Can preferred clearing reduce post-trade costs?

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Abstract

Preferred clearing mechanisms can yield lower equilibrium fees than full clearinghouse interoperability. We develop a simple model with two CCPs — a leader and a follower — and heterogeneous traders who choose a CCP and pay clearing fees. Under preferred clearing, trades settle on the follower CCP only when both counterparties are affiliated; otherwise, the leader CCP clears the trade. In equilibrium, strong network effects discipline competition and reduce fees, especially when high-frequency trading is prevalent. Incumbent CCPs opt for a preferred clearing system unless the share of high-frequency traders is sufficiently high, in which case they allow full interoperability with competitors.

Keywords: post-trade infrastructure, central clearing, network effects, market structure

JEL Codes: G11, G12, G14

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1 Introduction

"Ultimately, the EU should aim to create a single central counterparty platform (CCP) and a single central securities depository (CSD) for all securities trades."

– Mario Draghi, "The Future of European Competitiveness", September 2024

Clearing and settlement systems form the backbone of a well-functioning financial market, converting trade promises on exchanges into actual transfers of assets between investors. Following the financial crisis of 2008, regulators around the world intensified efforts to enhance market stability by mandating central counterparties (CCPs) to clear a range of over-the-counter derivatives and securities – through, notably, the Dodd-Frank Act in the United States and the European Market Infrastructure Regulation (EMIR) in the European Union.

What is the optimal market structure for central counterparties? On the one hand, CCPs exhibit characteristics of a natural monopoly, as consolidating buyers and sellers enhances netting efficiency and reduces systemic risk. On the other hand, fostering competition through multiple CCPs may lead to innovation, lower fees, and improved services. Different jurisdictions adopt distinct models: In the United States, the Depository Trust and Clearing Corporation (DTCC) effectively holds a monopoly over clearing. In contrast, the European market, historically more fragmented along national lines, supports multiple CCPs, some affiliated with major exchanges such as Euronext or the London Stock Exchange. In September 2024, former president of the European Central Bank (ECB) Mario Draghi suggested that Europe should converge toward the U.S. model to improve capital efficiency and lower post-trading costs.[1] In response, emerging European CCPs such as Cboe Clear argue for "competition and user choice rather [...] than forced consolidation."[2]

Two major models have emerged in Europe to manage competition among multiple central counterparty clearing houses: interoperability and preferred clearing. Interoperability allows multiple CCPs to provide clearing services to investors on a given trading venue, enabling both counterparties to a transaction (i.e., buyer and seller) to independently choose their preferred

[1]See European Commission, The Future of European Competitiveness, September 2024.
[2]See Cboe Clear Europe, Europe Needs Clearing Competition, Not a Single CCP, October 24, 2024.

CCP. In contrast, the preferred clearing model requires both counterparties to agree on the same CCP; if their choices do not align, the transaction is cleared through a default CCP. As of early 2025, 73% of trade flow in European equity markets is cleared through the interoperability model, while 22% follows the preferred clearing model.[3] Figure 1 provides a schematic representation of how traders can bypass an exchange's main CCP under preferred clearing arrangements.

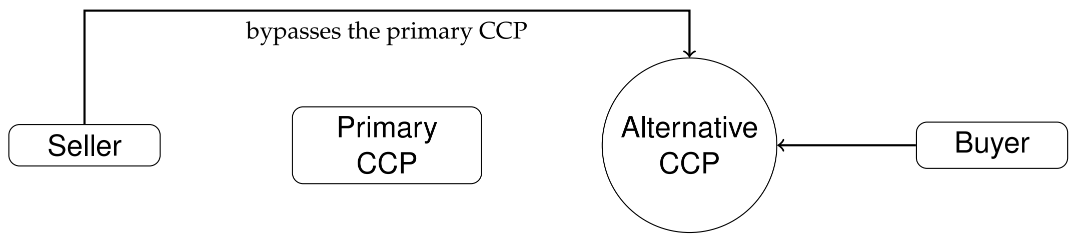


Figure 1: Preferred clearing mechanism.

In this paper, we develop a simple model of competition among post-trade infrastructures to compare investor costs between the interoperability and preferred clearing systems. In the model, two central clearing counterparties (CCPs) — an incumbent "leader" and an entrant "follower" — compete in clearing fees to attract a continuum of heterogeneous traders who differ in trading frequencies. The leader CCP represents large clearinghouses affiliated with major exchanges (e.g., Euronext Clear, Eurex Clearing, or LCH), while the follower stands in for newer, independent clearinghouses operating across multiple exchanges, such as Cboe Clear.

A key friction in our model is incumbency: When moving from the leader to the follower CCP, traders incur an upfront switching cost, representing operational expenses of migrating to a new infrastructure. To compensate for this cost and attract investors, entrant CCPs post lower clearing fees in equilibrium.

Which clearing house should investors choose? Intuitively, the answer depends on their trading horizon. High-frequency traders are more inclined to pay the upfront switching cost, as their larger volume allows them to recoup these costs more rapidly. In contrast, low-frequency traders, having fewer trading opportunities, are more likely to remain with the incumbent CCP.

[3]See Cboe Clear Europe, Preferred Clearing, accessed March 2025.

The key difference between interoperable and preferred clearing setups lies in the role of network effects. Under interoperable clearing, CCPs compete solely on fees; the incumbency advantage allows the leader to extract rents by easily deterring low-frequency traders from switching. In contrast, preferred clearing places greater emphasis on network effects. Once the follower CCP attracts high-frequency traders — who may already be active on alternative platforms — low-frequency investors are increasingly likely to trade against follower-affiliated counterparties, thereby strengthening their incentive to switch. Therefore, follower CCPs can leverage their existing investor base on alternative exchanges, and potentially the existence of cross-venue arbitrage opportunities to first capture high-frequency traders and subsequently build the critical network mass to draw in low-frequency traders as well.

What is the impact of the clearing mechanism on post-trade costs? In equilibrium, when the share of high-frequency traders is low, clearing fees are higher under the preferred clearing mechanism than under interoperability. In this case, entrant CCPs fail to achieve a critical mass, limiting competition and allowing the leader to extract higher fees due to its incumbent position. However, if the high-frequency trading volume share exceeds a threshold, stronger network effects enable the follower to leverage their growing client base. As a result, preferred clearing fees can drop below interoperability levels since leader CCPs are forced to reduce fees to retain their low-turnover customers. This dynamic ultimately reduces post-trade costs for investors.

Finally, we show that, in most cases, the leader CCP opts for a preferred clearing system because it preserves market share even if it requires reducing fees. However, when high-frequency traders make up a sufficiently large proportion of volume, or when there are abundant cross-market trading opportunities, the leader may find it unpalatable to lower fees substantially to counter growing network effects: in this case, it will permit full interoperability with other CCPs.

Our results have direct policy implications and contribute to the ongoing academic and regulatory debate on post-trade infrastructure. We show that preferred clearing fosters competition not only in prices but also in network size, which can lead to lower trading costs relative to interoperability arrangements that focus solely on price competition. This is especially likely in markets with significant high-frequency trading activity. Moreover, we derive conditions under which interoperability and preferred clearing emerge endogenously and show that the resulting market structure does not always guarantee the lowest trade costs for investors.

Related literature. We contribute to a growing literature on post-trade infrastructure (Menkveld and Vuillemey, 2021, provide a comprehensive survey on recent findings in the economics of clearing). Closest to our paper, Benos, Huang, Menkveld, and Vasios (2024) document that clearing fragmentation in USD interest rate swaps generates a dead-weight loss of $80 million a day, while Duffie and Zhu (2011) argue that a single clearinghouse for correlated asset classes (e.g., interest rate swaps and credit derivatives) enables more efficient netting. We complement this literature by comparing different CCP competition models in fragmented markets.

Several studies investigate the impact of central clearing on asset prices and systemic risk. For example, Bernstein, Hughson, and Weidenmier (2019) examine the 1892 introduction of a clearinghouse on the New York Stock Exchange, finding that it reduced network contagion and counterparty risk. Similarly, Menkveld, Pagnotta, and Zoican (2015) document that the introduction of a CCP on Nordic equity markets in the wake of the global financial crisis helped to reduce price volatility. Duffie, Scheicher, and Vuillemey (2015) build a model to argue that mandatory central clearing can reduce the aggregate collateral demand relative to a bilateral system. In contrast, Menkveld (2017) argue that clearinghouses can themselves become exposed to a new form of systemic risk arising from "crowded trades," particularly when netting efficiencies are low. Huang, Menkveld, and Yu (2020) estimate that trade crowding contributes 17% to the aggregate CCP risk exposure. Biais, Heider, and Hoerova (2016) argue that the mutualization of risk in clearing houses might enhance moral hazard concerns. In our paper, we abstract from the risk management functions of CCPs and focus solely on their role as post-trade operators who compete in clearing fees and may benefit from an incumbent advantage and network effects.

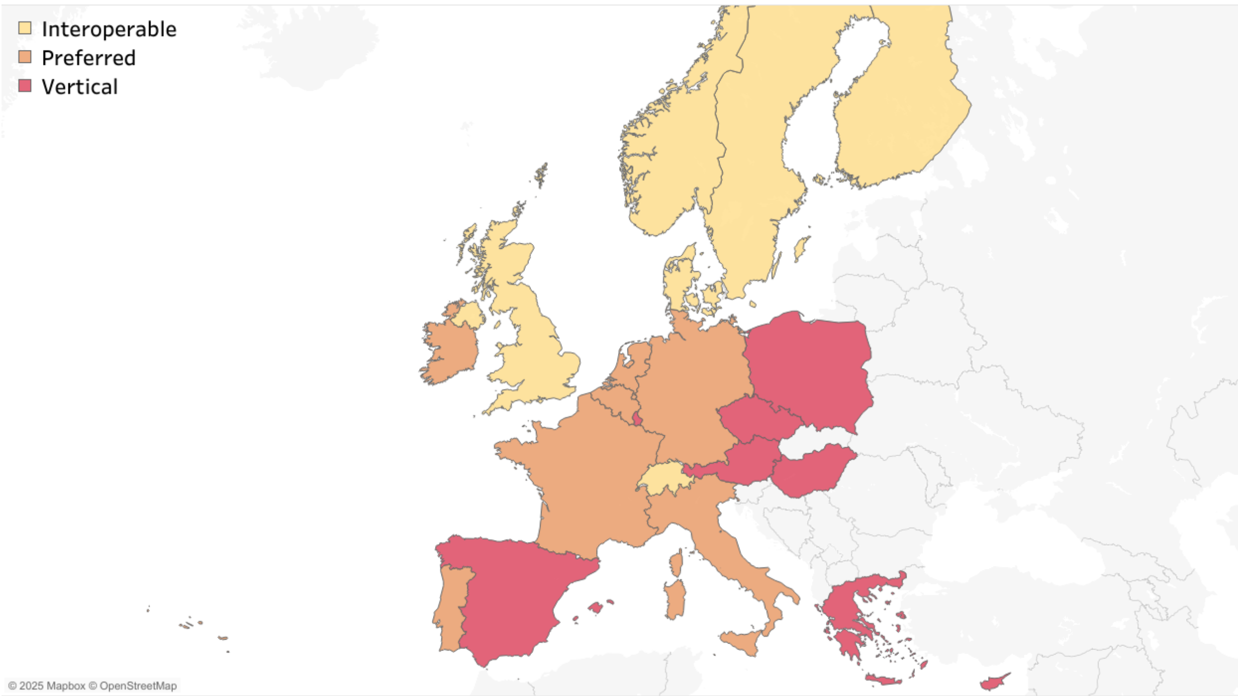
Another strand of literature focuses on the optimal design and industrial organization of the post-trade environment. Degryse, Van Achter, and Wuyts (2022) argue that clearing fees should be charged based on a trade's marginal cost rather than a flat fee, given that same-broker trades are cheaper to process. Their model resembles ours in that it abstracts from risk considerations and views clearinghouses as trade processors that incur only marginal costs. In a similar vein, Khapko and Zoican (2020) analyze the optimal settlement time, contending that penalties for failures-to-deliver should be contingent on security borrowing costs. Meanwhile, Huang and Zhu (2024) examine the optimal auction design for defaulting CCP members and advocate for juniorization, whereby members submitting inferior bids have their guarantee funds drawn upon before those of members with superior bids.

Finally, we build on a rich literature in industrial organization and finance that examines incumbency and network externalities. Katz and Shapiro (1986) raise the possibility of multiple equilibria in markets with network effects, while Pagano (1989) show that if an asset is traded on two identical exchanges, market participants gravitate to a single exchange due to these effects, although multiple equilibria are also. We model incumbency by employing the attached consumer equilibrium concept from Biglaiser and Crémer (2020), which serves as an effective equilibrium selection tool and enables us to derive sharp predictions regarding the formation of turnover-based clienteles for clearing services. Similarly, Khomyn, Putnins, and Zoican (2024) use this equilibrium concept to analyze clienteles across same-index ETFs.

2 Clearing landscape in European equity markets

Figure 2 provides an overview of the clearing landscape for European equities, which is governed by the European Market Infrastructure Regulation (EMIR). Several exchanges, particularly on smaller markets such as Athens, Prague, Warsaw, or Stuttgart, follow a vertical model and operate their own in-house clearing services. Larger exchanges, where participants typically operate across multiple venues, allow competition among clearinghouses by enabling either preferred clearing or fully interoperable models.

Figure 2: **Overview of clearing arrangements in European equity markets**
This figure provides an overview of clearing models adopted across European countries.



For instance, Euronext Clearing — which processes cash equity trades across the pan-European Euronext network (Paris, Amsterdam, Lisbon, Brussels, Milan, and Dublin) — and Eurex Clearing (operating on Germany's Deutsche Börse) both use a preferred clearing model. Under this system, traders may clear on alternative platforms (such as Cboe or LCH Ltd) provided both counterparties are affiliated with the alternative clearinghouse. In contrast, Nasdaq Nordic markets, SIX Swiss Exchange, most multilateral trading facilities (MTFs) and the equity arm of London's LCH employ fully interoperable clearing. A more detailed description of the clearing models adopted by different exchanges in each country is provided in Table 1.

Table 1: Clearing arrangements in European equity markets

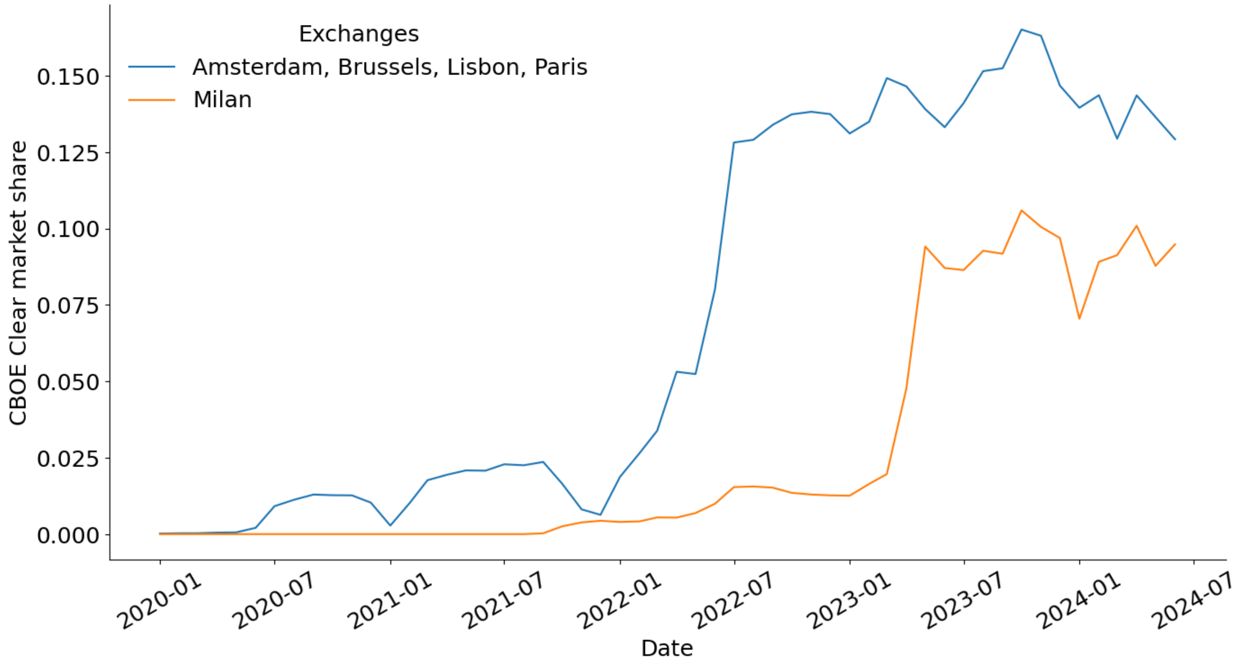
This table presents clearing arrangements in European equity markets by detailing the clearing model, country of operation, and the designated main and preferred clearing counterparties for each exchange.

Exchange	Model	Country	Main CCP	Preferred CCP
Athens Stock Exchange	Vertical	Greece	ATHEXClear	
Bolsas y Mercados Españoles	Vertical	Spain	BME Clearing	
Boerse Stuttgart	Vertical	Germany	Boerse Stuttgart Clearing	
Budapest Stock Exchange	Vertical	Hungary	KELER CCP	
Cyprus Stock Exchange	Vertical	Cyprus	in-house CCP	
London Stock Exchange (only International Order Book/ETF)	Vertical	UK	LCH Ltd	
Luxembourg Stock Exchange	Vertical	Luxembourg	in-house CCP	
Prague Stock Exchange	Vertical	Czech Republic	in-house CCP	
Vienna Stock Exchange	Vertical	Austria	CCP Austria	
Warsaw Stock Exchange	Vertical	Poland	KDPW_CCP	
Deutsche Börse	Preferred	Germany	Eurex Clearing AG	Cboe Clear
Euronext Milano	Preferred	Italy	Euronext Clearing	Cboe Clear and LCH.Ltd
Euronext Paris	Preferred	France	Euronext Clearing	Cboe Clear
Euronext Brussels	Preferred	Belgium	Euronext Clearing	Cboe Clear
Euronext Amsterdam	Preferred	Netherlands	Euronext Clearing	Cboe Clear
Euronext Lisbon	Preferred	Portugal	Euronext Clearing	Cboe Clear
Euronext Dublin	Preferred	Ireland	Euronext Clearing	Cboe Clear
SIX Swiss Exchange	Interoperable	Switzerland	SIX x-clear A	
Equiduct	Interoperable	-	Equiduct	
London Stock Exchange (SETS)	Interoperable	UK	LCH Ltd	
Nasdaq Helsinki	Interoperable	Finland	Nasdaq Clearing	
Nasdaq Stockholm	Interoperable	Sweden	Nasdaq Clearing	
Nasdaq Copenhagen	Interoperable	Denmark	Nasdaq Clearing	
Euronext Oslo	Interoperable	Norway	Euronext Clearing	
MTFs (CBOE, Turquoise, Aquis, Sigma X)	Interoperable	-	multiple	

Figure 3 showcases how a pan-European entrant clearinghouse (Cboe Clear) builds market share across several Euronext exchanges where it operates under a preferred clearing arrangement. Rather than expanding steadily, the entrant CCP's volume share increases in sudden jumps, which consistent with the presence of network externalities. That is, when large or high-frequency traders switch to the entrant CCP, they generate liquidity and matching benefits that entice additional traders to join in short bursts.

Figure 3: **Cboe Clear market share on preferred clearing markets**

This figure shows the dynamics of Cboe Clear's market share (in equity volume cleared) on Euronext exchanges in Amsterdam, Brussels, Lisbon, Paris, and Milan. Data source: Cboe Clear website.



3 A model of preferred clearing

Asset and market. We consider a continuous-time economy in which a single asset is traded. The asset has a constant common value $v_t \equiv v > 0$ for all $t > 0$.

To isolate the effects of post-trade infrastructure choices, we fix the trading price to be equal to the asset' common value (akin to Foucault, Kadan, and Kandel, 2013). This is equivalent to trading occurring in a single-tick limit order market with tick size v.

Agents. There are two types of agents in the economy:

(i) a unit continuum of risk-neutral traders indexed by i;

(ii) two competing clearinghouses (CCPs) that process trades.

There are infinitely many traders, ensuring that individual choices do not influence equilibrium outcomes. Following Pagnotta and Philippon (2018) and Khomyn, Putnins, and Zoican (2024), traders experience liquidity shocks at random times, exponentially distributed with rate λ_i. Each shock prompts a trader to buy or sell one unit of the asset with equal probability. All traders share a common discount factor $\rho \in [0, 1]$.

All trades must be cleared by one of two competing CCPs, which differ in their market position: one acts as the *leader* (L), the other as the *follower* (F). We interpret the leader clearinghouse as the incumbent CCP of a major national exchange (e.g., Euronext Clearing) and the follower as the clearinghouse of an alternative trading venue or multilateral trading facility (e.g., Cboe Clear). The clearinghouses charge fees f_L and f_F per trade. Without loss of generality, we normalize their operating costs to zero.

The follower clearinghouse F starts with a "captive" mass β of homogeneous traders, each arriving at rate Λ. These traders can be interpreted as natural alternative venue participants or, for instance, foreign investors with limited appetite to switch clearinghouses — such as Swiss investors trading French stocks without opening accounts with French CCPs.

The leader clearinghouse starts with a mass $1 - \beta$ of traders with heterogeneous arrival rates. The average arrival rate matches that of the follower clearinghouse fraction, such that in aggregate the arrival rate of traders affiliated with L is $(1 - \beta)\,\Lambda$. A fraction α of aggregate volume comes of high-turnover traders with arrival rate λ_h, while a volume share $1 - \alpha$ is generated by low-turnover traders with arrival rate λ_ℓ, where $\lambda_h > \lambda_\ell > 0$:

$$\underbrace{\int \lambda_h \,\mathrm{d}i}_{\alpha\Lambda} + \underbrace{\int \lambda_\ell \,\mathrm{d}i}_{(1-\alpha)\Lambda} = \Lambda. \tag{1}$$

Traders affiliated with the leader clearinghouse can switch to the follower by paying a fixed cost $c > 0$, which represents the operational expenses of adapting their systems to a different clearing infrastructure.

Clearing Mechanism. The leader clearinghouse can choose between *preferred clearing* and *full interoperability* with the follower:

1. Under *preferred clearing*, a trade clears with the follower CCP F if and only if both the buyer and the seller have switched to the follower. In this case, both parties pay the follower's clearing fee f_F. Otherwise, the trade clears with the leader CCP L, and traders pay fee f_L.
2. Under *full interoperability*, each trader pays the clearing fee of their affiliated CCP, irrespective of the counterparty's affiliation.

Timing. Figure 4 illustrates the sequence of events in the model. First, at time $t = -3$, the leader clearinghouse decides on whether to allow full interoperability with the entrant or use a preferred clearing model. Next, at $t = -2$, the leader and follower CCPs sequentially set their clearing fees. Given fees, at $t = -1$ traders decide on whether to stay with the leader clearinghouse or switch to the follower. Finally, continuous trading starts at $t = 0$.

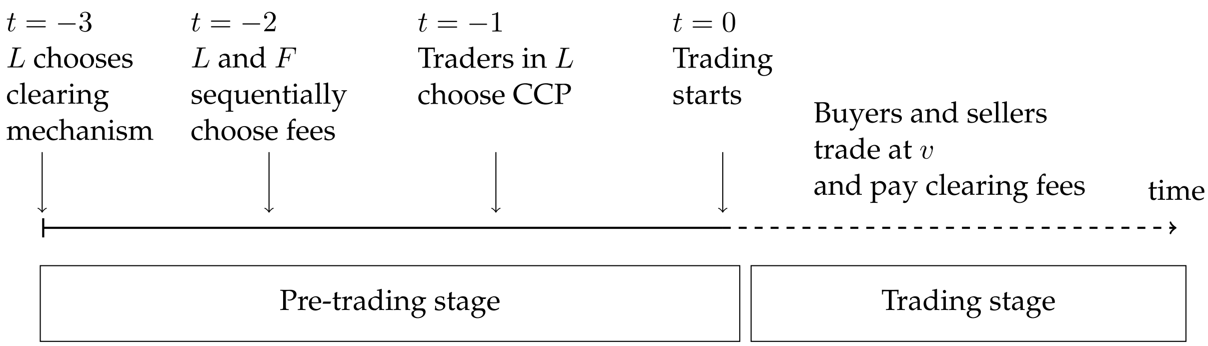


Figure 4: Model timing

4 Equilibrium

We solve the game by backward induction. Given the clearing mechanism and fees, we first determine traders' optimal choice of clearinghouse at $t = -1$. To do so, we apply the *attached consumers* equilibrium concept from Biglaiser and Crémer (2020), which emphasizes the role of incumbency. Next, we derive the equilibrium clearing fees at $t = -2$, followed by the leader's optimal choice between preferred and interoperable clearing at $t = -3$.

4.1 Trader clearinghouse choice at $t = -1$

Since all trades occur at the fundamental value v, traders select the clearinghouse that minimizes their lifetime costs, which include expected clearing fees and potential switching costs. Let Λ_k denote the aggregate arrival rate of traders affiliated with clearinghouse $k \in \{L, F\}$, which will be pinned down in equilibrium.

Consider a trader who receives liquidity shocks at rate λ_i. Upon receiving a shock, the trader enters the market and either executes against an outstanding order or waits for a counterparty to arrive. Since the market consists of a continuum of traders, the probability of finding an immediate match converges to one, implying negligible waiting times.[4] Therefore, trader i executes orders at rate λ_i.

If trader i remains with the *leader* clearinghouse, they pay the clearing fee f_L on each trade, regardless of the counterparty's affiliation or the clearing mechanism design. This results in a cost of $\lambda_i f_L$ per unit of time. Given the discount rate ρ, the expected lifetime cost is

$$\text{Cost}_i^L = \frac{\lambda_i}{\rho} f_L. \tag{2}$$

Switching under preferred clearing. Under a preferred clearing design, if trader i switches to the *follower* clearinghouse, they incur an upfront switching cost c. Additionally, they pay the follower clearing fee f_F when trading with a counterparty affiliated with CCP F, which occurs with probability $\frac{\Lambda_F}{\Lambda_F + \Lambda_L}$. Otherwise, they pay the leader's clearing fee f_L. Under preferred clearing, the expected lifetime cost from switching is

$$\text{Cost}_i^{F,\text{pc}} = c + \frac{\lambda_i}{\rho} \left(\frac{\Lambda_F}{\Lambda_F + \Lambda_L} f_F + \frac{\Lambda_L}{\Lambda_F + \Lambda_L} f_L \right). \tag{3}$$

[4] In steady state, an outstanding order remains unmatched until either trader i or a counterparty arrives to clear it. The probability that a counterparty's order is outstanding when trader i arrives is $p = \frac{\Lambda}{\Lambda + \lambda_i \, \mathrm{d}i} \approx 1$, where $\Lambda = \int \lambda_i \, \mathrm{d}i$. This follows from the steady-state balance equations of a Markov process: the probability of being in a given state equals the fraction of arrivals contributing to that state, divided by the total exit rate.

It follows that a trader with arrival rate λ_i switches to the follower CCP if and only if

$$\text{Cost}_i^{F,\text{pc}} < \text{Cost}_i^L \Leftrightarrow \frac{\lambda_i}{\rho} \underbrace{\frac{\Lambda_F}{\Lambda_F + \Lambda_L}}_{\text{network effects}} (f_L - f_F) > c. \tag{4}$$

Switching under interoperability. Under full clearing interoperability, a trader i who switches to the *follower* clearinghouse also incurs the switching cost c, but subsequently pays the follower's clearing fee f_F on all future trades. Under clearing interoperability, the expected lifetime cost from switching is

$$\text{Cost}_i^{F,\text{io}} = c + \frac{\lambda_i}{\rho} f_F. \tag{5}$$

With interoperability, a trader with arrival rate λ_i switches to the follower CCP if and only if

$$\text{Cost}_i^{F,\text{io}} < \text{Cost}_i^L \Leftrightarrow \frac{\lambda_i}{\rho}(f_L - f_F) > c. \tag{6}$$

Equations (3) and (6) yield three salient implications. First, economies of scale matter: more frequent traders (larger λ_i) have stronger incentives to switch, as they can amortize the fixed cost of adapting to a new post-trade infrastructure. Second, in both preferred clearing and interoperability market designs, the follower's fee must be lower than the leader's fee to induce traders to incur the switching cost. Third, and most importantly, while under full interoperability traders compare fees directly, under preferred clearing network effects play a crucial role — switching to a new clearinghouse is more likely when other traders have already migrated. Since the network effects term in (3) is always below one, it follows that switching is more difficult under preferred clearing than under interoperability, and entrant CCPs must offer deeper fee discounts.

We model the switching process using the *attached consumers* (AC) equilibrium concept from Biglaiser and Crémer (2020). The AC equilibrium is a refinement of Nash equilibrium particularly suited to settings where incumbency advantages matter and consumers face coordination frictions in sequential price competition. In our context, investors cannot easily coordinate to select the lowest-fee clearinghouse.

At $t = -1$, all investors are initially affiliated with the leader CCP, L, and may choose to migrate to the follower CCP, F. The migration process unfolds iteratively over an arbitrary number of steps. Investors evaluate their utility from remaining with L or switching to F, assuming no other investor moves. This assumption captures the coordination frictions inherent in clearinghouse selection under the preferred regime. Investors are ranked by their individual gains from switching, from highest to lowest. If some investors *strictly* benefit from migrating to F, a small measure of those with the highest gains switches first. The process repeats until no investor strictly prefers to move.

The inequalities (3) and (6) are more likely to hold for high-turnover traders than for low-turnover traders, as the former benefit from greater economies of scale and can better amortize the upfront switching cost. Consequently, under the logic of the AC equilibrium, high-turnover investors gain more from migrating to a cheaper CCP and will switch first, followed by low-turnover investors.

At the start of the migration process, the two clearinghouses have installed trader bases of $\Lambda_F = \beta\Lambda$ and $\Lambda_L = (1-\beta)\Lambda$. Under preferred clearing, from equation (3), a high-turnover investor switches to the follower CCP if and only if

$$\frac{\lambda_h}{\rho}\beta(f_L - f_F) > c. \tag{7}$$

The initial migration of a small fraction of high-turnover traders triggers a *snowballing* effect, ultimately leading all high-turnover traders to switch to the follower CCP. This dynamic arises from positive network externalities: each investor migration from L to F increases the likelihood of matching with another migrated trader, thereby reducing expected clearing costs and making F more attractive.

Once all high-turnover traders have migrated to the entrant CCP, the probability of matching with a trader affiliated with F increases to

$$\frac{\beta\Lambda + (1-\beta)\alpha\Lambda}{\Lambda} = \beta + (1-\beta)\alpha > \beta.$$

Next, low-turnover traders evaluate whether switching is individually optimal, which occurs if

$$\frac{\lambda_\ell}{\rho}\left(\beta+(1-\beta)\alpha\right)\left(f_L-f_F\right)>c. \tag{8}$$

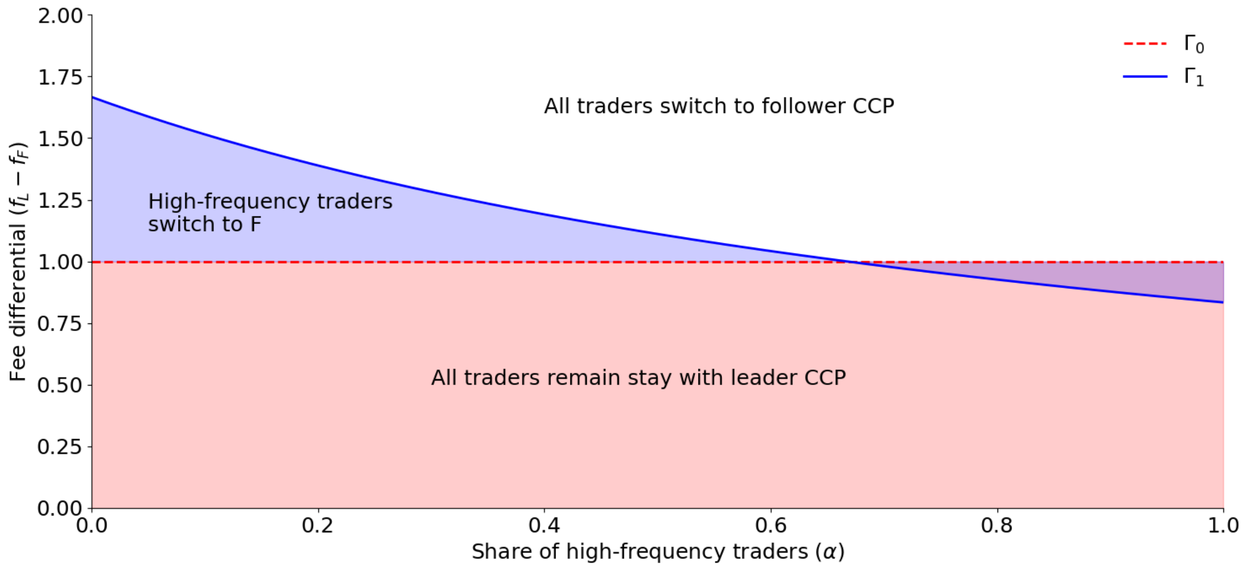
If inequality (8) does not hold, migration halts, and low-turnover traders remain with the incumbent clearinghouse. However, if (8) is satisfied, a small fraction of low-turnover traders switches to the entrant CCP. This triggers the same snowballing effect as in the case of high-turnover traders, leading to a full migration. Lemma 1 formalizes the result.

Lemma 1. (Trader's CCP choice at $t=-1$ under preferred clearing)
Define $\Gamma_0^{pc}=\frac{c\rho}{\lambda_h\beta}$ *and* $\Gamma_1^{pc}=\frac{c\rho}{\lambda_\ell(\beta+(1-\beta)\alpha)}$. *The unique AC equilibrium trading strategies in the game at* $t=-1$ *are:*

1. *If* $f_L-f_F\leq\Gamma_0^{pc}$*, all traders remain with the leader CCP* L*.*
2. *If* $\Gamma_0^{pc}\leq\Gamma_1^{pc}$ *and* $f_L-f_F\in(\Gamma_0^{pc},\Gamma_1^{pc}]$*, high-turnover traders migrate to the follower CCP* F*, while low-turnover traders stay with* L*.*
3. *If* $f_L-f_F>\max\left\{\Gamma_0^{pc},\Gamma_1^{pc}\right\}$*, all traders switch to the follower CCP* F*.*

Figure 5 illustrates the equilibrium trader switching behavior described in Lemma 1. The figure shows how the decision to switch from the leader to the follower CCP depends on the fee differential (f_L-f_F) and the share of high-frequency traders α. When the fee differential is low, all traders remain with the leader CCP. As the fee differential increases beyond Γ_0, high-frequency traders switch first, leveraging their higher trading intensity to recoup the switching cost. When the fee differential exceeds $\max\{\Gamma_0,\Gamma_1\}$, all traders migrate to the follower CCP.

Figure 5: **Trader CCP choice under preferred clearing.**
This figure shows the regions in which traders switch from the leader to the follower CCP, with the fee differential $(f_L - f_F)$ on the vertical axis and the share of high-frequency traders α on the horizontal axis. The red dashed line indicates Γ_0^{pc}, and the blue curve represents Γ_1^{pc}.



Under full interoperability, network effects disappear, which implies that traders' decisions depend solely on the clearing fee differential. This leads to a similar equilibrium structure but with different fee differential thresholds, as defined in Lemma 2.

Lemma 2. (Trader's CCP choice at $t = -1$ under interoperability)
Define $\Gamma_0^{io} = \frac{c\rho}{\lambda_h}$ and $\Gamma_1^{io} = \frac{c\rho}{\lambda_\ell} > \Gamma_0^{io}$ since $\lambda_\ell < \lambda_h$. It follows that the unique AC equilibrium trading strategies in the game commencing at $t = -1$ are:

1. *If $f_L - f_F \leq \Gamma_0^{io}$, all traders remain with the leader CCP L.*
2. *If $f_L - f_F \in (\Gamma_0^{io}, \Gamma_1^{io}]$, high-turnover traders migrate to the follower CCP F, whereas low-turnover traders stay with the leader CCP L;*
3. *Finally, if $f_L - f_F > \Gamma_1^{io}$, all traders switch to the follower CCP F.*

4.2 Clearing fees at $t = -2$

Next, we solve for the optimal clearing fees. At $t = -2$, the leader first sets the fee f_L, followed by the clearinghouse F, which sets the fee f_F.

Trades arrive at rate $\frac{\Lambda}{2}$, as each trade requires the arrival of both a buyer and a seller (in any order). To determine the arrival rates of different types of trades, consider an LL trade. The probability that a randomly arriving counterparty is affiliated with L is $\frac{\Lambda_L}{\Lambda}$. Since arrivals are independent, the probability that both counterparties are affiliated with L is

$$p_{LL} = \left(\frac{\Lambda_L}{\Lambda}\right)^2. \tag{9}$$

Given that the total trade arrival rate is $\frac{\Lambda}{2}$, the arrival rate of an LL trade is

$$R_{LL} = \frac{\Lambda}{2} p_{LL} = \frac{\Lambda_L^2}{2\Lambda}. \tag{10}$$

Applying the same reasoning, the arrival rates of trades in which both counterparties are affiliated with CCP F, and those in which counterparties are affiliated with different CCPs, are given by

$$R_{FF} = \frac{\Lambda_F^2}{2\Lambda} \text{ and } R_{LF} = \frac{\Lambda_L \Lambda_F}{\Lambda}, \tag{11}$$

respectively.

4.2.1 Clearing fees under preferred CCP design

In this section, we solve for equilibrium fees at $t = -2$ under a preferred clearing mechanism. Consider first the case in which $\Gamma_0^{\text{pc}} < \Gamma_1^{\text{pc}}$. If the leader CCP L sets a fee f_L at or below Γ_0^{pc}, then by Lemma 1, the follower CCP cannot attract any investors with a positive fee f_F. Consequently, at $t = -2$, CCP F opts not to enter the market. Second, if f_L falls within the range $\left(\Gamma_0^{\text{pc}}, \Gamma_1^{\text{pc}}\right]$, the follower's optimal strategy is to set $f_F = f_L - \Gamma_0^{\text{pc}}$ to attract high-turnover trader. Setting a higher fee would result in $f_L - f_F > \Gamma_0^{\text{pc}}$, preventing the follower from capturing any market share. Conversely, offering a discount greater than Γ_0^{pc} would lower the per-unit fee without increasing market share, thereby reducing profits.

The most interesting case occurs when $f_L > \Gamma_1^{\mathrm{pc}}$. In this scenario, the follower CCP faces a choice: to either offer a deep fee discount at $f_F = f_L - \Gamma_1^{\mathrm{pc}}$, allowing it to capture the entire market (that is, clear all trades happening at rate $\frac{\Lambda}{2}$), or offer a lower discount and set $f_F = f_L - \Gamma_0^{\mathrm{pc}}$, to serve only the α segment of high-turnover investors, which leads to clearing fees accruing at rate R_{FF}. The follower opts to target both high- and low-turnover investors if

$$\begin{aligned} \frac{\Lambda}{2} \times \left(f_L - \Gamma_1^{\mathrm{pc}}\right) > \frac{\left(\alpha(1-\beta)\Lambda + \beta\Lambda\right)^2}{2\Lambda} \times \left(f_L - \Gamma_0^{\mathrm{pc}}\right) \Rightarrow \\ \Rightarrow f_L > \Gamma_0^{\mathrm{pc}} + \left(\Gamma_1^{\mathrm{pc}} - \Gamma_0^{\mathrm{pc}}\right) \frac{1}{1-\left(\alpha+\beta\left(1-\alpha\right)\right)^2} > \Gamma_1^{\mathrm{pc}}, \end{aligned} \tag{12}$$

where the last inequality follows from $\frac{1}{1-(\alpha+\beta(1-\alpha))^2} > 1$.

Summing up, the follower's best response to the leader's clearing fee is given by

$$f_F^{\star}\left(f_L\right) = \begin{cases} 0 & \text{if } f_L \leq \Gamma_0^{\mathrm{pc}} \quad \text{(do not enter the market)}, \\ f_L - \Gamma_0^{\mathrm{pc}} & \text{if } f_L \in \left(\Gamma_0^{\mathrm{pc}}, \Gamma_0^{\mathrm{pc}} + \left(\Gamma_1^{\mathrm{pc}} - \Gamma_0^{\mathrm{pc}}\right) \frac{1}{1-(\alpha+\beta(1-\alpha))^2}\right], \\ f_L - \Gamma_1^{\mathrm{pc}} & \text{if } f_L > \Gamma_0^{\mathrm{pc}} + \left(\Gamma_1^{\mathrm{pc}} - \Gamma_0^{\mathrm{pc}}\right) \frac{1}{1-(\alpha+\beta(1-\alpha))^2}. \end{cases} \tag{13}$$

We now analyze the leader CCP's optimal clearing fee, f_L, given the follower's reaction function in equation (13). To monopolize the market, the leader cannot set a fee higher than Γ_0^{pc}. Additionally, the leader will never set f_L above $\Gamma_0^{\mathrm{pc}} + \left(\Gamma_1^{\mathrm{pc}} - \Gamma_0^{\mathrm{pc}}\right) \frac{1}{1-(\alpha+\beta(1-\alpha))^2}$, as this would allow the follower to offer a deep discount and capture the entire market.

However, the leader can accommodate entry by setting a clearing fee

$$f_L = \Gamma_0^{\mathrm{pc}} + \left(\Gamma_1^{\mathrm{pc}} - \Gamma_0^{\mathrm{pc}}\right) \frac{1}{1-\left(\alpha+\beta(1-\alpha)\right)^2}, \tag{14}$$

which allows them to retain both the R_{LL} and R_{LF} streams of trades, where

$$
\begin{aligned}
R_{LL}+R_{LF} &= \frac{\Lambda}{2}\left[(1-\alpha)^2(1-\beta)^2+2(1-\alpha)(1-\beta)(\beta+\alpha(1-\beta))\right] \\
&= \frac{\Lambda}{2}\left(1-(\alpha+\beta-\alpha\beta)^2\right). \qquad (15)
\end{aligned}
$$

It turns out that accommodating the entry of the follower CCP is optimal if

$$
\underbrace{\frac{\Lambda}{2}\left(1-(\alpha+\beta-\alpha\beta)^2\right)\left[\Gamma_0^{\text{pc}}+\left(\Gamma_1^{\text{pc}}-\Gamma_0^{\text{pc}}\right)\frac{1}{1-(\alpha+\beta(1-\alpha))^2}\right]}_{\substack{L \text{ profit if it} \\ \text{accommodates entry}}} > \underbrace{\left(1-\beta^2\right)\frac{\Lambda}{2}\Gamma_0^{\text{pc}}}_{\substack{L \text{ profit if it} \\ \text{deters entry}}}, \qquad (16)
$$

condition which can be written simpler as

$$
\Gamma_1^{\text{pc}} > \Gamma_0^{\text{pc}}\left(1+\alpha\left(1-\beta\right)\left(2\beta+\left(1-\beta\right)\alpha\right)\right). \qquad (17)
$$

If $\Gamma_0^{\text{pc}} > \Gamma_1^{\text{pc}}$, clearinghouses are unable to segment their investor clientele. At $t=-2$, the reaction function of CCP F simplifies to:

$$
f_F^{\star}(f_L) = \begin{cases} 0, & \text{if } f_L \le \Gamma_0^{\text{pc}} \quad \text{(no market entry)}, \\ f_L-\Gamma_1^{\text{pc}}, & \text{if } f_L > \Gamma_0^{\text{pc}} \quad \text{(complete market capture)}. \end{cases} \qquad (18)
$$

As before, setting $f_L \le \Gamma_0^{\text{pc}}$ deters the follower from entering the market. However, if the leader sets $f_L > \Gamma_0^{\text{pc}}$, the follower can undercut with $f_F = f_L - \Gamma_1^{\text{pc}}$ and capture the entire market. Consequently, the leader's optimal strategy is to set $f_L = \Gamma_0^{\text{pc}}$, the highest fee that prevents follower entry. Proposition 1 summarizes the equilibrium fees across all scenarios under preferred clearing.

Proposition 1. (Clearing fees under the preferred model)
Let $\Gamma_0^{pc} = \frac{c\rho}{\lambda_h\beta}$ *and* $\Gamma_1^{pc} = \frac{c\rho}{\lambda_\ell(\beta+(1-\beta)\alpha)}$ *as in Lemma 1. Then,*

(i) If $\Gamma_1^{pc} \le \Gamma_0^{pc}\left(1+\alpha\left(1-\beta\right)\left(2\beta+\left(1-\beta\right)\alpha\right)\right)$*, then the leader CCP sets* $f_L^{pc,\star} = \Gamma_0^{pc}$ *and captures*

both high- and low-turnover strategic traders. The follower CCP does not capture any strategic traders.

(ii) If $\Gamma_1^{pc} > \Gamma_0^{pc}\left(1+\alpha\left(1-\beta\right)\left(2\beta+\left(1-\beta\right)\alpha\right)\right)$*, then both CCP clear trades in equilibrium and post fees as:*

$$f_L^{pc,\star} = \Gamma_0^{pc} + \left(\Gamma_1^{pc} - \Gamma_0^{pc}\right)\frac{1}{1-\left(\alpha+\beta(1-\alpha)\right)^2} \text{ and}$$
$$f_F^{pc,\star} = f_L^{pc,\star} - \Gamma_0^{pc} = \left(\Gamma_1^{pc} - \Gamma_0^{pc}\right)\frac{1}{1-\left(\alpha+\beta(1-\alpha)\right)^2}. \tag{19}$$

At $t=-1$*, all high-turnover traders migrate to the follower CCP* F *whereas the low-turnover traders stay with the incumbent* L*.*

4.2.2 Clearing fees under interoperability

Under interoperability, each trader pays the clearing fee of their affiliated CCP. Thus, the leader clearinghouse captures the full fee stream from R_{LL} trades and half of the fee stream from R_{LF} trades:

$$R_{LL} + \frac{1}{2}R_{LF} = \frac{\Lambda_L^2}{2\Lambda} + \frac{\Lambda_L\Lambda_F}{2\Lambda} = \frac{\Lambda_L}{2}, \tag{20}$$

since by definition, $\Lambda_L + \Lambda_F = \Lambda$. Similarly, the follower clearinghouse captures the full fee stream from R_{FF} trades and half of the fee stream from R_{LF} trades:

$$R_{FF} + \frac{1}{2}R_{LF} = \frac{\Lambda_F^2}{2\Lambda} + \frac{\Lambda_L\Lambda_F}{2\Lambda} = \frac{\Lambda_F}{2}. \tag{21}$$

In contrast to the preferred clearing setup, under interoperability it always holds that $\Gamma_0^{\text{io}} < \Gamma_1^{\text{io}}$, as defined in Lemma 2: That is, clientele segmentation is always feasible with interoperability, though not necessarily incentive compatible for clearinghouses.

The argument proceeds along the same lines as in Section 4.2.1, with a few key differences regarding the expression for volume shares. In particular, the follower CCP opts to target the entire market if:

$$\frac{\Lambda}{2} \times \left(f_L - \Gamma_1^{\text{io}}\right) > \frac{\left(\alpha(1-\beta)+\beta\right)\Lambda}{2} \times \left(f_L - \Gamma_0^{\text{io}}\right) \Rightarrow$$
$$\Rightarrow f_L > \Gamma_0^{\text{io}} + \left(\Gamma_1^{\text{io}} - \Gamma_0^{\text{io}}\right)\frac{1}{(1-\alpha)(1-\beta)} > \Gamma_1^{\text{io}}, \tag{22}$$

which leads to the updated reaction function

$$f_F^{\star}(f_L) = \begin{cases} 0 & \text{if } f_L \leq \Gamma_0^{\text{io}} \quad \text{(do not enter the market)}, \\ f_L - \Gamma_0^{\text{io}} & \text{if } f_L \in \left(\Gamma_0^{\text{io}}, \Gamma_0^{\text{io}} + \left(\Gamma_1^{\text{io}} - \Gamma_0^{\text{io}}\right)\frac{1}{(1-\alpha)(1-\beta)}\right], \\ f_L - \Gamma_1^{\text{io}} & \text{if } f_L > \Gamma_0^{\text{io}} + \left(\Gamma_1^{\text{io}} - \Gamma_0^{\text{io}}\right)\frac{1}{(1-\alpha)(1-\beta)}. \end{cases} \tag{23}$$

Further, it turns out that accommodating the entry of the follower CCP under interoperability is optimal if

$$\underbrace{\frac{\Lambda}{2}(1-\alpha)(1-\beta)\left[\Gamma_0^{\text{io}} + \left(\Gamma_1^{\text{io}} - \Gamma_0^{\text{io}}\right)\frac{1}{(1-\alpha)(1-\beta)}\right]}_{\substack{L \text{ profit if it} \\ \text{accommodates entry}}} > \underbrace{\frac{\Lambda}{2}(1-\beta)\Gamma_0^{\text{io}}}_{\substack{L \text{ profit if it} \\ \text{deters entry}}}, \tag{24}$$

condition which can be written simpler as

$$\Gamma_1^{\text{io}} > \Gamma_0^{\text{io}}\left(1 + \alpha(1-\beta)\right). \tag{25}$$

Proposition 2 mirrors the result in Section 4.2.1 for the case of full interoperability.

Proposition 2. (Clearing fees under interoperability)
Let $\Gamma_0^{io} = \frac{c\rho}{\lambda_h}$ and $\Gamma_1^{io} = \frac{c\rho}{\lambda_\ell}$ as in Lemma 2. Then,

(i) If $\Gamma_1^{io} \leq \Gamma_0^{io}(1+\alpha(1-\beta))$, then the leader CCP sets $f_L^{io,\star} = \Gamma_0^{io}$ and captures both high- and low-turnover strategic traders. The follower CCP does not capture any strategic traders.

(ii) If $\Gamma_1^{io} > \Gamma_0^{io}(1+\alpha(1-\beta))$, *then both CCP clear trades in equilibrium and post fees as:*

$$f_L^{io,\star} = \Gamma_0^{io} + \left(\Gamma_1^{io} - \Gamma_0^{io}\right)\frac{1}{(1-\alpha)(1-\beta)} \text{ and}$$
$$f_F^{io,\star} = f_L^{io,\star} - \Gamma_0^{io} = \left(\Gamma_1^{io} - \Gamma_0^{io}\right)\frac{1}{(1-\alpha)(1-\beta)}. \tag{26}$$

At $t=-1$, *all high-turnover traders migrate to the follower CCP* F *whereas the low-turnover traders stay with the incumbent* L.

Figure 6: **Equilibrium clearing fees under preferred and interoperable clearing**

This figure illustrates the equilibrium clearing fees set by the leader (left) and follower (right) clearinghouses under different levels of trader segmentation (β). The top row corresponds to low β, while the bottom row corresponds to high β. Solid lines represent fees under the preferred clearing regime, while dashed lines represent fees under full interoperability. The horizontal axis shows the share of high-frequency traders (α).

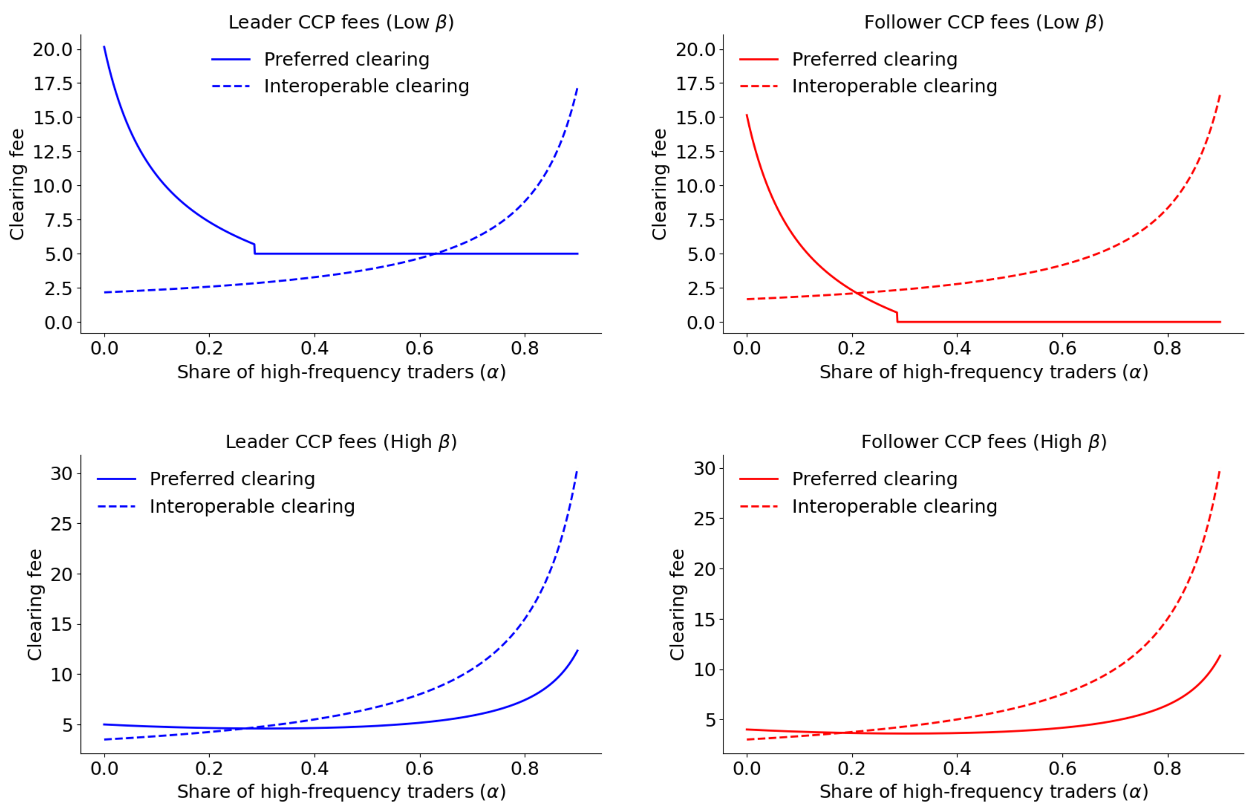


Figure 6 highlights how clearing fees evolve under different clearing regimes and distribution of trader horizons. A first insight is that the follower's clearing fees are always lower than those of the leader. This reflects the incumbency advantage of CCP L, which allows it to extract higher rents from traders who face switching costs. In contrast, the follower must compete aggressively to attract order flow, particularly from traders with lower barriers to switching.

Second, under interoperability, both the leader and follower fees increase in equilibrium with the share of high-turnover traders (α). If α is large, then a relatively small share of volume is generated by low-turnover investors. In this case, from equation (22), the follower CCP has little incentive to offer a deep fee discount to attract low-frequency traders, since this would harm revenues on its captive clienteles and high-frequency traders who have already switched. As a result, the leader CCP is able to set higher fees without fearing that they will be substantially undercut by the follower.

The economic mechanism is subtly different under a preferred clearing mechanism, since network effects play an important role. As high-frequency traders migrate to the follower CCP, the matching rate with F-affiliated traders improves. This effect strengthens incentives for low-frequency traders to also switch to CCP F. As a result, the leader CCP is forced to lower its fees to retain low-frequency traders. In turn, this drives down the follower's fees due to competition.

The net effect of these forces depends on the share of high-frequency traders. When α is low, the network effect dominates, and clearing fees decline as more traders move to the follower. However, when α is sufficiently high, the same fee-setting logic from interoperability takes over: the follower, having secured a critical mass of high-frequency traders, starts raising fees on its captive users. This effect is particularly strong when the follower CCP has a large installed base (β is high). At some point, if α is large enough, the leader may proactively lower fees to prevent further migration, limiting the entrant's market share.

The key result is that if both α and β are low – such that there are few high-frequency traders as well as trading opportunities on entrant markets – clearing fees under preferred clearing are higher than under interoperability, making traders better off with interoperability.

However, when α is high, network externalities serve as an effective disciplining force, keeping clearing fees below the interoperability level. This suggests that preferred clearing can be pro-competitive in markets where high-frequency traders are prevalent and play a central role in market liquidity.

4.3 Clearing mechanism choice at $t = -3$

To determine when the leader CCP allows for interoperability, we compare its profits under the two regimes. From Proposition 1, the equilibrium profit for the leader CCP under the preferred clearing regime is

$$\Pi_L^{\text{pc}} = c\rho \times \begin{cases} \dfrac{1-\beta^2}{\beta\lambda_h}, & \text{if } \dfrac{\lambda_h}{\lambda_\ell} \leq \tau_{\text{pc}}, \\ \dfrac{1-\Big(\alpha+\beta(1-\alpha)\Big)^2}{\lambda_h\beta} + \dfrac{1}{\lambda_\ell\left(\beta+(1-\beta)\alpha\right)} - \dfrac{1}{\lambda_h\beta}, & \text{if } \dfrac{\lambda_h}{\lambda_\ell} > \tau_{\text{pc}}. \end{cases} \tag{27}$$

where $\tau_{\text{pc}} = \frac{\beta+(1-\beta)\alpha}{\beta}\Big[(1+\alpha(1-\beta)\Big(2\beta+\alpha(1-\beta)\Big)\Big]$. Similarly, from Proposition 2, the equilibrium profit for the leader CCP under the interoperability regime is

$$\Pi_L^{\text{io}} = c\rho \times \begin{cases} \dfrac{1-\beta}{\lambda_h}, & \text{if } \dfrac{\lambda_h}{\lambda_\ell} \leq \tau_{\text{io}}, \\ \dfrac{(1-\alpha)(1-\beta)}{\lambda_h} + \dfrac{1}{\lambda_\ell} - \dfrac{1}{\lambda_h}, & \text{if } \dfrac{\lambda_h}{\lambda_\ell} > \tau_{\text{io}}, \end{cases} \tag{28}$$

where $\tau_{\text{io}} = 1 + \alpha(1-\beta)$.

Lemma 3. *Let $\tau_{io} = 1 + \alpha(1-\beta)$ and $\tau_{pc} = \Big[1+\alpha(1-\beta)\Big(2\beta+\alpha(1-\beta)\Big)\Big]\frac{\beta+\alpha(1-\beta)}{\beta}$. Then, $\tau_{io} < \tau_{pc}$.*

From equations (27) and (28), the leader CCP deters the follower's entry when the dispersion in arrival rates, measured by $\frac{\lambda_h}{\lambda_\ell}$, is sufficiently low. For a high degree of heterogeneity among investors, CCPs can segment the market and extract rents from their respective clienteles. In fact, Lemma 3 establishes a pecking order between the heterogeneity thresholds in the two regimes: the leader CCP is more likely to prevent entry under preferred clearing, thereby preserving its network effects.

To compare the leader's profits, it suffices to distinguish three regimes of investor heterogeneity (measured by $\frac{\lambda_h}{\lambda_\ell}$): low heterogeneity when $\frac{\lambda_h}{\lambda_\ell} \leq \tau_{\text{io}}$; moderate heterogeneity when $\frac{\lambda_h}{\lambda_\ell} \in (\tau_{\text{io}}, \tau_{\text{pc}}]$; and high heterogeneity when $\frac{\lambda_h}{\lambda_\ell} > \tau_{\text{pc}}$.

For low heterogeneity in investor arrival rates, i.e. when $\frac{\lambda_h}{\lambda_\ell} \leq \tau_{\text{io}}$ the leader CCP always opts for the preferred clearing mechanism. This follows immediately since

$$\frac{1-\beta^2}{\beta\lambda_h} > \frac{1-\beta}{\lambda_h} \Leftrightarrow \frac{1+\beta}{\beta} > 1 \quad \text{for all } \beta \in [0,1], \tag{29}$$

ensuring that the revenue from preferred clearing exceeds that from interoperability.

Proposition 3. *If $\tau_{io} < \frac{\lambda_h}{\lambda_\ell} \leq \tau_{pc}$, the leader's profit under the interoperability (IO) regime exceeds that under the preferred-clearing (PC) regime if and only if*

$$\frac{\lambda_h}{\lambda_\ell} > \frac{1}{\beta} + \alpha(1-\beta). \tag{30}$$

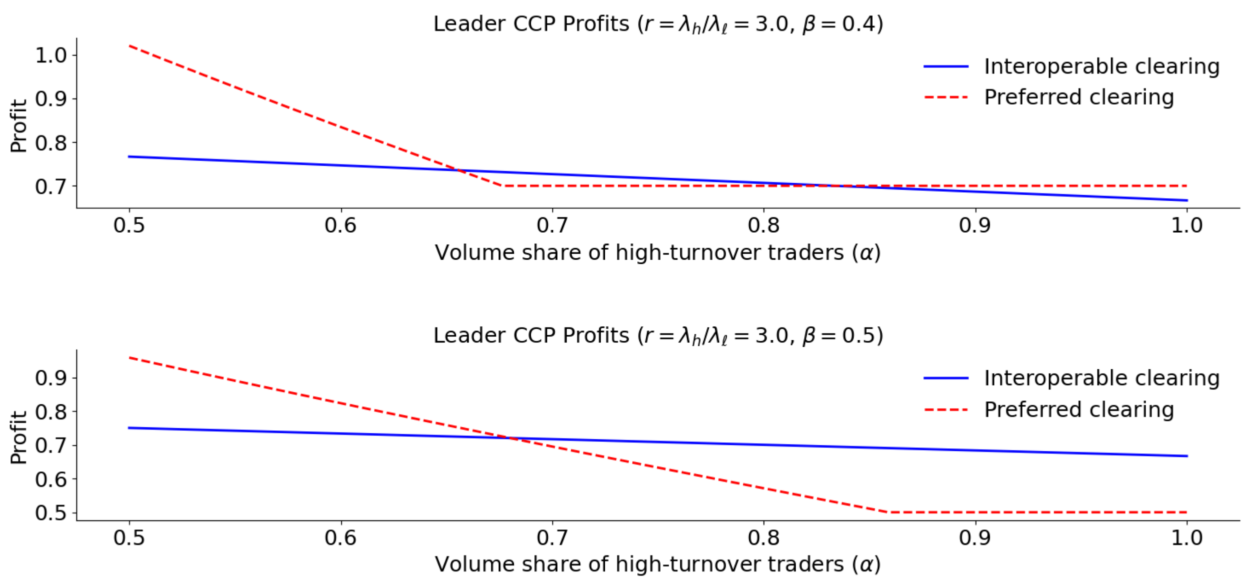
Conversely, if $\frac{\lambda_h}{\lambda_\ell} > \tau_{pc}$ the leader's profit under the interoperability (IO) regime exceeds that under the preferred-clearing (PC) regime if and only if

$$\frac{\lambda_h}{\lambda_\ell} < \frac{\alpha\left(\beta + \alpha(1-\beta)\right)^2}{\beta(1-\alpha)}, \tag{31}$$

a threshold which increases in α.

Figure 7 illustrates this result. When the share of high-turnover traders (α) is relatively low, the leader CCP earns higher profits under preferred clearing, leveraging its incumbency advantage and the follower's weaker potential to generate network effects. However, as α increases and the market becomes dominated by high-turnover traders, the follower CCP is able to attract volume more effectively, compelling the leader to reduce fees under the preferred regime. Beyond a critical mass of high-frequency traders, the leader finds it more profitable to adopt interoperability rather than maintaining low fees under preferred clearing. Futher, when traders have more opportunities on entrant markets (larger β), the leader CCP is willing to accept interoperability for a wider range of α values, since a larger captive base on the follower CCP amplifies its network effect. These results highlight how either regime can emerge in equilibrium, depending on the share of high-turnover traders and the size of the follower's captive clientele.

Figure 7: **Leader CCP profits under preferred and interoperable clearing.**
The figure shows the equilibrium profit of the leader clearinghouse as a function of the share of high-frequency traders (α), under both preferred clearing (solid line) and full interoperability (dashed line). The top panel corresponds to a low level of trading opportunities on the entrant market (β is low), while the bottom panel corresponds to a high level of trading opportunities (β is high).



5 Conclusion

We contribute to a lively policy debate on the optimal market structure of the clearing and settlement system. While some jurisdictions, such as the United States, leverage the natural monopoly characteristics of CCPs and mandate a single central counterparty, other markets — notably in Europe — encourage competition among multiple clearinghouses. Empirical evidence suggests that nearly three-quarters of traders clear through interoperable systems, allowing free CCP selection, whereas a significant share (22%) use the preferred system, first introduced by BATS in 2011. This divergence highlights a gap in incentives: large incumbent CCPs tend to favor the preferred model, while newer entrants advocate for interoperability.

Our analysis reveals that there is no one-size-fits-all solution. In our model, preferred clearing enables smaller CCPs to leverage trading opportunities on MTF venues and attract high-frequency traders. High-frequency traders may generate a critical network effect to overcome the inertia of low-frequency traders and induce a cascade of switching from incumbent to entrant CCPs, therefore disciplining fee competition. Although preferred clearing may lead to higher costs when trading opportunities on MTFs are sparse or the proportion of high-frequency traders is low, it can reduce post-trade costs in markets dominated by high-turnover investors.

These findings have important policy implications. Regulators must carefully consider the role of network externalities in either promoting or restricting fee competition when designing clearinghouse mandates. Future research should further explore the dynamic interplay between trader behavior and clearinghouse competition in the context of evolving market technologies (such as distributed ledger) and regulatory reforms. Our work lays the foundation for such investigations by highlighting the critical role of network effects in shaping post-trade outcomes.

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A Proofs

Lemma 3

Proof. Let $x = \alpha(1-\beta)$, so that we can write $\tau_{\text{io}} = 1 + x$ and $\tau_{\text{pc}} = \Big(1 + x(2\beta + x)\Big)\frac{\beta+x}{\beta}$. Multiplying both sides of the inequality $\tau_{\text{io}} < \tau_{\text{pc}}$ by the positive constant β, it suffices to show that

$$\beta(1+x) < \Big(1 + x(2\beta + x)\Big)(\beta + x)\,.$$

Note that

$$1 + x(2\beta + x) = 1 + 2\beta x + x^2.$$

Expanding the right-hand side, we have

$$(1 + 2\beta x + x^2)(\beta + x) = \beta + x + 2\beta^2 x + 3\beta x^2 + x^3\,.$$

Thus, the inequality becomes

$$\beta + \beta x < \beta + x + 2\beta^2 x + 3\beta x^2 + x^3\,.$$

Subtracting $\beta + \beta x$ from both sides yields

$$0 < x + 2\beta^2 x + 3\beta x^2 + x^3 - \beta x = x\Big[1 + (2\beta^2 - \beta) + 3\beta x + x^2\Big]\,.$$

Since $x > 0$ (because $\alpha > 0$ and $1 - \beta > 0$) and the bracketed expression is clearly positive for $\beta \in (0,1)$ and $x > 0$, the inequality holds. Therefore,

$$\tau_{\text{io}} < \tau_{\text{pc}}\,.$$

□

Proposition 3

Proof. We consider the two cases separately.

Case (i): Moderate heterogeneity. Suppose that

$$\tau_{\text{io}} < r \le \tau_{\text{pc}}, \tag{A.1}$$

Then, from equations (27) and (28), the inequality

$$\Pi_L^{\text{io}} > \Pi_L^{\text{pc}} \Leftrightarrow \frac{1}{\lambda_\ell} - \frac{\alpha+\beta-\alpha\beta}{\lambda_h} > \frac{1-\beta^2}{\beta\lambda_h}. \tag{A.2}$$

Multiplying both sides of (A.2) by $\lambda_h > 0$ gives

$$\frac{\lambda_h}{\lambda_\ell} - (\alpha+\beta-\alpha\beta) > \frac{1-\beta^2}{\beta}. \tag{A.3}$$

Letting $r = \frac{\lambda_h}{\lambda_\ell}$, (A.3) becomes

$$r > \frac{1-\beta^2}{\beta} + \beta + \alpha(1-\beta) = \frac{1}{\beta} + \alpha(1-\beta). \tag{A.4}$$

which is equivalent to condition (30).

Case (ii): Large heterogeneity. Now suppose that $r > \tau_{\text{pc}}$. Let $A = \alpha + \beta\,(1-\alpha)$, such that the IO profit can be rewritten as

$$\Pi_L^{\text{io}} = c\rho\left[\frac{1}{\lambda_\ell} - \frac{A}{\lambda_h}\right]. \tag{A.5}$$

Multiplying (A.5) by λ_h, we obtain

$$\lambda_h\,\Pi_L^{\text{io}} = r - A. \tag{A.6}$$

Similarly, rewriting (27) and using $\beta + (1-\beta)\alpha = A$, we have

$$\lambda_h\,\Pi_L^{\text{pc}} = \frac{1-A^2}{\beta} + \frac{r}{A} - \frac{1}{\beta} = \frac{r}{A} - \frac{A^2}{\beta}. \tag{A.7}$$

Thus, the inequality $\Pi_L^{\text{io}} > \Pi_L^{\text{pc}}$ is equivalent to

$$r - A > -\frac{A^2}{\beta} + \frac{r}{A}. \tag{A.8}$$

Rearrange (A.8) by subtracting $\frac{r}{A}$ and adding A from both sides:

$$r - \frac{r}{A} > A - \frac{A^2}{\beta}. \tag{A.9}$$

Factoring r on the left yields

$$r\left(1 - \frac{1}{A}\right) > A\left(1 - \frac{A}{\beta}\right). \tag{A.10}$$

Since $A < 1$, we multiply (A.10) by the negative number $\frac{A}{A-1}$ and obtain

$$r < A\,\frac{\beta - A}{\beta}\,\frac{A}{1 - A}. \tag{A.11}$$

Substituting $A = \alpha + \beta - \alpha\beta$, we obtain

$$r < \frac{\alpha A^2}{\beta(1-\alpha)} \quad (\text{since } 1 - A = (1-\beta)(1-\alpha)). \tag{A.12}$$

This is exactly condition (31). Combining the results of Cases (i) and (ii) completes the proof. □