Financial intermediation

Financial risk taxonomy
Financial intermediation
- Financial intermediaries
- Financial instruments

Financial risk taxonomy
 Functions of the financial system

**Resource allocation** under uncertainty, over time and geographically
- Gather resources from savers/lenders, transfer to investors/borrowers, or distribute among investors
  - Savers: person or firm with a surplus
  - “Investors”: person or firm using resources to add to society’s capital stock, e.g. machines, education, consumer durables
- Many steps along the chain, many multilateral connections

**Reduction and sharing of risk** via
- Insurance and diversification
- Trading and hedging

**Identification of opportunities** for investment or allocation of capital

**Monitoring** of agents, managers, e.g. corporate control

**Facilitate exchange** of goods and services, e.g. via money and media of exchange
- More generally, creation of (→)**liquid** assets

**Financial innovation** e.g. securitization, derivatives, cryptocurrencies
Constituents of the financial system

**Human beings:** also called i.a. *households, individuals, agents, or investors*

- May be organized into specialized firms called **financial intermediaries**
- Primarily banks and insurance companies, but also other types of firms
- Intermediaries *gather and create information*
  - Vetting, selecting and monitoring borrowers
- Information is costly: intermediaries are low-cost producers

**Assets** include

- **Financial instruments:** contracts such as equity, debt, derivatives contracts
- **Real assets:** real estate, commodities

**Financial markets** in which assets trade, prices set
Why is financial intermediation difficult?

- Who needs intermediaries? Intermediation should be easy through markets:
  - **Arrow-Debreu model**: contracts now for all future states and times; trade once at the beginning of history
  - **Modigliani-Miller theorem**: firm capital structure—mix of equity and debt financing—doesn’t affect firm value
- Households can adjust their own balance sheets
- But in the real world, costly due to **frictions**
  - **Incomplete markets**: only a tiny fraction of the necessary contingent claims actually exist
  - **Information costs** of distinguishing good from bad borrowers, monitoring, establishing trust
  - **Transaction costs** of contracting, including the costs of navigating conflicts of interest
- Intermediation also displays **economies of scale**→opportunities to specialize in carrying out every aspect, e.g. mortgage servicing, factoring
Types of financial intermediaries

- **Institutional perspective:** types of firms
  - Depository institutions, e.g. banks
  - Investment companies, e.g. mutual funds, hedge funds
  - Broker-dealers
  - Insurance
  - And much more...

- **Functional perspective:** types of services
  - Asset transformation, e.g. maturity, liquidity, diversification
  - Production of information, e.g. advice, monitoring
  - Facilitating transactions, e.g. brokerage, payments, clearing and settlement
  - And much more...
Aspects of asset transformation

How financial firms “use their balance sheets” to intermediate:

**Credit transformation:** changing (not always raising!) the credit quality of a debt contract. For example:
- Monitoring may raise quality
- **Collateral:** borrower puts assets under control of lender
- Adding guarantees
- Tranching (→capital structure, structured credit)

**Maturity transformation:** changing the term to maturity of a debt contract by borrowing short-term and lending long

**Liquidity transformation:** make debt contract more like money
- Goes hand-in-hand with maturity transformation
- **Examples:** banks, *money market mutual funds* (MMMFs)
Operational aspects of intermediation

Also called financial system “plumbing” or back-office operations

**Clearing** includes

- Matching trade records with counterparties
- Reconciling trades with firm’s books and records

**Payments** and **settlement:** transferring securities or other assets and making **final payments** via payments systems

- **Payment systems** transfer money between market participants and intermediaries
- **Examples:** *Fedwire* for interbank U.S. dollar funds transfers, *Depository Trust and Clearing Corporation* (DTCC) for securities, some derivatives

**Custodial services** include record-keeping, managing cash flows from investments
Gross and net settlement

- **Netting**: cancelling offsetting trades when contractually mandated or permitted and appropriate

  **Gross settlement** occurs via transfer of gross amounts due without netting

  **Net settlement** occurs at specific times, e.g. end of day, via transfer of net amount due

- **Real-time gross settlement** (RTGS) system
  - Large-value interbank funds transfer
  - Final settlement effected continuously
  - Have become widespread worldwide, examples include Fedwire, **TARGET** in Europe
Bank intermediation

- “What do banks do” a perennial question, no universally accepted definitions

**Commercial banks** make loans to households and companies
  - Funded by equity, deposits and other borrowing
  - **Retail banking**: loans to households, e.g. residential mortgages

**Investment banking**: financial services to companies include
  - Facilitate securities issuance by companies through underwriting and syndication
  - Advice, esp. on corporate actions such as merges and acquisitions
Brokers and dealers

- **Broker-dealers** facilitate trading and investment in securities
- As principal: **dealers** take positions, use equity and borrowed funds to finance and execute security trading
  - Also called (esp. in regulatory context) **market makers** or **liquidity providers**
  - Bear market and credit risk of securities inventories
  - Compensation through trading profits, interest
- As agents: **brokers** facilitate trades, provide trading infrastructure without taking positions
  - Compensation through fees, commissions, **payment for order flow** by dealers
A taxonomy of financial instruments

- Cash or **spot** versus **derivatives**: is the passing of time involved in the delivery of a payment or good?
- **Securities** versus bilateral contracts:
  - Securities are **fungible** (uniform) claims, can be bought, sold or transferred, documented via a certificate or book entry
- **Nominal** versus **real assets**:
  - Nominal assets are claims expressed in units of money
  - Real assets: claims expressed in units of purchasing power, e.g. **inflation-indexed bonds**, or on physical assets
- Debt versus equity instruments: who takes the first loss?
  - Long- versus short-term debt
- Over-the-counter (OTC) versus exchange-traded: do you find a counterparty at an organized exchange or at your dealer?
  - Standardization of OTC contracts via **master agreements**, defining payments, collateralization, termination conditions
- On- versus off-balance sheet, affecting tax and bankruptcy treatment, transparency
- Primary versus securitizations: is it a “claim on a claim”?
Cash forms of intermediation

Some important examples:

- Money, in its myriad forms
- Foreign exchange
- Shares
- Physical assets: real estate, commodities, artworks
- Short-term lending: money markets
- Long-term lending:
  - Bank loans, primarily mortgage loans, commercial and industrial (C&I) loans
  - Capital markets, great variety of bonds
- Even with cash forms, there is a time to settlement of trades
What is money?

- **Money** describes a range of assets providing **money services**:
  - **Payment services** when used: acts as a medium of exchange, can be readily transferred to third parties
    - Exchanged for other goods, assets
    - Or in settlement of debts
  - **Liquidity services** in storage: provides relative certainty of value
    - Stable **store of value**
    - Can be used as collateral to borrow a relatively certain amount
- Functions as **unit of account**: prices and values measured in money units
Why is money important?

- Money is a tool for overcoming trading frictions
- Widely-accepted medium of exchange solves two fundamental limitations of barter in a market economy

**Double coincidence of wants:** low likelihood of pair of agents meeting, each preferring the good offered by the other

- Myriad agents and commodities
- Desired at many points in time

**Trust:** IOU, or promise to “pay” later with counterparty’s desired good once located (indirect barter) isn’t credible

- Historical origins of money in remote past; competing theories:
  - **Emergent** via gradual, informal social agreement based on characteristics
    - Uniform, divisible, valuable, difficult to counterfeit
    - Value in exchange gradually exceeds intrinsic, direct-use value
  - **State theory:** government-annointed via taxation, military pay
Forms of money

- Characteristics of assets used as money:
  - Agreement/common acceptance
  - Stability of exchange value
- More recently includes digital currencies
- Many forms of money are liabilities of governments, central banks, financial intermediaries and nonfinancial businesses
  - The most liquid and short-term called near-money
  - May also be interest-bearing

...a species we may call monetary assets—marketable, fixed in money value, free of default risk.  Tobin, “Liquidity Preference as Behavior Towards Risk” (1958)
Money markets

- Forms of short-term lending:
  - **Bank deposits:** includes interbank lending, certificates of deposit (CDs)
    - Distinguished by **par redemption:** ability of depositor to withdraw funds at par value
    - On demand, i.e. instantaneously, for most deposit types
  - **Commercial paper:** short-term capital markets instrument
  - **Repo** and other secured forms (collateral markets)
- Non-bank deposit-like lending also intermediated by MMMFs
  - Funds with **fixed net asset value** (NAV) offer a form of par redemption
  - No bank charter, par redemption via accounting rule (SEC’s Rule 2a-7 under the Investment Company Act of 1940)
  - Fixed NAV restricted under postcrisis reforms to funds investing in government securities or with retail shareholders
Derivatives forms of intermediation

**Futures, forwards, and swaps:** Linear and symmetric relation of value to underlying asset price

- **Static hedging:** can be hedged with a one-time trade in the underlying asset
- Value driven by underlying, not volatility $\Rightarrow$ zero **net present value** (NPV) at initiation

**Options** Nonlinear and asymmetric relation of value to the underlying asset price

- **Dynamic hedging:** repeated trades are needed to stay hedged
- Value driven by volatility as well as underlying, asymmetric payoffs
- $\Rightarrow$ Cannot have zero NPV at initiation.
Financial intermediation

Financial risk taxonomy

- Market risk
- Credit risk
- Operational risks
Varieties of market risk

- **Market risk:** risk of loss from changes in market prices or risk factors

- Some forms of market risk
  - **Price risk:** asset prices go the wrong way
  - **Execution risk:** cannot execute trades quickly or skillfully enough to avoid loss
    - Example: *stop-loss risk*, the risk that you cannot exit a trade at the worst price you were willing to accept
  - **Mark-to-market risk:** losses may not be realized through sale or unwinding
    - Losses may nonetheless be recorded in firm’s accounts, publicly reported
    - Use of models to value illiquid, infrequently traded assets→**model risk**
Categories of market risk

- Major categories of market risk include exposures to prices or values of:
  - **Equity**: ownership interests in or residual claims on firms
  - **Interest rates**: fixed claims to cash flows
  - **Foreign exchange**: one currency in terms of others
  - **Physical assets**: commodities, real estate

- **Inflation rate risk** is the risk arising from changes in the general price level:
  - Generally associated most closely with interest rate risk
  - But interacts closely with all risk factors

- Many single-position exposures are exposed to several categories of market risk

- **Examples**:
  - Foreign stock indexes values in local currency depends on both foreign exchange and equity risk factors
  - Commodity futures prices fluctuate with both commodity prices and short-term interest rates
## Risk factors

- Market risk measurement generally decomposes exposures embedded in assets into exposures to **risk factors**
- Enables risk modeling of positions falling in several risk categories
- Accuracy: risk factors may help focus on predictable sources of variations in value
- Data on specific assets generally less available than than on factors
- Tractability: extremely large number of assets—securities, derivatives—but limited number of risk factors
- Dimensionality of larger sets of risk factors may be reduced via **principal components analysis** of their joint return behavior
Risk factor mapping

- Risk factor approaches require **mapping**: assignment of risk factors to positions
  - Including a measure—the **loading**—of the impact of each risk factor on each position
  - For example, option risk measured using price of underlying, with loading based on delta
- Risk factor mapping may combine intuition, statistical analysis and asset modeling
  - May include macroeconomic factors as well as asset prices
  - May be latent or unobservable
- **Factor models** that explain prices or values in terms of underlying and possibly unobservable variables
- **Examples** of risk mappings include
  - Equity prices as functions of stock market indexes or valuation measures
  - Long-term bond values as functions of key rates along curve
  - Foreign exchange rates as functions of major exchange rates, interest-rate differentials
Definition of credit risk

Risk that the creditworthiness of a debt obligation deteriorates:

**Default risk:** debtor becomes insolvent, i.e. unable to pay timely and in full

**Credit migration risk:** default *likelihood* rises→
- Issuer or security receives a lower *credit rating*
- Fall in market price of the security
Fixed income exposed to both market and credit risk

- Pure credit risk event: deterioration of firm’s credit quality without credit spread widening
  - Example: previously AAA-rated company downgraded to AA
  - But no change in AAA spreads or in risk-free rates

- Pure market risk event: spread widening—decline in risky bond prices—without downgrades
  - Example: widening spread between AAA and risk-free rates
  - But no credit event or change in credit quality
Counterparty risk

- It’s not just who you *lend* to, but also who you *trade* with
- **Counterparty risk**: trading counterparty does not fulfill an obligation to pay or deliver securities.
  - Exposure to credit risk, but size of exposure fluctuates with market prices
  - Challenging to disentangle market from credit risk
- Arises in derivatives trading
  - **Examples**: long option market value or swap NPV
Operational side of credit risk

**Clearing risk** includes

- Failure to record trades accurately in firm’s books and records (e.g. Soc Gen 2008)

**Settlement risk** includes

- Counterparty fails to complete settlement
- An issue particularly in foreign exchange transactions
- Also known as **Herstatt risk** after 1974 failure of large German correspondent bank

**Custodial risk:** examples include

- Customer securities or cash may be commingled with custodian’s assets, become unavailable in event of insolvency
Interactions between market and credit risk

Some examples:

- **Counterparty risk**: can arise from market or credit risk
  - **Market risk**: swaps and options on non-credit derivatives
  - **Credit risk**: CDS exposed to **double default risk**, both the underlying credit and counterparty default

- **Credit quality** depends in part on macroeconomic or specific market conditions
  - **Wrong-way risk**: interaction between counterparty and market risk
    - Presents itself when exposure greatest under market conditions putting counterparty at greatest default risk

- **Sovereign debt convertibility risk**: low default risk, but risk of
  - **Redenomination** at unfavorable exchange rate
    - E.g. if euro member leaves single-currency and converts debt to new local currency
  - **Currency depreciation or inflation**
Liquidity risk

Falls between market and credit risk: several meanings, interaction

**Market liquidity risk**  The market is not deep enough, at the time you have to buy or sell, to trade without pushing price against you
  •  →Greater risk to lender

**Funding liquidity risk**  Credit becomes unavailable, or offered only on more stringent terms
  •  →Forced unwinding, mark-to-market loss
Operational risk and other firm-killers

**Model risk:** potential for loss arising from incorrect model or use of a model, e.g. data, parametrization, omitted variables

**Operational risk:** “risk of loss resulting from inadequate or failed internal processes, people and systems or from external events” (Basel Committee, 2011)
  - Major regulatory capital component, alongside market and credit

**Legal risk:** firm may be sued for its financial practices, or a valuable contract cannot be enforced.
  - Part of operational risk in Basel taxonomy

**Regulatory and compliance risk,** including prohibition of a currently-permitted activity

**Reputational risk:** potential for damage to firm goodwill or brand

**Business or strategic risk**
Operational risk examples

- Squirrels and power lines: Nasdaq trading interruptions 09Dec1987 and 01Aug1994
The Knight Capital episode

Some examples:

- 01Aug2012: market-making firm Knight Capital places over 4 million erroneous orders in first 45 minutes of trading day
  - Resulting trades lead to losses of about $460 mill., eventual forced sale of firm
- Operational risk: “error in the operation of its automated routing system” (SEC cease-and-desist order) drives erroneous orders
- Business risk: code changes in response to NYSEs Retail Liquidity Program (RLP), permitting sub-penny pricing for retail investors
- Model risk: an existing algorithm had been revised and a new one introduced to implement RLP
- Regulatory risk: RLP a response to Rule NMS eliminating sub-penny pricing
  - And firm pays $12 mill. SEC fine for risk management failure
- Reputational risk: large customers cease trading with Knight
- Market risk: losses generated by changes in value of unintended positions taken