Corporate Finance 2

COMP0164 Lecture 3 (Week 8)

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Agenda

Readings

- Brealey Myers Allen chapters **17–18**
- Bodie Kane Marcus chapter **18**

Topics

- Valuation models
- Dividend discount models
- Free cash flow
- Debt financing
- Leverage
- Weighted average cost of capital (WACC)
- Taxes
- Bankruptcy

Valuation models: What is a firm worth?

book value: the net worth of a company as reported on its balance sheet.

liquidation value: the amount of money that could be realised after selling the firm's assets and repaying its debt.

- If a firm's market capitalisation falls below its liquidation value, the firm can be taken over and liquidated at a profit.

replacement cost (or **reproduction cost**): the cost of replacing a firm's assets in the marketplace, minus the firm's liabilities.

- If a firm's replacement cost falls below its market value, potential competitors can profit from entry.
- **Tobin's q**: the ratio of a firm's market price to its replacement cost.

Recall: Free cash flow

Free cash flow (**FCF**) is the amount of cash that a firm can pay out to investors after paying for all investments necessary for growth.

$$P_0 = \sum_{t=1}^{H} \frac{FCF_t}{(1+r)^t} + \frac{P_H}{(1+r)^H} \tag{1}$$

- P_i = price after i time periods (P_0 is current price)
- FCF_t = free cash flow at time t
- H = horizon
- r = market capitalisation rate

Recall: Dividend discount model (DDM)

The **dividend discount model** (or **DDM**, or **DCF**) characterises the price of common stock as follows:

$$P_0 = \sum_{t=1}^{H} \frac{D_t}{(1+r)^t} + \frac{P_H}{(1+r)^H} \tag{2}$$

$$= \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} \tag{3}$$

- P_i = price after i time periods (P_0 is current price)
- H = number of time periods
- D_t = dividend at end of time period t
- r = market capitalisation rate (cost of equity capital)

Recall: Estimating the cost of equity capital

We can model the value of a business as the value of a growing perpetuity:

$$P_0 = \frac{D_1}{r-g} = \frac{D_0(1+g)}{r-g} \tag{4}$$

$$r = \frac{D_1}{P_0} + g = \frac{D_0(1+g)}{P_0} + g \tag{5}$$

- P_0 = current price
- D_0 = current dividend
- D_1 = dividend at end of the first time period
- g = **sustainable growth rate**
- r = market capitalisation rate (cost of equity capital)

Multi-stage dividend discount model

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \ldots + \frac{D_H + P_H}{(1+r)^H} \tag{6}$$

$$= \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \ldots + \frac{D_H}{(1+r)^H} + \frac{D_H(1+g)}{(1+r)^H(r-g)} \tag{7}$$

- P_i = price after i time periods (P_0 is current price)
- H = number of time periods until the horizon
- D_t = dividend at end of time period t
- r = market capitalisation rate (cost of equity capital)
- g = constant growth rate starting at the horizon

Capital asset pricing model (CAPM)

$$r = r_f + \beta(E[r_m] - r_f) \tag{8}$$

- r = market capitalisation rate (cost of equity capital)
- r_f = risk-free rate
- $E[r_m]$ = expected market return
- β = **beta**: the sensitivity of the return of an asset (or portfolio) to the return of the market (a measure of systemic risk)

Important: In general, assets carry diversifiable (idiosyncratic) and undiversifiable (systemic) risk; β represents the **undiversifiable** risk of an asset (or portfolio).

Price-Earnings ratio (1)

The **price-earnings ratio** (or **multiple**) is the ratio of price per share to earnings per share.

$$P_0 = \frac{E_1}{r} + PVGO \tag{9}$$

$$\frac{E}{P_0} = r\left[1 - \frac{PVGO}{P_0}\right] \tag{10}$$

$$\frac{P_0}{E_1} = \frac{1}{r}\left[1 + \frac{PVGO}{E/r}\right] \tag{11}$$

- $P_0 =$ current price
- $E_1 =$ earnings per share (EPS) during time period 1
- $E =$ earnings per share (EPS) per time period
- $PVGO =$ present value of growth opporunities
- $r =$ market capitalisation rate
- $E/r =$ no-growth value of the firm

Price-Earnings ratio (2)

$$P_0 = \frac{D_1}{r - g} \tag{12}$$

$$D_1 = E_1(1 - b) \tag{13}$$

$$g = ROE \times b \tag{14}$$

$$P_0 = \frac{E_1(1 - b)}{r - ROE \times b} \tag{15}$$

$$\frac{P_0}{E_1} = \frac{1 - b}{r - ROE \times b} = \frac{1 - b}{r - g} \tag{16}$$

- $P_0 =$ current price
- $E_1 =$ earnings per share (EPS) during time period 1
- $r =$ market capitalisation rate
- $b =$ plowback ratio

Limitations of the Price-Earnings ratio

Inflation: Generally P/E ratios are lower during periods of high inflation, suggesting that earnings during such period are of "lower quality".

Earnings management: The flexibility in accounting rules allows managers to influence the apparent profitability of the firm.

Reported versus economic earnings: Earnings in DDM are defined as net of economic depreciation.

Forward versus trailing P/E: Our P/E equations are defined in terms of future earnings, but accounting reports are historical.

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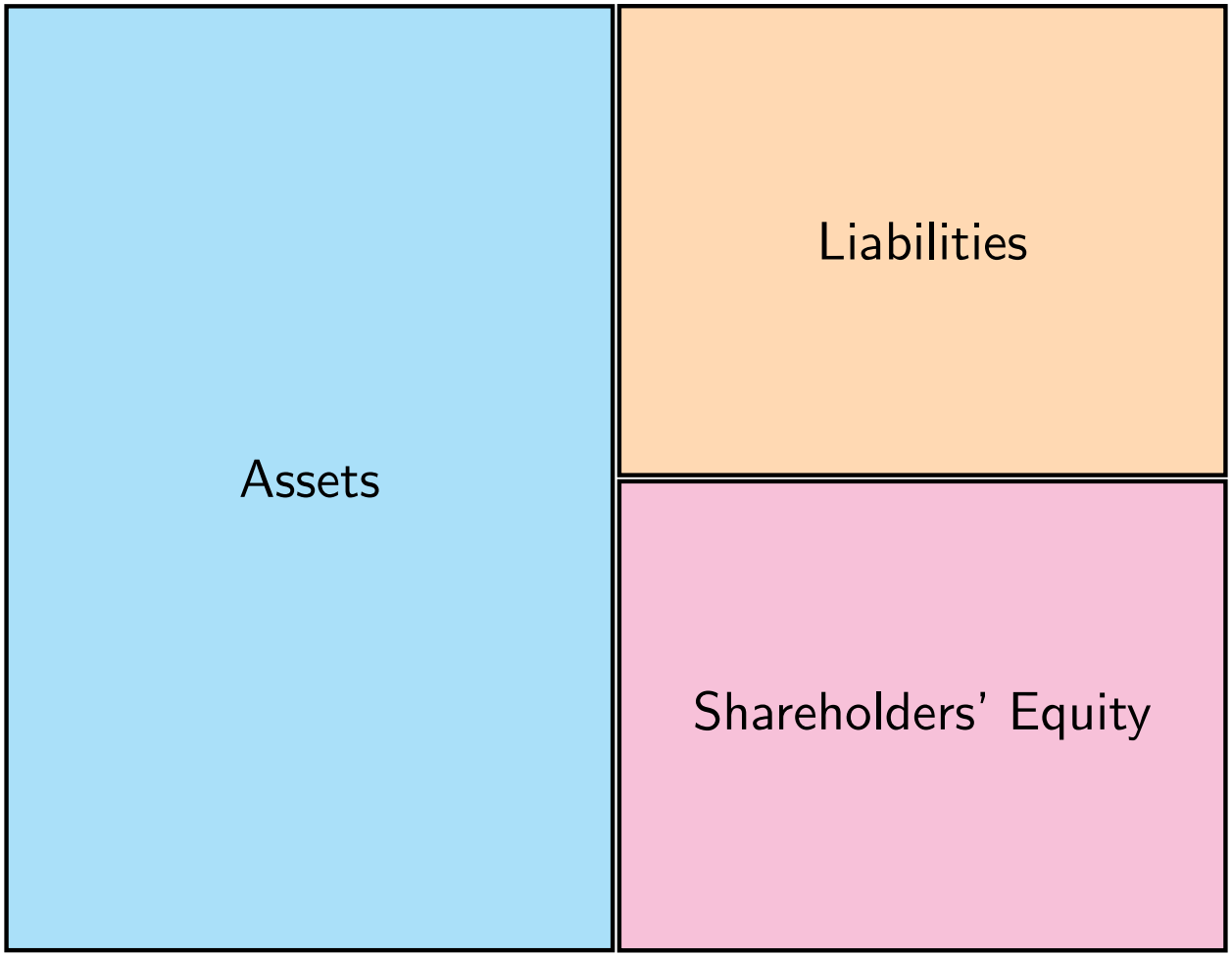
cyclically-adjusted P/E ratio (**CAPE**): price divided by sustainable long term earnings rather than current earnings[1]

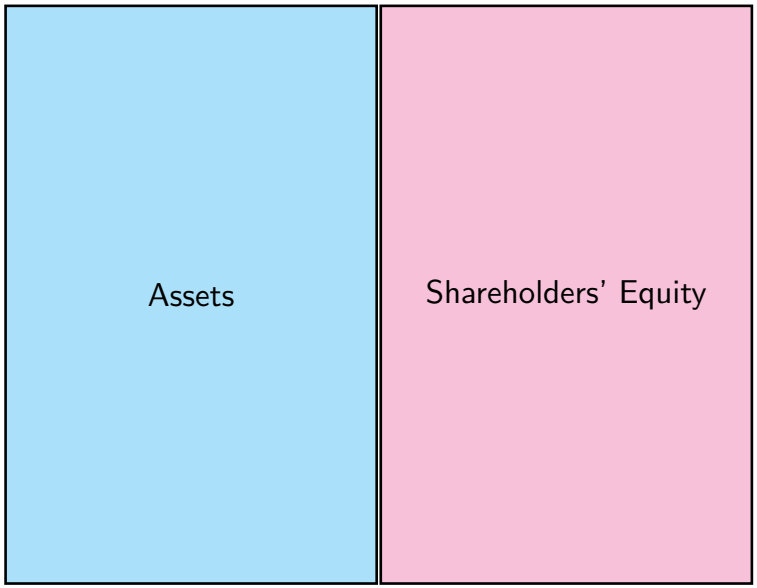
[1] In Irrational Exuberance, Robert Shiller proposed using average inflation-adjusted earnings over an extended period to address problems such as those listed above. (2000)

Recall: The balance sheet of a corporation



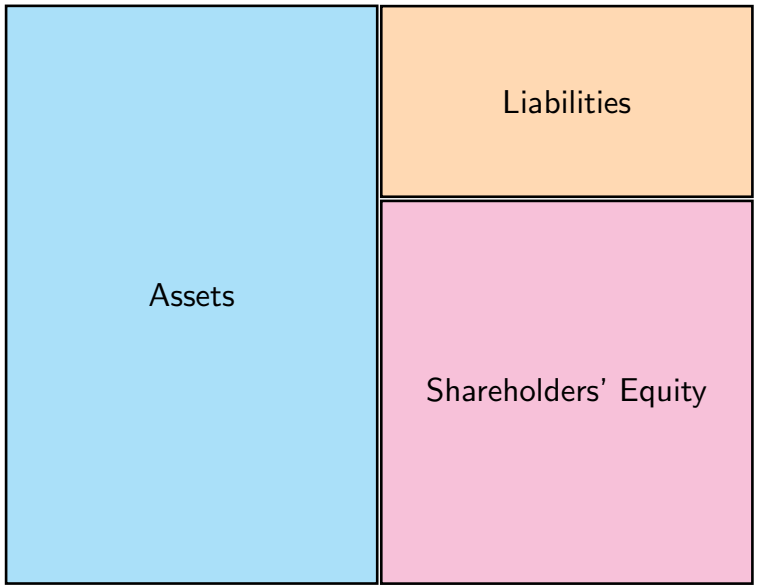
Leverage

Unlevered corporation



$$V_U = E$$

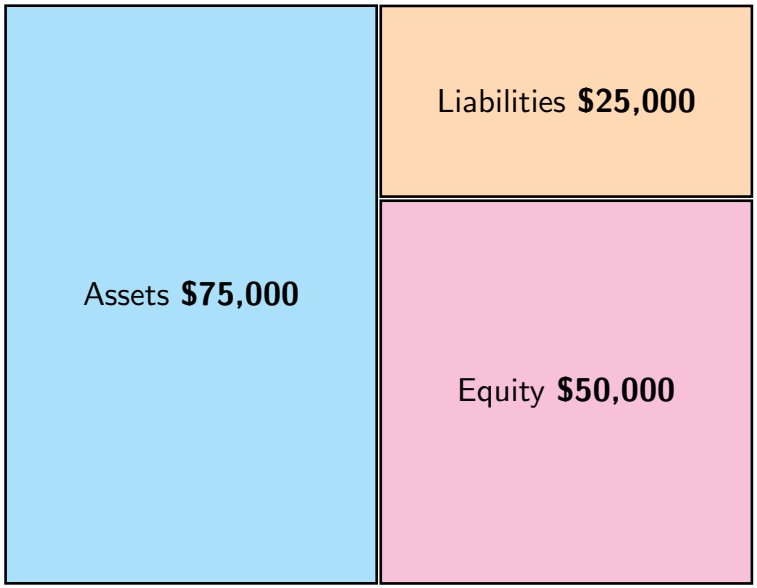
Levered corporation



$$V_L = D + E$$

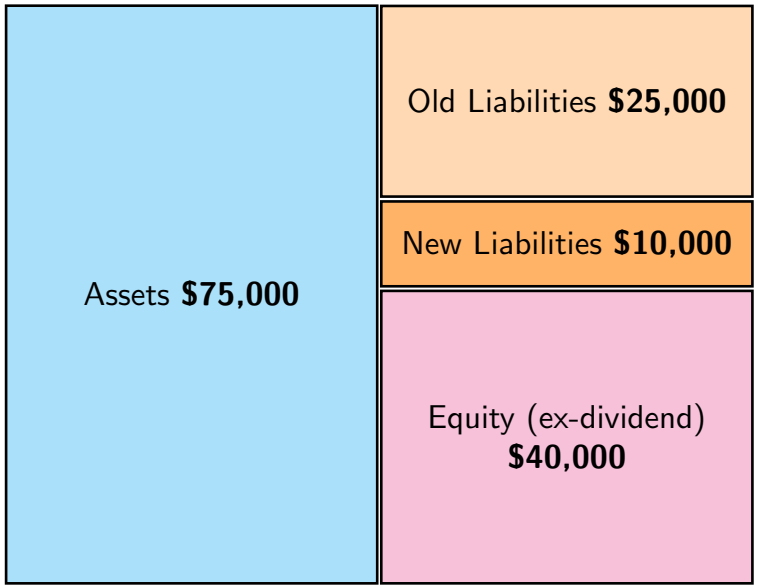
The effect of leverage: an example

Wapshot Mining Co., **before**



Shareholders are considering a change to the capital structure of the firm.

Wapshot Mining Co., **after**



The firm issues new debt securities totalling $10,000 and pays a special $10,000 dividend to shareholders.

How should a firm be financed?

What is the right capital structure for a firm?

Modigliani and Miller (MM) Theorem[2] (**the capital structure irrelevance principle**): how a firm is financed does not affect its value, subject to the following assumptions:

- Efficient markets.
- No taxes.
- No bankruptcy costs.
- No agency costs.
- No asymmetric information.

[2] F Modigliani and M Miller. "The Cost of Capital, Corporation Finance and the Theory of Investment." American Economic Review **53**(3), 1958, pp. 433–443.

MM Proposition 1

Conservation of value: Leverage does not affect the value of a firm.

$$V_U = V_L \tag{17}$$
$$= D_L + E_L \tag{18}$$

- V_U = value of a firm without leverage
- V_L = value of the same firm with leverage
- D_L = debt portion of levered firm
- E_L = equity portion of levered firm

Levered versus unlevered shares

Equity shares of a levered firm represent shares of the profit, minus interest:

$$E_L = V_L - D_L \tag{19}$$
$$= V_U - D_L \tag{20}$$
$$= E_U - D_L \tag{21}$$

- $V_U = E_U =$ value of a firm without leverage
- $V_L =$ value of the same firm with leverage
- $D_L =$ debt portion of levered firm
- $E_L =$ equity portion of levered firm

Weighted average cost of capital (WACC)

The **weighted average cost of capital** (**WACC**) is the expected return on assets:

$$\text{expected return on assets} = \tag{22}$$

$$r_A = \frac{\text{expected operating income}}{\text{market value of all securities}} \tag{23}$$

$$= \left[\frac{D}{D+E} \times r_D\right] + \left[\frac{E}{D+E} \times r_E\right] \tag{24}$$

- D = debt portion
- E = equity portion
- r_D = expected return on debt portion
- r_E = expected return on equity portion
- r_A = expected return on (all) assets (the **WACC**)

MM Proposition 2

The expected rate of return on the common stock of a levered firm increases in proportion to the **debt-equity ratio**, D/E, and the spread between the expected return on all securities, r_A, and the expected return on the debt, r_D.

$$r_A = \left[\frac{D}{D+E} \times r_D\right] + \left[\frac{E}{D+E} \times r_E\right] \tag{25}$$

$$r_E = r_A + (r_A - r_D)\frac{D}{E} \tag{26}$$

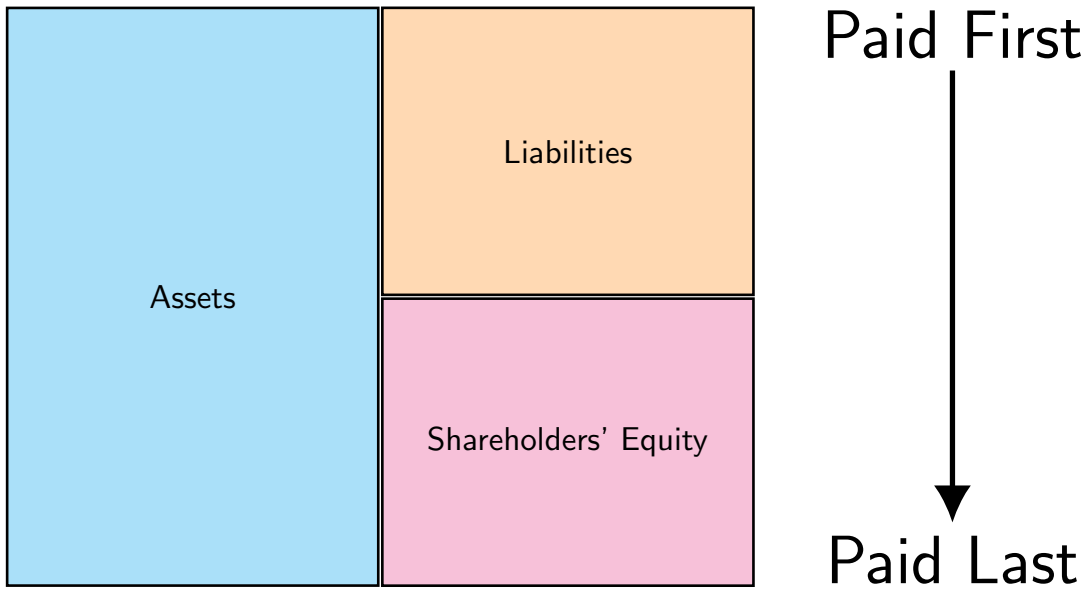
- D = debt portion
- E = equity portion
- r_D = expected return on debt portion
- r_E = expected return on equity portion
- r_A = expected return on (all) assets (the **WACC**)

Leverage and risk

- (**Proposition 1**) Leverage has no effect on shareholders' wealth.
- (**Proposition 2**) The expected ROE increases with leverage.

Investors are paid for taking risk.

Any increase in **expected** return is exactly offset by an increase in risk.
The shareholders' **required** rate of return rises to match the increased risk.



Leverage and beta (1)

The beta of an entire firm is the weighted sum of the beta of its securities:

$$\beta_A = \beta_D \frac{D}{V} + \beta_E \frac{E}{V} \tag{27}$$

$$\beta_E = \beta_A + (\beta_A - \beta_D) \frac{D}{E} \tag{28}$$

- β = **beta**: the sensitivity of the return of a security (or portfolio) to the return of the market (a measure of systemic risk)
- D = debt portion (by value)
- E = equity portion (by value)
- $V = D + E$ = total value of the securities of the firm
- β_A = **unlevered** beta of the firm
- β_E = **levered** (equity-only) beta of the firm (generally larger)

Leverage and beta (2)

The debt beta β_D is usually close to zero but can be larger, viz. **junk bonds**, which trade like equities (more on this next week).

The equity beta β_E is larger than the unlevered beta β_A, implying that levered equity is riskier.

Financial managers should consider the additional risk created by borrowing, although not all borrowing involves issuing debt securities.

Debt-equivalent obligations include:

- **Leases**, particularly long-term leases for property, plant, and equipment (PP&E).
- **Contracts with suppliers**, particularly long-term contracts.
- **Pension liabilities** and post-retirement health care for employees.

Leverage and beta (3)

Conclusion: **There is no magic in financial leverage.**

Debt is cheaper, but the savings are offset by a higher expected ROE, and levered equity holders experience more volatility even if default is unlikely.

The MM propositions apply to perfect capital markets, although **actual markets are imperfect**.

- Example: Suppose corporations can borrow more cheaply than individuals. Individuals can borrow **indirectly** by buying levered equity, and they might not be fully compensated for doing so.
- Financial services such as exotic securities and structured products seek to address market imperfections.
- If the MM propositions are right, then the cost of satisfying the demand for different kinds of securities is minimised.
- Opportunities arise from violations of the MM assumptions.

Income taxes and the WACC

In many countries, interest expenses are **tax-deductible** (thus reducing the cost of borrowing).

So, the **after-tax cost of debt** is given by $r_D(1 - T_c)$, and:

$$\text{after-tax WACC} = r_D(1 - T_c)\frac{D}{V} + r_E\frac{E}{V} \tag{29}$$

- D = debt portion
- E = equity portion
- r_D = expected return on debt portion
- r_E = expected return on equity portion
- T_c = corporate tax rate (on earnings after interest, EBT)

MM Proposition 1, with income taxes

Conservation of value: Leverage does not affect the value of a firm, except for the **tax shield**.

$$\text{tax shield} = \frac{T_c r_D D}{r_D} = T_c D \tag{30}$$

$$V_L = V_U + T_c D \tag{31}$$

$$D_L + E_L = E_U + T_c D \tag{32}$$

- V_U = value of a firm without leverage
- V_L = value of the same firm with leverage
- D_L = debt portion of levered firm
- E_L = equity portion of levered firm
- T_c = corporate tax rate (on earnings after interest, EBT)

MM Proposition 2, with income taxes

If companies receive a **tax shield** on their interest payments, then the after-tax WACC declines as debt increases:

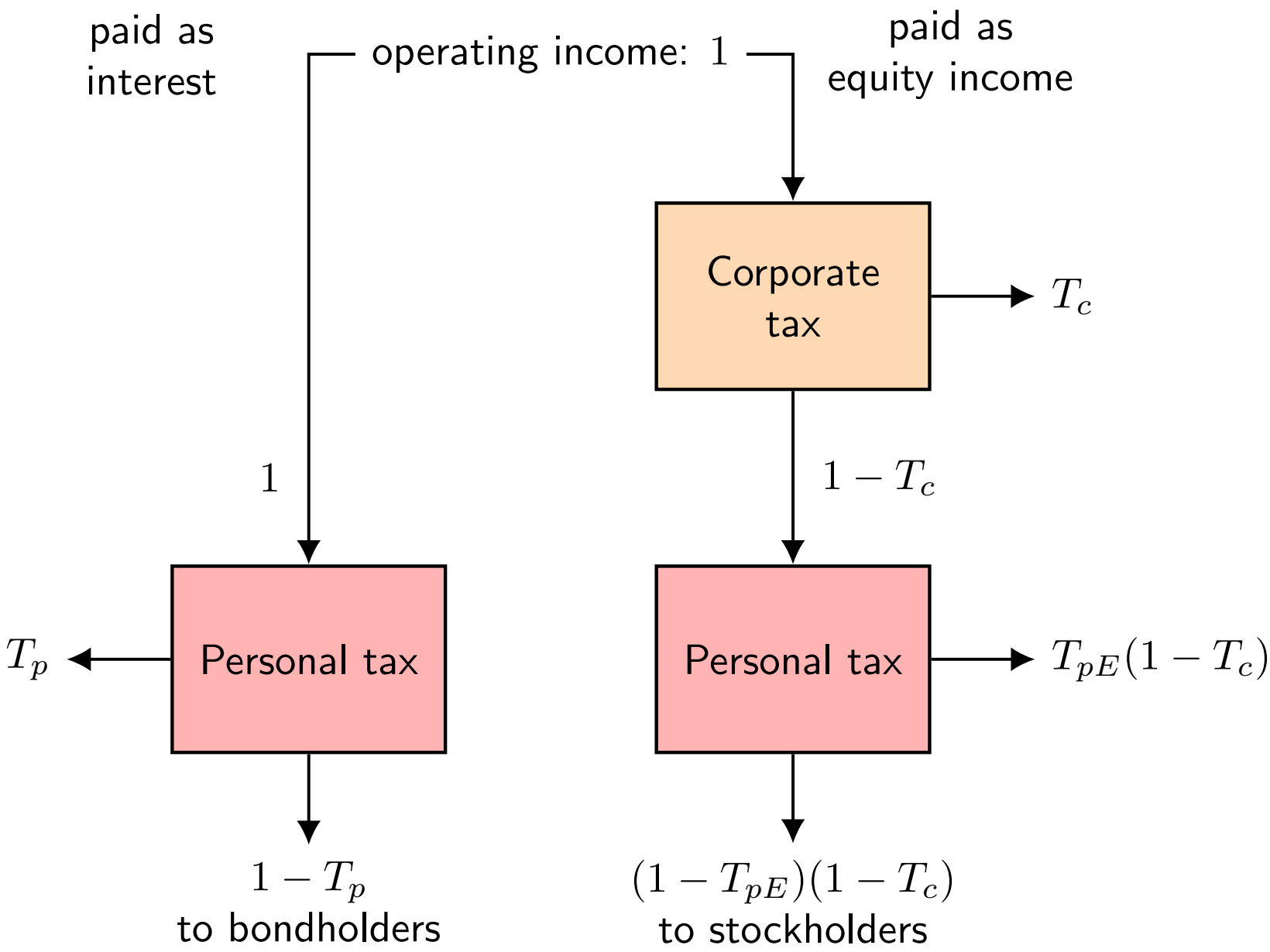
$$r_E = r_A + (r_A - r_D(1 - T_c))\frac{D}{E} \tag{33}$$

- D = debt portion
- E = equity portion
- r_D = expected return on debt portion
- r_E = expected return on equity portion
- r_A = expected return on (all) assets (the **WACC**)
- T_c = corporate tax rate (on earnings after interest, EBT)

Corporate and personal income taxes

- T_c = corporate tax rate (consider corporate tax domicile)
- T_p = personal tax rate on **interest income**
  (typically treated as ordinary income, sometimes with exceptions)
- T_{pE} = effective personal tax rate on **equity income**, comprising:
  - personal tax on **dividend income**
    (typically treated as ordinary income, sometimes with exceptions)
  - personal tax on **capital gains income**
    (typically set at a lower rate than ordinary income)

Corporate and personal income taxes, illustrated



Relative tax advantage of debt

In general, the **relative tax advantage of debt** is given by:

$$\text{relative tax advantage of debt} = \frac{1 - T_p}{(1 - T_{pE})(1 - T_c)} \tag{34}$$

If the personal tax rate is source-agnostic, then $T_p = T_{pE}$ and:

$$\text{relative tax advantage of debt} = \frac{1}{1 - T_c} \tag{35}$$

Debt could have a disadvantage if $1 - T_p < (1 - T_{pE})(1 - T_c)$, although note that not all bondholders and stockholders pay income tax.

Costs of financial distress

$$V = \left[\begin{array}{c}\text{value if}\\ \text{all-equity-financed}\end{array}\right] + \text{PV}\left[\text{tax shield}\right] - \text{PV}\left[\begin{array}{c}\text{costs of}\\ \text{financial distress}\end{array}\right] \quad (36)$$

The **trade-off theory** of capital structure suggests that the optimum amount of borrowing is reached when an increase in the value of the tax shield from borrowing is exactly offset by a corresponding increase in the present value of the costs of distress.

Costs of financial distress include:

- Bankruptcy costs
- Agency costs

Bankruptcy costs

bankruptcy: legal mechanism that allows creditors to take over when a firm defaults (fails to service its liabilities)

Direct costs of bankruptcy:

- Legal, accounting, and professional fees
- Typically larger (as a fraction of asset value) for small companies

Indirect costs of bankruptcy:

- Routine business decisions are burdened by procedures
- Firms may maintain negative-NPV activities during management transitions
- Creditors often do not receive **absolute priority** in their claims on a firm's assets and are more demanding than usual

Financial distress without bankruptcy

Risk aversion resulting from the **threat of bankruptcy** is also one of its implicit costs. Consider:

- **Suppliers** sometimes offer implicit financing by allowing firms to defer payment (viz. Apple). Suppliers might be more aggressive about chasing payments from firms facing bankruptcy.
- **Employees** might be more inclined to leave and less inclined to join firms facing bankruptcy.
- **Risky but NPV-positive projects** are less likely to be financed by firms facing bankruptcy, even if those projects might be essential to their survival.

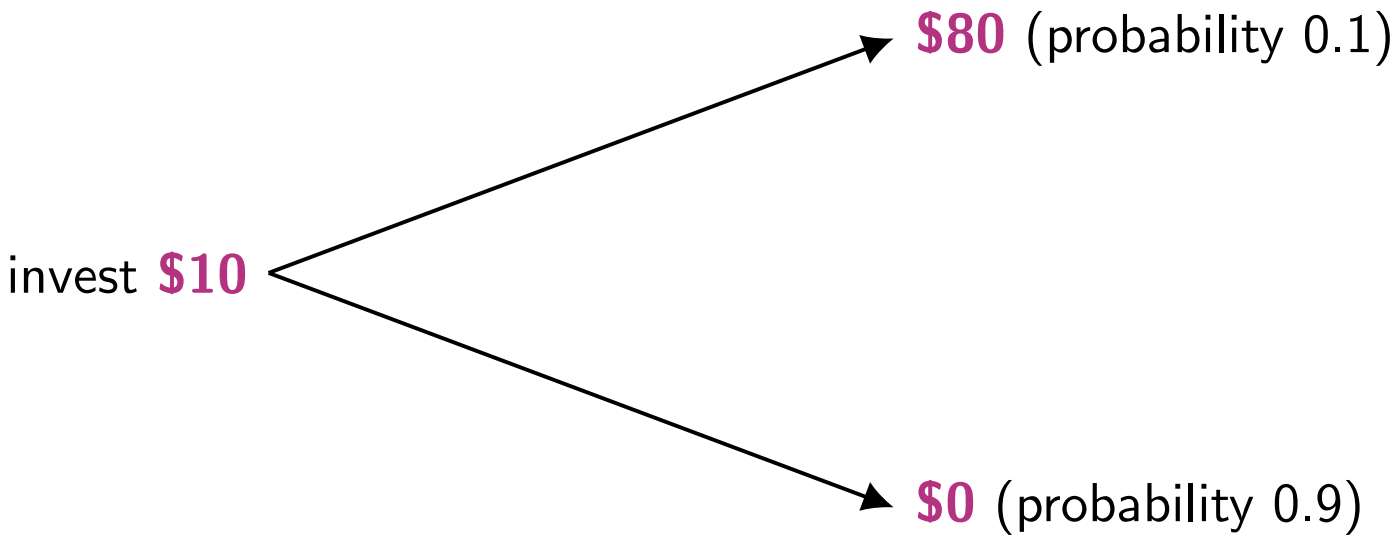
Agency costs

Both **stockholders** and **bondholders** have legal claims on the assets of a firm. But, in general, only **stockholders** are in control.

- The interests of stockholders and bondholders are not perfectly aligned.
- Stockholders might act at the expense of bondholders.

Agency costs: risk shifting

Consider this hypothetical project:

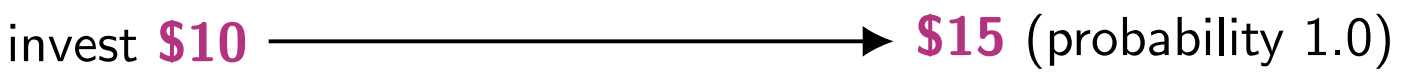


The NPV is **negative** (**–$2**), but if the firm is in distress, then:

- Stockholders might have positive NPV (e.g. **+$3**) by betting with money provided by bondholders and capturing the upside.
- Bondholders bear the downside (e.g. **–$5**).

Agency costs: refusing to contribute equity capital

Consider this hypothetical project:



The NPV is **positive** (**+$5**), but if the firm is in distress, then:

- Bondholders capture most of the benefit (e.g. **+$8**).
- Stockholders might have negative NPV (e.g. **–$3**) and are reluctant to fund a project that benefits bondholders at their expense.

Agency costs: other games

"Cash in and run"

- Stockholders issue themselves a **dividend**, leaving bondholders with more risk and a smaller asset base.

"Playing for time"

- Stockholders conceal the true extent of the trouble, encourage false hopes of recovery, or burnish the current operating performance (at the expense of future performance) by cutting corners on activities such as maintenance or R&D.

"Bait and switch"

- Stockholders issue a large volume of new risky debt to profit at the expense of existing bondholders.
- This strategy is a characteristic of a **leveraged buyout** (**LBO**).

Asymmetric information

Information asymmetry between buyers and sellers can lead to inefficient markets.[3]

In the case of capital structure decisions:

- An **optimistic** financial manager issues debt instead of equity because the equity would be undervalued by the market.
- A **pessimistic** financial manager would **also** issue debt instead of equity because issuing equity would force the stock price down, eliminating any advantage from doing so.

So, asymmetric information leads to the issuance of more **debt** than would be optimal.

[3] G Akerlof. "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism." Quarterly Journal of Economics **84**(3), 1970, pp. 488–500.

Pecking-order theory

(Compare to the **trade-off theory**.)

The **pecking-order theory** of corporate finance states:

- Firms prefer internal finance (no new securities).
- Firms adopt steady ("sticky") dividend policies.
- If cash flow exceeds capital expenditures, firms pay off debt or invest in securities; otherwise, firms draw down cash or divest securities.
- If external finance is required, firms prefer to issue debt rather than equity.

Evidence for theories of capital structure

Evidence supports both **trade-off theory** and **pecking order theory**:

- **Size**: Large firms have higher debt ratios.
- **Tangible assets**: Firms with high ratios of fixed assets to total assets have higher debt ratios.
- **Profitability**: More profitable firms have lower debt ratios.
- **Market to book**: Firms with higher ratios of market to book value have lower debt ratios.

Thank You

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