15.415x Foundations of Modern Finance

Leonid Kogan and Jiang Wang
MIT Sloan School of Management

Lecture 1: Introduction

Key Concepts

- Motivation
- What is Finance
- A unified framework for financial analysis
- Basic approach to asset valuation
- Roles of financial market
- Unifying principles of finance

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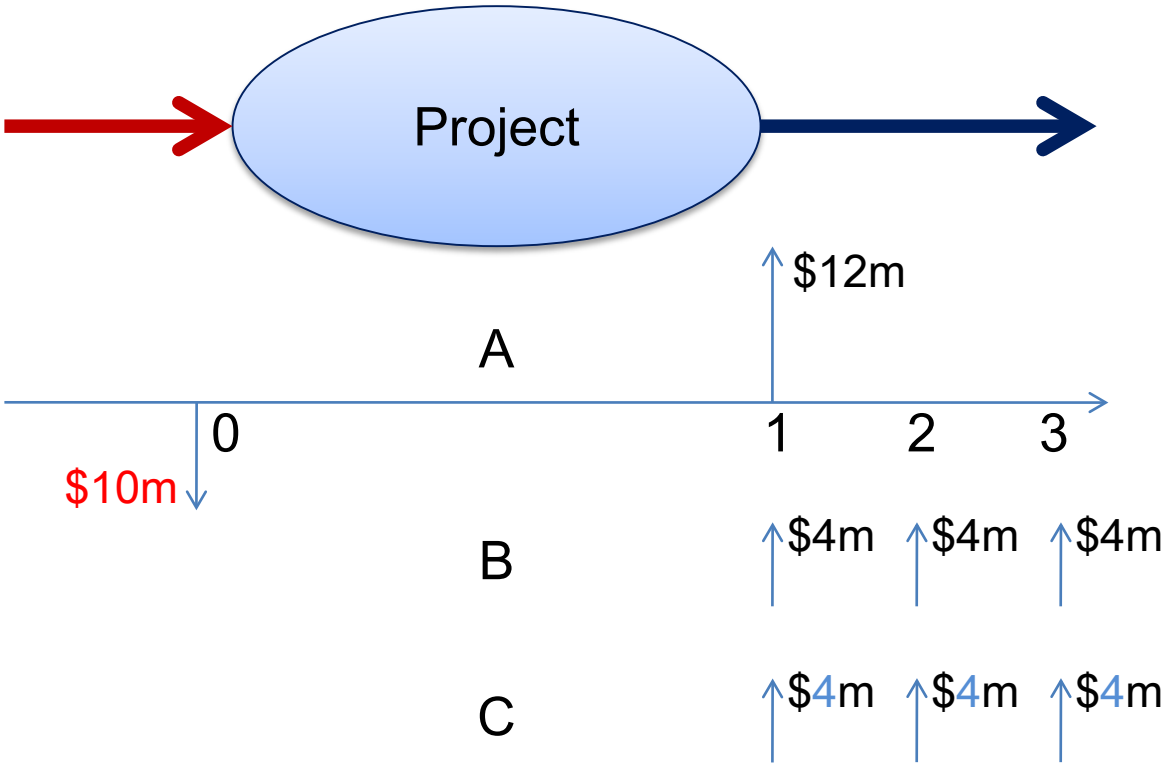
Motivation

How to make a business decision? (To create wealth.)



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What is Finance?

- Finance is about the bottom line of business activities.
- A business activity is a process of acquiring and disposing assets:
  - Real/financial,
  - Tangible/intangible.

asset: has economic value

- All business activities reduce to two functions:
  - Grow wealth (create value),
  - Manage wealth to best meet economic needs.
- Financially, a business decision starts with the valuation of assets.
  - "You can't create and manage what you can't measure."
- Value is an objective measure --- determined by the financial market.
- Valuation is the central issue of finance/business.

What is Finance?

Questions we would like to answer in this course:

1. How to value assets?
2. How corporations make financial decisions?
   - Capital budgeting/real investment: What projects to invest in?
   - Financing: How to finance a project?
     - Selling financial assets/securities/claims (debt, stock, …)
   - Payout: What to pay back to shareholders?
     - Paying dividends, buy back shares, …
   - Risk management: What risk to take or to avoid and how?
3. How households make financial decisions?

We do so by developing and applying a unified analytical framework and a set of basic principles of modern finance.

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A Framework for Financial Analysis

Financial state of a corporation/household

Balance sheet (in market value)

Assets	Liabilities
Cash	Debt (D)
Capital	Equity (E)
Intangibles	
Value	Value

conservation of value: total value of assets = total value of liabilities

In accounting, it is generally accepted that A = L + E

In the lecture, we define liabilities as the claims on the firm's assets. In this case, equity is included in liabilities as it is the claim of the shareholders

A Framework for Financial Analysis

Financial state of a corporation/household

Income statement

conservation of fund

$$\text{Source of funds} = \text{Use of funds}$$

$$NI + \Delta D + \Delta E = I + C + Div + T$$

- NI : net income funds generated by existing assets, such as interest of cash
- ΔD : funds raised from new debt issue
- ΔE : funds raised from new equity issue
- I : investment
- C : coupon payment debt
- Div : dividend payment equity
- T : tax payment

A Framework for Financial Analysis

Financial state of a corporation/household

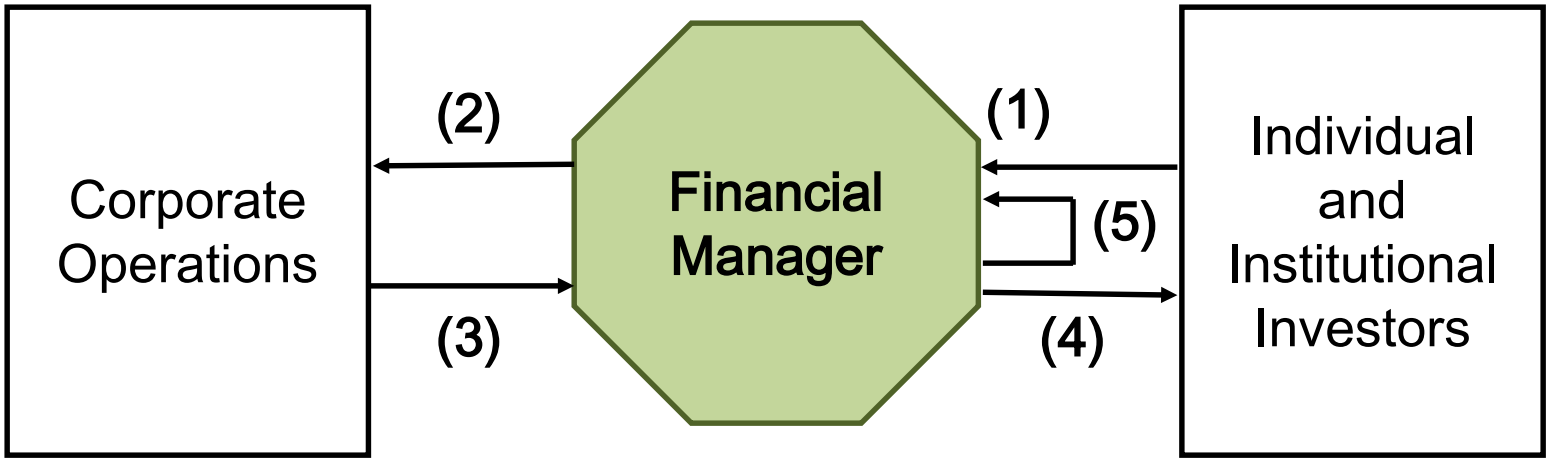
Balance sheet evolution:

Assets	Liabilities
Cash	Debt (D)
Capital	Equity (E)
Intangibles	
Value	**Value**

Assets	Liabilities
Cash	Debt ($D + \Delta D$)
Capital + I	Equity ($E + \Delta E$)
Intangibles	
Value	**Value**

A Framework for Financial Analysis

Corporate financial decisions 1-5: five cash flows



(1) Cash raised from investors by selling financial assets ($\Delta D + \Delta E$)

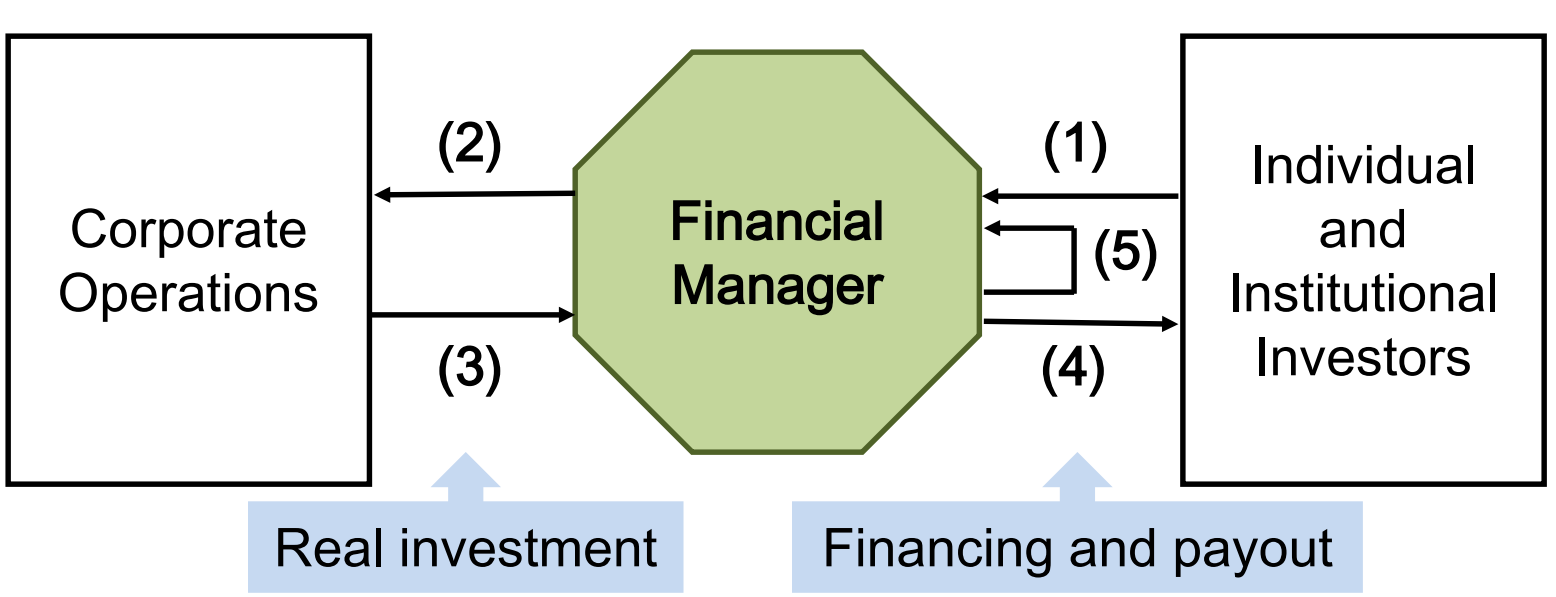
(2) Cash invested in real assets (tangible and intangible) (I)

(3) Cash generated by operations (after tax) ($NI - T$)

(4) Cash returned to investors (debt payments, dividends, etc.) ($C + Div$)

(5) Cash reinvested ($NI - T - C - Div$).

A Framework for Financial Analysis



Management decisions --- manage cash flow (1), (2), (4), (5).

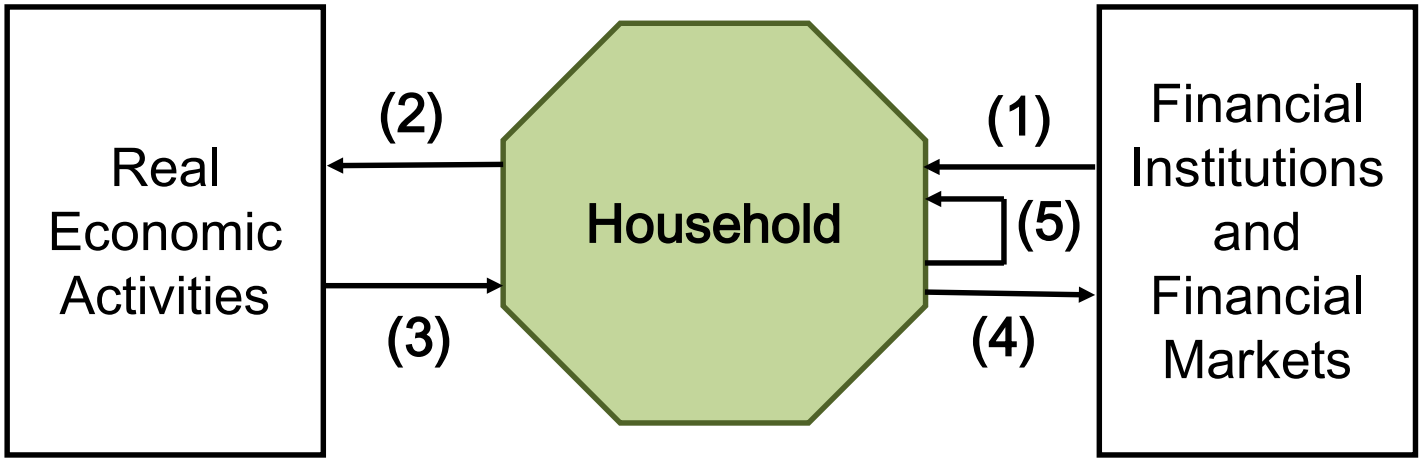
- Real investment/capital budgeting: (2), (3) -- valuing real assets
- Financing and payout: (1), (4), (5) -- valuing financial assets
- Risk management: (1) and (4) -- valuing financial contracts.

Objective: Create maximum value for shareholders.

Sound business decisions rely on how to value assets.

A Framework for Financial Analysis

Household financial decisions 5 cash flows



(1) loan or sell stocks

(1) Cash raised from financial institutions or from holdings of financial assets

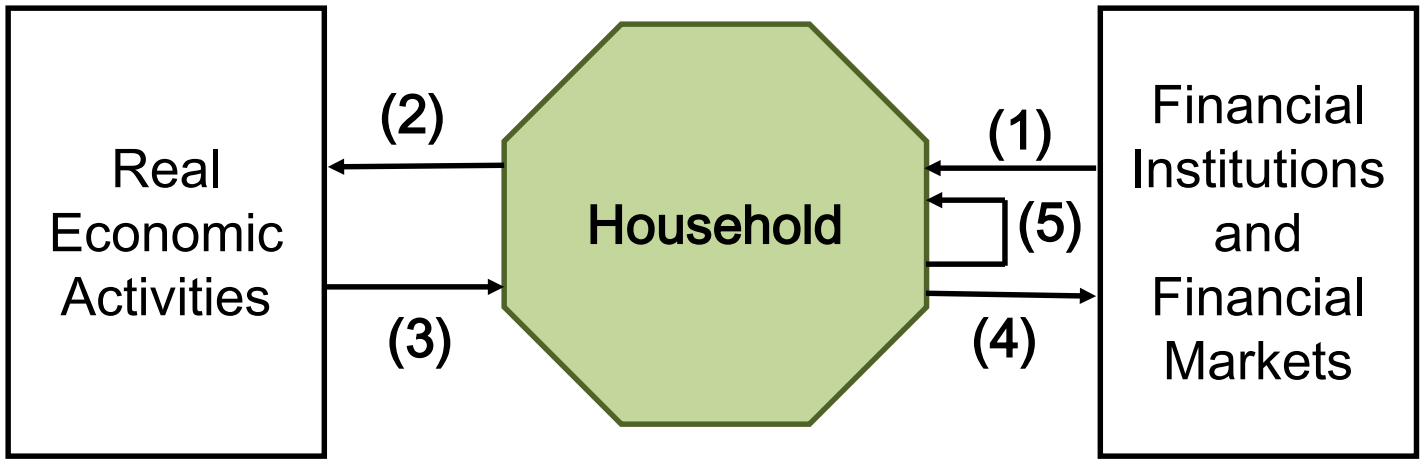
(2) Cash invested in real assets (tangible and intangible)

(3) Cash generated by labor supply and real assets

(4) Cash returned to financial institutions or invested in financial assets

(5) Cash consumed and reinvested.

A Framework for Financial Analysis



Household financial decisions --- manage cash flow (1), (2), (4), (5).

- Real investment: (2), (3) -- valuing real assets
- Consumption/saving/investment: (1), (4), (5) -- valuing financial assets
- Risk management: (1) and (4) -- valuing financial assets.

Objective: Maximize lifetime "happiness/welfare" or "utility".

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Valuation of Assets

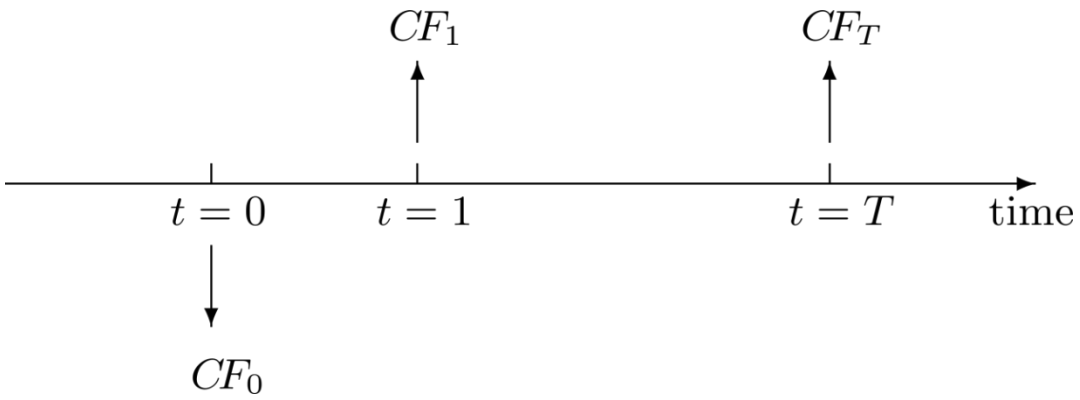
Each asset is defined by its cash flow (CF):

Time:	0	1	2	…
Cash Out:	$(-)CF_0$	.	.	…
Cash In:	.	CF_1	CF_2	…
Net cash flow:	CF_0	CF_1	CF_2	…

Value of an asset = Value of its cash flow

Valuation of Assets

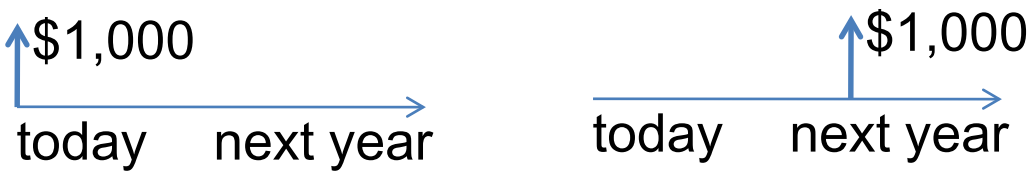
"Visualizing" a cash flow (an asset):



Time and Risk

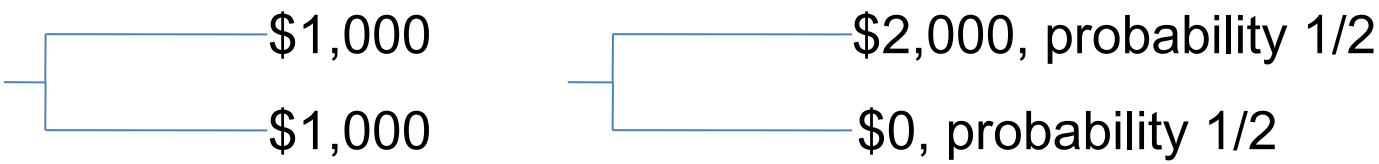
Two important characteristics of a cash flow (other than size):

1. Time



Which one do you prefer? --- Time value of money.

2. Risk



Which one do you prefer? --- Risk premium.

Time and risk are two key elements in finance.

Market Value

How can we value/price a cash flow (an asset)?

Example 1. (Safe asset) An asset yields cash flow in one year with a sure value of $1,000. How much is it worth today?

Suppose that assets/cash flows traded in the financial market with the same timing and risk offer a return of 5% (e.g., one-year US Treasury bonds, yielding a sure annual interest of 5%).

A potential buyer of the asset also expects a sure return of 5%. Let the price of the asset be X. Then,

$$X\,(1+0.05) = 1{,}000$$

or

$$X = \frac{1{,}000}{1+0.05} = 952$$

which gives the asset's current market value.

Market Value

What if the asset can be traded at a higher price, say $960?

Consider the following set of trades:

1) Buy $952.38 worth of 1-year US Treasury bonds, which will pay $1,000 in one year (at 5% interest rate), same as the asset;
2) Sell this sure cash flow of $1,000 in one year for $960 today.

These trades will net a positive cash flow or 960-952=$8 today. This is a free lunch.

If there are no frictions in the financial market (e.g., trading costs and constraints), there should be no free lunches.

- Thus, the price of the asset can't be higher than $952.
- How about lower? reverse the trade to eat free lunch
  the price should be exactly 952.38

Arbitrage (Free Lunch)

based on market info

Definition: An arbitrage (free lunch) is a set of trades in the financial market such that it

- requires non-positive initial cash flow/investment
- yields non-negative future payoffs
- at least one of the inequalities is strict.

Arbitrage (Free Lunch)

Example. Citi's 12-month lending rate is 1% and Chase is selling 12-month certificate of deposit (CD) at an interest rate of 1.125%.

Arbitrage trades:

1) Borrow \$100 from Citi at interest rate of 1% per year,
2) Buy \$100 worth of 12-month CD from Chase at 1.125% per year.

Resulting cash flow:

Cash flow	Year 0	Year 1
Borrow \$100 at 1%	100	$-(100)(1+0.01) = -101.000$
Buy \$100 of CD at 1.125%	-100	$(100)(1+0.01125) = 101.125$
Net cash flow	0	\$0.125

This is a free lunch: zero initial investment, \$0.125 sure profit in year 1.

Arbitrage (Free Lunch)

Example. IBM shares are trading on New York Stock Exchange (NYSE) at $195 and London Stock Exchange (LSE) at £120 and the pound/dollar exchange rate is at $1.50/£.

Arbitrage trades:

1) Sell 1 share of IBM at NYSE for $195,
2) Convert $190 into pounds at $1.50/£, obtaining £130,
3) Buy 1 share of IBM at LSE at £120.

Cash flow	Year 0	Year 1
Sell 1 share of IBM at NYSE at $195/share	$195	−1 share of IBM
Convert $195 into £ at $1.50/£, yielding £130	−$195 + £130	
Buy 1 share of IBM at LSE at £120/share	−£120	1 share of IBM
Net cash flow	£10	0

- This is a free lunch: initial cash flow of £10, zero cash flow in the future.
- Arbitrage trades will quickly shift prices to make the free lunch disappear.

Market Value

Example 2. (Risky asset) An asset yields a risky cash flow in one year with an expected value of $1,000. How much is it worth today?

Suppose that assets/cash flows traded in the financial market with the same timing and risk offer an expected return of 10% (e.g., stocks of similar risks, yielding an expected annual return of 10%).

A potential buyer of the asset also expects an annual return of 10%. Let the price of the asset be X. Then,

$$X\,(1+0.10) = 1{,}000$$

or

$$X = \frac{1{,}000}{1+0.10} = 909$$

which gives the asset's current market value.

Arbitrage and Asset Valuation

In a well functioning (frictionless) financial market, there should be no arbitrage opportunities.

- Why? any arbitrage opportunity will be eliminated quickly by investors choice to take advantage of them.
- How about frictions (e.g., entry cost, trading costs, constraints, information asymmetry, …)? prices seem to allow arbitrage, but various costs can prevent the actual arbitrage trades from being profitable.
- Don't need all investors to face limited frictions.

In absence of arbitrage, assets with same payoffs should have the same prices. – Law of One Price (LOP)

With a rich and well functioning financial market, all assets are valued/priced by the market (the prices of traded assets).

rich means that there is a large set of traded assets with cash flows covering the whole range in time and risk

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Finance/economy and financial market

Two important lessons so far:

1. Sound economic decisions rely on how to value assets;
2. Asset valuation is determined by the financial market.

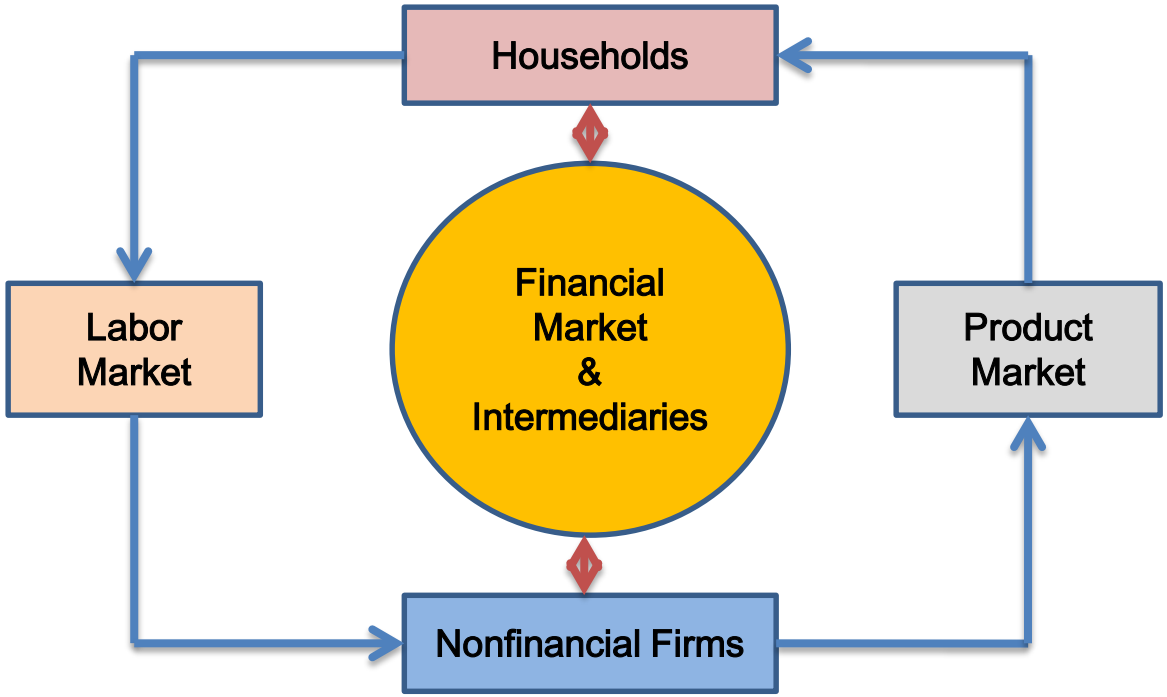
Central role of the financial market for the economy: It is where asset prices are determined

- Guiding economic decisions by firms/households at the micro level,
- Allocation resources across different economic activities at the macro level.

Financial Market

Financial market at the center of the economy:

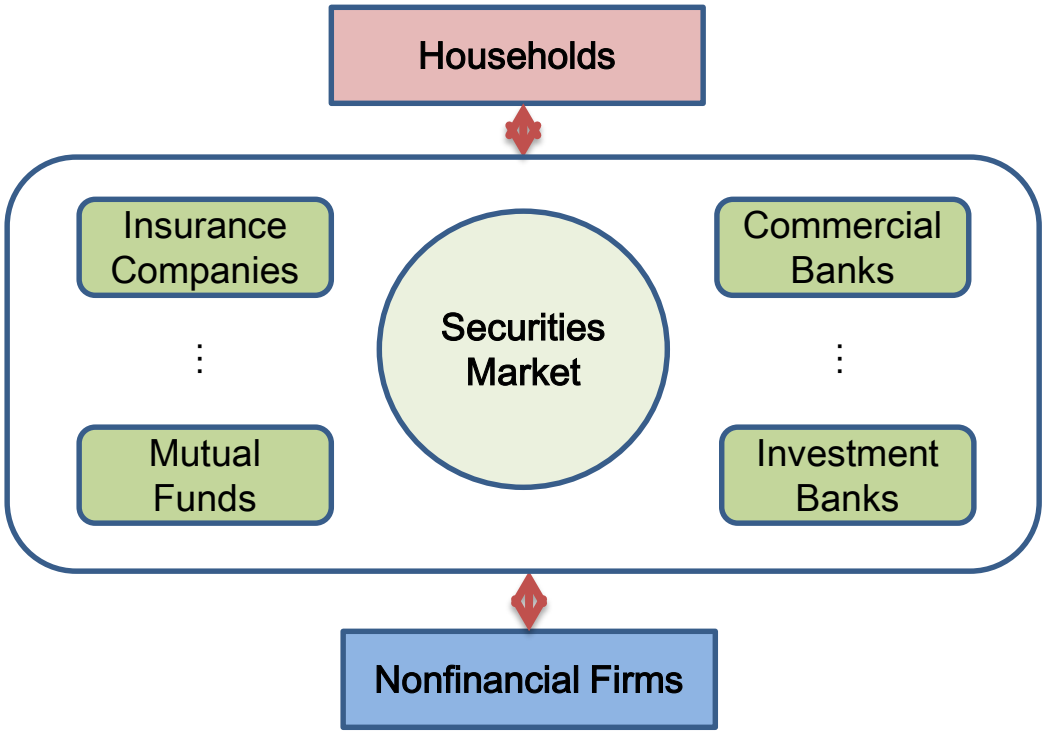
Labor and Product Market are referred to as the real economy.



Financial Market

Financial market & intermediaries

Two parts:
securities market where financial assets are traded more directly
financial intermediaries where financial assets or contracts are traded more indirectly



Financial Market

- Securities market - where financial assets/claims/contracts are traded
  - Money market: Short-term debt securities
    - Short-term government, bank and corporate debt (Treasury Bills, CDs, Commercial Papers, …)
  - Capital market: Long-term securities
    - Government and corporate bonds, asset-backed securities, …
    - Stocks, …
  - Derivatives: Securities with payoffs tied to other prices
    - Forwards and futures, swaps, options, …
- Financial Intermediaries - Own mostly financial assets
  - Banks, insurance companies, S&Ls, … saving and loan
  - Mutual funds, hedge funds, private equity (PE) funds, …
- Nonfinancial firms - Own mostly real assets
- Households - Own both real and financial assets
- Governments - Own both real and financial assets/liabilities

Functions of Financial Markets

1. Allocating resources
   - Across time

     Example. Borrow money to buy a home.
   - Across different states of the economy

     Example. Invest in stocks/bonds.

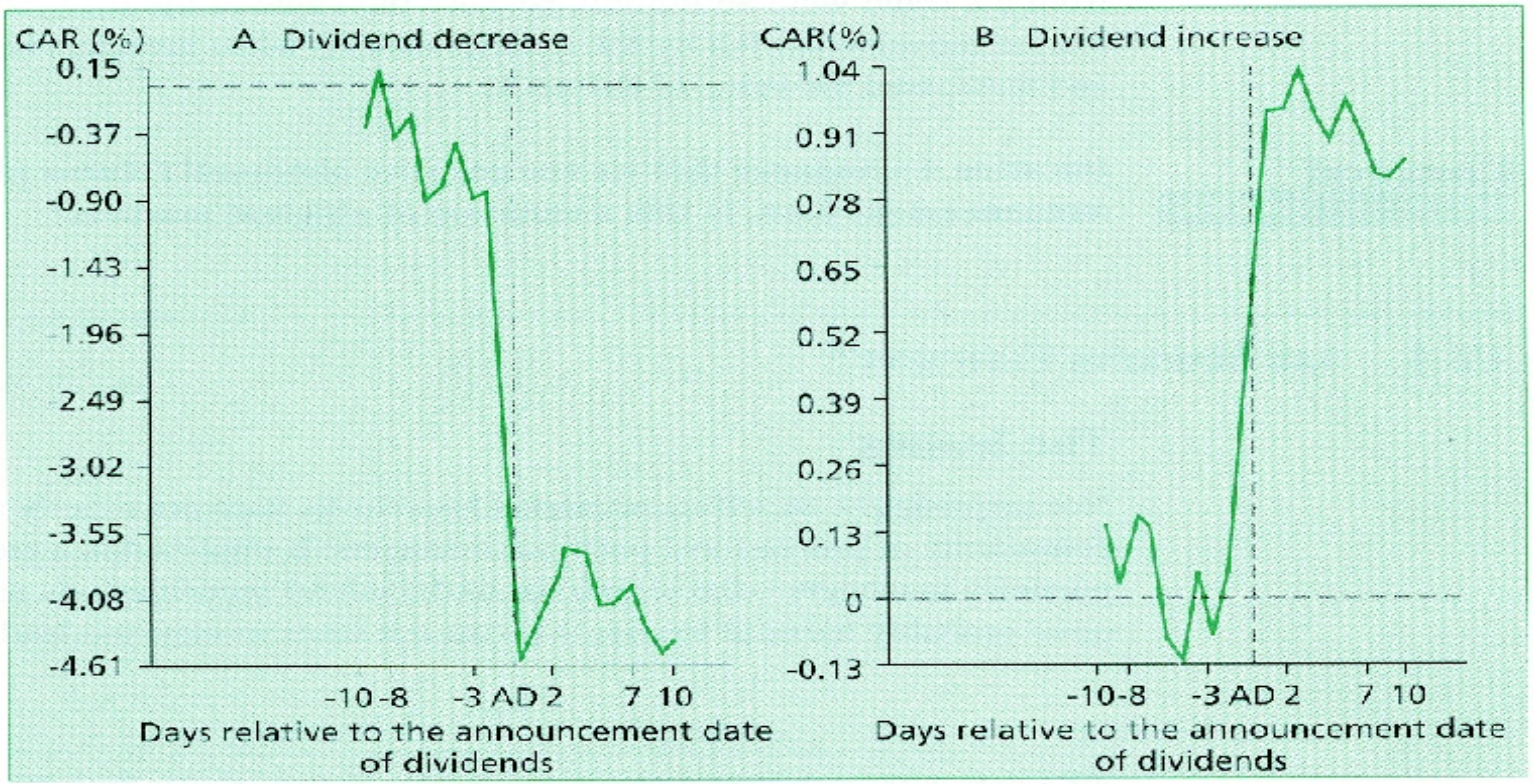
the household is moving future resources, like future income, to finance current housing consumption

2. Price discovery
   - Market prices reflect available information.

Price and Dividend Announcements

Price Change around Dividend Announcements

(Stock price change as measure by the cumulative abnormal return in the days around dividend announcement.)



Market Imperfections

- Market imperfections/frictions:
  - Transaction costs (TCs)
    - Missing markets
    - Access cost
    - Trading cost/liquidity
    - Position/trading constraints ...
  - Information asymmetry
    - Between a firm's different stakeholders like bondholders and stockholders
    - Between corporate managers and the financial market
    - Between different market participants
  - Taxes
    - Corporate taxes
    - Personal taxes
- Our analysis always starts with a frictionless market as the benchmark.
- Real markets have frictions, which will be considered when needed.

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Unifying Principles of Finance

not applied to labor/product market

P1: There is no such thing as a free lunch in the financial market.

P2: Other things equal, individuals/agents:

- Prefer more money to less (non-satiation);
- Prefer to avoid risk (risk aversion);
- Prefer money now to later (impatience).

market equilibrium

P3: Financial market prices shift to equalize supply and demand.

P4: Market imperfections are central to financial innovation.

Financial innovations to overcome the imperfections in the market lead to the realization of these profits and their eventual disappearance. i.e. arbitrage

When there are arbitrage opportunities in the financial market, the supply and demand in the market are not equal.

Summary

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