Inter Market Competition, Trading Fees and the Make/Take Decision

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Work in Progress, Comments Welcome!

Plan

1. **Introduction**
2. **Model**
3. **Equilibrium**
4. **Implications for bid-ask spreads and trading rates**
5. **Optimal fees with a single trading platform**
6. **Optimal fees with competing trading platforms**

Background

- **Important changes in the industrial organization of stock markets both in Europe and in the U.S.:**
  1. *Widespread adoption of limit order books.*
  2. *Entry of new platforms (BATS, Chi-X, LavaFlow, EdgeX)*$\Longrightarrow$Increased inter-market competition.
  3. *New pricing models: make/take fees.*
  4. *New breed of participants:* high frequency traders, electronic market-makers (GETCO, Optiver, Tradebots etc...)

Background (ctd)

- **Market Shares (US markets-Source: BATS website, July 2009.)**

1. Nasdaq: 19.5%
2. NYSE (Arca + Floor): 28.98%
3. BATS: 10.8%
4. DirectEdge (A+E): 10.7%

Make/Take Fees

- **Trading platforms charge different fees on "liquidity makers" (limit orders) and "liquidity takers" (market orders).** These fees add-up to millions of dollars per trading day.

	Make Fee	*Take Fee*	Total Fees
NYSEArca	-23	30	7
BATS	-24	25	1
EDGX	-25	30	5
Nasdaq	-20	30	10

Source: Traders' Magazine, Aug 2009 (in cents/100 shares)-Tape A

- **"Fee Structure"= "Pricing Model"**

In Europe

	Make Fee	*Take Fee*	Total Fees
Chi-X	-0.2	0.3	0.1
BATS	-0.2	0.3	0.1
Turquoise	-0.24	0.28	0.04

Source: Trading platforms' websites (in bps)

Effect and Role of Make/Take Fees

- **Very controversial:**
  "GETCO strongly believes that the advent of maker-taker pricing in the options markets [...] has resulted in numerous benefits [...] imposing artificial fee caps will harm the quality of executions for options customers, including retail customers" (GETCO, Sep.2008).

  "Citadel Investment Group L.L.C urges the Securities and Exchange Commission to address distorsions in the options markets caused by the excessive fees that may be charged by exchanges using maker/taker pricing" (Citadel, July 2008).

What do we know?

- **Not much...**
- **Models of competition between financial markets:** (Pagano (1989, QJE), Glosten (1994, JOF), Parlour and Seppi (2007, RFS), Foucault and Menkveld (2008, JOF) etc...)
  1. Do not consider the make/take decision.
  2. Ignore make/take fees
  3. Rarely endogenize trading platforms' fees.

Questions

- **How do make/take fees alter the choice between market and limit orders?**
- **Can trading platforms with different pricing models coexist? Are liquidity rebates inevitable?**
- **What is the outcome of competition between trading platforms in presence of make/take fees?**
- **Effect of trade-through rules/best execution?**
- **Should take fees be capped?**

Related literature

- **Dynamic models of limit order trading (**Foucault et al.(2005, Review of Financial Studies), Large (2008, Journal of Financial Economics), Rosu (2009, Review of Financial Studies**)**
- **Competition between trading platforms (**Pagano (1989, QJE), Glosten (1994, Journal of Finance), Parlour and Seppi (2007, Review of Financial Studies), Foucault and Menkveld (2008, Journal of Finance) etc...
- **Two-sided market**s (Rochet and Tirole (Rand, 2006))
- **Models of make/take fees with specialization** (Foucault, et al.(2008)).

Plan

1. **Introduction**
2. **Model**

Model

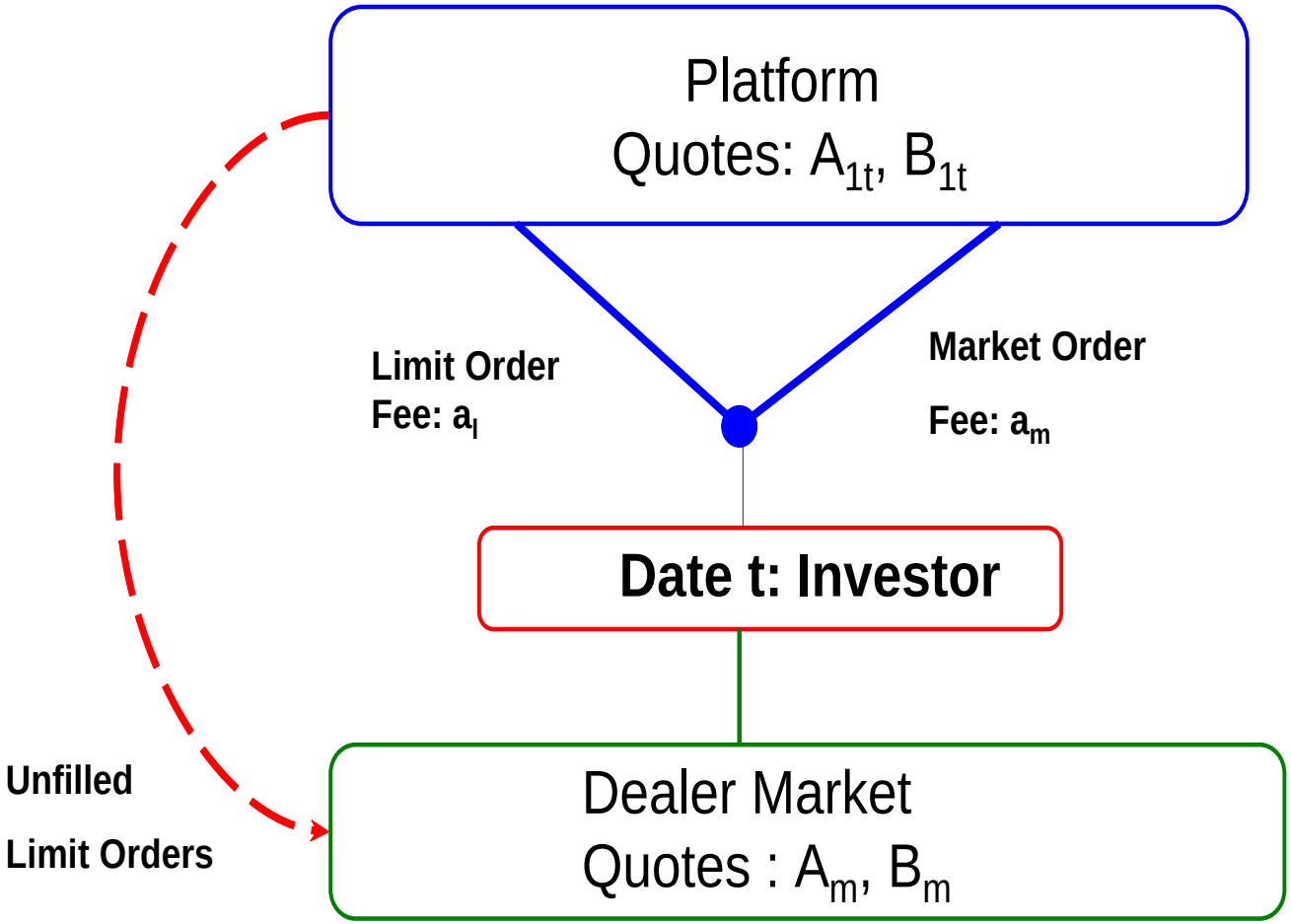
- **The market for a riskless security with heterogeneous traders** (as in Duffie, Garleanu, Pedersen, Econometrica, 2005)
- **Dynamic: t=1, 2, 3...., T, ..., ∞**
- **At each date a new trader arrives:**
  1. *A patient buyer* with valuation $v_H = v_0 + L$ and high discount factor (δ_H)
  2. *An impatient buyer* with valuation $v_H = v_0 + L$ and low discount factor (δ_L)
  3. *A patient seller* with valuation $v_L = v_0 - L$ and high discount factor (δ_H)
  4. *An impatient seller* with valuation $v_L = v_0 - L$ and low discount factor (δ_L)
- All transactions are for one unit.

Distribution of traders' types

	Buyer	**Seller**	**Proba**
Patient	$\pi/2$	$\pi/2$	π
Impatient	$(1-\pi)/2$	$(1-\pi)/2$	$(1-\pi)$
Proba.	$\frac{1}{2}$	$\frac{1}{2}$	

Baseline Case

- **Two trading venues**
  1. **A Limit Order Market (LOM) where traders can act as**
     - 1.1 **Taker:** hit the ask price or the bid price posted in the LOM when they arrive; **Fee:** a_t.
     - 1.2 **Maker:** submit a limit order valid for one period in this market. **Fee:** a_l.
     - 1.3 **Quotes at date t**: Ask: A_t^*; Bid: B_t^*; Endogenous.
  2. **A Dealer Market (DM) where investors can sell or buy the security at any point at:**
     - 2.1 Ask: $A^m = v_0 + \lambda$
     - 2.2 Bid: $B^m = v_0 - \lambda$
     - 2.3 Let $\Pi_m = L - \lambda$: the payoff of trading in the dealer market for an investor.



- **Example:** BATS vs. Nasdaq; Nasdaq dealers cannot charge take fees (see RegNMS).

Payoffs

- **Consider a buyer arriving at date t:**
  1. **Market order at price** A_t:

$$U_m^{bu}(A_t, a_m) = v_H - A_t - a_m.$$

  2. **Limit order at price** B:

$$U_l^{bu}(B, a_l, \delta_i) = \delta_i \left[P_{ex,t}^{bu}(B)(v_H - B - a_l) + (1 - P_{ex,t}^{bu}(B))\Pi^m \right].$$

- **Similar expressions for a seller:**

$$U_m^{se}(B_t, a_m) = B_t - v_L - a_m,$$

$$U_l^{se}(A, a_l, \delta_i) = \delta_i \left[P_{ex,t}^{se}(A)(A - v_L - a_l) + (1 - P_{ex,t}^{se}(A))\Pi^m \right].$$

Timing

- **The timing of the model is as follows:**
  1. The limit order market sets its total fee and the breakdown of its fee between makers and takers: a_T and (a_m, a_l).
  2. The trading game unfolds as described previously.
- We solve the game backward: (i) we first compute the equilibrium for fixed fees and then (ii) we solve for the optimal make/take fees.

Plan

1. **Introduction**
2. **Model**
3. **Equilibrium**

Order Placement Strategies

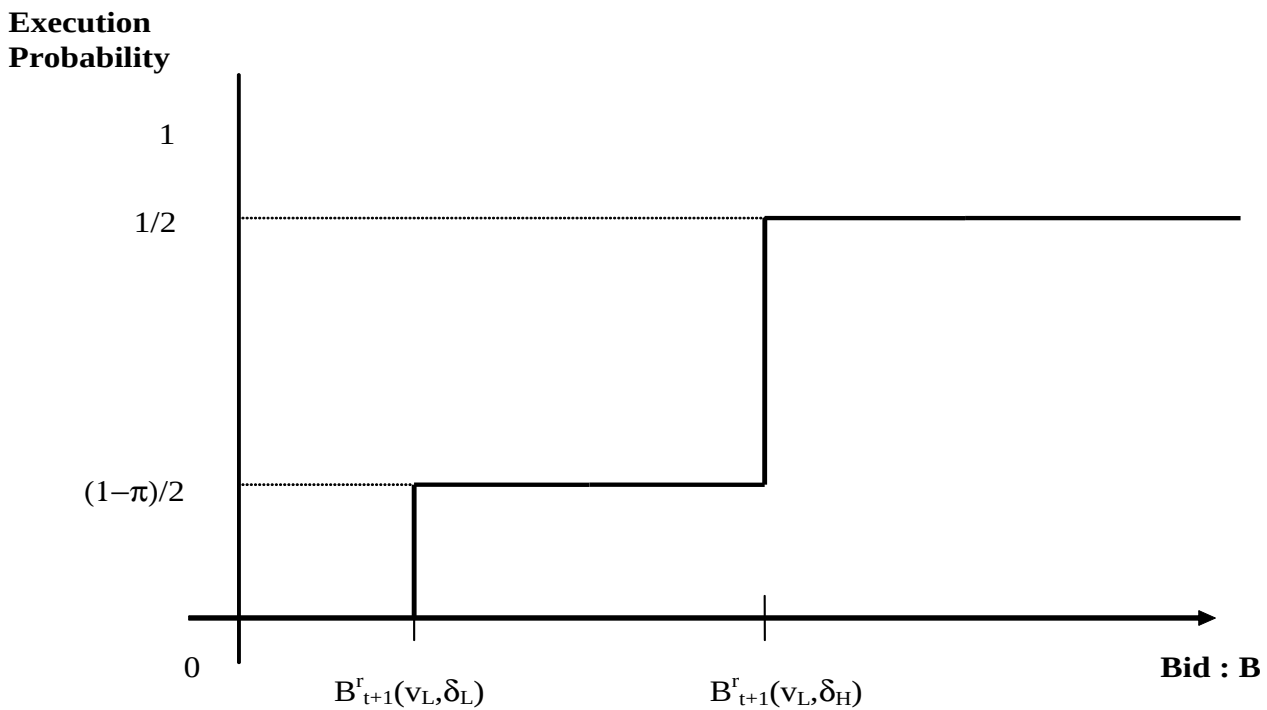
- **Once a buyer has decided to trade on the platform, his trading strategy can be described as follows:**
  1. If $A_t \leq A_t^r(v_H, \delta_i)$, submit a market order.
  2. If $A_t > A_t^r(v_H, \delta_i)$, submit a limit order at price $B(v_H)$
  3. with

$$\begin{aligned} B(v_H) &\in Argmax_B\, U_I^{bu}(B, a_I, \delta_i) \\ U_m^{bu}(A_t^r(v_H, \delta_i), a_m) &= Max\{Max_B\, U_I^{bu}(B, a_I, \delta_i), \Pi^m\} \end{aligned}$$

- **Once a seller has decided to trade on the platform, her trading strategy can be described as follows:**
  1. If $B_t \geq B_t^r(v_L, \delta_i)$, submit a market order.
  2. If $B_t < B_t^r(v_L, \delta_i)$, submit a limit order at price $A^*(v_L)$

Fill Rates

- **Execution probability for a buy limit order:**



Equilibrium Definition

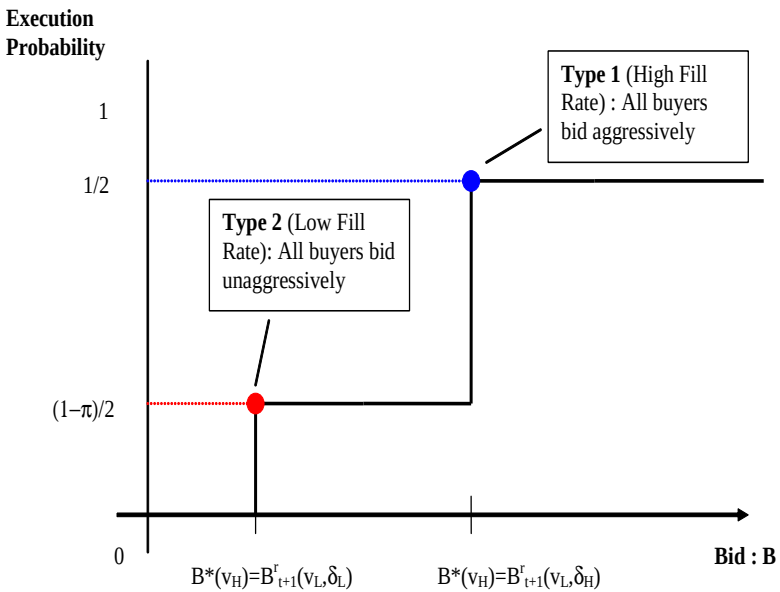
- **A Markov Perfect Equilibrium with an active limit order market is a set of strategies** $\{A^{r*}(v_H, \delta_i),\ B^*(v_H),\ B^{r*}(v_L, \delta_i), A^*(v_L)\}$ such that (i)

$$A^*(v_L) \in \text{Argmax}_A\ U_I^{se}(A, a_I, \delta_i),$$
$$B^*(v_H) \in \text{Argmax}_B\ U_I^{bu}(B, a_I, \delta_i),$$
$$U_m^{bu}(A^{r*}(v_H, \delta_i), a_m) = \text{Max}\{U_I^{bu}(B^*(v_H), a_I, \delta_i), \Pi^m\}$$
$$U_m^{se}(B^{r*}(v_L, \delta_i), a_m) = \text{Max}\{U_I^{se}(A^*(v_L), a_I, \delta_i), \Pi^m\}$$
$$\text{Max}\{U_I^{bu}(B^*(v_H), a_I, \delta_H), U_I^{se}(A^*(v_L), a_I, \delta_H)\} \geq \Pi^m$$

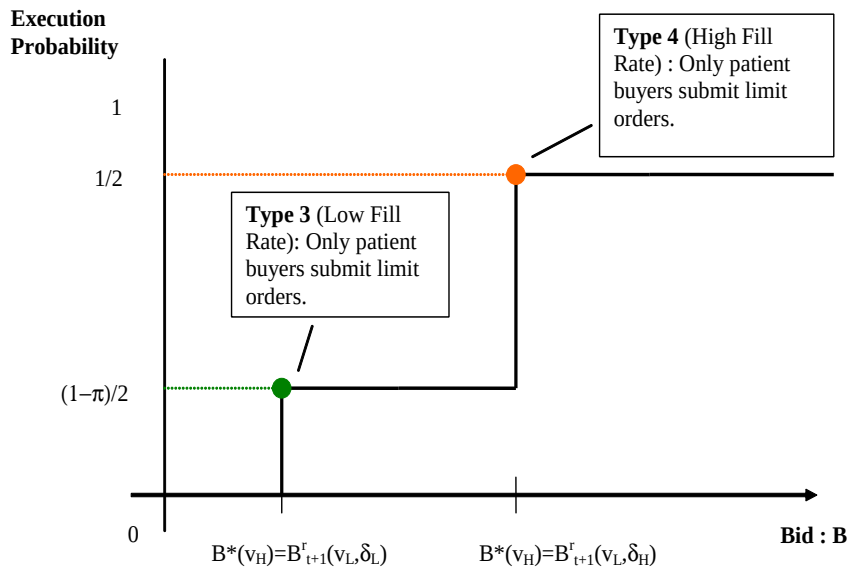
and (ii) traders have rational beliefs on the execution probabilities of limit orders (that is, $P_{ex}^{se}(A)$ and $P_{ex}^{bu}(B)$ are consistent with traders' cutoff prices).

Possible Types of Equilibria

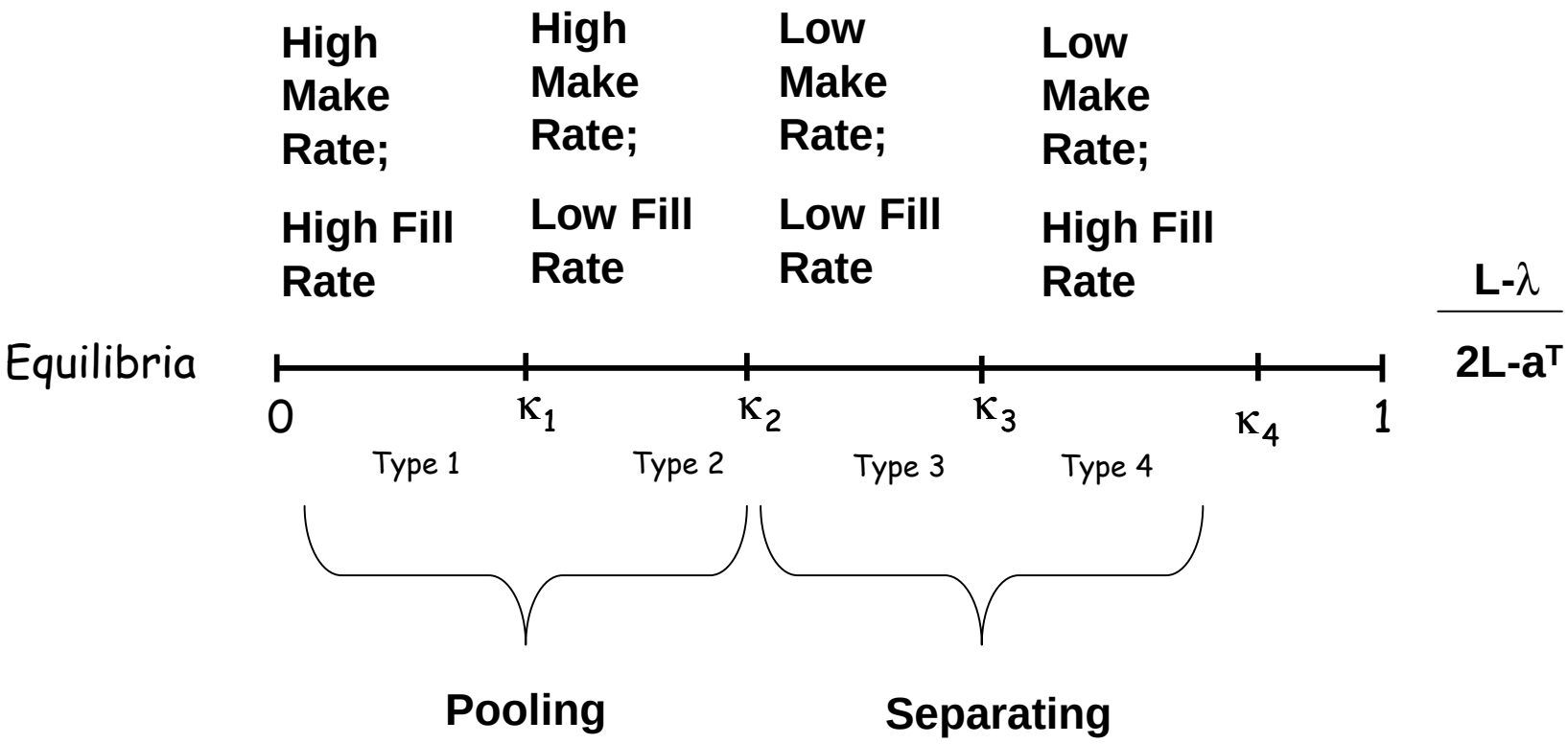
- **"Pooling" equilibria**



- **"Separating" equilibria**



Equilibria


High Make Rate; High Fill Rate
High Make Rate; Low Fill Rate
Low Make Rate; Low Fill Rate
Low Make Rate; High Fill Rate
L-λ / 2L-a^T
Equilibria
0
κ1
κ2
κ3
κ4
1
Type 1
Type 2
Type 3
Type 4
Pooling
Separating

Plan

1. **Introduction**
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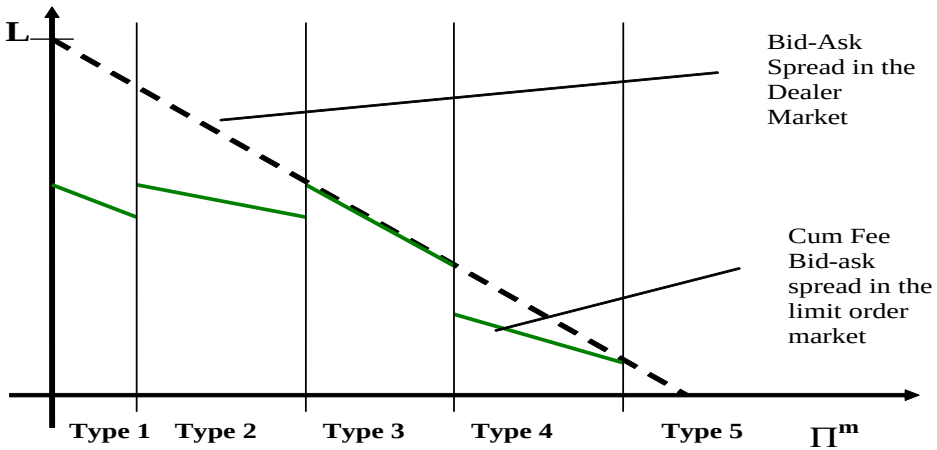
3. **Equilibrium**
4. **Implications**

Traded bid-ask spread and cum fee bid-ask spread

- **Traded Spread:** $S = A^* - B^*$; **Cum fee bid-ask spread:** $S^c = (A^* + a_m) - (B^* - a_m) = S + 2a_m$



- **Implication 1: The bid-ask spread in the limit order market increases in the bid-ask spread in the limit order market.**

Bid-ask spreads and make/take fees

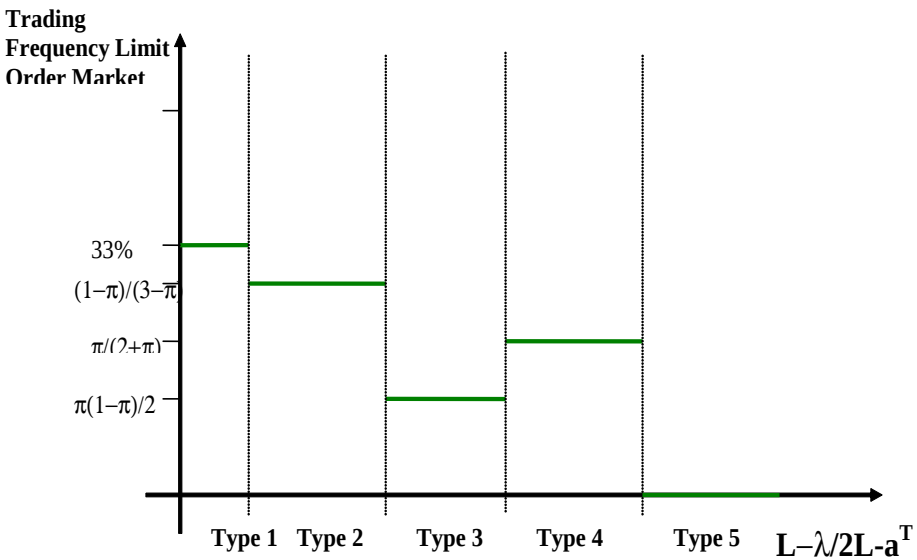
- **Implication 2:**
  1. **The traded bid-ask spread** increases in the make fee and decreases in the take fee.
  2. For a fixed total fee, $a_T = a_m + a_l$, **the cum fee bid-ask spread** is independent of the fee breakdown.
  3. **The cum fee bid-ask spread** increases in the total fee.

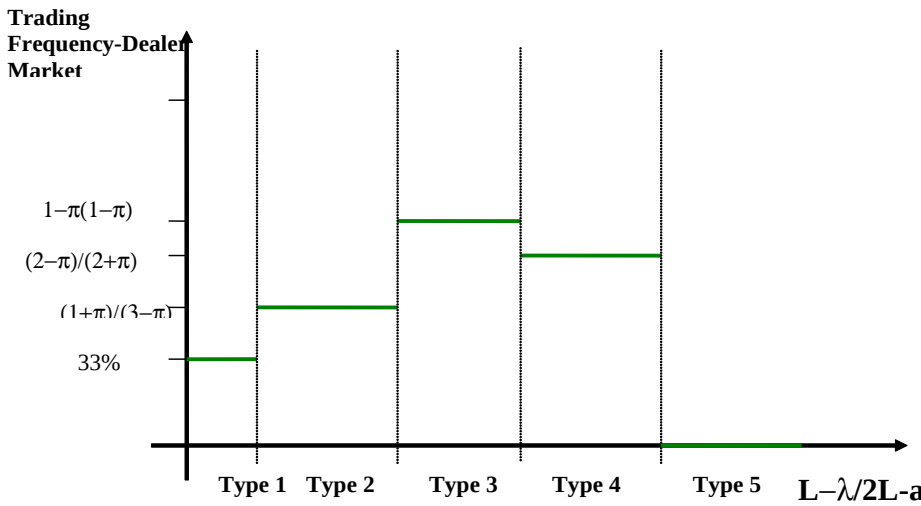
Economic intuition

- **Traders can choose between limit and market orders:**
  1. If limit orders become cheaper, trading profits with limit orders become larger other things equal
  2. But then traders are less willing to submit market orders: buyers' cut-off prices increase and sellers' cut-off prices decrease.
  3. $\Longrightarrow$ Limit order prices must be more attractive.
- **Conclusion: Adjustments in quotes neutralize the effect of changes in fee structure on the cum fee bid-ask spread.**

Trading Rates

- **Trading rate=likelihood of a trade per period.**
- **On the LOM:**
- **On the DM**





Trading Rate and Make/Take Fees

- **Implication 3:**
  1. **Make/Take fee breakdown is neutral:** The trading rate on the limit order market does not depend on the fee breakdown
  2. **The trading rate on the limit order market is non monotonic in the total fee:**
     - 2.1 An increase in the total fee can induce patient traders to place offers with higher execution probabilities$\Longrightarrow$ Higher trading rate.
     - 2.2 $\Longrightarrow$ Ambiguous relationship between the cum fee bid-ask spread and the trading rate.

Plan

1. **Introduction**
2. **Model**
3. **Equilibrium Definition**
4. **Bid-ask spreads, trading rate and fees**
5. **Optimal fees with a single trading platform**

Pricing Policy of the Limit Order Market

- **Objective Function:**

$$\text{Max}_{\text{Total Fee}} \text{ Trading Rate*Total Fee}$$

- **3 possible strategies:**

	Low Fee	**Medium fee**	**High Fee**
Fill Rate	High	Low	High
Make Rate	High	High	Low
Trading Rate	High	Medium	Low

Pricing Policy of the Limit Order Market

- **Findings:**
  1. In most cases, the platform chooses a high fill rate/high make rate strategy (low fee) or high fill rate/low make rate strategy (high fee).
  2. The smaller the bid-ask spread in the dealer market, the smaller is the fee charged by the platform$\Longrightarrow$ The platform is a kind of "market-maker.

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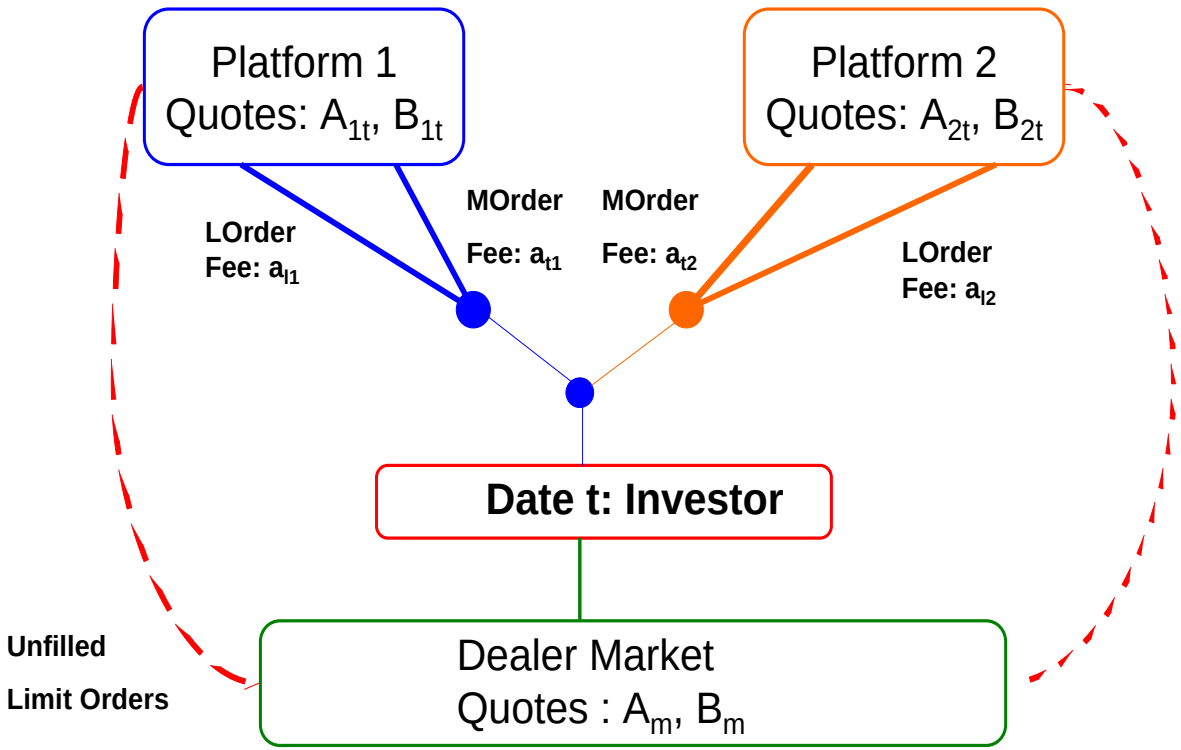
Competition between platforms

- **Common wisdom:** liquidity rebates are a consequence of competition between platforms.
- Is this right? What is the role of liquidity rebates in inter-market competition?
- $\Longrightarrow$ **Extension of the previous model to two limit order markets 1 and 2.**
  1. **Take fee on platform** $j \in \{1, 2\}$: a_{mj};
  2. **Make fee on platform** $j \in \{1, 2\}$: a_{lj};
  3. A_j^* and B_j^*: the quotes on each platform.

Competition between platforms



- **Important:** No captive clientele; No cost of observing quotes in each platform. **Example:** BATS; Arca; Nasdaq dealers

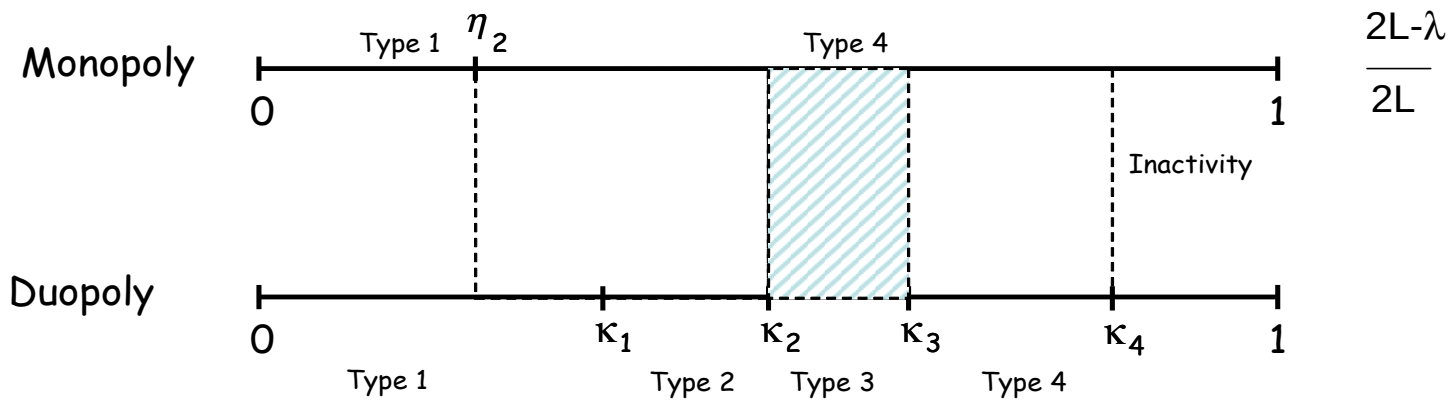
Findings

- **The platforms coexist (both attracts trades) if they have the same total fee** ($a_{l1} + a_{m1} = a_{l2} + a_{m2}$). Otherwise the platform with the smallest total fee attracts all trading.
- Whether the platforms coexist or not, the equilibrium for fixed fees has the same properties as in the single platform case.
- **Competition drives the total fee to zero.**
- **Conclusion: The breakdown of fees is irrelevant.** Both trading platforms can display very different fee structures and still coexist. Only the total fee matters.

Intuition

- Suppose that $a_{l1} < 0 < a_{l2}$ and $a_{m1} > 0 > a_{m2}$ but $a_{l1} + a_{m1} = a_{l2} + a_{m2}$. Then, in equilibrium,
  1. The traded spread is smaller on market 1 and
  2. The bid-ask spread cum fee identical on both markets.
  3. Eventually, traders are just indifferent between both markets.

Comparison monopoly/duopoly.



- **Intuition:** with two trading platforms, the total fee cannot be used to control traders' bidding choices$\Longrightarrow$ An equilibrium with low fill rate/low make rate (type 3) can happen while it never happens with a single platform.

Conclusion

- The make/take fee breakdown does not matter, whether we have a single trading platform or two
- Only, the total fee matters: higher fee in the platform leads to higher bid-ask spread and has an ambiguous effect on the trading rate.
- Policy focus should be on the total fee, not the breakdown.
- Why do people care about make/take fees? Frictions?
  1. Trade-throughs rules
  2. Specialization
  3. Price Discreteness

Plan

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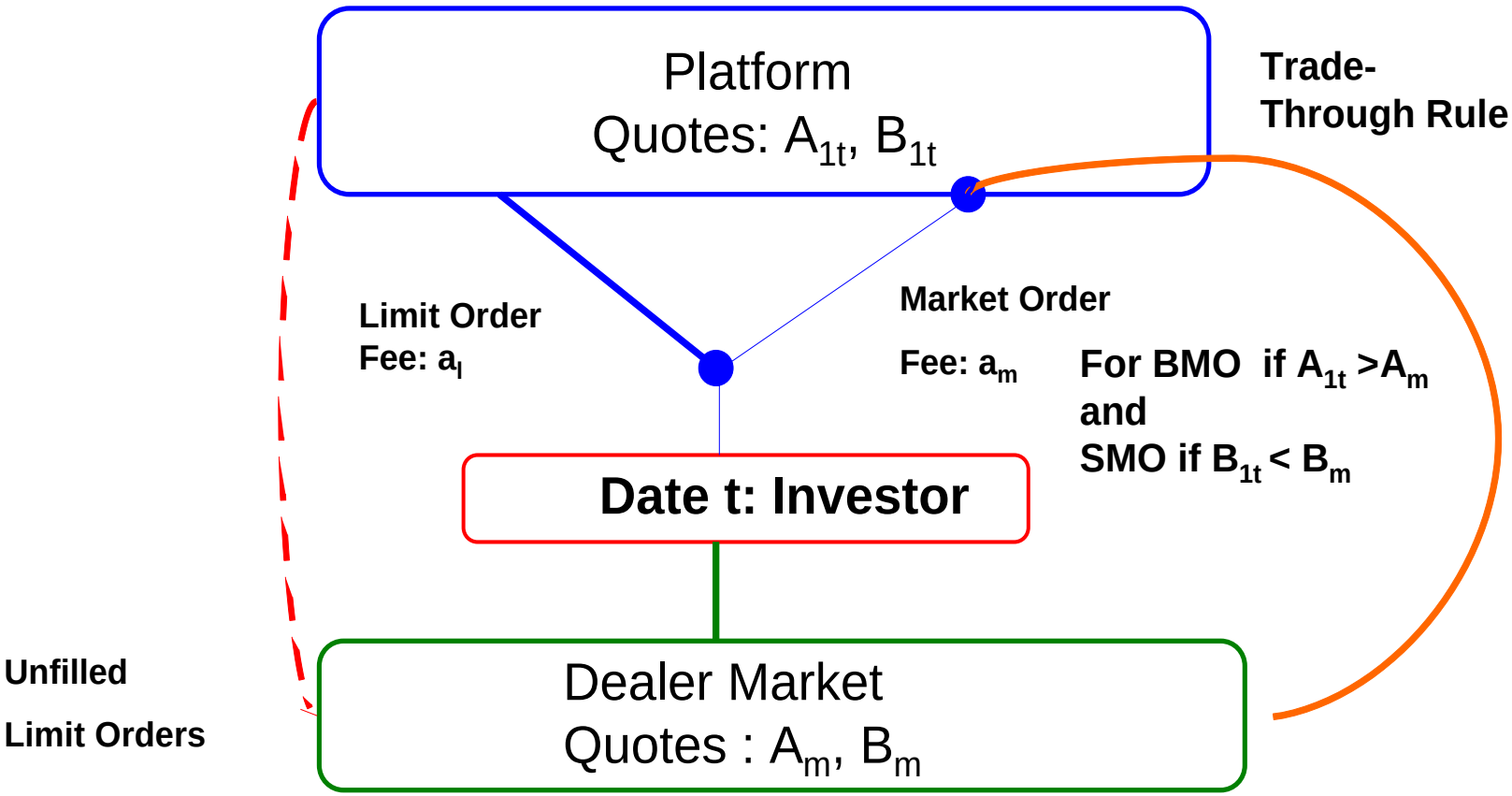
7. **Trade-Through Rule**

trade-through rule

- **Trade-through rule:**
  1. In the U.S., RegNMS obliges platforms to reroute buy/sell market orders to the platform posting the best ask/bid price at a given point in time.
  2. The rule is based on "raw" prices, not prices cum fees.
  3. How does a trade-through rule change the outcome of the game?


Platform
Quotes: A_{1t}, B_{1t}
Trade-Through Rule
Limit Order
Fee: a_l
Market Order
Fee: a_m
For BMO if $A_{1t} > A_m$
and
SMO if $B_{1t} < B_m$
Date t: Investor
Dealer Market
Quotes : A_m, B_m
Unfilled
Limit Orders

Trade-through rule with a single market 1/2

- **Observation 1: If** $a_m > 0$, the trade-through rule is not binding in the equilibria obtained without this rule (as the platform cannot attract order flow if $A^* + a_m > A_m$ and $B^* - a_m < B_m$.
- **Observation 2: The traded bid-ask spread decreases with the take fee $\Longrightarrow$The trade-through rule is binding only** if takers receive sufficiently large rebates.

Trade-through rule with a single market 2/2

- **Fix the total trading fee and suppose that the platform must choose between two "business models":**
  1. **Business Model 1**: A fee structure with liquidity rebates for takers
  2. **Business Model 2:** A fee tructure with liquidity rebates for makers
- **Finding: With a trade-through rule, the platform's expected profit with business model 1 is at least equal to its expected profit with business model 2, with a strict dominance for some parameter values.**

Trade-through rule with a single market 2/2

- **Why?**
  1. The trade-through rule prevents makers from fully "passing" the higher make fee to the takers as their quotes cannot be worse than dealers' quotes.
  2. Hence, liquidity rebates for takers tilt makers' choice in favor of quotes with high execution probabilities.
  3. Which results in a higher trading rate on the platform