The Value of the Non-Monopolist Specialist ∞

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First draft: January 2004
This draft: July 2004

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Abstract

Recent allegations of trading abuses by New York Stock Exchange (NYSE) specialist firms have called into question the future role for a specialist with information privileges. Theoretical models, such as Glosten (1989), characterize the privileged specialist as an information *monopolist* who derives market power from superior access to order flow information. In this study, we address the following related question: Can a specialist with no information advantage, i.e., a *non-monopolist*, enhance market quality? Consistent with theoretical predictions, we find that the Paris Bourse's non-monopolist specialist reduces temporal imbalances in order flow (Grossman and Miller (1988)) and increases the frequency with which markets clear (Garbade and Silber (1979)). Around the announcement of specialist introduction, stocks experience an average cumulative abnormal return of nearly five percent that is positively correlated with improvements in stock liquidity (Amihud and Mendelson (1986)). Overall, these results suggest that the specialist can improve the terms of trade even in the absence of any information advantage by merely maintaining a regular market presence.

Key Words: *Specialist; Market maker; Market quality; Electronic limit order book*

Our gripe isn't with the specialists themselves but with the monopoly privileges that allow them to operate to the detriment of all investors.[1]

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1. Introduction

In a seminal paper, Demsetz (1968) identifies the lack of "predictable immediacy of exchange in financial markets" as a fundamental trading problem. The problem arises because the arrival of buyers and sellers is not perfectly synchronized; therefore, counterparties may not be available at the point in time when traders demand liquidity. Demsetz argues that such trading uncertainty can be mitigated by the presence of a designated market maker (henceforth, specialist) who fills gaps arising from asynchronous order arrival. Analytical papers by Garbade and Silber (1979) and Grossman and Miller (1988) provide formal treatment of this fundamental role of the specialist. Specifically, the models demonstrate that the specialist, by maintaining a regular market presence, will reduce temporal imbalances in order flow, increase transaction frequency, and thus reduce investors' price risk. This paper provides direct tests of several theoretical models of specialist participation. In doing so, we attempt to shed light on a broader question: Can a specialist with no privileged information enhance market quality?

The laboratory for the investigation, the Paris Bourse, is well suited for testing theoretical predictions of specialist participation for several reasons. The Bourse is a limit order market that has introduced specialists to facilitate trading in a subset of its stocks. By comparing market quality for a given sample of stocks before and after specialist introduction while controlling for market wide effects using matched control stocks, we present relatively clean empirical tests that isolate the specialist's impact. To enhance the power of the investigation, we focus on a sample of less actively traded stocks for which economic theory predicts that the specialist's impact will

[1] *Fortune Magazine*, "Bringing Down the Temple", November 10, 2003, p. 119.

be most pronounced. Further, the sample firms that we analyze trade via twice daily call auctions both before and after specialist introduction. This market structure closely resembles that envisioned by theorists (e.g., Garbade and Silber (1979)) and allows us to construct market quality measures akin to those described in the relevant models.

Finally, the theoretical models we test propose that specialists enhance market quality by simply maintaining a regular market presence. However, empirical studies on specialist participation have typically focused on market structures (e.g., the New York Stock Exchange (NYSE)) where the specialist maintains an information advantage over other market participants. Theoretical models (see Glosten (1989)) characterize such a specialist as an information "*monopolist*" who derives market power from superior access to order flow information. In this paper, we adopt Glosten's information-based definition of a monopolist.[2,3] While the monopoly privileges may enhance the appeal of the NYSE specialist, this market structure interferes with clean tests of models that emphasize the more fundamental role of the specialist in resolving temporal order flow imbalances. In contrast, the Paris specialist is required to maintain a regular market presence, but is a *non-monopolist* in the sense that he observes the same order flow information as any other public trader.[4] Therefore, we test theories of specialist participation in a market structure that approximates the paradigm in which they were conceived.

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[2] As discussed in Glosten (1989, pg. 215), "Of course, the specialist is not a total monopolist – he faces competition from limit order submitters, other floor traders, and specialists in other securities. In fact some of the advantage that the specialist has is informational. He, and he alone, knows what is in the "specialist's book." Furthermore, he is in a position to know more about market activity since most trades will be crossed with him. Indeed, many formal and informal discussions of the position of the specialist assert that his monopoly position derives from this information. . . . the information is not about the future profitability of the firm or the future realization of its stock price, but rather about the uncertainty in the trading process."

[3] Note that this characterization is not merely academic. The NYSE specialist is frequently described in the popular press in terms of his monopoly privileges to order flow information. For example, Greenberg (2003, WSJ) says "Under the current rules, NYSE specialists have been granted a virtual monopoly…the specialist positions himself as a gatekeeper who has an unfair view of the direction in which bid and ask traffic is flowing and is likely to flow. He can trade accordingly."

Our empirical results strongly support theoretical predictions that specialists enhance market quality. We reconstruct estimates of the limit order book following Bessembinder and Venkataraman (2004) and measure the imbalance between the buy and sell sides of the market. We find that the regular presence of the specialist reduces the order imbalance before auction clearing, which suggests that the specialist participates by posting orders on the thin side of the market. In addition, the specialist significantly increases the likelihood of auction clearing, thereby reducing the price risk that equilibrium values may shift between order submission and execution. Thus, we present the first *direct* empirical evidence in support of the Garbade and Silber (1979) and Grossman and Miller (1988) predictions that the non-monopolist specialist improves liquidity by resolving temporal imbalances in order flow.

Around the announcement of specialist introduction, the sample firms experience a statistically significant average abnormal return of 4.9%. The price effects are directly related to the improvements in stock liquidity, which suggests that the specialist, by enhancing liquidity, lowers the risk-adjusted return required by investors (Amihud and Mendelson (1986)). We investigate several other explanations for the observed effects that are unrelated to specialist participation including increased firm visibility, capital raising activities, and certification of firm quality, but find little evidence to support the alternatives. The significant price effects surrounding specialist introduction, which our study is the first to document, strongly support the Garbade and Silber (1979) prediction that investors prefer to trade in a specialist intermediated market. These findings also contribute to the limited empirical literature studying the impact of market structure improvements on asset prices. In a seminal work, Amihud, Mendelson, and

[4] The Paris specialist is distinguished from other public traders in that he is required to maintain a regular market presence and is compensated for doing so by direct and indirect payments from the listing firm. Section 3.1 provides additional institutional details.

Lauterbach (1997) find that stocks switching from call trading to continuous trading on the Tel Aviv Stock Exchange experience an abnormal return of 5.5% around the transfer date. The findings in this study suggest that specialist participation represents another priced improvement in market structure.

This paper is closely related to two lines of prior work. The first concerns the competition between specialists and public limit order traders in providing liquidity. Glosten (1994) shows that competition for order flow from public liquidity providers in an open consolidated book will make this structure 'inevitable' in the sense that any alternative market structure, including the specialist structure, cannot successfully compete with it. An important assumption of this model is that all liquidity providers face identical trading costs. Seppi (1997) and Parlour and Seppi (2003) demonstrate that when this assumption is relaxed neither the specialist nor the limit order market pareto dominates.[5] A second key assumption in Glosten (1994) is the presence of a large number of public liquidity suppliers. The author, however, recognizes that this assumption is unlikely to be met in reality for less liquid stocks, characterized by a low rate of order arrival and a high degree of adverse selection risk, which can explain our finding that the specialist improves market quality.

The second line of research considers the manner in which stock exchanges compensate the specialist for assuming affirmative obligations to maintain orderly markets. The *monopolist* specialist in the NYSE is compensated via access to order flow information. The theoretical literature suggest that the monopolist specialist can resolve information asymmetry by subsidizing losses to informed traders with rents earned on uninformed trades (see Glosten and Milgrom (1985), Glosten (1989)) and by compelling traders to reveal information about trading

[5] A related strand of theoretical literature studies the competition for order flow across dealer markets and limit order books (see, for example, Viswanathan and Wang (2002)).

intentions (Benveniste, Marcus, and Wilhelm (1992)). Empirical evidence strongly supports the notion that the NYSE specialist can better discern the composition of order flow over time (Kavajecz (1999)) and can set more efficient prices at the open (Madhavan and Panchapagesan (2000)). This paper provides valuable insights by studying an alternative form of market intermediation – a *non-monopolist* specialist, who stands ready to trade should an order arrive, but who is compensated by cash rather than by information privileges, and therefore enjoys no market power. We document that the specialist can improve the terms of trade even in absence of order flow information advantage by merely maintaining a regular market presence.

The issues addressed here are of more than academic importance. Recent allegations that NYSE specialist firms abused their information monopoly have fostered a climate of growing dissatisfaction with the specialist system among members of the investment community. At the same time, we observe a global trend among stock exchanges towards limit order markets that operate without specialist participation, thus casting further doubt on the need for intermediation. To the extent that the market power of the specialist is successfully curtailed, either via direct regulatory oversight (the intended NYSE model) or via full disclosure of the trading process to all market participants (the Paris Bourse model), the results in this paper suggest that there is a role for the specialist in the landscape of the modern financial market.

The paper is organized as follows. The next section outlines the specific theoretical hypotheses that we will investigate. Section 3 describes the market structure of the Paris Bourse and the experimental design. Sections 4 and 5 present the results, and the final section concludes.

2. Background and Testable Predictions

2.1. Background

The fundamental trading problem of providing immediacy when order arrival is not perfectly synchronized is described in Demsetz (1968). Several theoretical papers, including Glosten (1994), emphasize that liquidity will arise endogenously because public traders can charge price concessions to cover their market making costs, including fixed operating costs (Demsetz (1968)), inventory control costs (Stoll (1978)), and adverse selection costs (Glosten and Milgrom (1985)). The price concessions depend upon the stock's order arrival rate, the composition of order flow, firm volatility, and the trading crowd available for diversifying risk (Grossman and Miller (1988)). They tend to be smaller for large capitalization stocks, which are characterized by high order arrival rates, low adverse selection risk, and large trading crowds. This reflects the insights provided by Glosten (1994) that public liquidity provision is most efficient for trading liquid stocks. In contrast, the literature predicts that small capitalization stocks will be characterized by large transaction costs when prices are set by public traders.

Another important branch of research argues that a designated dealer, called the specialist, can help reduce price concessions or, in the extreme, prevent market failure, especially for less liquid stocks. The specialist differs from public liquidity suppliers in that he has an affirmative obligation to maintain a regular market presence and to provide liquidity in circumstances when others might not. These affirmative obligations, however, impose additional risks upon the specialist for which he requires compensation beyond his normal trading revenues.

Stock exchanges differ in the manner in which the specialist is compensated. In some markets (e.g., the NYSE), the specialist is compensated with trading profits derived from privileged information regarding the stock's order flow. Such a specialist has been characterized as an information *monopolist* by Glosten (1989). The ability of the monopolist specialist to reduce market failure and enhance price discovery has been emphasized in the theoretical

literature.[6] Other research (see Stoll and Whaley (1990)) consider the implicit costs to the specialist's market power. For example, Rock (1997) and Ready (1999) contend that limit orders on the book are more likely to execute against informed traders in the presence of the monopolist specialist. Empirical research supports these theoretical predictions.[7]

In other markets (e.g., Euronext), the specialist is not granted exclusive access to order flow data. Instead, he is compensated in cash. Several theoretical papers model the value of a specialist with no information advantage, the *non-monopolist*, who simply maintains a regular market presence and, thereby, resolves idiosyncratic order arrival. While these analyses yield rich testable predictions, there has been little, if any, empirical work directly investigating their implications.[8] We summarize the testable predictions below.

2.2. Testable predictions

The role of the non-monopolist specialist is formalized in Garbade and Silber (1979), henceforth GS, and Grossman and Miller (1988), henceforth GM, who analytically show that the specialist resolves transient imbalances in public order flow by standing ready to transact should an order happen to arrive. They predict that the specialist will reduce the wait time for traders who demand liquidity and, thereby, mitigate the price risk that the equilibrium value may shift in the interim. These arguments suggest the following testable hypotheses:

[6] See, for example, Glosten and Milgrom (1985), Easley and O'Hara (1987), Glosten (1989), and Madhavan and Panchapegesan (2000). Along similar lines, the monopolist specialist in Benveniste, Marcus and Wilhelm (1992) elicits truth-telling on forthcoming order flow from floor participants and improves the overall terms of trade.

[7] See Stoll and Whaley (1990), Hasbrouck and Sofianos (1993), Madhavan and Smidt (1993), Madhavan and Sofianos (1998), Kavejecz (1999), Madhavan and Panchapagesan (2000), Heidle and Huang (2002), Goldstein and Kavejecz (2003), among others, for evidence from the NYSE. Mayhew (2002) and Anand and Weaver (2003) provide evidence from the CBOE and Kehr, Krahnen and Theissen (2001) from the Frankfurt Stock Exchange.

[8] A notable exception is Nimalendran and Petrella (2003), who study the non-monopolist specialist in the Italian Stock Exchange (ISE). Their study however largely tests models of the monopolist specialist as they characterize the ISE specialist as having an information advantage over other traders. Battalio (2003) argues that the ISE is an inappropriate setting for testing theories of the monopolist specialist. Our paper is distinguished from the Nimalendran and Petrella (2003) study because we test several hypotheses that their study could or did not.

Hypothesis 1: Specialist introduction resolves temporary imbalances in order flow.

Hypothesis 2: Specialist introduction increases the frequency with which markets clear.

GS emphasize a second dimension of price risk that is an artifact of immediacy provision - the uncertainty in transaction prices relative to the value of the underlying security. They argue that when auctions clear more frequently, fewer orders accumulate between auctions, and, therefore, the prices determined by thinner supply and demand schedules may provide a less accurate estimate of security value. One implication of this argument is that prices will become noisier in the presence of a specialist who facilitates trade on a more regular basis. This leads to our third testable hypothesis:

Hypothesis 3: Specialist introduction increases the noise in transaction prices.

The arguments in Demsetz (1968), GS, and GM suggest that the specialist's ability to provide liquidity will lead investors to prefer a specialist intermediated market over a purely public market. To gauge investor preference, we rely on Amihud and Mendelson (1986), who argue that liquidity is priced.[9] If the non-monopolist specialist improves liquidity, and if liquidity is priced, then the announcement of the specialist's introduction will be perceived by the market as value enhancing. We test this joint hypothesis:

Hypothesis 4: Specialist introduction is associated with positive abnormal returns.

Glosten (1994) argues that an order driven market in which public traders supply liquidity is competition proof. Under these conditions, the introduction of a specialist is unlikely to offer any marginal benefit. Glosten's (1994) proposition serves as a foundation for the null hypothesis against which we test all of the above: the introduction of a specialist has no effect.

[9] See, among others, Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996), and Easley, Hvidkjaer, and O'Hara (2002) for empirical support of this theory.

3. Institutional background and experimental design

3.1. Institutional background

The Paris Bourse is an open electronic limit order market.[10] Orders are submitted from 8:30 a.m. through 5:00 p.m. to a transparent electronic limit order book that is observable by all market participants. Orders are executed automatically according to strict price, exposure, and time priority rules. Trading takes place continuously for the more liquid securities. Less active stocks trade via twice-daily call auctions at 11:30 a.m. and 4:00 p.m.[11] Executions in the call auction are based on the single price that maximizes trading volume. Prior to the call auction, traders can place, modify, and cancel orders, and observe the indicative market-clearing price and trading volume that would result from the current book, without any trades actually taking place. (see Biais, Hillion and Spatt (1999) for a detailed description.)

According to exchange officials, the public order driven market mechanism was not entirely successful as some stocks experienced wide bid-ask spreads during continuous trading or infrequent clearing prices during the call auction. In 1992, the Paris Bourse initiated a program to allow specialists (known as animateurs) to facilitate trade in certain less liquid securities. In 1994, the program was extended such that more actively traded issues were also eligible. The exchange does not mandate that any stock trade under the auspices of the specialist, nor is it involved in the process of selecting the intermediary. Both decisions are made by the listed firm. The exchange merely acts as an agent by providing firms with a list of eligible specialists and their prior performance rankings.

[10] The time period analyzed in our study predates the September 2000 merger of the Paris Bourse, the Amsterdam Stock Exchange, and the Brussels Stock Exchange to form Euronext. The institutional details described in this section apply to the Paris Bourse during the analysis period. See Biais, Hillion and Spatt (1995,1999), Harris (1996), Demarchi and Foucault (1999), Venkataraman (2001), Muscarella and Piwowar (2001), Pagano and Schwartz (2003) and Bessembinder and Venkataraman (2004) for detailed descriptions of the Paris Bourse market structure.

The specialist in Paris is required by the Bourse to maintain a regular market presence, i.e., quote a maximum bid-ask spread and a minimum depth and execute, to a certain extent, orders partially or totally unmatched during the call auction. Unlike the NYSE specialist, the Bourse specialist is not obliged to maintain price continuity or to trade in a stabilizing manner.[12] The exchange surveillance team monitors and ranks the specialist and may terminate his service for poor performance. In return for providing liquidity, the specialist pays no exchange fees on market making related trades and is recognized as the primary facilitator for block transactions in the security. In contrast with his NYSE counterpart, the Paris specialist is not granted privileged access to the limit order book, nor does he have the opportunity to condition his price schedule on the arriving order flow. As such, he is a non-monopolist specialist.

In the absence of any information privileges, it is unclear whether professional liquidity provision is a profitable enterprise, especially for less liquid stocks. So, why become a specialist in Paris? First, the specialist and the listing firm typically negotiate a private liquidity agreement wherein the specialist is provided with an inventory of stocks for making markets and is paid an annual fee for his services. Second, and more importantly, the specialist is often the executor of the listed firm's investment banking ventures, which indirectly subsidize the market making business. Thus, a high performance rating from the Paris Bourse provides the specialist firm with a powerful marketing tool for additional investment banking business and is a major incentive to perform well as a liquidity provider.

Typically, liquidity agreements also stipulate that the specialist engage in other non-market making related functions that heighten investor interest and stimulate trading in the listed

[11] The call auction is used to trade less-liquid stocks in several world markets including Euronext (Brussels, Amsterdam, Paris), Athens, Lisbon, Madrid, Milan, Vienna, besides others. In addition, the call auction is commonly used by many stock exchanges to open and close trading in securities.

firm. These can include the production and dissemination of (positive) research reports or the distribution of the corporation's annual report. This role is not entirely unlike those observed in the U.S. market where firms provide investment banking business to security analysts as a reward for obtaining research coverage and (favorable) ratings. While the specialist might obtain unique information regarding the long-term fundamentals of the firm through his role as its promoter, his view of the order flow is limited to that observed by all other public traders.[13] It is the NYSE specialist's privileged access to the *order flow* that leads Glosten (1989) to characterize him as a monopolist. Conversely, it is the noticeable absence of such an information advantage that makes the Paris specialist a non-monopolist. Nevertheless, if the specialist increases investor interest, firm liquidity may improve for reasons that are independent of the economic theory in which we are interested. In section 5, we investigate this possibility.

3.2. Data and sample selection

Trade, order, and quote data are obtained from the Paris Bourse's Base de Données de Marche (BDM) database. The BDM database does not distinguish specialist orders and trades from those of public traders. The sample period covers four years from January 1995 to December 1998. The theoretical models we test were envisioned largely within the framework of a call auction, and several measures of market quality that we examine are most easily understood in this context. Further, the models predict that the role of the specialist will be most vital for less liquid securities. Therefore, we restrict our analysis to (61) French common stocks that trade in twice-daily call auctions (conducted for less liquid stocks) and for which the

[12] See Hasbrouck and Sofianos (1993) and Cao, Choe, and Hatheway (1997) for detailed discussions of the NYSE specialist performance criteria. The stabilization role of the specialist is analyzed in Goldstein and Kavacejz (2003).
[13] Bhattacharya and Daouk (2002) find that insider trading laws exist and are enforced in the French market. The Paris Bourse officials informed us that the exchange surveillance team closely monitor specialist participation to prevent market manipulation.

specialist is introduced for the first time during the sample period. The data on specialist introductions was provided by the Bourse and cross-checked on *Avis*, the official publication of the exchange. Specialists are sometimes introduced shortly after a security first appears in the BDM database. We therefore exclude from the analysis ten trade days following each stock's initial appearance to control for the potential confounding effect of security listing. We denote the *announcement day* of the specialist introduction by 'A' and the specialist *introduction day* by 'I'. The pre-specialist period is defined as A-34 through A-5, and the post-specialist period extends from I+5 through I+34. We screen the sample for sufficient activity by deleting any stock with less than 20 trades in the pre- or post- specialist periods. The final sample consists of 36 securities.

To control for time series variations in liquidity unrelated to specialist introduction, we analyze a matched sample of control stocks that are selected following the approach outlined by Huang and Stoll (1996). For each sample stock, the control stocks are selected from the pool of all French common stocks that trade without a specialist in the call market on the specialist introduction day. After screening control stocks for trading activity, we compute the following score for each pair of sample and control stocks:

$$\sum_{i=1}^{3}\left(\frac{x_i^c - x_i^s}{\left(x_i^c + x_i^s\right)/2}\right)^2, \qquad (1)$$

where the superscripts c and s refer to control stocks and sample stocks, respectively, and x_i is either average price in French Francs (FF), average daily share volume or the market capitalization during the pre-specialist period. We then match (without replacement) each control stock to the sample stock that yields the lowest score.

Summary statistics for the pre-specialist period are presented in Table 1. The distribution of stock price is very similar across sample and control stocks. The average stock price is FF 213

for sample stocks and FF 228 for control stocks. The sample stocks however have higher average daily trading volume (FF 222,500 vs. FF 154,900) and lower average market capitalization (FF 242 million vs. FF 327 million) than control stocks. On average, specialists are introduced less than two trading days after their pending introductions are announced. The median number of stocks per introduction is one, as specialists are typically introduced on a stock-by-stock basis.

One potential concern with this experiment is that, since firms choose for themselves to introduce a specialist, the results may reflect a self selection bias. That is, managers of firms that are more likely to benefit from specialist participation may be more inclined to assign a designated liquidity provider. But, perhaps surprisingly, comparison of the sample and control stocks suggests that firms introducing specialists tend to be less volatile and more actively traded than similar firms that do not. The median volume for sample firms is FF 115,200 versus FF 81,400 for the controls. Similarly, the volatility for the median sample stock is nearly 20% less than that of the median control. Thus, we find little evidence to suggest that less liquid firms that are more likely to benefit from specialist participation tend to self-select this market structure.[14] This likely reflects the outcome of a mutual choice process in which the prohibitive risks of market making discourage specialist firms from providing liquidity in highly illiquid securities. (Fernando, Gatchev and Spindt (2004) discuss the mutual choice between firms and underwriters in the context of equity issuance.)

3.3. Methodology

The theoretical models discussed in section 2 predict the specialist's impact on order

[14] We implement a two-stage estimation procedure to formally test for selection bias. In the first stage, the decision to introduce the specialist is modeled as a structured probit. In the second stage, the market quality measures for sample firms are estimated while controlling for selection bias. The coefficient on the selectivity bias adjustment variable is statistically insignificant, suggesting that selection bias is not a concern for this study. Results are not reported to conserve space.

imbalance, market clearing, and price discovery (hypotheses 1 through 3, respectively). To test these theories, we construct corresponding measures of market quality. The BDM database contains order level data for all stocks, which includes information on the firm symbol; date and time of order submission; a buy or sell indicator; the size of the order; and other fields to track order modifications, executions, and expirations. We follow the approach described in Appendix B of Bessembinder and Venkataraman (2004) to reconstruct from the BDM data estimates of the limit order book just prior to the auction.

We define $Imbalance_{i,t}$ as the absolute difference between the number of shares posted on the buy and sell sides of the limit order book for stock i just prior to auction t. $Clear_{i,t}$ equals one if we observe an auction clearing price in auction t for stock i, and zero otherwise. $AbsRtn_{i,t}$ is the absolute percentage price change for stock i from one auction clearing to the next. We employ a pooled time-series, cross-sectional regression approach to examine differences in market quality before and after specialist introduction. Specifically, for each market quality measure, $y_{i,t}$, we estimate the following regression model over all sample trading days before and after specialist introduction:

$$y_{i,t}, = \beta_0 + \beta_1 Control_i + \beta_2 Post_{i,t} + \beta_3 (Post_{i,t} * Control_i) + \varepsilon_{i,t} \quad (2)$$

where $Control_i$ equals 1 if stock i is a control stock and zero otherwise, and $Post_{i,t}$ equals 1 if auction t occurs in the period after specialist introduction, and zero otherwise. A significantly positive β_2 coefficient indicates that, all else equal, the market quality measure increases for the sample stocks following specialist introduction. A significantly negative β_3 coefficient indicates that the increase in market quality measure is larger for the sample stocks relative to the control stocks. The models are estimated using ordinary least squares regressions for *Imbalance* and *AbsRtn* measures and using logistical regressions for the *Clear* measure.

To test whether the market values the participation of the non-monopolist specialist (hypothesis 4), we measure the cumulative abnormal returns surrounding specialist introduction. Daily returns are computed using continuous compounding based on closing trade prices. The event window extends from A-5 to I+22. The days between announcement and introduction, which varied by stock, were combined. The market model is estimated from I+23 through I+154 employing Scholes-Williams betas to adjust for infrequent trading and using the value-weighted SBF120 Index as a proxy for the market portfolio. Since specialists may be announced for multiple securities on a single calendar date, cross-sectional correlation in returns could bias the results. Therefore, we form equally weighted portfolios of securities that have identical announcement dates and treat the portfolio returns as those of a single security. Test statistics, computed following Brown and Warner (1985), test the null hypothesis of zero abnormal returns against the alternative that the returns are positive.

4. Market Quality

4.1. Imbalance

This section investigates the impact of specialist introduction on various measures of market quality. In model 1 of Table 2, we test whether the specialist helps resolve temporal imbalances in order flow, as predicted by GS and GM. To control for time series variations in depth, model 1 incorporates $Depth_{i,t}$, the cumulative shares posted on the book for stock *i* just prior to auction *t*, as an explanatory variable.[15] As expected, imbalance is increasing in depth. More importantly, we find that imbalance declines significantly for sample stocks following

[15] Following specialist introduction, we find no change in the cumulative number of shares posted on the book for sample stocks relative to control stocks. We obtain similar imbalance results in model 1 of Table 2 when $Depth_{i,t}$ is omitted from the regression.

specialist introduction (β_2=-8.9). Control stocks also experience a slight decline in imbalance ($\beta_2+\beta_3$ =-2.8), but the difference is barely significant at the ten percent level (p=.095). Moreover, β_3=6.05 (significant at the one percent level) reveals that the decline in imbalance is greater for stocks that introduced a specialist than for those that did not. Overall, the findings support the prediction that specialists resolve temporal asynchronies in order flow by selectively providing liquidity on that side of the book where the public supply is insufficient (hypothesis 1).

An alternative interpretation is that the specialist, a hired agent of the listing firm, is simply providing price support by selectively participating on the buy-side of the book. To investigate this possibility, we examine *Signed Imbalance*$_{i,t}$, defined as the difference between the number of shares posted on the buy and sell sides of the book (sell-buy) for stock *i* just prior to auction *t*. If the specialist participates by posting liquidity on both the buy and sell sides of the market depending on the order imbalance, then signed imbalance should not change after specialist introduction. Alternatively, if the specialist is selectively buying for the listing firm, then we expect signed imbalance to decrease for stocks that introduce a specialist. Regression results are reported in model 2 of Table 2. Although signed imbalance declines for sample firms (β_2 =-8.48), control stocks also experience a decline of similar magnitude ($\beta_2+\beta_3$ =-9.29), and the difference between the two groups is statistically insignificant. These results are not consistent with price support.

4.2. Clearing frequency

Next, in model 3 of Table 2, we estimate logistical regressions to test hypothesis 2 that the market will clear more frequently in the presence of a specialist. In support, we observe a statistically significant increase in the likelihood that auctions clear following specialist introduction (β_2=0.24). Further, there is no change in the likelihood of auction clearing for

control stocks ($\beta_2+\beta_3$), and the improvement in auction clearing for sample stocks exceeds that for control stocks (β_3=-0.22). Overall, these findings support theoretical predictions that the non-monopolist specialist can reduce investors' price risk by increasing the frequency with which they are able to transact (Garbade and Silber (1979); Grossman and Miller (1988)).

4.3. Price discovery

More frequent market clearing after specialist introduction may increase the noise in transaction prices if the order flow that accumulates between auctions is not sufficiently consolidated to produce accurate estimates of value (hypothesis 3). In particular, if prices become noisier in the presence of a specialist, then, all else equal, we expect the auction-to-auction return volatility to increase. The results reported in model 4 in Table 2 provide some support for this prediction. The increase in *AbsRtn* experienced by sample stocks is not statistically different from zero; however, it is approximately 22 basis points larger than that experienced by control stocks, and the difference between the two groups is statistically significant. Thus, although the specialist facilitates more frequent trading, the relative magnitude of price changes is significantly larger in his presence, suggesting that the specialist also increases noise in transaction prices.

The increase in volatility could reflect the arrival of more information between auctions, although this explanation seems unlikely as the time between auction clearing is in fact shorter after specialist introduction. Nevertheless, to formally capture the transient component of volatility, we also examine the autocorrelation in returns between auctions. If prices are noisier in the presence of the specialist, then we expect that the change in price from one auction to the next will tend to reverse itself over time. Results (not reported in tables to conserve space) confirm that, consistent with our earlier result, the autocorrelation of returns for the sample

stocks is not affected by the introduction of the specialist. However, relative to control stocks, the degree of negative serial correlation increases, suggesting that prices tend to be noisier. The results provide additional support for the notion that greater immediacy may come at the cost of reduced price efficiency.

4.4. Firm-specific effects

Since we estimate pooled time-series, cross-sectional regression models, it is important to incorporate firm specific effects. We do this in two ways. First, we estimate a firm-pair fixed effects model where a dummy variable is included in the regressions for each sample/control pair. Second, we include post-period firm characteristics, $Price_i$, $Log(Volume_i)$, $Volatility_i$, and $Log(Size_i)$ as control variables in the regression. Regression results reported in Table 3 indicate that our main findings are robust to the inclusion of firm specific effects. That is, the presence of a specialist reduces average book imbalance (hypothesis 1) and increases market clearing frequency (hypothesis 2). There is some evidence that, relative to other similar stocks, specialist participation is associated with noisier prices (hypothesis 3).

4.5. Price effects

Table 4 reports the results on price effects. For the sample stocks, the announcement of specialist introduction yields an immediate and positive average cumulative abnormal return (CAR) of 3.33 percent that is statistically significant at the one percent level. The announcement day price increase reflects, in large part, the average abnormal returns of 1.30 percent and 1.11 percent (both significant at the one percent level) on the days immediately prior to the announcement, suggesting that there was some information leakage. The effect persists over the next trading month during which time prices drift upward by approximately 1.6 percent, and at day I+22, the CAR of 4.93 percent continues to be statistically significant at the five percent

level. In contrast, the announcement appears to have little effect for the control stocks. Average CARs of 0.21 percent just prior to announcement and 0.63 percent on the announcement day are not significantly different from zero. Although there is a slight upward drift over the next month, the CAR continues to remain insignificant throughout the event period (with the exception of I+5, when the CAR is significant at the 10 percent level). The results indicate the existence of a positive price reaction to specialist introduction that is permanent and economically meaningful. They offer strong support for the joint hypothesis that liquidity is priced (Amihud and Mendelson (1986)) and that investors prefer the specialist intermediated market over one in which liquidity is supplied strictly by public limit order traders (Garbade and Silber (1979)).[16]

5. Other Roles of the Paris Specialist

The results thus far suggest that specialist introduction enhances market quality. We have attributed the improvements in firm liquidity to the regular market presence of the specialist and his ability to facilitate the trading process. However, the observed effects may result from other non-market making related activities of the specialist.

5.1. Investor interest, certification, and capital raising

In addition to the specialist's role as a liquidity provider of last resort, liquidity agreements with the listing firm often specify that the specialist should increase investor interest by engaging in activities, such as the production of (positive) research reports and the distribution of annual reports. Furthermore, even if the specialist were not to actively promote a firm, the news that the specialist has entered into a liquidity agreement with the listing firm may elicit positive interest in the company. This can occur, as discussed in section 3, because

[16] Note that inventory accumulation by the specialist is unlikely to generate a permanent price reaction. Besides, as discussed earlier, the listing firm typically provides shares to the specialist as part of the liquidity agreement.

specialist introduction is the outcome of a mutual choice process between the listed and specialist firms. Specialists are most likely to select good prospects that will provide substantial future trading and investment banking business. Therefore, the establishment of a market making relationship may certify the quality of the listing firm, thereby garnering positive interest among investors and, ultimately, increasing firm value. We use two simple measures to capture the impact of increased investor interest – the trading volume per auction and the number of buy orders submitted between auctions. If liquidity improves as a result of successful promotional efforts by the specialist, we expect both trading volume and buy order flow to increase after specialist introduction.

Model 1 of Table 5 reports statistical tests of changes in log trading volume after specialist introduction.[17] While the *Post* coefficient provides some preliminary evidence that volume has increased in the presence of a specialist, β_3 is not significantly different from zero, indicating that the change in trading volume is no different between sample and control firms. Models 2 and 3 suggest that this finding is robust to the inclusion of firm specific effects. From model 4 in Table 5, we see that the number of buy orders for sample firms have increased after specialist introduction (β_2=0.52). However, the difference between the sample and control firms is not statistically significant. Combined, these results provide little support for the notion that market quality improves due to heightened investor interest.

Another possibility is that liquidity improves because the specialist helps raise additional equity for the firm, thus increasing firm size. To test this explanation, we calculate the percentage change in shares outstanding for the sample firms from the beginning of the pre-specialist period to the end of the post-specialist period, Cap_{30DAY} (results are not reported in the

[17] We add one to trading volume in order to compute log transformations of zero volume auctions.

tables to conserve space). We find that only one firm raised additional equity during this period. Further, the percentage change in shares outstanding is no different for sample and control firms. Even if firm size does not increase in the post period, the positive price effects surrounding specialist introduction may reflect the market's expectations of future capital raising. To investigate this possibility, we track equity issuance during the first year after specialist introduction, Cap_{1YEAR}, and find that only seven firms raised equity during this period. Again, the percentage change in shares outstanding is no different for sample and control firms. Thus, these findings provide little support for the capital raising explanation.

5.2. Competing explanations for price effects

As an additional test of the competing explanations, we estimate cross-sectional regressions of cumulative abnormal returns (*CAR*) on changes in the variables of interest (*Change*) for sample firms, where *Change is* the slope coefficient from stock-by-stock regressions of clearing frequency, trading volume, or buy order flow on the *Post* dummy. For Cap_{30DAY} and Cap_{1YEAR} measures, *Change* is simply computed as the percentage change in shares outstanding during the relevant period. The regression model is as follows:

$$CAR_i = \gamma_0 + \gamma_1 Change_i + \eta_i . \quad (3)$$

Our main hypothesis predicts that firms experiencing greater improvements in auction clearing tend to exhibit larger cumulative abnormal returns. If instead, the price effects reflect realized changes in firm size or expectations of future capital raising then we should observe a direct relation between abnormal returns and Cap_{30DAY} or Cap_{1YEAR}, respectively. Another possibility is that abnormal returns are explained by increased interest in the stock either because the liquidity agreement certifies firm quality or because the specialist engages in activities to promote the stock. In either case, we expect a positive relation between returns and volume

and/or buy order frequency.

Table 6 presents the results. From model 1, we see that the changes in market clearing explain 24 percent of the cross-sectional variation in abnormal returns. The γ_1 coefficient estimate is positive and statistically significant (at the one percent level), indicating stocks that clear more frequently following specialist introduction tend to experience larger abnormal returns. In sharp contrast, the coefficients on changes in trading volume, buy order flow, and shares outstanding (Models 2 through 5) are statistically insignificant at the five percent level Finally, joint tests of changes in market clearing with changes in investor interest and firm size (Models 6 through 9) confirm that market clearing explains abnormal returns after controlling for other factors. Thus, there is little support for the notion that the price effects are explained by the alternative roles of the specialist. That auction clearing is highly significant in the regressions with only 30 observations provides strong support for theoretical predictions that specialist participation improves market quality.

6. Conclusions

This paper studies the role of the non-monopolist specialist. We examine Paris Bourse specialists who, in contrast to their NYSE counterparts, possess no trading-related information advantage over other market participants. Consistent with the predictions of economic theory, the specialist resolves temporal imbalances in order flow and reduces investor price risk by increasing the frequency with which the market clears. These results suggest that the specialist adds value by simply maintaining a regular market presence.

The specialist also creates value in a literal sense by reducing the rate of return required by investors. We find that the announcement of specialist introduction elicits a permanent and

positive price reaction that is statistically significant and economically meaningful. The value effects are positively correlated with increases in the likelihood of market clearing, providing strong support for theoretical predictions that the resolution of price risk is an important contribution of the non-monopolist specialist.

This study has important policy implications for regulators, corporations, and stock exchanges. First, the provision of liquidity will likely not evolve endogenously from a pure profit motive for all securities at all times. Stock exchanges therefore have to address the fundamental trading problem of asynchronous order flow, especially for less liquid stocks, as markets continue to move towards a model of electronic trading with no intermediation. The finding that the non-monopolist specialist can resolve temporal order imbalances suggests that there continues to be an important role in the trading process for designated intermediaries with affirmative obligations.

Second, it may sometimes be necessary for corporations to directly compensate the specialists for providing liquidity in their stocks. Specifically, the specialist needs to be rewarded for accepting affirmative obligations to make markets in a stock. The monopolist specialist (at the NYSE) is compensated, in large part, via superior access to order flow information. In the absence of such a trading advantage, the non-monopolist must receive alternative inducements to make markets, such as annual fees and investment banking business from the corporation. An important distinction between these two approaches is that the monopolist specialist is compensated by uninformed public traders while the non-monopolist is compensated directly by the listing firm. Although we do not explicitly analyze the value of these side payments, the decision by managers to bear such costs in Paris suggests that investments in liquidity-increasing financial policies are positive net present value projects (Amihud and Mendelson (1986)).

While our findings suggest a valuable role for the specialist, several limitations must be noted. First, this paper distinguishes between the role of the specialist as an information repository and the role of the specialist as a liquidity provider. While we find that the specialist improves liquidity without privileged access to order flow data, the analysis has little to say with regard to how he might employ such information to affect market outcomes. In particular, the question remains open as to whether the expected benefits of increased specialist market power at the NYSE outweigh the expected agency costs. Second, the analysis in this study is restricted to securities that trade in call auctions. As economic theory often models continuous trading as a special case of the call market, the literature predicts that the insights developed in this paper are relevant for continuous markets as well. However, the extent of applicability is an empirical question. Finally, this study does not assess the specialist's value for the most actively traded securities nor does it examine the trading revenues earned by specialist firms. We believe that these questions provide interesting avenues for future research.

REFERENCES

Amihud, Yakov, and Haim Mendelson, 1986, Trading mechanisms and stock returns: An empirical investigation, *Journal of Finance* 42, 533-553.

Amihud, Yakov, Haim Mendelson, and Beni Lauterbach, 1997, Market microstructure and securities value: Evidence from Tel Aviv stock exchange, *Journal of Financial Economics* 45, 365-390.

Anand, Amber and Daniel Weaver, 2003, The value of a specialist: empirical evidence from the CBOE, Working paper, Syracuse University.

Battalio, Robert, 2003, Discussion of "Do 'Thinly-Traded' Stocks Benefit from Specialist Intervention?" by Nimalendran and Petrella, *Journal of Banking and Finance* 27, 1855-57.

Benveniste, Lawrence M., Alan J. Marcus, and William J. Wilhelm, 1992, What's special about the specialist? *Journal of Financial Economics* 32, 61-86.

Bessembinder, Hendrik, and Kumar Venkataraman, 2004, Does an electronic stock exchange need an upstairs market?, *Journal of Financial Economics* 73, 3-36.

Bhattacharya, Utpal and Hazem Daouk, 2002, The World Price of Insider Trading, *Journal of Finance* 57, 75-108.

Biais, Bruno, Pierre Hillion, and Chester Spatt, 1995, An empirical analysis of the limit order book and the order flow in the Paris Bourse, *Journal of Finance* 50, 1655-1689.

Biais, Bruno, Pierre Hillion, and Chester Spatt, 1999, Price discovery and learning during the pre-opening period in the Paris Bourse, *Journal of Political Economy* 107, 1218-1248.

Brennan, Michael J., and Avanidhar Subrahmanyam, 1996, Market microstructure and asset pricing: On the compensation of illiquidity in stock returns, *Journal of Financial Economics* 41, 441-464.

Brown, Stephen J., and Jerold B.Warner, 1985, Using daily stock returns: the case of event studies, *Journal of Financial Economics* 14, 3-31.

Cao, Charles Q., Hyuk Choe, and Frank Hatheway, 1997, Does the specialist matter? Differential execution cost and inter-security subsidization on NYSE, *Journal of Finance* 52, 1615-1640.

Demarchi, Marianne, and Thierry Foucault, 1999, Equity trading systems in Europe – A survey of recent changes, Working paper, SBF-Bourse de Paris and CETFI – University of Aix-Marseille III.

Demsetz, Harold, 1968, The cost of transacting, *Quarterly Journal of Economics*, 33-53.

Easley, David and Maureen O'Hara, 1987, Price, Trade Size, and Information in Securities

Markets, *Journal of Financial Economics* 19, 69-90.

Easley, David, Hvidkjaer, Soeren, and Maureen O'Hara, 2002, Is information risk a determinant of asset returns?, *Journal of* Finance, 57 (5), 2185-2221.

Fernando, Chitru, Vladimir Gatchev, and Paul Spindt, 2004, Wanna dance? How firms and underwrites choose each other, working paper, University of Oklahoma.

Garbade, Kenneth D. and William L. Silber, 1979, Structural organization of secondary markets: Clearing frequency, dealer activity, and liquidity risk, *Journal of Finance* 34, 577-593.

Glosten, Lawrence, 1989, Insider trading, liquidity, and the role of the monopolistic specialist, *Journal of Business* 62, 211-236.

Glosten, Lawrence, 1994, Is the electronic open limit order book inevitable? *Journal of Finance* 49, 1127-1161.

Glosten, Lawrence, and Paul Milgrom, 1985, Bid, ask and transaction prices in a specialist market with heterogeneously informed traders, *Journal of Financial Economics* 14, 71-100.

Goldstein, Michael, and Kenneth Kavajecz, 2003, Trading strategies during circuit breakers and extreme market movements, *Journal of Financial Markets* 7, 301-333.

Greenberg, M. R., 2003, Lose the Specialists, *Wall Street Journal*, A18.

Grossman, Sanford J., and Merton H. Miller, 1988, Liquidity and market structure, *Journal of Finance* 43, 617-633.

Harris, Lawrence E., 1996, Does a large minimum price variation encourage order exposure? NYSE Working Paper 96-05.

Hasbrouck, Joel, and George Sofianos, 1993, The trades of market makers: An analysis of NYSE specialist, *Journal of Finance* 48, 1565-1594.

Heidle, Hans G. and Roger D. Huang, 2002, Information-Based Trading in Dealer and Auction Markets: An Analysis of Exchange Listings, *Journal of Financial and Quantitative Analysis* 37, 391-424.

Huang, Roger, and Hans Stoll, 1996, Dealer versus auction markets: A paired comparison of execution costs on Nasdaq and NYSE, *Journal of Financial Economics* 41, 313-357.

Kavajecz, Kenneth A., 1999, A specialist's quoted depth and the limit order book. *Journal of Finance* 54, 747-771.

Kehr Carl-Heinrich, Jan P. Krahnen, and Erik Theissen, 2001, The anatomy of a call market: evidence from Germany, *Journal of Financial Intermediation* 10, 249-270.

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

Madhavan, Ananth, and Seymour Smidt, 1993, An analysis of changes in specialist quotes and inventories, *Journal of Finance* 48, 1595-1628.

Madhavan, Ananth, and George Sofianos, 1998, An empirical analysis of NYSE specialist trading, *Journal of Financial Economics* 48, 189-210.

Mayhew, Stewart, 2002, Competition, market structure and bid-ask spreads in stock options markets, *Journal of Finance* 57, 931-958.

Muscarella, Chris, and Michael S. Piwowar, 2001, Market microstructure and securities values, Evidence from the Paris Bourse, *Journal of Financial Markets* 4, 209-229.

Nimalendran**,** M. and Giovanni Petrella, 2003, Do 'Thinly-Traded' Stocks Benefit from Specialist Intervention?, *Journal of Banking and Finance* 27, 1823-54.

Pagano, Michael S., and Robert A. Schwartz, 2003, A closing call's impact on market quality at Euronext Paris, *Journal of Financial Economics* 68, 439-484.

Parlour, Christine A. and Duane Seppi, 2003, Liquidity-based competition for order flow, *Review of Financial Studies* 16, 301-343.

Ready, Mark J., 1999, The Specialist's Discretion: Stopped Orders and Price Improvement, *Review of Financial Studies* 12, 1075-1112.

Rock, K., 1997, The Specialist's Order Book and Price Anomalies, *Review of Financial Studies*, forthcoming.

Tully, Shawn, Bringing down the temple, *Fortune*, November 10, 2003, 119.

Seppi, Duane, 1997, Liquidity provision with limit orders and a strategic specialist, *Review of Financial Studies* 10, 103-150.

Stoll, Hans R., 1978, The Supply of Dealer Services in Securities Markets*, The Journal of Finance* 33, 1133-1151.

Stoll, Hans R. and Robert E. Whaley, 1990, Stock market structure and volatility, *Review of Financial Studies* 3, 37-71.

Venkataraman, Kumar, 2001, Automated versus floor trading: An analysis of execution costs on the Paris and New York exchanges, *Journal of Finance* 56, 1445-1485.

Viswanathan, S. and James J.D. Wang, 2002, Market Architecture: Limit-order Books versus Dealership Markets, *Journal of Financial Markets* 5, 127-167.

Table 1: Summary Statistics of Sample and Control Firms

Summary statistics are reported for 36 stocks that introduced specialists between 1995 and 1998 and for the matched sample of controls stocks that did not introduce specialists. Stocks per introduction is the total number of stocks introduced on each specialist introduction day (I). Days is the number of trading days between the specialist announcement day (A) and the specialist introduction day. Size is the average market capitalization (in FF millions) based on the number of shares outstanding on the specialist introduction day. Volume is the average daily trading volume (in 000's of FF). *Volatility* is the standard deviation of continuously compounded daily returns computed from closing trade prices. Price is the average transaction price (in FF). All statistics are computed over the pre-specialist period, A-34 through A-5.

Variable		Mean	Median	Std. Dev	Min	Max
Stocks per introduction		1.3	1.0	0.9	1.0	5.0
Days [A,I]		1.6	2.0	0.5	1.0	3.0
Size (in FF millions)	Sample	242.2	183.1	235.8	70.0	1,499.1
	Control	327.1	217.7	413.4	50.0	2,357.1
Volume (in FF thousands)	Sample	222.5	115.2	261.1	5.0	1,238.1
	Control	154.9	81.4	191.1	5.9	879.7
Volatility (%)	Sample	2.1	1.8	0.9	0.6	4.4
	Control	2.4	2.2	1.1	0.7	6.0
Price (in FF)	Sample	213.0	202.6	110.2	72.9	581.1
	Control	228.1	202.8	149.3	64.2	763.9

Table 2: Regression models of Changes in Market Quality around Specialist Introduction

Regression coefficients (with standard errors in parentheses) are reported for the following pooled time-series, cross-sectional regression model:

$$y_{i,t} = \beta_0 + \beta_1 Control_i + \beta_2 Post_{i,t} + \beta_3 (Post_{i,t} * Control_i) + \varepsilon_{i,t},$$

where $y_{i,t}$ is either $Imbalance_{i,t}$, $Signed\ Imbalance_{i,t}$, $Clear_{i,t}$, or $AbsRtn_{i,t}$. For auction t in stock i, $Signed\ Imbalance_{i,t}$ is the difference between the number of shares (in 00's) posted on buy and sell sides of the book (sell-buy) just prior to auction; $Imbalance_{i,t}$ is the absolute value of $Signed\ Imbalance_{i,t}$; $Clear_{i,t}$ equals one if auction clears and zero otherwise; $AbsRtn_{i,t}$ is the absolute percentage price change for stock i from one auction to the next; $Depth_{i,t}$, is the cumulative shares (in 00's) posted on the book just prior to auction; $Control_i$ equals 1 for control stocks and zero otherwise, $Post_{i,t}$ equals 1 if auction t occurs in the post-specialist period and zero otherwise. Reported F-statistics test the null hypothesis of no change in market quality for control stocks. The models are estimated using OLS regressions for *Imbalance, Signed Imbalance,* and *AbsRtn* measures and using logistical regressions for the *Clear* measure. Specifications (3) and (4) are estimated for 36 sample and 36 matched control stocks. Specifications (1) and (2) are estimated for 24 sample and 24 matched control stocks for which order level data is available to reconstruct the limit order book.

	Imbalance (1)		**Signed Imbalance** (2)		**Clearing** (3)		**Volatility** (4)	
Intercept	5.66	***	17.61	***	1.55	***	1.09	***
	(1.48)		(2.61)		(0.06)		(0.05)	
Control dummy (β_1)	-7.89	***	-15.06	***	-0.72	***	0.34	***
	(1.79)		(3.15)		(0.08)		(0.07)	
Post Dummy (β_2)	-8.85	***	-8.48	***	0.24	***	0.07	
	(1.68)		(2.95)		(0.09)		(0.07)	
Control*Post (β_3)	6.05	***	-0.81		-0.22	**	-0.22	**
	(2.38)		(4.19)		(0.11)		(0.10)	
Depth (in 00's of shares)	0.43	***	0.04	***				
	(0.01)		(0.01)					
F-statistic: $\beta_2+\beta_3=0$	2.79	*	9.89	***	0.14		4.41	**
Adjusted R^2	0.53		0.02		0.05	†	0.00	

***, **, and *: Significant at the one, five, and ten percent levels, respectively

† Generalized and rescaled coefficient of determination

Table 3: Regression Models of Changes in Market Quality with Firm Specific Effects

Regression coefficients (with standard errors in parentheses) are reported for models with firm specific effects. Models 1, 3, 5, and 7 incorporate firm-pair fixed effects by including a dummy variable for each sample/control pair. Models 2, 4, 6, and 8 include post-period firm characteristics: $Price_i$, $Log(Volume_i)$, $Volatility_i$, and $Log(Size_i)$. $Price_i$ is the average transaction price (in FF). $Volume_i$ is the average daily trading volume (in 000's of FF). $Volatility_i$ is the standard deviation of daily returns from closing trade prices. $Size_i$ is the average market size (in FF millions) on the specialist introduction day. For auction t in stock i, $Signed\ Imbalance_{i,t}$ is the difference between the number of shares (in 00's) posted on buy and sell sides of the book (sell-buy) just prior to auction; $Imbalance_{i,t}$ is the absolute value of $Signed\ Imbalance_{i,t}$; $Clear_{i,t}$ equals one if auction clears and zero otherwise; $AbsRtn_{i,t}$ is the absolute percentage price change for stock i from one auction to the next; $Depth_{i,t}$, is the cumulative shares (in 00's) posted on the book just prior to auction; $Control_i$ equals 1 for control stock and zero otherwise; $Post_{i,t}$ equals 1 if the auction occurs in the post-specialist period and zero otherwise. Reported F-statistics test the null hypothesis of no change in market quality for control stocks. The models are estimated using OLS regressions for *Imbalance*, *Signed Imbalance*, and *AbsRtn* and using logistical regressions for the *Clear* measure. Specifications (5)-(8) are estimated for 36 sample and 36 matched control stocks. Specifications (1)-(4) are estimated for 24 sample and 24 matched control stocks for which order level data is available to reconstruct the limit order book.

	Imbalance		**Signed Imbalance**		**Clearing**		**Volatility**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	14.29 ***	77.98 ***	-3.98	177.25 ***	2.47 ***	-4.56 ***	0.96 ***	1.23
	(3.95)	(23.67)	(6.80)	(41.85)	0.29	(0.80)	(0.06)	(0.76)
Control dummy (β_1)	-7.39 ***	-9.36 ***	-17.22 ***	-12.39 ***	-0.77 ***	-0.44 ***	0.37 ***	0.38 ***
	(1.73)	(1.83)	(2.99)	(3.23)	(0.08)	(0.08)	(0.07)	(0.07)
Post Dummy (β_2)	-8.41 ***	-8.09 ***	-7.77 ***	-9.27 ***	0.19 **	0.21 **	0.09	0.08
	(1.64)	(1.66)	(2.83)	(2.94)	(0.09)	(0.09)	(0.07)	(0.07)
Control*Post (β_3)	5.53 **	5.15 **	0.44	0.44	-0.24 **	-0.22 *	-0.25 ***	-0.26 ***
	(2.30)	(2.36)	(3.96)	(4.17)	(0.12)	(0.11)	(0.10)	(0.10)
Depth (in 00's of shares)	0.43 ***	0.45 ***	-0.02 *	0.03 ***				
	(0.01)	(0.01)	(0.01)	(0.01)				
Control								
Price (x1000)		9.15		-0.04 ***		-0.28		-1.67 ***
		(6.41)		(0.01)		(0.25)		(0.21)
Log(Volume)		-5.12 ***		3.04 **		0.50 ***		-0.01
		(0.72)		(1.28)		(0.03)		(0.02)
Volatility		4.96 ***		7.16 ***		-0.19 ***		
		(0.87)		(1.54)		(0.04)		
Log(Size)		-1.41		-10.50 ***		0.05		0.02
		(1.46)		(2.59)		(0.05)		(0.05)
Firm dummies	Yes	No	Yes	No	Yes	No	Yes	No
F-statistic: $\beta_2+\beta_3=0$	3.11 *	3.14 *	6.77 ***	9.10 ***	0.56	0.01	4.79 **	5.90 **
Adjusted R^2	0.57	0.54	0.13	0.04	0.17 †	0.14 †	0.04	0.02

***, **, and *: Significant at the one, five, and ten percent levels, respectively

† Generalized and rescaled coefficient of determination

Table 4: Cumulative Abnormal Returns around Specialist Introduction

Average abnormal returns (AR) and cumulative average abnormal returns (CAR) are reported for 36 stocks that announced the introduction of specialists between 1995 and 1998 and for 36 matched control stocks that did not. The event window extends from five days before the announcement day (A) to 22 days after the specialist introduction day (I). Event day I aggregates the period from A through I (the number of days in this period varies). The market model is estimated over a 132 day period that begins 23 days after the introduction day. Scholes-Williams betas are computed using the value-weighted SBF120 Index as a proxy for the market. Continuously compounded daily returns are calculated from closing prices (adjusted for dividends, splits, and other corporate actions). Stocks with identical introduction days are formed into equally weighted portfolios. Test statistics are computed following Brown and Warner (1985).

	Sample Firms		Control Firms	
Day	AR	CAR	AR	CAR
-5	-0.01	-0.01	-0.67 *	-0.67 *
-4	0.32	0.31	0.82 **	0.09
-3	0.59	0.87	-0.19	-0.08
-2	1.30 ***	2.07 **	0.35	0.20
-1	1.11 ***	3.11 ***	0.21	0.36
A	0.24	3.33 ***	0.63	0.90
I	-0.46	2.90 ***	-0.21	0.73
1	-0.75 *	2.23 **	0.79 *	1.38
2	-0.29	1.96 *	-0.10	1.28
3	0.63 *	2.59 **	0.18	1.43
4	0.19	2.78 **	-0.10	1.36
5	0.28	3.05 **	1.05 **	2.22 *
6	-0.03	3.02 **	0.05	2.26
7	1.05 **	4.07 **	-0.59	1.75
8	0.52	4.59 ***	0.01	1.76
9	0.27	4.86 ***	0.00	1.76
10	-0.60	4.28 **	-0.34	1.48
11	-0.28	4.01 **	0.21	1.66
12	-0.71 *	3.33 *	-0.65 *	1.10
13	-0.12	3.21 *	-0.34	0.81
14	0.45	3.63 **	0.37	1.13
15	0.39	3.99 **	0.41	1.49
16	0.10	4.08 **	-0.68 *	0.88
17	0.26	4.33 **	0.23	1.07
18	0.14	4.47 **	0.84 **	1.73
19	0.08	4.55 **	-0.06	1.68
20	0.33	4.87 **	0.10	1.76
21	0.22	5.09 **	0.28	2.01
22	-0.16	4.93 **	-0.49	1.57

***, **, and *: Significant at the one, five, and ten percent levels, respectively (one-tailed)

Table 5: Regression Models of Changes in Investor Interest around Specialist Introduction

Regression coefficients (with standard errors in parentheses) estimated using OLS are reported for the following pooled time-series, cross-sectional regression model:

$$y_{i,t} = \beta_0 + \beta_1 Control_i + \beta_2 Post_{i,t} + \beta_3 (Post_{i,t} * Control_i) + \varepsilon_{i,t},$$

where $y_{i,t}$ is either the natural log of one plus the trading volume (in FF) for stock *i* in auction *t* or the number of buy orders for stock *i* in auction *t*. $Control_i$ equals 1 for control stocks and zero otherwise, $Post_{i,t}$ equals 1 if auction *t* occurs in the post-specialist period and zero otherwise. Reported F-statistics test the null hypothesis of no change in market quality for control stocks. Specifications (1)-(3) are estimated for 36 sample and 36 matched control stocks. Specifications (4) through (6) are estimated for 24 sample and 24 matched control stocks for which order level data is available to reconstruct the limit order book. Models 2 and 5 incorporate firm-pair fixed effects by including a dummy variable for each sample/control pair. Models 3 and 6 include post-period firm characteristics: $Price_i$, $Log(Volume_i)$, $Volatility_i$, and $Log(Size_i)$. $Price_i$ is the average transaction price (in FF). $Volume_i$ is the average daily trading volume (in 000's of FF). $Volatility_i$ is the standard deviation of daily returns from closing trade prices. $Size_i$ is the average market size (in FF millions) on the specialist introduction day.

	Volume			Buy Orders		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	8.47 ***	10.82 ***	-23.75 ***	5.00 ***	8.39 ***	-17.76 ***
	(0.11)	(0.38)	(1.42)	(0.14)	(0.51)	(1.89)
Control dummy (β_1)	-1.48 ***	-1.47 ***	-1.58 ***	-1.62 ***	-1.63 ***	-0.83 ***
	(0.15)	(0.14)	(0.15)	(0.20)	(0.18)	(0.19)
Post Dummy (β_2)	0.39 ***	0.19	0.39 ***	0.52 ***	0.22	0.35 **
	(0.14)	(0.13)	(0.14)	(0.19)	(0.18)	(0.18)
Control*Post (β_3)	-0.18	-0.18	-0.22	-0.18	-0.17	-0.10
	(0.21)	(0.19)	(0.20)	(0.27)	(0.25)	(0.25)
Control						
Price (x1000)			-0.24			1.69 ***
			(0.44)			(0.56)
Log(Volume)						1.71 ***
						(0.06)
Volatility			-0.05			0.16 *
			(0.07)			(0.09)
Log(Size)			1.69 ***			0.12
			(0.08)			(0.12)
Firm dummies	No	Yes	No	No	Yes	No
F-statistic: $\beta_2+\beta_3=0$	2.18	0.00	1.42	3.04 *	0.07	1.95
Adjusted R^2	0.03	0.18	0.10	0.02	0.18	0.16

***, **, and *: Significant at the one, five, and ten percent levels, respectively

Table 6: Cross-sectional Regressions of CAR on Changes in Firm Characteristics

Coefficient estimates (with standard errors in parentheses) are reported for cross-sectional regressions of (I+10) cumulative abnormal returns on changes in firm characteristics (*Change*). *Change* is the slope coefficient from a stock-by-stock regression of $Clear_{i,t}$, $Volume_{i,t}$ or $BuyOrders_{i,t}$ on an indicator variable that equals 1 in the post period and zero otherwise. Logistical regressions are estimated for the *Clear* measure. Ordinary least squares regressions are estimated for *Volume* and *BuyOrders*. For Cap_{30DAY} and Cap_{1YEAR}, *Change* is the percentage change in shares outstanding from the beginning of the pre-period to the end of the post-period and to one calendar year from the beginning of the pre-period, respectively. $Clear_{i,t}$ equals one if auction t for stock i clears and zero otherwise, $Volume_{i,t}$ is the natural logarithm of one plus the number of FF that clear in auction t for stock i, and $BuyOrders_{i,t}$ is the number of buy orders submitted for stock i between auctions t-*1* and t. The sample consists of 36 stocks that introduced specialists between 1995 and 1998.

	Liquidity	**Firm Visibility**		**Capital Raising**		**Joint Tests**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	1.89	3.95 ***	3.86 **	4.15 ***	4.42 ***	2.17	1.90	1.96	2.29 *
	(1.26)	(1.45)	(1.54)	(1.54)	(1.58)	(1.30)	(1.29)	(1.31)	(1.33)
Clearing	4.04 ***					1.88	3.98 **	3.99 ***	4.01 ***
	(1.28)					(2.82)	(1.57)	(1.33)	(1.28)
Volume		1.54 *				1.23			
		(0.80)				(1.43)			
Buy Orders			-0.17				0.04		
			(0.35)				(0.47)		
Cap_{30DAY}				-2.11				-0.52	
				(3.00)				(2.27)	
Cap_{1YEAR}					-0.20				-0.15
					(0.21)				(0.16)
N	30	36	36	36	36	30	30	30	30
Adjusted R^2	0.24	0.07	-0.02	-0.01	0.00	0.23	0.21	0.21	0.23

***, **, and *: Significant at the one, five, and ten percent levels, respectively