THE JOURNAL OF FINANCE • VOL. LXII, NO. 3 • JUNE 2007

Reputation Effects in Trading on the New York Stock Exchange

ROBERT BATTALIO, ANDREW ELLUL, and ROBERT JENNINGS*

ABSTRACT

Theory suggests that reputations allow nonanonymous markets to attenuate adverse selection in trading. We identify instances in which New York Stock Exchange (NYSE) stocks experience trading floor relocations. Although specialists follow the stocks to their new locations, most brokers do not. We find a discernable increase in liquidity costs around a stock's relocation that is larger for stocks with higher adverse selection and greater broker turnover. We also find that floor brokers relocating with the stock obtain lower trading costs than brokers not moving and brokers beginning trading post-move. Our results suggest that reputation plays an important role in the NYSE's liquidity provision process.

KLEIN (1997) DOCUMENTS THAT REPUTATION HAS PLAYED A ROLE in facilitating trade since at least the Middle Ages by reducing information asymmetries between buyers and sellers. Diamond (1991), Boot, Greenbaum, and Thakor (1993), and Wilner (2000) model reputation's role in various financial market settings. Despite its perceived importance, there is little direct empirical evidence as to the economic value of relationships in financial markets. DeJong, Forsythe, and Lundholm (1985) and others find that reputation matters in experimental markets, but it is difficult to generalize these results. Carter and Manaster (1990) find that an underwriter's reputation is associated with returns of initial public equity offerings, but there seems to be no evidence of reputation effects in secondary equity markets.[1] Here, we use a natural experiment to evaluate the

*Battalio is from the Mendoza College of Business at the University of Notre Dame. Ellul and Jennings are from the Kelley School of Business at Indiana University. We thank the NYSE for providing data. We thank an anonymous referee, Markus Brunnermeier, Shane Corwin, Thierry Foucault, Larry Harris, Frank Hatheway, Christian Lundblad, Thomas McInish, Marco Pagano, Tavy Ronen, Katherine Ross, Gideon Saar, Duane Seppi, Kumar Venkataraman, Ingrid Werner, and participants in seminars at Indiana University, London School of Economics, the NYSE, Oxford Financial Research Summer Symposium, Southern Methodist University, University of Kansas, University of Memphis, University of Notre Dame, Rutgers University, University of Utah, and participants at the 2006 American Finance Association and the Financial Economics and Accounting Conference at the University of Southern California. The opinions expressed in the paper do not necessarily reflect those of the employees, members, or officers of the NYSE.

[1] Cohen (2003 p. 7) notes that Dimensional Fund Advisors (DFA) "reduced adverse selection problems both by dealing with parties that had shown themselves to be trustworthy and by taking steps to encourage greater trustworthiness in trading partners. . . . Preferred sellers were firms (and individuals within those firms) that consistently made full disclosure to DFA of everything they knew about the stock. Such brokers would be more likely to get a deal done and to negotiate

economic importance of relationships on the New York Stock Exchange (NYSE) floor.

The NYSE is organized so that all orders in a security go to one particular floor location where members trading that security gather. One individual, the specialist, trades only the securities assigned to that location. Other individuals, floor brokers, might trade securities at several locations but usually handle all of their brokerage firm's orders in a particular security. Repeated face-to-face interactions between specialists and floor brokers and between different floor brokers provide an opportunity for each of these agents to form reputations—reputations that Pagano and Roell (1992), Benveniste, Marcus, and Wilhelm (1992), Chan and Weinstein (1993), and Desgranges and Foucault (2005) argue play a role in a security's trading process. If relationships are important in attenuating adverse selection, then exogenous disruptions to these relationships allow us to examine their economic importance. We investigate the joint hypothesis that trading relationships matter and that these relationships affect the trading process by examining liquidity costs for a sample of securities that change their trading location on the NYSE floor.

Benveniste, Marcus, and Wilhelm (1992) develop a model of the specialist trading system in which specialists improve the welfare of both exchange members and the investing public by reducing incentives to exploit information advantages. Because of repeated dealings with floor brokers, specialists can sanction traders who use private information to disadvantage other traders, for example, by providing less favorable future prices or by working less hard to find natural counterparties. If a trader bears the full cost of informed trading instead of only the pro rata cost of such behavior, then that trader is less likely to impose adverse selection costs on others. This ability to sanction allows specialists to narrow bid–ask spreads without reducing market-making profitability. In a multiperiod setting, Chan and Weinstein (1993) also conclude that specialists can quote tighter bid–ask spreads because of repeated dealings with floor brokers. In their model, specialists reward brokers revealing private information by providing them information about standing orders.

We identify trading relocations by specialist firms, reorganizations of the floor due to specialist-firm mergers, and the opening of a new trading floor. None of these events result from endogenous changes in trading costs or are associated with NYSE disciplinary actions. If the imminent departure of a specialist from the current trading location suggests that the specialist cannot sanction undesirable and/or reward desirable behavior in the future, then we might observe changes in trading behavior prior to a stock's relocation on the NYSE floor. Specifically, if the floor broker will not be subject to a particular specialist's power to sanction or reward (because the specialist moves but the

a less steep discount. DFA would be more cautious with brokers with whom it was less familiar. Such sellers might find DFA wanted to do smaller deals until a trusting relationship had been established, or that DFA might negotiate a particularly steep discount because of the greater risk associated with the possibility of being 'picked off'." In the dual market trading environment of the German stock exchange, Grammig, Schiereck, and Theissen (2001) document a lower probability of information-based trading on the floor than in the parallel electronic market.

floor broker does not), then trading costs could increase before the move to compensate for the possibility of additional adverse selection risk. In theory, the old equilibrium unravels when the location change is anticipated. If trading relationships matter and these relationships are not established instantaneously at the new location, then the disruption in relationships caused by the relocation also might manifest itself in a security's trading for some time after the change in location. In summary, if relationships are important, then we expect to find an increase in trading costs prior to and a disruption in the trading process after the date that a security changes location on the NYSE floor.

Alternatively, it is possible that the floor broker community is relatively unimportant to the specialist. For example, relationships with individual floor brokers might be irrelevant because much of the trading strategy is determined by traders at the brokerage firm's trading desk and not by the broker on the NYSE floor. That is, knowing that investors and traders are unaffected by the NYSE's space reallocations, the specialist behaves no differently immediately before and after the change in location. In addition, because floor brokers at the new location work for the same brokerage firm as those at the former location, the specialist can punish/reward the new brokers for the behavior of their colleagues at the prior trading location. These arguments suggest there might be no change in trading behavior when a security's trading location on the floor of the NYSE changes.

We begin by demonstrating that floor brokers typically do not follow a stock to its new trading location. Less than 5% of broker badge numbers associated with trades in a stock before its relocation also appear post-move. This suggests that the move disrupts relationships. Next, using the NYSE Trade and Quote (TAQ) database, we examine spreads around the time securities relocate on the NYSE floor. We find a discernible increase in liquidity costs for moving stocks. Consistent with theory, the rise in trading costs is positively related to measured adverse selection and to the broker turnover associated with the moving stock. We also examine the trading costs of individual brokers who do and do not trade the stock at both locations. In the days just before the move, we find that trading costs for brokers that move with the specialist to the stock's new location are somewhat less than the costs faced by nonmoving brokers. These two groups of brokers face similar trading costs in times further from the relocation day. We find that post-move trading costs paid by moving brokers are lower than those paid by the brokers that are new to the trading crowd. This result is especially strong in the first few days after the move when the specialist is trading with a new crowd, and is true regardless of whether the trade is between two moving brokers (who have dealt with each other previously) or between the specialist and a moving broker (who also have traded with each other before). Nonmoving/new brokers are at a trading cost disadvantage when trading with the specialist or with a moving broker. We verify this result in a multivariate setting for stocks with high adverse selection.

Our results suggest that electronic venues might not render the NYSE obsolete. Although anonymous electronic markets are faster and cheaper to operate and monitor than floor-based markets, a large empirical literature finds that floor-based exchanges excel at handling orders possibly motivated by private information.[2] Our work is the first to empirically support theoretical arguments that relationships are a source of this advantage. Although face-to-face interactions appear to be an advantage of floor-based trading, it is not clear that this advantage alone outweighs the cost advantages and potential anonymity available on electronic markets. Furthermore, it is possible that nonanonymous electronic venues also could facilitate relationships.

The remainder of the paper is organized as follows. Section I develops the hypotheses to be tested and introduces the data. Section II examines changes in trading costs around the specialist's location change using publicly available trade and quote data. Section III reviews in detail the trades of the moving and nonmoving brokers using NYSE proprietary data. Section IV concludes.

I. Hypothesis Development, Data, and Microstructure Variables

A. Hypothesis Development

The NYSE floor is organized such that a security trades at one physical location. Each location typically trades multiple securities, the exact number being determined by security characteristics such as trading volume. One individual, the specialist, trades only at one location and is responsible for maintaining a "fair and orderly" market in the securities that trade there.[3] Other individuals, floor brokers, represent customer trading interests. Sofianos and Werner (2000) find that NYSE floor brokers' trades represent 44% of the value of all buys and sells in January and February of 1997. Because orders are time sensitive, the physical area that a floor broker covers typically is limited to something less than the entire exchange floor. In most cases, a floor broker executes all of his firm's orders in a given stock. The organization of trading on the NYSE suggests that specialists and floor brokers trade with each other repeatedly. Furthermore, because trading on an exchange floor is conducted in a face-to-face fashion, the trading relationships among the floor community are more likely to play a role in the floor's trading process than in an anonymous electronic setting.

Theory suggests that relationships among floor brokers and specialists are important in the exchange trading process. Benveniste, Marcus, and Wilhelm (1992), hereafter BMW, argue that repeated face-to-face interactions on the NYSE floor allow specialists (and other floor brokers) to sanction floor brokers

[2] See, for example, Chakravarty (2002), Venkataraman (2001), Garfinkel and Nimalendran (2003), Barclay, Hendershott and McCormick (2003), Waisburd (2003), Bessembinder and Venkataraman (2004), Theissen (2000), Handa, Schwartz and Tiwari (2004), Boehmer, Saar, and Yu (2005), Madhavan and Panchapagesan (2000), Corwin and Lipson (2000), and Coval and Shumway (2001). Each presents evidence that suggests the floor is informationally rich.

[3] Cao, Choe, and Hatheway (1997), Corwin (1999), Coughenour and Saad (2004), and Corwin and Coughenour (2005) present evidence that a stock's trading characteristics are related to the specialist firm trading the stock.

who exploit private information.[4] For example, floor brokers who obtain favorable transaction prices by misrepresenting time-sensitive orders as liquidity trades to specialists or fellow floor brokers might find those parties less willing to trade with them in the future. BMW posit that the ability to sanction is important in constraining individual floor brokers from imposing adverse selection costs on the specialist and/or other brokers in the crowd. In the days before a specialist moves, floor brokers who do not expect to follow the specialist might become increasingly willing to trade on private information. Anticipating this possibility, specialists and other floor brokers might become more cautious when interacting with the floor brokers that they expect to remain behind.

After the move is complete, the specialists and floor brokers regain their ability to sanction crowd members that trade on private information. That is, for the foreseeable future the new floor community will again be involved in repeated face-to-face trades. If the discipline argument is the sole driver of floor relationships, then we expect trading to return to normal immediately after stocks relocate. However, in addition to the discipline hypothesis, we posit that traders have trading reputations that take time to build. Although he focuses on borrower–lender relationships, Diamond (1989) presents a model in which reputation building affects how agents behave and, as a result, equilibrium prices. Diamond shows that borrowers alter their behavior to influence what lenders learn about them. In the presence of sufficient adverse selection, Diamond demonstrates that it takes time for market participants to build their reputations. In our setting, typically there are many new floor brokers in the crowd following the specialist's relocation. Until relationships are formed with the new crowd members, providing liquidity to new floor brokers is more risky than providing liquidity to those with established reputations. This suggests that liquidity providers will offer less-favorable prices for orders handled by new floor brokers to compensate them for bearing the increased adverse selection risk.[5]

BMW, Chan and Weinstein (1993), and Diamond (1989) together suggest that we should see changes in the trading process prior to and following the stock's relocation if crowd relationships attenuate adverse selection. In particular, these theories suggest that the effective spreads paid by orders handled by floor brokers that leave (join) the crowd following a specialist's relocation

[4] Chan and Weinstein (1993) reach similar conclusions, arguing specialists reward floor brokers that reveal private information regarding their orders by offering them tighter bid–ask spreads on future trades. Carlin, Lobo, and Viswanathan (2004 p. 2) theoretically conclude that "traders cooperate through repeated interactions providing liquidity to each other."

[5] Alternatively, in a multiple equilibria game theory setting, the post-switch event period could be considered the time required to move from one equilibrium to another. For example, in Carlin, Lobo, and Viswanathan (2004), traders might find themselves in the noncooperative equilibrium immediately after the switch because they are unfamiliar with each other, but gradually move to the cooperative equilibrium as they become comfortable with each others' trading styles. A competing hypothesis is that it simply takes time for new traders to learn how a stock trades. However, Ellul, Pagano, and van Brommel (2005) demonstrate that initial public offerings reach an equilibrium level of liquidity costs very quickly.

should rise (fall) in the days preceding (following) the move. Although these changes should occur in all relocated stocks, they should be most drastic for stocks with the most asymmetric information and for stocks with the greatest floor broker turnover.

B. Data

Our analysis uses three primary databases. We begin by identifying changes in location on the NYSE floor using "post and panel" data obtained from the Exchange. We then use the NYSE's TAQ database to analyze NYSE trading costs around specialist relocations. Although this approach does not provide the sharpest test of our hypotheses, it provides insight into the overall economic importance of the relocations. Finally, we use proprietary consolidated equity audit trail data (CAUD) obtained from the NYSE to examine whether effective spreads for orders handled by floor brokers that leave (join) the crowd following a specialist's relocation rise (remain elevated) in the days leading up to (following) the move.

The NYSE floor is divided into 20 trading posts. Posts are subdivided into as many as 30 "panels," each with a specialist. Panels are so-named due to the flat-screen panel mounted above the specialist that lists the stocks trading at that location and other pertinent data. The combination of post (numbered one through 20) and panel (lettered, beginning at A in each post) provides a unique floor location.[6] The NYSE's post and panel data provide daily information about where stocks trade beginning in June 1999. We obtain these data for the June 1999 to April 2003 period. To determine changes in location, we first difference these data.

Note that we are not interested in all location changes. The distance a stock moves must be great enough to suggest a turnover in the stock's trading crowd. The NYSE floor is divided into five rooms. The "Garage" contains posts 1 through 4. The "Main Room" consists of posts 5 through 11. Posts 12 through 14 are in the "Blue Room" and 15 through 17 are in the "Extended Blue Room." Finally, "Thirty Broad" contains posts 18 through 20. To be included in our sample, a stock must move from one room to another. Floor brokers are commonly assigned to a specific "room" if the brokerage firm is large enough to have multiple brokers. This prevents a broker from covering too much territory, which slows order placement. The broker typically works from a single location regardless of the mix of stocks trading in that room. Thus, when a stock changes rooms, it is likely to be traded by different floor brokers than it was previously as the brokers in the new room begin coverage.[7] Our sample consists of all location changes from June 1999 through April 2003 involving an entire panel of stocks switching rooms. We require that the panel of stocks remains constant (i.e., the specialist trades the same stocks before and after the relocation). The

[6] A schematic of the floor can be seen at http://marketrac.nyse.com/mt/index.html.

[7] Of the 801 broker badges trading the sample stocks before their relocation, only 34 trade in multiple rooms.

Table I

Events Involving Relocating a Panel of Stocks between Rooms on the NYSE Floor

On the dates listed below, the indicated number of stocks changed the location at which they trade on the floor of the NYSE. The move involves the entire panel of stocks moving to a new room on the floor and continuing to trade as one panel. The apparent reason for the relocation is indicated. Our data cover the period from July 1999 through April 2003.

Date	Number of Relocating Stocks	Apparent Reason for Relocation
July 28, 1999	11	Internal reallocation by Fleet
June 1, 2000	100	Internal reallocations by LaBranche, Fleet, and Susquehanna
November 20, 2000	410	Opening of new trading floor at 30 Broad Street
December 11, 2000	380	Spear Leeds acquires Benjamin Jacobson
December 20, 2000	167	Fleet acquires Meehan
March 25, 2002	28	Internal reallocations by Performance, Susquehanna, and Van Der Moolen

fact that an entire panel of stocks changes location suggests that the specialist and stocks do not change, but that there is a potential change in the floor broker community.

We find six occasions during our sample period in which one or more panels of stocks remains together after a room change. Table I summarizes our sample. The July 1999, June 2000, and March 2002 events appear to be internal reorganizations by one or more specialist firms.[8] Although there are many such reorganizations, these three appear to be the only ones that result in a panel of stocks changing rooms.[9] The majority of our sample of location changes occurs on three dates in 2000: November 20, December 11, and December 20. The November date corresponds to the opening of the 30 Broad trading floor. The latter two dates are apparently the result of specialist mergers. Specialist firms prefer to trade stocks at contiguous posts/panels due to efficiencies that can be gained in support staff. Thus, following specialist mergers, the Exchange typically reallocates space to accommodate the acquiring firm.

To measure the broker turnover associated with these location changes, we acquire NYSE CAUD. Among other information, CAUD provides the counterparties to each trade. For trades involving a floor broker, the broker's badge number (both buyer and seller badge numbers if both are floor brokers) is part of the record. The badge number uniquely identifies an individual member.

[8] There seems to be no publicly available NYSE announcement stating that stocks will change locations.

[9] To the best of our knowledge, these relocations are not due to poor quality executions. Specialists are monitored by the Exchange and evaluated by floor brokers. If the specialist provides unacceptable execution quality, the stock can be reallocated to another specialist. This is not the case for our sample of relocations, which occur for reasons exogenous to trading costs.

By examining CAUD for a period of time before and after the switch in location, we can estimate how many floor brokers follow the specialist to the new location on the floor. We obtain audit trail data for the 2 weeks before and the 2 weeks after each switch. We assume that a broker trades at least once in each of those periods. If that is not true, then we mistakenly classify that broker as one that did not move to the new location (trades before, but not after) or as one that began trading after the switch (trades after, but not before). Table II provides descriptive statistics regarding floor broker turnover around our sample relocations.

Prior to the switch date, about 35 different floor brokers execute trades for the average sample stock. On average, fewer than two brokers (4.7% of the 35.66) appear in *both* the pre- and the post-switch trade data. These brokers participate in about 2.7% of the total trades, but they trade 6.3% of the total shares prior to the specialist's move. Thus, floor brokers that follow the specialist to the new location make fewer but larger trades than the average floor broker.

Table II

Descriptive Statistics for Floor Broker Trading Around Stock Relocations

We examine the trading associated with unique broker badge numbers in the NYSE's audit file in the days immediately prior to and the days immediately following the change in location to create the table's statistics. We have uninterrupted data for 2 weeks before and 2 weeks after the relocation (i.e., event days −10 through +10) and we have data for event days −15 and −20.

Panel A: Floor Broker Trading in Relocating Stocks	
Mean number of floor brokers trading in a sample stock prior to the relocation:	35.66
Percentage of relocating stocks in which a floor broker makes at least one trade prior to the relocation:	89.16%
Mean number of floor brokers trading in a sample stock prior to the relocation conditional on there being floor broker trading activity in the stock prior to the move:	39.99
Percentage of floor brokers moving with the specialist to the new trading location:	4.70%
Percentage of total trades executed prior to the move associated with relocating brokers:	2.69%
Percentage of total shares executed prior to the move associated with relocating brokers:	6.32%

Panel B: Characteristics of Floor Broker Trading Activity

	Relocating Brokers	Nonrelocating Brokers
Mean number of panels at which the floor broker trades before the stock relocates:	1.68	3.08
Median number of panels at which the floor broker trades before a stock relocates:	1.00	2.00
Maximum number of panels at which the floor broker trades before a stock relocates:	8.00	16.00
Percentage of floor broker badge numbers with trades at only one panel before a stock relocates:	50%	10%

In Panel B of Table II, we describe the pre-switch distribution of trading by brokers that do and do not trade in both the pre- and post-move sample periods. Moving brokers concentrate their trading activity in fewer locations than nonmoving brokers (1.68 panels vs. 3.08 panels), on average. Brokers that trade at multiple panels must decide which relationships to disrupt if one panel of stocks moves; that is, they must stay and begin trading the stocks relocated to the vacated panel or move and extinguish relationships with nonmoving panels. Fully one-half of the moving brokers trade at a single panel. For these brokers, it is no surprise that they move to the new location as there is no conflict in deciding which relationships to sever.

We compute spreads (trading costs) and the Huang and Stoll (1996) adverse selection measure around specialist relocations using the NYSE's TAQ database, which contains intraday trades and quotes for NYSE-listed securities.[10] At each moment, we compute a stock's National Best Bid and Offer (NBBO) by taking the highest bid and the lowest offer (i.e., the best prices) quoted by venues on which the stock trades. Time weighting the NBBOs provides the average quoted spread. Computing effective (realized) spreads requires trades matched with the NBBO when (5 minutes after) trades are reported.

C. Microstructure Variables

We use effective spreads to examine the impact of specialist relocations on trading costs. The effective spread, which is the product of an indicator variable that equals 1 (–1) for buy (sell) orders and twice the difference between the trade price and the midpoint of the trade time NBBO ([bid price + offer price]/2), estimates the round-trip immediacy cost liquidity demanders pay. If the spread midpoint represents the stock's true value, then buyers paying more than the midpoint and sellers receiving less than the midpoint pay for immediacy. As the TAQ data do not identify trades as buys or sells, we use the Lee and Ready (1991) algorithm to infer whether a trade is buyer- or seller-initiated.[11] The Lee and Ready (LR) algorithm attempts to classify a trade as a buy or a sell by comparing the trade's execution price to prevailing quotes. Trades with trade prices above (below) the execution time midpoint are typed as buys (sells). To classify trades executing at the midpoint of the execution time quotes, the LR algorithm looks to prior trades. If the price of the prior trade is lower (higher) than the current trade's price, then the current trade is classified as a buy (sell). If the prior trade has the same execution price as the current trade, then the LR algorithm moves backward in time until it finds a prior trade with a different price and follows similar logic. The realized spread, computed as the product of an indicator

[10] See the NYSE's TAQ2 User's Guide for an in-depth description of the TAQ database. Following Bessembinder and Kaufman (1997) and others, we eliminate trades with a Condition Code of "Z" or "G" or a Correction Code exceeding one.

[11] Lee and Radhakrishna (2000), Odders-White (2000), and Finucane (2000) use the NYSE's Trades, Orders and Quotes (TORQ) database to test the Lee and Ready algorithm and document a success rate in excess of 85%.

variable that equals 1 (–1) for buy (sell) orders and twice the absolute difference between the trade price and the midpoint of the NBBO prevailing 5 minutes after a trade, provides an estimate of the gross trading revenue earned by liquidity providers. Finally, the adverse selection component of the spread as defined by Huang and Stoll (1996) is the difference between the effective spread (i.e., what investors pay) and the realized spread (i.e., what liquidity providers earn). Thus, stocks in which quoted prices move against liquidity suppliers (falling after they buy and rising after they sell) have realized spreads that are less than effective spreads and substantial adverse selection as we measure it. Following Bacidore and Sofianos (2002) and others, we standardize each of our microstructure variables by the execution time NBBO midpoint to control for variation in spreads due to differences in price levels.

To ensure that observed changes in trading costs are due to relocations (and not market events), we compare spreads for stocks that change locations with spreads for a matched nonmoving stock sample. For each stock that changes location, we find a similar nonmoving NYSE-listed security. We match on the basis of market capitalization, share price, trade volume, and share price volatility. For market capitalization, we use the year-end Center for Research in Security Prices (CRSP) market capitalization preceding a stock's relocation date. The remaining three matching variables are averages of daily values measured from event day −100 through event day −50. Share price is the average closing price, trade volume is the average number of trades in a day, and share price volatility is the natural log of the ratio of the high and the low trade prices in a day. More specifically, following Bacidore and Sofianos (2002) and Huang and Stoll (1996), we find the matching, nonmoving stock that minimizes the equation

$$\sum_{i=1}^{4}\left(\frac{c_i^{Moving}-c_i^{Non-Moving}}{(c_i^{Moving}+c_i^{Non-Moving})/2}\right)^2,$$

where c_i^{Moving} denotes the value of the ith matching variable for the relocating stock, and $c_i^{Non-Moving}$ denotes the value of the ith matching variable for the stock that does not relocate. For each matching characteristic, i, this minimization is done subject to the constraint

$$\left|\frac{c_i^{Moving}-c_i^{Non-Moving}}{(c_i^{Moving}+c_i^{Non-Moving})/2}\right|<1.$$

We then compare spreads across stocks. Because low-priced stocks can have large relative spreads, we eliminate relocating stocks and their controls on any day that either stock's average trade price is less than $5.00 per share. We include only stock days for which the relocating stock and its control have two or more trades. The price screen decreases the chance that our results are driven by large percentage spreads on low-priced stocks and the trading activity screen increases the reliability of our trading cost estimates. Table III provides descriptive statistics for our sample and control stocks with these screens in place.

Table III

Descriptive Microstructure Statistics for Relocating and Matched Control Stocks

The sample stocks changed the room on the floor of the NYSE in which they trade between July 1999 and April 2003. An entire panel of stocks made the switch and continued to trade as a panel after the relocation. Each sample stock is matched with a nonmoving stock on the basis of market capitalization, share price, trading volume, and share price volatility. The statistics provided below are estimated using data from event day −100 through event day −50. We characterize the distribution of daily averages of various microstructure statistics for both relocating and matched stocks below.

		Mean	Median	Std. Dev	Minimum	Maximum
Trade-weighted average price	Sample	$26.80	$22.41	$20.13	$5.00	$195.53
	Control	$26.22	$22.60	$18.03	$5.00	$181.04
Share-weighted average price	Sample	$26.80	$22.41	$20.13	$5.00	$195.56
	Control	$26.22	$22.60	$18.02	$5.00	$180.84
Average no. of trades per day	Sample	156	41	310	2	3,612
	Control	150	41	287	2	3,908
Average no. of shares traded per day	Sample	342,471	47,000	1,137,852	200	83,995,400
	Control	334,418	49,500	914,421	200	24,106,600
Trade-weighted effective spread	Sample	$0.0603	$0.0463	$0.0566	$0.0000	$2.7251
	Control	$0.0598	$0.0456	$0.0488	$0.0000	$2.3851
Trade-weighted realized spread	Sample	$0.0226	$0.0187	$0.0516	−$1.4848	$3.2210
	Control	$0.0231	$0.0194	$0.0459	−$0.9268	$4.0169
Share-weighted effective spread	Sample	$0.0704	$0.0550	$0.0644	$0.0000	$2.7563
	Control	$0.0700	$0.0545	$0.0578	$0.0000	$2.2109
Share-weighted realized spread	Sample	$0.0219	$0.0174	$0.0604	−$3.4223	$3.2375
	Control	$0.0216	$0.0177	$0.0515	−$1.6672	$4.0495
Time-weighted quoted spread	Sample	$0.1952	$0.1499	$0.1584	$0.0426	$1.8867
	Control	$0.1871	$0.1385	$0.1517	$0.0316	$1.5293

Both sets of stocks have an average share price of about $26, and average about 150 trades and 340,000 shares trading daily during the sample period. The mean quoted spread is about 20 cents, the mean effective spread is 6 or 7 cents, and the mean realized spread is about 2 cents. Thus, the stated price of immediacy (i.e., the quoted spread) is $0.20 for a round-trip trade. The actual cost of immediacy is $0.06 to $0.07 (i.e., trades fill inside the quoted prices, on average). Prices tend to move against liquidity providers in the short run, reducing the realized spread to $0.02 within 5 minutes.

II. NYSE Trading Costs around Stock Relocations

Theory suggests the relationships between crowd members who plan to follow a relocating stock and those who do not begin to break down as the relocation date nears. Theory also suggests that it takes time and multiple interactions for relationships to form between members of the new crowd. In each of these situations, the breakdown of relationships creates greater adverse selection problems for liquidity providers in the crowd. Thus, if relationships on the

NYSE floor help attenuate adverse selection, then we posit that the trading costs (effective spreads) increase in the days leading up to a stock's relocation, remain high on the day the stock relocates, and then gradually decline in the days following the stock's relocation.

As theory provides no guidance as to *when* relationships break down or evolve, we compute spreads for each relocating stock and its match from 60 trading days before to 60 trading days after the sample stock moves. We then test our hypothesis by examining the difference between the effective spreads of the moving and nonmoving stocks across time using standard event study methodology.

A. Relocation and Trading Costs (Effective Spreads)

First, we plot the differences in relative effective spreads for sample and control stocks around the sample stocks' relocation on the NYSE floor. For each stock pair in the sample on a given event day, we subtract the matched stock's share-weighted relative effective spread for the day from the sample stock's share-weighted relative effective spread on the same day. Because theory suggests larger trades are most likely to be affected by disruptions to relationships, we aggregate effective spreads on a stock day by share-weighting effective spreads on individual trades.[12] Next, we find the median difference across all stock pairs in the sample on that day and plot these differences for event day −60 through event day +60 for the entire sample and for the group of relocating stocks with above-median adverse selection costs in Figure 1.

Figure 1 presents evidence that is consistent with our hypothesis. We find that the relative effective spreads for the entire sample of relocating stocks and their controls are approximately equal in the period of time well before and well after the location change. Beginning about 40 to 45 trading days prior to the switch, relative effective spreads for the relocating stocks increase versus their controls. From event day −5 through event day +27 the median (mean) difference is about 2 (5) basis points. With an average sample stock price of \$26.80, a 5-basis point increase in relative effective spreads represents a mean increase in trading costs of \$0.0134 per share. Given that the average dollar effective spread is \$0.0704, this represents an economically significant increase in effective spreads of 19%.

Table IV reports the results of cross-sectional *t*-tests (Wilcoxon tests) of the mean (median) spread difference between relocating stocks and their controls for event days −55 through +55.[13] Consistent with the results presented in

[12] Our conclusions are unaffected when we trade-weight effective spreads. We also reach the same conclusions if we focus on trades for 10,000 or more shares or trades exceeding 2.5% of average daily volume.

[13] We anticipate that the location change causes an increase in spread variance, which produces a test statistic that overrejects the null hypothesis of zero spread differences (see Brown and Warner (1980, 1985)). We use the standardized cross-sectional test developed by Boehmer, Musumeci, and Poulsen (1991) to solve this problem. The results reported in the paper use the period from event day −120 through event day −80 as the base period. Similar results obtain when we use the period from event day −100 through event day −50 as the base period and when we use the standard *t*-test.

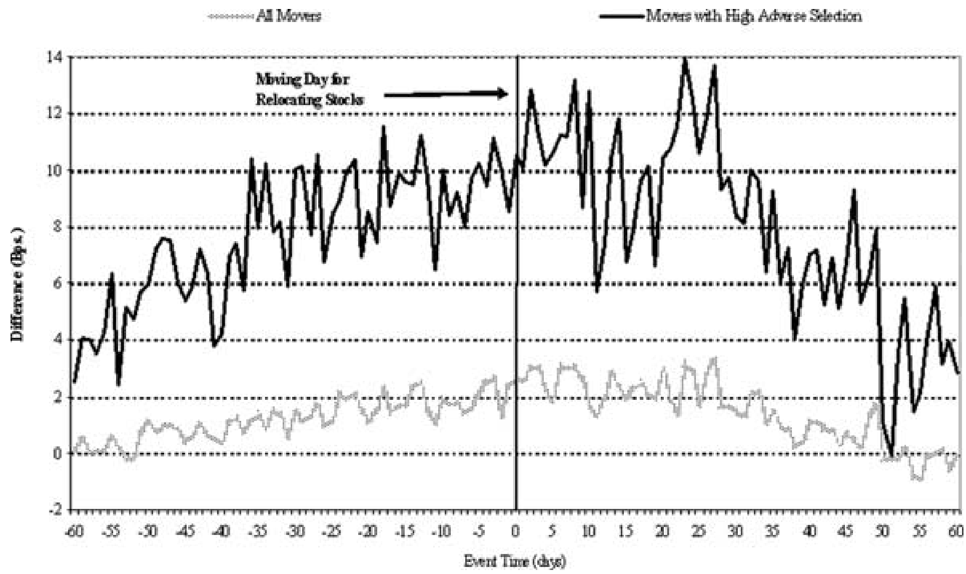

Figure 1. Median differences in the share-weighted relative effective spreads of relocating stocks and their controls.

Figure 1, we find evidence of statistically increased relative effective spreads for relocating stocks versus their controls starting around event day −35 and ending after event day +35. This suggests that the trading process is disrupted about 7 weeks prior to the relocation and that it takes about 7 weeks for spreads to return to "normal" after a location change. These results support the hypothesis that reputation effects matter in the trading process.

Theory suggests that the stocks for which relationships are most important are those with high levels of adverse selection. In stocks with little private information, ending or starting a relationship should not matter much. To investigate this intuition, we divide the sample of relocating stocks into two groups based on their level of adverse selection. As in Huang and Stoll (1997), we measure adverse selection as the difference between the relocating stocks' effective and realized spreads on event days −120 through −80.[14] If the effective spread is much larger than the realized spread, then we conclude that there is substantial adverse selection. We divide the sample stocks into high and low adverse selection subsamples by comparing each relocating stock's adverse selection measure to the median measure.

We repeat the event study for the sample stocks with high adverse selection. Figure 1 graphs the median differences in the stock pair's daily share-weighted

[14] We choose a different period of time from that used to select our control stocks; however, using the same period as we use to select control stocks (days −100 through −50) produces nearly identical high/low designations. Likewise, using a ranking based on the probability of information-based trading (Easley, Kiefer, and O'Hara (1997)) is very similar (93% agreement).

Table IV

Differences in the Share-Weighted Relative Effective Spreads of Relocating Stocks and Their Controls

Control stocks are selected based on market capitalization, share price, trading volume, and stock price volatility. To compute the reported number, we take the difference between the average share-weighted relative effective spread of the stock moving to a new location and the corresponding control stock that does not relocate. Sample stocks relocate on event day 0. The statistical test for the mean difference being positive is conducted using the Boehmer, Musumeci, and Poulsen (1991) t-statistic with the period −120 to −80 as the base period. Each of the differences that are found to be statistically significant with the standardized cross-sectional test is also found to be significant using the standard t-test. We use the Wilcoxon test to examine the differences in medians.

Event Time (days)	Difference in Basis Points		Event Time (days)	Difference in Basis Points	
	Mean	Median		Mean	Median
−55	2.43[a]	0.57[a]	0	6.05[a]	2.60[b]
−45	1.38	0.38	1	5.87[a]	2.57[b]
−35	3.58[b]	1.39[a]	2	4.58	3.01[b]
−25	3.65[b]	1.12[a]	3	6.63[b]	3.00[b]
−20	1.00	1.06[a]	4	6.00[b]	2.20[b]
−19	2.81[b]	1.49[a]	5	5.30[b]	1.83
−18	4.19[b]	2.29[a]	6	5.37[b]	3.08[b]
−17	3.23[b]	1.45[a]	7	4.62[b]	3.00[b]
−16	4.42[b]	1.69[a]	8	5.50	3.07[b]
−15	5.39[b]	1.74[a]	9	4.97[b]	2.61[b]
−14	4.12[b]	2.39[b]	10	4.63[b]	1.65[a]
−13	4.57[b]	2.49[b]	11	3.85[b]	1.34
−12	3.89[b]	1.50[a]	12	6.96[b]	1.96[a]
−11	2.99	1.05	13	3.96[b]	2.80[a]
−10	4.17[b]	1.92[a]	14	6.43[b]	2.37[a]
−9	3.65[b]	1.80[a]	15	4.65[b]	1.92[a]
−8	3.93[a]	1.71[a]	16	4.34	2.29[a]
−7	4.52[a]	1.42	17	5.26[b]	2.47[b]
−6	3.66[b]	1.62[a]	18	4.86[b]	2.15[b]
−5	4.10[b]	2.11[b]	19	4.97[a]	1.94[a]
−4	4.53	2.46[b]	20	7.10[b]	2.97[a]
−3	6.81[b]	2.68[b]	35	4.45[a]	1.40[a]
−2	4.41[b]	1.28[a]	45	2.90[a]	0.67
−1	7.84	2.36[b]	55	1.92	−0.92

[a] The difference is statistically significant at the 0.95 confidence level.
[b] The difference is statistically significant at the 0.99 confidence level.

relative effective spreads. The pre- and post-event difference in effective spreads is about 3 basis points. This is not surprising as we rank relocating stocks on their adverse selection levels before the event period. Around the switch, the difference increases to between 10 and 14 basis points, an increase in the spread difference of 7 to 11 basis points. This exceeds the change documented for the overall sample, which is consistent with the claim that reputations matter more for stocks with greater adverse selection. Given the $17.14 average share price for the high adverse selection sample stocks, a 10-basis point increase translates into a 1.7-cent increase in effective spreads. Again, this is economically significant when compared to a \$0.0814 average effective spread (a 21% increase). The difference in effective spreads returns to its pre-relocation level by event day +50.

As with the overall sample, we conduct statistical tests of the differences in daily relative effective spreads in the period surrounding the relocation of stocks with above-median levels of adverse selection and report the results in Table V. The evidence of widening effective spreads for the high adverse selection subsample is stronger than that for the overall sample. With few exceptions, starting 45 days before the switch and continuing 35 days afterward, the relocating stocks with high adverse selection have relative effective spreads that exceed their controls using at least one of the statistical tests. These results are consistent with the hypothesis that the relationships on the floor of the NYSE are economically meaningful.

We employ three other approaches for measuring the statistical significance of the effective spread's changes during our event period to assess our results' robustness; to conserve space, we do not report the details. First, we compute the differences between the effective spread on a particular event day for a given stock (sample and control) and the mean share-weighted spread for that stock between event days −120 and −50. Then, for each sample control pair, we compute a difference-in-differences and average these differences across all pairs. The differences-in-differences are consistently significantly elevated on event days −35 through +37. Second, we compare a sample stock's daily share-weighted average effective spread to its own overall mean share-weighted effective spread. For the July 28, 1999, the June 1, 2000, and the March 2, 2002 moves, the overall mean share-weighted effective spread includes all trades on event days −120 through +120. For the three moves occurring in late 2000, we include only the post-move days prior to the change to decimal pricing (January 29, 2001) when computing the overall mean effective spread in order not to bias our test toward finding an increased spread around the move date. We compute the equally weighted average difference (daily effective spread minus overall mean) across sample stocks for all appropriate event days. Using this approach, we find that the effective spreads are consistently significantly elevated from event day −28 through event day +27. Third, we conduct an odds ratio test in which we compare event period effective spreads to a benchmark period's (days −120 to −50) mean effective spread. We compute the ratio of the number of sample stocks with elevated effective spreads on a particular event day to the number of sample stocks with decreased effective spreads on the same event day, and compare this ratio to the comparable ratio using the control stocks. A quotient greater than 1.0 is consistent with an increase in spreads. The odds ratio is significantly greater than 1.0 from about event day −24 through event day +29.

In summary, although the length of the period over which we observe increased effective spreads differs across methodologies, we consistently conclude that the trading costs are elevated in the period of time around a stock's relocation on the NYSE floor. This is consistent with relationships being important in the trading process.

Table V

Differences in the Share-Weighted Relative Effective Spreads of Relocating Stocks with High Adverse Selection and Their Controls

Control stocks are selected based on market capitalization, share price, trading volume, and stock price volatility. To compute the reported number, we take the difference between the average share-weighted relative effective spread of the stock moving to a new location and the corresponding control stock that does not relocate. Sample stocks relocate on event day 0. Adverse selection is measured as the difference between the sample stocks' effective and realized spreads on event days −120 through −80. Our sample of high adverse selection stocks is comprised of relocating stocks with higher-than-median levels of adverse selection. The statistical test for the mean difference being positive is conducted using the Boehmer, Musumeci, and Poulsen (1991) t-statistic with the period −120 to −80 as the base period. Each of the differences that are found to be statistically significant with the standardized cross-sectional test is also found to be significant using the standard t-test. We use the Wilcoxon test to examine the differences in medians.

Event Time (days)	Difference in Basis Points		Event Time (days)	Difference in Basis Points	
	Mean	Median		Mean	Median
−55	6.70	6.35	0	17.73[b]	10.53[b]
−45	7.59[a]	5.39[a]	1	13.08[a]	10.08[b]
−35	9.65[b]	7.93[a]	2	11.77	12.82[b]
−25	12.75[a]	8.48[a]	3	16.53[b]	11.21[b]
−20	9.15[b]	8.55[a]	4	15.55[a]	10.19[b]
−19	10.96[b]	7.46	5	14.67[b]	10.59[b]
−18	13.13[b]	11.59[b]	6	15.17[b]	11.20[b]
−17	9.44[b]	8.72	7	13.63[b]	11.16[b]
−16	11.92[b]	9.93[a]	8	11.08	13.22[b]
−15	12.24[a]	9.58[a]	9	13.34[b]	8.70
−14	10.34[b]	9.47[a]	10	14.44[b]	12.75[b]
−13	13.15[b]	11.23[b]	11	10.37	5.72
−12	9.59	9.75	12	17.10[b]	7.39[b]
−11	11.29[b]	6.51	13	12.24[b]	10.40[b]
−10	12.34[a]	9.98[b]	14	18.74[b]	11.82[b]
−9	8.67	8.40[b]	15	12.37[b]	6.76
−8	13.17[b]	9.25[b]	16	10.10[b]	7.86
−7	12.74	8.00[b]	17	13.11[b]	9.63[b]
−6	11.41[a]	9.65[b]	18	14.89[b]	10.13[b]
−5	10.61[a]	10.24[b]	19	10.79	6.60
−4	11.85	9.41	20	16.49[a]	10.41[b]
−3	14.95[b]	11.14[b]	35	11.86[a]	9.27[a]
−2	14.41[b]	10.04[b]	45	8.64[a]	6.68
−1	17.17[b]	8.56[a]	55	8.87	2.06

[a] The difference is statistically significant at the 0.95 confidence level.
[b] The difference is statistically significant at the 0.99 confidence level.

B. Relocation and Quoted and Realized Spreads

Effective spreads represent the actual price of immediacy. Quoted spreads represent the displayed cost of immediacy. Thus, if traders always receive quoted prices, then effective spreads equal quoted spreads. To determine if the displayed price of immediacy changes in the days around a stock's relocation, we provide the time series of quoted spreads in Figure 3. For each stock day, we compute the time-weighted NBBO quoted spread, that is, we weight a given NBBO spread by the proportion of the day it exists. If, for example, a stock has a \$0.0625 spread one-half of the 23,400-second trading day and a \$0.125 spread the other half, then that day's time-weighted NBBO spread is \$0.09375. We report the median difference (sample minus control) in relative quoted spreads across stocks in Figure 2.

Because quoted spreads are relevant only for small trades (the liquidity provider's liability is limited to the quoted size), we do not expect as much of an impact on quoted spreads as we document for share-weighted effective spreads. Although muted in comparison with the time-series pattern of effective spreads, quoted spreads seem to exhibit a small elevation around event days. The overall average quoted spread difference increases from about 1.3 basis points over event days −60 through −40 to over 2.0 basis points from event day −20 through event day +40. For the high adverse selection subsample, quoted spreads exhibit a time-series pattern similar to effective spreads, rising prior to the switch and falling slowly afterward. The quoted spread difference is about 15 basis points from event days −60 through −40 and again past event day +35. It rises to over 20 basis points around (particularly after) the stock's relocation. Thus, the sample stocks' higher actual cost of immediacy (effective spreads) is due partially to a rising displayed cost of immediacy (quoted spread) and partially to reduced trading within the quoted spread.

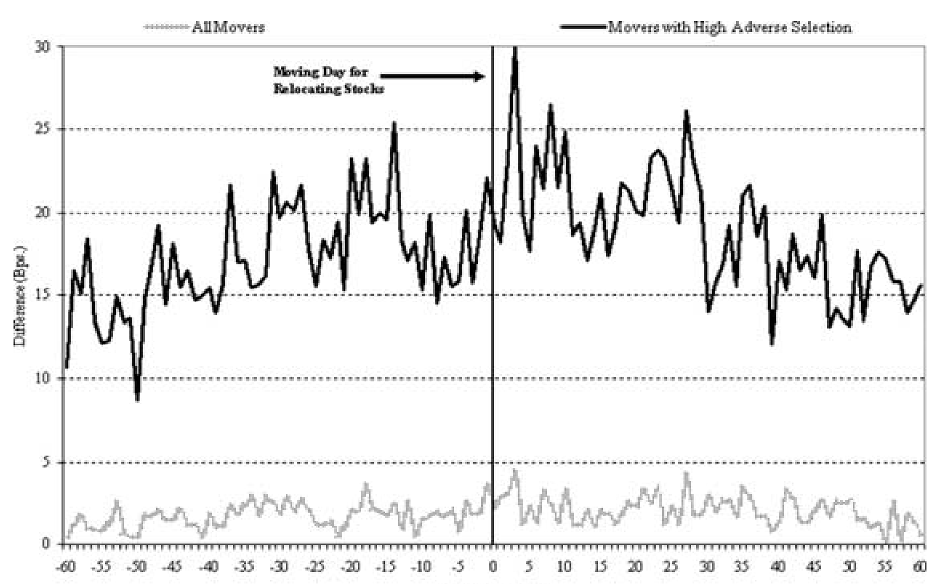

Figure 2. Median differences in the time-weighted relative quoted spreads of relocating stocks and their controls.

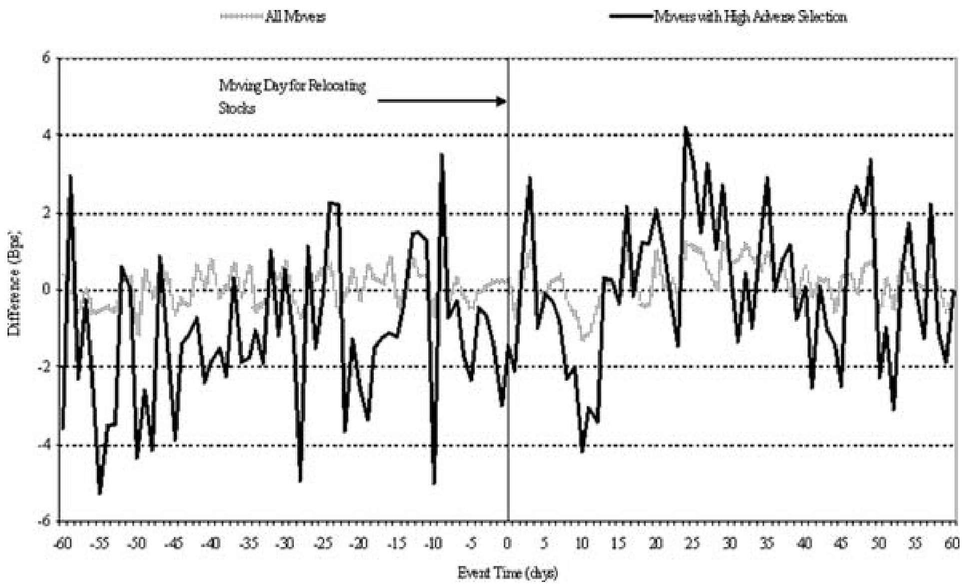

Figure 3. Median differences in the share-weighted relative realized spreads of relocating stocks and their controls.

One possible explanation for less trading inside the quoted spread (i.e., reduced price improvement) is a reduction in the frequency with which the specialist interacts with incoming orders. The specialist participation rate is the number of shares the specialist trades divided by the total number of shares traded. It is possible that the specialist (either consciously or not) trades less during the period of time around the stocks' relocation than at other times. Although TAQ does not permit us to determine whether the specialist participates in a particular trade, CAUD does. Using CAUD, we compute the specialist participation rate of sample stocks around their relocation. The average specialist participation rate is about 24.5% (24.3% pre-move and 25.4% post-move). This varies between 20% and 29% across the days of available CAUD data, but there is no time-series pattern associated with the move date. Thus, we conclude that a reduction in the specialist interaction is not responsible for the increased effective spread.

Next, we investigate if the higher trading costs paid by investors for immediacy translates into an increase in the estimated trading revenue liquidity providers earn. We use the realized spread, which compares the trade price to the bid–ask spread's midpoint 5 minutes after the trade, as a proxy for gross trading revenue. If a liquidity provider buys (sells) and the stock price falls (rises) after a trade, then the liquidity provider might lose all or part of the trade-time effective spread paid by the liquidity demander at the time of the trade. Implicitly, this measure assumes that, on average, liquidity providers unwind their positions at the midpoint of the bid–ask spread 5 minutes after they trade. Larger realized spreads around the time of the location change would suggest that liquidity providers (including the specialist) retain at least a portion of the increase in effective spreads. Should the realized spread remain constant across the change, however, we would conclude that the increase in effective spreads is just sufficient to offset additional adverse selection costs. Finally, a falling realized spreads in the days preceding and immediately following stock relocations would suggest that liquidity providers are harmed by the changes in locations.

Figure 3 contains a plot of the daily median difference in the mean relative realized spread (relocating stock minus control) for both the overall sample and the high adverse selection subsample. We see little change in realized spreads around the relocation date; the realized spread differential seems to fluctuate around zero. This suggests that the increase in effective spreads is approximately sufficient to compensate liquidity providers for the higher levels of adverse selection around location changes.[15]

C. Multivariate Analysis of the Differences in Relative Effective Spreads

We have shown that the relocating stocks' effective spreads rise relative to their controls prior to the location change, remain elevated for some time, and then return to "normal." As theory predicts, this is particularly true for sample stocks with high adverse selection. To determine if these results are robust in a multivariate setting, we estimate regression equation (1) below. Note that we have one observation per stock day using all trades from event days −120 through +120. Where appropriate, we compute daily average variables for each sample and control stock. Thus, the maximum number of observations that we could have is 264,136 (= 241 days times 1,096 stock pairs). After imposing the constraints that: (1) the average trade price must be at least \$5.00 and (2) the stock must have at least two trades per day, our sample has 202,994 observations. The regression specification is as follows:

$$\begin{aligned}\Delta ES_{jt} = \alpha &+ \beta_1(High\ AS_j)(Event\ Time)^2 + \beta_2(Low\ MB_j)(Event\ Time)^2\\ &+ \beta_3(ASCosts_{jt}) + \beta_4(\Delta TradeSize_{jt}) + \beta_5(\Delta\ no.\ of\ Trades_{jt})\\ &+ \beta_6(\Delta TradePriceInv_{jt}) + \beta_6(\Delta PriceVolatility_{jt})\\ &+ \beta_7(New\ Location\ Dummy) + \varepsilon_{jt},\end{aligned} \tag{1}$$

where ΔES_{jt} is the difference in the relative effective spreads for stock pair j (sample minus control) on event day t, $High\ AS_j$ is a binary variable taking the value of 1 if the relocating stock has a higher-than-median level of adverse selection in the control period, $(Event\ Time)^2$ is the event date squared, $Low\ MB_j$ is a binary variable taking the value of 1 if the fraction of floor brokers that follows a stock to its new location is less than the 75th percentile for relocating stocks and

[15] Cross-sectional t-tests of the mean and Wilcoxon tests of the median quoted and realized spread differences between relocating and controls stocks for event days around day 0 confirm these conclusions. We do not report results to conserve space.

zero otherwise,[16] $ASCosts_{jt}$ is the daily average of the difference between the relocating stock's effective and realized spreads, $\Delta TradeSize_{jt}$ is the difference in average trade sizes for stock pair j on event day t, Δ *no. of* $Trades_{jt}$ is the difference in the number of trades for stock pair j on event day t, $\Delta TradePriceInv_{jt}$ is the difference in the inverses of the trade prices for stock pair j on event day t, $\Delta PriceVolatility_{jt}$ is the difference in the log of the ratio of high price to low price for stock pair j on event day t,[17] and the *New Location Dummy* is a binary variable taking the value of 1 if event day t is on or after the relocation date and the value of zero otherwise. We include fixed effects for each event day in the regression, but we do not report those results.

Theory suggests that the estimates of β_1 and β_2 will be negative—consistent with a larger effect on ΔES (more curvature in the time series of differences in relative effective spreads) for relocating stocks with high adverse selection and few relocating floor brokers. We documented the former effect in a univariate setting. Here, we hypothesize that relocating stocks with fewer brokers moving have more turnover in the trading crowd, and therefore, have more disruption in the trading process. Trade size, trade price, price volatility, and the number of trades are control variables. We include the time series of the relocating stock's adverse selection to allow the level of adverse selection to change throughout the event window.

Table VI contains the results of our multivariate analysis of the differences in effective spreads around location changes. Relative to their controls, relocating stocks have larger effective spreads when they have larger trades than their controls, when they have fewer trades than their controls, when they have more volatility than their controls, and when they have lower prices than their controls. The difference in effective spreads between moving stocks and their controls also is directly related to the moving stock's level of adverse selection during the event period. Of particular interest, we see that the time series of differences in effective spreads (relocating stocks minus their controls) is more extremely "humped" for relocating stocks with high levels of adverse selection costs and/or for moving stocks with few relocating floor brokers. We obtain similar results when the two factors are considered separately (models 1 and 2), together (model 3), or together with an additional post-switch binary variable (model 4). These results are consistent with the hypothesis that reputations are useful in countering the adverse selection problem on the floor of the NYSE.[18]

[16] We use the 75th percentile rather than the median as over 50% of the sample stocks had no broker moving.

[17] We use various functional forms of the high–low price ratio and return without affecting the conclusions.

[18] With over 200,000 observations, it is possible to reject a null hypothesis that is only slightly incorrect (Lindley (1957)). To address this issue, we conduct 10,000 regressions of 500 observations, where each observation is randomly selected from the sample of 202,994 observations. The coefficients of interest (β_1 and β_2) are statistically significant with the opposite sign of what is reported in Table VII in less than 2% of the regressions and are statistically insignificant in 6% to 7% of the regressions.

Table VI

Multivariate Analysis of Differences in the Relative Effective Spreads of Relocating Stocks and Their Controls Around Location Changes

The dependent variable is the difference in the relative effective spreads of a relocating stock and its control. The estimates shown are obtained from a fixed-effects (*Event Time*) regression model. *High AS* is a binary variable taking the value of 1 if the relocating stock has higher-than-median level of adverse selection. Low MB is a binary variable taking the value of 1 if the fraction of NYSE floor brokers following a stock to its new location is less than the 75th percentile for relocating stocks. (*High AS*)(*Event Time*)^2 is an interactive variable between the *High AS* and the square of event time relative to the switch date. (*Low MB*)(*Event Time*)^2 is an interactive variable between Low MB and the square of event time relative to the switch date. *ASCosts* is the daily average of the difference between the effective and the realized spread for relocating stocks. Difference in *TradeSize* is the daily average difference between the trade size (in shares) of relocating stocks and their controls. Difference in the *no. of Trades* is the daily average difference between the number of trades in relocating stocks and their controls. Difference in *TradePrice* is the daily average difference between the inverse of the trade price of relocating stocks and their controls. Difference in *PriceVolatility* is the daily average difference between the log of the ratio of high to low price of moving stocks and their controls. New Location Dummy is a binary variable taking the value of 1 for trades occurring on trading days after the location change. We have 202,994 observations. t-statistics are shown in parentheses.

	Model 1	Model 2	Model 3	Model 4
Constant	−0.08[a]	−0.07[a]	−0.07[a]	−0.08[a]
	(−18.49)	(−16.80)	(−17.40)	(−17.51)
(*High AS*)(*Event Time*)^2 $\times 10^6$	−2.75[a]		−2.61[a]	−2.61[a]
	(−7.04)		(−6.72)	(−6.71)
(*Low MB*)(*Event Time*)^2 $\times 10^6$		−1.76[a]	−1.43[a]	−1.44[a]
		(−9.43)	(−8.14)	(−8.22)
ASCosts	0.41[a]	0.41[a]	0.41[a]	0.42[a]
	(19.66)	(20.24)	(19.67)	(19.65)
(Difference in *Trade Size*) $\times 10^6$	0.85	0.83	0.83	0.82
	(2.38)	(2.32)	(2.34)	(2.33)
(Difference in *no. of Trades*) $\times 10^4$	−1.33[a]	−1.32[a]	−1.34[a]	−1.39[a]
	(−34.40)	(−32.67)	(−33.79)	(−33.79)
(Difference in *Trade Price Inverse*) $\times 10^6$	2.54[a]	2.55[a]	2.55[a]	2.53[a]
	(55.53)	(55.26)	(55.52)	(54.35)
Difference in *PriceVolatility*	2.92[a]	2.91[a]	2.93[a]	2.92[a]
	(31.65)	(31.48)	(31.68)	(31.63)
New Location Dummy				0.02[a]
				(10.84)
Adjusted R^2	0.26	0.26	0.26	0.26

[a] The difference is statistically significant at the 0.99 confidence level.

D. Summary

We find that the disruptions to NYSE floor relationships are associated with increases in trading costs. Relative to a matched sample of nonmoving stocks, our relocating stocks' quoted and effective spreads rise in the weeks before moving and remain elevated for several weeks after the move, while realized spreads are unaffected. The increase in effective spreads is evident in both univariate and multivariate analyses. We hypothesize that this dislocation is due to disruptions in trading relationships. Consistent with theory, we also find that the increase in trading costs is positively related to the adverse selection of the relocating stock and is inversely related to the fraction of brokers that relocate with the moving stock.

III. Analyses Using CAUD

The NYSE's CAUD allow us to examine the apparent effects of a change in trading location on the NYSE in greater detail. Because we have floor broker badge numbers, we can study individuals' trading behaviors. We examine the trading behavior of brokers moving with the specialist to the new location, brokers not moving (in the pre-move period), and brokers that begin trading in the post-move period. We compute trading costs associated with trades between parties who maintain a relationship and between parties who either terminate their relationship or establish a new relationship. We expect that the trades between the specialist and a floor broker that occur after a stock relocates might enjoy lower trading costs when the specialist and the floor broker have had face-to-face interactions in the past. It is also possible that floor brokers treat each other differently after a move. Trades between relocating brokers might enjoy a level of comfort (i.e., a relationship) not evident when a relocating broker trades with a new (i.e., nonmoving) broker.

To examine the effective spreads incurred by moving and nonmoving brokers, we use CAUD to identify trades in which a floor broker transacts with either the specialist or another floor broker. We then determine if the floor broker(s) involved in the trade follow the specialist to the new location or if the broker(s) are nonmover(s). Prior to the relocation, nonmoving brokers are brokers who cease to trade the stock after the move. Following the relocation, many floor brokers are new to the trading crowd and must initiate new relationships. For simplicity in exposition, we also refer to these new brokers as nonmoving brokers. When both counterparties are floor brokers, we distinguish between trades in which both parties are moving brokers and those trades in which one broker is a mover and the other a nonmover. As CAUD does not provide quote data, we merge the TAQ quote data with the CAUD trade data to compute effective spreads. We limit our univariate analysis to stock days on which both moving and nonmoving brokers trade a given stock.

We report the results of a statistical test for differences in the median share-weighted effective spreads for trades involving moving and nonmoving brokers in Table VII. Comparing the median effective spreads that the movers and nonmovers pay when trading with the specialist in Panel A reveals that nonmoving brokers pay higher effective spreads for most days in the pre-move period (statistically so for days -8, -5, and -1) and consistently in the 4 days following the relocation. The wider gap between movers' and nonmovers' spreads is due to an increase in the nonmovers' spread around the event day. Movers' spreads remain relatively constant (5-day averages of the movers' median spreads are 22 to 23 basis points). This result is consistent with the joint hypotheses that relocating brokers receive better trade prices from specialists than nonmoving brokers and that relationships are disrupted by the move.

Table VII

Share-Weighted Relative Effective Spreads for Moving and Nonmoving Brokers before and after Stocks Relocate

We compute the share-weighted effective spread for trades handled by brokers relocating with the specialist and for trades handled by brokers who do not relocate with the specialist. Quotes are obtained from TAQ and trades from CAUD. The median values are obtained from the NYSE's CAUD database and are reported from event day −10 through event day +10. Event day 0 is the first day of trading at the relocating stock's new location.

Panel A: Trades between Moving (Nonmoving) Brokers and the Specialist

Event Time	Median Effective Spread (bps.)		Event Time	Median Effective Spread (bps.)	
	Movers	Nonmovers		Movers	Nonmovers
−10	20.20	21.08	0	19.78	28.95[a]
−9	25.30	29.58	1	18.68	24.30[a]
−8	19.87	24.67[a]	2	27.23	32.72[a]
−7	21.75	21.03	3	28.19	30.69
−6	25.94	27.14	4	18.85	25.09[a]
−5	22.77	29.03[a]	5	21.74	21.65
−4	27.40	29.74	6	24.67	23.38
−3	24.51	19.58	7	31.04	36.71[a]
−2	20.98	21.53	8	25.95	21.68
−1	21.31	28.81[a]	9	20.14	18.97
			10	29.40	26.11

Panel B: Trades between Brokers

Event Time	Median Effective Spread (bps.)		Event Time	Median Effective Spread (bps.)	
	Both Movers	One Mover		Both Movers	One Mover
−10	29.72	29.63	0	29.47	28.08
−9	29.69	31.73	1	26.35	30.42[a]
−8	27.49	29.93	2	27.08	30.85[a]
−7	29.11	33.37[a]	3	28.34	29.63
−6	35.96	37.71	4	25.34	27.82
−5	29.47	33.23[a]	5	27.53	35.08[a]
−4	27.47	32.32[a]	6	31.20	29.98
−3	30.72	27.93	7	32.79	32.31
−2	26.22	29.81[a]	8	33.43	34.30
−1	28.57	31.16	9	29.49	33.29[a]
			10	37.46	33.84

[a] The difference between the effective spreads is statistically significant at the 0.95 confidence level.

Finally, we examine the effective spreads in trades between floor brokers around a stock's relocation. Although the Exchange monitors specialists regardless of where they trade on the floor, it is possible that the move disrupts the ability of floor brokers to evaluate specialists and/or makes it temporarily unclear which specialist firm (bidder or target) is required to monitor the specialist in the specialist-firm merger subsample. If there is sufficient disruption in specialist monitoring, then specialists might try to gain an advantage when taking one side of the trade. However, this should not affect trades between floor brokers. In Panel B of Table VII, we examine trades between floor brokers. There is evidence that trades involving two moving brokers have lower trading costs than trades involving one mover and one nonmover beginning 7 days prior to the move (except for day −3). On 8 of the 10 pre-move days, trades between movers have lower effective spreads (significantly so on event days −7, −5, −4, and −2). Afterward, the floor community knows who moved with the stock and who is new. In other words, a relocating broker knows whether she is trading with someone with whom she is familiar or not. We find that after stocks relocate, trades between two moving brokers have lower effective spreads than trades between unfamiliar floor brokers for 5 of the first 6 post-move trading days (significantly so on days +1, +2, and +5). Averaging the daily medians, we find that the movers' effective spreads are lowest in the period of time from event day −5 through event day +5. These results provide more empirical evidence that reputations matter even if the specialist is not involved in the trade.

Because differences might exist between moving and nonmoving brokers' trades, the univariate analysis presented in Table VII (despite conditioning) could simply reflect differences in trade characteristics. To investigate this issue further, we conduct a multivariate analysis. Our goal is to understand the extent to which relationships among floor brokers and between floor brokers and the specialist help attenuate the adverse selection problem faced by liquidity providers on the NYSE floor. Thus, we wish to explain the effective spread of trades between floor brokers and specialists conditional on whether the floor broker follows the specialist to the stock's new trading location. Market microstructure theory suggests that we should control for trade size, share price level and volatility, and trading activity when trying to explain effective spreads. In addition, we distinguish between stocks with above-median levels of adverse selection and those with below-median levels. We also posit the existence of two time effects, one to distinguish the pre- and the post-move periods and another to allow for a heightened difference close to the move date. Specifically, we estimate the following regression using each trade involving a floor broker on one side and a specialist on the other side on event days −10 through +10:

$$
\begin{aligned}
ES = {} & \\
& \alpha + \beta_1(\mathit{Moving\ Broker}) + \beta_2(\mathit{Moving\ Broker})(\mathit{Event\ Time})^2 \\
& + \beta_3(\mathit{Moving\ Broker})(\mathit{High\ AS}) + \beta_4(\mathit{Moving\ Broker})(\mathit{New\ Location\ Dummy}) \\
& + \beta_5(\mathit{High\ AS}) + \beta_6(\mathit{TradeSize}) + \beta_7(\mathit{TradePriceInv}) + \beta_8(\mathit{no.\ of\ Trades}) \\
& + \beta_9(\mathit{PriceVolatility}) + \beta_{10}(\mathit{New\ Location\ Dummy}) + \varepsilon, \qquad (2)
\end{aligned}
$$

where *ES* is the effective spread of the trade of interest, *Moving Broker* is a binary variable taking the value of 1 if the broker associated with the trade of interest moves with the specialist and a value of zero otherwise, *High AS* is a binary variable taking the value of 1 if the stock being traded has higher-than-median adverse selection costs and the value of zero otherwise, *New Location Dummy* is a binary variable taking the value of 1 if the trade occurs after the stock has relocated and the value of zero otherwise, *Trade Size* is the size of the trade in shares, *TradePriceInv* is the inverse of the transaction price, *PriceVolatility* is the log of the ratio of high to low prices on the stock day of interest, and *no. of Trades* is the number of trades in the stock day of interest. We expect that trades facilitated by moving brokers have lower costs (i.e., $\beta_1 < 0$). Because we expect relationships to be more important when trading stocks with above-median levels of adverse selection, we interact *Moving Broker* and *High AS* and expect that $\beta_3 < 0$. We interact *Moving Broker* with *Event Time* squared to allow for a nonlinear trend in effective spreads around the change in location. If concerns about adverse selection increase just prior to the move, and if time is required for the specialist to become familiar with new traders after the move, then we expect the trading cost advantage moving brokers enjoy over nonmoving brokers to diminish over time (i.e., $\beta_2 > 0$). We allow for a discontinuity in the association between moving brokers and the effective spreads by interacting *Moving Broker* and the *New Location Dummy*. Finally, all else equal, we expect that effective spreads are higher for trades that are large, for trades in low priced stocks, for trades in low volume stocks, for trades in high volatility stocks, and for trades in stocks with high adverse selection costs. We report the result of estimating equation (2) in Table VIII.

As expected, trades in stocks with low share prices and high price volatilities have higher effective spreads than trades in high priced, low volatility stocks (i.e., both β_7 and β_9 are positive). Trades in stocks with high adverse selection tend to have higher effective spreads than trades in stocks with less adverse selection, but the overall difference is insignificant. Turning to the variable of interest, we find that moving brokers enjoy significantly lower (statistically and economically) effective spreads than nonmovers when we differentiate the pre- and post-move periods. This advantage is particularly strong in stocks for which the adverse selection problem is more severe. For high adverse selection stocks, moving brokers trade with effective spreads that are 25 basis points ($\beta_1 + \beta_3 + \beta_4$) less than nonmovers on the event date. For a $15.00 stock, this translates into a cost advantage of $0.036 per share. As we move further from the event day in either direction, the advantage enjoyed by the moving brokers dissipates (β_2 is positive). This is consistent with the idea that specialists become more concerned about endgame problems in the pre-move period and gradually learn the trading styles of new brokers after they relocate. If the trend we identify in the 10 post-move days of CAUD data we analyze continues, then the advantage relocating brokers enjoy over new brokers in stocks with above-median levels of adverse selection vanishes about 21 days after the move. Moving brokers have

Table VIII

Multivariate Analysis of Effective Spreads for Trades of Moving and Nonmoving Brokers Around Location Changes

The dependent variable is the effective spread paid by moving and nonmoving brokers for trades with the specialist. The period covered is from event day −10 through event day +10. Event day 0 is the first day that a relocation stock trades at its new location. Moving Broker is a binary variable that takes the value of 1 if the broker moves with the specialist and the value of zero otherwise. The Hi Adverse Selection Dummy takes the value of 1 if the relocating stock has an above-median level of adverse selection costs (measured as the difference between the stock's effective and realized spread) and the value of zero otherwise. New Location Dummy is a binary variable taking the value of 1 for trades occurring on trading days after the location change. *TradeSize* is the size (in shares) of each trade and *TradePrice* is the inverse price of each trade. No. of Trades is the daily number of trades. *PriceVolatility* is the log of the ratio of daily high price to low price. We have 66,005 observations. *t*-statistics are shown in parentheses.

	Model 1	Model 2	Model 3
Constant	0.0620	0.0344	−0.0229
	(1.32)	(0.80)	(−0.40)
Moving Broker	−0.1269[a]	−0.0234	−0.0209
	(−3.42)	(−1.05)	(−0.91)
(Moving Broker)(*EventTime*)^2	0.0005[a]	0.0005	0.0005
	(3.12)	(1.99)	(2.15)
(Moving Broker)(Hi Adverse Selection Dummy)	−0.1981[a]	−0.1836[a]	−0.1876[a]
	(−3.10)	(−3.15)	(3.00)
(Moving Broker)(New Location Dummy)	0.1764[a]		
	(3.56)		
High Adverse Selection Dummy	0.0188	0.0167	0.0148
	(0.46)	(0.40)	(0.35)
(*TradeSize*) $\times 10^6$	0.561	0.514	0.526
	(2.02)	(1.74)	(1.87)
Trade PriceInverse	9.5773[a]	9.5507[a]	9.6082[a]
	(6.65)	(6.58)	(6.39)
(*No. of Trades*) $\times$ 10	−0.0004[a]	−0.0004[a]	−0.0005
	(−2.50)	(−2.66)	(−2.39)
PriceVolatility	1.4064	1.4366	1.4184
	(1.85)	(1.91)	(1.88)
New Location Dummy	−0.1260	−0.0841	
	(−2.38)	(−1.76)	
Adjusted R^2	0.34	0.33	0.33

[a] The difference between the effective spreads is statistically significant at the 0.99 confidence level.

no advantage over new brokers in trading stocks with below-median levels of adverse selection after a stock relocates (i.e., β_4 is approximately equal to β_1 in absolute value). Thus, we conclude that relocating brokers do enjoy lower trading costs than brokers that do not follow stocks with high levels of adverse selection to their new locations, even when we control for other factors known to influence effective spreads. This provides yet more evidence in support of the claim that reputations play a role in the trading process on the floor of the

NYSE. Finally, the coefficient on the post-switch binary variable is negative, suggesting that regaining the ability to discipline is valuable.[19]

IV. Conclusion

This paper explores whether relationships on the floor of the NYSE play an economically important role in the trading process. To test this hypothesis, we identify instances in which stocks change trading locations (move to different rooms) on the NYSE floor for exogenous reasons. For the relocations we study, the specialist and the set of stocks are held constant but the floor community changes dramatically. We find an economically and statistically meaningful increase in trading costs as measured by relative effective spreads in the days leading up to and following the relocation of stocks on the NYSE floor versus a matched sample of stocks that do not move. This effect is strongest for stocks for which the adverse selection problem is most severe. This result suggests that relationships on the floor of the NYSE are economically important.

Using proprietary consolidated audit trail NYSE data, we find direct evidence that the NYSE floor fosters relationships that attenuate adverse selection problems inherent in equity trading. Specifically, we find that the floor brokers that maintain a relationship with the specialist when stocks relocate between rooms on the floor of the NYSE obtain better execution prices than the floor brokers that terminate relationships when stocks leave their old location or begin relationships when stocks trade at their new location. Finally, we find that the trades involving a moving and a nonmoving floor broker that occur after a stock changes location have somewhat higher effective spreads than similar trades between floor brokers that follow the stock to its new location. Together, these results suggest that the reputations nurtured on the floor of the NYSE play an economically important role in the trading process. It is possible that the establishment of relationships on the NYSE floor at least partially explains the decrease in effective spreads observed by Bennett and Wei (2003), Barclay, Kandel, and Marx (1998), and Christie and Huang (1994) when firms move their stock listing from Nasdaq to the NYSE. More generally, these results provide an economic justification for floor-based exchanges.

Whether the advantages to nonanonymous trading are sufficient to overcome the cost advantages of electronic trading is an empirical question. Even for stocks with relatively high levels of adverse selection, we find that the effective spreads increase by little more than 10 basis points in the days surrounding a stock's relocation. It is possible that the efficiency of electronic exchanges

[19] Again, we employ a bootstrapping analysis in which we conduct 10,000 regressions of equation (2) using 500 randomly selected observations. Of the results discussed in the text, only the volatility (a control variable) effect is weaker in this analysis. In particular, the coefficients associated with the moving broker binary variable have a statistically significant coefficient with the opposite sign as we report in Table VIII in less than 2% of the regressions and are statistically insignificant in 7% to 8% of the regressions. All mean coefficient estimates associated with the moving broker binary variable exclude zero by more than 2.5 standard deviations.

more than offsets this difference. Conversely, our estimates of the advantage of repeated interactions on the floor of the NYSE may understate the economic benefit of reputations. The upstairs market provides an alternative venue for brokers to use their reputations to attenuate adverse selection in the trading of NYSE-listed securities (see Seppi (1990)). Furthermore, on the NYSE, the specialist's obligation to provide liquidity does not change when a stock relocates. Because we estimate the value of relationships in this environment, our estimates may not fully capture the value of face-to-face trading.

REFERENCES

Bacidore, J., and G. Sofianos, 2002, Liquidity provision and specialist trading in NYSE-listed non-U.S. stocks, *Journal of Financial Economics* 63, 133–158.

Barclay, M., T. Hendershott, and T. McCormick, 2003, Competition among trading venues: Information and trading on electronic communications networks, *Journal of Finance* 58, 2639–2667.

Barclay, M., E. Kandel, and L. Marx, 1998, The effects of transaction costs on stock prices and trading volume, *Journal of Financial Intermediation* 7, 130–150.

Bennett, P., and L. Wei, 2003, Market structure, fragmentation and market quality: Evidence from recent listing switches, New York Stock Exchange Working Paper 2003–04.

Benveniste, L., A. Marcus, and W. Wilhelm, 1992, What's so special about the specialist?, *Journal of Financial Economics* 32, 61–86.

Bessembinder, H., and H. Kaufman, 1997, A cross-exchange comparison of execution costs and information flow for NYSE-listed stocks, *Journal of Financial Economics* 46, 293–319.

Bessembinder, H., and K. Venkataraman, 2004, Does an electronic stock exchange need an upstairs market?, *Journal of Financial Economics* 73, 3–36.

Boehmer, E., J. Musumeci, and A. Poulsen, 1991, Event-study methodology under conditions of event-induced variance, *Journal of Financial Economics* 30, 253–272.

Boehmer, E., G. Saar, and L. Yu, 2005, Lifting the veil: An analysis of pre-trade transparency at the NYSE, *Journal of Finance* 60, 783–816.

Boot, A., S. Greenbaum, and A. Thakor, 1993, Reputation and discretion in financial contracting, *American Economic Review* 83, 1165–1183.

Brown, S., and J. Warner, 1980, Measuring security price performance, *Journal of Financial Economics* 8, 205–258.

Brown, S., and J. Warner, 1985, Using daily stock returns: The case of event studies, *Journal of Financial Economics* 14, 3–31.

Cao, C., H. Choe, and F. Hatheway, 1997, Does the specialist matter? Differential execution costs and inter-security subsidization on the NYSE, *Journal of Finance* 52, 1615–1640.

Carlin, B., M. Lobo, and S. Viswanathan, 2004, Episodic liquidity crises: The effect of predatory and cooperative trading, Unpublished manuscript, Duke University.

Carter, R., and S. Manaster, 1990, Initial public offerings and underwriter reputation, *Journal of Finance* 45, 1045–1067.

Chakravarty, S., 2002, Stealth-trading: Which traders' trades move stock prices?, *Journal of Financial Economics* 61, 289–307.

Chan, Y., and M. Weinstein, 1993, Bid-ask spread and market structure *Financial Analysts Journal*, 57–62.

Christie, W., and R. Huang, 1994, Market structures and liquidity: A transactions data student of exchange listings, *Journal of Financial Intermediation* 3, 300–326.

Cohen, R., 2003, Dimensional Fund Advisors— 2002, *Harvard Business School Case No. 9-203-026*, Harvard Business School Publishing, Boston, MA.

Corwin, S., 1999, Differences in trading behavior across NYSE specialist firms, *Journal of Finance* 54, 721–745.

Corwin, S., and J. Coughenour, 2005, Making many markets: Limited attention and the allocation of effort in security trading, Unpublished manuscript, University of Notre Dame.

Corwin, S., and M. Lipson, 2000, Order flow and liquidity around NYSE trading halts, *Journal of Finance* 55, 1771–1801.

Coughenour, J., and M. Saad, 2004, Common market makers and commonality in liquidity, *Journal of Financial Economics* 73, 37–69.

Coval, J., and T. Shumway, 2001, Is sound just noise?, *Journal of Finance* 56, 1887–1910.

DeJong, D., R. Forsythe, and R. Lundholm, 1985, Ripoffs, lemons, and reputation formation in agency relationships: A laboratory market study, *Journal of Finance* 40, 809–820.

Desgranges, G., and T. Foucault, 2005, Reputation-based pricing and price improvements in dealership markets, Unpublished manuscript, University of Cergy.

Diamond, D., 1989, Reputation in debt markets, *Journal of the Political Economy* 97, 828–862.

Diamond, D., 1991, Monitoring and reputation: The choice between bank loans and directly placed debt, *Journal of Political Economy* 99, 689–721.

Easley, D., N. Kiefer, and M. O'Hara, 1997, One day in the life of a very common stock, *Review of Financial Studies* 10, 805–835.

Ellul, A., M. Pagano, and Jos van Bommel, 2005, Information revelation and evolution of liquidity in after-market trading, Unpublished manuscript, Indiana University.

Finucane, T., 2000, A direct test of methods for inferring trade direction from intra-day data, *Journal of Financial and Quantitative Analysis* 35, 553–576.

Garfinkel, J., and M. Nimalendran, 2003, Market structure and trader anonymity: An analysis of insider trades, *Journal of Financial and Quantitative Analysis* 38, 591–610.

Grammig, J., D. Schiereck, and E. Theissen, 2001, Knowing me, knowing you: Trader anonymity and informed trading in parallel markets, *Journal of Financial Markets* 4, 385–412.

Handa, P., R. Schwartz, and A. Tiwari, 2004, The economic value of a trading floor: Evidence from the American Stock Exchange, *Journal of Business* 77, 331–355.

Huang, R., and H. Stoll, 1996, Dealer versus auction markets: A paired comparison of execution costs on Nasdaq and the NYSE, *Journal of Financial Economics* 41, 313–357.

Huang, R., and H. Stoll, 1997, The components of the bid-ask spread: A general approach, *Review of Financial Studies* 10, 995–1034.

Klein, D., ed., 1997, *Reputation: Studies in the Voluntary Elicitation of Good Conduct* (University of Michigan Press, Ann Arbor).

Lee, C., and B. Radhakrishna, 2000, Inferring investor behavior: Evidence from TORQ data, *Journal of Financial Markets* 3, 183–204.

Lee, C., and M. Ready, 1991, Inferring trade direction from intraday data, *Journal of Finance* 46, 733–746.

Lindley, D., 1957, A statistical paradox, *Biometrika* 44, 187–192.

Madhavan, A., and V. Panchapagesan, 2000, Price discovery in auction markets: A look inside the black box, *Review of Financial Studies* 13, 627–658.

Odders-White, E., 2000, On the occurrence and consequences of inaccurate trade classification, *Journal of Financial Markets* 3, 259–286.

Pagano, M., and A. Roell, 1992, Auction and dealership markets: What is the difference? *European Economic Review* 36, 613–623.

Seppi, D., 1990, Equilibrium block trading and asymmetric information, *Journal of Finance* 45, 73–94.

Sofianos, G., and I. Werner, 2000, The trades of NYSE floor brokers, *Journal of Financial Markets* 3, 139–176.

Theissen, E., 2000, Market structure, informational efficiency and liquidity: An experimental comparison of auction and dealer markets, *Journal of Financial Markets* 3, 333–363.

Venkataraman, K., 2001, Automated versus floor trading: An analysis of execution costs on the Paris and New York Stock Exchanges, *Journal of Finance* 56, 1445–1485.

Waisburd, A., 2003, Anonymity and liquidity: Evidence from the Paris Bourse, Unpublished manuscript, Neeley School of Business, Texas Christian University.

Wilner, B., 2000, The exploitation of relationships in financial distress: The case of trade credit, *Journal of Finance* 55, 153–178.