

ORF 474: High Frequency Trading
Spring 2020
Robert Almgren

Lecture 4a

Feb 24, 2020

Today

Office hours today:
12:30 – 1:30 PM
JRR A07

- Maker-taker pricing and Roll model (slides)
- Liquidity provision (slides)
- Finish Roll model (on board)
- Glosten-Milgrom model (on board)

MEMORANDUM

TO: SEC Market Structure Advisory Committee (“Committee”)

FROM: Securities and Exchange Commission (“SEC”) Division of Trading and Markets¹

DATE: October 20, 2015

RE: Maker-Taker Fees on Equities Exchanges

To attract order flow while incentivizing market participants to provide liquidity at the most competitive prices, many exchanges and other non-exchange markets have adopted a fee structure where they pay a per-share rebate to their members to encourage them to place resting liquidity-providing orders on their trading systems. If an execution occurs, the liquidity providing “maker” receives a rebate, and the “taker” that executes against that resting order pays a fee to the market. This “maker-taker” fee model has been the subject of significant recent attention and debate, with a particular focus on the effects it may have on market structure, broker routing practices, and investor interests.

The purpose of this memorandum is to facilitate an objective assessment of maker-taker fees in the U.S. equity markets by outlining the development of the maker-taker fee model in the U.S. and summarizing the current public debate about its impact on equity market structure. The memorandum will present both the asserted advantages and disadvantages of maker-taker fee structures. Though less frequently the focus of contemporary debate, it is important to note the asserted advantages of the maker-taker fee model. Specifically, some believe the maker-taker model is an important competitive tool for exchanges and directly or indirectly can provide better prices for retail investors. On the other hand, some believe it may exacerbate conflicts of interest between brokers and their customers, contribute to market fragmentation and market complexity through the proliferation of new exchange order types, and undermine price transparency.

<https://www.sec.gov/spotlight/emsac/memo-maker-taker-fees-on-equities-exchanges.pdf>

I. Background

As noted above, the maker-taker fee model is a pricing structure in which a market generally pays its members a per share rebate to provide (i.e., “make”) liquidity in securities and assesses on them a fee to remove (i.e., “take”) liquidity.² For example, a maker-taker market may charge \$0.003 per share to take liquidity (i.e., 30 cents per 100 shares) and pay a rebate of \$0.002 per share to post liquidity (i.e., 20 cents per 100 shares). In this example, the market would earn as its revenue the difference between the two of \$0.001 (i.e., 10 cents per 100 shares).

The maker-taker payment model originated with electronic trading venues in the late 1990s.³ At the time, electronic trading venues were nascent alternatives to registered exchanges and NASDAQ that competed by, among other things, charging low fees while offering fast and fully automated trading and the ability for a trader to co-locate its system close to the ECN’s matching engine.⁴ In 1997, the Island ECN was among the first markets to adopt maker-taker fees, which it employed to attract order flow through liquidity rebates.⁵ Combined with the speed of its trading system, Island’s rebates, which provided traders with a source of income in addition to the spread between their bid and offer prices, helped it develop relationships with traders and liquidity providers while incentivizing those participants to post competitive quotes to allow it to attract order flow from other markets, including NASDAQ.⁶ As a result, Island’s market share of reported NASDAQ trades increased to almost 13% in 1999 from roughly 3% in 1997.⁷ In many of the most active NASDAQ stocks, Island was the number one daily market participant.⁸

Other non-exchange alternative trading systems (“ATSs”) soon followed Island in offering maker rebates and charging taker fees in an effort to attract liquidity and order flow from equities exchanges.⁹ In response to the competition from non-exchange markets, many exchanges began to adopt maker-taker fees of their own.¹⁰ By the mid-2000s, the maker-taker pricing model had gained widespread adoption as a standard pricing model in the U.S. equities market.¹¹

Maker-taker fees increase effective spread

Maker-Taker Pricing Effects on Market Quotations

Larry Harris*

USC Marshall School of Business

November 14, 2013

The exchange maker-taker pricing scheme affects incentives to take or make markets resulting in narrower bid-ask spreads. This study traces the effect of maker-taker pricing on stock quotations. The analyses consider distributions of quotation sizes, values implied from these sizes, and changes in these sizes and values. The results help inform the current debate on whether tick sizes should be made smaller for actively traded low price stocks. They also shed light on various problems associated with maker-taker pricing and its cousin taker-maker pricing, which allows traders to engage in sub-penny quotation behavior that legally violates the spirit of Regulation NMS.

1 Introduction

Exchanges changed how they price their services over the last 15 years. Traditionally, they charged a small fee to the buyer, the seller, or both. Now most exchanges charge a relatively high fee to the trade initiator (the taker) and rebate most of it to the liquidity supplier (the maker). Liquidity suppliers are buyers or sellers whose standing limit orders or quotes provide options to trade. They make markets. Trade initiators are sellers or buyers who take these options to trade by submitting marketable orders.

2.2 Implications

Holding constant the quoted bid and ask prices, the 0.3¢/share access fee effectively increases net bid-ask spreads paid by makers by 0.6¢/share over the quoted market spreads. Buyers who initiate trades pay the quoted ask price plus the 0.3¢ access fee while taking sellers receive the quoted bid price less the 0.3¢ access fee. The net spread received by makers likewise increases by approximately 0.5¢/share.

<http://bschool.huji.ac.il/.upload/hujibusiness/Maker-taker.pdf>.

Why maker-taker?

- Competition between exchanges
post on one exchange rather than another
- Incentivize liquidity provision
Overcome other costs of liquidity provision:
fixed costs (Roll)
adverse selection (Glosten-Milgrom)

Liquidity provision

- Fishing analogy:
spear (market order) vs bait on hook (limit order)
- Walrasian auction:
prices and quantities are set before trading
no response to other participants' orders
in fact: information is very circular

Execution problem

You must buy some amount

- Market order

immediate execution

pay 1/2 spread to current midpoint

future moves likely to be up

- Limit order (and at what level?)

execution is uncertain

capture 1/2 spread to current midpoint

but where is price relative to future?

Offers

Bids

Limit order: where will the price go
conditional on you getting filled?

Market making

- Capture 1/2 spread on every trade
- But often get filled when do not want
- Observe trade actions to determine information

Buyer - How much is it?

Seller - \$1.50.

Buyer - OK, I'll take it.

Seller - It's \$1.51.

Buyer - What? You said \$1.50.

Seller - That was before I knew you would take it.

Buyer - You can't do that!

Seller - It's my store ...

Buyer - But I need to buy a hundred!

Seller - A hundred? Then it's \$1.52.

Buyer - You're ripping me off...

Seller - It's supply and demand, buddy. You want it or not?

from 6, by Alexandre Laumonier (quoted by Bouchaud et al)

SNIPER IN MAHWAH & FRIENDS

It's all about market structure. "Pretium iustum mathematicum licet soli Deo
notum"

<https://sniperinmahwah.wordpress.com/>

The implementation shortfall: Paper versus reality

Reality involves the cost of trading and the cost of not trading.

André F. Perold

Journal of Portfolio Management; Spring 1988; 14, 3; ABI/INFORM Global
pg. 4

you do not know whether having your limit order filled is a blessing or a curse — a blessing if you have just extracted a premium for supplying liquidity, a curse if you have just been bagged by someone who knows more than you do. Because you are so much in the dark, you proceed carefully, and strategically.

Included in the shortfall is something called the cost of *adverse selection*.⁴ Typically, some of the transactions that execute on paper but not in the real portfolio do not execute because you choose not to incur the price impact; some, particularly limit orders, do not execute because the market chooses not to execute them. When you place a limit order to buy, you are giving the market a free put option, and when you place a limit order to sell, you are giving the market a free call option.⁵

The market will often exercise these options strategically. If the order executes, it is because you are offering the best price — your price is better than “fair value.” Thus, to some extent, your real portfolio tends to get stuck with stocks you are paying top dollar for, even though you are executing at your limit price. You will tend not to own the stocks the market decides it likes better than your limit price. Meanwhile, your paper portfolio owns both the ones the market likes and the ones it does not like.



T has been pointed out by Colyer Crum and others that financial institutions are dominated by organizational goals other than invest-

sionally managed portfolios have shown not only that professional in-

Professor Michael Jensen of the University of Rochester) of profes-

enthusiasm with which people play the stock market game. The turn-

Mr. Bagehot is a veteran observer of the economic scene.

Jack Treynor



20 May 2016

Jack L. Treynor and the Birth of the Quants

By **Mark Harrison, CFA**



Imagine for a moment an investment world without the accomplishments of [Jack L. Treynor](#).

Treynor was a key member of a tiny group of theorists from which the efficient markets hypothesis (EMH), the capital asset pricing model (CAPM), and the random walk hypothesis emerged in the 1960s. In this imaginary Treynor-less world, mass casino psychology and fund manager guru-worship

might rule, unchallenged by any metrics other than crude popularity and marketing spend.

In another *F AJ* piece, “The Only Game in Town,” written under the pseudonym Walter Bagehot, Treynor evaluated the economics of market making, asking, Why do investors persist in trading despite their dismal long-run trading record and why isn’t trading against the public consistently profitable?

THE MARKET CONSENSUS

It is well known that market makers of all kinds make surprisingly little use of fundamental information. Instead they observe the relative pressure of buy and sell orders and attempt to find a price that equilibrates these pressures. The resulting market price at any point in time is not merely a consensus of the transactors in the market place, it is also a consensus of their mistakes.

On the other hand the market maker always gains in his transactions with liquidity-motivated transactors. The essence of market-making, viewed as a business, is that in order for the market maker to survive and prosper, his gains from liquidity-motivated transactors must exceed his losses to information-motivated transactors. To the market maker, the two kinds of transactors are largely indistinguishable. The spread he sets between his bid and asked price affects both: the larger the spread, the less money he loses to information-motivated transactors and the more he makes from liquidity-motivated transactors (assuming that a wider spread doesn't discourage the latter transactions).

**BID, ASK AND TRANSACTION PRICES IN A SPECIALIST
MARKET WITH HETEROGENEOUSLY INFORMED TRADERS***

Lawrence R. GLOSTEN

Northwestern University, and University of Chicago, Chicago, IL 60637, USA

Paul R. MILGROM

Yale University, New Haven, CT 06520, USA

Received August 1983, final version received September 1984

The presence of traders with superior information leads to a positive bid–ask spread even when the specialist is risk-neutral and makes zero expected profits. The resulting transaction prices convey information, and the expectation of the average spread squared times volume is bounded by a number that is independent of insider activity. The serial correlation of transaction price differences is a function of the proportion of the spread due to adverse selection. A bid–ask spread implies a divergence between observed returns and realizable returns. Observed returns are approximately realizable returns plus what the uninformed anticipate losing to the insiders.

The approach taken in this paper is based on the idea that a bid–ask spread can be a purely informational phenomenon, occurring even when all the specialist's fixed and variable transactions costs (including his time, inventory costs, etc.) are zero and when competition forces the specialist's profit to zero. The core idea is that the specialist faces an adverse selection problem, since a customer agreeing to trade at the specialist's ask or bid price may be trading because he knows something that the specialist does not. In effect, then, the specialist must recoup the losses suffered in trades with the well informed by gains in trades with liquidity traders. These gains are achieved by setting a spread. This informational source of the spread has also been suggested by Bagehot (1971) and formally analyzed by Copeland and Galai (1983).