Chapter 1

Introduction to Finance

Road Map

Part A Introduction to finance.

- Financial decisions and principles of finance.
- Present value.

Part B Valuation of assets, given discount rates.

Part C Determination of discount rates.

Part D Introduction to corporate finance.

Main Issues

- Financial Challenges.
- Unifying Principles.
- Opportunity Cost of Capital and Present Value.
- Role of Financial Markets.
- Objectives of Financial Manager.

Contents

1 What is Finance?

- Finance is about the bottom line of business activities.
- Every business is a process of acquiring and disposing assets:
  - Real assets - tangible and intangible.
  - Financial assets.
- Two objectives of business:
  - Grow wealth (creat value).
  - Use wealth (assets) to best meet economic needs.
- Financially, a business decision reduces to:
  - Valuation of assets.
  - Management of assets.
- Valuation is the central issue of finance.

Questions we would like to answer in this course:

1. How financial markets determine asset prices?

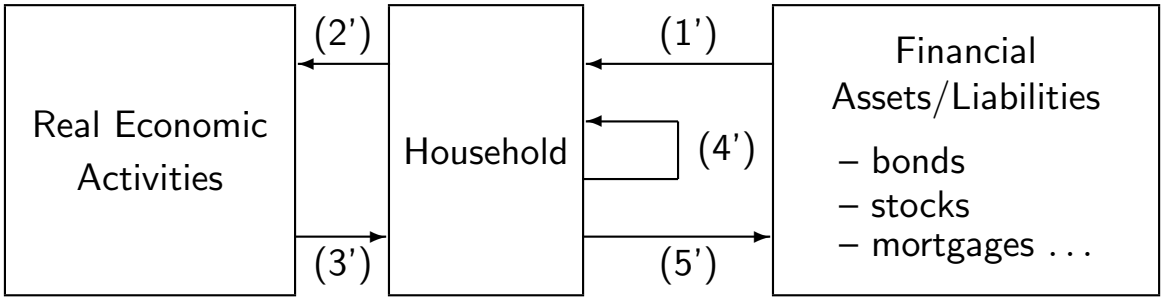
2. How households make financial decisions?

   - Savings decision:
     - How to allocate wealth over time?
   - Investment decision:
     - How to grow wealth?
     - How to allocate wealth over states?
   - Financing decision:
     - How to finance consumption and investment?

3. How firms make financial decisions?

   - Investment decision:
     - What projects to invest in?
   - Financing decision:
     - How to finance a project?
   - Payout decision:
     - What to pay back to shareholders?
   - Risk management decisions:
     - What risks to hedge and how?

Cash Flows and Financial Decisions of Households



(1') Cash raised by selling *financial assets*

(2') Cash invested in *real assets* (tangible and intangible).

(3') Cash generated by real assets.

(4') Cash consumed and reinvested.

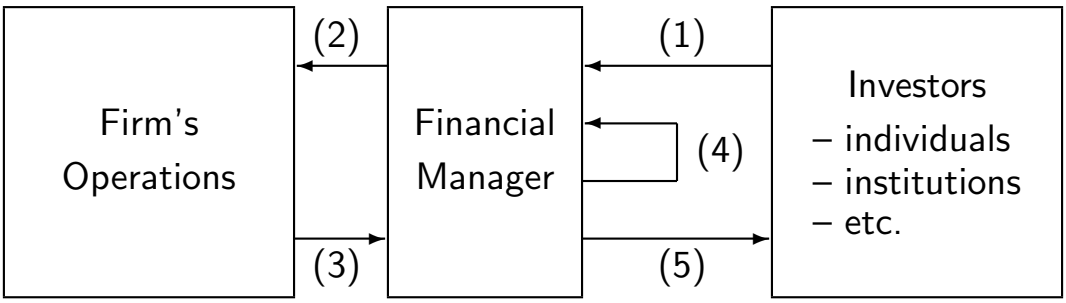
(5') Cash invested in financial assets.

Decisions: Manage Cash Flow (1'), (2'), (4'), (5').

- Real investment decision: (2') $\Rightarrow$ (3').
- Consumption/financing decision: (1'), (4').
- Saving and financial investment decision: (5').

Objective: Grow wealth and achieve optimal consumption.

Cash flows and Financial Decisions of Firms



(1) Cash raised from investors by selling *financial assets*.

(2) Cash invested in *real assets* (tangible and intangible).

(3) Cash generated by operations.

(4) Cash reinvested.

(5) Cash returned to investors (debt payments, dividends, ...)

Decisions: Manage Cash Flow (1), (2), (4), (5).

- Investment: (2) $\Rightarrow$ (3).
- Financing: (1), (4).
- Payout: (5).
- Risk management: (1), (5).

Objective: Create value for shareholders.

Financial decisions and asset valuation:

- Real investment decisions
  - How real assets are priced.
- Financing and payout decisions
  - How financial assets are priced.

Financial decisions and asset management:

- Risk management decisions
  - How to meet future investment/financing needs.
- Personal savings/financing/financial investment decisions
  - How to meet personal consumption needs.

2 Time and Risk

Each asset is defined by its cash flow.

- An asset $\Longleftrightarrow$ A cash flow

Time:	0	1	2	$\cdots$
Cash out:	CF_0	$\cdot$	$\cdot$	$\cdots$
Cash in:	$\cdot$	CF_1	CF_2	$\cdots$
Net cash flow:	$-CF_0$	CF_1	CF_2	$\cdots$

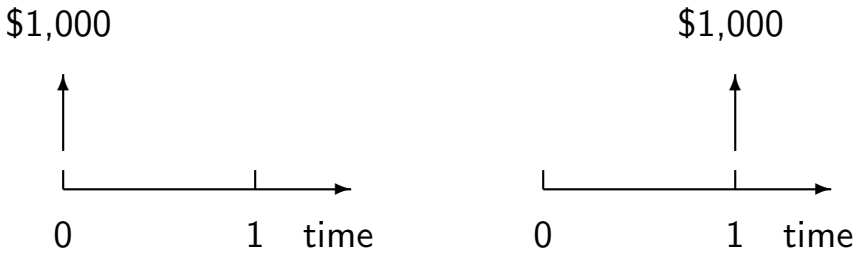
- Value of an asset $=$ Value of its cash flow:

$$\text{Value of Investment} = \text{Value}\left(\{CF_0, CF_1, CF_2, \cdots\}\right).$$

Two Characteristics of A Cash Flow

1. Time.

   Example. $1,000 today verses $1,000 next year.



2. Risk.

   Example. $1,000 for sure vs. $0 and $2,000 with equal odds.

Time and uncertainty are two key elements in finance.

3 Unifying Principles of Finance

In this section, we describe the working assumptions and the three basic principles of finance to be applied through out the course.

3.1 Assumption of A Perfect Financial Market

Financial market is where financial assets are traded.

We assume the financial market is "perfect":

- A rich set of securities (financial assets) being traded.
- Security contracts are enforceable.
- Free access.
- Competitive trading process.
- No frictions/constraints in trading.

3.2 First Principle: No Arbitrage

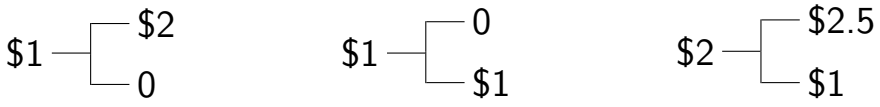
Definition: An arbitrage is a set of transactions such that

- requires non-positive initial investment
- yileds non-negative payoffs
- at least one of the inequalities is strict.

Example. Citibank's 3-month lending rate is $3\frac{7}{8}\%$ and Fleet is selling 3-month CDs at an interest rate of 4%.

Example. IBM is trading at \$100 in New York, £60 in London and the current dollar/sterling exchange rate is \$1.50/£.

Example. You see the following prices:



1st Principle of Finance: There are no arbitrage opportunities in the financial market.

1st Approach of Asset Valuation: By Arbitrage

(a) Given any asset, find a traded security with matching CF

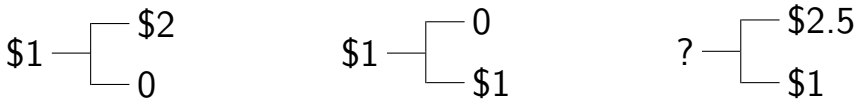
- Timing
- Risk

(b) Value of the given asset must equal the market price of the traded security.

Assets having same payoffs must have same prices.

Example (continued). IBM is trading \$100 and dollar/sterling exchange rate is \$1.50/£. What should be the price of IBM in London?

Example (continued). Given the prices of the first two securities, what should be the price of the third security?



3.3 2nd Principle: Preference

Definition: A preference is a complete ranking of pairs of consumption (cash flow) streams.

Given any

$$c \equiv (c_0, c_1) \quad \text{and} \quad c' \equiv (c'_0, c'_1)$$

a household can decide which one is better:

$$c \succeq c' \quad \text{or} \quad c \preceq c'.$$

Assumption 0: Consistency (Transitivity).

$$c \succeq c',\ c \succeq c'' \ \Rightarrow\ c \succeq c''.$$

There exists a "utility function", $u(c) = u(c_0, c_1)$, such that

$$c \succeq c' \ \Leftrightarrow\ u(c) \geq u(c').$$

When c is uncertain, we assume that there exists a u, such that

$$\tilde{c} \succeq \tilde{c}' \ \Leftrightarrow\ \mathrm{E}[u(\tilde{c})] \geq \mathrm{E}[u(\tilde{c}')].$$

2nd Principle of Finance: Each household has a preference expressed by its (expected) utility.

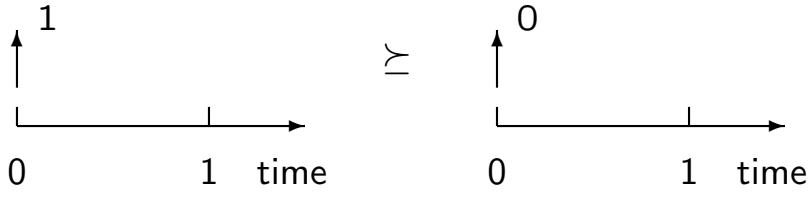
Further simplification:

$$u(c) = u(c_0, c_1) = u(c_0) + \rho\, u(c_1)$$

where ρ is time-preference parameter.

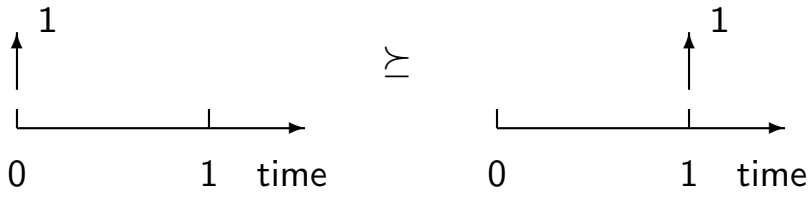
Three assumptions on preferences:

Assumption 1: More cash is preferred to less (Non-satiability).



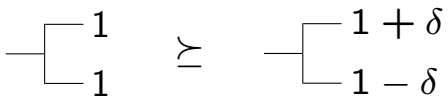
Thus, $u' \geq 0$.

Assumption 2: Cash now is preferred to cash later (Impatience).



Thus, $\rho \leq 1$.

Assumption 3: Safe cash is preferred to risky cash (Risk-aversion).



Thus, $u'' \leq 0$.

3.4 3rd Principle: Optimization

Consider a household:

- Endowed with certain resources (endowments) $(e_0, \tilde{e}_1)$.
- Facilitated by a financial market:
  - a risk-free bond offering interest rate r_F
  - a risky stock offering return $\tilde{r}$.
- Faced with the choice:
  - Consumption/saving c_0
  - Investment/financing $x = (x_0, x_1)$
    - x_0 = dollar investment in bond
    - x_1 = dollar investment in stock.
- Optimize to achieve maximum utility feasible

$$\begin{aligned} \mathrm{E}[u(c_0, \tilde{c}_1)] &= u(c_0) + \rho \mathrm{E}[u(\tilde{c}_1)] \\ c_0 &= e_0 - x_0 - x_1 \\ \tilde{c}_1 &= \tilde{e}_1 + x_0(1 + r_F) + x_1(1 + \tilde{r}) \end{aligned}$$

- Utility function satisfies
  - $u' \geq 0$ (non-satiability)
  - $u'' \leq 0$ (risk-aversion)
  - $\rho \leq 1$ (impatience).

3rd Principle of Finance: Each Household optimizes.

Example. Anna has endowment 100 now and 25 later. Interest rate is r_F. She prefers smooth consumption over time (i.e., $u_0 = u_1 = u$).

Her consumption/saving decision is

$$\begin{aligned} \max \ & u(c_0) + u(c_1) \\ \text{s.t.} \ & c_1 = 25 + (100 - c_0)(1 + r_F) \end{aligned}$$

The optimality condition is

$$\begin{aligned} u'(c_0) &= u'[25 + (100 - c_0)(1 + r_F)](1 + r_F) \\ &= u'(c_1)(1 + r_F) \end{aligned}$$

- For $r_F = 0$, $c_0 = c_1 = 62.5$.
- For $r_F > 0$ (c_0 is more expensive), $c_0 < c_1$.
- For $r_F < 0$ (c_0 is less expensive), $c_0 > c_1$.

Example. Ben has 100 if the economy recovers (state a) and and 25 otherwise (state b). Ben prefers same consumption independent the performance of the economy.

Merrill Lynch is offering "market insurance" contracts: The "bull-contract" pays \$1 if the economy recovers and 0 otherwise and the "Bear-contract" pays 0 if the economy recovers and \$1 otherwise. The price for Bull is p_a and Bear is p_b. The two possibilities are equally likely.

His consumption/saving decision is

$$\begin{aligned} \max \;\; & E[u(\tilde{c})] = \frac{1}{2}[u(c_a) + u(c_b)] \\ \text{s.t.} \;\; & c_b = 25 + (100 - c_0)p_a/p_b. \end{aligned}$$

The optimality condition is

$$u'(c_a) = u'(c_b)(p_b/p_a)$$

- For $p_b = p_a$, $c_a = c_b = 62.5$.
- For $p_a > p_b$ (c_a is more expensive), $c_a < c_b$.
- For $p_a < p_b$ (c_a is less expensive), $c_a > c_b$.

3.5 4th Principle: Market in Equilibrium

The optimization behavior of households and firms determines their demand for financial assets, which depends on

- Endowments and preferences
- Expectation about asset payoffs (timing and risk)
- Asset prices.

Asset prices must be such that demand equals supply (market in equilibrium).

4th Principle of Finance: Market equilibrium determines security prices in terms of "fundamentals"

- Expectation of future cash flow
- Investors' preferences for the cash flow.

2nd Approach of Asset Valuation: By Equilibrium

(a) Derive aggregate asset demand, as a function of asset prices.

(b) Find the asset prices at which demand equals supply.

Example. CAPM.

4 Opportunity Cost of Capital and PV

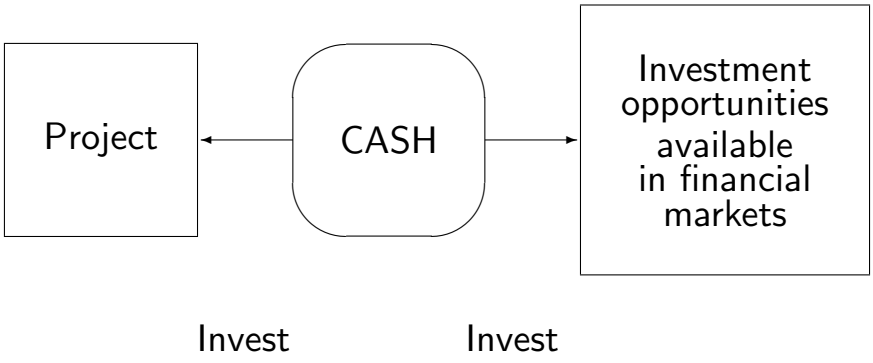
4.1 Opportnity Cost of Capital

Acquisition of a real asset (an investment):

- Pay cash today
- Receive cash flow in the future.

Investment Trade-off:

1. Invest in the real asset.
2. Invest the cash in financial markets.



Definition: *Opportunity cost of capital* is the expected rate of return offered by *equivalent* investments in the financial market.

Equivalence means match in timing and risk.

4.2 Present Value (PV)

Definition: The present value of an asset is the value of its cash flow discounted at the expected rate of return on equivalent investments in the financial market (opportunity cost of capital or required rate of return).

Example. An one-period asset with certain cash flow.

- Asset pays \$1,000 in one year for sure.
- Current interest rate is 5%.

What should be the present value of the asset?

Let its value be PV.

- Holder of the asset pays $\$PV$ and receives \$1,000 in one year.
- If the money is left in a bank, he receives $\$PV(1+0.05)$.
- Two alternatives require same initial investment and lead to safe payoffs at the same time, their payoffs must equal:

$$1000 = PV(1.05) \quad \Rightarrow \quad PV = \frac{1000}{1.05} = \$952.38.$$

What if they give different payoffs?

Example. An one-period asset with uncertain cash flow.

- Asset is expected to pay \$1,000 in one year.
- A stock of similar risk earns a return of 25% a year.

What should be the (present) value of the asset?

Let its value be PV.

- Holder of the asset pays $\$PV$ now and expects to receive \$1,000 in one year.
- If the money is invested in the stock, he expects to receive $\$PV(1+0.25)$ in one year.
- Two alternatives require same initial investment and lead to similar risky payoffs, their expected payoffs must equal:

$$1000 = PV(1.25) \quad \Rightarrow \quad PV = \frac{1000}{1.25} = \$800.$$

4.3 Net Present Value and Decision Rule

Definition: *Net present value* (NPV) of an investment is the net present value of its cash flows.

NPV of an investment is the current market value of its (total) CF.

Consider a project that requires an investment of \$100 and yields expected cashflow of CF_1 in one year. The opportunity cost of capital is 10%.

- The market value of CF_1 today (present value) is

$$PV_0 = \frac{\mathrm{E}[CF_1]}{1+0.1}.$$

- By taking the project, you pay \$100 in exchange of PV_0.

$$\text{NPV} = -100 + PV_0 = -100 + \frac{\mathrm{E}[CF_1]}{1.1}.$$

- If $PV_0 > 100$, it is a good deal and you take the project.

- If $PV_0 < 100$, it is a bad deal and you reject the project.

Investment Rule: Accept a project if its NPV is positive.

Example 1. One-period project, cash flow known with certainty.

- Invest \$1,000 at $t = 0$ (now): $CF_0 = -\$1,000$
- Receive \$1,300 at $t = 1$ (1 year later): $CF_1 = \$1,300$.

Assume investors can buy securities in financial markets which offer 15% safe return.

Decision:

- Invest because 30% project return exceeds 15% opportunity cost

- Invest because PV of \$1,300 next year exceeds \$1,000 now.

$$\text{PV}(CF_0) = -1,000; \qquad \text{PV}(CF_1) = \frac{1300}{1.15} = 1130.$$

$$\begin{aligned} \text{NPV} = \text{PV}(CF_0, CF_1) &= \text{PV}(CF_0) + \text{PV}(CF_1) \\ &= -1000 + 1130 = 130. \end{aligned}$$

Result: Firm value increases by \$130.

Observation: Present value properly adjusts for CF timing.

Example 2. One-period project, cash flow uncertain.

- Invest \$1,000 at t=0 (now): $CF_0 = -\$1,000$
- Receive uncertain payoff at $t = 1$ (1 year later).
- Forecasted payoff is \$1,300: $\mathrm{E}[CF_1] = \$1,300$.

Assume investors can buy equally risky securities in the capital markets which offers 35% forecasted return.

Decision:

- Do not invest because 30% project return is less than the opportunity cost of 35%.

- Do not invest because PV of expected payoff is less than \$1,000.

$$\mathrm{PV}(CF_0) = -1,000; \qquad \mathrm{PV}(CF_1) = \frac{1300}{1.35} = 963.$$

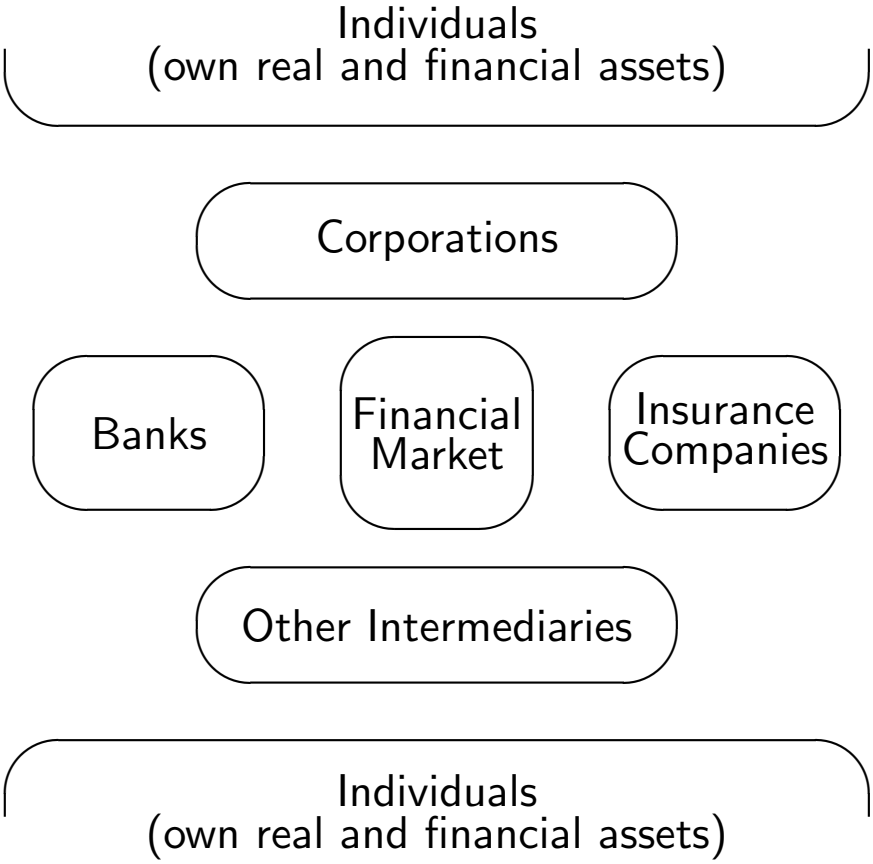
$$\begin{aligned} \mathrm{NPV} = \mathrm{PV}(CF_0, CF_1) &= \mathrm{PV}(CF_0) + \mathrm{PV}(CF_1) \\ &= -1000 + 963 = -37. \end{aligned}$$

Result: Firm value decreases by \$37 if the project is taken.

Observation: Present value properly adjusts for risk.

5 Role of Financial Market

5.1 Financial Market at Center of Universe



- *Financial Market* - where financial assets are traded
  - Money markets: Debt securities with maturities up to 1-year
    - Treasury bills, CDs, commercial papers, ...
  - Capital markets: Other securities
    - Government debt (Treasury notes and bonds, ...)
    - Corporate and agency debt, mortgage-backed securities, ...
    - Stocks, ...
  - Derivatives
    - Forward and futures
    - Options, ...

- *Corporations* - Own mostly real assets

- *Financial Services Industry* - Own mostly financial assets
  - Banks
  - Insurance companies
  - S&Ls
  - Mutual funds, ...

- *Individuals* - Own both real and financial assets.

5.2 Function of Financial Markets

1. Allocating resources
   - Allocate resources across time
   - Allocate resources across different states of economy.

2. Communicating information
   - Market prices reflect available information.

Assumptions on the financial market: A perfect financial market.

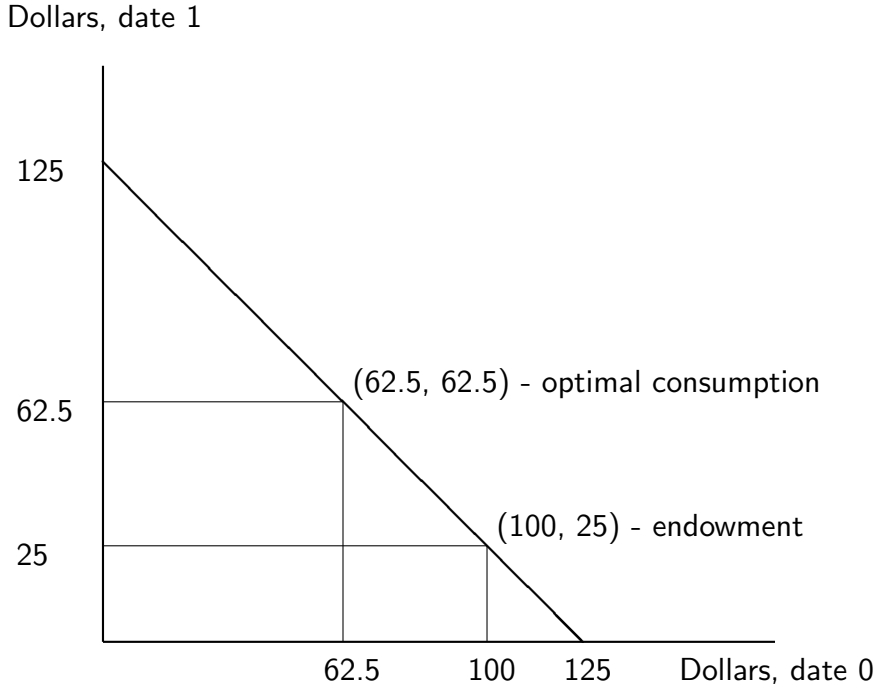
Example 1. Allocating resources over time.

An individual lives for two dates: now ($t = 0$) and later ($t = 1$).

- She is endowed with \$100 now and \$25 later.
- Her utility depends on consumption now and later: c_0 and c_1.
- She prefers a smooth consumption path over time.
- There is a credit market with zero interest rate.

1. Without credit market, she consumes endowments: $(c_0, c_1) = (100, 25)$.

2. With credit market, she lends \$37.5 now and receives \$37.5 later, achieving consumption $(c_0, c_1) = (62.5, 62.5)$.



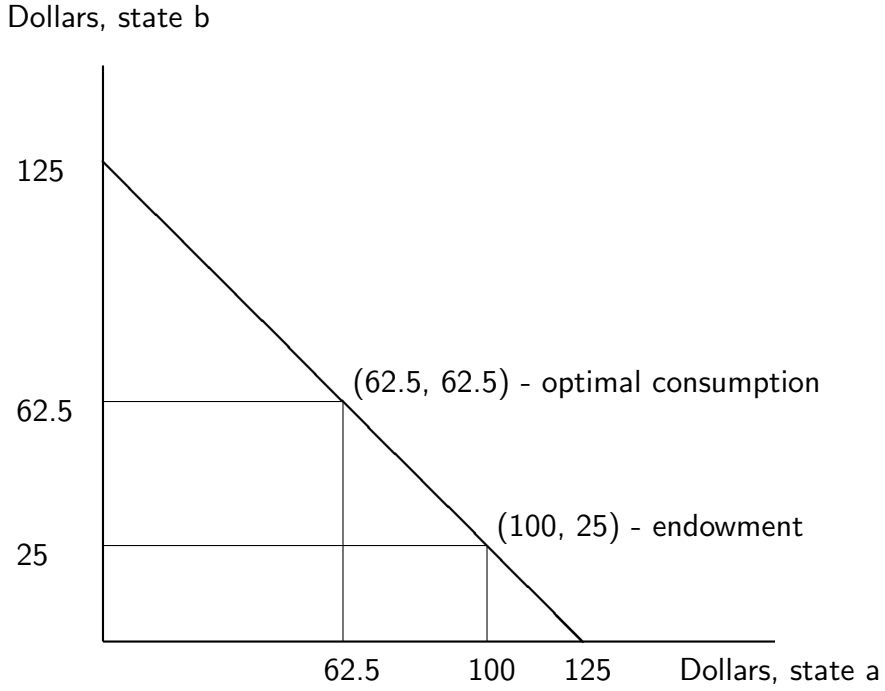
Example 2. Allocating resources across different states.

Future economy can be in state a or b.

- An individual is endowed with \$100 in state a and \$25 in b.
- Her utility depends on consumption in both states: c_a and c_b.
- She prefers similar consumption level in the two states.
- There is a securities market: security A pays \$1 only in state a and B pays \$1 only in state b. They have the same prices.

1. Without the securities market, she consumes endowments: $(c_a, c_b) = (100, 25)$.

2. With the securities market, she sells 37.5 units of A for 37.5 units of B, achieving consumption $(c_a, c_b) = (62.5, 62.5)$.



Conclusions:

1. Financial markets allow agents to allocate resources
   (a) over time
   (b) across different states of economy.

2. All agents agree at the margin on the value of money
   (a) over time
   (b) across different states of economy.

3. Value of money over time and across states equal market prices of corresponding financial securities.

Assumptions (again): A "perfect" financial market.

6 Objectives of Financial Manager

Maximize *current market value* of the firm.

1. Maximizing current market value is the only plausible *financial* objective.
   - Timing?
   - Risk?
   - Accounting?
   - "Long-run" value?
   - ...

2. Current market value incorporates present value of all current and future cash flows, adjusted for timing and risk.

3. Market value rule is independent of shareholders' differences.

The Case for Value Maximization:

1. Shareholders' financial objectives:

   (a) Increase of wealth

   (b) Right time-pattern of consumption

   (c) Right balance of expected future consumption and risk.

2. Shareholders can do (b) and (c) on their own, through financial markets.

3. Financial manager can help only with (a), by increasing firm's market value (i.e., shareholders wealth).

Example 1. Financial markets reconcile time preferences for CF.

You, your dad and your grandma jointly own a controlling interest in Solid State Inc. (SSI), which is traded on NASDAQ. You are asked to evaluate two alternatives, A and B, to expand SSI's current business. After a week of analysis, you conclude:

- Both have positive NPV's.
- SSI can only take one of them.
- B has a higher NPV.
- A pays off in three years and B starts to payoff after ten years.

You recommend B over A, but grandma says:

"Kid, you missed one thing: I am 85 now and probably could not wait to see any payoff if we take B."

What would you say?

Example 2. Financial markets reconcile risk tolerances.

After talking to new friends at Sloan, you came up with an e-finance business plan for SSI.

- New plan is very risky: If successful, the plan could lead SSI into a much higher latitude. But it could also bring SSI to the ground if fails.
- All the evidence suggests that market's immediate reaction to this plan would be very positive.
- Your hobby is flying small airplanes and your dad's is golf.

After hearing your plan, your dad adamantly opposes:

"I am NOT going to risk my membership at my favorite clubs."

How would you convince your dad to agree to your plan?

Example 3. Financial markets reconcile expectations.

Unconvinced by your reasoning, your dad calls up a old friend, who is a reputable analyst of the industry. This friend says:

- Your forecast about the new business is in agreement with the market consensus
- But the market is over heated about e-finance
- In his view, the new plan is a loser.

What would you say to your dad after hearing this?

Conclusions:

1. Financial managers should maximize firm's current market value.

2. Shareholder differences can be settled in financial markets by trading on their own account.

3. Perfect financial markets allow separation of ownership and management.

Practical Issues:

- Agency problems
  - Management may put their own interest first
- Other stakeholders
- Imperfections in financial markets.

7 Summary

Key Points:

1. Evaluating a business boils down to valuation of its assets.
2. An asset is defined by its cash flow (CF).
3. Two important characteristics of CF: timing and risk.
4. Value of assets (CFs) are determined by financial markets.
   - Assets with matching CF (real/financial) have same value.
5. Cost of capital: expected return on equivalent investments in financial markets.
6. Decision rule: take positive NPV projects.
   - NPV adjusts for timing and risk.
7. Role of financial markets: allow agents to choose timing and risk, subject only to wealth constraint.
8. Objective of financial manager: maximize firm's current market value (increase shareholders' wealth).

Key Assumptions:

1. Perfect financial market.
2. No agency problems.

8 Homework

Readings:

- BKM Chapters 1, 2, 3.
- BM Chapters 1, 2.