

Market Microstructure and Continuous Trading

Summarized Presentation

November 17, 2024

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P1: Overview

- ▶ **The Role of Financial Markets Inside the Financial Network**
- ▶ **Recent Evolutions of Financial Markets**
- ▶ **Fragmentation(s)**

P2: Market Microstructure

Participants:

- ▶ Intermediaries (banks and brokers)
- ▶ Buyers and sellers

Key Concepts:

- ▶ Managing inventory risks
- ▶ Synchronizing transaction flows

P3: Financial Network Role

Maturity Transformation:

- ▶ Banks act as intermediaries, bridging natural borrowers with longer maturities and natural lenders with shorter ones.
- ▶ Borrowers often need mid to long-term loans for purposes like investments or projects.
- ▶ Lenders typically provide funds for short to mid-term durations, seeking quick returns.

Risk Management:

- ▶ Banks aim to avoid residual risks in their inventories, guided by regulatory measures such as capital requirements.
- ▶ A bank selling mortgage-backed securities may aim to fully hedge these positions to ensure no residual exposure.

Systemic Risk:

- ▶ Diversification at the system level is crucial; issues arise when banks hold risks in the same direction, as seen in the 2008 crisis.

Transaction Timing:

- ▶ Banks balance inflows and outflows asynchronously,

P4: Risk Transformation

Cash Portfolio Managers (PMs):

- ▶ Cash-rich but lack safety, driven by a "fear of losing money."

Risk Portfolio Managers (PMs):

- ▶ Rich in securities but yield-poor, requiring leverage and non-linear strategies to beat benchmarks.

Intermediaries:

- ▶ Bridge the gap between Cash PMs (liabilities) and Risk PMs (assets).
- ▶ Transactions are marked-to-market, ensuring that all interactions are tied to traded prices.

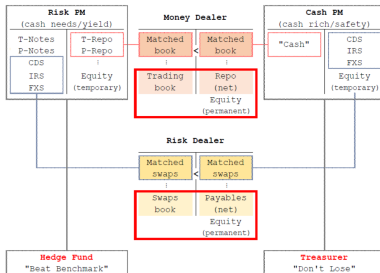
Hedging Challenges:

- ▶ Full netting of risks is rare; banks must hedge residual risks using markets and optimal trading algorithms.
- ▶ Continuous hedging assumes that someone in the market carries the opposite risk, enabling position netting through central counterparties (CCPs).

Liquidity Concerns:

- ▶ "Wrong-way risk" negatively impacts market liquidity, as

Risk Transformation Pictures



Source: Pozsar on Shadow Banking (2013)

Figure: Risk transformation

P5: Intermediation of Risks

Key Players:

- ▶ CCPs (Central Counterparties), Clearing Exchanges, and Triparty Agents (repo third-parties).

Regulation Goals:

- ▶ Secure financial transactions through cash or collateral deposits and netting positions and contracts.

Regulators' Perspective:

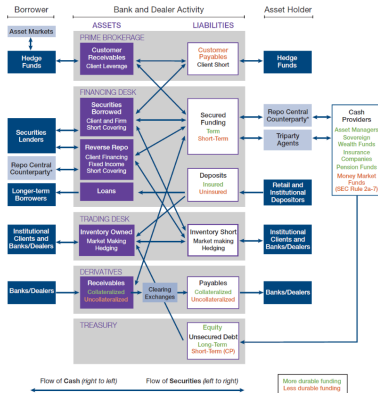
- ▶ A few well-regulated, unconflicted intermediaries provide comfort and stability for regulators and policymakers.

P6: Inside Investment Banks

Key Recommendations for Investment Banks:

- ▶ Net all books to reduce risk and cost.
- ▶ Enhance internal communication and match orders internally.
- ▶ Implement facilitation-like market-making schemes within the bank to synchronize metaorders.
- ▶ Smooth execution in external markets.
- ▶ Counterparty awareness is critical; trading one-way risk could have future cost implications.

Inside IB



Source: OFR Annual Report 2013

Figure: Inside IB

P7: Suboptimal Hedging

Examples of Suboptimal Hedging:

- ▶ Algorithms ignoring market impact (e.g., July 19, 2012 incident).

Insights:

- ▶ Literature highlights issues in execution costs and market impact.

Implications:

- ▶ Continuous hedging of remaining positions outside banks does not guarantee optimal outcomes.

P8: Modern Organization of Intermediaries

Key Recommendations for Investment Banks:

- ▶ Net all books to avoid maintaining two opposite positions, as it is both costly and risky.
- ▶ Improve internal communication to facilitate better risk management.
- ▶ Match small metaorders internally to reduce external market reliance.
- ▶ Execute remaining quantities in external markets as smoothly as possible.
- ▶ Ensure counterparty awareness to avoid future implications of one-way risk.

P9: Definition of Exchange

What is an Exchange?

- ▶ The owner of the price formation process (Regulator).
- ▶ A place to finance the economy and compete for clients (Exchange).
- ▶ A place where risk decreases (Market Maker).
- ▶ A venue where sellers meet buyers (Alternative Venue).

P10: Trading on Exchanges

Trading Types:

- ▶ **Batch Auctions:** Transactions grouped and executed at a single price.
- ▶ **Continuous Auctions:** Trades executed as orders arrive in real-time.

Logic:

- ▶ Price-driven mechanisms.
- ▶ Order-driven systems.

Limit Order Book (LOB):

- ▶ Multilateral, order-driven, continuous double auctions.
- ▶ Core infrastructure for modern market microstructure.

Trading on Exchange pictures



A Limit Order Book (LOB) hosts multilateral, order driven, continuous double auctions.

Figure: Trading on Exchange

P11: The Old Way

Three Distinct Layers:

- ▶ **Buy-Side:** Investors seeking to purchase assets.
- ▶ **Sell-Side:** Intermediaries like investment banks and brokers selling services, including liquidity.
- ▶ **Market Operators:** Entities like exchanges, CCPs, etc.

Evolving Perspectives:

- ▶ Earlier models (e.g., [Kyle, 1985]) often ignored the role of market operators.
- ▶ Modern works (e.g., [Foucault and Menkveld, 2008]) emphasize their importance in market dynamics.

Oldwayofexchange

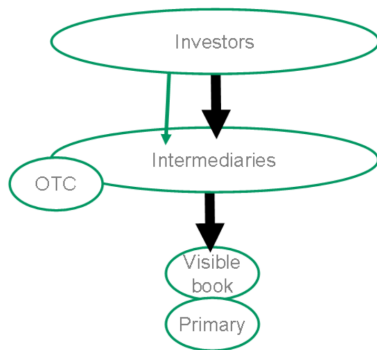


Figure: Old way of exchange

P12: Recent Evolution of Equity Markets

Goals of Market Regulation:

- ▶ Increase service quality with reliable, faster matching engines.
- ▶ Provide better, easier access to meaningful information (e.g., Chi-X, BATS, Fidessa).
- ▶ Reduce costs with lower trading fees and maker/taker models.
- ▶ Incentivize innovation through pegged orders, hidden orders, and new matching rules.

Limitations:

- ▶ No significant changes in listing mechanisms.
- ▶ No competition in fixing (close) auctions.

P13: Emergence of New Market Structures

Shift in Trading Practices:

- ▶ Trading occurs on a distributed network of heterogeneous platforms rather than centralized exchanges.

Emergence of new market Structures

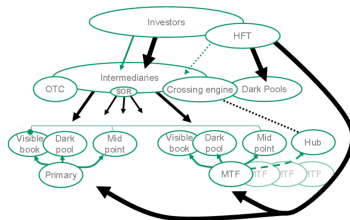


Figure: Emergence of new market

P14: New Participants

MTFs (Multilateral Trading Facilities):

- ▶ Offered a "one-size-fits-all" trading approach but required liquidity providers.
- ▶ Introduced rebates for limit orders to attract participants.

Emergence of High-Frequency Trading (HFT):

- ▶ Statistical arbitrage technologies combined with automated market-making led to the rise of HFT.
- ▶ Regulatory pressure (e.g., MiFID) forced brokers to adopt Smart Order Routers (SOR).

Market Complexity:

- ▶ Increased competition and technology adoption caused fear among participants (concerns about HFT profits).
- ▶ Development of dark pools in Europe to reduce information leakage.

Mergers and Consolidation:

- ▶ High fixed costs and intense competition resulted in mergers (e.g., LSE + Turquoise, BATS + Chi-X).

Technology Shift:

P15: Fragmented Markets

Nature of Fragmentation:

- ▶ Evident in trading flows and significantly affects communication protocols and order/transaction types.

Impact:

- ▶ Fragmentation increases investor choices but adds complexity to trading.

P16: Optimization Paradox

Core Idea:

- ▶ Adding parameters improves the optimum but increases complexity in finding it.

Application:

- ▶ Trading strategies benefit from added tools but require greater effort to optimize.

P17: The Role of Market Makers

Pan-European Market:

- ▶ Market making must be understood on a broader scale with trading spanning across Europe.

Dynamics of Liquidity:

- ▶ Traditional static liquidity measures are insufficient; dynamic measures are critical.

Redefinition of Services:

- ▶ Adaptation to fragmented, fast-paced markets is necessary.
- ▶ Splitting orders complicates the understanding of market makers' roles.

P18: Bilateral vs. Multilateral Trading

Bilateral Trading:

- ▶ Each market maker has a direct relationship with investors.
- ▶ Information asymmetry offers protection against adverse selection.
- ▶ Example: NYSE specialists historically operated under this bilateral model.

Multilateral Trading:

- ▶ Current market structures favor anonymous counterparties.
- ▶ Prices and quantities are disclosed to all participants.

Challenges:

- ▶ Increased risk of adverse selection.
- ▶ Difficulty in maintaining the same level of protection as bilateral systems.

P19: Fragmented Stock

Fragmentation Metrics:

- ▶ Aggregating transactions helps estimate exchange revenues.
- ▶ Useful for analyzing market share and liquidity distribution.

P20: Fragmentation in US vs. Europe

US Fragmentation:

- ▶ **Reg NMS:** Requires re-routing orders for better pricing.
- ▶ **NBBO:** Aggregates quotes from all venues.
- ▶ Consolidated tape ensures price transparency and efficiency.

European Fragmentation:

- ▶ Post-trading costs vary by venue, making consolidated tapes less useful.
- ▶ Brokers implement **Smart Order Routers (SOR)** for “Best Execution Policy.”

P21: Consolidated Tapes

Challenges in Europe:

- ▶ Unlike the US, post-trade costs vary across venues, reducing the utility of consolidated tapes.

Latency Issues:

- ▶ Smart Order Routers (SOR) interact with multiple venues at varying latencies.
- ▶ Order books are not synchronized, leading to potential inefficiencies.

Solutions:

- ▶ SORs delay orders to ensure simultaneous arrival but face challenges with dynamic market changes.

P22: Dealing with Latency

Latency Issues:

- ▶ SORs interacting with unsynchronized venues rely on outdated order book snapshots.

Example:

- ▶ Orders reaching venues at different times may result in incomplete execution due to cancellations.

Technology Considerations:

- ▶ GPUs are less ideal for low-latency tasks.
- ▶ FPGAs offer superior performance for handling data flows and reducing latency.

P23: Low Latency vs. High Frequency

Low Latency Trading:

- ▶ Focuses on reacting quickly to external information over long distances.
- ▶ Does not require frequent updates.

High Frequency Trading (HFT):

- ▶ Involves frequent adjustments (e.g., 100 times per second).
- ▶ Requires proximity to order books for efficient operations.

P24: Timestamping and Event Ordering

Key Concepts:

- ▶ Simultaneous events may appear in different orders based on observer position.
- ▶ Traders must decide between:
 - ▶ Using estimators for order book states.
 - ▶ Optimizing strategies across venues.

Examples in Dark Pools:

- ▶ Deterministic Optimization ([Ganchev et al., 2010]).
- ▶ Minimum Regret Approach ([Agarwal et al., 2010]).
- ▶ Stochastic Optimization ([Pagès et al., 2011]).

P25: Measuring Fragmentation

Market Share Metrics:

- ▶ Probability of a trade occurring on a specific venue.
- ▶ Likelihood of finding sufficient liquidity.
- ▶ Average trade size on each venue.
- ▶ Roundtrip costs for specific amounts on venues.

P26: Optimal Router Viewpoint

Core Concept:

- ▶ Traders optimize order allocation based on liquidity consumption flow (Φ_k) for each venue.

Challenges:

- ▶ Estimating liquidity flows is difficult due to latency in updates.
- ▶ Reaction time is constrained by the update rate:

$$\tau_{\text{reaction}} = \frac{1}{2\rho}$$

For $\rho = 250$ Hz, $\tau_{\text{reaction}} = 2$ ms.

Solutions in Literature:

- ▶ Adjusting limit prices and quantities using stochastic methods ([Pagès et al., 2011], [Laruelle et al., 2013]).

P27: Back to Intermediation

Intermediation Beyond Electronic Markets:

- ▶ Intermediaries ensure anonymity and price diffusion for transactions.
- ▶ They hedge remaining risks on electronic markets.

Recent Evolutions:

- ▶ Continuous risk hedging and flow crossing due to automation and regulation.

Challenges:

- ▶ Planning and scheduling within intermediaries.
- ▶ Synchronizing small parts of orders in anonymous pools.

References

- ▶ ensuring that all interactions are tied to traded prices.(?)
- ▶ Risk Neutral Pricing: Structured around sellable risks, allowing pricing without complete hedging.(?);No arbitrage
- ▶ Full netting of risks is rare; banks must hedge residual risks using markets and optimal trading algorithms.(?)
- ▶ Continuous hedging assumes that someone in the market carries the opposite risk, enabling position netting through central counterparties (CCPs).(?)
- ▶ Literature Examples: References to works by Stoikov and Saglam (2009) and Carmona and Webster (2012), exploring market-making and hedging risks.(?)
- ▶ Fragmentation: Trading flow, Communication protocol, Order and Transaction Types:
- ▶ Include references to works cited: [Stoikov and Saglam, 2009], [Carmona and Webster, 2012], etc.
- ▶ ;Additional