Price Fixing at Nasdaq?
A Reconsideration of the Evidence

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I. Introduction

In August 1996, the U.S. Securities and Exchange Commission published the results of its investigation of price fixing in the Nasdaq stock market in a document now known as the 21(a) Report.¹ The report detailed the SEC’s claims about five different types of trader behavior. These were: 1) traders generally were following an anti-competitive “pricing convention” of quoting stock prices primarily on even eighths, and avoiding odd eighths, thus increasing trading costs to customers; 2) some traders were practicing quote painting and tape painting, 3) some traders were front-running their customers’ orders and sharing information with other traders to allow them to also front-run the customers’ orders, 4) some traders were backing away from their quotes when customers would seek to execute trades with them at those quotes, and 5) some traders were reporting their trades late. The Report also found serious deficiencies of the NASD’s performance as a self-regulatory organization.

The main outcomes of the investigation and report were that the SEC instructed the NASD to restructure its self-regulatory operation, to adopt substantial changes to the way it handles customer orders, and to establish a system for recording orders and trades to facilitate auditing of how orders were handled.

My analysis is concerned with the allegation of price fixing. I examine the evidence about Nasdaq. I begin by addressing the phenomenon that sparked the investigation—the clustering of dealer quotes on even-eighth prices, as opposed to odd-eighth prices, and the specific allegation of a collusive agreement to quote prices on even-eighths instead of odd-eighths. The evidence is strong that clustering is not associated with wider proportional (to price) spreads.

The second section addresses whether there is any general evidence of collusion on Nasdaq. That is, are all Nasdaq quotes, not just even-eighth quotes, in some sense too wide? Here the analysis compares quoted spreads and effective spreads of stock traded on Nasdaq to those of stocks traded on the exchanges. This

section includes a discussion of important institutional differences between the operation of the dealer market and the exchange markets relevant to the interpretation of spreads. These include how Nasdaq quotes and NYSE quotes are generated, how trading commissions are charged, trading in Instinet, and the role of Nasdaq’s Small Order Execution System.

The second set of studies, those asking whether spreads are wider on Nasdaq, are not as dispositive with respect to price fixing allegations as are the studies on the clustering of quotes. This is partly due to technical issues involved in estimating the impact of economic forces on the spreads, and partly due to unobserved factors such as the level of commissions and to business arrangements known as “preferencing” and “payment for order flow”. In these arrangements, brokers who do business with individual investors agree to send their customers’ orders for execution to specific market makers, who pay the broker (an undisclosed amount) for the right to execute these orders.

The third and last section thus takes up the issue of preferencing and payment for order flow and the academic discussions of them, and evaluates their impact on the competitiveness of the market for stock trading services and the treatment of the orders of individuals in particular.

Though I conclude that there is scant evidence of price fixing on Nasdaq, none of my analysis should be taken to imply that the SEC’s other complaints are not serious. Tape painting occurs when brokers engineer sham trades to record a price (“painting the tape” on which trade prices and size are recorded). Quote painting occurs when a trader posts a quote in order to deceive a customer about the price at which the stock is currently trading. Tape and quote painting deceive customers about the prevailing market price. Neither of these is price fixing; both are forms of fraud.

Front-running of customer orders refers to the practice of a trader buying (or selling) for the broker’s account when holding a buy (sell) order from a customer large enough to move price. By trading prior to submitting the customer’s order, (trading in front of the order, hence front running) the trader causes the price to move even more than it would just as a result of the customer’s own trade, causing the customer to pay a higher (lower) price, and thus enabling the trader to profit by selling (buying) back the shares purchased for his own account at the new higher (lower) price after the customer’s order has been executed. Customers always prefer not to be front-run. The NASD has rules against front-running customers.

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2 “The tape” is the ticker tape, or its more modern analog, a digital display which replaced the paper tape, to which the price and number of shares traded for virtually all trades in organized markets in the U.S. must be reported. The tape is disseminated publicly and reports trading activity as it happens with a delay measured only in seconds.
But front-running is difficult to detect, and in some foreign markets it is pervasive and there are no rules against it. It is an understood form of compensation, rather like bank accounts that earn no interest. But if the NASD has such a rule, it should enforce its own rule.

Traders who refuse to execute an order at their own posted quotes when learning the identity of the customer are breaking NASD rules. But the fact that dealers do sometimes back away from their quotes implies that quotes could be even wider than they are, as there are some customers with whom dealers do not want to trade even at their posted quote, much less at a better price. Why would this ever be? Usually because the trader infers, from the identity of the customer, that the customer knows something the trader does not, and that after the trade takes place, price will move against the dealer. Should traders be forced to do business that they think they will lose money on? Why do traders post quotes at which they do not want to trade with some customers? Customers would clearly prefer for the quotes to be firm and for traders to never back away. But the firmer the quotes are (the more difficult it is for a trader to back away), the wider the quotes will be. Some customers benefit from firmer quotes (those from whom dealers would back away) and some from narrower quoted spreads. Nonetheless, the rule is the NASD’s own rule, and it is disorderedly for it not to be enforced.

Late trade reporting is another instance where a case can be made for different rules, for the benefit of all customers and traders as well, but again, the prompt reporting of all trade prices and sizes is the NASD’s own rule. On the London stock exchange, for example, very large trades can be reported with considerable delay. The thinking behind delayed reporting of large trades is that if they are reported contemporaneously, they tend to move prices, but often only temporarily. The temporary price move makes it more risky and costly for the trader to rebalance inventory, and thus more costly for the trader to serve the customer. It also makes prices more volatile. Nonetheless the NASD should enforce its own rules or change them.3

In contrast to these four practices, neither the SEC nor the NASD had rules against the use of any particular increments for quoting prices. The SEC has allowed the market to set the prices of transactions services embodied in the spreads. While the SEC found and reported in the 21(a) Report instances of traders harassing other traders to widen a quotes4 and thus raise prices, some even claiming that this was a

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3 For further discussion, see Mulherin, 1993, and Narayan, Neuberger, and Viswanathan, 1996.

4 Intimidation of traders by another trader is also against NASD rules, see the 21(a) Report, Appendix, p. 19.
general and accepted practice, such findings should not be the end of an investigation of price fixing. Instead we should ask whether the practices actually elevated prices, that is, resulted in wider spreads. I now turn to the scientific evidence as to whether such price elevation has occurred.

II. The Clustering of Quotes on Nasdaq: Evidence of Price Fixing?

The issues raised by the charge of price fixing relate to some of the special features of markets for securities. The product potentially affected by collusion is transaction services, the buying or selling of stocks. The price at issue—that the 21(a) Report claimed was being elevated by collusion among the dealers—is the quoted spread, the difference between the price that a dealer posts to a selling customer and the price to a buying customer.

In Nasdaq, dealers post quotes to buy and sell. These posted quotes are prices at which they must transact with any customer who turns up and wishes to transact. Dealers are free to negotiate better prices with customers, and often do, especially with regular customers. Quotes are stated in deliberately limited precision. Prior to June 4, 1997 (the date when Nasdaq changed its standard “tick size” from eighths to sixteenths.), a quote for most stocks had to take the form of dollars plus eighths of dollars. With a one-eighth tick, the fraction part of a quote could take one of 8 possible values: 0, 1/8, ¼, and so on, up to 7/8. One might think that quotes would be distributed randomly among these 8 possibilities. The observation that gave rise to the charge of collusion in the transaction service market was that the quotes tend to fall disproportionately into the categories 0, ¼, ½, and ¾. This phenomenon has come to be called clustering on even eighths, or just clustering. How does the clustering of price quotes for stocks relate to the pricing of transaction services? No claim has been made that dealers have colluded to influence the level of stock prices, nor would dealers have any interest in having that influence, since they make money on the spread, not on the level of prices.⁵

First, consider stocks with the smallest possible spread, 1/8. Suppose that the bid price (the quote at which a dealer will buy from a customer) is 10. Then the ask price (the price at which a dealer will sell to a customer) will be 10-1/8. If the bid is, ⁵ The conduct of dealers can affect price levels indirectly—if dealers succeed in keeping spreads too wide, this will depress stock prices generally. Assets that are cheaper to trade, other things equal, are worth more.
say, 9-5/8, then the ask will be 9-3/4. One of the two quotes will be at an odd eighth. If all spreads were 1/8, we would find no clustering on even eighths.

Now consider stocks with the second smallest spread, ¼. For these, if the bid is at an even eighth, so will be the ask. The bid and ask have are either both even or both odd (they have the same parity—evenness or oddness). For these stocks, clustering on even eighths can occur. Similar analyses apply to larger spreads. If the spread is an odd eighth, bid and ask prices will have opposite parity and clustering will not occur; if the spread is an even eighth, clustering may occur, but not necessarily.

What conclusion follows from the finding that quotes cluster on even eighths? First, not all spreads are odd eighths, and second, that there is some tendency for the prices of even-eighth spread stocks to cluster on even eighths. And how does this relate to possible collusion among dealers to raise their spreads? If the competitive level of spreads were always 1/8, an odd eighth, then the finding of clustering would imply that some spreads must be ¼ or another even eighth, and that spreads are being held above the competitive level. The force resulting in the elevated spreads could be collusion, perhaps through an agreement on the convention of quoting only on even-eighth prices.

Thus the focus on the clustering of prices is somewhat, but not completely, off the point. The real issue is spreads—which are the prices at issue—rather than at the distributions of quoted prices. The distribution of spreads reveals the following: Many stocks have spreads of 1/8, the lowest possible. More have spreads of ¼. Relatively few have spreads of 3/8, not as many as have spreads of ½. There are also gaps in the distribution of spreads at 5/8 and 7/8. In any case, it is unambiguous that not all stocks have the minimum possible spread. From the perspective of antitrust economics, the finding is the same as the following: Suppose it is thought that the competitive price of a class of products is $10. In fact, some of the products do sell for $10, but some sell for $10.99, some for $11.99, and others for $12.99. None sell for prices in between. The primary burden of analysis, given these facts, would be to show that the competitive price is actually $10, and not higher for the products that sell for higher prices—that is, there is no explanation based on cost for the higher-priced products. Explaining the clustering on prices ending in .99 would be distinctly secondary.

An economic analysis of spreads indicates why some spreads are wider than 1/8. Presentation of the full analysis occupies most of the rest of this paper. I will start here with the simplest and most powerful determinant of the spread, the price of the stock. Spreads tend to be proportional to price. So it is highly informative to look at the distribution of spreads calculated as percents of prices, rather than in dollars.

Suppose there were collusion among dealers to widen the spreads in some but not all stocks. If successful, the collusion would result in greater percentage spreads for some stocks, other factors equal. Suppose further that the collusion took the form
of setting spreads to the next higher even eighth above the competitive level, so that
stocks that should have spreads of 1/8 actually have spreads of ¼, those that should be
3/8 are at ½, and so on. Then stocks with spreads of even eighths (those affected by
collusion) would have higher percentage spreads than those with spreads of odd
eighths (those not affected by collusion).

The evidence on percentage spreads is close to fatal to the hypothesis that
collusion takes the form of quoting wider spreads for selected stocks. Rather, the
evidence shows, uniformly, that percentage spreads are about the same for all stocks,
whether they are traded at spreads of 1/8 or higher. There is no evidence of any group
of stocks where spreads have been elevated by an agreement that affects just that
group. In particular, stocks whose usual spreads are ¼ actually have slightly lower
percentage spreads that those whose usual spreads are 1/8. The only reason the ¼-
trading stocks have wider spreads than the 1/8-trading stocks is that their prices are
higher—about twice as high as those with spreads of 1/8.

What did the SEC make of the evidence about price clustering and spreads? In
the 21(a) Report we read

"Nasdaq market makers widely followed a pricing convention pursuant to
which many securities were quoted only in even-eighth prices. Adherence to
this practice, as detailed in this Report, was not the result of natural economic
forces and often increased the transaction costs paid by investors."

This allegation was not original with the SEC. The claim was first made by
two professors of finance, William Christie and Paul Schultz, in a 1994 paper cited in
the 21(a) Report as a factor stimulating the investigation. Examining a sample of 100
Nasdaq stocks—the largest 50 companies plus another 50 randomly chosen from the
remaining with equity of at least $100 million—plus a sample of New York Stock
Exchange and American Stock Exchange stocks matched on price and size, they
documented that there was clustering of quoted bid and ask prices on even-eighth
prices. They noted that there was clustering in NYSE quoted prices also, but it was
not as pronounced. Christie and Schultz could think of no explanation for the

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6 21(a) Report, p. 2.
Quotes?" Harris, 1991, was the first to establish that there is clustering in securities markets and that
Nasdaq are more clustered than NYSE prices. The main difference between Harris vs. Christie and Schultz
is the allegation of collusion.
pronounced clustering except that Nasdaq dealers were colluding through a convention of quoting on even-eighths.

In the 21(a) Report, the SEC concurs:

“This pricing convention was well understood and widely observed by traders throughout the Nasdaq market. According to some market makers, the pricing convention was based on tradition and represented the “professional” way to quote in the Nasdaq market. Indeed, a number of traders testified that senior traders at their respective firms trained them to follow the pricing convention. Other traders have described the practice as an “ethic”, a “custom” or a “tradition”.”

The report continues

“There is, however, no valid economic justification for the widespread avoidance of odd-eighth quotations which resulted from adherence to the pricing convention”.  

The scientific evidence regarding clustering on the quotes denies this claim. Instead, in this evidence we find abundant valid economic justification for the patterns of bid and ask quotes in Nasdaq. Four sophisticated statistical inquiries demonstrate the absence of suspicious patterns in percentage spreads. This research also shows that much of the variation of percentage spreads can be explained with reasonable economic variables. The research speaks with one voice that trading costs are no higher for stocks quoted in even eighths than they are for stocks quoted in odd eighths.

A table produced by Furbush and Smith\textsuperscript{10} illustrates well the power of simple economic variables, in particular, the level of the stock price, to explain the quote increments. This table shows the mean of quoted dollar spreads, stock prices, (measured as bid-ask midpoints), and most important, relative spreads (spread divided by bid-ask midpoint) for the 2,676 quarter- and eighth-quoting Nasdaq National Market (NNM) stocks for January, 1994:

\textsuperscript{1} 21(a) Report, p.18.
\textsuperscript{2} 21(a) Report, p. 21.
\textsuperscript{10} Furbush and Smith, 1996
This table shows that stocks whose prices cluster on quarters also generally have wider spreads, and that the *proportional* or relative or percentage spreads for stocks quoting mainly on quarters (even eighths) is roughly the same as the proportional spreads for the stocks quoting on eighths. The single most important variable in explaining quoted bid-ask spreads is the level of the stock price. Other things equal, the higher the stock price, the wider the bid-ask spread.

Other variables besides price matter. Furbush and Smith go on to estimate two specifications relating economic determinants to spreads. The first estimates the effect of price, the volume of trading, and the volatility of prices, and the implicit increments in which the stock is quoted (via dummy variables), on proportional quoted spreads. The second is an ordered probit regression (a tool designed to deal with discrete variables such as quote increments), estimating the effect of price, volume, and volatility on the choice of quote increment (1/8 vs. 1/4, etc.), using data from January of 1993, 1994 and 1995, on the 2,656, 3,051, and 3,259 Nasdaq National Market stocks (respectively). The analysis concludes that while the price, volume, and variance variables all have an impact on quoted spreads, there is no relation between the quoting convention (the choice of increment) and the proportional quoted spreads.

A study by Paul Godek\footnote{Godek, 1996} pursues the point I noted earlier that clustering of prices on even-eighth increments reflects the predominance of even-eighth quotes to be on even-eighth prices, and that the relative absence of odd-eighth quotes simply reflects the absence of odd-eighth spreads. Godek also takes a second look at the logit...
model explored by Christie and Schultz on their sample of 100 NNM stocks which caused them to reject a competitive explanation for quote clustering. Godek shows that for all 2,486 NNM common stocks (the Nasdaq population in 1994), the logit model correctly classifies—chooses the same quote increment used by the market place—for 87 percent of NNM stocks.\textsuperscript{12} Godek looks more closely and sees that the distribution based on the entire year hides the fact that within the year, there is substantial switching between the few-odd-eighths and the many-odd-eighth groups. For the 1,874 securities that stay consistently within one group or the other, the logit regression correctly classifies 92 percent. Godek, like Furbush and Smith, also concludes that adding the quote increment in which a stock is traded to the equation estimating the impact of the determinants of the proportional quoted spreads adds nothing, and concludes that clustering does not signal elevation in the proportional quoted spreads for stocks quoted in even eighths.

Paul Laux’s\textsuperscript{13} study investigates the same question—what is the relation between quote clustering and proportional quoted spreads—in a different way. Laux first estimates a model of the spreads using only the NNM stocks that quote in odd-eighths (with spreads of 1/8, 3/8, etc.). He then asks how well this model fits the other stocks that quote in different increments, and finds that it fits very well. His approach summarizes the spread-reducing impact should a stock that quotes on even eighths, but has characteristics that are average of the sample otherwise, were to begin quoting on all eighths. He finds no impact. He makes use of statistical techniques that deal with selection bias and endogeneity (a statistical problem that arises because the proportional spreads and the quote increment are determined simultaneously; we cannot say that one causes the other). Like Furbush and Smith, and Godek, Laux concludes that there is no connection between quote clustering and proportional spreads.

Perhaps the most significant study of clustering and proportional spreads is by Huang and Stoll\textsuperscript{14}, who are colleagues of Christie and Schultz. Using 175 pairs of NYSE and Nasdaq firms for the year 1991, matched on 2-digit SIC codes, price, long-term debt, book equity, and market value (but not variance or volume), Huang and Stoll measure differences in quoted spreads and effective spreads (using an exhaustive set of measures of effective spreads) and conclude spreads are bigger on Nasdaq. (This result will be discussed in more depth in the next section.) They investigate the

\textsuperscript{12} Comparing the correctly classified 92 percent to the fraction correctly classified by a “naïve” model (no information except the observed frequency of each price increment) generates a “pseudo-r-squared” of .75, Godek, p. 470).

\textsuperscript{13} Laux, 1995

\textsuperscript{14} Huang and Stoll, 1996.
relation of quote clustering to spreads by adding a dummy variable for each stock that signifies the main quote increment in which the stock trades. The dummy variable adds no explanatory power to the equation and has no statistical significance. Thus they conclude that these wider spreads are not due to more frequent use of even eighth quotes.

Another study that bears on the issue of quote clustering is that of Grossman, Miller, Fischel, Cone, and Ross. This paper demonstrates that quote clustering is the rule, not the exception, in dealer markets for all kinds of financial instruments (London Stock Exchange, gold markets, currency markets, option markets) and that Nasdaq is not unique in its degree of quote clustering. They also elaborate on the suggestion of Larry Harris that restricting prices to a set of increments more coarse than pennies saves time in negotiation. The main idea is that by restricting bidding to eighths of a dollar rather than pennies in the stock market, and to increments of $250 at auctions for art, for example, the bidding process is completed more quickly, and buyers and sellers are more likely to participate in the bidding because their bids (including submitting limit orders, in the case of the securities markets) are less likely to be bettered when the quote increment is larger. They observe that the organization of markets world wide is consistent with the hypothesis that features of market organization markets, including by their choice of quote increments, are chosen to conserve on resources devoted to the process of pricing and trading.

These studies show that the practices of inter-trader harassment over quotes uncovered by the SEC were not successful in moving quotes from odd-eighth spreads to even eighth spreads in any systematic or economically significant way. There is no evidence that trading costs are higher for those stocks that trade at even eighths—they are mainly just stocks with higher prices.

**Changes after the Bear, Stearns Meeting**

Another topic of the 21(a) Report is a meeting held in May 1995, when the publicity surrounding the Christie and Schultz study was at its height, of about one hundred security traders at the offices of Bear, Stearns in New York. At this meeting, traders were urged to narrow spreads voluntarily. After this meeting, the spreads of some stocks narrowed. Christie, Schultz, and Harris, in their piece, “Why did Nasdaq


16 Harris, 1991

17 Perhaps this meeting did not reflect the best judgment on the part of the traders in dealing with the adverse publicity, but they were not unique in their reaction. See Sproul 1993, for a discussion of the reactions of those accused, and subsequently acquitted, of price fixing.
market makers stop avoiding odd eighth quotes?" documented the narrowing of spreads in five high-profile stocks.

Paul Godek\(^1\) investigated the trend in the fraction of Nasdaq stocks that quoted in even eighths. Instead of finding a general decline in quoted spreads in all Nasdaq NNM stocks after the Bear, Sterns meeting, he found the continuation of a slight upward trend, established the prior year, in the fraction of NNM stocks quoting in quarters. Grossman \textit{et al.}\(^2\), also look at trends in quotes, but limit their investigation to the largest 500 Nasdaq stocks, and find a slight general downward trend, with no particular reaction after the Bear, Stearns meeting. Furbush and Smith\(^3\) give separate estimations for their model from January, 1994 data (pre-Bear, Stearns) and January, 1995 data (post-Bear, Stearns), which show that the model estimates of the factors that determine spreads are essentially the same both before and after the meeting. Kleidon and Willig\(^4\) note that one of the five high profile stocks that did have a reduction in quote increment soon after the Bear, Stearns meeting, Microsoft, had a particularly easy explanation for its quote change: a stock split. The change in quote increments for the remaining four high-profile, hand picked, stocks is no evidence of a "breakdown of collusion" in the face of the very stable quote patterns for the 500 largest and the full 3000 or so NNM stocks.

In sum, it is now well documented that whether stocks were quoted in even eighths or odd eighths bears no relation to the proportional spread in Nasdaq. It follows that the large fraction of Nasdaq quotes on even eighths is not evidence of price fixing, because the price of transaction services—the proportional spread—is no greater in the stocks quoted on even eighths than those for odd-eighth stocks. Nor was the behavior of market makers after the May 1995 Bear, Stearns meeting evidence that the Nasdaq pricing convention was artificial, because there was in fact no significant change in behavior.

\(^1\) Christie, Harris, and Schultz 1994 "Why did Nasdaq market makers stop avoiding odd eighths?"

\(^2\) Godek, 1996, p. 472. Godek also notes that it is not unusual for there to be price declines around the announcement of an antitrust suit, even by parties eventually acquitted, and refers the reader to Sproul, 1993, for research on this topic.

\(^3\) Grossman, Miller, Fischel, Cone, and Ross, 1997, p.49.

\(^4\) Furbush and Smith, 1996, Table 4.

III. Other Evidence of Price Fixing in Nasdaq?

While the data strongly deny the existence of an even-eighth quoting convention that amounts to price fixing and elevates trading costs, one might still ask the question whether or not all Nasdaq spreads are too high, not just the ones quoted on even eighths. The question arises both because the research on the determinants of the spreads in Nasdaq and other markets suggest that Nasdaq spreads are higher, and also because of what can be seen with the naked eye in the Instinet stock trading system.

Trading in Instinet

Another issue of concern in the 21(a) Report is the finding that market makers put better quotes into Instinet than into the general Nasdaq marketplace:

...further evidence that the pricing convention was an artificial constraint on the Nasdaq market ...(is found)... in the trading activity of market makers in Instinet.\(^{23}\)

It is not in dispute that spreads are narrower on Instinet than in the Nasdaq market. For the period April through June 1994, approximately 85 percent of the quotes that market makers placed on Instinet were better than the inside quote in the Nasdaq market.\(^{24}\)

Instinet is a proprietary system, a network of computers, in which Nasdaq and other stocks are traded. The system is accessible only to the institutional investors and broker-dealers who subscribe to it. The system is essentially a members-only open limit order book. Members can see the limit orders—offers to buy and sell specified amounts of stock at given prices—of other members. These orders are visible and accessible only to other members and not to the trading community in general. Under the rules operating prior to 1997, the inside quotes placed in the Instinet system were not displayed on Nasdaq or otherwise broadcast to non-Instinet members, although all trades executed in Instinet are reported to the tape.

Instinet is formally a broker, but not a market maker, because it has no inventory of stock and does not trade with customers. It merely offers a communication system in which customers can find each other and trade directly with

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\(^{23}\) 21(a) Report, p. 22.

\(^{24}\) 21(a) Report, p. 22.
each other, anonymously, thus bypassing a market maker, and avoiding payment of a spread. Instinet now regularly does 15 to 25 percent of Nasdaq volume. In terms of trading volume, Instinet is, after the NYSE and Nasdaq, the third largest stock market in the U.S. It is larger than the Amex or any of the regional stock exchanges. It is important that we understand why market makers would put better quotes into Instinet than into Nasdaq.

There is one easy reason—Instinet charges explicit commissions. In the Nasdaq system, market makers trade with other market makers and with institutions without charging explicit trading commissions. The commission is implicitly included in the stock price. Instinet’s commissions depend on the amount of trading a customer does with Instinet, and while the commissions are not public, they are generally known to be in the range of two to five or even six cents per share. To measure trading costs, one should compare Nasdaq spreads to Instinet spreads plus commissions. Instinet’s prices have to be better than those of market makers in order for the system to attract any business. For example, most of the trading in New York Stock Exchange-listed stocks through Instinet is in stocks that trade on the NYSE at a spread of one eighth. The stock is traded by institutions in Instinet at one sixteenth, (tick size is up to the customer in Instinet) and normally occurs at the midpoint of the NYSE bid and ask. Neither pays a spread. Each saves roughly 6¼ cents per share compared to trading at the prevailing quotes on the NYSE. Each pays a commission to Instinet. Thus institutions balance the savings from trading directly with another Instinet customer against the commissions Instinet charges.

A straightforward second reason why Instinet prices are better is that the Instinet market is inherently thinner than Nasdaq. In a typical stock, Instinet might handle 20 percent of the trading on Nasdaq, and Nasdaq dealers handle the other 80 percent. Thus, someone placing an order on Instinet may have to wait for a counterparty to appear at the right price. Sometimes customers prefer to trade immediately with a dealer rather than wait for a trade in Instinet at a better price. Nasdaq offers customers immediacy and charges them for it.

A third reason that prices posted in Instinet are more favorable to the customer than the quotes posted by dealers in Nasdaq is that Nasdaq customers, especially regular customers, often get prices better than the quotes by negotiating with dealers. A dealer’s quote should be interpreted as a “list” price—the price at which regular customers of that dealer start negotiation. Huang and Stoll report that 28 percent of

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25 The savings is on average somewhat smaller than 6 ¼ cents per share, because some of the time an institution’s market order placed on the NYSE, will meet another customer’s limit order on the preferred side of the spread, giving the customer an even better deal than trading at the midpoint of the spread.

26 Huang and Stoll, 1996
Nasdaq trades took place at prices inside the best market-wide Nasdaq quotes. But Instinet inside quotes should be regarded as prices intermediate in the negotiation process.

But there are yet more subtle reasons why Instinet's quotes are often narrower than Nasdaq's. First, traders have anonymity in Instinet. If a trader has accumulated a large imbalance in inventory, or an institution has a large order, display of a big order or repeated placing of smaller orders on the Nasdaq system might tip off the market to an unusual demand for buying or selling, making the party with a large order vulnerable to front-running. But by placing orders in Instinet, the trader is more likely to be able to work a large order or inventory imbalance without anyone sniffing out the unusual demand and exploiting (front-running) it.

A second subtle reason that traders prefer Instinet and are willing to offer better prices in this system is that the system is closed to some undesirable potential counterparties. The term economists use to describe the problem that arises when traders trade with someone who may know more than they do about which way price will move is adverse selection—the tendency of some counterparties to select their times to trade adversely to the interests of the market maker. Adverse selection is well established and well studied as an important component of the cost of doing business in securities trading. While price movements resulting from the trades of informed traders affect the value of the holdings of everyone in the market, those who trade at the new prices bear a higher cost because their inventory moves in the opposite direction of the price change. If the concealed news is good, price moves up on the dealer's smaller inventory; if the news is bad, price moves down on the dealer's larger inventory.

If there are two markets in which the same securities are traded, but one marketplace is less fraught with adverse selection than the other, the market with less adverse selection will have narrower quoted spreads. There is nothing sinister or anti-competitive about this. It is exactly the same phenomenon as is seen every day at ordinary supermarkets. In the produce section, there are usually common fruits or

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27 About five percent of Nasdaq trades took place outside the quotes—usually for very large trades.

28 Bagehot (1971) is recognized as one of the first discussions of the role of adverse selection. Glosten and Milgrom (1985) and Kyle (1985) developed models in which quoted spreads rise with the average amount of adverse selection presented by customers. Affleck-Graves et al (1994) and Jones and Lipson (1995) study empirical measures of adverse selection in Nasdaq and at the NYSE. Barclay and Warner (1993) study NYSE trades of different sizes and conclude that medium-size trades are the "stealth" trades that contain the most adverse selection. Chiaing and Venkatesh (1993) provide an estimate of the impact of insider holdings as a proxy for this source of adverse selection on quoted spreads for NYSE stocks. This list is not exhaustive.
vegetables, such as oranges, grapefruits, onions, that are sold both in bags, of say five or ten pounds, and also loose, by the pound. The per pound price of the loose fruit is always higher, even if the loose fruit is exactly the same fruit emptied from the bags. This is because the customers who choose the loose fruit choose it adversely to the interests of the grocer. They choose the better, less blemished specimens, and leave the worse. No one objects or accuses the grocer of price fixing. Everyone understands that the fruit remaining in the loose fruit bin at the end of the day will be inferior to the average fruit in the ten pound bags. Some of it will expire worthless. This is a cost of selling loose produce that the supermarket must cover.

Likewise, if market makers—or institutions—expect there is less chance of trading with a counterparty to whom they will lose money in Instinet, they will be willing to offer better prices in Instinet. The evidence that Instinet is such a trading venue—one with lower adverse selection—is an inference made from indirect evidence rather than any direct evidence based on measures of adverse selection in price changes. This indirect evidence lies in the various controversies that have surrounded Instinet.

In its early years, Instinet was strictly an institutional network. Broker-dealers were excluded from the system. Instinet opened its system to broker-dealers only with great reservations and after lengthy discussion with customers regarding their concerns. On the one hand, customers wanted to see the Instinet market thicken, but they were afraid of being exploited (front-run, mainly) by those who discerned their trading intentions. The concerns of the institutional customers were addressed by allowing institutions the option to display their orders only to other institutions, called an “I-only” display. Should a limited display (I-only) order (that a broker cannot see) match a broker-dealer order, a trade executes automatically for the smaller order size, so broker-dealers can still benefit from the I-only orders even when they cannot see them. Institutions do use the I-only display feature in Instinet. This demonstrates that even in Instinet, some counter parties are feared.

A notable set of traders excluded from Instinet are known as the SOES bandits. Nasdaq’s Small Order Execution System was established after the 1987 market crash because of complaints that small investors could not get through to the markets on the phone. Participation in SOES became mandatory for Nasdaq market makers in 1988. SOES is the only facility in Nasdaq that provides for automated delivery and instantaneous execution of orders. The orders executed through SOES are of limited size. As SOES orders arrive, they are delivered instantaneously to the market makers who are posting the inside (that is, best) quotes. If there is more than

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29 Alltech, a broker who accommodates SOES trading, was once a customer of Instinet but was ousted due to complaints from other customers.
one market maker posting the inside quote, orders are allocated to the market makers on a round-robin basis.\textsuperscript{30} SOES orders were originally limited to 1,000 shares, the same amount for which NASD rules require that market maker quotes be firm. The orders size was lowered to 500 shares on January 31, 1994. SOES traders can submit more than one order, but must wait 15 seconds between order deliveries, giving the market maker the 15 seconds to update his quote.

One of the main strategies of the SOES bandits is to sit and wait for episodes when a market maker appears to not be paying attention to one market and consequently allows that market maker’s quotes to become stale, that is, to fall behind the true market price. For example, suppose prices move up and the market maker’s ask price is low. The bandit then “hits” the stale ask price with an instant buy, confident of being able to sell soon at a higher price. Most SOES traders are individual day traders, retail customers who sit and watch screens, looking to buy and sell to make money on quick turnaround. They do not accumulate large positions. Research on the price moves for SOES-sized trades confirms the complaints of market makers—these trades are associated with adverse price moves, and market makers lose money to SOES traders.\textsuperscript{31} The opportunity to trade in Instinet, shielded from the SOES bandits, is something market makers value and institutions require. And they are willing to post better quotes in such a system. When the SOES system was set up, its creators did not imagine that it would evolve to be used as it now is, by screen-watching day traders trolling for deals, like customers who troll grocery stores looking for mis-priced items.

That the prices posted in Instinet market makers are usually better than the inside quotes in Nasdaq is thus not evidence of price fixing or any other sinister behavior on the part of Nasdaq market makers. Due to its membership restrictions, Instinet is a venue in which the cost of doing business for market makers is lower, in some ways, than in the general market. On the other hand, Instinet charges commissions and its service is not the same as what Nasdaq offers because there is no assurance of an immediate execution. And despite the better prices nearly always seen in Instinet, it has not taken all of Nasdaq’s institutional or inter-market maker business, and has only nibbled at NYSE business—Instinet trading in NYSE stocks is mainly institutional trades at 1/16 in stocks whose spread is 1/8 on the exchange.

\textsuperscript{30} Unlike many other dealer markets, Nasdaq has “minimum quote” rules that require the larger market makers to post quotes within a band of the market’s best quotes and to be at the best quote some of the time. It seems that the main role of these rules is to assure that all large dealers take their turn serving the SOES traders, much in the way assigned risk pools allocate the money-losing risks to auto insurance companies.

\textsuperscript{31} Harris and Schultz, 1996.
Instinet is a very successful competitor in the stock trading business, but not so successful as to dominate it. Dealers and specialists are still viable.

**Costs of Trading in the Nasdaq Dealer Market vs. the Exchanges**

So far I have evaluated the charge that price fixing on Nasdaq took the form of a collusive convention to quote only in even eighths, and the allegation that the willingness of dealers to post narrower quotes in Instinet implied that their regular Nasdaq quotes were too wide. The quantitative analysis of Nasdaq quotes reveals no evidence at all of wider percentage spreads in even-eighth-quoting stocks, and the institutional structure of Instinet offers many explanations for why its quotes are narrower. But how does the whole of Nasdaq compare to other venues where stocks are traded?

In order to make this comparison, we must first note some important institutional differences between Nasdaq and the exchanges (the New York Stock Exchange, the American Stock Exchange, and the regional exchanges). First, in Nasdaq, prior to the January 1997 rule changes, no explicit commissions were generally charged in Nasdaq. For institutions and other market makers, commissions were included in the stock price. Only individual investors, whose orders must be handled by brokers, paid commissions to their brokers, who forwarded the orders to market makers. On the exchanges, explicit commissions are charged to all customers, including floor traders. For the simple reason that exchange stock prices do not include commissions and Nasdaq stock prices do, we should expect to find wider quoted spreads on Nasdaq.

A second important institutional difference is that in Nasdaq, prior to the January 1997 rule changes, all posted quotes were offers posted by dealers. At the exchanges, quotes sometimes reflect the specialist’s offer to buy or sell, but more often reflect a customer limit order—a customer’s offer to trade a specified amount of stock at a given price or better. On Nasdaq, customer limit orders played no role in the quotes. Thus, Nasdaq quotes should be thought of as “list” prices, that is, prices at which negotiation begins. Exchange quotes, however, already reflect part of the negotiation process. Other things equal (the type of stocks traded, treatment of commissions and the types of customers), we would expect quoted spreads on exchanges to be narrower than quoted spreads on Nasdaq because Nasdaq quotes are more purely list prices.

On Nasdaq, a customer, especially a regular institutional customer or another dealer, can get a price better than the quoted price by negotiating with a dealer, usually on the phone, or by trading through Instinet. On the exchanges, a customer can get a better price when another customer’s order arrives close to simultaneously and the specialist matches the two orders at a price inside the prevailing quotes, be they customer limit orders or the specialist’s quote(s). Another way a customer can
get a price better than the quote is if a floor trader decides to take the customer's order at a price better than the prevailing quote. Floor traders often do this when they are working an order, and they see a new order arrive that they believe is from a low adverse selection customer—that is, coming from a customer they believe does not know more than the floor trader knows—and hence is a low cost order. Most trades from individual investors fall into this category.

How much "price improvement" over the quotes customers get is a function of how much adverse selection the floor traders and specialist believe customer's orders reflect. For example, on the New York Stock Exchange, the orders of individual investors on average get the most price improvement, apparently because their orders are the least feared by the specialist and floor traders, and because their orders are seldom large enough to move price.\footnote{See Angel, 1993} In other words, the least knowledgeable customers get the best prices because they are the lowest cost customers. The price improvement received by institutions (called agency trades) is significantly inferior to that received by individuals. On Nasdaq, in contrast, orders for less than 500 shares seldom get price improvement, but about one-third of the orders larger than 500 shares get price improvement,\footnote{Author's own research while at the SEC.} and about five percent of the larger Nasdaq trades take place at prices outside the prevailing quotes. (The very different treatment of small, informationless orders at the NYSE vs. Nasdaq is the main issue in the last section.)

As a result of opportunities for price improvement on both systems, we need to compare not just the quoted spreads but also the effective spreads in order to compare the cost of trading at the different venues. A straightforward way to measure effective spreads is to take the difference between the customer's transaction price and the midpoint of the quoted bid-ask spread.\footnote{There are many other measures of effective spreads. The work of Huang and Stoll (1996) suggests that while the measures produce very different absolute measures of the effective spread, the analyses of them, in particular, Nasdaq vs. the NYSE, are not very different.}

There are three studies using fairly recent transaction data that compare the cost of trading on exchanges to the cost of trading on Nasdaq (including the dealer market plus Instinet). First is Goldstein,\footnote{Goldstein, 1994.} who compares two samples of NYSE and Nasdaq stocks. All have a minimum market capitalization of $18 million. He examines quoted spreads and effective spreads and uses firm size, the volume of trading, the volatility of returns, and the stock price to explain variation in the spreads.
He finds that after his accounting for these variables, quoted spreads on Nasdaq are about 24 cents wider, and effective spreads are 22 cents wider, than on exchanges.

Another study by Huang and Stoll\textsuperscript{36} compares 175 pairs of NYSE and Nasdaq firms for the year 1991. The sample is chosen by matching firms on the basis of 2-digit SIC codes, price, long-term debt, book equity, and market value from the two different markets. Huang and Stoll examine differences in quoted spreads, and use several different measures of effective spreads, and use all of the variables used to match firms plus the volume of trading and return variability to explain variation in the spreads. They conclude that, other things equal, spreads are wider on Nasdaq. They find that the fraction of trades inside the quotes is 27 percent on Nasdaq and 38 percent on the NYSE. They find that for small trades, the difference in the effective spreads is 12.2 cents, for a one-way trading cost of about 6.1 cents per share. For large trades, the difference in effective spreads is 5 cents, or 2.5 cents for a one-way trading cost.

A third study by Kleidon and Willig\textsuperscript{37} uses the same sample of 100 pairs of matched firms that Christie and Schultz used in their original study, and uses price, firm size, the volume of trading, the variance of stock prices, and whether the stock has a listed and trading option to explain variation in the spreads. They find a difference in proportional effective spreads of 2.1 percent. This would be 4.2 cents on a $20 stock, or 10.5 cents on a $50 stock.

There are two statistical issues that make these three studies difficult to compare: sample selection, and equation specification. The sample selection issue has to do with which stocks are selected for the investigation. The equation specification issue concerns which variables that might have an impact on spreads are included in the analysis, and whether it is the simple variable, its square, or the log of it that has the correct relation to the spreads.

These two statistical issues were well illuminated in a study of a very similar issue by Davis and Lightfoot.\textsuperscript{38} They examined the differences in the spreads for stocks listed on the NYSE before April 26, 1979 and those listed after this date.\textsuperscript{39} This is of interest because for companies listed prior to 1979, NYSE members must bring

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\textsuperscript{36} Huang and Stoll 1996

\textsuperscript{37} Kleidon and Willig, 1995

\textsuperscript{38} Davis and Lightfoot, 1995

\textsuperscript{39} Stocks listed before April 26, 1979 trade under NYSE Rule 390, which requires that members of the NYSE bring all customer orders to the floor of the exchange for execution. Stocks listed after April 26, 1970 trade under SEC Rule 19c-3, which allows even NYSE members to trade the stock off-board.
all customer orders to the NYSE for execution. Only non-NYSE members can trade these stocks off-board, that is, away from the floor of the exchange. For those stocks listed after 1979, any broker/dealer, including NYSE members, may trade the stock off-board. The study addresses whether the "market fragmentation" that occurs in the post-1979 stocks impairs the quality of their markets. As of July 1993, stocks traded under Rule 19c-3 comprised 60 percent of NYSE listings, and accounted for 45 percent of NYSE volume.

Davis and Lightfoot perform an investigation much like the comparisons of Nasdaq and exchange stocks in these other studies, in that they use price, volume, and a measure of return volatility and average trade size to explain the percentage spreads. Percentage quoted spreads are measured as the average of bid-ask spread divided by the prevailing stock price over the sample week. They begin with the 1,020 stocks extant as of 1993 that can be traded off-board by NYSE members (traded under SEC Rule 19c-3) and match each one to a stock without this privilege (traded under NYSE Rule 390) on the basis of price and volume of trading. They then order the pairs by the goodness of the match and construct five matched samples of the first 100, 200, 400, 600 and 800 matched pairs, respectively. The full sample of 1,020 stocks traded under Rule 19c-3 stocks and the 870 stocks traded under Rule 390 comprises the sixth sample.

The results of their estimations are startling and instructive. First, experimenting with the specification of the variables, they show that the explanatory power of the regression (the $R^2$) doubles, from 31 percent of variance explained to 61 percent for the best matched sample in the quoted spread regressions (and from 14 percent to 42 percent for the full sample), by using the log of price and the log of volume rather than the straight price and volume variables. (Results are similar for both percentage quoted spreads and percentage effective spreads.) Second, and more important, the size and significance of the dummy variable (indicating whether NYSE members can trade the stock off-board) changes dramatically from the best-matched sample to the worst. For the 100 best-matched stocks, the regression explains 61 percent of the variance and the dummy variable is both statistically and economically insignificant. In the full sample (the worst matched sample), 42 percent of the variance is explained, and the coefficient on the dummy variable, while not economically large (.0004), is highly significant ($t = -6.59$).

This should give us pause to think about the interpretation of these spread regressions. First, it is clear that the specification using $log$s of price and volume is far
better at explaining spreads than the specification that does not use logs of these variables. This implies that spreads rise, although at a decreasing rate, as price or volume rises. But also, even using the log of price and volume, the specification must be in some way lacking because the size and significance of the impact of New York members’ opportunity to trade the stock off-board changes so dramatically as the sample is enlarged and the matches become poorer.

The well-matched sample allows us to isolate the impact of the trading rule by restricting the comparison to stocks that are very similar in the explanatory variables that matter. Recall that the basic research strategy is to use a dummy variable indicating whether the stock trades under the new or the old rule. In the well matched sample, if we have not correctly specified how the other variables affect the spreads, this will not pollute the dummy variable’s coefficient because the samples are so similar in the variables potentially mis-specified. Even in the very poorly specified equations (using straight price and volume instead of log price and volume), we get a correct read on the importance of the trading rule using the best-matched sample, and a misleading one using the full, more poorly-matched sample.

The companies who listed on the NYSE prior to 1979 are now the larger, older, more stable, less volatile companies in our economy, the ones with higher prices and narrower relative spreads. Though many of the post-1979 listings have grown very large, they are in many ways still different from the more mature companies. What happens as we enlarge the sample to poorer matches is that we pick up the older, less volatile, higher volume and higher priced old companies, and more volatile, lower volume, lower priced young companies. What matched sample regressions show is that the dummy variable in the full sample regressions is not picking up the impact of the off-board trading rule alone, but rather is also reflecting the differences between the two sets of companies subject to the different rules that the regression equations have failed to properly account for.

These results of Davis and Lightfoot give us some solid guidance in interpreting the three studies comparing trading costs on Nasdaq and the exchanges. The Kleidon and Willig estimates are the most reliable for two reasons. First, their samples are matched on the basis of price and size (size is highly correlated with trading volume). On this ground, their estimates are more reliable than those of Goldstein, who did not try to match samples at all, trusting the regressions entirely. The Kleidon and Willig estimates are also more reliable than those of Huang and Stoll, who matched their sample on price and size, but used straight volume instead of

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42 Jeff Davis was the Deputy Chief Economist and Lois Lightfoot a staff economist in the Office of the Chief Economist, both at the SEC at the time this research was done.
the log of volume in their regressions. The Kleidon and Willig regressions combine the better matched sample with the better specification of the regression equation.

Thus, the number to focus on in looking for price elevation at Nasdaq is the coefficient on the dummy variable for trading venue (Nasdaq vs. an exchange) in Kleidon and Willig's proportional effective spread regression. This coefficient is 0.0021 indicating that effective spreads are 0.21 percent (of stock price) higher on Nasdaq, other things equal, with a t-statistic of 2.85, highly significant. This means that on a $30 stock, the Nasdaq effective spread will be 6.3 cents per share wider, or that the trading cost is 3.1 cents per traded share higher. An adjustment must be made to this figure because it gives the average difference between NYSE spreads and Nasdaq spreads, other things equal, which we are seeking to interpret as the commission implicit in Nasdaq prices. Because 20 percent of Nasdaq trading occurs in Instinet, which charges explicit commissions and thus reports prices net of commissions, the implicit commission on the remaining 80 percent must be higher than 3.1 cents. Dividing 3.1 cents by .8 gives an average commission implicit in the Nasdaq spread of 3.875 cents (still on a $30 stock). This is not an alarming figure at all. Nasdaq spreads include commissions on 80 percent of all trades and, and 3.875 cents is well within the range of normal trading commissions. It is certainly not a figure that ought to mobilize the Antitrust Division of the Department of Justice.

**Moving from One Exchange to Another**

A final issue to consider in comparing the actual spreads and the factors that influence them is what happens when companies move their stock trading venue from one exchange to another. The various marketplaces compete for listings. Most companies on the NYSE were first traded on an exchange or system that traded stock in smaller companies, and moved from there to the NYSE. Companies move from Nasdaq to Amex, from Nasdaq to the NYSE, from Amex to Nasdaq, but almost never from the NYSE to anywhere else, as the NYSE's Rule 500, which requires a supermajority vote of shareholders to approve delisting, is a formidable barrier to moving.

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41 This incorrect specification of volume will bias the intercept upward, because a log function curves down as the independent variable approaches zero, whereas a straight line does not. In Huang and Stoll's specification, the intercept indicates the difference in spreads due to trading venue (Nasdaq vs. exchanges). Thus, Stoll's specification makes the difference between Nasdaq and exchange spreads appear larger than does a specification that reflects the relationship between spread and volume more accurately.

44 Multiplying 3.1 by 1.25 (= 1/8) gives 3.875.

45 For a thorough discussion, see Aggerwal and Angel, 1996.
As a result of these moves, we have evidence on what happens to spreads and stock prices when companies move. From some nearly 500 moves, we learn that when companies move from Nasdaq to an exchange, effective spreads narrow about 45 percent and prices rise, about two percent. From just under 50 moves, we learn that when companies move from Amex to Nasdaq, spreads widen, but, again, prices rise, about two percent. The fact that prices rise even as spreads widen is critical to interpreting these results. Other things equal, we would expect price to rise when spreads fall, and for price to fall when spreads rise. This is simply because if assets are cheaper to buy and sell, other things equal, they are worth more. But even though the spreads widen when firms move to Nasdaq, their prices rise. Apparently there is some improvement in the marketplace offsetting the rise in effective spreads that occurs when companies move from Amex to Nasdaq.

It is clear from these data that there is more to quoted spreads than simply trading costs. This is not to say that they all should move, but that Nasdaq has something to offer that is important for some companies, and that the companies who choose to move on average choose correctly—as is evidenced by their prices rising. After all, there are now more than 900 companies trading on Nasdaq who qualify for listing on the NYSE, but stay on Nasdaq. The hypothesis of Aggarwal and Angel (1996) for their inertia is that regardless of the venue a company chooses, institutions can find economical trading costs through negotiation and Instinet. So making trading cheaper for the institutions is not the goal of switching listing venue. But the support—both liquidity and market research—that Nasdaq provides is valuable, and it is especially valuable to small companies.

IV. Preferencing, Internalization, Payment for Order Flow, and Price Fixing

The difference between Nasdaq trading costs and exchange trading costs is in the range of normal trading commissions. This evidence of competitive prices could

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46 See Jones and Lipson, 1995 (data are from their work) Christie and Huang, 1994, and Barclay, 1996.

47 See Clyde, Schultz, and Zaman, 1996.

48 Aggarwal and Angel, 1996

49 Research of Affleck-Graves, et al (1994) and Jones and Lipson (1995) suggest that when firms move to an exchange, the cost of processing trades declines, but the adverse selection cost of trades rises. Jones and Lipson conclude that Nasdaq is inherently a deeper market.
dispose fully of accusations of price fixing on Nasdaq. But among the academic observers of securities trading, there is great suspicion of the business practices surrounding the handling of orders from individual investors, known as “retail” orders in the business of stock trading. The suspicion is not difficult to understand. On the NYSE, retail orders get among the best prices of any class of customers. But on Nasdaq, they get among the worst prices. To understand why this is not to the disadvantage of the retail customer, we must explore the trading institutions in detail.

On exchange floors, even though there is only one specialist per stock, competition among the floor traders and the specialist continues until each order is executed. As orders arrive at the exchange floor, floor traders and the specialist assess the order on the basis of size and the identity of the introducing broker, and decide at what price they are willing to fill it. Should no floor trader offer to take the order, it will be executed at either the price of a prevailing inside public limit order or the specialist’s quote, whichever is better. Since retail orders are uninformed and too small to move prices even temporarily, they are on average filled at prices considerably better than the average order. This happens as the floor trader or specialist places an offer inside the prevailing quotes to take the retail market order. The quotes then move back to where they were before the retail order arrived.

For stocks traded only on Nasdaq, all retail orders go from a broker to a dealer/market maker. The competition is over once the order reaches the dealer’s desk. But a different and equally important form of competition takes place in choosing to which dealer’s desk the order will go. If the broker is part of a larger organization with a market-making capacity in the stock, the order will almost certainly go to the in-house market maker (the order is internalized.). If the broker is not part of such an organization, the broker must select an outside market maker. In either case, by SEC rules, the order will be filled at the prevailing inside market-wide quotes regardless of what quotes the market maker who receives the order is posting. Virtually all retail orders in Nasdaq stocks are treated the same way.50

Because retail orders are the lowest cost orders in the stock market, it is quite profitable to execute them at the list prices represented by the market’s inside quotes. The profit elicits competition for these orders. The competition takes the form of dealers paying brokers for sending them their retail orders. This practice is known as payment for order flow. For internalized orders, no explicit payment is made because the profits go to the same organization. In both cases, the order is said to be

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50 There have been isolated exceptions. Prior to the 1997 Nasdaq order handling rules, Madoff was executing retail orders in Nasdaq stocks at Selectnet inside quotes rather than the market-wide quotes in the Nasdaq stocks in which they made a market.
preferred to a given market maker, that is, sent to a given market maker for execution regardless of whether that market maker is posting the inside quotes.

All preferred order flow is screened by the market maker who receives it to assure that it is uninformed. Preferencing agreements are not written; the executing market maker can at any time cut off the broker sending orders if displeased with the nature of the order flow. Or the introducing broker can send orders to a different market maker if offered a higher payment or other preferred terms. The order flow is not captive.

On its face, preferencing seems anti-competitive, because it appears to corral the orders of the market’s most ignorant customers to a venue remote from where prices are being determined, and thus to prevent competition on the spot for executing an order on the most favorable terms for the investor. There are two reasons why this is the wrong interpretation of preferencing arrangements. First, competition to determine the payment for the order can substitute completely for the competition for a better stock price. For example, if a systematic effort to execute an order at the best possible price will, on the average, improve price by one percent, then the customer should be willing to give up the opportunity to search for the best price in return for a rebate of one percent. Indeed, a risk-averse customer should prefer the certain one-percent rebate to the random price improvement. Competition over the rebate replaces competition for the execution of each order. And if it is cheaper not to search for the best possible price for each order, the rebate system would dominate in the market because it is more efficient.

Second, competition for the order can substitute for the competition of a better price because these orders contribute little to the price discovery process. Studies of the information content of various types of orders in the stock market reflect what the preferencing brokers and market makers long knew and what the NYSE trade-by-trade data confirm: retail orders contain little information. Retail customers almost never know which way the price will be moving. If these orders do not on average have an impact on price, nothing is lost—by these customers themselves or the rest of the market—by taking the market’s prices and applying the appropriate discounts to fill these orders.

There is payment for orders even in stocks listed on exchanges, though the payment is much smaller because the prices at which orders are executed are better to begin with. In other words, there is less rent per share in executing retail orders in NYSE-listed stocks at their quotes than there is in executing Nasdaq stocks at their quotes. But the rent in listed stocks is not zero. Both the NYSE and “third market” dealers who compete with it and trade NYSE stocks off the exchange pay for retail orders. How can the NYSE give these orders the best prices and at the same time pay for them? The specialist’s and floor traders’ guesses about whether an order is retail or not are just that—guesses, because their information is good, but not perfect. Thus,
if the orders are batched and, in effect, certified as retail orders, they are more valuable to the market maker than orders which are just likely to be retail orders.

On Nasdaq, the standard by which retail orders are handled, and the expected “price improvement” over the quotes (execution quality) is the same regardless of the venue (market maker) to which the order is routed. This is not true for orders in NYSE stocks. When third market payment for NYSE retail orders began in 1985, dealers executed the orders at the prevailing NYSE quotes. Since retail orders often get prices better than this on the exchange floor, a cry of outrage followed. The one study of the difference in execution quality for NYSE vs. dealer market\(^5\) indicated that the average difference in NYSE vs. third market executions was roughly a penny per share. Since then, some preferencing dealers in NYSE stocks have adopted procedures for “exposing” orders by advertising them briefly (30 to 60 seconds) over the Intermarket Trading System, a computerized linkage among the NYSE, the regional exchanges, and the third market dealers. Still, orders likely have a slightly better chance for price improvement at the NYSE than at most third market dealers.

Even with competing venues treating orders differently, the competition for order flow should be able to substitute for competition for a better price. If one venue gives slightly worse prices, on average, but makes a higher payment for order flow, the broker receiving payment has lower total costs and can offer lower commissions, and the customer is not necessarily worse off.

In order to evaluate the alternatives for where to place a trading order in an NYSE stock, customers need to know both the average quality of retail executions at the different venues where orders are sent as well as the broker’s commission. In a Nasdaq stock, the customer only needs to know the broker’s commission because the execution quality is the same everywhere: execution at the quotes. Thus, the marketplace for NYSE-listed stocks on average gives better prices and makes smaller payments for order flow. Nasdaq executes at worse prices, but makes larger payments for order flow. But since Nasdaq has more consistent treatment of retail orders, it presents a situation that is inherently easier for the customer, especially the retail customer, to assess. Another reason why Nasdaq might give a more consistent result is that it rebates from dealer quotes rather than a changing mix of dealer quotes and customer limit orders, as is done in NYSE stocks. Indeed, we should see the market search for a price which has a consistent relation to the competitive price for retail orders.

\(^5\) Lee, 1993. It is not clear that this study’s estimate is definitive because there was some confusion in Lee’s data about which orders were limit orders and which market orders.
There are no public data on the amounts paid for order flow. Does this secrecy matter? On the one hand, the advocates of transparency argue that when everyone can see what prices everyone else is getting, the market is more efficient. On the other, displayed prices (like posted quotes and real-time reporting to the tape) allow rivals to see each other’s price changes as least as soon as customers do. The potential for rivals’ fast response undermines the inclination of others to lower prices. Further, the SEC rule that requires all preferring dealers to execute retail market orders at prices at least as good as the market-wide inside quotes essentially requires rivals to match any change in any dealer’s quote (for purposes of executing retail orders) and allows them to do it without changing their own quotes. This guarantees that market share in the preferred market will not be won on the basis of quotes.

Even absent these rules, the competition for retail orders cannot take place at the quotes, because dealers cannot move a quote far enough to be competitive for retail orders without attracting customers who are much higher cost than retail. Retail business in Nasdaq has to be competed for by some sort of side payment, simply because quotes must be good for all comers and cannot be customized. Retail business will thus be won on the basis of order flow payment, the efficiency of order handling, (the more efficient, the more the dealer can afford to pay for the order), and how quickly the orders are executed, in other words, in how well the preferencing dealer assists the broker in serving the retail customer. It is not clear at all that the secrecy of the size order flow payments impairs or underlines competition.

Before the accusations of price fixing at Nasdaq, the discussion of payment for order flow focused on whether or not the customer was being disadvantaged, and was exclusively concerned with the diversion of orders in NYSE stocks to third market dealers off the exchange, where orders were not exposed to floor competition, but simply executed at the inside quotes. Now the debate has shifted: order preferencing, internalization, and payment for order flow in Nasdaq are suspected to be additional facets of the price-fixing conspiracy: the competition for retail orders takes the shape of payment for order flow and results in less competition for the execution of individual orders.

For example, Godek, who found no bias in proportional quoted spreads nor evidence of widespread changes in quotes after the Bear, Stearns meeting, nonetheless suggests that preferencing makes the competition at the quotes less acute. Blume and Goldstein, also suspicious, look at trading venues to which orders for NYSE stocks

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52 The SEC responded with a required disclosure in 1995 to alert customers that their orders were being routed for compensation, but did not require disclosure when the order was given, in preference to all others, to the broker’s own market maker.

53 Godek, (1996), p. 466-467
are preferred and assess how much of the time these venues are posting inside quotes. Madhavan\textsuperscript{54} developed a model in which tacit collusion is possible because preferencing enfeebles competition at the quotes, though he acknowledges that if the dealers to whom orders are being preferenced are paying for these orders (and in reality, they all are), the result collapses to competition. Huang and Stoll look at the widening of Nasdaq quoted spreads since 1988 and conclude “We believe that preferencing has increased over time consistent with the increase in spreads, although we do not have direct evidence of this.”\textsuperscript{55}

Huang and Stoll are unlikely to find such evidence, because virtually all Nasdaq retail orders have always been preferred either through payment or internalization.\textsuperscript{56} Retail orders were simply too small and too infrequent (from any given customer) for retail customers to be able to call a market maker directly and negotiate a price. A bit of history is in order. Sometime in the early 1970s, “800” telephone numbers became common, and considerably lowered the cost of calls paid for by the receiving party. Prior to that time, retail stock trading orders in OTC\textsuperscript{57} stocks were

transferred by brokers to correspondents (by telex, cheaper than telephones) who forwarded the orders to market makers. The market makers paid the correspondents two pennies or so per share. When 800 numbers became available, the market makers advertised to brokers to call directly on their 800 lines, and the market makers would give the brokers the correspondent’s two pennies. As the price of long distance telephone service fell, correspondents disappeared. The practice of paying for order flow in OTC stocks nonetheless continued without notice until 1985, when Madoff, a large third market dealer, first offered to pay for order flow in NYSE stocks, to the outrage of the NYSE. Only then did the controversy begin, and the only concern was about trades being lured away from the NYSE floor.

Indeed, there still should be no controversy regarding the preferencing of retail orders in Nasdaq, because the treatment of orders is the same at all venues (the various market makers). In the dealer market, there is no facility for exposing orders. Small and infrequent customers have a poor position from which to negotiate. The discount from the list price (the quotes) is paid in the form of payment for the order flow. The customer’s brokerage house negotiates the discount from list for its retail

\textsuperscript{54} Madhavan, (1966).


\textsuperscript{56} And now virtually all retail orders in NYSE stocks are paid for by either third market dealers, or as internalized orders at member firms, or by the NYSE itself.

\textsuperscript{57} As Nasdaq was called in its earlier days.
customers as a group. This competition for retail orders in Nasdaq is inherently no
less competitive than the form competition takes at the NYSE.

The principle that competition among suppliers benefits consumers is disputed
in virtually no other market: it is accepted that lower prices for car parts will lower the
price of cars, and that higher prices for scrap metal left over from manufacture will
also lower the price of cars. For NYSE stocks, there is legitimate dispute over the
benefits of payment for orders only because of the difficulty retail customers might
have in comparing execution quality across venues. In Nasdaq, there is no such
problem.

Even for NYSE stocks, we find indirect evidence that the preferencing of retail
orders has a competitive impact on the total trading costs paid by retail investors.
First, of course, is the well-advertised decline in brokerage commissions to retail
customers as preferencing in exchange-listed stocks has stimulated the building of
facilities for electronic delivery and execution of retail orders in all stocks. Second,
when a big preferencing market maker enters the market for an NYSE stock (no
preferencing dealer makes a market in all stocks), the quotes in that stock
narrow.58 Third, as the regional exchanges in Cincinnati and Boston have opened
programs to make it easier to preference and internalize retail orders, these venues are
more often displaying the inside quote; and the posting of these inside quotes attracts
trading.59 Bloomfield and O'Hara, in a creative application of experimental markets
ask “Does Order Preferencing Matter?” and find that if there are only two dealers,
both preferencing, in their experiment, prices have a monopolistic aspect. But when
there are three dealers or more, all preferencing, prices are competitive. This is
entirely consistent with the findings in both empirical and experimental research in
industrial organization: The Cournot model of prices in a market with few suppliers
does well at predicting prices with only two competitors, but for more, competition
erupts60 and the above-competitive prices it predicts are not seen.61

Those who see order preferencing as an anti-competitive influence are among
many others who do not see the pervasiveness of cost-based price discrimination in
the stock markets. One of the first pieces of research to establish empirically the
difference between quoted and effective spreads, for example, asked in its title “Good

58 Battalio, 1997, and Battalio, Greene, and Jennings, May 1996

59 Blume and Goldstein, 1997

60 See Chapter 10, Carlton and Perloff, 1997.

61 The Bloomfield and O'Hara experiment is more parallel to Nasdaq than to the NYSE market,
because the dealers are themselves the different venues and all handle preferenced orders similarly.
Prices or Bad Quotes?\textsuperscript{62}, failing to identify the quotes as perfectly good prices for bad (high cost, information-possessing) customers. Other studies looked for quoted spreads in Nasdaq to narrow when the rules governing the SOES bandits, notoriously bad (high cost) customers, were changed, resulting in a much lower volume of SOES business. The quoted spreads did not narrow, but the effective spreads did.\textsuperscript{63} If the quotes are driven by the worst customer rather than the average customer, the interpretation is clear: the worst customers were still there; the quotes reflect their continuing presence. The effective spreads narrowed because fewer of the trades are with the worst customers at the quoted prices, rather than at better prices, inside the quotes, available only to better (lower cost) customers.

Another study\textsuperscript{64} of purchased order flow asks whether it is a form of “cream skimming” and looks at a sample of thirty NYSE stocks in which order flow is purchased, and finds that indeed, trades going to Cincinnati (an exchange that specializes in accommodating preferencing dealers) contain less information than those going to the NYSE. Cincinnati is taking the best (lowest cost) customers! This is taken as evidence that diversion of orders away from the NYSE is not competitive (even though other research confirms that the Madoff firm’s entry through Cincinnati into a new stock often narrows the quotes\textsuperscript{65}). The authors suggest that NYSE prices are worse as a result and will worsen further if more order flow is diverted.

These authors are right—NYSE prices will, on average, worsen (effective spreads will widen) as additional retail orders are diverted, in the same way Nasdaq effective spreads improved as some of the worst trades were deterred. But the prices obtained by the remaining NYSE customers should not change. The specialists and floor traders remain, and they still have a good idea of which customers are which and who knows what. Based on this familiarity, the specialists and floor traders will continue to compete in serving these customers. Face-to-face trading and its telephone equivalent have not been made obsolete by computers. Identity still matters. As retail order flow departs, on average the NYSE will be dealing with worse (higher cost) customers, and charging them more than they would charge the lowest cost customers if they were still around.\textsuperscript{66} But to claim that the customers remaining at the NYSE are

\textsuperscript{62} Petersen and Fialkowski 1994

\textsuperscript{61} See both Furlong 1994, and Harris and Schultz, 1996

\textsuperscript{64} Easley, Keifer, and O’Hara, 1966

\textsuperscript{66} What is more, as NYSE prices worsen, the rent in executing retail orders, and thus the payment for order flow, should rise. Even the retail customer whose order is preferenced is not made worse off by the widening of spreads at the NYSE.
made worse off by the departure of the retail trades is to suggest that everyone in the stock market gets, on average, the same prices (spreads), a claim which is firmly rejected by the data.\footnote{Perhaps the thinking of academic researchers on this point is influenced by the prevailing models of adverse selection, Glosten and Milgrom, 1985, and Kyle, 1985, both of which model the market as one in which specialists cannot tell which customers are which. In such a model, quotes are wide enough to cover the costs of average adverse selection; customers on average pay the same price because the specialist is unable to discriminate among them.}

Is there a better way to treat retail orders? Consider a few alternatives. First, many market critics simply want to see all retail orders exposed to competition as they are on the NYSE floor. We know that this results in them getting very good prices. But we also know there is some rent left because even after such an exposure to competition, the NYSE itself can still pay for retail order flow. Perhaps the NYSE price discovery process would get closer to competing out all of the rent if the retail orders were more clearly identified as such on the floor. In any case, it is clear that competition from third market dealers benefits customers whose orders are executed on the NYSE floor, as it forces the NYSE to pay for order flow, too.

Suppose instead we were to create a market-wide arena to which all retail orders, but only retail orders, would be submitted to competing market makers. This would essentially create a sub-market in which market makers could post quotes good only for retail orders. We would expect the quotes in this market to be, like the quotes in Instinet, narrower than the general market-wide quotes. But then other parties would want access to the superior quotes offered to uninformed customers. Who will monitor the placing of orders to assure they are low cost? If orders could be submitted electronically, by customers sitting in the broker's offices, watching screens, this system would simply become another SOES, plagued with adverse selection and wide prevailing quotes. Without some certifying agent, customers with information—wolves in sheep's clothing—will enter orders and impose costs on market makers, and the quotes will widen to reflect the presence of higher cost customers.

Another possibility is that the retail orders could be entered into a facility as described above, but executed with a delay of, say, ten minutes. The delay would blunt some of the value of any information screen-watchers were gathering. But if there is any other way customers can enter orders—such as electronic entry of limit orders or SOES orders, they may be able to have an impact on price near the time their own order is to be executed, thus re-introducing adverse selection, and again
widenning spreads. What is needed is not just a delay, but a delay of random length.\textsuperscript{68} Such an order handling procedure, like order preferencing, removes the retail orders from the price discovery process. Its advantage would be to give the retail orders better prices directly rather than through commissions reflecting rebates to their brokers.

The problem with the random delay is that, according to brokers, retail customers \textit{like} the opportunity to call their broker, learn the prevailing quotes, and get a confirmation almost immediately of the price at which their order traded. These uninformed customers are probably over-valuing the opportunity to trade immediately. Since they do not know which way price is going to move over the very short term, they will gain as often as lose by a brief delay. They should be willing to trade this for a reduction in the cost of handling orders. But there is no reason to deny the customer even their irrational desires: The system of preferencing, involving as it does the long-term relations between brokers and preferencing market makers, competitive payment for the orders, and the screening of order flow, should obtain for the customer, on average, as good a result in terms of prices and commissions as would a randomized delayed execution in a retail-only market, especially in the Nasdaq market, where all retail orders are handled similarly.

Obtaining a price for uninformed retail orders that reflects their low-cost nature requires that their orders be identified as such. Customers cannot declare this themselves; for the claim to be credible, a certifying party must do it for them. These orders also must be competed for in a way that prevents higher cost orders from obtaining the same deal. The actual prices must come from orders other than the uninformed; which, by their nature contribute little to the price discovery process. The current arrangements in order preferencing agreements do all of this. They certify the orders, compete on the basis of discounts from list, and execute based on market-wide quotes. While we could possibly craft alternative institutions that also do all of this, it is not clear that retail customers would prefer them.

\textsuperscript{68}A similar problem arose in the early days of POSIT, a proprietary trading system that takes institutional customer orders to buy and sell and crosses any matches at the midpoint of the NYSE quotes at a specific time. Originally POSIT specified the precise execution time, giving traders the opportunity to put a large order into POSIT, then to attempt to influence price on the NYSE floor near the execution time by entering smaller orders there. The problem was solved by randomizing the execution time, thus eliminating the opportunity to “bang” the NYSE price. Customers will get the NYSE midpoint at some time randomly chosen in a 30-minute interval. Posit trades, like retail trades that are preferenced, contribute to the price discovery process only very indirectly.
Conclusion

My analysis asked first if Nasdaq dealers appear to have fixed prices above competitive levels through a tacit agreement to quote only on even eighths. There is no evidence that they did. Despite the tape recordings of traders harassing other traders regarding their quotes, the evidence strongly indicates that within Nasdaq, the trading costs for stocks quoted in even eighths are no higher than those for stocks traded in odd-eighths.

The second analysis examined the question of whether there is general evidence of services being priced at above-competitive levels in Nasdaq as compared to other stock trading organizations. While this question involves more difficult statistical issues than the first, the evidence again indicates that once differences in the systems and in the kinds of stocks traded in them are accounted for, Nasdaq trading costs appear to be no higher than trading costs on exchanges. Comparisons of quoted and effective proportional spreads, explicit commissions, Instinet trading, and movements of stock issuing companies from one exchange to another all support the notion of healthy competition both within Nasdaq and across trading venues.

The third analysis addressed the role of preferred orders paid for by market makers. This practice, while appearing superficially anti-competitive, is an effective way for infrequent, uninformed customers to have their status as low cost customers represented by their brokers, and thus get the prices and trading commissions that reflect the costs they impose. While some questions remain regarding whether customers are sufficiently informed for competition to work most effectively for exchange-listed stocks, where different venues offer different execution quality, no such question is present in Nasdaq.

The securities market is one of capitalism’s more complex economic institutions. The interpretation of security prices depends on many factors—the stock traded, the customer served, the system used, the time of day, and other factors as well. The analysis incorporating all of these factors indicates a competitive market, one in which there is no tendency for stocks quoted on even eighths to have proportional quoted or effective spreads greater than those quoted on all eighths. Furthermore, a comparison of quoted and effective spreads for Nasdaq and the exchanges, adjusted for the nature of the stocks traded and the customers for whom it is traded, also indicates a competitive market. Business arrangements that appear to limit competition are, when examined more deeply, the opposite: they make competition more effective, not less, by assuring that each class among diverse customers bears the costs, but no more than the costs, that it imposes on the marketplace. This is true both of Instinet, which prices commissions explicitly and offers valued and legitimate services that no other trading venue offers, and of the practice of payment for preferred orders, which is the most effective means the
market has yet crafted for identifying and serving the customers who impose the lowest costs on the markets.

The competitive prices and business arrangements of the stock market are not different from what we expect in a market where competitors are numerous and where the entry and exit of competitors are low cost and frequent events. When we see these conditions, we should expect to find the market competitive. Only evidence of systematically elevated prices, not just a casual observation of clustered prices or other arcana, should persuade us that the industry is anything other than competitive.
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APPENDIX I  
From Davis and Lightfoot  
TABLE 3  
EQUATION 2 REGRESSION RESULTS  
Equation 2: \( \% \text{spread} = a_0 + a_1 \log \text{price} + a_2 \log \text{volume} + a_4 \beta + a_5 \text{size} + a_3 19c-3 \)

<table>
<thead>
<tr>
<th>Sample</th>
<th>( a_0 )</th>
<th>( a_1 )</th>
<th>( a_2 )</th>
<th>( a_3 )</th>
<th>( a_4 \times 10^7 )</th>
<th>( a_5 )</th>
<th>Adjusted ( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Stocks</td>
<td>0.0658</td>
<td>-0.014</td>
<td>-0.00077</td>
<td>0.00080</td>
<td>1.75</td>
<td>-0.000404</td>
<td>.42</td>
</tr>
<tr>
<td></td>
<td>(67.54)</td>
<td>(-76.61)</td>
<td>(-11.94)</td>
<td>(2.34)</td>
<td>(4.00)</td>
<td>(-6.59)</td>
<td></td>
</tr>
<tr>
<td>Matched 800</td>
<td>-0.0616</td>
<td>-0.013</td>
<td>-0.00072</td>
<td>-0.00008</td>
<td>1.73</td>
<td>-0.000211</td>
<td>.46</td>
</tr>
<tr>
<td></td>
<td>(73.28)</td>
<td>(-77.90)</td>
<td>(-13.39)</td>
<td>(-0.22)</td>
<td>(4.80)</td>
<td>(-4.21)</td>
<td></td>
</tr>
<tr>
<td>Matched 600</td>
<td>0.0616</td>
<td>-0.013</td>
<td>-0.00079</td>
<td>-0.00017</td>
<td>1.7</td>
<td>0.000021</td>
<td>.48</td>
</tr>
<tr>
<td></td>
<td>(66.66)</td>
<td>(-70.32)</td>
<td>(-13.07)</td>
<td>(-0.47)</td>
<td>(4.45)</td>
<td>(0.37)</td>
<td></td>
</tr>
<tr>
<td>Matched 400</td>
<td>0.0479</td>
<td>-0.009</td>
<td>-0.00068</td>
<td>0.00030</td>
<td>1.66</td>
<td>0.000009</td>
<td>.65</td>
</tr>
<tr>
<td></td>
<td>(67.29)</td>
<td>(-63.32)</td>
<td>(-13.82)</td>
<td>(1.32)</td>
<td>(4.22)</td>
<td>(0.20)</td>
<td></td>
</tr>
<tr>
<td>Matched 200</td>
<td>0.0478</td>
<td>-0.009</td>
<td>-0.00070</td>
<td>0.00022</td>
<td>1.84</td>
<td>0.000017</td>
<td>.64</td>
</tr>
<tr>
<td></td>
<td>(46.45)</td>
<td>(-44.29)</td>
<td>(-9.70)</td>
<td>(0.66)</td>
<td>(3.28)</td>
<td>(0.28)</td>
<td></td>
</tr>
<tr>
<td>Matched 100</td>
<td>.0518</td>
<td>-0.011</td>
<td>-0.00064</td>
<td>0.00009</td>
<td>2.14</td>
<td>0.000011</td>
<td>.61</td>
</tr>
<tr>
<td></td>
<td>(31.65)</td>
<td>(-31.31)</td>
<td>(-5.35)</td>
<td>(0.16)</td>
<td>(2.14)</td>
<td>(0.11)</td>
<td></td>
</tr>
</tbody>
</table>

Note: T-Statistics appear in parentheses below the coefficients. A t-statistic of 1.96 or greater (in absolute value) indicates significance at the 5% level of confidence.

This table gives statistics from the investigation of the impact of Rule 19c-3 (which allows NYSE members to make a market off the exchange in stocks listed on the exchange after April, 1979) on market quality as measured by proportional quoted spreads. The first regression includes all NYSE stocks, and the subsequent equations include stocks matched on the independent variables. The last equation included only the best 100 matches, the next to the last the best 200, and so on. He decreasing size and significance of \( a_5 \), the coefficient on the dummy variable, as sample match improves, indicates that the dummy variable is picking up more than just whether the stocks are traded under Rule 19c-3 or Rule 390.