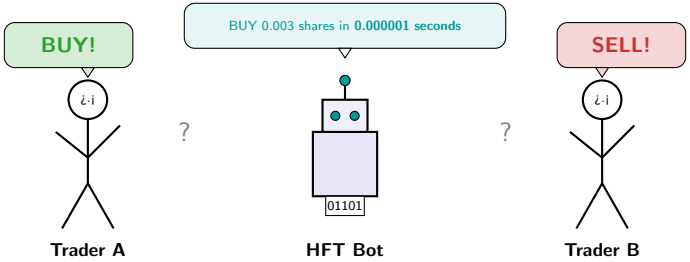
Financial Markets & Trading Infrastructure

Lesson 06

Digital Finance



Markets used to run on adrenaline. Now they run on microseconds.

Outline

Learning Objectives

By the end of this lesson, you will be able to:

1. Explain the economic functions of financial markets (price discovery, liquidity, risk transfer, capital allocation)
2. Describe supply and demand dynamics in asset markets and the concept of market efficiency
3. Explain order types, execution mechanisms, and modern trading infrastructure
4. Analyze the settlement and clearing process and its role in managing counterparty risk
5. Evaluate the impact of technology on market structure (algorithmic trading, tokenized securities)

These objectives build on earlier lessons: information asymmetry (L01), principal-agent problems (L03), and distributed ledgers (L05).

Why Do Financial Markets Exist at All?

A company needs capital to grow. A retiree needs income from savings. Without markets, they'd never find each other — and even if they did, neither would know the fair price.

Financial markets exist to perform four core economic functions:

1. **Price discovery**: Aggregating dispersed information into a single price signal (connects to information asymmetry from L01)
2. **Liquidity**: Enabling participants to buy or sell quickly without significantly moving the price
3. **Risk transfer**: Allowing risk-bearers to transfer risk to those more willing or able to accept it
4. **Capital allocation**: Directing savings from households to productive investments in firms

Each function creates value for society. Price discovery helps coordinate economic activity. Liquidity reduces the cost of adjusting portfolios. Risk transfer allows specialization. Capital allocation funds innovation and growth.

These four functions explain why markets exist – and why their design matters enormously.

Why Can Asset Demand Rise When Prices Rise?

Asset prices are determined by supply and demand, but asset markets differ from goods markets in a fundamental way:

Demand depends on expectations about future value, not just current utility. An asset's value today reflects the discounted stream of future cash flows.

Key concepts:

- **Bid-ask spread**: The difference between the highest price a buyer is willing to pay (bid) and the lowest price a seller will accept (ask)
- The spread represents the **cost of immediacy** – the price paid for executing a trade right now rather than waiting
- Market makers provide liquidity by posting both bid and ask quotes, profiting from the spread

Unlike goods markets where demand falls as price rises, asset demand can *rise* with price if investors extrapolate past returns (momentum trading).

Asset markets are unique because demand is driven by beliefs about the future, not current utility.

Can Anyone Consistently Beat the Market?

The **Efficient Market Hypothesis (EMH)**, developed by Eugene Fama, states that asset prices fully reflect all available information.

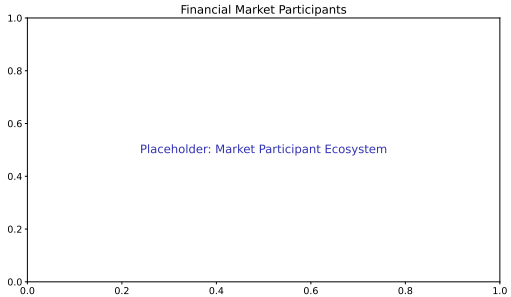
Three forms of market efficiency:

- **Weak form**: Prices reflect all past price and volume data (technical analysis cannot beat the market)
- **Semi-strong form**: Prices reflect all publicly available information (fundamental analysis cannot beat the market)
- **Strong form**: Prices reflect all information, public and private (even insider information is priced in)

If markets are efficient, prices are "correct" and active management cannot systematically outperform passive indexing. Evidence suggests most markets are *mostly* efficient most of the time, but not perfectly.

EMH remains one of the most debated ideas in finance – its validity shapes investment strategy.

Who Are the Players in a Financial Market?



Key participants:

- **Retail investors**: Individual investors trading for their own accounts
- **Institutional investors**: Pension funds, mutual funds, hedge funds, insurance companies managing large pools of capital
- **Market makers**: Provide liquidity by continuously quoting bid and ask prices, profit from the spread
- **Brokers**: Facilitate trades on behalf of clients (principal-agent relationship from L03)
- **Exchanges**: Provide trading venues and match orders
- **Regulators**: Ensure market integrity, protect investors, prevent manipulation

Market makers provide liquidity by always being willing to buy and sell – they profit from the spread.

When Is a Centralized Exchange Better than Bilateral Trading?

Financial markets can be organized in two main ways:

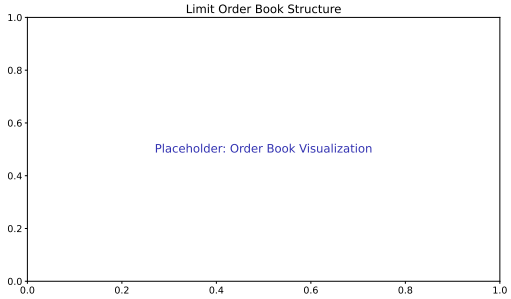
Feature	Exchange Markets	OTC (Over-the-Counter)
Organization	Centralized, organized venue	Bilateral, decentralized
Products	Standardized contracts	Customized contracts
Transparency	High (public order book)	Low (private negotiation)
Regulation	Highly regulated	Less regulated
Counterparty risk	Mitigated by CCP	Direct between parties
Examples	NYSE, SIX Swiss Exchange	FX spot, corporate bonds

Economic logic: Exchanges reduce transaction costs for standardized products by pooling liquidity. OTC markets allow customization for complex or large transactions where standardization is costly.

Swiss context: SIX Swiss Exchange is the primary exchange for Swiss equities and derivatives.

Exchanges reduce transaction costs for standard products; OTC allows customization for complex needs.

What Does a Real-Time Map of Supply and Demand Look Like?



The **order book** is a real-time list of buy and sell orders at different price levels.

Key concepts:

- **Bid**: Highest price buyers are willing to pay
- **Ask**: Lowest price sellers will accept
- **Spread**: Ask minus Bid (cost of immediacy)
- **Depth**: Volume of orders at each price level
- **Price impact**: Large orders move prices by consuming depth

Deeper order books indicate more liquid markets. Narrow spreads indicate low trading costs.

The order book is a real-time map of supply and demand – deeper books mean more liquid markets.

How Do You Choose Between Price Certainty and Execution Speed?

You want to buy shares in a company. Right now. Do you accept whatever price is available, or do you name your price and wait? Each choice carries a different risk.

Different order types manage different tradeoffs between price certainty and execution certainty:

Order Type	Execution Certainty	Price Certainty
Market order	High (executes immediately)	Low (price uncertain)
Limit order	Low (may not execute)	High (price guaranteed)
Stop order	Conditional	Conditional

Details:

- **Market order**: "Buy 100 shares at whatever price." Prioritizes execution speed over price.
- **Limit order**: "Buy 100 shares at $50 or less." Will only execute if price reaches the limit.
- **Stop order**: "Sell if price falls to $45." Used for risk management (stop-loss) or to enter positions (stop-buy).

Choosing the right order type is about managing the tradeoff between price certainty and execution certainty.

What Determines Which Orders Execute First?

Order matching algorithms determine which orders execute first:

Price-time priority (most common): Orders are matched first by best price, then by time of arrival. This incentivizes posting aggressive (better) prices and rewards speed.

Auction mechanisms:

- **Continuous auction**: Orders execute immediately when matched (most liquid stocks)
- **Periodic auction**: Orders accumulate and execute at discrete times (opening/closing auctions, less liquid stocks)

Execution venues have proliferated:

- **Primary exchange**: Traditional lit market (e.g., SIX Swiss Exchange)
- **Dark pools**: Private venues where orders are not displayed (reduce market impact for large trades)
- **Systematic internalisers**: Firms that execute client orders against their own inventory

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Multiple venues exist because different participants have different needs – transparency vs anonymity vs speed.

How Does Regulation Prevent Brokers from Cheating Clients?

Best execution is a regulatory obligation for brokers to achieve the best possible result for clients when executing orders.

MiFID II (Markets in Financial Instruments Directive II) mandates:

- Brokers must take all sufficient steps to obtain the best possible result for clients
- Factors include **price, cost, speed, likelihood of execution and settlement**
- Brokers must disclose execution venues and quality of execution
- Transaction reporting to regulators for transparency

Economic rationale: Best execution directly addresses the **principal-agent problem** (L03) between broker and client. Without regulation, brokers might route orders to venues that pay them (payment for order flow) rather than venues offering best prices for clients.

MiFID II's best execution rule directly addresses the principal-agent problem between broker and client.

Is Speed an Unfair Advantage in Trading?

In 1990, a stock trade was executed by a human on a trading floor in about 30 seconds. Today, algorithms execute trades in 0.000001 seconds — faster than a hummingbird's wingbeat.

Evolution of trading technology:
Floor trading → Electronic trading → Algorithmic trading → AI-driven trading

Algorithmic trading: Using computer programs to execute orders based on predefined rules. Main purpose is to **reduce transaction costs** for large orders by slicing them into smaller pieces and timing execution.

High-frequency trading (HFT):

- Subset of algorithmic trading characterized by ultra-low latency (microseconds)
- Accounts for approximately 50% of US equity trading volume
- Strategies include market making, arbitrage, and short-term momentum

Debate: HFT provides liquidity (narrow spreads) but may also exploit informational advantages at the expense of slower traders.

Algorithmic trading is fundamentally about reducing the transaction costs of executing large orders.

Can Satellite Photos and Credit Card Data Predict Stock Prices?

Theory: Machine learning transforms trading from rule-based systems to data-driven pattern recognition.

Categories of data-driven strategies:

- **Momentum/trend-following:** ML identifies price patterns from historical returns (supervised learning)
- **Mean reversion:** Detect when asset prices deviate from fair value; trade the convergence (pairs trading)
- **Sentiment-driven:** NLP analyzes news headlines, social media, and earnings call transcripts for sentiment signals
- **Alternative data:** Satellite imagery (parking lot traffic), credit card data, web scraping (price changes), shipping data

Example pipeline: Collect alternative data → extract features → train predictive model → generate trading signal → execute via algorithm

Limitations:

- **Overfitting:** Model fits noise rather than signal; fails on new data
- **Regime changes:** Model trained in bull market fails in bear market
- **Crowding:** Too many traders exploit the same signal, eroding its value

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Data-driven trading shifts the edge from speed (HFT) to information extraction—whoever finds signal in noise wins.

Why Is Data Infrastructure as Critical as Trading Infrastructure?

Theory: Data infrastructure is the foundation of modern financial markets—you cannot trade what you cannot measure.

Market data levels:

- **Level 1:** Best bid and ask prices (top of book)
- **Level 2:** Full order book depth (all resting orders)
- **Level 3:** Individual order information (available only to exchange members)

Data vendors: Bloomberg, Refinitiv (LSEG), ICE Data Services provide real-time and historical data to financial institutions worldwide.

Alternative data market:

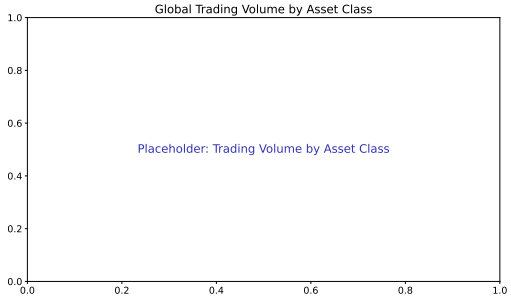
- Estimated market size: $7B+ and growing 30%+ annually
- Sources: satellite imagery, social media sentiment, web traffic, credit card transactions, geolocation
- Challenge: signal-to-noise ratio is low; expensive to acquire and process

Regulatory dimension: MiFID II mandates transaction reporting and pre-/post-trade transparency, generating vast quantities of structured market data.

Swiss context: SIX Financial Information serves as the primary Swiss market data provider.

In modern markets, data infrastructure is as critical as trading infrastructure—you cannot trade what you cannot measure.

Which Market Trades 7.5 Trillion Dollars Every Day?



Global daily trading volumes (approximate):

- **Foreign exchange (FX)**: $7.5 trillion/day – the largest market
- **Equities**: $200-300 billion/day
- **Bonds**: $100-150 billion/day
- **Derivatives**: Highly variable by product

Electronic trading penetration:

- FX: ¿75% electronic
- Equities: ¿90% electronic
- Bonds: 50% electronic (growing)

FX is the largest market because every international trade and investment requires currency conversion.

What Happens After You Click "Buy"?

You click "buy" and the app says "done." It feels finished. But the actual exchange of securities and cash hasn't happened yet — and won't for two days.

After a trade is executed, the **post-trade process** ensures delivery versus payment:

Four stages:

1. **Trade capture**: Recording trade details (price, quantity, counterparties)
2. **Confirmation**: Both parties agree on trade details
3. **Clearing**: Determining what is owed by each party (often involves a CCP)
4. **Settlement**: Actual exchange of securities and cash

Between trade execution and settlement, **counterparty risk** exists: the risk that one party fails to deliver.

Straight-through processing (STP): Automated post-trade processing reduces operational risk and delays.

Post-trade processing is invisible to most investors but critical for market integrity.

How Does a CCP Become the Buyer to Every Seller?

A **Central Counterparty (CCP)** interposes itself between buyer and seller, becoming the buyer to every seller and the seller to every buyer.

Functions:

- **Mutualization of counterparty risk**: No bilateral credit risk between original counterparties
- **Netting**: Offsetting obligations reduces the number of settlements (A sells to B, B sells to A $\rightarrow$ net to zero)
- **Margin requirements**: Both parties post collateral to the CCP
- **Default fund**: Pooled resources to cover losses if a member defaults

Example: SIX x-clear (Swiss CCP for derivatives and repos).

Tradeoff: CCPs reduce systemic risk by mutualizing counterparty risk – but concentrate risk in the CCP itself, making it systemically important.

CCPs reduce systemic risk by mutualizing counterparty risk – but concentrate it in the CCP itself.

Why Does Settling a Trade Still Take Two Days?

Settlement cycle refers to the number of business days after trade execution until delivery versus payment.

Cycle	Regions	Counterparty Risk Window
T+2	Europe (current), Asia (most)	2 days
T+1	United States (since 2024)	1 day
T+0	Proposed future standard	Same day

Central Securities Depositories (CSDs): Hold securities in electronic form and facilitate settlement. Swiss example: **SIX SIS**.

Shorter settlement cycles reduce counterparty risk exposure. The move from T+2 to T+1 cuts risk exposure by approximately 50%. **Distributed ledger technology (DLT)** (L05) could enable near-instantaneous T+0 settlement.

The move from T+2 to T+1 reduces counterparty risk exposure by approximately 50%.

Is Commission-Free Trading Really Free?

Digital platforms have **democratized** access to financial markets:

Commission-free trading model (e.g., Robinhood):

- No explicit commissions on equity trades
- Revenue from **payment for order flow (PFOF)**: Market makers pay the platform to execute retail orders
- Revenue from securities lending, margin lending, premium subscriptions

Features:

- **Fractional shares**: Buy portions of expensive stocks (e.g., 0.1 shares of a $1,000 stock)
- Mobile-first user experience
- Concerns about **gamification**: design patterns that encourage excessive trading

Swiss example: **Swissquote** offers digital trading platform for Swiss and international markets.

Commission-free trading is not truly free – revenue comes from payment for order flow and other sources.

Can Blockchain Finally Deliver Instant Settlement?

Tokenization represents traditional securities (stocks, bonds) as digital tokens on a blockchain.

Security Token Offerings (STOs): Issuing securities in tokenized form, subject to securities regulation (unlike many ICOs).

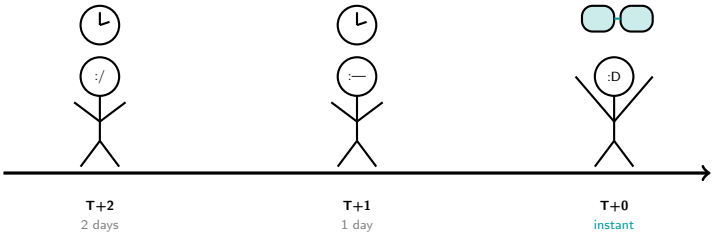
Digital asset exchanges:

- **SIX Digital Exchange (SDX)**: Fully regulated digital exchange for tokenized securities, integrated trading, settlement, and custody
- Enables 24/7 trading and near-instantaneous settlement via DLT

Swiss DLT Act (2021): Created legal framework for tokenized securities, allowing direct registration in DLT systems without intermediary ledgers.

Tokenized bonds and equities combine programmability (smart contracts from L05) with regulatory compliance.

Switzerland's SDX is among the first regulated digital exchanges in the world.



Settlement gets faster — but counterparty risk never fully disappears.

Summary

Five key takeaways:

1. Financial markets perform four economic functions: **price discovery, liquidity provision, risk transfer, and capital allocation**. Market design directly impacts efficiency.
2. Asset markets differ from goods markets because demand depends on **expectations about future value**. The **EMH** suggests prices reflect available information, but efficiency is debated.
3. **Order types and execution mechanisms** manage tradeoffs between price certainty and execution certainty. Regulatory rules like **MiFID II best execution** address principal-agent conflicts.
4. **Clearing and settlement infrastructure** (CCPs, CSDs) mitigates counterparty risk. Shorter settlement cycles (T+2 $\rightarrow$ T+1 $\rightarrow$ T+0) reduce risk exposure.
5. **Technology is transforming markets**: Algorithmic trading reduces transaction costs, retail platforms democratize access, and tokenized securities on digital exchanges (e.g., **SIX SDX**) enable programmable, near-instant settlement.

Next lesson: Risk Management and Regulation – quantifying and managing the risks that markets create.