

In-Class Exercise: Algorithmic Trading Business Models

Exercise 1: Structured Debate — “Is Citadel Securities a Market Maker or a Hidden Exchange?”

Format: Split into two teams. Each team prepares arguments for its assigned position, then presents. After both sides speak, the class votes — but first, read the debrief questions.

Team A — “Citadel Securities Is a Market Maker”

Anchoring evidence: Citadel Securities is registered as a market maker, takes principal risk, holds inventory on its own balance sheet, and is paid through the spread between its bid and offer quotes. It is the counterparty on every fill it provides; it is not a venue.

Team A: Citadel Securities Is a Market Maker

Argument I

Argument II

Argument III

 Concession *Strongest argument AGAINST your position:*

 Closing *How you address the concession:*

Team B — “Citadel Securities Is a Hidden Exchange”

Anchoring evidence: A large share of US retail equity orders never touches a public exchange; they are internalised by wholesalers like Citadel Securities. From the retail investor’s point of view, the firm performs the function of a venue — matching buy and sell interest — even though the legal label is different.

Team B: Citadel Securities Is a Hidden Exchange

Argument I

Argument II

Argument III

 Concession *Strongest argument AGAINST your position:*

 Closing *How you address the concession:*

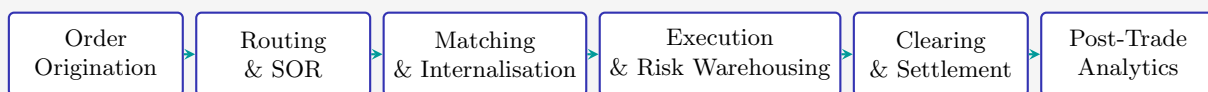
Debrief Questions

Q1: Does the answer — market maker or hidden exchange — matter for how regulators should supervise wholesale market makers? Why or why not?

- Q2:** Could the answer genuinely be “both”? If so, what does that imply about the usefulness of the traditional venue/principal distinction in modern equity markets?
- Q3:** Name another firm (in any sector) that performs the economic function of a marketplace while wearing a different legal label. What tensions does that mismatch create?

Exercise 2: Value Chain Mapping

Scenario: The trade lifecycle for an institutional order can be broken into six links. Algorithmic firms attack individual links with specialised solutions. Your task: for each link, identify which firm in the slate (Citadel Securities, Virtu, Jane Street, Two Sigma, or Optiver) most directly attacks it, describe the friction it removes, and predict the long-term outcome for the incumbent broker-dealer.



Trade-Lifecycle Link	Firm attacking It	Attack-Friction moved	Re-Replaces or Improves?	Bank Loses or Adapts?
Order Origination				
Routing & SOR				
Matching & Internalisation				
Execution & Risk Warehousing				
Clearing & Settlement				
Post-Trade Analytics				

Synthesis Question

- Q1:** Which link in the lifecycle is *most vulnerable* to algorithmic attack? Which is *most resistant*? Defend your reasoning with reference to switching costs, regulatory barriers, and the venue-habitat constraint discussed in the lecture.

Facilitator Solutions

Sample answers for instructor reference. These are illustrative; student reasoning may diverge and still be valid.

Exercise 1: Debate Sample Answers

Team A (Citadel Securities Is a Market Maker) — sample arguments

Argument I. Citadel Securities is registered and supervised as a market maker. Its quoting obligations, capital treatment, and risk-management framework all flow from that classification, not from venue rules. Regulatory form follows economic substance: the firm takes principal risk, warehouses inventory, and is paid through the spread it captures, exactly as a classical market maker does.

Argument II. On every fill the firm provides, it is the counterparty. There is no order book the public can post into; there is no membership; there is no matching of two external sides in the venue sense. Instead the firm absorbs the order, prices it from its inventory and risk view, and stands as the sole opposing principal. That is the defining mechanic of market making.

Argument III. The firm's revenue is the bid-offer spread net of inventory cost, hedging cost, and infrastructure cost. That revenue logic differs sharply from a venue, which earns access fees, market-data fees, and rebates rather than principal trading P&L. Two firms with similar market shares can therefore have very different economics depending on whether they sit in the venue role or the principal role.

Concession. The strongest argument against Team A is that economically, retail flow internalised at a wholesaler does not reach a public exchange, and from the retail investor's vantage point the wholesaler performs the matching function the exchange would otherwise have performed.

Closing. Even if the wholesaler captures order flow that would otherwise have gone to a public venue, the legal, regulatory, and economic substance of its role is principal market making. Treating it as a venue would mislabel both how it earns its margin and how it bears its risk.

Team B (Citadel Securities Is a Hidden Exchange) — sample arguments

Argument I. A large share of retail equity orders is internalised by wholesalers and never reaches a lit exchange. From the perspective of the buying and selling investors, the wholesaler is performing the matching function: their interests meet inside the wholesaler's book rather than in a public venue. Function, not legal label, determines whether the firm acts as a marketplace.

Argument II. The wholesaler's quoting behaviour shapes the price formation that the public sees. Because so much retail flow is internalised, the publicly quoted spreads are partly a function of what the wholesaler chooses to interact with. A firm whose decisions materially shape public price formation is, in economic substance, a venue, even if it carries a principal label.

Argument III. The wholesaler maintains direct connectivity to many retail-broker pipes and to many institutional venues; it is the connective layer between retail and institutional liquidity. That connective role is exactly what an exchange occupies, even though the wholesaler does not formally operate an order book.

Concession. The strongest argument against Team B is that the wholesaler bears principal risk on every fill and is paid through the spread, which exchanges do not do; calling it a venue obscures the principal-risk transformation that the wholesaler performs.

Closing. Whether or not the firm carries the legal label of an exchange, its economic function in the equity ecosystem — matching retail and institutional flow, shaping public price formation, and serving as the connective layer between two sides of the market — is much closer to a venue than the legal classification suggests. Supervision and disclosure should reflect that.

Debrief Q1 — Regulatory supervision

The classification matters because it drives which supervisory tools are deployed. A market maker is supervised primarily under principal-risk and quoting-obligation rules: capital adequacy, position-limit monitoring, fair-quoting standards, and best-execution responsibilities for its broker counterparties. A venue is supervised under venue rules: order-book transparency requirements, equal-access rules, fee-disclosure obligations, and market-integrity surveillance. When a firm performs functions of both, the regulator must decide which supervisory perimeter governs which slice of the activity. Mislabelling the firm leaves either the principal-risk dimension or the price-formation dimension under-supervised. The right answer therefore has direct consequences for systemic risk and for retail-investor protection.

Debrief Q2 — “Both” as an answer

The honest answer is often “both”: a wholesale market maker is structurally a principal counterparty for every fill and simultaneously the connective infrastructure between retail flow and institutional venues. That duality reveals that the traditional principal/venue distinction, inherited from a world where exchanges were physical floors and dealers were balance sheets, cannot cleanly capture a firm whose technology stack performs matching, hedging, and connectivity in one continuous workflow. If “both” is the right answer, it implies that supervisors, market-structure analysts, and academic researchers need a finer-grained taxonomy — function-by-function rather than entity-by-entity — to describe the modern wholesale-liquidity layer.

Debrief Q3 — Cross-sector blurring example

Amazon Marketplace blurs the boundary between retailer and marketplace. It sells products as a principal (sourced from suppliers, owned in inventory, sold from its own balance sheet) while simultaneously operating a marketplace where third-party sellers list directly to consumers. From the consumer’s vantage point, the same site performs both roles. The tension this creates is acute for competition policy (does Amazon compete with the sellers it hosts, and on what terms?), for tax authorities (which jurisdiction owes which tax on which leg of the transaction?), and for consumers (which entity is responsible if a marketplace product is defective?). The parallel to Citadel Securities is direct: the firm performs the economic function of both a principal counterparty and a marketplace, and the legal label captures only one of those roles.

Exercise 2: Value-Chain Mapping Sample Answers

Trade-Lifecycle Link	Firm Attacking It	Friction Removed	Replaces or Improves?	Bank Loses or Adapts?
Order Origination	Two Sigma (systematic strategies)	Reliance on traditional fundamental research for systematic flow generation	Improves	Bank Adapts
Routing & SOR	Virtu (algo execution stack)	Buy-side reliance on internal smart-order-routing engineering	Replaces	Bank Adapts
Matching & Internalisation	Citadel Securities	Public-venue execution cost for predictable retail flow	Replaces	Bank Loses
Execution & Risk Warehousing	Optiver (continuous options quoting)	Voice-RFQ relationship dependency for liquid options contracts	Improves	Bank Adapts
Clearing & Settlement	Established CCPs and brokers (incumbent-served)	None displaced by algo firms; the link sits with the regulated clearing infrastructure	Improves	Bank Adapts
Post-Trade Analytics	Jane Street and Virtu (TCA tooling)	Sell-side reliance on bespoke transaction-cost analysis spreadsheets	Improves	Bank Adapts

Synthesis Question Sample Answer

The most vulnerable link is Matching and Internalisation. Switching costs at the matching stage are very low for the broker that routes the order: the routing decision is a software setting, and the broker's customers are largely indifferent to which counterparty fills their order so long as price improvement is delivered. Cross-side network effects compound the vulnerability — the more retail-broker flow a wholesaler attracts, the better the price improvement it can offer, which attracts the next broker. The most resistant link is Clearing and Settlement. The clearing infrastructure depends on regulated central counterparties, on legal finality of settlement, and on supervisory oversight of margin and default-management procedures. None of these is contestable by an algorithmic firm without acquiring full venue and clearing licences, which would convert it into the very kind of regulated infrastructure it might otherwise have hoped to disrupt. Furthermore, the venue-habitat constraint discussed in the lecture means an algorithmic firm whose BM is built around continuous quoting on lit electronic venues would have nothing to bring to the clearing layer beyond what incumbents already provide.