in 2006, effective from 2011, changing the way business and energy trusts were taxed. But REITs retained their favorable tax treatment. Thus, many business and energy trusts opted to covert back to standard corporate structures.

Example.

Rework the same example, assuming the corporation in that example was actually a real estate investment trust (REIT) and flowed through all earnings to trust unit owners. We will assume you hold some of the trust units within your TFSA, so they are not subject to personal taxes. For the trust units held outside your TFSA, suppose you pay tax at a rate of 46%.
Since the trust units are held inside a TFSA, there is no tax on the income from these units. Therefore earnings before any tax: $\$5$ per unit. Since the earnings are within a TFSA, no taxes are applied. So, the entire $\$5$ per unit remains after all taxes.
For the trust units held outside the TFSA, you need to account for your personal tax on the earnings:

- Earnings before any tax: $\$5$ per unit.
- Personal $\text{tax}(46\%) : 5 \times 0.46 = 2.30$ per unit.
- Earnings after personal tax: $5 - 2.30 = 2.70$ per unit.

1.2 Ownership and control of a corporation

Definition 1.9: Board of directors

A group elected by shareholders that has the ultimate decision making authroty in the corporation.

Definition 1.10: Chief executive officer

The CEO is a person charged with running the corporation by instituting the rules and policies set by the board of directors. CEO can be a part of board of directors.

Definition 1.11: Financial manager

A person in a company responsible for making investment decisions, making financial decisions, managing the firm's cash flows.

Definition 1.12: Chief financial officer

The most senior financial manager who reports directly to the CEO.

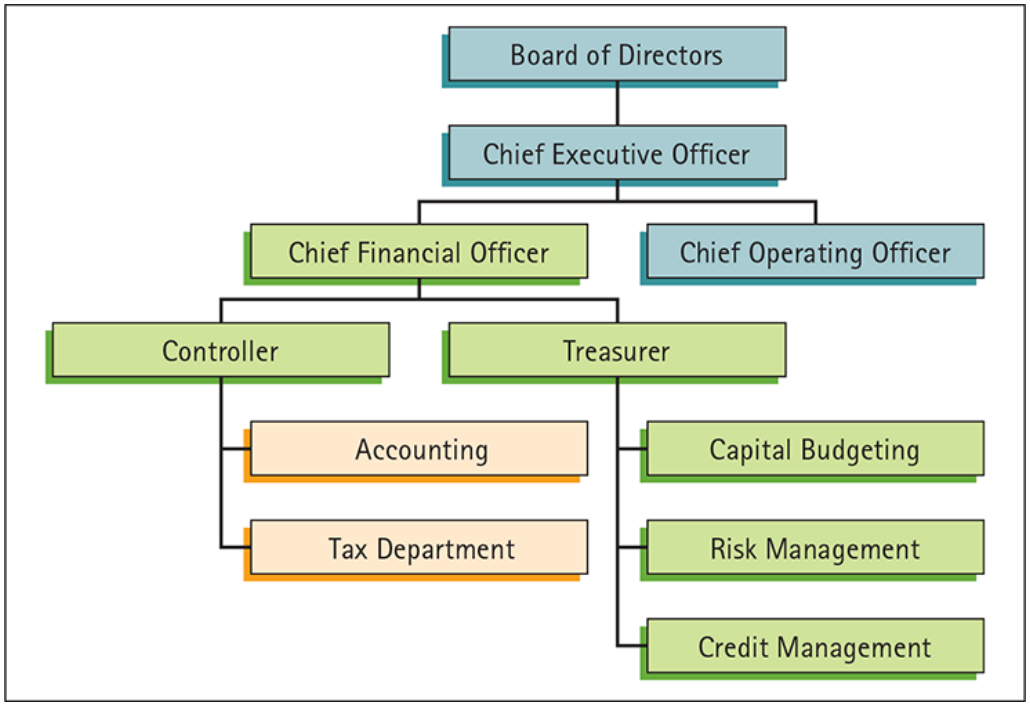

Figure 1: Corporation structure

Definition 1.13: Shareholder wealth maximization

A corporate objective that seeks to maximize the financial benefits to all people holding stock in the corporation by maximizing the current value of a company's stock. This objective usually units all the shareholders in the company.

In a corporation, direct control and ownership are often separate. Owners do not usually control the corporation on a daily basis. Even if all the shareholders agree on the goals of the firm, the goals must be implemented by the management team. Because of this separation of ownership and control in a corporation, the managers have little incentive to work in the interest of the shareholders when this means working against their own interest.

Definition 1.14: Shrinking

Neglecting the responsibilities of managing a corporation.

Definition 1.15: Perquisites

Benefits provided free of charge to managers of corporation.

For shareholders, shrinking and perquisites do not benefit them even though managers can benefit a lot, so, managers love shrinking and perquisites instead of working. Thus, we have a problem.

Definition 1.16: Principle agent problem

A problem that arises when employees in control act in their own interest rather than in the interest of the owners. The downfall of many companies can ultimately be blamed on the principle agent problem.

We address this problem by minimizing the number of decisions managers must make for which their self-interest substantially differs from the interest of the shareholders. Thus, we can tie the manager's compensation with company performance. However, this plan has some issues:

- When trying the compensation with company performance. the shareholders may ask the managers to take on more risk than they are confortable taking.
- Compensation tied to profits or share price may lead to short-slighted behavior by managers who can purpue a strategy that artifically boost short term result

1.3 CEO performance and hostile takeover

In reality, directors and top executives are very rarely replaced through shareholder's pressure. Instead, shareholders will sell shares. The stock price of the corporation is a meter for the corporate leaders that continuously gives the feedback on their shareholder's opinion of their performance:

- If the CEO performs poorly, shareholders will sell shares, drivers down the stock price.
- If the CEO performs good, shareholders want to buy more shares, drives up the stock price.
- If the stock perform poorly, the board may react by replacing CEO depending on the situation.

Continue poor performance and low stock prices create profit opportunity called hostile takeover.

Definition 1.17: Hostile takeover

A situation in which an individual or organization, called corporate raider, purchase a large fraction of a target corporation's stock and in doing so gets enough votes to replace the CEO and the board. The hostile takeover can result in increasing of the stock price with new management team and profits for corporate raider and other shareholders.

Remark.

A hostile takeover is often enough discipline to bad managers.

1.4 Shareholders and stakeholders

Definition 1.18: Stakeholders

Any person with an interest in what a corporation does.

Definition 1.19: Stakeholder satisfaction

A corporate objective seeks to meet the interests of all the corporation's stakeholders.

Definition 1.20: Corporate social responsibility

A corporation efforts to assess and be responsible for its activities, particularly in relation to their environmental and social impacts, and may also include initiatives to promote positive social and environmental changes.

Thus, we know shareholder wealth maximization, stakeholder satisfaction, and corporate social responsibility are convergent and are aligned. Neglecting any part leads to long term hard to the other part.

1.5 Corporate bankrupcy

Definition 1.21: Corporate bankrupcy

A legal process that occurs when a company is unable to meet its financial obligation to creditors and seeks relief from some or all of its debts. And we have two types of bankrupcy:

- **Reorganization:** the process that allows a company to restructure its debt and operations while continuing to operate. Ideally, the company continuous operations with a manageable debt loan and a more efficient structure.
- **Liquidation:** The process that dissolves the company and sells its assets to pay off creditors. Creditors receive payments based on the liquidation value of the company's assets, often result in loss of equity holders.

2 Introduction to financial statement analysis

2.1 The disclosure of financial information

Definition 2.1: Financial statements

They are firm-issued accounting reports with past performance information over a specific period.

Remark.

Canadian public companies are required to file these reports called interim financial statements (Quarterly or annually) and annual reports with their provincial securities commissions. Annual reports include financial statements.

Remark.

This process is centralized nationally through the System for Electronic Document Analysis and Retrieval (SEDAR).

Definition 2.2: Generally accespted accounting principles GAAP

It is a financial reporting framework including a common set of rules and a standard format for public companies to use when they prepare their reports.

Remark.

The Accounting Standards Board of Canada has adopted International Financial Reporting Standards (IFRS) for GAAP in Canada for publicly accountable enterprises.

Definition 2.3: Auditor

Neutral third party that checks a firm's financial statements.

Remark.

Corporations are required to hire auditor to check the annual financial statements, to ensure they are prepared according to GAAP, and to verify that the information is reliable.

Under IFRS in Canada, every public company is required to produce

- Balance sheet or statement of financial position
- Statement of comprehensive income (which includes the income statement)
- Statement of cash flows
- Statement of changes in equity
- Notes including accounting policies.

2.2 The balance sheet

Definition 2.4: Balance sheet

A list of a firm's assets and liabilities that provides a snapshot of the firm's financial position at a given point in time.

GLOBAL CONGLOMERATE CORPORATION

Consolidated Balance Sheet
As at December 31 (in $ millions)

Assets	2021	2020	Liabilities and Shareholders' Equity	2021	2020
Current Assets			**Current Liabilities**		
Cash	21.2	19.5	Accounts payable	29.2	24.5
Accounts receivable	18.5	13.2	Notes payable/short-term debt	3.5	3.2
Inventories	15.3	14.3	Current maturities of long-term debt	13.3	12.3
Other current assets	2.0	1.0	Other current liabilities	2.0	4.0
Total current assets	57.0	48.0	Total current liabilities	48.0	44.0
Long-Term Assets			**Long-Term Liabilities**		
Land	22.2	20.7	Long-term debt	99.9	76.3
Buildings	36.5	30.5	Capital lease obligations	—	—
Equipment	39.7	33.2	Total debt	99.9	76.3
Less: accumulated depreciation	(18.7)	(17.5)	Future income tax	7.6	7.4
Net property, plant, and equipment	79.7	66.9	Other long-term liabilities	—	—
Goodwill	20.0	20.0	Total long-term liabilities	107.5	83.7
Other long-term assets	21.0	14.0	**Total Liabilities**	**155.5**	**127.7**
Total long-term assets	120.7	100.9	**Shareholders' Equity**	**22.2**	**21.2**
Total Assets	**177.7**	**148.9**	**Total Liabilities and Shareholders' Equity**	**177.7**	**148.9**

Figure 2: Example balance sheet

Notice that the balance sheet is divided into two parts: the assets on the left side and the liabilities on the right.

2.2.1 Assets in balance sheet

Definition 2.5: Assets

The cash, inventory, property, plant and equipment, and other investments a company has made. It contains current assets or long term assets.

Current assets: Cash or assets that could be converted into cash within one year. This category includes marketable securities, accounts receivable, inventories, and pre-paid expenses such as rent and insurance.

- *Marketable securities:* Short-term, low-risk investments that can be easily sold and converted to cash (such as money market investments, like government debt, that mature within a year).
- *Accounts receivable:* Amounts owed to a firm by customers who have purchased goods or services on credit.
- *Inventories:* A firm's raw materials as well as its work-in-progress and finished goods.
- Other current assets is a catch-all category that includes items such as prepaid expenses (expenses, such as rent or insurance, that have been paid in advance).

Long-term assets: Net property, plant, and equipment, as well as property not used in business operations, start-up costs in connection with a new business, investments in long-term securities, and property held for sale.

Definition 2.6: Depreciation

A yearly deduction a firm makes from the value of its fixed assets (other than land) over time according to a depreciation schedule that depends on an asset's lifespan.
The cumulative depreciation of an asset up to a given point in its life; equal to last period's accumulated depreciation plus the current period's depreciation expense.

Definition 2.7: Book value

The acquisition cost of an asset less its accumulated depreciation.

Remark.

Net property, plant, and equipment shows the total book value of these assets in the balance sheet. Thus, we subtract depreciation in the balance sheet. It is not a actual cash expense in the business.

Definition 2.8: Goodwill

The difference between the price paid for a company and the book value assigned to its assets. Goodwill captures the value of other "intangibles" that the firm acquired through the acquisition (e.g., brand names and trademarks, patents, customer relationships, and employees).

Remark.

So, we add goodwill in the balance sheet.

Remark.

If the value of these intangible assets declines over time, the amount of goodwill listed on the balance sheet will be reduced by a write-down that captures the change in value of the acquired assets. Like depreciation, the write-down is not an actual cash expense.

Remark.

Other long-term assets can include such items as property not used in business operations, start-up costs in connection with a new business, trademarks and patents, and property held for sale.

2.2.2 Liabilities in balance sheet

Definition 2.9: Liabilities

A firm's obligations to its creditors. They are classified into current liabilities and long term liabilities.

Current liabilities: Liabilities that will be satisfied within one year. They include accounts payable, notes payable, short-term debt, current maturities of long-term debt, salary or taxes owed, and deferred or unearned revenue.

- *Accounts payable:* The amounts owed to creditors for products or services purchased on credit.
- *Short-term debt:* Debt with a maturity of less than one year.

- *Notes payable:* Short term borrowing with a promissorty notes.
- *Current maturities of long-term debt*
- Items such as salaries (wages payable) or taxes (taxes payable) that are owed but have not yet been paid, and deferred or unearned revenue (revenue that has been received for products that have not yet been delivered).

Long-term liabilities: Liabilities that extend beyond one year.

- *Long-term debt:* Any loan or debt obligation with a maturity of more than a year.
- *Capital lease:* Long-term lease contract that obligates a firm to make regular lease payments in exchange for the use of an asset. Viewed as an acquisition for accounting purposes, the lessee lists the asset on its balance sheet and incurs depreciation expenses. The lessee also lists the present value of the future lease payments as a liability, and deducts the interest portion of the lease payment as an interest expense. Also called a finance lease.
- *Future income tax:* An account that shows taxes that have been recognized on the firm's financial statements but are not yet charged according to tax law.

Definition 2.10: Net working capital

The difference between a firm's current assets and current liabilities that represents the capital available in the short term to run the business.

2.2.3 Equity in balance sheet

Definition 2.11: Equity (Book value)

An accounting measure of a firm's net worth that represents the difference between the firm's assets and its liabilities; also called stockholders' equity. This is the value written on the balance sheet.

Definition 2.12: Equity (Market value) / Market capitalization

This is also known as, which is the total market value of equity; equals the market price per share times the number of shares.

$$\text{Market Value of Equity} = \text{Shares Outstanding} \times \text{Market Price per Share}$$

Remark.

The book value of equity, while accurate from an accounting perspective, is an inaccurate assessment of the true value of the firm's equity.

Example.

If Global has 3.6 million shares outstanding, and these shares are trading for a price of $\$14$ per share, what is Global's market capitalization? How does the market capitalization compare to Global's book value of equity in 2021 ?
Global's market capitalization is $(3.6$ million shares $) \times (\$14/$ share $) = \$50.4$ million. This market capitalization is significantly higher than Global's book value of equity of $\$22.2$ million. Thus, investors are willing to pay $50.4/22.2 = 2.27$ times the amount Global's shares are "worth" according to their book value.

Definition 2.13: Market to book ratio

The ratio of a firm's market (equity) capitalization to the book value of its shareholders' equity. Also called the price-to-book (PB) ratio.

$$\text{Market-to-Book Ratio} = \frac{\text{Market Value of Equity}}{\text{Book Value of Equity}}$$

Definition 2.14: Value stock and growth stock

Value stock: Firms with low market-to-book ratios.
Growth stock: Firms with high market-to-book ratios.

2.2.4 Enterprise value

Definition 2.15: Enterprise value

The total market value of a firm's equity and debt, less the value of its cash and marketable securities. It measures the value of the firm's underlying business.

$$\text{Enterprise Value} = \text{Market Value of Equity} + \text{Debt} - \text{Cash}$$

Example.

On December 31,2018, BCE Inc. 's common stock price was $\$53.93$, and it had 898.2 million shares outstanding, a market-to-book ratio of 2.96 , total debt of $\$24.41$ billion, and cash of $\$425$ million. In addition, it had $\$4.33$ billion of preferred and other equity. What was the market capitalization of BCE's common stock? How does that compare to the book value of its common equity? What was BCE's enterprise value?
We have the market cap as:

$$\text{Market Capitalization} = 898.2 \times 53.93 = 48,465.03 \text{ million or } \$48.465 \text{ billion}$$

We can rearrange this to find the book value of equity:

$$\text{Book Value of Equity} = \frac{\text{Market Capitalization}}{\text{Market-to-Book Ratio}}$$
$$\text{Book Value of Equity} = \frac{48.465 \text{ billion}}{2.96} = 16.372 \text{ billion}$$

So, the book value of BCE's common equity is $\$16.372$ billion. And:

$$\text{Enterprise Value} = 48.465 + 24.41 + 4.33 - 0.425 = 76.78 \text{ billion}$$

2.3 The income statement

Definition 2.16: Income statement

A list of a firm's revenues and expenses over a period of time. Also known as statement of financial performance.

Definition 2.17: Net income

The last or "bottom line" of a firm's income statement that is a measure of the firm's income over a given period of time. Also called earnings.

GLOBAL CONGLOMERATE CORPORATION

Income Statement
Year ended December 31 (in $ millions, except per share amounts)

	2021	2020
Total sales	186.7	176.1
Cost of sales	(153.4)	(147.3)
Gross Profit	**33.3**	**28.8**
Selling, general, and administrative expenses	(13.5)	(13.0)
Research and development	(8.2)	(7.6)
Depreciation and amortization	(1.2)	(1.1)
Operating Income	**10.4**	**7.1**
Other income	—	—
Earnings Before Interest and Taxes (EBIT)	**10.4**	**7.1**
Interest expense	(7.7)	(4.6)
Earnings Before Taxes (EBT)	**2.7**	**2.5**
Taxes	(0.7)	(0.6)
Net Income	**2.0**	**1.9**
Earnings per share	$0.556	$0.528
Diluted earnings per share	$0.526	$0.500

Figure 3: Income statement example

Definition 2.18: Gross profit

It is the first few lines of the income statement. The difference between net sales revenue and the cost of goods sold.

$$\text{Gross profit} = \text{Revenue} - \text{Cost of goods sold}$$

Definition 2.19: Operating expenses

These are expenses from the ordinary course of running the business that are not directly related to producing the goods or services being sold.
This includes depreciation and amortization, amortization is a charge that captures the change in value of acquired assets. Like depreciation, amortization is not an actual cash expense.

Definition 2.20: Operating income

A firm's gross profit less its operating expenses.

$$\text{Operating income} = \text{Gross profit} - \text{Operating expenses}$$

Definition 2.21: Earnings before interest and taxes EBIT

A firm's eamings before interest and taxes are deducted. It can equal to the operating income, after We include other sources of income or expenses that arise from activities that are not the central part of a company's business, such as cash flows from the firm's financial investments.

Definition 2.22: Earnings before taxes and net income

From EBIT, we deduct the interest paid on outstanding debt to get EBT

Definition 2.23: Net income

EBT minus taxes, which represents the total earnings of the firm's equity holders.

2.3.1 EPS and diluted EPS

Definition 2.24: Earnings per share (EPS)

A firm's net income divided by the total number of shares outstanding.

$$\text{EPS} = \frac{\text{Net Income}}{\text{Shares Outstanding}}$$

Definition 2.25: Stock options and convertible bonds

Stock options: A form of compensation a firm gives to its employees that gives them the right to buy a certain number of shares of stock by a specific date at a specific price.
Convertible bonds: Corporate bonds with a provision that gives the bondholder an option to convert each bond owned into a fixed number of shares of common stock

Definition 2.26: Diluted EPS

A firm's disclosure of its potential for dilution from options it has awarded which shows the earnings per share the company would have if the stock options and convertible bonds were exercised, which result in a increased number of shares.

2.4 Statement of cash flows

The income statement provides a measure of the firm's profit over a given time period. However, it does not indicate the amount of cash the firm has earned. There are two reasons.

- There are non-cash entries on the income statement, such as depreciation and amortization.
- Certain uses of cash, such as the investing in properties, are not reported on the income statement.

Definition 2.27: Statement of cash flows

An accounting statement that shows how a firm has used the cash it earned during a set period.

The statement of cash flows is divided into three sections: operating activity, investment activity, and financing activity.

GLOBAL CONGLOMERATE CORPORATION

Statement of Cash Flows
Year ended December 31 (in $ millions)

	2021	2020
Operating activity		
Net income	2.0	1.9
Depreciation and amortization	1.2	1.1
Other non-cash items	(2.8)	(1.0)
Cash effect of changes in		
Accounts receivable	(5.3)	(0.3)
Accounts payable	4.7	(0.5)
Inventory	(1.0)	(1.0)
Cash From Operating Activities	**(1.2)**	**0.2**
Investment activity		
Capital expenditures	(14.0)	(4.0)
Acquisitions and other investing activity	(7.0)	(2.0)
Cash From Investing Activities	**(21.0)**	**(6.0)**
Financing activity		
Dividends paid	(1.0)	(1.0)
Sale or purchase of shares	—	—
Increase in short-term borrowing	1.3	3.0
Increase in long-term borrowing	23.6	2.5
Cash From Financing Activities	**23.9**	**4.5**
Change in Cash	**1.7**	**(1.3)**

Figure 4: Example cash flow statement

2.4.1 Operating activities

The first section of statement of cash flows adjusts net income by all non-cash items related to operating activity.

	2021	2020
Operating activity		
Net income	2.0	1.9
Depreciation and amortization	1.2	1.1
Other non-cash items	(2.8)	(1.0)
Cash effect of changes in		
Accounts receivable	(5.3)	(0.3)
Accounts payable	4.7	(0.5)
Inventory	(1.0)	(1.0)
Cash From Operating Activities	**(1.2)**	**0.2**

Figure 5: Operating activities section

- Depreciation is deducted when computing net income, but it is not an actual cash expense. Thus, we add it back to net income when determining the amount of cash the firm has generated.
- When a sale is recorded as part of net income, but the cash has not yet been received from the customer, we must adjust the cash flows by deducting the increase in accounts receivable.
- We add increases in accounts payable. Accounts Payable represents borrowing by the firm from its suppliers. This borrowing increases the cash available to the firm.

- We deduct increases to inventory. Increases to inventory are not recorded as an expense and do not contribute to net income (the cost of the goods are only included in net income when the goods are actually sold). However, the cost of increasing inventory is a cash expense for the firm and must be deducted.

2.4.2 Investing activities

Investment activity		
Capital expenditures	(14.0)	(4.0)
Acquisitions and other investing activity	(7.0)	(2.0)
Cash From Investing Activities	**(21.0)**	**(6.0)**

Figure 6: Investing activities section

Definition 2.28: Capital expenditures

Purchases of new property, plant, and equipment.

we subtract the actual capital expenditure that the firm made. Similarly, we also deduct other assets purchased or investments made by the firm, such as acquisitions.

2.4.3 Financing activities

Financing activity		
Dividends paid	(1.0)	(1.0)
Sale or purchase of shares	—	—
Increase in short-term borrowing	1.3	3.0
Increase in long-term borrowing	23.6	2.5
Cash From Financing Activities	**23.9**	**4.5**

Figure 7: Financing acitivities section

Definition 2.29: Retained earnings

The difference between a firm's net income and the amount it spends on dividends.

$$\text{Retained Earnings} = \text{Net Income} - \text{Dividends}$$

Changes in borrowing impact this section as repayment is subtraction, and borrow is addition. Paying dividends is also a subtraction becuase it is a cash outflow.

Remark.

$$\begin{aligned}\text{Change in Shareholders' Equity} &= \text{Retained Earnings} + \text{Net Sales of Shares} \\ &= \text{Net Income} - \text{Dividends} + \\ &\quad \text{Sales of Shares} - \text{Repurchases of Shares}\end{aligned}$$

Example.

Suppose Global had an additional $\$1$ million depreciation expense in 2021. If Global's tax rate on pre-tax income is 26%, what would be the impact of this expense on Global's earnings? How would it impact Global's cash at the end of the year?

The additional depreciation reduces taxable income by $\$1$ million. To calculate the tax savings:

$$\text{Tax Savings } = 1,000,000 \times 0.26 = 260,000 \text{ or } \$260,000$$

Since depreciation reduces taxable income, the net impact on after-tax earnings is:

$$\text{Impact on Earnings} = -1,000,000 + 260,000 = -740,000 \text{ or } \$740,000$$

So, the impact on Global's earnings would be a decrease of $\$740,000$.
Although the additional depreciation reduces earnings by $\$740,000$, it is a non-cash expense, so it does not reduce cash flow directly. In fact, the tax savings increase cash flow.
The impact on cash flow is simply the tax savings, as depreciation itself does not involve a cash outflow.

$$\text{Impact on Cash Flow } = \text{ Tax Savings } = 260,000 \text{ or } \$260,000$$

So, the impact on Global's cash at the end of the year would be an increase of $\$260,000$.

2.5 Other financial statements

Definition 2.30: Management discussion and analysis (MD&A)

A preface to the financial statements in which a company's management discusses the recent year (or quarter), providing a background on the company and any significant events that may have occurred.

Remark.

Management should also discuss any important risks that the firm faces or issues that may affect the firm's liquidity or resources. Management is also required to disclose any off-balance-sheet transactions, which are transactions or arrangements that can have a material impact on the firm's future performance yet do not appear on the balance sheet.

Definition 2.31: Statement of shareholders' equity

An accounting statement that breaks down the shareholders' equity computed on the balance sheet into the amount that came from issuing new shares versus retained earnings.

Definition 2.32: Statement of comprehensive income

Statement showing the total income and expenses for a period by combining net income (or profit) from the income statement with information not reported on the income statement, such as gains and losses that affect equity through reserve or other accounts.

Definition 2.33: Notes to the financial statement

Detail disclosure and explanations in the financial statements for additional clearity and context.

2.6 Finanacial statement analysis

Investors often use accounting statements to evaluate a firm in one of two ways:

- Compare the firm with itself by analyzing how the firm has changed over time.

- Compare the firm to other similar firms using a common set of financial ratios.

2.6.1 Profitability ratio

The income statement provides very useful information regarding the profitability of a firm's business, and how it relates to the value of the firm's shares.

Definition 2.34: Gross margin

$$\text{Gross Margin} = \frac{\text{Gross Profit}}{\text{Sales}}$$

A firm's gross margin reflects its ability to sell a product for more than the cost of producing it.

Definition 2.35: Operating margin

$$\text{Operating Margin} = \frac{\text{Operating Income}}{\text{Sales}}$$

The operating margin reveals how much a company earns before interest and taxes from each dollar of sales.

Definition 2.36: Net profit margin

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

The net profit margin shows the fraction of each dollar in revenues that is available to equity holders after the firm pays interest and taxes.

2.6.2 Liquidity ratio

It measures how efficient a firm is when it comes to liquidating the firm.

Definition 2.37: Current ratio

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

We use this ratio to assess whether the firm has sufficient working capital to meet its short-term needs.

Definition 2.38: Quick ratio

$$\text{Quick Ratio} = \frac{\text{Current assets} - \text{Inventory} - \text{Prepaid expenses}}{\text{Current Liabilities}}$$

Similar to the current ratio, but compares only cash and "near cash" assets, such as short-term investments and accounts receivable to current liabilities.

Definition 2.39: Cash ratio

$$\text{Cash Ratio} = \frac{\text{Cash}}{\text{Current Liabilities}}$$

The most straight forward liquidity ratio.

2.6.3 Working capital ratio

The ratios measures how efficient firm uses its working capital.

Definition 2.40: Accounts receivable days

$$\text{Accounts Receivable Days} = \frac{\text{Accounts Receivable}}{\text{Average Daily Sales}}$$

The average time a customer takes to pay back a business for products or services purchased.

Definition 2.41: Accounts payable days

$$\text{Accounts Payable Days} = \frac{\text{Accounts Payable}}{\text{Average Daily Cost of Sales}}$$

It shows the average number of days it takes for a business to pay its vendors over a certain amount of time.

Definition 2.42: Inventory days

$$\text{Inventory Days} = \frac{\text{Inventory}}{\text{Cost of Goods Sold}}$$

Average number of days on average it takes for a company to convert its inventory on hand into revenue.

Definition 2.43: Inventory turnover

$$\text{Inventory Turnover} = \frac{\text{Annual Cost of Sales}}{\text{Inventory}}$$

Average number of times a company's inventory is sold and replaced over a specific period

2.6.4 Interest coverage ratio

It is a ratio used by the lenders to see if firm can cover interest payments.

Definition 2.44: EBITDA

$$\text{EBITDA} = \text{Net Income} + \text{Taxes} + \text{Interest Expense} + \text{D\&A}$$

$$\text{Interest Coverage Ratio} = \frac{\text{EBIT}}{\text{Interest Expense}}$$

$$\text{Interest Coverage Ratio} = \frac{\text{EBITDA}}{\text{Interest Expense}}$$

2.6.5 Leverage ratio

A type of financial ratio that measures a company's level of debt relative to another financial metric.

Definition 2.45: Debt to equity ratio

Here we use market value equity

$$\text{Debt-Equity Ratio} = \frac{\text{Total Debt}}{\text{Total Equity}}$$

It measures how much debt a company has taken on relative to the value of its assets net of liabilities.

Definition 2.46: Debt to capital ratio

$$\text{Debt-to-Capital Ratio} = \frac{\text{Total Debt}}{\text{Total Equity} + \text{Total Debt}}$$

It measures the financial leverage of a company by comparing its total liabilities to total assets.

Definition 2.47: Debt to enterprise value ratio

$$\begin{aligned}\text{Debt-to-Enterprise Value Ratio} &= \frac{\text{Net Debt}}{\text{Market Value of Equity} + \text{Net Debt}} \\ &= \frac{\text{Net Debt}}{\text{Enterprise Value}}\end{aligned}$$

Where:

$$\text{Net Debt} = \text{Total Debt} - \text{Excess Cash \& Short-Term Investments}$$

Amount of debt relative to the total value of the enterprise.

2.6.6 Valuation ratio

Definition 2.48: Price earning ratio

$$\text{P/E Ratio} = \frac{\text{Market Capitalization}}{\text{Net Income}} = \frac{\text{Share Price}}{\text{Earnings per Share}}$$

It shows what the market is willing to pay for a stock based on its past or future earnings.

2.6.7 Operating returns

Definition 2.49: Return on equity

$$\text{Return on Equity} = \frac{\text{Net Income}}{\text{Book Value of Equity}}$$

Definition 2.50: Return on assets

$$\text{Return on Assets} = \frac{\text{Net Income} + \text{Interest Expense}}{\text{Book Value of Assets}}$$

Definition 2.51: Return on invested capital

$$\text{Return on Invested Capital } = \frac{\text{EBIT}(1 - \text{ Tax Rate })}{\text{Book Value of Equity } + \text{ Net Debt}}$$

$$\text{ROE} = \underbrace{\left(\frac{\text{Net Income}}{\text{Sales}}\right)}_{\text{Net Profit Margin}} \times \underbrace{\left(\frac{\text{Sales}}{\text{Total Assets}}\right)}_{\text{Asset Turnover}} \times \underbrace{\left(\frac{\text{Total Assets}}{\text{Book Value of Equity}}\right)}_{\text{Equity Multiplier}}$$

3 Valuation of stocks

3.1 Dividend discount model

The Law of One Price implies that, to value any security, we must determine the expected cash flows an investor will receive from owning it. Thus, this leads to dividend discount model.

When an investor owns a stock, there are two primary sources of potential cash flows:

- Dividends: These are periodic payments made by the firm to its shareholders. They represent a portion of the company's profits that are distributed to stockholders.
- Sale of the Stock: The investor may decide to sell the stock at some future date, generating cash from the sale.

The total cash an investor receives from a stock depends on their investment horizon—the length of time they plan to hold the stock.

3.1.1 For a one year investor

For a one-year investor, the cash flows within that year would include any dividends paid and the proceeds from selling the stock at the end of the year. When an investor buys a stock, they pay the current market price, denoted as P_0. During the year, the stock may pay dividends, denoted as Div_1. At the end of the year, the investor may sell the stock at the new market price, P_1.

The future dividend payment (Div_1) and the future stock price (P_1) are not known with certainty at the time of purchase. These values are based on the investor's expectations about the company's future performance and the overall market conditions.

Since the future cash flows (Div_1 and P_1) are uncertain and risky, they cannot be discounted using the risk-free interest rate (the rate of return on a riskless asset). Instead, they must be discounted using the equity cost of capital (r_E), which represents the expected return on investments of equivalent risk to the stock in question.

The formula for the current stock price (P_0) is derived as follows:

$$P_0 = \frac{\text{Div}\, v_1 + P_1}{1 + r_E}$$

If the current market price of the stock (P_0) were less than the value derived from the formula, it would present a positive-NPV investment opportunity. Investors would recognize this undervaluation, rush to buy the stock, and the increased demand would drive the price up until it reaches the equilibrium price (where NPV $= 0$).

Conversely, if the stock price were greater than this amount, it would indicate that the stock is overvalued, creating an incentive for investors to sell. The increased selling pressure would drive the stock price down to the equilibrium level.

In a perfectly competitive market, the price of a stock should always adjust to a point where the NPV of buying or selling the stock is zero. This ensures that there are no arbitrage opportunities—no easy profit opportunities without risk. As a result, the stock price is always aligned with the present value of expected future cash flows, discounted by the appropriate rate that reflects the stock's risk.

3.1.2 Divident yields, capital gains, and total returns

We can rewrite $P_0 = \frac{\text{Div}\, v_1 + P_1}{1 + r_E}$ as:

$$r_E = \frac{Div_1}{P_0} + \frac{P_1 - P_0}{P_0}$$

- $\frac{Div_1}{P_0}$ represents the Dividend Yield. It is calculated by dividing the expected dividend (Div_1) by the current stock price (P_0).

- $\frac{P_1 - P_0}{P_0}$ represents the Capital Gain Rate. It is the difference between the expected sale price (P_1) and the current purchase price (P_0), divided by the current price.
- Total return = Dividend Yield + Capital Gain Rate

Remark.

Total Return of the stock should equal the Equity Cost of Capital (r_E). In other words, the expected total return on the stock should be equivalent to the return investors could earn on other investments with the same level of risk.

- **If the stock offers a higher return than other investments with the same risk**, investors would shift their money from those other investments to the stock. This increased demand would push up the stock price (P_0), which would reduce the dividend yield and capital gain rate until the total return equals the equity cost of capital.
- **If the stock offers a lower return than other investments with the same risk**, investors would sell the stock. This selling pressure would lower the stock price, increasing the dividend yield and capital gain rate until the total return matches the equity cost of capital.

3.1.3 A multiple year investor

For a two-year investor, the stock price today (P_0) is determined by the present value of the future cash flows over the two years. This includes the dividends in Year 1 (Div_1) and Year 2 (Div_2), as well as the stock price in Year 2 (P_2):

$$P_0 = \frac{\text{Div}_1}{1 + r_E} + \frac{\text{Div}_2 + P_2}{(1 + r_E)^2}$$

- Even though a one-year investor only plans to hold the stock for one year, they still care about what happens in Year 2. This is because the price at which they can sell the stock in Year 1 (P_1) is influenced by the expected future cash flows in Year 2.
- Suppose the one-year investor sells the stock to another one-year investor who plans to hold it for the second year. The second investor will base their price (P_1) on the expected dividend and stock price in Year 2, using the same valuation principles:

$$P_1 = \frac{Div_2 + P_2}{1 + r_E}$$

- When we substitute this expression back into the original equation for the one-year investor:

$$P_0 = \frac{\text{Div}_1 + P_1}{1 + r_E}$$

We get:

$$P_0 = \frac{\text{Div }_1}{1 + r_E} + \frac{1}{1 + r_E}\left(\frac{\text{Div }_2 + P_2}{1 + r_E}\right)$$

Simplifying further:

$$P_0 = \frac{\text{Div}_1}{1 + r_E} + \frac{Div_2 + P_2}{(1 + r_E)^2}$$

Remark.

It shows that the formula for the stock price for a two-year investor is identical to the one for a sequence of two one-year investors. This means that the stock's price today reflects the present value

of all expected future cash flows, regardless of whether an investor plans to hold the stock for one year, two years, or any other period.

3.1.4 Extending the DDM to multiple years

Previously, we examined the stock price for one-year and two-year investors. Now, let's extend this to any number of years, n, and derive a general formula for the stock price.

Starting from the principles discussed earlier, if we want to determine the stock price for an investor planning to hold the stock for n years, the stock price today (P_0) can be expressed as the present value of all expected dividends over those n years plus the present value of the expected stock price at the end of the nth year (P_n):

$$P_0 = \frac{\text{Div}_1}{1+r_E} + \frac{\text{Div}_2}{(1+r_E)^2} + \cdots + \frac{\text{Div}_n}{(1+r_E)^n} + \frac{P_n}{(1+r_E)^n}$$

A crucial insight from this formula is that it applies regardless of the investor's horizon:

- **Single n-year investor:** An investor planning to hold the stock for exactly n years will collect dividends for n years and then sell the stock at price P_n.
- **Sequence of shorter-term investors:** Alternatively, a series of investors might each hold the stock for shorter periods and resell it, but the overall valuation remains the same. Each successive investor values the stock based on the same future cash flows, meaning the stock's value remains consistent across different investors and their horizons.

This equation holds for any horizon n. Whether an investor plans to hold the stock for one year, two years, or indefinitely, the price they are willing to pay today (P_0) will be the same **if they share the same expectations about future dividends and risks**. This reflects the idea that the length of time an investor plans to hold the stock, and whether they collect returns in the form of dividends or capital gains, is irrelevant to the stock's value.

In some cases, the firm is expected to continue paying dividends indefinitely, and the stock might never be sold (or the company never acquired). Here, we let n approach infinity:

$$P_0 = \frac{\text{Div}_1}{1+r_E} + \frac{\text{Div}_2}{(1+r_E)^2} + \frac{\text{Div}_3}{(1+r_E)^3} + \cdots = \sum_{t=1}^{\infty} \frac{\text{Div}_t}{(1+r_E)^t}$$

3.2 DDM model in rea life

The DDM formula expresses the value of a stock as the present value of all expected future dividends:

$$P_0 = \frac{\text{Div}_1}{1+r_E} + \frac{\text{Div}_2}{(1+r_E)^2} + \frac{\text{Div}_3}{(1+r_E)^3} + \cdots = \sum_{t=1}^{\infty} \frac{\text{Div}_t}{(1+r_E)^t}$$

This formula indicates that the stock's value today is the sum of the present values of all expected future dividends. However, estimating these future dividends, especially in the distant future, is challenging due to uncertainties in a company's growth and profitability.

3.2.1 Constant dividend growth assumption

To simplify the estimation, a common approximation is to assume that dividends will grow at a constant rate (g) indefinitely. This is known as the Constant Dividend Growth Model.

Assume that the firm's dividends will grow at a constant rate g each year. If you buy the stock today and hold it, the timeline of expected dividends would look like this:

- Year 1: Dividend $= Div_1$

- Year 2: Dividend $= Div_2 = Div_1 \times (1+g)$
- Year 3: Dividend $= Div_3 = Div_2 \times (1+g) = Div_1 \times (1+g)^2$
- And so on.

Given that the dividends are expected to grow at a constant rate, these cash flows form a constant growth perpetuity. The formula for the present value of a constant growth perpetuity is:

$$P_0 = \frac{\text{Div}_1}{r_E - g}$$

- The stock's value is directly proportional to the expected dividend next year (Div_1). Higher expected dividends increase the stock's price.
- The required return (r_E) reflects the riskiness of the stock. If investors demand a higher return (due to perceived risk), r_E increases, reducing the stock price.
- The growth rate (g) of dividends is critical. If dividends are expected to grow quickly, g is high, which reduces the denominator ($r_E - g$) and increases the stock price. Conversely, if g is low or close to zero, the stock price will be lower.

Remark.

> This model assumes that dividends will grow at a constant rate indefinitely, which is a strong assumption. It's most applicable to mature companies with stable growth rates, like utilities or large consumer goods companies.

3.2.2 Dividends versus investment and growth

The Constant Dividend Growth Model equation is:

$$P_0 = \frac{\text{Div}_1}{r_E - g}$$

Naturally, a firm aiming to maximize its share price would want to increase both Div_1 and g. However, there's often a tradeoff because increasing g typically requires investment, which reduces the amount of earnings available to pay as dividends.

To understand how a firm's dividends grow, let's break down the determinants of its dividends:

$$\text{Div}_t = \frac{\text{Earnings}_t}{\text{Shares Outstanding}_t} \times \text{Dividend Payout Rate}_t$$

This formula shows that a firm can increase its dividends in three ways:

1. **Increasing Earnings (Net Income):** Higher earnings mean more potential dividends.
2. **Increasing the Dividend Payout Rate:** A higher payout rate means a greater portion of earnings is distributed as dividends.
3. **Decreasing Shares Outstanding:** Fewer shares increase the EPS, potentially boosting dividends per share.

However, let's assume that the number of shares outstanding remains constant, so the focus is on the tradeoff between increasing earnings and increasing the payout rate. A firm's earnings can be either paid out as dividends to shareholders, or retained and reinvested to generate future growth.

By reinvesting its earnings, the firm can potentially increase its future earnings and dividends. This reinvestment drives the firm's growth. If the firm chooses not to invest, its earnings and dividends remain constant. If all future growth in earnings comes solely from new investments made with retained earnings, the growth in earnings can be expressed as:

$$\text{Change in Earnings} = \text{New Investment} \times \text{Return on New Investment}$$

Where New Investment = Earnings × Retention Rate, the Retention Rate is the fraction of earnings that the firm keeps instead of paying out as dividends.

The growth rate of earnings, which reflects how much the firm's earnings are expected to increase over time, can be derived as:

$$\text{Earnings Growth Rate} = \text{Retention Rate} \times \text{Return on New Investment}$$

If the firm maintains a constant dividend payout rate, the growth rate of dividends (g) will equal the growth rate of earnings:

$$g = \text{Retention Rate} \times \text{Return on New Investment}$$

This formula defines the firm's sustainable growth rate-the rate at which the firm can grow its earnings (and therefore its dividends) using only the earnings it retains and reinvests.

The equation $g =$ Retention Rate × Return on New Investment highlights a crucial tradeoff:

- Higher Growth (g): To increase the growth rate, the firm needs to retain more earnings (increase the retention rate). However, this means paying out less in dividends today.
- Higher Dividends: If the firm pays out more of its earnings as dividends (increasing the dividend payout rate), it retains less for reinvestment, which may reduce future growth.

The decision to either retain earnings for investment or pay them out as dividends depends on the profitability of the firm's investments. Cutting the firm's dividend to increase investment will raise the stock price if, and only if, the new investments have a positive NPV (Rate of return on the investment $> r_E$).

3.2.3 Changing growth rates

For firms with changing growth rates, the Constant Dividend Growth Model (CDGM) has significant limitations. Despite the limitations of the CDGM, we can still value such firms using the General Dividend-Discount Model (DDM). The key idea is to apply the CDGM to estimate the stock price in the future, once the firm has matured and its growth rate stabilizes.

Let's say that after n years, the firm is expected to grow at a constant, long-term growth rate g. At that point (Year n+1), we can use the CDGM to estimate the stock price P_n, which is known as the terminal value or continuation value:

$$P_n = \frac{Div_{n+1}}{r_E - g}$$

To find the current stock price P_0, we need to calculate the present value of:

1. The dividends expected during the high-growth phase (Years 1 through n).
2. The terminal value P_n.

The formula for P_0 becomes:

$$P_0 = \frac{\text{Div}_{\ 1}}{1 + r_E} + \frac{\text{Div}_{\ 2}}{(1 + r_E)^2} + \cdots + \frac{\text{Div}_{\ n}}{(1 + r_E)^n} + \frac{1}{(1 + r_E)^n}\left(\frac{\text{Div}_{\ n+1}}{r_E - g}\right)$$

3.3 Limitations of DDM

The DDM is highly sensitive to assumptions about the growth rate and cost of capital. Small changes in these inputs can lead to significant differences in the estimated stock price, making it difficult to rely on the model without strong justifications for the assumptions.

Forecasting dividends involves predicting future earnings, dividend payout rates, and share counts—factors influenced by management decisions like borrowing, share repurchases, and reinvestment strategies. These variables introduce a high degree of uncertainty, reducing the reliability of the DDM.

3.4 Total payout model

In the traditional Dividend-Discount Model (DDM), the value of a stock is calculated based on the present value of expected future dividends:

$$P_0 = PV(\text{ Future Dividends per Share })$$

This approach assumes that dividends are the only form of cash payout from the firm to its shareholders.

However, many firms have increasingly replaced or supplemented dividend payouts with share repurchases. In a share repurchase, the firm uses excess cash to buy back its own stock from the market. This has two important consequences:

- **Reduced Dividends:** The more cash a firm uses for share repurchases, the less it has available for dividend payments.
- **Reduced Share Count:** By repurchasing shares, the firm reduces the total number of shares outstanding, which increases Earnings Per Share (EPS) and Dividends Per Share (DPS) for the remaining shares.

The Total Payout Model overcomes these limitations by considering all cash distributions to shareholders—both dividends and share repurchases—when valuing the firm's equity.

- **Total Payouts:** Instead of focusing on dividends alone, the model values the total payouts the firm makes to shareholders, which includes both dividends and the cash used for share repurchases.
- **Valuing the Entire Firm's Equity:** The model first calculates the present value of all expected future payouts (dividends and repurchases):

$$PV \text{ (Future Total Dividends and Repurchases)}$$

- **Determining the Share Price:** To find the per-share price, this total present value is then divided by the current number of shares outstanding:

$$P_0 = \frac{PV(\text{ Future Total Dividends and Repurchases })}{\text{Shares Outstanding}}$$

3.5 Discounted free cash flow model

The Discounted Free Cash Flow Model (DFCFM) values a firm by estimating the total value of its operations—known as the Enterprise Value. This model is particularly useful when we want to account for both equity and debt holders, rather than focusing solely on the dividends or payouts to equity holders, as in the Dividend-Discount Model.

To estimate a firm's enterprise value, we focus on the Free Cash Flow (FCF), which is the cash generated by the firm that is available to pay both debt and equity holders. The FCF can be calculated as follows:

$$\text{Free Cash Flow} = \text{EBIT} \times (1 - \tau_c) + \text{Depreciation - Capital Expenditures - Change in Net Working Capital}$$

Sometimes, it's helpful to define Net Investment as:

$$\text{Net Investment} = \text{Capital Expenditures - Depreciation}$$

This represents the investment above and beyond what is necessary to maintain the firm's existing operations, essentially the investment intended to support the firm's growth.

To estimate the firm's current enterprise value (V_0), we compute the present value of the firm's future free cash flows:

$$V_0 = PV(\text{ Future Free Cash Flow of the Firm })$$

This involves discounting future FCFs back to the present using the firm's Weighted Average Cost of Capital (WACC).

Once we have the enterprise value, we can estimate the share price P_0 using the following equation:

$$P_0 = \frac{V_0 + \text{Cash}_0 - \text{Debt}_0}{\text{Shares Outstanding}}$$

- $V_0 = \frac{FCF_1}{1+r_{\text{wacc}}} + \frac{FCF_2}{(1+r_{\text{wacc}})^2} + \cdots + \frac{FCF_n}{(1+r_{\text{wacc}})^n} + \frac{V_n}{(1+r_{\text{wacc}})^n}$
- Often, the terminal value is estimated by assuming a constant long-run growth rate g_{FCF} for free cash flows beyond year n, so that:

$$V_n = \frac{FCF_{n+1}}{r_{\text{wacc}} - g_{FCF}} = \left(\frac{1+g_{FCF}}{r_{\text{wacc}} - g_{FCF}}\right) \times FCF_n$$

A crucial difference in the DFCFM is the discount rate used:

- WACC (Weighted Average Cost of Capital) is used instead of the equity cost of capital (r_E) because we are valuing cash flows available to both debt and equity holders. If the firm has no debt, $r_{\text{wacc}} = r_E$.
- WACC reflects the average risk of the firm's investments and is typically lower than the equity cost of capital since debt is generally less risky.

The DFCFM is closely linked to the NPV rule used in capital budgeting. The firm's enterprise value can be seen as the sum of the NPVs of its current and future projects. Positive NPV projects add value to the firm, thereby increasing the enterprise value and, ultimately, the stock price.

3.6 Valuation based on comparable firms

The Law of One Price states that two assets with identical cash flows should have the same price. In the context of valuation, this means that if two firms are expected to generate similar future cash flows, their market values should be comparable.

The Method of Comparables (or "comps") involves valuing a firm by comparing it to other, similar firms that are publicly traded. If these comparable firms are expected to generate similar cash flows, their current market values can provide a benchmark for estimating the value of the firm in question.

In practice, finding truly identical firms is challenging. Even companies in the same industry selling similar products can differ significantly in size, growth prospects, and capital structure. To address these differences, the Method of Comparables uses valuation multiples to adjust for scale and other variations between firms.

3.6.1 Valuation multiplier

A valuation multiple is a ratio of a firm's value to a measure of its scale, such as earnings, sales, or book value. This allows for direct comparisons between firms of different sizes.

The P/E ratio is one of the most common valuation multiples. It is calculated as:

$$P/E = \frac{\text{Share Price}}{\text{Earnings Per Share (EPS)}}$$

- **Forward P/E:** Based on expected earnings over the next 12 months. This is generally preferred for valuation because it focuses on future earnings.
- **Trailing P/E:** Based on earnings over the prior 12 months.

The formula for the Forward P/E ratio, derived from the constant dividend growth model, is:

$$\text{Forward P/E} = \frac{P_0}{EPS_1} = \frac{\text{Div}_1/EPS_1}{r_E - g} = \frac{\text{Dividend Payout Rate}}{r_E - g}$$

This formula suggests that firms with higher growth rates (g) and higher dividend payout rates will have higher P/E ratios, assuming they have the same equity cost of capital (r_E).

Enterprise Value (EV) provides a more comprehensive view of a firm's value by including both debt and equity:

$$\text{Enterprise Value} = \text{Market Value of Equity} + \text{Debt - Cash}$$

EV multiples are particularly useful when comparing firms with different levels of leverage. Common EV multiples include:

- EV/EBIT: Enterprise Value to Earnings Before Interest and Taxes.
- EV/EBITDA: Enterprise Value to Earnings Before Interest, Taxes, Depreciation, and Amortization. $\frac{V_0}{EBITDA_1} = \frac{FCF_1/EBITDA_1}{r_{\text{wacc}} - g_{FCF}}$, and $P_0 = \frac{V_0 + \text{Cash}_0 - \text{Debt}_0}{\text{Shares Outstanding}}$.
- EV/FCF: Enterprise Value to Free Cash Flow.

3.6.2 Other multipliers

Beyond P/E and EV multiples, other industry-specific multiples can be useful, depending on the nature of the business:

- EV/Sales: Useful when margins are similar across firms, allowing comparisons based on revenue.
- Price-to-Book Ratio: The ratio of a firm's market value to its book value, often used for firms with substantial tangible assets.
- Industry-Specific Multiples: For example, in the cable TV industry, EV per subscriber might be a relevant metric.

4 Capital structure in a perfect market

The chapter assumes a world of perfect capital markets. Here's what that means:

- **Fair Pricing:** All securities (debt, equity, etc.) are fairly priced, meaning they reflect all available information and there's no opportunity for arbitrage.
- **No Taxes or Transaction Costs:** There are no frictions like taxes or costs of issuing securities that might influence the decision.
- **Independence of Financing and Firm Value:** The total cash flows generated by the firm's projects are assumed to be independent of how the firm is financed. That is, the way a firm raises money doesn't change the cash flows from its investments.

4.1 Equity versus debt financing

Definition 4.1: Capital structure

The mix of different types of securities a firm uses to finance its operations, primarily debt and equity. We have two primary options:

- Financing solely with equity: Raising funds by issuing shares of stock.
- Financing with a combination of debt and equity: Raising funds by issuing both shares and borrowing.

4.1.1 Finance with only equity

Let's consider an example with an entrepreneur who has an investment opportunity:

- Initial Investment: $\$800$ (outflow in Year 0).
- Cash Flows in Year 1:
  - Strong Economy: \$1,400
  - Weak Economy: $\$900$

Both outcomes are equally likely (50% probability each). The project's risk requires a premium above the risk-free rate to compensate investors for the uncertainty. The current risk-free interest rate is 5% and suppose that, given the market risk of the investment, the appropriate risk premium is 10%.

$$\text{Expected Cash Flow } = \frac{1}{2}(\$1,400) + \frac{1}{2}(\$900) = \$1,150$$

$$\text{Cost of Capital } = \text{ Risk-Free Rate } + \text{ Risk Premium } = 5\% + 10\% = 15\%$$

$$\text{NPV} = -\$800 + \frac{\$1,150}{1.15} = -\$800 + \$1,000 = \$200$$

The NPV is $\$200$, meaning the project is profitable and creates value for the entrepreneur. If the project is financed entirely with equity, the firm's value today (present value of future cash flows) would be:

$$PV(\text{ Equity Cash Flows }) = \frac{\$1,150}{1.15} = \$1,000$$

The entrepreneur can raise $\$1,000$ by selling equity, pay the $\$800$ needed for the project, and keep the $\$200$ profit (equal to the NPV).

Definition 4.2: Unlevered Equity

Equity in a firm with no debt. The equity holders get all the project cash flows.

	Date 0 Initial Value	Date 1: Cash Flows	Date 1: Returns
Unlevered Equity	$\$1,000$	Strong Economy: $\$1,400$, Weak Economy: $\$900$	Strong Economy: 40%, Weak Economy: -10%

$$\text{Expected Return } = \frac{1}{2}(40\%) + \frac{1}{2}(-10\%) = 15\%$$

Since unlevered equity reflects the project's risk, the expected return equals the required return of 15%.

4.1.2 Finance with both equity and debt

Now, suppose the entrepreneur decides to use both debt and equity:

- Debt Issued: $\$500$ (at 5% risk-free rate)
- Repayment in Year 1:

$$\text{Debt Repayment } = \$500 \times 1.05 = \$525$$

With debt, the remaining cash flows after paying debt holders go to equity holders (levered equity).

	Date 0 Initial Value	Date 1: Cash Flows
Debt	$\$500$	$\$525$ (both scenarios)
Levered Equity	? (to be determined)	Strong: $\$875$, Weak: $\$375$
Firm	$\$1,000$	Strong: $\$1,400$, Weak: $\$900$

The total value of the firm is determined by the present value of its future cash flows, regardless of how those cash flows are divided between debt and equity holders. This remains the same whether the firm is financed entirely with equity (unlevered) or with a combination of debt and equity (levered). Since the firm's only asset is this project, the value of the firm is equal to the present value of the project's cash flows. Thus, the firm's total value is $1,000. Thus:

$$E = \$1,000 - \$500 = \$500$$

Thus, levered equity sells for $\$500$ by the Law of One Price in perfect capital market, but the firm can still raise $\$1,000$ overall, as with unlevered equity.

Definition 4.3: Levered equity

Equity in a firm with debt, both debt holders and equity holders share the cash flows.

	Date 0 Initial Value	Date 1 Cash Flows	Date 1 Returns	Expected Return
Debt	$\$500$	$\$525$	5%	5%
Levered Equity	$\$500$	Strong: $\$875$, Weak: $\$375$	Strong: 75%, Weak: -25%	25%
Unlevered Equity	$\$1,000$	Strong: $\$1,400$, Weak: $\$900$	Strong: 40%, Weak: -10%	15%

Levered Equity is riskier but has a higher expected return (25%) compared to unlevered equity (15%).

	Return Sensitivity (Systematic Risk)	Risk Premium
	$\Delta R = R(\text{ strong }) - R(\text{ weak })$	$E[R] - r_f$
Debt	$5\% - 5\% = 0\%$	$5\% - 5\% = 0\%$
Unlevered equity	$40\% - (-10\%) = 50\%$	$15\% - 5\% = 10\%$
Levered equity	$75\% - (-25\%) = 100\%$	$25\% - 5\% = 20\%$

Leverage doubles the systematic risk for equity, hence the higher risk premium and required return.

4.2 Modigliani-Miller I: leverage, arbitrage, and firm value

Proposition 4.4

MM Proposition I states: *In a perfect capital market, the total value of a firm's securities (debt and equity) is equal to the market value of the total cash flows generated by its assets. This value is not affected by the firm's choice of capital structure (i.e., the mix of debt and equity used).*

The Law of One Price underpins MM Proposition I. It asserts that in the absence of taxes, transaction costs, and other market imperfections, the value of a firm's total securities must equal the total value of the firm's assets. In other words, financing through debt or equity does not change the overall value of the firm—it merely redistributes the same value between debt holders and equity holders.

Homemade leverage refers to the ability of investors to replicate a firm's capital structure on their own by borrowing or lending. This means that if an investor prefers a different leverage ratio than what the firm offers, they can create their preferred leverage by adjusting their personal portfolio.

Example.

If a firm is unlevered (all-equity financed), an investor who prefers leverage can achieve the same effect by borrowing money personally and buying the firm's equity with that borrowed money. Conversely, if a firm is levered, an investor can achieve an unlevered position by combining the firm's debt and equity in their portfolio.

This table demonstrates how an investor can mimic levered equity by using homemade leverage:

	Date 0 Initial Cost	Date 1: Cash Flows (Strong Economy)	Date 1: Cash Flows (Weak Economy)
Unlevered Equity	$\$1,000$	$\$1,400$	$\$900$
Margin Loan	$-\$500$	$-\$525$	$-\$525$
Levered Equity	$\$500$	$\$875$	$\$375$

The investor borrows $\$500$ at the risk-free rate and uses it to purchase $\$1,000$ of unlevered equity.

	Date 0 Initial Cost	Date 1: Cash Flows (Strong Economy)	Date 1: Cash Flows (Weak Economy)
Debt	$\$500$	$\$525$	$\$525$
Levered Equity	$\$500$	$\$875$	$\$375$
Unlevered Equity	$\$1,000$	$\$1,400$	$\$900$

By first buying and holding both debt and equity in the firm, the investor replicates the unlevered equity's cash flows.

4.3 Violation of MM I and arbitrage opportunity

Example.

This example shows an arbitrage opportunity that arises when MM Proposition I is violated: Two identical firms exist-one unlevered with equity valued at $\$990$, and one levered with equity valued at $\$510$ and debt valued at $\$500$. The total value of the levered firm $(\$1,010)$ exceeds that of the unlevered firm ($990), contradicting MM Proposition I.

1. Borrow $\$500$, buy the unlevered firm's equity ($\$990$), and sell the levered firm's equity $(\$510)$.
2. The total initial cost is $\$990$ (borrowed $\$500 + \$490$ personal investment), but by short selling the levered equity for $\$510$, the investor pockets $\$20$ upfront.
3. The arbitrage process corrects the price discrepancy, ensuring that both firms are valued equally, in line with MM Proposition I.

	Date 0	Date 1: Cash Flows	
	Cash Flow	Strong Economy	Weak Economy
Borrow	$\$500$	$-\$525$	$-\$525$
Buy unlevered equity	$-\$990$	$\$1400$	$\$900$
Short sell levered equity	$\$510$	$-\$875$	$-\$375$
Total cash flow	$\$20$	$\$0$	$\$0$

Example.

Suppose there are two firms, each with date 1 cash flows of $\$1400$ or $\$900$. The firms are identical except for their capital structure. One firm is unlevered, and its equity has a market value of $\$1010$. The other firm has borrowed $\$500$, and its equity has a market value of $\$500$. Does MM Proposition I hold? What arbitrage opportunity is available using homemade leverage?
MM Proposition I states that the total value of each firm should equal the value of its assets. Because these firms hold identical assets, their total values should be the same. However, the problem assumes the unlevered firm has a total market value of $\$1,010$, whereas the levered firm has a total market value of $\$500$ (equity) $+\$500$ (debt) = $1,000. Therefore, these prices violate MM Proposition I.
Because these two identical firms are trading for different total prices, the Law of One Price is violated and an arbitrage opportunity exists. To exploit it, we can buy the equity of the levered firm for $\$500$, and the debt of the levered firm for $\$500$, re-creating the equity of the unlevered firm by using homemade leverage for a cost of only $\$500 + \$500 = \$1000$. We can then sell the equity of the unlevered firm for $\$1010$ and enjoy an arbitrage profit of $\$10$.

	Date 0	Date 1: Cash Flows	
	Cash	Strong Economy	Weak Economy
Buy levered equity	$-\$500$	$\$875$	$\$375$
Buy levered debt	$-\$500$	$\$525$	$\$525$
Short sell unlevered equity	$\$1,010$	$\$1,400$	$-\$900$
Total cash flow	$\$10$	$\$0$	$\$0$

4.4 Market value balance sheet

The market value balance sheet is a tool that reflects the true economic value of a firm's assets and liabilities. It is different from an Accounting Balance Sheet

- Inclusion of Intangible Assets: All assets, including intangibles like reputation, intellectual property, and human capital, are considered.
- Use of Market Values: The balance sheet reflects current market values rather than historical costs.

Assets	Liabilities + Equity
Collection of Assets and Investments Undertaken by the Firm:	Collection of Securities Issued by the Firm:
Tangible Assets (Cash, Inventory, Plant, etc.)	Debt (Short-term, Long-term, Convertible)
Intangible Assets (Intellectual Property, Reputation, Human Capital)	Equity (Common Stock, Preferred Stock, Warrants)
Total Market Value of Firm's Assets	Total Market Value of Firm's Securities

The market value balance sheet captures the idea that the value of a firm is determined by its assets, and the capital structure only determines how this value is split among different securities.

4.5 Leveraged recapitalization

Leveraged recapitalization is when a firm borrows money to repurchase its own shares. This process can be explained using the market value balance sheet:

Example.

Harrison Industries is an all-equity firm with 50 million shares at $4 per share. The firm borrows $80 million to repurchase 20 million shares.

Stage	Assets	Liabilities + Equity	Shares Outstanding	Value per Share
Initial	$200 million (existing assets)	$200 million (equity)	50 million	$4.00
After Borrowing	$280 million (existing + cash)	$80 million (debt), $200 million (equity)	50 million	$4.00
After Repurchase	$200 million (existing assets)	$80 million (debt), $120 million (equity)	30 million	$4.00

Despite repurchasing shares, the share price remains $4. This shows that the recapitalization is a zero-NPV transaction-leveraging does not change the firm's total value, only how it is divided between debt and equity.

4.6 Modigliani-Miller II: Leverage, risk, and the cost of capital

While MM Proposition I asserts that a firm's total value is independent of its capital structure, MM Proposition II examines how leverage influences the cost of capital, particularly the cost of equity.

4.6.1 Leverge cost and equity cost of capital

At first glance, debt seems like a cheaper source of capital compared to equity. Debt typically has a lower required return (the interest rate) because it is less risky—debt holders have a priority claim on the firm's assets in the event of bankruptcy. However, this lower cost of debt does not imply that the overall cost of capital for the firm decreases when debt is introduced. This is because as a firm takes on more debt, the risk to equity holders increases, and they demand a higher return as compensation.

MM Proposition I states:

$$E + D = U = A$$

This equation tells us that the total market value of the firm's securities (debt + equity) equals the market value of its assets, regardless of whether the firm is levered or unlevered.

- E : Market value of equity (levered)

- D : Market value of debt
- U : Market value of equity (unlevered)
- A : Market value of the firm's assets

The return on a portfolio of levered equity and debt can be expressed as:

$$\frac{E}{E+D}R_E + \frac{D}{E+D}R_D = R_U$$

Where:

- R_E is the return on levered equity
- R_D is the return on debt
- R_U is the return on unlevered equity (equal to the return on the firm's assets)

Rearranging the above equation to solve for R_E, we get:

$$R_E = R_U + \frac{D}{E}(R_U - R_D)$$

This equation reveals that the return on levered equity R_E consists of two components:

1. R_U : The return due to the inherent risk of the firm's assets.
2. $\frac{D}{E}(R_U - R_D)$: The additional return required by equity holders due to the increased risk from leverage.

This equation highlights that leverage increases the expected return on equity because equity holders require compensation for the additional risk they bear when the firm takes on debt.

MM Proposition II formalizes this relationship:

$$r_E = r_U + \frac{D}{E}(r_U - r_D)$$

Where:

- r_E : Expected return on levered equity (cost of equity)
- r_U : Expected return on unlevered equity (cost of capital for the firm's assets)
- r_D : Expected return on debt (cost of debt)

As the firm increases its debt D relative to equity E, the cost of equity r_E increases. This is because equity holders now face more risk-they only get paid after debt holders have been satisfied. The increased return r_E compensates equity holders for the additional financial risk introduced by the leverage.

4.6.2 Capital budgeting and WACC

Capital budgeting involves evaluating potential investments and deciding which ones to pursue. A key element in this process is determining the appropriate discount rate or cost of capital for evaluating the project's future cash flows.

When a firm finances its operations through both equity and debt, the risk of its assets reflects the risk of the combined portfolio of its equity and debt. The appropriate cost of capital for the firm's assets is therefore the Weighted Average Cost of Capital (WACC). This WACC represents the average rate of return required by both debt holders and equity holders.

$$r_{\text{wacc}} = \frac{E}{E+D} \cdot r_E + \frac{D}{E+D} \cdot r_D$$

In a perfect capital market (no taxes, transaction costs, or bankruptcy costs), the WACC simplifies because there is no tax shield on debt, so:

$$r_{\text{wacc}} = r_U = r_A$$

This equation tells us that the firm's WACC, and consequently its cost of capital for evaluating new projects, is independent of the firm's capital structure. Whether the firm is financed with debt, equity, or a combination of both, the overall cost of capital remains the same as the unlevered cost of capital.

- If a firm has no debt (100% equity financing), the WACC equals the unlevered equity cost of capital, r_U.
- As the firm introduces debt into its capital structure, it borrows at a lower cost (r_D), causing the cost of equity (r_E) to increase. This increase in r_E occurs because equity holders bear more risk when the firm is levered (debt has priority over equity in the event of bankruptcy). However, the overall WACC remains constant because the increase in r_E is exactly offset by the lower r_D (due to the proportion of financing coming from cheaper debt).
- If the firm continues to increase its leverage, the risk of default increases, making debt more risky and increasing r_D.

  Despite the increase in both r_E and r_D, the WACC remains unchanged as long as the weight of the cheaper debt balances the higher cost of equity.

This concept demonstrates that the WACC remains stable regardless of the firm's capital structure, affirming MM Proposition I: The value of the firm is unaffected by its capital structure.

4.6.3 WACC with multiple securities

$$r_{\text{wacc}} = \frac{E}{E+D+W} r_E + \frac{D}{E+D+W} r_D + \frac{W}{E+D+W} r_W$$

4.7 Levered and unlevered betas

The unlevered beta represents the market risk of a firm's assets without considering the effects of leverage (debt). It reflects the risk inherent in the firm's operations and investments, independent of how those operations are financed.

$$\beta_U = \frac{E}{E+D}\beta_E + \frac{D}{E+D}\beta_D$$

- $\beta_U =$ Unlevered (or asset) beta
- $\beta_E =$ Levered (or equity) beta
- $\beta_D =$ Debt beta (often assumed to be close to zero if the debt is low-risk)
- $E =$ Market value of equity
- $D =$ Market value of debt

When a firm introduces debt into its capital structure, the risk to equity holders increases because debt holders have a prior claim on the firm's assets. As a result, the levered beta is higher than the unlevered beta. This increased risk to equity holders due to leverage is captured in the levered beta.

$$\beta_E = \beta_U + \frac{D}{E}(\beta_U - \beta_D)$$

- β_U represents the risk of the firm's underlying assets.

- The term $\frac{D}{E}(\beta_U - \beta_D)$ accounts for the additional risk introduced by leveraging the firm's equity with debt.
- When assessing the firm's leverage and WACC, it's important to consider net debt rather than gross debt because net debt gives a clearer picture of the firm's financial risk.

4.8 Leverage on Earnings per Share

In this example, we analyze how leverage affects a firm's Earnings per Share (EPS) and why this increase in EPS does not necessarily lead to an increase in the firm's stock price, as explained by the Modigliani-Miller (MM) Propositions.

Levitron Industries (LVI) is considering altering its capital structure by borrowing $\$15$ million at an 8% interest rate and using the proceeds to repurchase 2 million shares. Before making this change, LVI is an all-equity firm with 10 million shares outstanding and an Earnings Before Interest and Taxes (EBIT) of $\$10$ million. The firm's shares are trading at $\$7.50$ each.

As an all-equity firm, LVI's EPS is calculated as:

$$\text{EPS} = \frac{\text{Earnings}}{\text{Number of Shares}} = \frac{\$10 \text{ million}}{10 \text{ million shares}} = \$1 \text{ per share}$$

If LVI takes on $\$15$ million in debt at an 8% interest rate, the annual interest expense will be:

$$\text{Interest Expense } = \$15 \text{ million } \times 8\% = \$1.2 \text{ million}$$

The firm's earnings after interest expense would then be: Earnings After Interest = EBIT - Interest $= \$10$ million $-\$1.2$ million $= \$8.8$ millior Since LVI will use the borrowed funds to repurchase 2 million shares, the number of shares outstanding will decrease to:

$$\text{New Number of Shares } = 10 \text{ million } - 2 \text{ million } = 8 \text{ million shares}$$

The new EPS after leverage is:

$$\text{EPS} = \frac{\$8.8 \text{ million}}{8 \text{ million shares}} = \$1.10 \text{ per share}$$

As seen in the calculation, LVI's EPS increases from $\$1$ to $\$1.10$ after taking on debt. However, this increase in EPS does not imply that shareholders are better off. The reason lies in the increased risk due to leverage.

Leverage amplifies the firm's earnings variability:

- **Higher Risk at Low EBIT:** If EBIT falls, the interest payments remain fixed, causing EPS to decline more sharply compared to an unlevered scenario. For instance, if EBIT drops to $\$4$ million:

  Without leverage, EPS would be $\$4$ million $\div 10$ million shares $= \$0.40$ per share.

  With leverage, EPS would be $(\$4$ million $-\$1.2$ million $) \div 8$ million shares $= \$0.35$ per share.
- The break-even EBIT level where EPS with and without leverage is the same can be identified at $\$6$ million EBIT. Below this level, leverage reduces EPS; above this level, leverage increases EPS.

Panel (a) Calculating earnings per share for different levels of EBIT.

EBIT ($ million)	Unlevered EPS ($)	EBIT – Interest ($ million)	Levered EPS ($)
0	0.00	−1.2	−0.15
4	0.40	2.8	0.35
6	0.60	4.8	0.60
10	1.00	8.8	1.10
16	1.60	14.8	1.85
20	2.00	18.8	2.35

Panel (b) LVI earnings per share for different levels of EBIT.

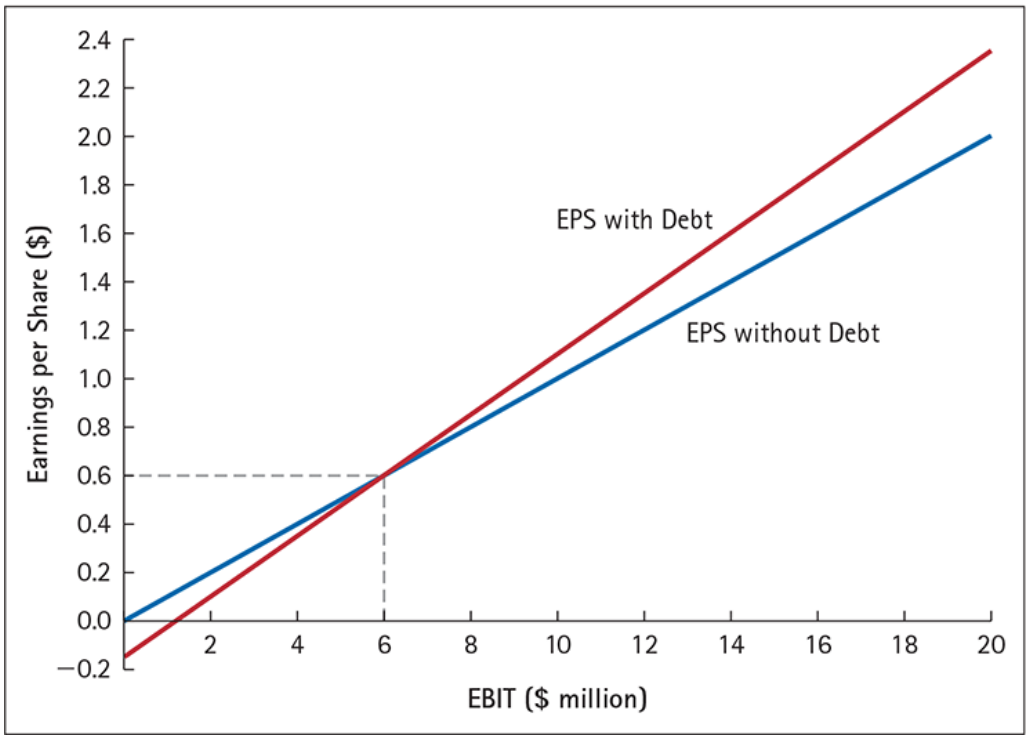

Figure 8: EPS with debt and without debt

According to MM Proposition I and II:

- Proposition I states that in perfect capital markets, leverage does not affect the total value of the firm. Therefore, the increase in EPS should not lead to a higher stock price.
- Proposition II indicates that as leverage increases, the cost of equity (r_E) also increases due to the higher risk faced by equity holders.

Assume that LVI's EBIT is not expected to grow in the future and that all earnings are paid as dividends. And assume we are in a perfect capital market. This means:

$$P = \frac{EPS}{r_U} \Rightarrow r_U = \frac{\$1}{\$7.50} = 13.33\%$$

Where: Market value of the firm $=$ 10 million shares $\times \$7.50 = \$75$ million
After repurchasing shares, Remaining Equity Value $= \$75$ million $- \$15$ million $= \$60$ million
Debt-to-equity ratio:

$$\frac{D}{E} = \frac{\$15 \text{ million}}{\$60 \text{ million}} = 1/4$$

Levered cost of equity (r_E) :

$$r_E = r_U + \frac{D}{E}(r_U - r_D) = 13.33\% + \frac{1}{4}(13.33\% - 8\%) = 14.66\%$$

New share price:

$$P = \frac{\$1.10}{r_E} = \frac{\$1.10}{14.66\%} = \$7.50 \text{ per share}$$

Even though EPS increases to $\$1.10$, the higher required return r_E due to increased risk keeps the share price unchanged at $\$7.50$.

The key takeaway is that while leverage can increase EPS, it also raises the risk for equity holders, which in turn increases the required return on equity. This increased return requirement offsets the EPS increase, leaving the stock price unchanged. Thus, in a perfect market, the increase in EPS from leverage does not translate into a higher stock price, consistent with MM Proposition I.

4.9 The Dilution fallacy

The concern about dilution often arises when firms consider issuing new equity to finance investments or expansion projects. The common belief is that issuing new shares will dilute the ownership of existing shareholders, potentially reducing the value of each share. However, this concern is based on a misunderstanding of how equity issuance works in the context of corporate finance.

Dilution, in this context, refers to the idea that issuing more shares will spread the same amount of earnings or cash flows over a larger number of shares, thereby reducing the value per share. This perspective overlooks a critical aspect: the cash raised from issuing new shares increases the firm's assets, which can generate additional value.

Example.

Let's consider the example of Jet Set Airlines (JSA) to clarify this concept. Current Market Value of Equity $= 500$ million shares $\times \$16 = \$8$ billion
JSA has announced an expansion plan that requires $\$1$ billion to purchase new planes. This expansion will be financed by issuing new equity.
Before the equity issuance, the market value of JSA's equity is $\$8$ billion. By issuing new shares worth $\$1$ billion, the firm's total assets will increase to: New Market Value of Assets $= \$8$ billion $+\$1$ billion $= \$9$ billion
The price per share before the issue is $\$16$. To raise $\$1$ billion, the number of new shares that need to be issued is:

$$\text{Number of New Shares } = \frac{\$1 \text{ billion}}{\$16 \text{ per share}} = 62.5 \text{ million shares}$$

After the issuance, the total number of shares outstanding will be: Total Shares Outstanding $= 500$ million $+62.5$ million $= 562.5$ million shares
The total value of the firm post-issue is $\$9$ billion. The new share price is calculated by dividing the total value of the firm by the total number of shares outstanding:

$$\text{New Share Price } = \frac{\$9 \text{ billion}}{562.5 \text{ million shares}} = \$16 \text{ per share}$$

The share price remains unchanged at $\$16$ per share, despite the increase in the number of shares outstanding. This is because the additional capital raised through the new equity issuance is used to finance an expansion that adds value to the firm.

The key point that refutes the dilution fallacy is that issuing new shares does not dilute the value of existing shares as long as the funds raised are used to invest in positive-NPV projects or assets that add value to the firm.

5 Debt and taxes

In a perfect capital market, the choice between debt and equity financing doesn't affect a firm's value, as all financial transactions have a neutral impact (NPV of zero). However, in reality, firms spend significant resources managing their capital structure, and there are notable differences across industries—like low debt in software firms and high debt in real estate companies. This suggests that capital structure is important, contrary to theoretical models. The chapter will explore how market imperfections, specifically taxes, make leverage relevant by potentially increasing firm value through tax savings.

5.1 Understanding interest tax deduction

Corporations are required to pay taxes on their profits, but they can deduct interest payments on debt from their taxable income. This reduction in taxable income effectively reduces the overall tax burden for the company. This mechanism creates a strong incentive for firms to use debt financing, as it lowers their tax liability.

Example.

Let's dissect the example given for Loblaw Companies Limited, a major Canadian retailer. Loblaw had EBIT of $2,270 million in 2019. This figure represents the company's operating income before any interest expenses or taxes are deducted. Loblaw paid $\$747$ million in interest on its debt. This interest expense is deductible, meaning Loblaw can subtract it from its EBIT to determine its taxable income, known as Earnings Before Taxes (EBT).

- With Leverage, after subtracting the interest expense from the EBIT, Loblaw's EBT drops to $\$1,523$ million.
- Without Leverage, if Loblaw had no debt, its EBT would remain at $\$2,270$ million, as there would be no interest expense to deduct.
- With Leverage, with the reduced EBT of $\$1,523$ million, the taxes Loblaw pays at a tax rate of 25.74% amount to $\$392$ million.
- Without Leverage, without interest deductions, Loblaw would pay $\$584.3$ million in taxes on its full EBIT of $\$2,270$ million.

After paying $\$392$ million in taxes, Loblaw's net income is $\$1,131$ million. Without leverage, the net income would be higher at $\$1,685.7$ million. However, while the net income available to equity holders is lower with leverage ($\$1,131$ million) than without ($\$1,685.7$ million), the total amount available to all investors (both debt and equity holders) is actually higher with leverage. Specifically:

- With Leverage: Total payouts include $\$747$ million to debt holders (interest payments) and $\$1,131$ million to equity holders, totaling $\$1,878$ million.
- Without Leverage: Total payouts would be $\$1,685.7$ million, all to equity holders.

Thus, Loblaw could pay out $\$192.3$ million more to all investors with leverage compared to without it. This extra value comes from the interest tax shield.

Definition 5.1: Interest tax shield

The interest tax shield is the tax savings that result from the tax-deductibility of interest payments. In Loblaw's case, the tax shield is calculated as:

$$\text{Interest Tax Shield} = \text{Interest Expense} \times \text{Tax Rate} = 747 \times 25.74\% = 192.3 \text{ million}$$

This shield represents the amount of taxes the firm would have paid without leverage.

5.2 Valuation of interest tax shield

5.2.1 Interest tax shield and the value of the firm

The relationship between a firm's value and its capital structure can be summarized by the modified Modigliani-Miller Proposition I in the presence of taxes:

$$V^L = V^U + PV(\text{ Interest Tax Shield })$$

Here:

- V^L is the value of the levered firm (with debt).
- V^U is the value of the unlevered firm (without debt).
- PV (Interest Tax Shield) is the present value of the interest tax shield, which is the tax benefit the firm gains by using debt.

Example.

DSB expects to make $\$100$ million in interest payments annually for 10 years. The firm's marginal tax rate is 35%. The rate is 5%, indicating that the interest payments are considered riskfree. The annual tax shield from the interest payments is:

$$\text{Interest Tax Shield} = 35\% \times 100 \text{ million} = 35 \text{ million annually.}$$

To find the present value of this tax shield, we treat it as a 10-year annuity (a series of equal payments over a fixed period). The present value of this annuity is calculated using the risk-free rate (5%) :

$$PV(\text{ Interest Tax Shield }) = 35 \times \frac{1}{0.05}\left(1 - \frac{1}{1.05^{10}}\right) = \$270 \text{ million.}$$

This calculation shows that the tax shield increases the firm's value by $\$270$ million over the 10-year period.

5.2.2 When the debt is permanent

If a firm plans to maintain a fixed level of debt indefinitely (permanent debt), the present value of the interest tax shield simplifies to:

$$PV(\text{ Interest Tax Shield }) = \tau_c \times D$$

Where:

- τ_c is the corporate tax rate.
- D is the amount of debt.

This formula indicates that for every dollar of debt, the firm's value increases by τ_c (for example, if $\tau_c = 35\%$, the firm's value increases by $\$0.35$ for every $\$1$ of debt).

5.2.3 WACC with taxes

The Weighted Average Cost of Capital (WACC) is the firm's cost of capital, considering both equity and debt. When taxes are considered, the WACC decreases as the firm increases its leverage due to the tax deductibility of interest payments. The formula for WACC with taxes is:

$$r_{\text{WACC}} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D \left(1 - \tau_c\right)$$

Or

$$r_{\text{wacc}} = \underbrace{\frac{E}{E+D} r_E + \frac{D}{E+D} r_D}_{\text{Pretax WACC}} - \underbrace{\frac{D}{E+D} r_D \tau_c}_{\text{Reduction Due to Interest Tax Shield}}$$

Here:

- E is the market value of equity.
- D is the market value of debt.
- r_E is the cost of equity.
- r_D is the pre-tax cost of debt.
- τ_c is the corporate tax rate.

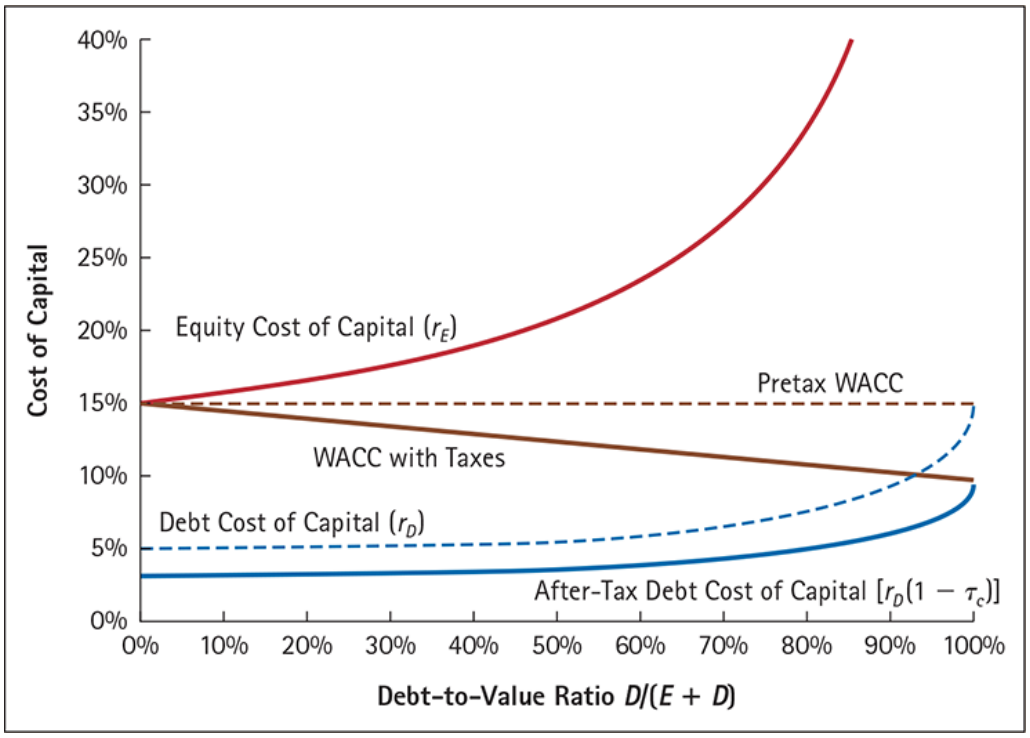

Figure 9: WACC with and without tax

- Debt Cost of Capital (r_D) : This is generally lower than the cost of equity because debt is less risky than equity.
- Equity Cost of Capital (r_E): As leverage increases, equity becomes riskier, and hence, the cost of equity rises.
- Pretax WACC: Without considering taxes, WACC remains constant as leverage increases.

- WACC with Taxes: The effective WACC, considering the tax shield, decreases as leverage increases due to the tax benefit of debt. This reduction in WACC reflects the tax advantage gained from the interest tax shield.

As a firm increases its leverage, the interest tax shield lowers its WACC, thereby reducing the overall cost of capital and increasing the firm's value. This makes debt financing attractive, especially when the firm can borrow at lower rates and maintain a stable tax rate.

5.2.4 Interest tax shield with a target D/E ratio

In this section, we're exploring a more dynamic approach to valuing the interest tax shield, where a firm maintains a target debt-equity ratio rather than a fixed amount of debt. This approach reflects a more realistic scenario for many firms, as their level of debt adjusts in proportion to their size over time. Let's break down the example given:

Example.

West Fraser Timber is expected to generate free cash flow of $\$4.25$ million in the coming year, which will grow at a rate of 4% annually. The firm's cost of equity is 10%, and its cost of debt is 6%. The firm has a target debt-equity ratio of 0.50 and pays a corporate tax rate of 35%.
To compute the unlevered value, you need to discount the firm's free cash flow using its pre-tax WACC. Since the firm is unlevered in this step, the WACC is calculated without considering the tax shield:

$$\text{Pre-tax WACC } = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D = \frac{1}{1+0.5} \times 10\% + \frac{0.5}{1+0.5} \times 6\% = 8.67\%$$

Since the free cash flow is expected to grow at a constant rate, you can value the firm as a perpetuity:

$$V^U = \frac{\$4.25 \text{ million}}{8.67\% - 4\%} = \frac{4.25}{0.0467} = \$91 \text{ million}$$

Next, calculate the firm's value with leverage by considering the WACC with taxes:

$$WACC = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D \left(1 - \tau_c\right)$$

Plugging in the numbers:

$$WACC = \frac{1}{1+0.5} \times 10\% + \frac{0.5}{1+0.5} \times 6\% \times (1 - 0.35) = 7.97\%$$

$$V^L = \frac{\$4.25 \text{ million}}{7.97\% - 4\%} = \frac{4.25}{0.0397} = \$107 \text{ million}$$

Finally, the value of the interest tax shield is the difference between the levered and unlevered firm values:

$$PV(\text{ Interest Tax Shield }) = V^L - V^U = \$107 \text{ million } - \$91 \text{ million } = \$16 \text{ million}$$

5.3 Recapitalizing to capture the tax shield

Recapitalization (or "recap") is when a firm makes a significant change to its capital structure. In this section, we're looking at a specific type of recapitalization known as a leveraged recapitalization, where the firm issues debt and uses the proceeds to pay a special dividend or repurchase shares.

Let's break down how this recapitalization works using the example of Midco Industries. Consider the following initial Situation:

- Shares Outstanding: 20 million
- Market Price per Share: $\$15$
- Market Value of Equity (Unlevered Firm Value, V^U):

$$V^U = 20 \text{ million shares } \times \$15/ \text{ share } = \$300 \text{ million}$$

- Debt: None initially, so the firm is unlevered.

Midco plans to issue $\$100$ million in permanent debt. With a corporate tax rate (τ_c) of 35%, the present value of the interest tax shield is:

$$PV(\text{ Interest Tax Shield }) = \tau_c \times D = 35\% \times \$100 \text{ million } = \$35 \text{ million}$$

$$V^L = V^U + PV(\text{ Interest Tax Shield }) = \$300 \text{ million } + \$35 \text{ million } = \$335 \text{ million}$$

This $\$335$ million represents the total value of Midco's equity and debt after the recapitalization. Since $D = 100million$:

$$E = V^L - D = \$335 \text{ million } - \$100 \text{ million } = \$235 \text{ million}$$

Suppose Midco repurchases its shares at their current price of $\$15$ per share.

$$\text{Shares Repurchased } = \frac{\$100 \text{ million}}{\$15/ \text{ share}} = 6.67 \text{ million shares}$$

Shares Remaining After Repurchase:

$$20 \text{ million } - 6.67 \text{ million } = 13.33 \text{ million shares}$$

New Share Price:

$$\frac{\$235 \text{ million}}{13.33 \text{ million shares}} = \$17.625/ \text{ share}$$

Capital Gain per Share:

$$\$17.625 - \$15 = \$2.625/ \text{ share}$$

Total Gain for Remaining Shareholders:

$$\$2.625/ \text{ share } \times 13.33 \text{ million shares } = \$35 \text{ million}$$

This shows that the shareholders who remain after the recap benefit from the tax shield through a higher share price.

The previous scenario represents an arbitrage opportunity. Investors could buy shares for $15 immediately before the repurchase, and they could sell these shares immediately afterward at a higher price. But this activity would raise the share price above $15 even before the repurchase: Once investors know the recap will occur, the share price will rise immediately to a level that reflects the $35 million value of the interest tax shield that the firm will receive.

- **Initial Share Price Rise:** Upon the recap announcement, investors anticipate the tax shield benefit, pushing the share price up from $\$15$ to $\$16.75$, reflecting the firm's new value with the tax shield ($\$335$ million / 20 million shares $= \$16.75/$ share).
- **Fair Repurchase Price:** Midco must offer at least $\$16.75$ per share for the repurchase; otherwise, shareholders wouldn't sell at $\$15$ when they know the shares are worth $\$16.75$.

If Midco offers more than $\$16.75$ per share, the benefits of the recap will skew towards those who sell their shares:

Repurchase Price	Shares Repurchased (million)	Shares Remaining (million)	New Share Price ($/share)
$\$15.00$	6.67	13.33	$\$17.63$
$\$16.25$	6.15	13.85	$\$16.97$
$\$16.75$	5.97	14.03	$\$16.75$
$\$17.25$	5.80	14.20	$\$16.55$
$\$17.50$	5.71	14.29	$\$16.45$

- Repurchase Price Above $\$16.75$: If the price is higher, fewer shares will be repurchased, leaving more shares outstanding. The new share price after the transaction will be lower than $\$16.75$, meaning shareholders who sell at the higher repurchase price capture more of the tax shield benefit.
- If Midco Offers Above $\$16.75$: Shareholders eager to sell would prefer to tender their shares. The share repurchase might become oversubscribed, requiring Midco to select shares to buy back, often through a lottery, leaving some shareholders with fewer or no shares repurchased.

This recapitalization can also be understood using a market value balance sheet, which balances the total market value of the firm's assets with its securities (equity and debt). The process includes:

1. Recap Announcement: Anticipation of the tax shield increases the firm's asset value by $\$35$ million.
2. Debt Issuance: Midco raises $\$100$ million in cash, increasing both assets (cash) and liabilities (debt).
3. Share Repurchase: Cash decreases by $\$100$ million, equity decreases by the repurchased shares, and the remaining equity is valued based on the new share price.

	Initial	Step 1: Recap Announced	Step 2: Debt Issuance	Step 3: Share Repurchase
Assets				
Cash	0	0	100	0
Original assets $\left(V^U\right)$	300	300	300	300
Interest tax shield	0	35	35	35
Total assets	300	335	435	335
Liabilities				
Debt	0	0	100	100
Equity (Assets - Liabilities)	300	335	335	235
Shares outstanding (million)	20	20	20	14.03
Price per share ($/share)	$\$15.00$	$\$16.75$	$\$16.75$	$\$16.75$

Leveraged recapitalization can significantly benefit shareholders by increasing the firm's value through the interest tax shield. However, the timing and pricing of the recap are crucial to ensuring that shareholders capture the full benefit. The initial rise in share price upon recap announcement reflects the market's anticipation of the tax shield benefits.

5.4 Personal tax and interest tax shield

This section focuses on the role of personal taxes in evaluating the true benefit of leverage for a firm. Up until now, we've considered the corporate tax savings that come from using debt (the interest tax

shield). However, once we include personal taxes—taxes that investors pay on their income from both debt and equity—the story becomes more complex.

The value of a firm ultimately depends on the after-tax cash flows that it can generate for its investors. Personal taxes on these cash flows diminish their value, reducing the attractiveness of the interest tax shield.

- Interest Income: Taxed as regular income at the personal tax rate for interest income (τ_i). For instance, in Canada, the average personal tax rate on interest income in 2020 was around 50.16%.
- Equity Income (Dividends and Capital Gains): Taxed at lower rates. Dividends and capital gains are often taxed more favorably than interest. The average tax rate on equity income (τ_e) in 2020 was about 29.94%.

The comparison in after-tax cash flows for a firm's $\$1$ of EBIT (Earnings Before Interest and Taxes) paid out as interest versus equity income (dividends or capital gains) is shown in the image and explained as follows:

- If Paid as Interest: The full $\$1$ goes to debt holders as pre-tax cash flow. Debt holders then pay personal tax on this income at the rate τ_i. After-tax cash flow to debt holders: $(1-\tau_i) \times \$1$.
- If Paid as Dividends/Capital Gains: The firm first pays corporate tax at the rate τ_c, leaving $(1-\tau_c) \times \$1$ as pre-tax cash flow to equity holders. Equity holders then pay tax on this income at the rate τ_e. After-tax cash flow to equity holders: $(1-\tau_c) \times (1-\tau_e) \times \$1$.

The formula to calculate τ^* (effective tax advantage of debt) is:

$$\tau^* = 1 - \frac{(1-\tau_c)(1-\tau_e)}{(1-\tau_i)}$$

This shows the net effect of both corporate and personal taxes on the perceived advantage of debt financing. The value of τ^* determines how much of a tax shield debt provides after considering personal taxes:

- If $\tau^* > 0$: There is still a net tax advantage to debt.
- If $\tau^* < 0$: Debt financing is actually tax-disadvantaged relative to equity.

When $\tau^* < \tau_c$, the benefit of leverage decreases because personal taxes erode the corporate tax savings from debt. Thus, the value of the firm with leverage (V^L) adjusts as:

$$V^L = V^U + \tau^* \times D$$

Similarly, the Weighted Average Cost of Capital (WACC) will decline more slowly with leverage when personal taxes reduce the effective tax benefit of debt.

Several assumptions were made in estimating the effective tax advantage of debt after taking personal taxes into account that may need adjustment when determining the actual tax benefit for a particular firm or investor.

- Unlike interest income or dividends, which are typically taxed annually, capital gains taxes are only paid when the gain is realized—i.e., when the asset (such as stock) is sold.

  This deferral effectively reduces the present value of the tax liability. For example, if an investor holds an asset for a long period before selling, the effective capital gains tax rate is lower than the stated rate because future taxes are discounted back to the present.

  This lower effective tax rate on capital gains reduces the comparative tax burden on equity income, thereby decreasing the perceived advantage of debt, which is taxed at higher rates annually.

- The calculation of the tax rate on equity income (τ_e) depends on the mix between dividends and capital gains. The analysis usually assumes an average dividend payout ratio, where shareholders receive a portion of earnings as dividends and the rest as capital gains.

  If a firm has a high dividend payout ratio, the effective tax rate on equity income might be closer to the dividend tax rate. Conversely, for firms that retain most of their earnings (leading to lower dividends), the capital gains tax rate becomes more relevant.

  The actual effective tax rate on equity income (τ_e) can vary significantly based on the firm's dividend policy. This variation affects the calculation of τ^*, as firms with different payout policies may have different tax advantages or disadvantages when using debt.

- The personal tax rate on interest income (τ_i) can vary widely depending on the investor's tax bracket. For example, a high-income investor might face a significantly higher tax rate on interest income than a lower-income investor. Similarly, the tax rate on equity income (τ_e) can differ based on whether the investor is taxed primarily on dividends or capital gains, and how long they hold the investment.

- Many investors hold stocks and bonds in accounts like 401(k)s, IRAs, or TFSAs, where income (interest, dividends, or capital gains) is either tax-deferred or tax-free. In such cases, the difference between τ_i and τ_e may be negligible or non-existent. If a significant portion of a firm's investors holds their shares through retirement accounts or similar vehicles, the effective tax advantage of debt (τ^*) might closely align with the corporate tax rate (τ_c). This could imply a greater tax advantage for debt, as personal taxes become less relevant.

5.5 Optimal capital structure with debt

The optimal level of leverage from a tax saving perspective is the level such that interest equals the income limit for the tax deduction i.e. Interest $= r_D \times$ Debt $\leq$ EBIT or Debt $\leq$ EBIT $/r_D$. In this case, the firm takes full advantage of the corporate tax deduction of interest, but avoids the tax disadvantage of excess leverage at the personal level i.e. $\tau^*_{ex} = 1 - \frac{(1-\tau_e)}{(1-\tau_i)} = \frac{\tau_e - \tau_i}{(1-\tau_i)} < 0$.

The optimal fraction of debt, as a proportion of a firm's capital structure, declines with the growth rate of the firm. This is becuase the higher the growth rate, the higher the value of equity. As a result, the optimal proportion of debt in the firm's capital structure [D / (E + D)] will be lower, the higher the firm's growth rate.

The interest expense of the average firm is well below its taxable income, implying that firms do not fully exploit the tax advantages of debt. This does not mean that the firms are operating subpotimally, but instead A key item missing from the analysis thus far is that increasing the level of debt increases the probability of bankruptcy. If bankruptcy is costly, these costs might offset the tax advantages of debt financing.

6 Financial distress, managerial incentives, and information

Definition 6.1: Financial distress

Financial distress occurs when a firm has trouble meeting its debt payments, which can lead to bankruptcy.

This chapter will delve into how market imperfections complicate the capital structure decision. By understanding the risks and costs associated with financial distress, as well as how leverage influences managerial behavior and investor perceptions.

6.1 Financial distress and bankruptcy in a perfect market

Definition 6.2: Default

When a firm opts for debt financing, it takes on an obligation to repay the principal amount along with interest. Failing to make these payments results in the firm being in default.

Upon default, debt holders gain certain rights over the firm's assets. In the most severe case, this can lead to bankruptcy, where debt holders take legal ownership of the firm's assets through a court-ordered process. Unlike debt holders, equity holders (i.e., shareholders) don't have guaranteed returns like interest payments. They may receive dividends, but the firm isn't legally obligated to pay these. Hence, equity financing doesn't carry the same risk of bankruptcy.

A key question arises: Does the risk of bankruptcy pose a significant disadvantage to using debt? Surprisingly, the answer in a perfect market is no. The Modigliani and Miller (MM) theorem continues to apply even when debt is risky and the firm faces the possibility of default.

6.1.1 Hypothetical example: Armin industries

Armin Industries is facing a tough business environment due to increased foreign competition, leading to a drop in revenues. The company is betting on a new product to revive its fortunes. However, the success of this product is uncertain. If it succeeds, the company will be worth $\$150$ million at the end of the year. If it fails, the company will only be worth $\$80$ million. Armin can choose between:

1. **All-Equity Financing:** The company is financed entirely by equity.
2. **Debt Financing:** The company uses debt that requires a repayment of $\$100$ million at the end of the year.

Consider two scenarios:

- **Scenario 1: New Product Succeeds**

  Without Leverage: If the product succeeds, the company is worth $\$150$ million, which belongs entirely to the equity holders.

  With Leverage: The company must repay the $\$100$ million debt, leaving $\$50$ million for the equity holders.

  Even if Armin doesn't have $\$100$ million in cash, it can raise this amount through new loans or issuing new shares because the value of its assets exceeds its liabilities. In a perfect market, Armin can issue 20 million new shares at $\$5$ per share (since its equity is worth $\$50$ million, and there are currently 10 million shares outstanding). After paying off the debt, the equity would still be worth $\$150$ million, spread across 30 million shares, keeping the share price at $\$5$ per share.

  This shows that as long as the firm's assets are worth more than its liabilities, the firm can avoid default by raising new capital. Default is determined by the relative values of assets and liabilities,

not by immediate cash flows. Many firms with negative cash flows can remain solvent if they have access to capital markets.

- **Scenario 2: New Product Fails**

  Without Leverage: If the product fails, the company is worth only $\$80$ million. Equity holders will see a decrease in value, but there's no legal repercussion for the firm.

  With Leverage: The company cannot make the $\$100$ million debt payment, leading to default. In bankruptcy, debt holders would take control of the company's assets, worth $\$80$ million, resulting in a $\$20$ million loss for them (relative to the $\$100$ million owed). Equity holders get nothing, but they aren't liable for the shortfall due to limited liability.

Without Leverage: In the success scenario, equity holders own $\$150$ million; in failure, they own $\$80$ million.
With Leverage: In the success scenario, equity holders own $\$50$ million, and debt holders own $\$100$ million. In failure, debt holders own $\$80$ million, and equity holders own nothing.

In both scenarios, the total value to all investors is the same, \$150 million if the product succeeds and $\$80$ million if it fails. The difference is only in how this value is distributed between debt and equity holders. The decline in value due to the product's failure is the same whether the firm is levered (uses debt) or unlevered (uses only equity). This means the economic distress (a significant drop in asset value) occurs regardless of the financial distress caused by leverage.

The Modigliani-Miller theorem asserts that in perfect capital markets, the value of the firm is unaffected by its capital structure. Even if a firm goes bankrupt due to leverage, the total value to all investors doesn't decrease further. Thus, in a perfect market, there is no inherent disadvantage to using debt.

Example.

Here we will explore Bankruptcy risk and firm value. Assume the risk-free rate is 5%, and Armin's product has an equal chance of success or failure. The project's beta is 0 , meaning its risk is diversifiable, and the cost of capital is the risk-free rate.

- The firm value without leverage is:

  $\text{Equity (Unlevered)} = V^U = \frac{\frac{1}{2}(\$150 \text{ million }) + \frac{1}{2}(\$80 \text{ million })}{1.05} = \$109.52 \text{ million}$

- When we have leverage, equity holders receive either $\$50$ million or nothing, while debt holders receive either $\$100$ million or $\$80$ million.

  $\text{Equity (Levered)} = \frac{\frac{1}{2}(\$50 \text{ million }) + \frac{1}{2}(\$0 \text{ million })}{1.05} = \$23.81 \text{ million}$

  $\text{Debt} = \frac{\frac{1}{2}(\$100 \text{ million }) + \frac{1}{2}(\$80 \text{ million })}{1.05} = \$85.71 \text{ million}$

  $V^L = E + D = \$23.81 \text{ million} + \$85.71 \text{ million} = \$109.52 \text{ million}$

The total value of the firm is the same with or without leverage, confirming MM Proposition I. Thus, the firm can raise the same amount of money from investors regardless of its capital structure.

Example.

Consider the following outcomes for the following scenarios with and without leverage for Armin Industries' new venture:

Value of Debt and Equity with and without Leverage ($million)				
	Without Leverage		With Leverage	
	Success	Failure	Success	Failure
Debt Value	–	–	$150	$90
Equity value	$250	$90	$100	$0
Total to all investors	$250	$90	$250	$90

Assume Armin's new venture is equally likely to succeed or to fail. The risk-free rate is 4%. The venture has a beta of 0 and the cost of capital is equal to the risk-free rate.

- When there is no leverage, equity holders get all the values. Equity (unlevered) $= V^U = \frac{.5(\$250)+.5(\$90)}{1.04} = \$163.46$ million
- When there is leverage, debt and equity holders share the values.

$$\text{Equity (Levered)} = V^L = \frac{.5(\$100) + .5(\$0)}{1.04} = \$48.08 \text{ million}$$
$$\text{Debt } = \frac{.5(\$150) + .5(\$90)}{1.04} = \$115.38 \text{ million}$$
$$V^L = \$48.08 + \$115.38 = \$163.46$$

As stated by MM Proposition I, the total value of the firm is unaffected by leverage.

In a perfect market, bankruptcy risk due to leverage does not reduce the overall value of a firm. The total value to investors remains constant, whether the firm is levered or unlevered, as demonstrated by MM Proposition I. This means that, theoretically, debt financing does not create a disadvantage simply because it introduces bankruptcy risk. The real-world implications, however, can differ due to market imperfections.

6.2 The costs of bankruptcy and financial distress in the real world

In a perfect market, as discussed earlier, bankruptcy doesn't reduce the overall value of a firm—it simply transfers ownership from equity holders to debt holders. However, in reality, bankruptcy is far more complex and involves significant costs, both direct and indirect, that can greatly diminish the value of a firm's assets.

6.2.1 Bankruptcy law and the complex process of default

When a firm defaults on its debt obligations, the process of bankruptcy is not straightforward or instantaneous. Instead, it involves a legal process with multiple steps to ensure that creditors are treated fairly and that the firm's assets are managed in a way that maximizes their remaining value.

Upon default, creditors can legally seize the firm's assets. However, this can be complicated because most firms have multiple creditors, each with their own claims. If creditors acted independently, seizing assets in a piecemeal manner could destroy the overall value of the firm, as some assets might be more valuable if kept together.
In Canada, the laws are:

- **Bankruptcy and Insolvency Act (BIA):** This act is generally used by smaller companies and individuals. It often results in liquidation, where the firm's assets are sold off and the proceeds distributed to creditors. Before liquidation, a firm can propose a plan to its creditors, but this plan must be approved by a majority in number and two-thirds in value within each class of creditors. If the proposal fails, a trustee oversees the auction of the firm's assets, and the firm ceases to exist.

- **Companies' Creditors Arrangement Act (CCAA):** This applies to firms with $5 million or more in debt. It allows a firm to avoid formal bankruptcy by proposing a reorganization plan under court protection. Once the firm applies for protection, all debt collection actions are suspended. The existing management continues to operate the firm while under the supervision of a court-appointed monitor, usually the firm's auditor. The reorganization plan needs approval from creditors and the court. If no acceptable plan is proposed, the firm may eventually enter bankruptcy under the BIA.

Comparing to the law in the United States:

- Similar to the BIA in Canada, where the firm's assets are sold off to pay creditors.
- Similar to the CCAA in Canada, allowing the firm to reorganize its debts while continuing operations. However, under Chapter 11, the court can impose a reorganization plan even if all creditor classes do not approve it, a process known as a "cram down."

6.2.2 Direct costs of bankruptcy

Even though bankruptcy law aims to provide an orderly process, the process itself is costly, time-consuming, and complex.

When a firm enters bankruptcy, it typically hires outside professionals such as lawyers, accountants, consultants, and investment bankers to help manage the process. These professionals are expensive, and their fees can significantly reduce the value of the firm's assets.

Creditors also incur costs during the bankruptcy process. In the U.S., Chapter 11 reorganizations can take years, during which creditors do not have access to their money. To protect their interests, creditors often hire their own legal and professional advisors, further adding to the costs.

These direct costs reduce the value of the assets that the firm's investors will ultimately receive. Studies typically estimate that direct bankruptcy costs average 3% to 4% of a firm's pre-bankruptcy market value.

To avoid these high costs, firms in financial distress often try to negotiate directly with creditors before filing for bankruptcy. If successful, this is known as **a workout**, which can be less costly than formal bankruptcy. Another strategy is a **prepackaged bankruptcy (or prepack)**, where the firm negotiates a reorganization plan with its major creditors before filing for bankruptcy. The plan is then implemented through the bankruptcy court, reducing the time and costs involved.

6.2.3 Indirect cost of financial distress

In addition to the direct costs of bankruptcy, firms also face significant indirect costs when they experience financial distress. These costs are more difficult to measure but can be much larger than the direct costs.

- **Loss of Customers and Suppliers:** Customers may avoid doing business with a financially distressed firm out of fear that it might not be able to fulfill its obligations. Similarly, suppliers may demand stricter payment terms or even cease doing business with the firm.
- **Loss of Employees:** Key employees may leave the firm if they believe it is in trouble, leading to a loss of valuable human capital.
- **Operational Disruptions:** The uncertainty surrounding a financially distressed firm can lead to disruptions in its operations, further harming its business.
- **Reduced Credit Terms:** Financially distressed firms may face higher borrowing costs or lose access to credit altogether, exacerbating their problems.
- **Fire Sales of Assets:** If a firm needs to sell assets quickly to raise cash, it may be forced to sell them at significantly below their market value, resulting in further losses.

6.2.4 Overall impacts of the indrect costs

The total indirect costs of financial distress can be substantial. When estimating these costs, it's important to focus on the losses to the firm's total value, not just to equity holders or debt holders. Moreover, these costs should be measured as the additional losses due to financial distress, over and above any losses due to the firm's economic distress (i.e., a decline in the firm's business prospects).

A study by Gregor Andrade and Steven Kaplan on highly leveraged firms estimated that financial distress could lead to a loss of 10% to 20% of a firm's value, highlighting the significant impact these indirect costs can have.

6.3 Cost of financial distress and firm values

This section explores the impact of financial distress costs on firm value, illustrating how these costs alter the predictions of Modigliani and Miller's (MM) propositions in a real-world setting where markets are not perfect. Unlike in MM's theoretical framework, the existence of financial distress costs means that the choice of capital structure—whether a firm uses debt or equity—can indeed affect the firm's value.

6.3.1 Same hypothetical example: Armin Industries

If Armin Industries finances itself entirely with equity, its assets will be worth \$150 million if the new product is successful, and \$80 million if the product fails.

If Armin borrows $\$100$ million and the product fails, the firm will be forced into bankruptcy. However, bankruptcy and financial distress will erode some of the firm's value, leaving the debt holders with less than $\$80$ million.

Assumes that due to financial distress costs, debt holders receive only $\$60$ million instead of $\$80$ million if the product fails. This $\$20$ million difference represents the costs of financial distress.

The table shows that the total value available to all investors decreases with leverage when the new product fails. Without leverage, the total value of the firm is \$80 million if the product fails. With leverage, this value drops to \$60 million due to financial distress costs.

Scenario	Without Leverage	With Leverage
Success: Debt Value	–	$\$100$ million
Success: Equity Value	$\$150$ million	$\$50$ million
Failure: Debt Value	–	$\$60$ million
Failure: Equity Value	$\$80$ million	$\$0$
Total Value in Success	$\$150$ million	$\$150$ million
Total Value in Failure	$\$80$ million	$\$60$ million

The difference of $\$20$ million (i.e., $\$80$ million - $\$60$ million) is the cost of financial distress. This cost causes the total value of the firm with leverage to be less than it would be without leverage when financial distress is a factor. Therefore, MM Proposition I, which states that the value of the firm is independent of its capital structure, does not hold when financial distress costs are considered.

6.3.2 Who ultimately pays for financial distress costs

At first glance, it might seem that financial distress costs only affect debt holders since they receive less money in the event of a default. Equity holders, whose investments are already wiped out in bankruptcy, might appear unaffected by these costs.

However, debt holders are aware that they won't receive the full value of the firm's assets in bankruptcy due to these distress costs. As a result, they will demand a lower price for the debt upfront to compensate for the expected loss. This reduced price directly impacts the amount of capital the firm can raise through debt.

Because the firm raises less money from debt issuance, there is less money available to distribute to shareholders (e.g., through dividends or share repurchases). Thus, the shareholders indirectly bear the financial distress costs through a reduction in the firm's overall value and, consequently, their share price.

Example.

This example provides a numerical comparison of Armin Industries' value with and without leverage, taking into account the financial distress costs.
Assumes risk-free rate is 5%. The new product has a 50% chance of success and a 50% chance of failure. Financial distress costs reduce the value of debt from $\$80$ million to $\$60$ million if the product fails.
The debt is worth $\$100$ million if the product succeeds and $\$60$ million if it fails. The expected value of debt is:

$$\text{Debt Value } = \frac{1}{2}(\$100 \text{ million }) + \frac{1}{2}(\$60 \text{ million }) = \$80 \text{ million}$$

Discounting this at the risk-free rate:

$$\text{Present Value of Debt } = \frac{\$80 \text{ million}}{1.05} = \$76.19 \text{ million}$$

The value of the levered firm is the sum of the present value of equity (from previous example, $\$23.81$ million) and the present value of debt ($\$76.19$ million):

$$V^L = E + D = \$23.81 \text{ million } + \$76.19 \text{ million } = \$100 \text{ million}$$

This is less than the unlevered firm value of $\$109.52$ million, demonstrating a loss of $\$9.52$ million due to financial distress costs.

The shareholders bear the cost of financial distress upfront because the firm can raise less money through debt due to the anticipated reduction in debt value from these costs. This reduction in firm value is reflected in a lower stock price.

Example.

Consider the following outcomes for the following scenarios with and without leverage for Armin Industries' new venture:

Value of Debt and Equity with and without Leverage (\$million)				
	Without Leverage		With Leverage	
	Success	Failure	Success	Failure
Debt Value	–	–	\$150	\$75
Equity value	\$250	\$90	\$100	\$0
Total to all investors	\$250	\$90	\$250	\$75

- When there is no leverage:

$$\text{Equity (unlevered)} = V^U = \frac{.5(\$250) + .5(\$90)}{1.04} = \$163.46 \text{ million}$$

- When there is leverage:

$$\text{Equity (Levered)} = V^L = \frac{.5(\$100) + .5(\$0)}{1.04} = \$48.08 \text{ million}$$

$$\text{Debt } = \frac{.5(\$150) + .5(\$75)}{1.04} = \$108.17 \text{ million}$$

$$V^L = \$48.08 + \$108.17 = \$156.25$$

$V^L \neq V^U$ in the presence of financial distress costs. The difference, ($\$163.46 - \$156.25 = \$7.21$), is the present value of the $\$15$ million in financial distress costs:

$$\text{PV(Financial Distress Costs)} = \frac{.5(\$0) + .5(\$15)}{1.04} = \$7.21 \text{ million}$$

Example.

This example illustrates how financial distress costs impact Armin Industries' stock price when the firm decides to leverage its capital structure by issuing debt.
Suppose that at the beginning of the year, Armin Industries has 10 million shares out-standing and no debt. Armin then announces plans to issue one-year debt with a face value of $\$100$ million and to use the proceeds to repurchase shares. Given the data in Table 19.2, what will the new share price be? As in the previous examples, assume the risk-free rate is 5%, the new product is equally likely to succeed or fail, and this risk is diversifiable.
From previous example, the value of the firm without leverage is $\$109.52$ million With 10 million shares outstanding, this value corresponds to an initial share price of $\$10.952$ per share. In previous example, we saw that with leverage, the total value of the firm is only $\$100$ million. In anticipation of this decline in value, the price of the stock should fall to $\$100$ million $\div 10$ million shares $= \$10$ per share on announcement of the recapitalization.
Let's check this result. From previous example, due to bankruptcy costs, the new debt is worth $\$76.19$ million. Thus, at a price of $\$10$ per share, Armin will repurchase 7.619 million shares, leaving 2.381 million shares outstanding. In previous example, we computed the value of levered equity as $\$23.81$ million. Dividing by the number of shares gives a share price after the transaction of

$$\$23.81 \text{ million } \div 2.381 \text{ million shares } = \$10 \text{ per share}$$

Thus the recapitalization will cost shareholders $\$0.952$ per share or $\$9.52$ million in total. This cost matches the PV of financial distress costs computed in previous example. Thus, although debt holders bear these costs in the end, shareholders pay the PV of the costs of financial distress up front.

6.4 The tradeoff theory

This section discusses how firms should balance the benefits and costs of leverage to determine their optimal capital structure. The analysis, known as the **tradeoff theory**, weighs the advantages of debt, particularly the tax shield, against the costs of financial distress that come with higher leverage.

According to the tradeoff theory, the total value of a levered firm V^L can be expressed as:

$$V^L = V^U + PV(\text{ Interest Tax Shield }) - PV(\text{ Financial Distress Costs })$$

Where:

- V^U is the value of the firm without leverage (unlevered value).
- PV (Interest Tax Shield) represents the present value of the tax savings that arise from using debt, since interest payments are tax-deductible.
- PV (Financial Distress Costs) represents the present value of the costs associated with financial distress, such as bankruptcy costs, which increase with higher levels of debt.

Calculating the precise present value (PV) of financial distress costs is complex and depends on three key factors:

1. **Probability of Financial Distress:** This depends on how likely it is that a firm will default on its debt obligations. The probability increases with the firm's liabilities and with the volatility of its cash flows and asset values. For example, firms with stable and predictable cash flows, like utilities, can safely carry more debt. Conversely, firms with volatile cash flows, like tech companies, must use less debt to avoid a high risk of default.

2. **Magnitude of Financial Distress Costs:** This varies by industry. Firms with significant intangible assets (e.g., tech firms) or customer dependence might incur high distress costs due to the loss of reputation, customers, or key personnel. Firms with more tangible assets, like real estate firms, typically have lower distress costs because their assets can be more easily sold off in distress situations.

3. **Discount Rate:** The appropriate discount rate reflects the risk of these distress costs and is generally aligned with the firm's cost of capital.

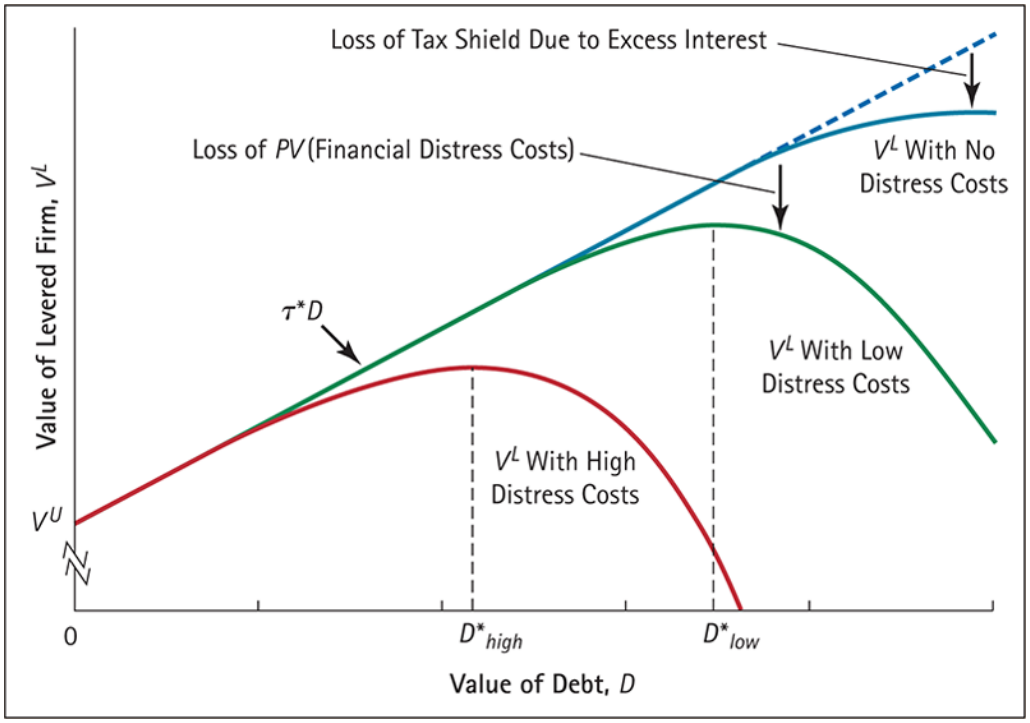

Figure 10: Optimal leverage with taxes and financial distress costs

The tradeoff theory states that firms should increase their leverage until it reaches the level for which the firm value is maximized. Thus, the optimal level of debt D^* for a firm occurs where the marginal benefit of the interest tax shield equals the marginal cost of financial distress. As debt increases:

- The tax benefits of debt (from interest deductibility) rise, reflected in $\tau^* D$, where τ^* is the effective tax advantage of debt.
- The probability of financial distress also increases, raising the expected financial distress costs.

If there were no financial distress costs, the firm's value would rise continuously with debt due to the tax shield until the interest exceeds EBIT.

With Distress Costs, as the firm takes on more debt, financial distress costs reduce the firm's value. The optimal level of debt D^* is where these opposing forces balance out.

- Low Distress Costs: Firms with low financial distress costs can afford to take on more debt, leading to a higher optimal debt level D^*_{low} .

- High Distress Costs: Firms with high financial distress costs should opt for lower leverage, leading to a lower optimal debt level D^*_{high} .

Example.

This example helps illustrate how a firm like Mapleleaf Industries would determine its optimal debt level based on the tradeoff theory.
Mapleleaf is considering adding up to $\$35$ million in debt. The CFO estimates the PV (Interest Tax Shield) and PV (Financial Distress Costs) at various levels of debt (in millions):

Debt Level ($ million)	0	10	20	25	30	35
PV (Interest Tax Shield)	0.00	1.50	3.00	3.75	4.50	5.25
PV (Financial Distress Costs)	0.00	0.00	0.38	1.62	4.00	6.38

To find the optimal debt level, subtract the PV (Financial Distress Costs) from the PV (Interest Tax Shield) to calculate the net benefit of debt for each level:

Debt Level ($ million)	0	10	20	25	30	35
Net Benefit ($ million)	0.00	1.50	2.62	2.13	0.50	-1.13

The optimal debt level is $\$20$ million, where the net benefit is maximized at $\$2.62$ million. Here, the firm gains $\$3$ million from the tax shield but loses $\$0.38$ million due to financial distress, resulting in the highest net benefit.

Example.

Holland, Inc. is considering adding leverage to its capital structure. Holland's managers believe they can add as much as $\$50$ million in debt and exploit the benefits of the tax shield. They estimate $\tau_C = 39\%$. However, they also recognize that higher debt increases the risk of financial distress. Based on simulations of the firm's future cash flows, the CFO has made the estimates on the next slide (in millions of dollars):

Debt	0	10	20	30	40	50
PV (Interest tax shield)	0	3.9	7.8	11.7	15.6	19.5
PV (Financial distress costs)	0	0	0	3.38	19.23	23.47

Debt	0	10	20	30	40	50
Net Benefit	0	3.9	7.8	8.32	-3.63	-3.97

The level of debt that leads to the highest net benefit is $\$30$ million. Holland will gain $\$11.7$ million due to tax shields, and lose $\$3.38$ million due to the present value of financial distress costs, for a net gain of $\$8.32$ million.

6.5 Agency cost of debt

This section delves into another significant aspect of capital structure: how it can create incentives for managers to make decisions that favor shareholders at the expense of debt holders. These decisions, often arising when a firm is facing financial distress, can decrease the overall value of the firm. The losses from these conflicts are known as **agency costs of debt**, which occur due to conflicts of interest between different stakeholders, particularly between equity holders and debt holders.

6.5.1 Overview of the agency cost

Agency costs arise when the interests of different stakeholders diverge. In leveraged firms, managers, who typically represent the interests of shareholders, might make decisions that benefit shareholders but harm debt holders. This problem is exacerbated when the firm is close to financial distress, as the conflicting interests between debt and equity holders become more pronounced.

There are three types of agency cost of debt:

1. **Excessive risk-taking and asset substitution:**

   Consider Poisson Ltd., a firm on the brink of financial distress with a $\$1$ million debt due at the end of the year. Without any change in strategy, Poisson's assets will be worth $\$900,000$, leading to a default.

   Poisson's executives consider a new, high-risk strategy. There's a 50% chance the firm's assets will increase to $\$1.3$ million (enough to pay off the debt and leave $\$300,000$ for shareholders) and a 50% chance they will fall to $300,000 (leaving nothing for shareholders and debt holders receiving only $\$300,000$).

   The expected value of the firm's assets with the new strategy is $\$800,000$-a loss compared to the original $\$900,000$. However, shareholders stand to gain if the strategy succeeds because they would get $\$300,000$ instead of nothing. This creates an incentive for shareholders to prefer the risky strategy, even though it reduces the firm's overall value.

   Debt holders bear the loss from this strategy if it fails. Their expected payoff drops from $\$900,000$ to $\$650,000$ due to the increased risk taken by the firm.

	Old	Success	Failure	Expected
Value of assets	900	1300	300	**800**
Debt	900	1000	300	**650**
Equity	0	300	0	**150**

   The strategy has a negative NPV of $\$100,000$ because it reduces the expected value of the firm's assets from $\$900,000$ to $\$800,000$. This means that, on average, the new strategy destroys $\$100,000$ of value for the firm.

   When a firm faces financial distress, shareholders can gain at the expense of debt holders by making sufficiently risky investments, even if they have negative NPV. This result is often referred to as the asset substitution problem. It can also lead to over-investment. If the firm increases risk through a negative-NPV decision or investment, the total value of the firm will be reduced.

2. **Debt overhang and under-investment:**

   Suppose Poisson has an opportunity to invest in a new project that requires $\$100,000$ and will yield a risk-free return of 50%, increasing the firm's total value from $\$900,000$ to $\$1,050,000$.

   If equity holders fund the project, they will receive $\$50,000$ after repaying the debt, but they need to invest $\$100,000$ upfront. This scenario discourages equity holders from investing in the project, even though it has a positive NPV for the firm.

	Without New Project	With New Project
Existing assets	**900**	**900**
New project		150
Total firm value	900	1050
Debt	900	1000
Equity	0	**50**

The debt holders would benefit from the new project, but the equity holders bear the upfront cost without enough return, leading to under-investment in positive-NPV projects-a phenomenon known as debt overhang or under-investment.

3. **Cashing out:**

   Poisson owns equipment worth $\$25,000$ that it could sell immediately. However, selling the equipment would reduce the firm's future value from $\$900,000$ to $\$800,000$.

   If Poisson is likely to default, selling the equipment allows shareholders to pay a dividend now, even though it harms the firm's future value. Debt holders bear the loss, but shareholders might still prefer this course of action, leading to a reduction in firm value.

6.5.2 Quantifying debt overhang

The debt overhang problem can be assessed using a profitability index rule:

$$\frac{NPV}{I} > \frac{\beta_D D}{\beta_E E}$$

- NPV/I: The profitability index of the project.
- β_D : The beta (risk measure) of the firm's debt.
- β_E : The beta of the firm's equity.
- D/E: The firm's debt-to-equity ratio.

This rule suggests that for equity holders to find a project worthwhile, its profitability index must exceed a certain threshold. The higher the firm's leverage and the riskier the debt, the higher the threshold, and the more likely that positive-NPV projects will be rejected.

Example.

> Equity beta $(\beta_E) = 1.36$, Debt beta $(\beta_D) = 0.17$, Debt-equity ratio $= 0.30$. Minimum profitability index $= (0.17/1.36) \times 0.30 = 0.0375$. Thus, NPV must be at least $\$3,750$ for shareholders to benefit.

6.5.3 Agency cost and value of the leverage

Debt holders, understanding these potential conflicts, will anticipate that the firm might engage in behavior that harms them. As a result, when debt is first issued, debt holders will demand a higher yield (or pay a lower price) to compensate for the risk of these adverse actions by equity holders and managers. This higher cost of debt reflects the expected losses from potential future agency costs.

While in the short term, shareholders might benefit from these negative-NPV decisions (e.g., taking on risky projects that might pay off for equity holders), the long-term effect is a reduction in the value of the firm. This reduction occurs because the cost of debt rises to account for these risks. Consequently, the amount of money the firm can raise through debt is reduced, which in turn lowers the initial share price. Essentially, shareholders pay for these agency costs upfront through a lower valuation of the firm.

Agency costs of debt are particularly relevant when there is a non-trivial chance that the firm will default on its debt obligations. If default is likely, the conflicting incentives between equity holders and debt holders become more pronounced.

Example.

> Would the agency costs of debt described previously (like excessive risk-taking, under-investment, and cashing out) arise if Poisson Ltd. had less leverage and owed $\$400,000$ instead of $\$1$ million?
>
> 1. If Poisson makes no new investments or changes to its strategy, the firm will be worth $\$900,000$. Thus, the firm will remain solvent, and its equity will be worth $\$900,000 - \$400,000 = \$500,000$.

Consider first the decision to increase risk. If Poisson takes the risky strategy, its assets will be worth either $\$1.3$ million or $\$300,000$, so equity holders will receive $\$900,000$ or $\$0$. In this case, the equity holders expected payoff with the risky project is only $\$450,000$. Thus, equity holders will reject the risky strategy. Thus, there will be no asset substitution issues.

2. If Poisson raises $\$100,000$ from equity holders to fund a new investment that increases the value of assets by $\$150,000$, the equity will be worth as given below:

$$\$900,000 + \$150,000 - \$400,000 = \$650,000$$

This is a gain of $\$150,000$ over the $\$500,000$ equity holders would receive without the investment. Because their payoff has gone up by $\$150,000$ for a $\$100,000$ investment, they will be willing to invest in the new project. Thus, there is no more debt overhang issue.

3. Similarly, Poisson has no incentive to cash out and sell equipment to pay a dividend. If the firm pays the dividend, equity holders receive $\$25,000$ today. But their future payoff declines to $\$800,000 - \$400,000 = \$400,000$. Thus, they give up $\$100,000$ in one year for a $\$25,000$ gain today. For any reasonable discount rate, this is a bad deal and shareholders will reject the dividend. Thus, there is no more cashing out issues

Thus, with this much lower debt level, none of the agency costs of debt described for Poisson will arise.

6.5.4 The leverage ratchet effect

The Leverage Ratchet Effect describes a situation where, once a firm has taken on debt, shareholders may have incentives that lead to suboptimal financial decisions for the firm as a whole. Specifically:

- **Incentive to Increase Leverage:** Shareholders might push for increasing leverage even when doing so would reduce the overall value of the firm. This happens because the costs associated with additional leverage, such as the increased risk of default or higher agency costs, are primarily borne by the existing debt holders, not by the shareholders.
- **Resistance to Deleveraging:** Shareholders might resist reducing leverage (i.e., repaying or buying back debt) even when deleveraging would increase the firm's value. This is because the benefits of reducing leverage, such as lowering the risk of default and reducing agency costs, accrue to the debt holders, while shareholders would need to pay a premium to buy back the debt.

Example.

Will Poisson's shareholders would benefit from reducing the firm's debt level from $\$1$ million to $\$400,000$, even though doing so would increase the overall value of the firm?
Now, suppose Poisson could reduce its debt from $\$1$ million to $\$400,000$. This reduction would make the firm solvent and eliminate the under-investment problem, as equity holders would have an incentive to invest in the new project.
To reduce the debt from $\$1$ million to $\$400,000$, Poisson would need to repurchase $\$600,000$ of debt. Because the debt would become risk-free after the buyback, Poisson would need to pay at least the present value of this amount, which is $\$600,000/1.05$ (assuming a risk-free rate of 5%). This equals $\$571,429$.
After repurchasing the debt and raising an additional $\$100,000$ from equity holders to fund the project, the firm's assets would be worth $\$1.05$ million. The firm would then pay off the $\$400,000$ in remaining debt, leaving equity holders with $\$650,000$.
Equity holders would need to invest a total of $\$671,429$ (i.e., $\$571,429$ for the debt buyback $+\$100,000$ for the new investment). However, they would only receive $\$650,000$ in return. Therefore, reducing the debt would actually cost shareholders more than they would gain from the resulting increase in firm value.

6.5.5 Ways to mitigating the agency costs

Two main strategies can mitigate these costs:

- **Short-Term Debt:** Shorter debt maturities limit the time frame within which equity holders can exploit debt holders, reducing agency costs. However, frequent refinancing can increase the firm's risk of financial distress.
- **Debt Covenants:** Creditors often impose covenants restricting the firm's actions (e.g., limits on dividends, new debt, or risky investments). While covenants can reduce agency costs, they also restrict management's flexibility, potentially preventing the firm from pursuing positive-NPV opportunities.

6.6 Mitigate the principal-agent problem with debt

In this section, we explore how debt can act as a tool to align the interests of managers with those of equity holders, helping to mitigate the principal-agent problem. This problem arises because managers, who typically own only a small fraction of a firm's equity, may make decisions that benefit themselves at the expense of shareholders. By introducing debt into the capital structure, the firm can reduce certain agency costs associated with equity and motivate managers to act in the firm's best interest.

6.6.1 Agency cost of equity

In large corporations, there's often a separation between ownership (the shareholders) and control (the managers). Since managers own only a small portion of the firm, they may not always act in the best interest of the shareholders. This situation creates what is known as the **principal-agent problem**.

Managers who face little risk of being fired may prioritize their own interests, leading to decisions that are not aligned with maximizing shareholder value. For example, they might avoid risky but profitable projects to secure their jobs or enjoy perks that do not contribute to the firm's profitability.

Agency cost of equity arise when managers make decisions that reduce the overall value of the firm due to their own interests, such as reduced effort or excessive spending on perks. These costs are ultimately borne by the original shareholders, as new investors will discount the price they pay for equity to reflect these agency problems.

6.6.2 Use leverage to reduce the agency cost

Introducing debt into a firm's capital structure can help align the interests of managers with those of equity holders in several ways:

1. **Concentration of Ownership:**

   Manmeet, the owner of a furniture store, faces a choice between financing his expansion by issuing debt or equity. If he issues equity, he would dilute his ownership from 100% to 60%, meaning he gains only 60 cents for every dollar increase in the firm's value. However, if he uses debt, he retains full ownership and reaps the full benefits of his efforts.

   With a higher ownership stake, Manmeet is more likely to work harder and make decisions that increase the firm's value. Conversely, if his ownership is diluted, he may be more tempted to overspend on perks, knowing that new equity holders will share the costs.

2. **Reduction of Wasteful Investment:**

   As ownership becomes more diluted over time, especially in large, widely held firms, managers may engage in wasteful investments. This behavior is driven by moral hazard—the tendency to take excessive risks when the consequences are not fully borne by the decision-maker.

Managers might engage in "empire building" by making investments that increase the size rather than the profitability of the firm, often motivated by the desire for higher salaries, prestige, or personal recognition. Overconfident managers may also overestimate the value of new projects, leading to negative-NPV investments.

Free Cash Flow Hypothesis: This hypothesis suggests that managers are more likely to make wasteful investments when the firm has excess cash flow. Leverage can mitigate this problem by committing the firm to regular interest payments, which reduces excess cash and limits the potential for wasteful spending.

3. **Leverage and Managerial Commitment:**

   High leverage creates a pressure on managers to ensure the firm performs well enough to meet its debt obligations. This pressure can lead to more focused and effective management, as the threat of financial distress or bankruptcy becomes a significant motivator.

   Example of Air Canada: During its reorganization under the CCAA in 2003-2004, Air Canada was able to secure wage concessions from its unions by leveraging the threat of bankruptcy. Without this pressure, such concessions might have been harder to achieve, showing how leverage can be used as a strategic tool to motivate managers and other stakeholders to align with the firm's objectives.

6.7 Agency cost and tradeoff theory

In this section, the traditional tradeoff theory of capital structure is expanded to include not only the tax benefits and financial distress costs of debt but also the agency costs and benefits that arise when a firm uses leverage. The refined equation for the value of a levered firm $\left(V^L\right)$ is:

$$V^L = V^U + PV(\text{ Interest Tax Shield }) \quad -PV(\text{ Financial Distress Costs }) \\ -PV(\text{ Agency Costs of Debt }) \quad +PV(\text{ Agency Benefits of Debt })$$

The optimal level of debt, D^*, is where the firm's value is maximized by balancing these various costs and benefits. As debt increases, the firm initially benefits from the interest tax shield and improved managerial incentives, leading to an increase in firm value. However, if debt levels become too high, the value begins to decrease due to rising financial distress costs and agency costs of debt. The optimal debt level D^* is reached when the incremental benefits of additional debt are exactly offset by the incremental costs.

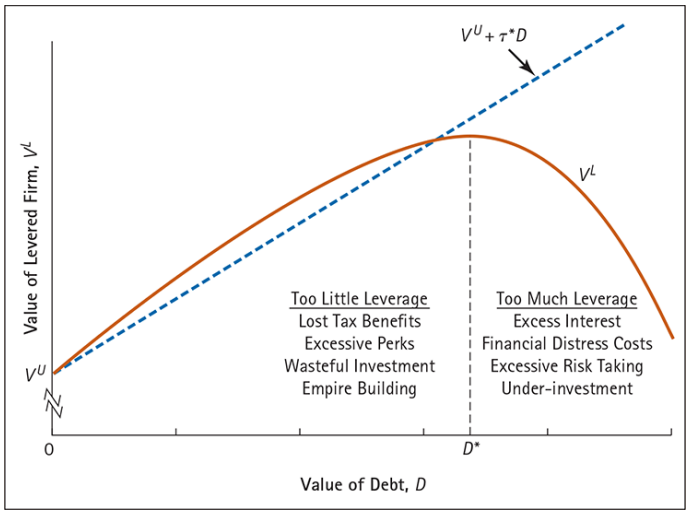

Figure 11: Optimal Leverage With Taxes, Financial Distress, and Agency Costs

The optimal capital structure varies depending on the characteristics of the firm:

1. **R&D-Intensive Firms**

   These firms typically have high research and development costs, significant future growth opportunities, and high human capital. Such firms tend to maintain low levels of debt. This is becuase:

   - The costs of financial distress are high because much of the firm's value is tied to intangible assets and human capital.
   - These firms can easily increase the riskiness of their strategies, which would exacerbate conflicts between debt holders and equity holders.

2. **Low-Growth, Mature Firms**

   These firms are often in industries with stable cash flows and tangible assets, and they have fewer growth opportunities. Such firms tend to have higher levels of debt. The reasons include:

   - Because they have tangible assets that can be easily liquidated, the costs associated with financial distress are lower.
   - These firms are less likely to engage in risky behavior, so the agency costs of debt are lower.

6.7.1 Optimal debt level in practice

While the tradeoff theory explains how firms should ideally choose their capital structures, there are reasons why firms might not achieve the optimal debt level D^*:

- If a firm's debt exceeds D^* due to negative shocks or poor decisions, reducing leverage becomes difficult because the benefits of deleveraging (such as reduced bankruptcy risk) accrue primarily to creditors rather than shareholders. Shareholders may resist reducing leverage because they would have to bear the immediate costs.
- Managers might intentionally maintain lower leverage to avoid the discipline that debt imposes. High leverage increases the risk of financial distress, which could lead to job loss for managers. By keeping debt low, managers can avoid this risk, even if it means sacrificing firm value. If managers keep leverage too low and sacrifice too much value, shareholders might attempt to replace them or sell the firm to an acquirer, pushing the firm back toward the optimal level D^*.

6.8 Asymmetric information and capital structure

In this section, we explore how asymmetric information—where managers have more information about the firm than outside investors—can influence a firm's capital structure decisions. The presence of asymmetric information can lead to different behaviors and strategies as firms seek to signal their value to investors and avoid the pitfalls of adverse selection.

6.8.1 Leverage as a credible signal

Managers often have more information about the firm's future prospects than outside investors. When a firm's stock is undervalued by the market, managers may want to convey their confidence in the firm's future to investors. However, simply stating that the firm is undervalued might not be convincing, as investors may view such statements with skepticism.

The credibility principle states that:

> Claims in one's self-interest are only credible if supported by actions that would be too costly to take if the claims were untrue. Essentially, actions speak louder than words.

One way a firm can signal its strong future prospects is by taking on additional debt. The idea here is that a firm confident in its future cash flows will be more willing to take on debt because it expects to be able to meet future debt obligations without difficulty.

Signaling Theory of Debt: Taking on substantial debt acts as a signal to investors that the management is confident in the firm's future prospects, as they are willing to face the risk of financial distress if they are wrong.

Example.

Beltran International currently uses all-equity financing. Depending on the success of its new strategy, the firm's market value will be either $\$100$ million or $\$50$ million. Investors currently believe both outcomes are equally likely. If Beltran takes on $\$25$ million in debt, it faces no risk of financial distress, regardless of the strategy's outcome. This level of debt would not be a credible signal because it doesn't demonstrate strong confidence in future cash flows.
However, if Beltran takes on $\$55$ million in debt, and the new strategy fails, the firm risks financial distress. This higher level of debt|serves as a credible signal because it implies that Mazurek is confident about the success of the new strategy; otherwise, she would not risk the firm's stability with such high leverage.

6.8.2 Adverse selection with equity

Adverse selection occurs when one party in a transaction has more information than the other, leading to a situation where the party with less information (the buyer) assumes the worst. This concept was formalized by economist George Akerlof in his study of the used-car market, where buyers assume that cars being sold are likely to be "lemons" (i.e., of lower quality).

Lemons Principle: When a seller has private information about the value of a good, buyers will discount the price they are willing to pay due to adverse selection. In the context of capital structure, this principle means that investors will assume the worst when a firm issues new equity, believing that the firm's stock might be overvalued or that the firm's prospects are poor.

Example.

Puchatek stock is worth either $\$100, \$80$, or $\$60$ per share, and investors believe each outcome is equally likely, so the current price is $\$80$ per share. If the CEO announces a plan to sell most of his holdings to "diversify," investors may suspect that the CEO knows something negative about the firm's future. If the CEO tries to sell, the market will likely assume the stock is worth $\$60$, not $\$80$ or $\$100$. The CEO will only sell if the stock is actually worth $\$60$ per share, reinforcing the idea that the stock is a "lemon."

6.9 Implications for equity issuance

When a firm announces an equity issue, it often signals to the market that the firm's management believes the stock is overvalued. As a result, the stock price typically falls. Empirical studies show that stock prices drop by about 3% on average when a public firm announces an equity issue.

Managers may delay equity issuance until after positive news has been released, which explains why stock prices often rise before an equity issue. This timing minimizes the negative impact of adverse selection.

Firms tend to issue equity when information asymmetry is minimized, such as immediately after earnings announcements. This timing reduces the negative price impact since the market is more informed.

6.10 Implication for capital structure

The pecking order hypothesis suggests that firms prefer to finance investments using internal funds (retained earnings), then debt, and only issue equity as a last resort. This order reflects the increasing costs of adverse selection and the desire to avoid issuing undervalued equity.

- Managers who perceive that the firm's equity is underpriced will have a preference to fund investment using retained earnings, or debt, rather than equity.
- The converse is also true: Managers who perceive the firm's equity to be overpriced will prefer to issue equity, as opposed to issuing debt or using retained earnings, to fund investment.

Example.

Axon Industries needs to raise \$10 million for a new project. The company can finance this project using retained earnings, debt, or equity.

- Retained Earnings: The cost to shareholders is the full $\$10$ million.
- Debt: If the firm issues debt at a 7% interest rate (though management believes 6% is fair), the cost is $\$10.094$ million (present value).
- Equity: If equity is underpriced by 5%, Axon would need to issue $\$10.5$ million in equity to raise the $\$10$ million, making this the most expensive option.

In conclusion, retained earnings are the cheapest option, followed by debt, with equity being the most expensive due to the adverse selection cost.

The market timing view of capital structure suggests that a firm's capital structure is influenced by market conditions at the time when it sought funding. Managers may choose to issue equity when they believe the stock is overvalued and avoid it when they believe the stock is undervalued.

7 Payout policy

7.1 Payout policy

Definition 7.1: Payout

The way a firm chooses between the alternative ways to distribute free cash flow to equity holders. This distribution can take two primary forms: dividends or share repurchases.

7.1.1 Dividends

Dividends are cash payments made to shareholders, typically on a regular basis, as a way to distribute a portion of the firm's earnings.

- **Declaration Date:** This is the date when the company's board of directors formally announces the dividend. Once declared, the company is legally required to pay the dividend.
- **Record Date:** Shareholders who are registered as of this date are eligible to receive the dividend. Because it takes time for share ownership records to update, shareholders need to have purchased the stock at least two business days before this date to be eligible.
- **Ex-Dividend Date:** This is the cutoff date that determines who receives the dividend. If you purchase the stock on or after the ex-dividend date, you will not receive the upcoming dividend. The ex-dividend date is typically one business day before the record date.
- **Payable Date:** This is the date when the company actually distributes the dividend, usually by mailing checks or depositing funds into shareholders' accounts.

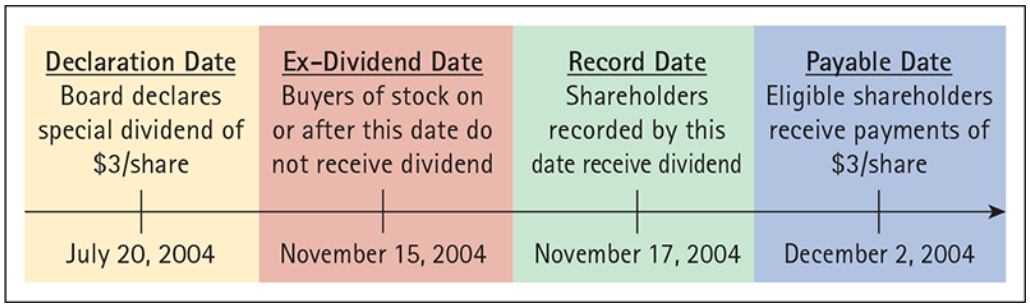

Figure 12: Microsoft Example

Definition 7.2: Regular dividends and special dividends

Regular dividends are paid consistently at set intervals (e.g., quarterly).
Special Dividends are one-time payments that are often much larger than regular dividends, typically reflecting extraordinary profits or cash reserves.

Definition 7.3: Stock split

On the other hand, stock splits involve increasing the number of shares outstanding by issuing additional shares to current shareholders. For example, in a 2-for-1 split, each shareholder receives an additional share for every share they own, but the dividend per share is halved, keeping the total payout the same. A stock split is also known as a stock dividend.

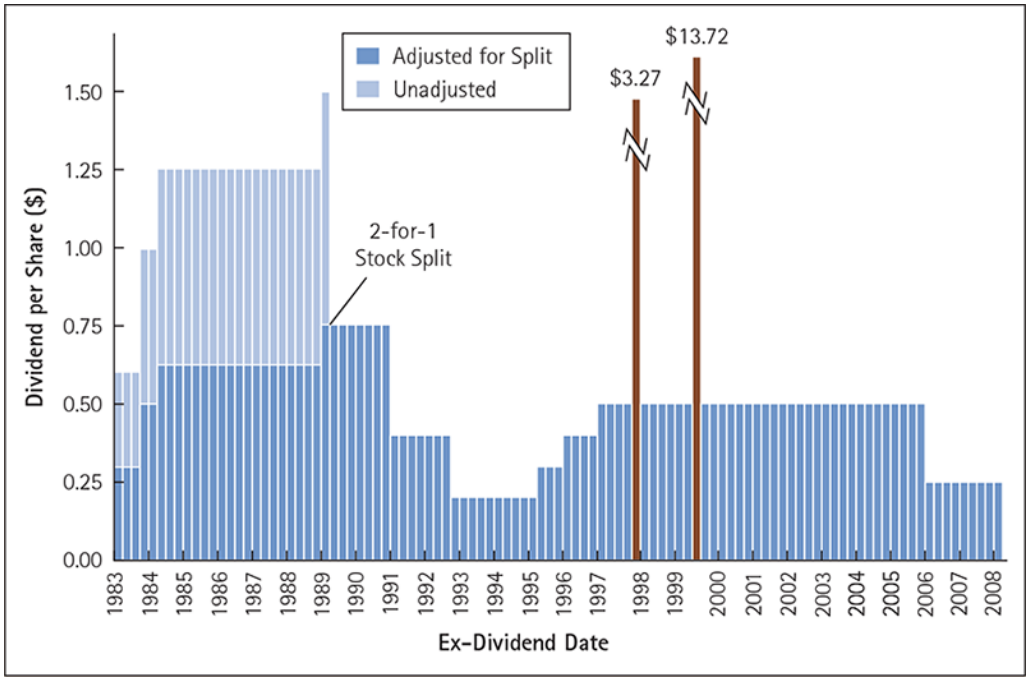

Figure 13: GM did a stock split in 1989

Definition 7.4: Return of capital

Other than regular dividends, return of capital are treated as a capital gain for tax purposes, often used when dividends are paid from sources other than retained earnings, like paid-in capital or liquidation of assets.

7.1.2 Shares repurchase

Definition 7.5: Shares repurchase

Share repurchases involve the company buying back its own shares from the market, reducing the number of shares outstanding.

There are five types of shares repurchase:

1. **Open Market Repurchase:**

   The most common method of share repurchase. The firm buys its shares on the open market over time, similar to any other investor. There are regulations to prevent market manipulation, such as limits on the volume of shares repurchased on a given day (e.g., no more than 25% of the average daily trading volume).

2. **Tender Offer:**

   The firm offers to buy back shares at a specific price, usually at a premium to the current market price. This offer is typically open for a limited time (about 20 days). If not enough shares are tendered, the firm may cancel the buyback.

3. **Dutch Auction:**

   A variation of the tender offer. The firm specifies a range of prices, and shareholders indicate how many shares they are willing to sell at each price. The firm then buys back shares at the lowest price that allows it to purchase the desired amount.

4. **Targeted Repurchase:**

   The firm buys shares directly from a major shareholder, often at a negotiated price. This can be used to prevent a takeover threat (a practice known as "greenmail") or to facilitate the sale of a large block of shares in an illiquid market.

5. **Greenmail:**

   When a company repurchases shares from a hostile shareholder at a premium to avoid a takeover.

7.2 Comparing dividends and share repurchase in perfect capital market

Genron Corporation is used as a hypothetical example to analyze how different payout policies affect the firm's share price and shareholder value. Genron has $\$20$ million in excess cash and expects to generate $\$48$ million in free cash flow (FCF) annually. With an unlevered cost of capital of 12%, the present value (PV) of its future FCF is calculated as $\$400$ million. Including the $\$20$ million in cash, the total market value of Genron is $\$420$ million.

7.2.1 Alternative Policy 1: Paying Dividends with Excess Cash

With 10 million shares outstanding, Genron will be able to pay a $\$2$ dividend immediately. The firm expects to generate future free cash flows of $\$48$ million per year, thus it anticipates paying a dividend of $\$4.80$ per share each year thereafter.

Definition 7.6: Cum-dividend

When a stock trades before the ex-dividend date, entitling anyone who buys the stock to the dividend.

The cum-dividend price of Genron will be

$$P_{cum} = \text{ Current Dividend } + PV(\text{ Future Dividends }) = 2 + \frac{4.80}{0.12} = 2 + 40 = \$42$$

With unlevered cost of capital of 12% becuase this company has no debt.

After the ex-dividend date, new buyers will not receive the current dividend and the share price of Genron will be

$$P_{ex} = PV(\text{ Future Dividends }) = \frac{4.80}{0.12} = \$40$$

	December 11 (cum-dividend)	December 12 (ex-dividend)
Cash (millions)	$\$20$	$\$0$
Other assets (millions)	$\$400$	$\$400$
Total market value (millions)	$\$420$	$\$400$
Shares (millions)	10	10
Share price	$\$42$	$\$40$

Before the dividend, the firm's total market value is $\$420$ million. After paying the dividend, the cash decreases by $\$20$ million, reducing the market value to $\$400$ million. The share price decreases accordingly from $\$42$ to $\$40$, but shareholders do not lose value-they receive $\$2$ in cash and retain $\$40$ in stock value.

The price drop equal to the dividend ensures no arbitrage opportunities exist. If the price dropped by less or more than the dividend, investors could exploit this discrepancy for profit, which would not occur in a perfect market. Thus:

In a perfect capital market, when a dividend is paid, the share price drops by the amount of the dividend when the stock begins to trade ex-dividend.

7.2.2 Alternative Policy 2: Share Repurchase (No Dividend)

Instead of paying a dividend, Genron could use the $\$20$ million to repurchase shares. At $\$42$ per share, the company would buy back approximately 0.476 million shares, leaving 9.524 million shares outstanding.

Unlike the dividend scenario, the share price remains at $\$42$ after the repurchase. The market value of the firm's assets decreases by $\$20$ million (from $\$420$ million to $\$400$ million), but since there are fewer shares outstanding, the share price does not change.

	December 11 (cum-dividend)	December 12 (ex-dividend)
Cash (millions)	$\$20$	$\$0$
Other assets (millions)	$\$400$	$\$400$
Total market value of assets (millions)	$\$420$	$\$400$
Shares (millions)	10	9.524
Share price	$\$42$	$\$42$

The reduced number of shares means that future dividends per share will be higher ($\$5.04$ per share instead of $\$4.80$ i.e. $P_{\text{rep}} = \frac{5.04}{0.12} = \$42$), keeping the present value of future dividends consistent with the cum-dividend price. Thus:

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.

7.2.3 Investor Preferences and Homemade Dividends

Investor Indifference: In a perfect market, investors should be indifferent between dividends and share repurchases because they can adjust their holdings to create their desired cash flow. This is called homemade dividends. For instance:

- If an investor prefers cash, they can sell some shares during a repurchase.
- If they prefer to reinvest dividends, they can use the cash from dividends to buy more shares.

Homemade Dividends: The concept of "homemade dividends" shows that investors can replicate the effect of any payout method by buying or selling shares. Therefore, the firm's payout policy does not affect the total value of the investor's holdings in perfect markets.

Example.

Genron decides to repurchase shares instead of paying a dividend. The share price before the repurchase is $\$42$. n investor holds 2,000 shares of Genron stock, worth $\$84,000$ in total ($\$42 \times 2,000$ shares). The investor wants to receive $\$4,000$ in cash, similar to what they would have received if Genron had paid a $\$2$ per share dividend.
The investor can sell enough shares to generate $\$4,000$ in cash. Since each share is worth $\$42$, the investor sells approximately $\$4,000 \div \$42 = 95.238$ shares (rounded to 95 shares).

Example.

Genron decides to pay a $\$2$ dividend per share. The investor receives $\$4,000$ in cash from the dividend (2,000 shares $\times\$2$ per share). After the dividend, the stock price drops to $\$40$ per share. The investor prefers to have more shares rather than holding cash.
The investor uses the $\$4,000$ dividend to purchase more shares at the ex-dividend price of $\$40$ per share. $\$4,000 \div \$40$ per share $= 100$ shares
The investor now owns 2,100 shares (original 2,000 shares $+100$ new shares). The value of the portfolio is 2,100 shares $\times\$40 = \$84,000$.

7.2.4 Alternative Policy 3: High Dividend with Equity Issue

If Genron wants to pay a higher dividend than the available $\$20$ million, it could raise additional cash by issuing new shares. For example, raising $\$28$ million by issuing 0.67 million new shares would allow Genron to pay a $\$4.50$ dividend per share.

$$\$28 \text{ million } \div \$42 \text{ per share } = 0.67 \text{ million shares}$$

$$\frac{\$48 \text{ million}}{10.67 \text{ million shares}} = \$4.50 \text{ per share}$$

This higher dividend now would reduce future dividends to $\$4.50$ per share (compared to $\$4.80$ or $\$5.04$ under the other policies), but the present value of future dividends still keeps the share price at $\$42$.

$$P_{\text{cum}} = 4.50 + \frac{4.50}{0.12} = 4.50 + 37.50 = \$42$$

This outcome illustrates that increasing the current dividend by issuing new equity does not enhance shareholder value.

7.2.5 MM and payout policy

Modigliani and Miller argue that in perfect capital markets, a firm's dividend policy is irrelevant. The initial share price is determined by the present value of future dividends, regardless of how or when these dividends are paid. Thus, whether the firm pays out cash through dividends or repurchases, or even raises equity to pay higher dividends, the firm's value and share price remain unchanged.

The MM theorem assumes no taxes, transaction costs, or information asymmetries. Under these conditions, the way a firm distributes its cash does not impact the firm's value, as shareholders can achieve their preferred payout through homemade dividends.

7.3 The Tax Disadvantage of Dividends

The section explores how taxation affects a firm's decision to distribute profits to shareholders through dividends or share repurchases.

Shareholders are taxed on the dividends they receive and on capital gains when they sell shares. Historically, dividend income has often been taxed at a higher rate than capital gains. In Canada, this is generally the case, and it was true in the U.S. until a period from 2003 to 2012 when the rates were equal. Taxes on capital gains are deferred until the stock is sold, which often results in a lower present value of taxes compared to dividends.

When dividends are taxed more heavily than capital gains, shareholders tend to prefer share repurchases over dividends. This preference is because share repurchases allow for a lower tax burden, as homemade dividends created through share sales are taxed at the capital gains rate.

Example.

Suppose a firm raises $\$10$ million from shareholders and uses this cash to pay them $\$10$ million in dividends. If the dividend is taxed at a 40% rate, and if capital gains are taxed at a 15% rate, how much will shareholders receive after taxes?

The firm distributes the $\$10$ million raised from issuing new equity as dividends. Dividends are taxed at 40%.

$$40\% \times \$10 \text{ million } = \$4 \text{ million}$$

So, shareholders will pay $\$4$ million in taxes on the dividends.

When the firm pays out $\$10$ million in dividends, its value decreases by the same amount, assuming

no other changes. This reduction in the firm's value means that the potential capital gain (the profit shareholders would make when selling the stock) is reduced. Capital gains tax is 15%. Since the firm's value drops by $\$10$ million, shareholders will pay $\$1.5$ million less in capital gains taxes in the future (15% of $\$10$ million):

$$15\% \times \$10 \text{ million } = \$1.5 \text{ million}$$

Thus, in total, shareholders will pay $\$4$ million - $\$1.5$ million $= \$2.5$ million in taxes, and they will receive back only $\$7.5$ million of their $\$10$ million investment.

If the dividend tax rate exceeds the capital gain tax rate, shareholders will prefer share repurchases to dividends, as this approach minimizes their tax liabilities and increases the firm's value.

Firms paying dividends need to offer a higher pre-tax return to match the after-tax return provided by firms that use share repurchases, due to the tax disadvantages of dividends.

Historical data shows a significant decline in the number of firms paying dividends from 1978 to 2002 in the U.S., influenced by the higher tax burden on dividends. The reduction in the U.S. dividend tax rate in 2003 led to a reversal of this trend, increasing the fraction of firms paying dividends.

Initially, dividends were the primary method for distributing cash, accounting for over 80% of corporate payouts until the early 1980s. The importance of share repurchases grew significantly in the mid-1980s, surpassing the value of dividend payments by the late 1990s. A similar pattern is observed in Canadian firms, where the dollar amount of share repurchases eclipsed dividends by 2004.

Despite the tax disadvantages of dividends, many firms continue to issue them, a phenomenon often referred to as the **dividend puzzle**. This puzzle highlights the complexity of corporate payout policies and suggests that other factors beyond tax considerations influence the decision to pay dividends.

7.4 Dividend Capture and Tax Clienteles

The section delves into the complexities of how different tax rates on dividends and capital gains influence investor behavior and, consequently, a firm's payout policy.

7.4.1 The Effective Dividend Tax Rate

To understand investor preferences, it's crucial to quantify the tax burden on dividends compared to capital gains, which is done through the concept of the effective dividend tax rate.

Consider an investor who buys a stock just before it goes ex-dividend to capture the dividend and then sells it immediately after. The investor receives the dividend but also incurs a capital loss because the stock price typically drops by the dividend amount after the ex-dividend date. The tax on the dividend is at the dividend tax rate τ_d, while the capital loss is at the capital gains tax rate τ_g.

The investor profits if the after-tax dividend exceeds the after-tax capital loss. To avoid arbitrage opportunities, the price drop ($P_{\text{cum}} - P_{\text{ex}}$) must equal the dividend after adjusting for the tax differences i.e $(P_{cum} - P_{ex})(1 - \tau_g) = \text{Div}(1 - \tau_d)$:

$$P_{\text{cum}} - P_{\text{ex}} = \text{Div} \times \left(\frac{1 - \tau_d}{1 - \tau_g} \right) = \text{Div} \times (1 - \tau_d^*)$$

where τ_d^* is the effective dividend tax rate:

$$\tau_d^* = \frac{\tau_d - \tau_g}{1 - \tau_g}$$

This rate measures the additional tax burden on dividends relative to capital gains.

The effective dividend tax rate varies significantly across different types of investors due to factors such as income level, investment horizon, tax jurisdiction, and type of investment account.

- **Income Level:** Investors in higher tax brackets face higher taxes on dividends and capital gains, but the disparity between the two can drive preferences for share repurchases.

- **Investment Horizon:** Long-term investors can defer capital gains taxes, effectively lowering their tax burden. In some cases, such as donations to charity, capital gains taxes can be entirely avoided.
- **Tax Jurisdiction:** Taxes differ by province and between countries. For example, U.S. investors in Canadian stocks face a 15% withholding tax on dividends, but not on capital gains.
- **Type of Investor or Investment Account:** Non-taxed accounts (like RRSPs, RRIFs, and TFSAs) or entities (like pension funds) do not pay taxes on either dividends or capital gains, making them indifferent to the tax implications of payout methods. Corporations have a tax advantage for dividends, as they can exclude dividends from their taxable income but not capital gains.

Clientele effect: The varying tax preferences across different investor groups lead to a "clientele effect," where a firm's dividend policy attracts a specific group of investors whose tax preferences align with that policy.

- **High-Tax Bracket Investors:** Prefer low or no dividends.
- **Tax-Free Investors:** Prefer high dividends, as they face no tax burden on these payouts.
- **Corporations:** Also prefer high dividends due to the tax benefits.

Investor Group	Dividend Policy Preference	Proportion of Investors
Individual investors	Tax disadvantage for dividends Prefer share repurchase	$\sim 52\%$
Institutions, pension funds, and retirement accounts	No tax preference Prefer dividend policy that matches income needs	$\sim 47\%$
Corporations	Tax advantage for dividends	$\sim 1\%$

Dynamic Clientele Effect: Also known as the dividend-capture theory, it posits that investors might engage in short-term trading around dividend dates to exploit the tax differences.

- **Strategy:** High-tax investors sell just before the ex-dividend date, while low- or no-tax investors buy to capture the dividend, and then reverse these trades after the ex-dividend date.
- **Example:** The case of Value Line, Inc. in 2004 illustrates this, where a special dividend led to a surge in trading volume around the ex-dividend date as investors acted on these strategies.

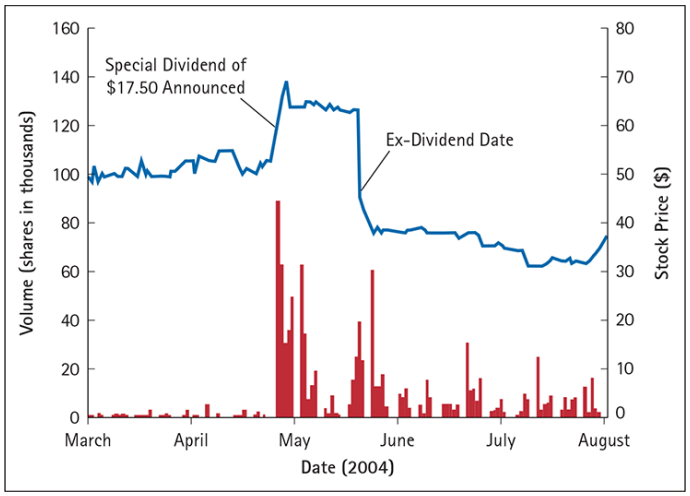

Figure 14: Volume and Share Price Effects of Value Line's Special Dividend

7.5 How much cash to return to shareholders versus how much to retain

The section delves into a critical aspect of a firm's payout policy: deciding how much cash to return to shareholders versus how much to retain within the firm. The discussion integrates both theoretical perspectives from perfect capital markets and practical considerations involving market imperfections like taxes, issuance costs, and agency costs.

7.5.1 Retaining Cash in Perfect Capital Markets

If a firm has excess cash, it should first invest in any available positive-NPV (Net Present Value) projects. These investments increase the value of the firm and, consequently, benefit shareholders.

Once all positive-NPV projects are funded, the firm faces a choice between retaining the remaining cash or paying it out to shareholders. In a perfect capital market (no taxes, no transaction costs, and no information asymmetry), this decision is irrelevant to the firm's value:

- Retaining cash doesn't add value beyond what shareholders could achieve on their own by investing the payout themselves.
- If the firm decides to retain cash and invest in financial securities, the return on these investments will be equivalent to what shareholders would earn by investing the payout independently.

Example.

> Yellowknife Mining has $\$100,000$ in excess cash and is considering either investing it in treasury bills (paying 6% interest) to pay a dividend next year or paying the dividend immediately.
> In a perfect market, shareholders are indifferent. Whether the firm retains the cash or pays it out immediately, the present value to shareholders remains the same ($100,000), demonstrating the MM Payout Irrelevance principle.

7.5.2 When we have taxes

When taxes are introduced, the scenario changes significantly. Retaining cash can result in a tax disadvantage because the firm has to pay corporate taxes on the interest earned from retained cash.

Example.

> If Yellowknife Mining retains its $\$100,000$ and invests it in treasury bills, it earns a 6% interest rate, but after paying corporate taxes at 35%, the effective return is only 3.9%. This results in a dividend of $\$103,900$ after a year, less than the $\$106,000$ shareholders could have earned if they invested the $\$100,000$ themselves.
> Corporate taxes reduce the benefit of retaining cash, making it more tax-efficient for firms to pay dividends immediately, especially when shareholders (like pension fund investors) are tax-exempt on their income.

Example.

> If Microsoft had retained the $\$32$ billion it used for a special dividend in 2004 , it would have faced $\$11.2$ billion in additional taxes over time i.e. $\frac{\$32 \text{ billion} \times r_f \times 35\%}{r_f} = \$32 \text{ billion} \times 35\% = \$11.2 \text{ billion}$.
> The $\$11.2$ billion tax savings can also be expressed on a per-share basis. Since the total dividend was $\$3$ per share, the per-share tax savings from paying out the dividend instead of retaining the cash would be:
>
> $$\text{Tax savings per share } = \$3 \times 35\% = \$1.05 \text{ per share}$$
>
> This means that by paying out the $\$3$ dividend per share, Microsoft saved shareholders an effective $\$1.05$ per share in taxes that would have been incurred if the cash had been retained and taxed at the

corporate level.

7.5.3 Adjusting for Investor Taxes

Investor taxes also affect the decision to retain or pay out cash. Retaining cash can lead to a double taxation scenario, where both the firm and the investor are taxed on the returns from the retained cash.

If the firm paid the cash to its shareholders instead, they could invest it and be taxed only once on the interest that they earn.

The cost of retaining cash therefore depends on the combined effect of the corporate and capital gains taxes, compared to the single tax on interest income.

$$\tau^*_{\text{recain}} = \left[1 - \frac{(1-\tau_c)(1-\tau_g)}{(1-\tau_i)}\right]$$

7.5.4 Issuance and Distress Costs

Despite the tax disadvantages of retaining cash, firms often do so to avoid the costs associated with raising capital in the future. These costs include direct issuance costs (1-3% for debt, 3.5-7% for equity) and indirect costs like agency costs and adverse selection.

7.5.5 Agency Costs of Retaining Cash

Retaining excessive cash can lead to agency costs, where managers might misuse the funds for non-value-adding projects, perks, or inefficient acquisitions.

Example.

Alsand Oil is an all-equity firm with 100 million shares outstanding. The firm has $\$150$ million in cash available. Alsand expects to generate $\$65$ million per year in future free cash flows. Management is considering using the $\$150$ million in cash to expand the firm's operations. This expansion is expected to increase future free cash flows by 12%.

- If Alsand does not pursue the expansion, its future free cash flows remain at $\$65$ million per year.
- If Alsand proceeds with the expansion, future free cash flows will increase by 12%, from $\$65$ million to $\$72.8$ million per year.
- The cost of capital for Alsand's investments is 10%. This is the discount rate used to calculate the present value of future cash flows.

The new free cash flows are $\$72.8$ million annually. The present value of these future cash flows (assuming they continue indefinitely) is calculated using the perpetuity formula:

$$\text{Value with Expansion} = \frac{\$72.8 \text{ million}}{0.10} = \$728 \text{ million}$$

With 100 million shares outstanding, the share price would be:

$$\text{Share Price with Expansion} = \frac{\$728 \text{ million}}{100 \text{ million shares}} = \$7.28 \text{ per share}$$

If Alsand does not expand, future free cash flows remain $\$65$ million annually. The present value of these cash flows is:

$$\text{Value without Expansion} = \frac{\$65 \text{ million}}{0.10} = \$650 \text{ million}$$

Alsand's current cash holdings of $\$150$ million are added to this value:

$$\text{Total Value without Expansion} = \$650 \text{ million} + \$150 \text{ million} = \$800 \text{ million}$$

The share price without expansion is: Share Price without Expansion $= \frac{\$800 \text{ million}}{100 \text{ million shares}} = \$8.00$ per share

The share price is higher if Alsand does not pursue the expansion. This indicates that the expansion project is not adding value to the company—it has a negative NPV.

The expansion requires the use of $\$150$ million in cash. The expansion increases free cash flows by $\$7.8$ million annually (from $\$65$ million to $\$72.8$ million). The value of the increase is:

$$\text{Value of Increase} = \frac{\$7.8 \text{ million}}{0.10} = \$78 \text{ million}$$

$$\text{NPV} = \text{ Value of Increase } - \text{ Cost of Expansion } = \$78 \text{ million } - \$150 \text{ million } = -72 \text{ million}$$

$$\text{NPV per share} = \frac{-\$72 \text{ million}}{100 \text{ million shares}} = -\$0.72 \text{ per share}$$

The expansion has a negative NPV of $\$72$ million, which means it reduces the overall value of the firm by $\$0.72$ per share. Instead of using the $\$150$ million for expansion, Alsand could repurchase its own shares. If Alsand uses the $\$150$ million to buy back shares at $\$8$ per share, it would repurchase:

$$\text{Shares Repurchased} = \frac{\$150 \text{ million}}{\$8 \text{ per share}} = 18.75 \text{ million shares}$$

The total value of the firm after the repurchase would be the value of the remaining future free cash flows, which is $\$650$ million. The new share price is: Share Price after Repurchase $= \frac{\$650 \text{ million}}{81.25 \text{ million shares}} = \$8.00$ per share

Pursuing negative-NPV projects (like the expansion in this case) reduces shareholder value, as it lowers the firm's overall market value and share price. Using excess cash to repurchase shares is a more effective way to enhance or maintain shareholder value when the alternative investment (like the expansion) would destroy value.

If management decided to go ahead with the expansion despite its negative NPV, it could indicate agency problems where management's interests diverge from those of shareholders. By repurchasing shares, management aligns more closely with shareholder interests, reducing the potential for value destruction.

7.6 Signalling With Payout Policy

The section explores how firms use their payout policies, such as dividends and share repurchases, to signal information to the market, particularly in the presence of asymmetric information.

7.6.1 Asymmetric Information and Payout Policy

Asymmetric information occurs when managers have more information about the firm's future prospects than investors do. This information gap can influence how investors interpret a firm's payout decisions.

Payout policies, particularly changes in dividends or share repurchase programs, can act as signals to investors about the firm's future performance and managerial confidence.

7.6.2 Dividend Smoothing

Definition 7.7: Dividend smoothing

Firms tend to keep their dividend payments stable over time, even if their earnings fluctuate. This practice is known as dividend smoothing.

Reasons for Dividend Smoothing:

- **Investor Preferences:** Management often believes that investors prefer stable dividends that grow sustainably over time.
- **Long-Term Target:** Firms aim to maintain a consistent dividend payout ratio relative to earnings, adjusting dividends cautiously and infrequently.
- **Financial Strategy:** To maintain stable dividends, firms may adjust share repurchases, retain earnings, or use other financial strategies rather than increasing dividends when earnings rise temporarily.

7.6.3 Dividend Signalling Hypothesis

The dividend signalling hypothesis suggests that changes in dividend payments convey information about a firm's future earnings prospects.

- Dividend Increase: Signals that management expects strong future earnings and the ability to sustain higher dividends.
- Dividend Cut: Typically signals that management is pessimistic about future earnings, leading to negative market reactions.

While an increase of a firm's dividend may signal management's optimism regarding its future cash flows, it might also signal a lack of investment opportunities. Conversely, a firm might cut its dividend to exploit new positive-NPV investment opportunities. In this case, the dividend decrease might lead to a positive, rather than negative, stock price reaction.

Historical studies have shown that firms raising dividends by 10% or more tend to see their stock prices increase by an average of 1.34%, while firms cutting dividends by the same amount experience an average decline of 3.71%. The magnitude of the stock price reaction tends to be larger for dividend cuts than for dividend increases, reflecting the negative signal associated with cutting dividends.

Using debt as a signal (e.g., increasing leverage) is generally a stronger signal than dividend changes because failing to meet debt obligations has more severe consequences than cutting dividends. Studies show more significant stock price reactions to changes in leverage compared to dividend changes.

7.6.4 Signalling with Share Repurchases

Like dividends, share repurchases can also signal managerial confidence in the firm's future, but there are differences in how these signals are perceived:

- **Less Commitment:** Managers are less committed to share repurchases than to dividends. Firms can announce a share repurchase program without fully executing it, making repurchases a weaker signal of future earnings than dividends.
- **Market Timing:** The cost of a share repurchase depends on the stock's market price. Managers are more likely to repurchase shares if they believe the stock is undervalued, making repurchases a potential signal that the firm's shares are underpriced.

Example.

> Clark Industries has 200 million shares outstanding. The current market price of Clark's shares is $\$30$ per share. The company has no debt and a total market capitalization (market cap) of $\$6$ billion ($\$30$ per share $\times 200$ million shares). Cash: $\$600$ million (part of the market cap that Clark plans to use for the share repurchase). And other Assets: $\$5.4$ billion (the value of all other assets besides cash).

	Before Repurchase	After Repurchase	After New Information
Cash (millions)	$600	$0	$0
Other assets (millions)	$5400	$5400	$6400
Total market			
value of assets (millions)	$6000	$5400	$6400
Shares (millions)	200	180	180
Share Price	$30.00	$30.00	$35.56

If Clark waited for the new information to come out before repurchasing the shares, it would buy shares at a market price of $35 per share. Thus it would repurchase only 17.1 million shares. The share price after the repurchase would be $6.4 billion $\div 182.9$ shares $= \$35$ per share.
By repurchasing shares while the stock is under-priced, the ultimate share price will be $0.556 higher, for a total gain of $\$0.556 \times 180$ million shares $= \$100$ million for long-term shareholders. Note, this gain equals the loss to the selling shareholders from selling 20 million shares at a price that is $5 below their true value.

The timing of the share repurchase is crucial. By repurchasing shares when they are undervalued, Clark Industries effectively increases the value for remaining shareholders. The market's adjustment to the true value after the repurchase results in a higher share price for those who hold onto their shares. The repurchase of shares at an undervalued price signals to the market that management believes the firm is undervalued. This signaling can lead to a positive adjustment in the share price, benefiting long-term shareholders. The example illustrates how strategic share repurchases can create additional value for shareholders, especially if the stock is undervalued at the time of repurchase.

7.7 Stock Dividends, Splits, and Spin-Offs

The section explores non-cash methods of distributing value to shareholders, focusing on stock dividends, stock splits, reverse splits, and spin-offs.

7.7.1 Stock Dividends and Splits

Definition 7.8: Stock dividends

A stock dividend is when a firm distributes additional shares to its existing shareholders instead of paying cash. For instance, a 10% stock dividend means a shareholder receives one additional share for every 10 shares owned.

Stock dividends increase the number of shares outstanding but do not change the firm's total equity value. Therefore, the stock price adjusts downward proportionally to the increase in shares to keep the total market capitalization unchanged.

Definition 7.9: Stock splits

A stock split is a significant form of a stock dividend, typically 50% or more. For example, a 3-for-2 stock split means each shareholder receives one additional share for every two shares owned, effectively increasing the number of shares by 50%.

Like stock dividends, a stock split does not change the total market value of the firm's equity but does lower the share price proportionally. For instance, after a 3-for-2 split, the stock price will decrease to two-thirds of its original value.

If Genron declares a 50% stock dividend (3-for-2 split), the number of shares increases from 10 million to 15 million. The share price decreases from $\$42$ to $\frac{2}{3} \times 42 = \$28$, but the total value of a shareholder's

portfolio remains unchanged.

Companies often use stock splits to make their shares more affordable and attractive to small investors. A lower share price increases liquidity and can boost demand, potentially driving up the stock price. Firms use stock splits to keep share prices within a desirable range, typically below $100. If the price becomes too high, a split can lower it, making the stock more accessible. Conversely, if the price falls too low, a reverse split can raise it to avoid issues like increased transaction costs or delisting from major exchanges.

Definition 7.10: Reverse split

A reverse split consolidates shares, reducing the number of shares outstanding and increasing the share price. For example, a 1-for-10 reverse split replaces every 10 shares with a single share.

Reverse splits are used to avoid the negative effects of a low share price, such as delisting risks or higher bid-ask spreads.

7.8 Spin offs

Definition 7.11: Spin offs

A spin-off occurs when a firm distributes shares of a subsidiary or division to its shareholders, creating a separate, independent company.

In a spin-off, shareholders receive shares of the subsidiary as a special dividend. This method avoids the tax implications of a cash dividend and defers capital gains taxes until the shareholder sells the spin-off shares.

Example.

> In 2000, Bell Canada Enterprises (BCE) spun off its 35% ownership of Nortel by distributing Nortel shares to BCE shareholders. Each BCE shareholder received 1.570386 shares of Nortel for each BCE share owned. This distribution was valued at $\$135.82$ per BCE share based on Nortel's share price at the time. This spin-off allowed BCE to avoid transaction costs associated with selling Nortel shares and provided tax advantages to shareholders, who only had to pay capital gains tax when they sold the Nortel shares.

8 Risk management

8.1 Commodity Price Risk

Commodity price risk refers to the uncertainty in profits that firms face due to fluctuations in the prices of raw materials or products. This risk is significant for many industries where commodities like oil, cocoa, or metals play a crucial role. For example, in the airline industry, fuel costs, which are highly volatile, can severely impact profitability.

Definition 8.1: Hedging

Hedging is a risk management strategy used by firms, investors, and financial institutions to protect themselves against potential losses due to adverse price movements or other financial risks. Essentially, hedging involves taking an offsetting position in a related asset or financial instrument to reduce or eliminate the risk associated with an original position.

- A firm or investor has a primary position that is exposed to some form of risk. This could be holding a commodity that might decrease in value, a currency that could depreciate, or an investment in a stock that could drop in price.
- To hedge, the firm or investor takes a secondary position that will gain value if the primary position loses value. This offsetting position is typically in a financial instrument such as options, futures, or forward contracts.

8.1.1 Hedging with Vertical Integration and Storage

Vertical integration involves merging with or acquiring firms in the supply chain, either suppliers (backward integration) or customers (forward integration), to control costs and reduce exposure to price fluctuations. If a company relies on a specific commodity, acquiring the supplier of that commodity can help stabilize costs.

Vertical integration can reduce commodity price risk by internalizing the supply chain. If the price of a key input rises, the firm might offset this cost increase with higher revenues from the newly acquired supplier. However, merging unrelated businesses (like an airline with an oil producer) could lead to inefficiencies and lack of focus, potentially harming the firm's performance.

Firms might buy and store large quantities of a commodity to hedge against future price increases. If an airline is worried about rising fuel prices, it could buy and store large amounts of fuel at current prices, locking in its cost. This strategy eliminates the risk of future price increases since the firm already holds the necessary commodity at a known price. However, storing large quantities of commodities can be expensive. For many commodities, like fuel, the costs of storage (including maintaining the quality of the stored goods) might outweigh the benefits of hedging. And maintaining a large inventory ties up a firm's capital in non-productive assets, increasing working capital needs.

8.1.2 Hedging with Long-Term Contracts

Firms can enter into long-term contracts with suppliers or customers to fix the price of a commodity for future transactions, providing price stability. hese contracts provide certainty and protect against unfavorable price movements. If the market price of the commodity rises, the firm benefits from having locked in a lower price. However, once entered, long-term contracts are not easily canceled or modified, and their market value is hard to determine, complicating the tracking of potential gains or losses. And these contracts are bilateral and non-anonymous. The buyer and seller know each other's identity, which might reveal sensitive information about the firm's risk exposure to competitors. And the risk that the counterparty might not fulfill the contract if market conditions change dramatically (e.g., if the price falls significantly below the contracted price, the supplier might be tempted to default).

Example.

A chocolate maker needs 10,000 metric tonnes of cocoa beans next year. The current price is $\$2900$ per tonne, and the firm expects an EBIT of $\$44$ million. If the price rises to $\$3500$ per tonne, the firm's EBIT drops to $\$38$ million. If the price falls to $\$2600$ per tonne, the EBIT rises to $\$47$ million. With a **Forward Contract:** The firm can lock in a price of $\$2950$ per tonne, ensuring an EBIT of $\$43.5$ million, effectively eliminating price risk but sacrificing some potential profit.

Example.

Consider a cereal manufacturer that will need 20 million bushels of corn next year. The current market price of corn is $\$3$ per bushel. At $\$3$ per bushel, the firm expects earnings before interest and taxes of $\$50$ million next year. What will the firm's EBIT be if the price of corn rises to $\$3.50$ per bushel? What will the EBIT be if the price of corn falls to $\$2.25$ per bushel? What will the EBIT be in each scenario if the firm enters into a supply contract for corn for a fixed price of $\$3.25$ per bushel?

- At $\$3.50$ per bushel:

$$\begin{aligned} \text{EBIT} &= \$50,000,000 - [(\$3.50 - \$3.00) \times 20,000,000] \\ &= \$40,000,000 \end{aligned}$$

- At $\$2.25$ per bushel:

$$\begin{aligned} \text{- EBIT} &= \$50,000,000 - [(\$2.25 - \$3.00) \times 20,000,000] \\ &= \$65,000,000 \end{aligned}$$

- At $\$3.25$ per bushel:

$$\begin{aligned} \text{- EBIT} &= \$50,000,000 - [(\$3.25 - \$3.00) \times 20,000,000] \\ &= \$45,000,000 \end{aligned}$$

8.1.3 Hedging with Futures Contracts

A futures contract is a standardized legal agreement to buy or sell a specific quantity of a commodity or financial instrument at a predetermined price on a specified future date. These contracts are traded on organized exchanges, such as the New York Mercantile Exchange (NYMEX), ensuring transparency, liquidity, and regulation.

The terms of futures contracts (e.g., the quantity of the commodity, delivery date, and location) are standardized. This standardization makes futures contracts highly liquid, as they can be easily traded between parties.

- If a firm agrees to buy a commodity in the future, it takes a "long" position in a futures contract. This position benefits if the price of the commodity increases because the firm will pay the agreed-upon lower price instead of the higher market price.
- Conversely, a firm that agrees to sell a commodity in the future takes a "short" position. This position benefits if the price of the commodity decreases because the firm can sell at the higher agreed-upon price rather than the lower market price.

Example: An airline anticipating higher fuel prices might go long in a crude oil futures contract, locking in the price at $\$50$ per barrel. If the market price rises to $\$70$, the airline benefits from paying the lower $\$50$ price agreed upon in the futures contract.

The future contract has several advantages:

- Unlike forward contracts, futures contracts are traded on exchanges, meaning the identity of the buyer and seller is anonymous. This prevents competitors from gaining insights into a firm's risk management strategies.
- The presence of many buyers and sellers in the market ensures that firms can enter or exit futures contracts relatively easily.
- The standardized nature of futures contracts facilitates easy trading, pricing, and settlement, making them a popular hedging tool.

8.1.4 Mitigating Credit Risk with Futures Contracts

One major concern with forward contracts is credit risk—the possibility that one party might default on the contract if market conditions change significantly. Futures contracts address this risk through two mechanisms:

1. **Margin Requirements:** Both parties (buyers and sellers) must post collateral, known as a "margin," when entering a futures contract. This margin acts as a security deposit, ensuring that both parties have a financial stake in honoring the contract.
2. **Marking to Market:** Futures contracts are "marked to market" daily. This means that the contract's value is adjusted daily based on the current market price of the commodity. Any gains or losses are settled immediately by adjusting the margin accounts. For example, if the futures price decreases, the margin account of the party in the long position (the buyer) is debited, and the margin account of the party in the short position (the seller) is credited.

Example.

Suppose an airline enters into a futures contract to buy crude oil at \$50.83 per barrel in May 2025. Over time, the futures price fluctuates daily, reflecting changing market conditions.

1. **Day 1:** If the futures price drops to \$48 per barrel, the airline's margin account is reduced by \$2.83 per barrel, reflecting a loss.
2. **Day 2:** If the price rises to \$50 per barrel, the margin account is credited by \$2 per barrel.

This process continues daily until the contract's expiration. The cumulative gains or losses reflect the difference between the original futures price and the current market price.
By the time the contract matures in May 2025, if the final futures price is \$79 per barrel, the airline would have gained \$28.17 per barrel in its margin account (the difference between the final price and the marked-to-market losses over time). Thus, despite the market price rising to \$79, the airline effectively pays the originally agreed price of \$50.83 per barrel.

Companies that anticipate needing a commodity in the future, such as an airline needing jet fuel, can hedge against price increases by going long in futures contracts. This strategy locks in the purchase price, protecting against potential cost spikes. Commodity producers, like an oil company, might go short in futures contracts to lock in a selling price, protecting against potential price drops that could reduce their revenue.

8.1.5 Hedging with options

Options are financial derivatives that give the holder the right, but not the obligation, to buy or sell an underlying asset (such as a commodity, stock, or index) at a predetermined price (strike price) before or at the expiration date. Unlike futures contracts, options provide flexibility as they do not require the holder to execute the contract if it is not favorable.

- **Call Options:** These give the holder the right to buy the underlying asset at the strike price.
- **Put Options:** These give the holder the right to sell the underlying asset at the strike price.

Options have several advantages:

- **Flexibility:** Options provide flexibility since the holder can choose whether to exercise the option depending on the market conditions.
- **Limited Downside Risk:** For the buyer of an option, the maximum loss is limited to the premium paid for the option. This contrasts with futures contracts, where potential losses can be substantial.
- **Potential Upside:** Options allow the holder to benefit from favorable market movements while protecting against adverse movements.

Example.

Consider this example illustrates how two parties, Magda Nowak (a canola farmer) and Japan Canola Crushers (JCC, a canola buyer), can hedge against the risk of unfavorable price changes in the canola market using either futures contracts or options contracts.

1. Magda (Canola Farmer) is concerned that the price of canola might drop by the time she harvests and sells her crop in November. To protect against a potential price drop, Magda can:

   - Enter a Short Futures Contract: She locks in a selling price of $\$600$ per metric tonne, ensuring she will receive $\$600,000$ for her 1,000 metric tonnes of canola regardless of market price changes.

     Outcome: By entering a short futures contract, Magda locks in a price of $\$600$ per metric tonne. This means she will sell her 1,000 metric tonnes of canola for $\$600,000$, regardless of whether the market price is higher or lower in November.

     Advantage: No additional cost for the hedge; she is completely protected from price drops.

     Disadvantage: She cannot benefit if the canola price rises above $\$600$ in November.
   - Purchase Put Options: She buys put options with a strike price of $\$600$ per metric tonne, costing $\$36,000$ in total. This option gives her the right to sell her canola at $\$600$ per tonne if the market price drops.

     If Price $< \$600$ **:** Magda will exercise her put options and sell her canola at the strike price of $\$600$ per tonne. The net amount she receives will be $\$600,000$ (from selling canola) $-\$36,000$ (cost of options) $= \$564,000$. This translates to $\$564$ per tonne.

     If Price $> \$600$ **:** Magda will let her options expire and sell her canola at the higher market price. However, she will still bear the cost of the options, so her net per tonne revenue will be the market price minus $\$36$ (the option cost).

2. Japan Canola Crushers (JCC) is concerned that the price of canola might increase by the time they need to buy it in November. To protect against a potential price increase, JCC can:

   - Enter a Long Futures Contract: They lock in a buying price of $\$600$ per metric tonne, ensuring they will pay $\$600,000$ for the 1,000 metric tonnes of canola regardless of market price changes.

     Outcome: By entering a long futures contract, JCC locks in a price of $\$600$ per metric tonne. This means they will buy the 1,000 metric tonnes of canola for $\$600,000$, regardless of whether the market price is higher or lower in November.

     Advantage: No additional cost for the hedge; they are completely protected from price increases.

     Disadvantage: They cannot benefit if the canola price falls below $\$600$ in November.

- Purchase Call Options: They buy call options with a strike price of $\$600$ per metric tonne, costing $\$34,000$ in total. This option gives them the right to buy canola at $\$600$ per tonne if the market price rises.

  If Price $> \$600$ **:** JCC will exercise their call options and buy canola at the strike price of $\$600$ per tonne. The net amount they pay will be $\$600,000$ (for canola) $+\$34,000$ (cost of options) $= \$634,000$. This translates to $\$634$ per tonne.

  If Price $< \$600$ **:** JCC will let their options expire and buy canola at the lower market price. However, they will still bear the cost of the options, so their net per tonne cost will be the market price plus $\$34$ (the option cost).

With futures, both parties completely eliminate price risk but give up any potential gain from favorable price changes. With options, both parties reduce the risk of adverse price movements but must pay for this protection. They retain the ability to benefit from favorable price movements but at the cost of the option premiums.

8.1.6 Deciding to Hedge Commodity Price Risk

We have the following benefits on hedging:

1. **Reduced Financial Distress Costs:** By locking in prices or protecting against price drops, a firm can avoid severe financial losses that might otherwise lead to financial distress or bankruptcy. This stability can be particularly important for firms operating in volatile markets.

2. **Reduced Issuance Costs:** A firm facing less uncertainty about its future cash flows may find it easier and cheaper to issue new equity or debt, as investors perceive it as a lower-risk investment.

3. **Tax Savings:** By stabilizing earnings through hedging, firms may be able to smooth out their taxable income, potentially reducing their overall tax burden. In some tax systems, predictable and stable earnings can lead to lower effective tax rates.

4. **Increased Debt Capacity:** A firm with more predictable cash flows due to hedging might be able to borrow more, as lenders view it as less risky. This increased debt capacity can be beneficial for financing growth or operations.

5. **Improved Managerial Incentives and Risk Assessment:** By reducing the uncertainty surrounding commodity prices, managers can make more informed decisions regarding investments, operations, and financial planning. This can lead to better alignment of managerial incentives with the long-term goals of the firm.

While hedging is intended to reduce risk, speculation involves taking on additional risk in hopes of profiting from market movements. Speculation can occur when traders take positions that do not correspond to the firm's actual exposure to risk, this happens when investors use futures to place a bet on the direction in which they believe the market is likely to move. Speculating increases the firm's risk rather than reducing it.

8.2 Exchange Rate Risk

An exchange rate is the market rate at which one currency can be exchanged for another. For example, the exchange rate between the Canadian dollar (CAD) and the U.S. dollar (USD) has fluctuated significantly over time. Exchange rates are determined by the supply and demand for each currency, influenced by factors like international trade, investment flows, and central bank actions. This is also known as the float rate, which is how exchange rate in most countries are determined.

Exchange rates can be highly volatile, as illustrated by the CAD/USD exchange rate, which has seen dramatic shifts over time. This volatility creates risks for firms engaged in international trade, known as

the "importer-exporter dilemma." For instance, if a Canadian firm imports goods priced in USD, it faces the risk that the CAD might weaken, making those imports more expensive.

Example.

In March 2009, Whole Foods Market (a U.S. company) ordered shampoos from Avalon Natural Products (a Canadian company) for $\$520,000$ CAD, with payment due in one year. At the time of the order, the exchange rate was 1.3000 CAD/USD. By the time payment was due in March 2010, the exchange rate had changed to 1.0251 CAD/USD.

If Price is Set in CAD: Whole Foods must convert USD to CAD at the new exchange rate. With the CAD appreciating (becoming more valuable), Whole Foods now needs more USD to pay the same amount in CAD. The actual cost in USD turns out to be $\$507,267.58$, which is 26.8% higher than it would have been if the price had been set in USD originally.

If Price is Set in USD: If the price had been set in USD $(\$400,000)$, Avalon would have received less CAD due to the depreciated value of the USD. The CAD amount received would be only $\$410,040$ CAD, which is 21% less than if the price had been set in CAD.

Exchange rate fluctuations can cause significant financial losses to either party in an international transaction, depending on how the price is set. This uncertainty creates a strong incentive for both parties to hedge against exchange rate risk.

8.2.1 Hedging with Forward Contracts

A currency forward contract is an agreement to exchange a specific amount of one currency for another at a predetermined rate on a future date. This allows firms to lock in an exchange rate and eliminate the uncertainty of future exchange rate fluctuations. The contract specifies:

1. The exchange rate (known as the forward exchange rate).
2. The amount of currency to be exchanged.
3. The delivery date when the exchange will take place.

When a firm enters into a forward contract, it transfers the exchange rate risk to the bank that writes the contract. The bank can manage this risk by entering into offsetting contracts, thus balancing its exposure and charging fees to both parties involved.

Example.

In March 2009, Whole Foods Market agreed to buy $\$520,000$ CAD worth of shampoos from Avalon Natural Products, with payment due in one year. Simultaneously, Whole Foods entered into a forward contract with a bank to buy $\$520,000$ CAD at a forward exchange rate of 0.7575 USD/CAD.

Regardless of the actual exchange rate in March 2010, Whole Foods will pay $\$393,900$ USD to receive $\$520,000$ CAD. This protects Whole Foods from any unfavorable movement in the exchange rate. Without the forward contract, and given the actual exchange rate in March 2010 (1.0251 CAD/USD), Whole Foods would have paid $507,267.58 USD for the same amount of CAD. The forward contract thus saved Whole Foods over $\$113,000$ USD.

If the exchange rate had moved in the opposite direction (e.g., the CAD weakened to 0.7000 USD/CAD), Whole Foods would still have been locked into the higher forward rate, paying more than the market rate. This illustrates that while forward contracts eliminate risk, they also eliminate the opportunity to benefit from favorable exchange rate movements.

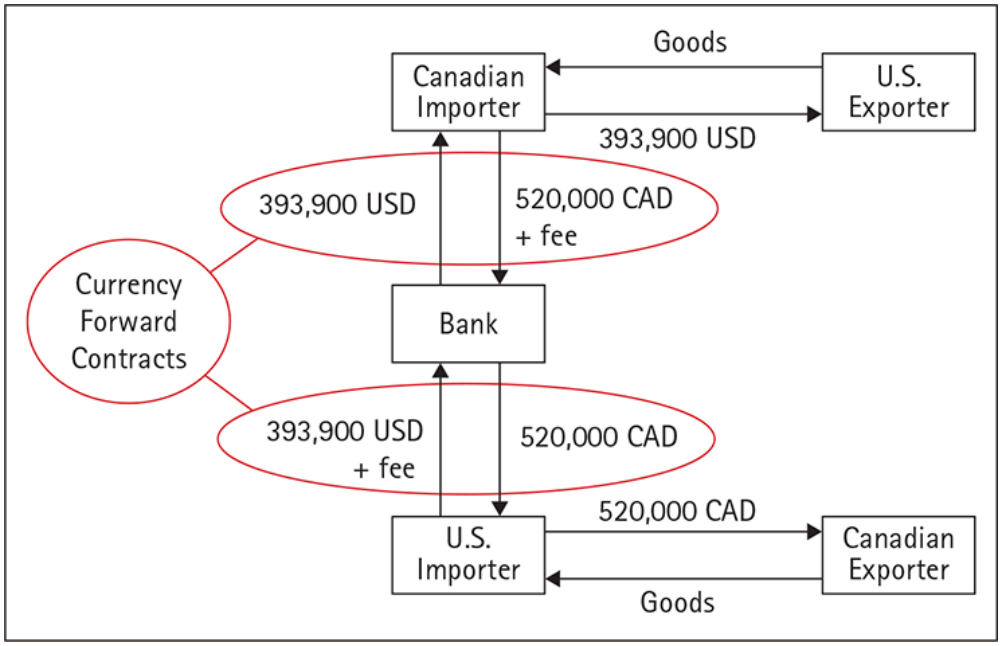

Figure 15: The Use of Currency Forwards to Eliminate Exchange Rate Risk

In this example, the Canadian importer and the U.S. importer both hedge their exchange rate risk by using currency forward contracts at 0.7575USD/CAD (shown in red). By writing offsetting contracts, the bank bears no exchange rate risk and earns a fee from each transaction.

8.2.2 Cash-and-Carry Strategy

The cash-and-carry strategy is a method to eliminate exchange rate risk by simultaneously engaging in three financial transactions:

1. **Borrowing in One Currency:** Borrow a certain amount of a foreign currency (CAD) today at the prevailing interest rate in that currency (r_{CAD}).
2. **Converting to Another Currency:** Convert the borrowed amount into the domestic currency (USD) at the current spot exchange rate ($S_{USD/CAD}$).
3. **Investing in the Domestic Currency:** Invest the converted amount in the domestic currency (USD) at the prevailing interest rate in that currency (r_{USD}).

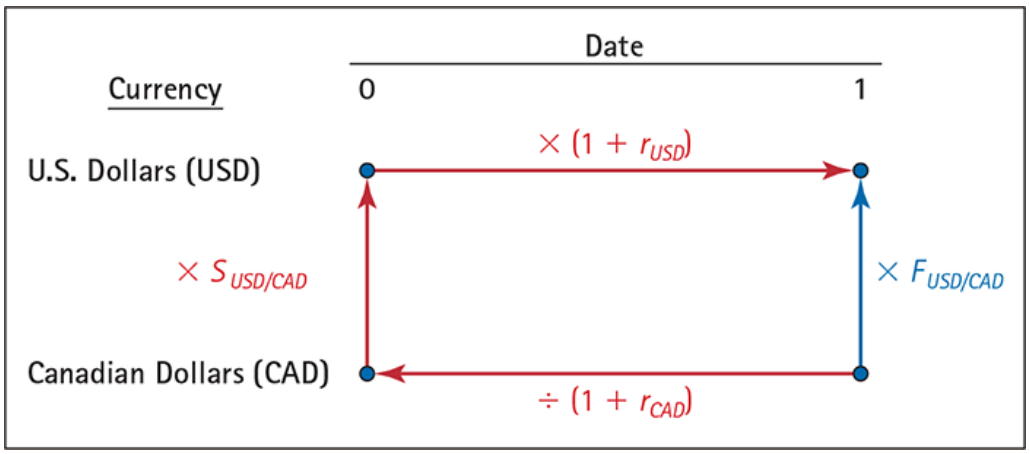

Figure 16: Currency timeline

After one year, the borrowed amount in CAD is repaid (including interest), and the invested amount in USD is received (including interest). This effectively converts CAD into USD at a future date, similar to what a forward contract would do.

The law of one price states that identical goods should have the same price in different markets when prices are expressed in a common currency, assuming no transportation costs or barriers. Applied to currency markets, this means that different methods of converting currencies should yield the same result if no arbitrage opportunities exist.

Since both the forward contract and the cash-and-carry strategy achieve the same goal—converting CAD to USD in one year—they must, according to the Law of One Price, yield the same forward exchange rate if no arbitrage opportunities exist.

No-Arbitrage Formula: The no-arbitrage forward exchange rate can be derived using the cashand-carry strategy as follows:

$$F = S \times \frac{1 + r_{USD}}{1 + r_{CAD}}$$

Where:

- $F =$ Forward exchange rate (USD/CAD) for one year.
- $S =$ Spot exchange rate (USD/CAD) today.
- $r_{USD} =$ Interest rate in the USD currency.
- $r_{CAD} =$ Interest rate in the CAD currency.

Letting T equal the number of years, the no-arbitrage forward rate for an exchange that will occur T years in the future is

$$\mathrm{F} = \mathrm{S} \times \frac{(1 + r_{USD})^T}{(1 + r_{CAD})^T}$$

The covered interest parity (CIP) equation is a financial theory stating that the difference between the forward exchange rate and the spot exchange rate is directly related to the interest rate differential between the two currencies. When interest rates differ between two countries, investors might try to profit by borrowing in the lower interest rate currency and investing in the higher interest rate currency. However, by locking in a forward exchange rate, the potential benefits from the higher interest rate are offset by the forward rate, preventing arbitrage.