Earning More Attention:

The Impact of Market Design on Attention Constraints

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Abstract

We show that when some stocks handled by a dedicated market maker have earnings announcements, liquidity is lower for non-announcement stocks handled by the same market maker. This effect is not explained by inventory risk management; it is consistent with attention constraints binding on the individual market maker. We further find that a market design change that speeds up trading and increases automation reduces the liquidity deterioration for non-announcement stocks. The results have implications for optimal market design and are relevant to many financial markets, including electronic limit order markets that have recently introduced dedicated market makers for some stocks.

1. Introduction

Since Daniel Kahneman's introduction of bounded rationality as an explanation for seemingly irrational economic choices, a number of studies have found evidence of attention constraints binding in financial market settings.[1] Studies that focus on the individual investor as the decision-maker show that correlation in asset return volatility (Peng, Bollerslev, and Xiong (2007)), under-reaction to long-term information (DellaVigna and Pollet (2008)), under-reaction to earnings announcements (Hirshleifer, Lim, and Teoh (2008)), and the speed of price adjustment (Peng (2005)) can all be explained in models that incorporate attention constraints.

Attention constraints can also affect designated market makers (henceforth "DMMs"), who are contractually bound to provide liquidity for a defined set of securities. In recent years many financial markets, including limit order markets, have reintroduced DMMs for at least some securities.[2] Corwin and Coughenour (2008) show that when some of a DMM's stocks are unusually active intraday, the liquidity of the DMM's other stocks worsens, suggesting a binding attention constraint. However, data limitations prevent Corwin and Coughenour from ruling out inventory risk management as an explanation of their findings. Both inventory risk management and attention constraints predict that when some stocks are unusually active, other stocks handled by the same DMM will have worse liquidity.

In this paper we document the attention constraint on DMMs, controlling for inventory risk management, and present the first evidence of how market design changes can ease the effects of DMMs' attention constraint. In particular, we study how the introduction of the NYSE's Hybrid market affects DMMs' attention constraint and the liquidity of the stocks they handle. DMMs on the NYSE trading floor are called specialists, and each individual specialist is responsible for a set of stocks called a panel.[3] The Hybrid market introduction in 2006-2007 ushers in several changes at the NYSE. It gives the specialist

[1] The term "bounded rationality," coined by Herbert Simon, refers to the fact that humans' limited computational capacity leads them to make choices that may not be optimal under the assumption that they can make choices by considering all alternatives and outcomes. Kahneman and Tversky use this concept to overcome some limitations of the rational-agent model in the literature; see Kahneman (2003) for a survey of their work.

[2] For a survey of stock markets with designated market makers, see Charitou and Panayides (2006).

[3] Throughout this paper our focus is on individual specialists, the people who manage panels of stocks, not the firms that employ them, since attention constraints primarily affect individual humans.

additional electronic tools for managing his stocks (potentially easing the attention constraint); it leads to a reduction in the number of specialists and an increase in the average number of stocks each specialist handles (potentially worsening the attention constraint); and it makes it easier for off-floor market makers to compete with the specialist on the NYSE (potentially mitigating the effect of the specialist's attention constraint).[4] Greater competition from off-floor market makers could also affect stock liquidity by alleviating the effects of specialists' risk management, which we control for in our analysis. Our hypothesis is that the net effect of the Hybrid market changes is to reduce the impact of the specialist's attention constraint on stock liquidity.

To test this hypothesis, we identify earnings-announcement days as times that a specialist's attention is likely to be absorbed by a subset of his assigned stocks, those making earnings announcements. Since earnings-announcement days are times of increased information in the market (Beaver (1968), Easley, Engle, O'Hara, and Wu (2008), and Levi and Zhang (2008)), a specialist's likelihood of trading with informed traders increases, so stocks that have earnings announcements are likely to demand more of the specialist's attention.

We first examine the effect of earnings announcements on the liquidity of non-announcement stocks on each specialist's panel using a pooled time-series and cross-sectional analysis of daily data for the year surrounding the rollout of the Hybrid market. In the full year, we find that the liquidity of the non-announcement stocks handled by the specialist worsens (spreads widen) when some of the stocks on his panel have earnings announcements, even after controlling for specialist inventories. For example, when half the stocks on a panel have earnings announcements, the effective spread of non-announcement stocks on that panel widens by about 1.4 basis points, or 10% of its average. Our results show that the specialist's attention constraint affects the liquidity of stocks on his panel over and above the inventory risk-management effect. We also find that the impact of earnings announcements on the liquidity of non-

[4] Hybrid's faster execution eliminates many of the advantages specialists had over off-floor traders, gives off-floor traders more up-to-date information about the state of the market, and enables off-floor traders to act on this information more quickly. Taken together, these changes make it easier for off-floor market makers to compete with specialists on the NYSE. For a detailed discussion of the Hybrid market changes, see, e.g., Boni and Rosen (2006), Hendershott and Moulton (2009), and NYSE Group (2006).

announcement stocks is lower after Hybrid, consistent with our hypothesis that the Hybrid market design changes alleviate the effects of the attention constraint. Our results are robust to the inclusion of panel-level control variables and controls for market-wide earnings announcements and liquidity.

We next examine how the Hybrid market mitigates the effect of a specialist's attention constraint. Do specialists find their constraint lowered (for example, because of their additional electronic tools), allowing them to participate more in the trading of non-announcement stocks on earnings announcement days? Or does off-floor market makers' enhanced ability to compete with the specialist make the specialist's attention constraint less consequential for the liquidity of non-announcement stocks? To answer these questions we analyze the effect of earnings announcements on specialist participation in the trading of non-announcement stocks. Over the full year, we find that the specialist participates less in the trading of non-announcement stocks when some of the stocks on his panel have earnings announcements, consistent with his attention constraint binding. Surprisingly, the specialist's participation in non-announcement stocks actually falls *more* on earnings-announcement days *after* Hybrid, as the specialist participates more in the trading of stocks with earnings announcements. Further analysis shows that this effect is driven by the specialist panels containing the fewest stocks, which also have the smallest increase in average number of stocks from pre- to post-Hybrid. These panels generally contain the highest-priced, largest, and most active stocks, which are likely to demand the most attention on earnings-announcement days. These are also the stocks for which off-exchange liquidity is typically highest (Fong, Madhavan, and Swan (2001)), which may allow the specialist to reduce his participation in the non-announcement stocks in the panel. These observations suggest that the participation of off-floor market makers accounts for non-announcement stocks suffering less liquidity deterioration on earnings announcement days despite specialists' lower participation after the Hybrid market's introduction.

Our paper is the first to address the role of market design in mitigating the effects of attention constraints. In particular, we show that by facilitating the participation of off-floor market makers, exchanges can alleviate the effects of DMM attention constraints during times of extreme activity in certain securities. This issue is important to both researchers and practitioners. After converting from human-intermediated to purely-electronic markets over the past two decades, many electronic markets have in recent years been reintroducing DMMs to enhance the liquidity of their listed stocks.[5] Bessembinder, Hao, and Lemmon (2008) show that DMMs can enhance efficiency particularly when information asymmetries are important; in the time series, this is also likely to be when attention constraints bind most. Attention constraints are an enduring human attribute, and the reintroduction of DMMs on many financial exchanges makes it important to find ways to alleviate attention constraints.

More generally, this paper provides the first test of DMM attention constraints that controls for a traditional explanation for liquidity commonality among stocks handled by the same specialist firm: inventory risk management. We find that attention constraints affect the liquidity of stocks handled by a single specialist beyond the effects of specialist inventory on liquidity predicted by models including Amihud and Mendelson (1980), O'Hara and Oldfield (1986), and Brunnermeier and Pedersen (2007) and documented by Comerton-Forde et al. (2008).

This work also contributes to the literature on earnings announcements. Earnings announcements are among the most studied events in the accounting literature, and previous work has documented spread widening around earnings announcements (see, e.g., Easley, Engle, O'Hara, and Wu (2008)). Our research suggests that the DMM's attention constraint combined with multiple earnings announcements on the same days may contribute to the widening of spreads on earnings-announcements days. This effect likely exacerbates the spread widening caused by increased stock-specific adverse selection, as modeled by Glosten and Milgrom (1985), Kyle (1985), and Easley and O'Hara (1987).

The remainder of the paper is organized as follows. Section 2 reviews related literature and develops our main hypotheses. Section 3 describes our data and sample. Section 4 presents our results on liquidity and attention constraints. Section 5 explores the link between specialist trading and attention constraints. Section 6 concludes.

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[5] Jain (2005) documents the rise of purely electronic market structures beginning in the 1980s. Markets that have since introduced designated market makers include the Paris Bourse (Venkataraman and Waisburd (2007)), Euronext Amsterdam (Menkveld and Wang (2008)), the Chicago Board of Options Exchange (Anand and Weaver (2006)), the Stockholm Stock Exchange (Anand, Tanggaard, and Weaver (2008), the Italian Stock Exchange (Perotti and Rindi (2008), the Singapore Exchange, Euronext Derivatives, Eurex, and NYSE ARCA.

2. Background and Hypotheses

Limited attention and attention allocation have long been recognized as potentially important factors in financial markets, with a large and growing literature focusing on how attention constraints affect investor behavior. For example, Peng (2005) posits that investors who have limited time and attention allocate their information capacity across multiple sources of uncertainty to minimize their total portfolio uncertainty, leading to faster information incorporation in large than small stocks. Hirshleifer and Teoh (2003) and DellaVigna and Pollet (2008) predict that investors' failure to pay attention to public information can lead to mispricing. Similarly, Sims (2003) argues that the inability of economic agents to process all the information available leads them to under-react to new information. Evidence of the effects of investors' limited attention is provided by numerous empirical studies, including Huberman (2001), Huberman and Regev (2001), Peng and Xiong (2006), and Barber and Odean (2008). Hirshleifer, Lim, and Teoh (2008) use days with many corporate earnings announcements as a proxy for when investors are likely to face a heavy information load and thus be most affected by their attention constraints. They find that the market reaction to a corporate earnings surprise is weaker on days with many other announcements.

Examinations of attention constraints' effects on investor behavior are largely indirect tests, as it is difficult to observe how investors allocate their attention across securities. Shifting the focus from investors to market makers can provide more direct evidence, since DMMs such as NYSE specialists have well-defined lists of securities for which they are responsible. Each NYSE specialist is assigned a set of stocks, referred to as the specialist's panel, for which he bears market-making responsibilities.[6] This offers researchers the advantage of knowing the set of securities that are competing for each specialist's attention. Corwin and Coughenour (2008) use this information and find that liquidity for individual NYSE stocks is worse over 30-minute periods in which other stocks handled by the same specialist are unusually active (measured by high volume and large price changes). They also find evidence suggesting

[6] For a discussion of the specialist's obligations on the NYSE, see, e.g., Panayides (2007).

that the specialist provides less price improvement (compared to advertised quotes) for individual stocks during intraday periods in which other stocks he handles are unusually active. This evidence is consistent with Corwin and Coughenour's interpretation that specialists' allocation of effort due to limited attention has a significant impact on liquidity provision; however, it is also consistent with risk-management theories that predict specialists provide less liquidity when they accumulate large inventory positions (e.g., Amihud and Mendelson (1980), O'Hara and Oldfield (1986), Shen and Starr (2002), and Brunnermeier and Pedersen (2007)). Because of their obligations as designated liquidity providers, specialists are likely to accumulate more inventory in a stock that is unusually active. We control for this competing explanation in our analysis.

At the end of 2006 the NYSE introduced its Hybrid market, expanding automated electronic trading and providing specialists with new tools to participate in trading electronically.[7] One of the NYSE's stated reasons for introducing the Hybrid market is that "higher volume can be handled more efficiently in a more automated system" (NYSE Group (2006)), a statement that may encompass a recognition of attention constraints as well as manual processing capabilities.

The main questions we address in this paper are whether the specialist's attention constraint affects stock liquidity and whether the introduction of the Hybrid market reduces the effects of the specialist's attention constraint. A key element of this study is our ability to identify days when the specialist's attention is focused on some subset of his panel stocks, so that we can observe how other stocks on his panel are affected. Our proxy for days when particular stocks demand more attention is earnings-announcement days. Studies suggest that more information arrives in the market on earnings-announcement days than at any other time (Beaver (1968)), information asymmetry is highest before earnings announcements (Levi and Zhang (2008)), and the probability of informed trading rises before earnings announcements and falls after them (Easley, Engle, O'Hara, and Wu (2008)). We thus expect that stocks with earnings announcements on a particular day will demand the most attention from the specialist.

[7] For a detailed discussion of the Hybrid market, see Hendershott and Moulton (2009).

Null hypothesis. Our null hypothesis is that the structural features of the specialist system are sufficient to ensure that the liquidity of the stocks handled by a particular specialist is not affected by his attention constraint when other stocks on his panel have earnings announcements. Specialist firms generally organize panels in order to balance the demands on a specialist's attention, putting the most active stocks on panels with few other stocks and diversifying across industries on a panel. According to the NYSE Rule Book and filings with the U.S. Securities and Exchange Commission, specialists are assigned a number of stocks to handle based on the stocks' normal trading volume and other risk criteria. When trading volumes rise significantly above their normal levels, a specialist may call in a relief specialist to help trade the stocks on the panel. Stocks may also be reassigned to other panels; stock reassignments across panels are common occurrences on the NYSE. Both the variable panel size and the availability of relief specialists should work against our finding evidence of attention constraints affecting stock liquidity.[8] Finally, although Hybrid's introduction of electronic tools for specialists may be expected to alleviate their attention constraints *ceteris paribus*, specialist firms simultaneously reduce the number of specialists they employ and increase the average number of stocks per specialist panel by combining panels, potentially offsetting the effects of increased automation at the specialist level.

Alternative hypotheses. Our first alternative hypothesis is that if the structural features in the specialist system are not sufficient to offset the effects of a specialist's attention constraint, then we expect to see liquidity worsen for non-announcement stocks on a panel when other stocks on the panel have earnings announcements. Similarly, we expect to see the specialist participating less in the trading of non-announcement stocks on a panel when other stocks on the panel have earnings announcements. To attribute the liquidity and participation effects to the specialist's attention constraint, we must control for risk-management effects. On earnings-announcement days, stocks may not only attract more of a specialist's attention but also demand more of his capital as he takes on larger inventory positions. In order to focus on the effects of the specialist's attention constraint, we control for specialist inventories.

[8] Unfortunately the data we have do not indicate when a relief specialist is called in, so we are unable to isolate those events in our analysis.

Our second hypothesis is that the increase in automation introduced by the Hybrid market should alleviate the effects of the specialist's attention constraint, reducing the liquidity effect on non-announcement stocks post-Hybrid. This effect may be driven by the specialist's new ability to manage his stocks algorithmically (using his new electronic tools) as well as the potentially greater involvement of other, off-floor market makers encouraged by the faster execution systems of the Hybrid market. Note that such off-floor market makers (including hedge funds and other traders pursuing a market-making strategy) are not constrained to trading any particular set of stocks; they can trade opportunistically and may see the greatest opportunities in some stocks when a specialist is occupied by other stocks on his panel (as in Pasquariello and Vega (2008)). Thus we may see the specialist participating in the trading of non-announcement stocks more after Hybrid, because his attention constraint is less binding, or less after Hybrid, because other, off-floor market makers can compete with him more effectively. We note that the increased participation of off-floor market makers after Hybrid could also reduce the effect of specialists' risk management on stock liquidity, leading to the same findings (lower liquidity effect for non-announcement stocks post-Hybrid) but for a different reason. We address this possibility by controlling for specialist inventories in our empirical strategy.

3. Data and Sample Selection

Our analysis uses data from the NYSE's Trade and Quote (TAQ) database, the Center for Research in Security Pricing (CRSP), the Chicago Board of Options Exchange (CBOE), the NYSE Specialist Equity Trade Summary (SPETS) file, the NYSE Symbol Trading Location file, and IBES. We collect data from June 1, 2006 through May 31, 2007.[9] This period covers roughly four months before to four months after the Hybrid rollout period, which began on October 6, 2006 and concluded on January 24, 2007.

[9] We exclude data from February 27, 2007, when the Shanghai stock market crashed, former Federal Reserve Chairman Greenspan warned of a recession, and Dow Jones reported erroneous values for the Dow Jones Industrial Average: a perfect storm of record volume and market dislocation that led to irregular reporting on all U.S. stock markets.

3.1 Sample Construction

We construct our sample of NYSE-listed stocks as follows. We begin by collecting from TAQ all NYSE-listed stocks during our sample period, then use the TAQ Master History file to determine CUSIP numbers that correspond to the symbols in TAQ, to match stocks in CRSP and TAQ. We eliminate two stocks, Berkshire Hathaway Class A and Class B shares, because they trade at such high prices (averaging over $100,000 and $3,000 per share, respectively, over our sample period) that their trading is not representative of the market in general. All other NYSE-listed stocks that can be matched between TAQ and CRSP are included in our sample, for a total of 2,681 sample stocks. We deliberately retain small and low-priced stocks in our sample because specialist panels often comprise a mix of high- and low-activity stocks, which may be an attempt by specialist firms to manage the specialist's attention constraint. Eliminating inactive stocks from our study would thus risk misconstruing the true activity and attention on a specialist's panel. Summary descriptive statistics about the sample stocks are included in Panel A of Table 1.

[Table 1 Here]

Note that because the Hybrid market changes are rolled out stock-by-stock between October 2006 and January 2007, the full-year statistics in Panel A (in the first four columns) are not a simple average of the pre-Hybrid and post-Hybrid averages (in the last eight columns).

3.2 Data and Measures

Since we envision the attention constraint binding on individual specialists, most of the variables in our analysis are aggregated at the specialist level by equal-weighting them across stocks on the specialist's panel.[10] Each day we update the set of stocks traded on each specialist panel, using the information provided in the NYSE Symbol Trading Location file. Panel B of Table 1 summarizes the sample characteristics at the panel level for the full year and for the pre-Hybrid and post-Hybrid sub-

[10] We equal-weight stocks within the panel, rather than weighting by market capitalization, because it is likely that the smaller stocks on a panel suffer most when the specialist's attention constraint is binding.

periods; a panel is deemed to be post-Hybrid as soon as at least one of its stocks has gone Hybrid.[11] The average panel size rises from 7.19 stocks in the pre-Hybrid period to 8.67 stocks in the post-Hybrid period. We measure the industry diversification on a panel as the ratio of the number of distinct two-digit SIC codes on the panel to the number of stocks on the panel. Panels appear to be arranged to have significant industry diversification, consistent with specialist firms attempting to manage the individual specialist's attention constraint. Industry diversification within the panels declines somewhat with the increase in panel size following Hybrid.

Panel C of Table 1 further breaks down the sample by panel-size quartiles. Panels with the largest number of stocks (Quartile 1) tend to contain the least active stocks. For example, over the full year the largest panels have average daily share volume of 456,580 compared to average daily share volume of 1,167,710 in the smallest panels (Quartile 4). This reflects the specialist firms' attempt to manage individual specialists' attention constraints by assigning the most active stocks to the smallest panels (generally with the highest industry diversification) and the least active stocks to larger panels (often at the expense of industry diversification). Note that the average number of stocks per panel increases and the average industry diversification falls from pre- to post-Hybrid in all panel quartiles, as specialist firms reallocate stocks in the wake of the increase in automation brought on by Hybrid. These changes should generally work against our finding an easing of the effects of limited attention after Hybrid is introduced.

Figure 1 shows that the greatest decrease in the number of specialist panels (and commensurate increase in the average number of stocks per panel) occurs between October 2006 and January 2007, during the rollout of the NYSE's Hybrid market structure.[12]

[Figure 1 Here]

Liquidity. The liquidity measures in Table 1 and throughout the paper are calculated from NYSE trades and quotes data from TAQ.[13] We equal-weight spread measures across trades within the day to

[11] For over 80% of the panels, all of the stocks on the panel go Hybrid on the same day.
[12] The number of specialist firms is constant at seven over the sample period, but the number of individual specialists the firms employ declines as stocks are reassigned to create larger panels; see Lucchetti (2007).

calculate measures for each stock each day.[14] The quoted spread is the difference between the best ask price and the best bid price; the percentage quoted spread is the quoted spread divided by the prevailing quote midpoint.

The effective spread for each trade captures the difference between an estimate of the true value of the security (the quote midpoint) and the actual transaction price. The effective spread for stock *j* at time *k* on day *t* is calculated as:

$$Effective\ Spread_{j,k,t} = 2\, q_{j,k,t}\, (p_{j,k,t} - m_{j,k,t})\ , \qquad (1)$$

where $q_{j,k,t}$ is an indicator variable that equals one for buyer-initiated trades and negative one for seller-initiated trades, $p_{j,k,t}$ is the trade price, and $m_{j,k,t}$ is the prevailing quote midpoint. The percentage effective spread is the effective spread divided by the prevailing quote midpoint. We follow the standard trade-signing approach of Lee and Ready (1991) and use contemporaneous quotes to sign trades (see Bessembinder (2003)).

Panel C of Table 1 shows that spreads are generally higher for panels containing the largest number of stocks: In the full-year period percentage effective spreads average 17.36 basis points for panels in Quartile 1 (the largest panels) versus 11.77 basis points for panels in Quartile 4. This is consistent with specialist firms assigning the least liquid (and least active) stocks to larger panels and the most liquid stocks to smaller panels, in recognition of specialists' attention constraint. We also note the general downward trend in spreads from pre- to post-Hybrid, which we control for by including a time trend in our empirical analysis.

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[13] We apply the following filters to clean the trade and quote data. We use trades and quotes from regular-hours trading only. We use only trades for which TAQ's CORR field is equal to zero, one, or two and for which the COND field is either blank or equal to @, E, F, I, J, or K. Trades with non-positive prices or quantities are eliminated, as are trades with prices more than (less than) 150% (50%) of the previous trade price. We use only quotes for which TAQ's MODE field is equal to 1, 2, 6, 10, 12, 21, 22, 23, 24, 25, or 26. We eliminate quotes with non-positive price or size, with bid price greater than ask price, when the quoted spread is greater than 25% of the quote midpoint, or when the ask price is more than 150% of the bid price. We calculate all spreads two ways: (i) using trades and quotes from the NYSE only; and (ii) using trades and quotes from NYSE, ARCA, and Nasdaq (we exclude other exchanges, which account for less than two percent of off-NYSE trading volume during our sample period, to avoid stale quotes). Results based on both spread calculations are qualitatively similar; for brevity we present only the NYSE spread results.

[14] Using measures volume-weighted within the day yields qualitatively similar results, which are available from the authors upon request.

Specialist participation. Our proxy for specialist attention is the daily specialist participation rate from the SPETS file. The participation rate equals the number of shares traded by the specialist, divided by twice total volume in the stock that day. This measure has the advantage of capturing the specialist's actual level of trading in each stock. We do not use attention measures based on price improvement (trades that execute inside the quote), as in Corwin and Coughenour (2008), because price improvement has declined sharply over the past five years and virtually disappears with the introduction of the Hybrid market during our sample period (see Boni and Rosen (2006)).

Panel B of Table 1 shows that specialist participation rates vary widely across panels over the full year, from near zero in some panels to 46.58% in others. There is a pronounced decline in specialist participation rates over our sample period, with average specialist participation per panel falling from 10.68% pre-Hybrid to 6.91% post-Hybrid (see Hendershott and Moulton (2009) for an analysis of the change in specialist trading around the Hybrid introduction). We control for this decline by including a time trend in our empirical analysis.

Earnings announcements. We determine the earnings announcement dates for each stock in our sample from the IBES database.[15] In aggregate the sample stocks have 7,478 earnings announcements, and these announcements occur on 243 different days (out of 250 trading days in our sample period). Throughout our analysis we designate both the day listed in IBES and the following trading day as earnings announcement dates, because the prevalence of after-hours earnings announcements in recent years has shifted much of the earnings-related trading activity to the following trading day (Berkman and Truong (2008)). Figure 2 shows that the percentage of stocks on a specialist panel having earnings announcements exhibits considerable variation over time and across panels, with earnings announcements peaking in July, October, January, and April. Because earnings announcements tend to cluster in time, we use standard errors that are robust to cross-sectional and time-series correlation throughout our empirical analysis.

[15] IBES is missing earnings announcement dates for 8% of the stocks in our sample, and we do not exclude from our analysis stocks that lack earnings announcement data. We are in the process of gathering earnings announcement dates for the stocks not covered by IBES.

[Figure 2 Here]

We also measure earnings surprises for each stock, defined as the absolute difference between the announced earnings and the most recent analyst forecast preceding the announcement, normalized by the stock price.[16] We use the single most timely forecast rather than the consensus as our expectation proxy because it is relatively more accurate than the consensus (O'Brien (1988)), earnings surprises based on this measure, rather than the consensus, are more highly associated with stock prices (Brown and Kim (1991)), and it better represents the definition of earnings surprise, as the specialist is likely to update his expectation to reflect the most recent analyst forecasts.

In Appendix A we examine the correlation between earnings announcements, earnings surprises, and the three trade-based measures of attention in Corwin and Coughenour (2008). Corwin and Coughenour construct measures of attention based on stock trading activity over 30-minute periods; we calculate their full-day analogs and find that they are highly correlated with earnings announcements and earnings surprises.

Control variables. We obtain the specialist closing dollar inventory for each stock each day from the SPETS file. Coughenour and Saad (2004) find evidence that capital is allocated at the specialist-firm level, and conversations with the former head of a large specialist firm confirm that risk management is most often handled at the firm level, rather than at the individual specialist level. To measure the amount of risk assumed by each specialist firm, we aggregate (signed) dollar inventory for all stocks handled by each specialist firm and then take the absolute value to get the magnitude of the overall position at the end of day t-1 (as in Comerton-Forde et al. (2008)). To measure market-wide volatility we use the daily opening CBOE volatility index (VIX), which is derived from S&P 500 stock index options. We collect each stock's closing price, number of trades, and average trade size from NYSE trades in TAQ, and we collect daily stock returns from CRSP. We determine the date on which each stock went Hybrid from the rollout list posted on the NYSE website.

[16] If there is more than one forecast released on the forecast day closest to the earnings announcement, we use the average forecast from that day.

Table 2 shows simple correlations between our main variables of interest and key control variables. Most variables are aggregated at the panel level; the two exceptions are specialist inventory, which is aggregated at the specialist-firm level, and market-wide volatility. Variables with the superscript "non-EA" are calculated as the equal-weighted average on each panel of the stocks that do not have earnings announcements that day. The correlations show that spreads tend to be wider for non-announcement stocks on days when more stocks on their panel have earnings announcements (correlation of 0.04, significant at the 1% level). Likewise specialist participation tends to be lower for non-announcement stocks on days when more stocks on their panel have earnings announcements (correlation of -0.10, significant at the 1% level). Spreads and specialist participation rates both fall with the percentage of the panel that has gone Hybrid (coefficients of -0.13 and -0.21, both significant at the 1% level). Specialist panels containing more stocks tend to have wider spreads (correlation of 0.32, significant at the 1% level), reflecting the specialist firms' allocation of the least liquid stocks to larger panels. Finally, the number of stocks per panel is positively correlated with the percentage of panel stocks that have gone Hybrid (coefficient of 0.16, significant at the 1% level), consistent with our observations in Table 1 of the consolidation of specialist panels following Hybrid.

[Table 2 Here]

4. Liquidity and Limited Attention

Our main empirical goals are to test whether the liquidity of some stocks suffers when other stocks handled by the same specialist demand more attention and whether this attention constraint is eased by the introduction of the Hybrid market. To examine the effects of the attention constraint, we test whether the spreads of non-announcement stocks widen on days when other stocks on a specialist's panel have earnings announcements. We employ a two-stage least-squares methodology to control for the possibility that specialist risk management could also lead to wider spreads for non-announcement stocks if the specialist builds up inventory in the announcement stocks. In the first stage we regress the average percentage effective spread for the non-announcement stocks on specialist panel *p* on day *t* on specialist-firm inventory on day *t*-1.[17] The residual from the first-stage regression is the variation in the non-announcement effective spread that is not explained by variations in specialist-firm inventory. In the second stage we use this residual as the dependent variable in regression Equation (2) below. Control variables account for other possible factors influencing spreads, such as market-wide volatility, trade size, and absolute stock returns.

$$EffSpread_{p,t}^{non-EA} = \alpha + \beta EA_{p,t} + \gamma Hybrid\%_{p,t} + \delta Volatility_{t} + \sum_{i=1}^{5} \lambda_i ControlVar_{i,p,t} + \varepsilon_{p,t}, \quad (2)$$

where $EffSpread_{p,t}^{non\text{-}EA}$ is the average percentage effective spread for the non-announcement stocks on specialist panel *p* on day *t*, after controlling for specialist-firm inventories.[18] $EA_{p,t}$ is one of four measures of the attention demanded by stocks with earnings announcements on panel *p* on day *t*: (i) *Earnings ann'ment* $\%_{p,t}$ is a continuous variable equal to the percentage of stocks on panel *p* that have earnings announcements on day *t;* (ii) *High Earnings ann'ment* $\%_{p,t}$ is a discrete variable equal to one for panel-days in the top quartile in terms of the percentage of stocks that have earnings announcements, else zero*;* (iii) *Earnings* $surprise_{p,t}$ is a continuous variable equal to the average absolute earnings surprise (normalized by stock price) of stocks on panel *p* that have earnings announcements on day *t;* (iv) *High Earnings* $surprise_{p,t}$ is a discrete variable equal to one for panel-days in the top quartile in terms of average absolute earnings surprise, else zero. We test the discrete as well as continuous measures of earnings announcements because the attention constraint may be binding only on the most extreme earnings-announcement days; Sims (2006) suggests that attention may be non-linear. $Hybrid\%_{p,t}$ is the percentage of stocks on panel *p* that are in Hybrid on day *t*; $Volatility_t$ is market-wide volatility measured by the opening value of the VIX index on day *t*; and $ControlVar_{i,p,t}$ are five control variables: the number of stocks on specialist panel *p* on day *t*, log of the average number of trades for non-announcement stocks on panel *p* on day *t*, log of the average trade size for non-announcement stocks on panel *p* on day *t*,

[17] We lag inventories by one day consistent with Comerton-Forde et al. (2008), who find that spreads widen after specialists take on large inventory positions. Tests using same-day inventory yield identical inference, as do tests using panel-level inventory.

[18] Results using dollar effective spreads, percentage quoted spreads, and dollar quoted spreads yield identical inference, so we present only percentage effective spreads for brevity. Results using other spread measures are available from the authors upon request.

average absolute return for non-announcement stocks on panel *p* on day *t*, and a time trend. The time trend is included because spreads are generally downward trending over the sample period. We exclude a specialist panel on any day that it contains only one stock. We conduct inference in this and all subsequent regressions using double-clustered Thompson (2006) standard errors, which are robust to both cross-sectional correlation and idiosyncratic time-series persistence.[19]

Table 3 presents the results from the second-stage regression Equation (2). The first four columns present the results for the full year, columns five through eight present the pre-Hybrid results, and columns nine through 12 present the post-Hybrid results.

[Table 3 Here]

The first two specifications in Table 3 show that spreads are wider for non-announcement stocks on a panel when more of the stocks on that panel have earnings announcements. The coefficient of 2.71 on *Earnings Ann'ment %* in the full-year regressions indicates that when half the stocks on a panel have earnings announcements, the effective spread of the non-announcement stocks on the panel is 1.36 basis points higher (2.71 coefficient times 0.5 earnings announcement percentage), after controlling for specialist inventory. In terms of economic significance, 1.36 basis points represents ten percent of the full-period average effective spread per panel (13.39 basis points, from Panel B of Table 1). The results are statistically significant using both the continuous measure (*Earnings ann'ment %*) and the discrete measure (*High Earnings ann'ment %*), which flags the top 25% of panel-days with earnings announcements. Furthermore, the coefficient estimate on the earnings announcement percentage declines from 3.03 in the pre-Hybrid period to 2.12 in the post-Hybrid period, supporting our hypothesis that the attention constraint has less impact on spreads following the introduction of the Hybrid market structure.

Using earnings surprises to measure the attention constraint yields qualitatively similar but less statistically significant results. While intuitively we expect that earnings surprises demand even more

[19] An alternative specification in which inventory is included as an additional explanatory variable in a one-stage regression analogous to Equation (2), with simple non-announcement effective spread as the dependent variable, provides similar inference: The sign, magnitude, and statistical significance of the coefficients on earnings-announcement variables are similar to those reported in Table 3, but significant collinearity between inventory and the other control variables affects many of their coefficient estimates.

attention than earnings announcements in general, using analyst forecasts to determine earnings surprises introduces measurement error. Statistical power may also be an issue given that less than half of the earnings announcements in our sample yield earnings surprises. For these reasons we focus on earnings announcements as our measures of the attention constraint for the remainder of the paper.

We next investigate whether the effects of attention constraints on liquidity are primarily driven by the panels containing the most or least stocks. Table 4 presents the results from two-stage regressions analogous to those in Equation (2), broken down by panel-size quartile. Recall that the size of most panels changes over our sample period, which has two implications for our empirical strategy. First, we define the cutoffs for the panel-size quartiles separately with respect to the full year, pre-Hybrid, and post-Hybrid periods by examining the distribution of the number of stocks per panel within each period. Second, we assign the panels to panel-size quartiles each day to account for changes in panel size within the period.[20] Note that a panel may fall in different quartiles in the full-year and sub-period analyses, because average panel size rises from pre-Hybrid to post-Hybrid. Coefficients on control variables are similar to those in the full sample regressions in Table 3, so for brevity they are not reported here.

[Table 4 Here]

The biggest effect of the attention constraint on spreads appears in Quartile 1, the panels with the largest number of stocks, where the coefficient on *Earnings ann'ment %* is 4.96. The coefficient on the earnings announcement percentage is significant in all four panel-size quartiles, indicating that the effect is not limited to the largest panels, which typically contain the least active stocks. Likewise the coefficient on the earnings announcement percentage declines from pre-Hybrid to post-Hybrid in all four quartiles, suggesting that the Hybrid market eases the attention-constraint effect for stocks on all size panels.

The regression results reported above control for specialist inventory risk management, panel-level characteristics, and market-wide volatility, but the results may still reflect other market-wide factors. For example, Figure 2 shows that earnings announcements tend to cluster in time: Perhaps our results reflect

[20] For example, on April 3, 2007, five stocks were reallocated to panel 1B, increasing 1B's total to 13 stocks and shifting panel 1B from Quartile 2 to Quartile 1 in the full-year analysis.

market-wide earnings announcements (as in Hirshleifer, Lim, and Teoh (2008)) as well as earnings announcements on the same panel, since other investors are not restricted to trading only stocks on the specialist's panel. To control for this possibility as well as commonality in liquidity (Chordia, Roll, and Subrahmanyam (2000)), we incorporate controls for market-wide earnings announcements and market-wide liquidity (which should encompass the effects of market-wide inventory – see Comerton-Forde et al. (2008)).

We calculate *Off-panel Earnings ann'ment %* as the earnings announcement percentages across all stocks not traded on the panel, and off-panel liquidity as the equal-weighted percentage effective spread across all stocks not traded on the panel. We then employ a two-stage least squares methodology to control for market liquidity and market earnings announcements simultaneously. In the first stage we regress the liquidity for non-announcement stocks (on each panel) on market-wide liquidity. The residual from the first-stage regression is the variation in the non-announcement effective spread that is not explained by variations in market-wide liquidity. In the second stage we use this residual as the dependent variable in regressions similar to Equation (2), with the addition of the explanatory variable *Off-panel Earnings ann'ment %* to control for market-wide earnings announcements.

[Table 5 Here]

Table 5 presents the results of the analysis controlling for market-wide liquidity and earnings announcements. Coefficients on control variables are similar to those reported in Table 3 and are not reported here for brevity. The results provide further evidence in support of our hypothesis that the specialist's limited attention leads to wider spreads for non-announcement stocks when other stocks on his panel have earnings announcements. The coefficients on *Earnings ann'ment %* (which reflects the percentage of stocks on that panel having earnings announcements on that day) are positive and of similar magnitude to the results in Table 3 (2.34 for the full year with market-wide controls compared to 2.71 for the full year in Table 3), while the coefficients on *Off-panel Earnings ann'ment %* are generally not significant.

5. Specialist Activity and Limited Attention

We next test whether the specialist devotes less attention to some stocks when other stocks he handles demand more attention. In particular, we test whether the specialist's participation rate in non-announcement stocks falls on days when other stocks on his panel have earnings announcements and how his participation on announcement days changes with the Hybrid market introduction.

To study how earnings announcements affect the specialist's participation in non-announcement stocks on his panel, we run regressions of the following form:

$$PRate_{p,t}^{non-EA} = \alpha + \beta EA_{p,t} + \gamma Hybrid\%_{p,t} + \delta Volatility_{t} + \sum_{i=1}^{6} \lambda_i ControlVar_{i,p,t} + \varepsilon_{p,t}, \qquad (3)$$

where $PRate_{p,t}$ is the log of the odds ratio (*prate*/(1-*prate*)), with *prate* equal to specialist's average participation rate for the non-announcement stocks on specialist panel *p* on day *t*.[21] The right-hand side variables are as described for the effective spread regressions in Equation (2) with the addition of one control variable, the inverse of the average price for non-announcement stocks on panel *p* on day *t*.[22] Both the time trend and the definition of our explanatory variable of interest, which compares days with versus days without earnings announcements, help to filter out the effects of the general downward trend in specialist participation over the sample period.[23]

Table 6 presents the results from regression Equation (3). The first two columns present the results for the full year, the next two columns present the pre-Hybrid results, and the last two columns present the post-Hybrid results.

[Table 6 Here]

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[21] We transform the participation rate using the log odds ratio because it is a limited dependent variable. Regressions using the simple participation rate as the dependent variable yield identical inference and are available from the authors on request.

[22] Stock price is not included as a control variable in regressions with percentage effective spread as the dependent variable, since stock price has a mechanical relation to percentage effective spread when spreads are limited by a discrete price grid.

[23] Hendershott and Moulton (2009) document two levels on which specialist participation declines with the Hybrid introduction: (i) specialists account for a smaller fraction of trading on the NYSE after Hybrid; and (ii) off-NYSE (mainly Nasdaq and Arca) trading volume of NYSE-listed stocks increases post-Hybrid, while NYSE trading volume remains roughly constant, so the NYSE handles a lower percentage of total trading volume.

The full-year analysis shows that specialist participation is lower for non-announcement stocks when other stocks on his panel have earnings announcements, consistent with the attention constraint binding. Surprisingly, the effect is greater in the post-Hybrid period than in the pre-Hybrid period: The coefficient on *Earnings ann'ment %* falls from -0.09 pre-Hybrid to -0.32 post-Hybrid. One potential explanation is that the increase in panel size following Hybrid increases the specialist's attention constraint despite the increase in automation. Another potential explanation is that the Hybrid market structure reduces the importance of the specialist as a dedicated market maker in specific stocks, as other off-floor market makers can more effectively compete with the specialist in the more automated Hybrid market. The specialist can thus focus more of his attention on the active earnings-announcement stocks on his panel, knowing that other market makers will step in to trade the non-announcement stocks in his (relative) absence. In our panel-size quartile analysis below we attempt to disentangle these two possible explanations.

Table 7 presents the results from regressions analogous to those in Equation (3), broken down by panel-size quartile. Coefficients on control variables are similar to those in the full sample regressions in Table 6, so for brevity they are not reported here.

[Table 7 Here]

The panel-size results show that it is in Quartiles 3 and 4, the panels with the fewest stocks, that the reduction in specialist participation for non-announcement stocks is greatest after Hybrid. Quartiles 3 and 4 contain the highest-priced and most actively traded stocks (see Table 1). Since a higher share price is directly associated with larger firm size (Dyl and Elliott (2006)) and larger firms have higher analyst following (Bradley, Jordan, and Ritter (2003)), it is likely that when a stock in Quartile 3 or 4 has an earnings announcement, it demands greater attention from the specialist than a stock in Quartile 1 or 2. Moreover, it is precisely for high-priced stocks that off-exchange liquidity is typically highest (Fong, Madhavan, and Swan (2001)), allowing the specialist to reduce participation in the non-announcement stocks in the panel. Quartiles 3 and 4 also experience the smallest increases in average panel size from pre- to post-Hybrid (see Table 1). Taken together, these observations suggest that it is less likely the increase in panel size and more likely the specialists' choosing to focus more attention on announcement stocks, knowing that off-floor market makers are more able to participate since Hybrid, that accounts for specialists' lower participation in non-announcement stocks post-Hybrid.

Our interpretation of the shifting importance of specialists versus off-floor market makers to the liquidity of non-announcement stocks assumes that specialists increase their trading of earnings-announcement stocks after Hybrid. To test this assumption, we run stock-level regressions of the following form:

$$PRate_{i,t} = \alpha_i + \beta EarningsAnn'ment_{i,t} + \gamma Hybrid_{i,t} + \delta Volatility_t + \sum_{j=1}^{5} \lambda_j ControlVar_{j,i} + \varepsilon_{i,t}, \quad (4)$$

where $PRate_{i,t}$ is the log of the odds ratio (*prate*/(1-*prate*)), with *prate* equal to specialist's participation rate for stock *i* on day *t*; α_i are stock fixed effects; $Earnings\ Ann'ment_{i,t}$ is an indicator variable equal to one on days when stock *i* has an earnings announcement, else zero; $Hybrid_{i,t}$ is an indicator variable equal to one if stock *i* has gone Hybrid by day *t*, else zero; $Volatility_t$ is market-wide volatility measured by the opening value of the VIX index; and $ControlVar_{j,i,t}$ are five stock-level control variables: the inverse price, log of the number of trades, log of the average trade size, absolute return, and a time trend. Both the time trend and the definition of our explanatory variable of interest, which compares days with versus days without earnings announcements, help to filter out the effects of the general downward trend in specialist participation over the sample period. We run these regressions at the stock level, rather than at the panel level, because our primary interest is how the specialist's trading changes for individual stocks with earnings announcements, rather than how the specialist's trading in announcement stocks as a group is affected by the percentage of announcement stocks on his panel.[24]

Table 8 presents the results from regression Equation (4). The first column presents the results for the full year, the middle column presents the pre-Hybrid results, and the last column presents the post-Hybrid results.

[Table 8 Here]

[24] Only about 1% of panel/days in our sample have more than one earnings announcement.

The regressions in Table 8 show that specialist participation increases in stocks on their earnings announcement days, as those stocks demand more of the specialist's attention. Furthermore, specialist participation rises more for stocks on their earnings announcement days after the Hybrid market introduction than before, consistent with specialists shifting more of their attention from non-announcement to announcement stocks after Hybrid. The reduction in liquidity impact for non-announcement stocks following Hybrid (Table 3) suggests that the specialist's reduced attention is not detrimental to the liquidity of non-announcement stocks, as off-floor market makers take on a greater role as liquidity providers following Hybrid.

6. Conclusion

In this paper we examine how changes in market structure can alleviate the constraints of limited attention in financial markets. We focus on the attention constraint of designated market makers, NYSE specialists, each of whom has a well-defined panel of securities for which he is responsible. This structure allows us to directly examine how increased attention demands from some stocks on a specialist's panel affect the liquidity of other stocks on his panel. We use earnings announcements to proxy for days when particular stocks are likely to require the most attention. We find that the liquidity of non-announcement stocks is worse on days when other stocks on the specialist's panel have earnings announcements, consistent with Corwin and Coughenour's (2008) finding that the intraday liquidity of some stocks is worse when other stocks on the specialist's panel are unusually active. Our analysis shows that the specialist's attention constraint affects stock liquidity even after controlling for inventory. We further find that the effect of this attention constraint is lower after the NYSE introduces a set of structural changes referred to as the Hybrid market. The Hybrid market gives the specialist additional electronic tools for managing his stocks; it leads to an increase in the average number of stocks each specialist handles; and it increases the speed and automation of trading, making it easier for off-floor market makers to compete with the specialist.

Surprisingly, we find that the specialist's participation in non-announcement stocks actually falls *more* on earnings-announcement days after Hybrid, as the specialist participates more in the trading of stocks with earnings announcements. This result is driven by the panels containing the fewest stocks – typically panels containing the most active and most closely-watched stocks. These panels also have the smallest increase in panel size after Hybrid, suggesting that the specialist's attention constraint should not have tightened much. Our interpretation is that the increased participation of off-floor market makers providing liquidity in the Hybrid market allows the specialist to focus more of his attention on stocks with earnings announcements, knowing that the liquidity of non-announcement stocks is supported by off-floor participants.

While we use the NYSE's Hybrid market change to examine how market structure changes can ease the effects of attention constraints, our findings should generalize to other markets with dedicated market makers. Mao and Pagano (2007) show that DMMs can offer risk-management services that are valuable to investors. Bessembinder, Hao, and Lemmon (2008) show that DMMs can enhance efficiency particularly when information asymmetries are important; in the time series, this is also likely to be when attention constraints bind most. In recent years many markets have introduced DMMs, including the Paris Bourse, Euronext Amsterdam, the Chicago Board of Options Exchange, the Stockholm Stock Exchange, and NYSE ARCA. The rise of DMMs on numerous financial markets suggests that the human intermediary, with his attention constraints, is likely to remain. Thus a key question is how markets can be designed to reduce the impact of attention constraints, as the NYSE's Hybrid market changes did.

This research highlights the need for models of optimal market design to consider the implications of attention constraints in addition to the inventory, adverse selection, and fixed cost considerations that drive most models. For example, does the existence of multiple DMMs for each stock, as in Menkveld and Wang (2008), mitigate the effect of attention constraints, particularly if the overlapping DMMs are responsible for different sets of stocks? More broadly, are there market structure changes that could alleviate the many asset-pricing anomalies attributed to investors' attention constraint?

References

Amihud, Yakov, and Haim Mendelson, 1980, Dealership market: Market making with inventory, *Journal of Financial Economics* 8, 31–53.

Anand, Amber, Carsten Tanggaard, and Daniel G. Weaver, 2008, Paying for market quality, *Journal of Financial and Quantitative Analysis*, forthcoming.

Anand, Amber, and Daniel G. Weaver, 2006, The value of the specialist: Empirical evidence from the CBOE, *Journal of Financial Markets* 9, 100-118.

Barber, Brad M., and Terrance Odean, 2008, All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors, *Review of Financial Studies* 21, 785-818.

Beaver, William H., 1968, The information content of annual earnings announcements, *Journal of Accounting Research* (Supplement), 67-92.

Berkman, Henk and Cameron Truong, 2008, Event day 0? After-hours earnings announcements, *Journal of Accounting Research*, forthcoming.

Bessembinder, Hendrik, 2003, Issues in assessing trade execution costs, *Journal of Financial Markets* 6, 233-257.

Bessembinder, Hendrik, Jia Hao, and Michael Lemmon, 2008, Why designate market makers? Affirmative obligations and market quality, Working paper.

Boni, Leslie and Michael Rosen, 2006, Hello Hybrid, goodbye price improvement!, UNX Strategy Paper.

Bradley, D., B. Jordan, and J. Ritter, 2003, The quiet period goes out with a bang, *Journal of Finance* 58, 1-36.

Brown, Lawrence D., and Kim, Kwon-Jung, 1991, Timely aggregate analyst forecasts as better proxies for market earnings estimates, *Journal of Accounting Research* 29, 382-385.

Brunnermeier, Markus, and Lasse H. Pedersen, 2007, Market liquidity and funding liquidity, *Review of Financial Studies*, forthcoming.

Charitou, Andreas, and Marios A. Panayides, 2006, Market making in international capital markets: Challenges and benefits of its implementation in emerging markets, *International Journal of Managerial Finance*, forthcoming.

Chordia, Tarun, Richard Roll, and Avanidhar Subrahmanyam, 2000, Commonality in liquidity, *Journal of Financial Economics* 56, 3-28.

Comerton-Forde, Carole, Terrence Hendershott, Charles M. Jones, Pamela C. Moulton, and Mark S. Seasholes, 2008, Time variation in liquidity: The role of market maker inventories and revenues, *Journal of Finance*, forthcoming.

Corwin, Shane A. and Jay F. Coughenour, 2008, Limited attention and the allocation of effort in securities trading, *Journal of Finance* 63, 3031-3067.

Coughenour, Jay, and Mohsen Saad, 2004, Common market makers and commonality in liquidity, *Journal of Financial Economics* 73, 37-69.

DellaVigna, Stefano, and Joshua Pollet, 2008, Investor inattention and Friday earnings announcements, *Journal of Finance*, forthcoming.

Dyl, Edward A., and William B. Elliott, 2006, The share price puzzle, *Journal of Business* 79, 2045-2066.

Easley, David, Robert Engle, Maureen O'Hara, and Liuren Wu, 2008, Time-varying arrival rates of informed and uninformed trades, *Journal of Financial Econometrics* 6,171-207.

Easley, David, and Maureen O'Hara, 1987, Price, trade size and information in securities markets, *Journal of Financial Economics* 19, 69-90.

Fong, Kingsley, Ananth Madhavan, and Peter L. Swan, 2001, Why do markets fragment? A panel-data analysis of off-exchange trading, Working paper.

Glosten, Lawrence R., and Paul R. Milgrom, 1985, Bid-Ask spreads and transactions prices in a specialist market, *Journal of Financial Economics* 14, 71-100.

Hendershott, Terrence and Pamela C. Moulton, 2009, Speed and stock market quality: The NYSE's Hybrid, Working paper.

Hirshleifer, David, Sonya Seongyeon Lim, and Siew Hong Teoh, 2008, Driven to distraction: Extraneous events and underreaction to earnings news, *Journal of Finance*, forthcoming.

Hirshleifer, David, and Siew Hong Teoh, 2003, Limited attention, information disclosure, and financial reporting, *Journal of Accounting and Economics* 36, 337-386.

Huberman, Gur, 2001, Familiarity breeds investment, *Review of Financial Studies* 14, 659-680.

Huberman, Gur, and Tomer Regev, 2001, Contagious speculation and a cure for cancer: A nonevent that made stock prices soar, *Journal of Finance* 56, 387-396.

Jain, Pankaj, 2005, Financial market design and the equity premium: Electronic versus floor trading, *Journal of Finance* 60, 2955-2985.

Kahneman, Daniel, 2003, Maps of bounded rationality: Psychology for behavioral economics, *American Economic Review* 93, 1449-1475.

Kyle, Albert S., 1985, Continuous auctions and insider trading, *Econometrica* 53, 1315-1335.

Lee, Charles, and Mark Ready, 1991, Inferring trade direction from intraday data, *Journal of Finance* 46, 733-747.

Levi, Shai and Xiao-Jun Zhang, 2008, Information asymmetry, liquidity, and expected returns, Working paper.

Lucchetti, Aaron, 2007, The NYSE: Faster (and lonelier), *Wall Street Journal*, January 24, C1.

Mao, Wen, and Michael Pagano, 2007, Specialists as risk managers: The competition between intermediated and non-intermediated markets, Working paper.

Menkveld, Albert J. and Ting Wang, 2008, How do designated market makers create value for small-caps?, Working paper.

NYSE Group, 2006, NYSE Hybrid FAQ, Document available online at http://www.nyse.com/productservices/nyseequities/1126821290257.html.

O'Brien, Patricia C., 1988, Analysts' forecasts as earnings estimates, *Journal of Accounting and Economics* 10, 53-83.

O'Hara, Maureen, and George S. Oldfield, 1986, The microeconomics of market making, *Journal of Financial and Quantitative Analysis* 21, 361-376.

Panayides, Marios A, 2007, Affirmative obligations and market making with inventory, *Journal of Financial Economics* 86, 513-542.

Pasquariello, Paolo, and Clara Vega, 2008, Strategic cross-trading in the U.S. stock market, Working paper.

Peng, Lin, 2005, Learning with information capacity constraints, *Journal of Financial and Quantitative Analysis* 40, 307-329.

Peng, Lin, Tim Bollerslev and Wei Xiong, 2007, Investor attention and time-varying comovements, *European Financial Management* 13, 394-422.

Peng, Lin, and Wei Xiong, 2006, Investor attention, overconfidence and category learning, *Journal of Financial Economics* 80, 563-602.

Perotti, Pietro, and Barbara Rindi, 2008, Market makers as information providers: The natural experiment of STAR, Working paper.

Shen, Pu, and Ross Starr, 2002, Market-makers' supply and pricing of financial market liquidity, *Economics Letters* 76, 53-58.

Sims, Christopher A., 2003, Implications of rational inattention, *Journal of Monetary Economics* 50, 665-690.

Sims, Christopher A., 2006, Rational inattention: Beyond the linear-quadratic case, *American Economic Review* 96, 158-163.

Thompson, Samuel, 2006, Simple formulas for standard errors that cluster by both firm and time, Working paper.

Venkataraman, Kumar, and Andrew C. Waisburd, 2007, The value of the designated market maker, *Journal of Financial and Quantitative Analysis* 42, 735-758.

Table 1: Sample Descriptive Statistics

Descriptive statistics are presented for the sample of 2681 stocks allocated to 470 panels over the period June 1, 2006 through May 31, 2007. For each stock (panel), variables are averaged across all days in the period, and we report the cross-sectional average of these individual stock (panel) means. *Price* is the closing stock price; *Dollar volume* is the daily dollar volume traded; *Share volume* is the daily share volume traded; *Number of trades* is the daily number of trades; *Trade size* is the daily average trade size; *Absolute return* is the absolute daily return; *Specialist participation rate* is the daily number of shares bought or sold by the specialist divided by twice total daily volume; *Quoted spreads* and *Effective spreads* are as defined in the text; *Stocks per panel* is the number of stocks traded on a panel. *Industry diversification* is the ratio of the number of distinct two-digit SIC codes on the panel to the number of stocks on the panel, calculated on June 1, 2006 for the full year, September 30, 2007 for pre-Hybrid, and February 1, 2007 for post-Hybrid. Measures are calculated from TAQ, CRSP, SPETS, and the NYSE Symbol Trading Location file.

Panel A: Stock Level (N = 2681)

	Full Year				Pre-Hybrid				Post-Hybrid			
	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean	Median	Min	Max
Price ($)	35.33	27.99	0.80	755.76	33.58	26.73	0.80	751.90	37.67	29.79	0.98	760.08
Dollar volume ($millions)	21.69	5.10	0.00	897.85	21.50	5.02	0.00	849.95	23.41	5.61	0.01	936.11
Share volume (thousands)	565.53	200.73	0.29	18264.08	581.49	203.38	0.42	15697.66	582.64	194.89	0.65	28799.09
Number of trades	1207.81	665.74	0.00	17908.29	1037.99	610.10	0.00	11023.77	1501.46	779.06	0.71	23405.99
Trade size	441.72	346.29	128.86	8111.06	488.83	375.33	130.46	7069.21	367.91	281.76	125.97	11514.43
Absolute return (bps)	111.60	103.88	2.42	1352.28	117.70	108.14	1.16	1352.28	104.07	98.81	2.42	600.88
Specialist participation rate (%)	9.23	6.01	0.00	49.48	10.75	7.58	0.00	50.00	6.48	3.68	0.45	48.13
Quoted spread (cents)	6.64	3.85	1.02	381.28	6.86	3.96	1.01	394.55	6.10	3.46	1.03	359.86
% Quoted spread (bps)	25.48	15.10	2.06	516.32	28.07	16.11	2.27	516.32	20.84	13.20	1.89	424.85
Effective spread (cents)	4.14	2.40	0.83	163.06	4.21	2.52	0.78	162.68	3.82	2.11	0.87	216.84
% Effective spread (bps)	16.15	9.60	1.55	341.18	17.46	10.33	1.61	341.18	13.46	7.91	1.40	218.63

Panel B: Specialist Panel Level (N = 470)

	Full Year				Pre-Hybrid				Post-Hybrid			
	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean	Median	Min	Max
Stocks per panel	7.83	7.09	1.00	32.26	7.19	6.02	1.00	45.74	8.67	8.00	1.00	26.00
Industry diversification (%)	81.17	85.71	4.00	100.00	80.92	85.71	4.00	100.00	69.65	75.00	3.70	100.00
Price ($)	39.11	34.08	7.18	542.91	38.01	32.95	6.29	521.28	41.14	36.29	8.89	567.11
Dollar volume ($millions)	32.26	18.32	0.16	320.98	35.89	17.51	0.16	439.94	33.38	18.39	0.08	862.75
Share volume (thousands)	851.88	508.41	3.28	12605.65	987.32	500.76	3.86	17218.60	817.71	508.17	3.07	17921.60
Number of trades	1530.96	1319.03	4.14	10759.50	1383.01	1213.49	2.78	6179.64	1853.15	1484.51	4.20	10759.50
Trade size	454.81	378.86	150.85	3287.81	540.38	428.24	164.21	6319.51	370.98	315.97	135.90	2320.20
Absolute return (bps)	125.07	122.17	12.27	1073.44	138.76	126.76	11.84	2256.59	109.59	109.12	12.29	764.76
Specialist participation rate (%)	8.91	6.62	0.00	46.58	10.68	8.24	3.51	49.31	6.91	4.57	0.00	46.45
Quoted spread (cents)	6.58	4.86	1.17	210.73	6.71	4.81	1.15	198.51	6.44	4.46	1.17	224.40
% Quoted spread (bps)	21.71	17.30	3.29	153.24	23.29	18.33	2.71	159.38	18.90	15.58	2.75	118.44
Effective spread (cents)	4.00	2.93	0.95	126.31	4.07	2.88	0.92	121.62	3.87	2.71	0.95	131.56
% Effective spread (bps)	13.39	10.89	2.52	75.54	14.10	11.17	1.99	76.13	11.90	9.69	2.11	72.25

Panel C: Specialist Panel by Panel-Size Quartile												
	Full Year				Pre-Hybrid				Post-Hybrid			
	Quartile 1 Mean	Quartile 2 Mean	Quartile 3 Mean	Quartile 4 Mean	Quartile 1 Mean	Quartile 2 Mean	Quartile 3 Mean	Quartile 4 Mean	Quartile 1 Mean	Quartile 2 Mean	Quartile 3 Mean	Quartile 4 Mean
Stocks per panel	12.45	8.81	6.90	5.29	13.04	7.82	6.00	3.91	16.04	10.48	7.43	4.41
Industry diversification (%)	46.30	76.84	87.56	92.71	58.22	82.37	88.29	91.26	35.79	61.30	76.83	88.32
Price ($)	31.33	36.19	39.76	49.32	30.10	35.87	39.80	43.59	34.48	38.28	42.18	47.30
Dollar volume ($millions)	16.75	22.36	32.09	49.27	10.61	24.18	30.70	56.20	14.69	23.05	31.10	51.78
Share volume (thousands)	456.58	591.12	804.12	1167.71	332.80	686.35	817.31	1513.03	385.02	613.44	718.67	1333.62
Number of trades	972.10	1335.96	1720.27	2045.01	689.09	1194.36	1466.15	1865.74	1065.53	1584.14	1952.32	2649.30
Trade size	448.24	382.12	402.65	463.90	460.33	451.52	488.32	656.80	364.92	328.33	332.03	409.04
Absolute return (bps)	107.49	122.46	121.85	120.83	115.33	135.25	134.80	134.31	101.01	110.36	110.71	112.55
Specialist participation rate (%)	9.32	8.20	8.30	9.67	11.50	10.20	10.38	11.33	6.27	5.85	6.83	7.14
Quoted spread (cents)	6.56	6.55	5.56	8.66	6.64	6.40	5.72	7.02	6.13	5.69	6.25	6.95
% Quoted spread (bps)	28.09	22.40	18.65	19.38	30.54	23.18	20.59	19.16	23.26	18.18	17.15	15.87
Effective spread (cents)	3.84	3.67	3.39	5.33	3.99	3.75	3.52	4.44	3.80	3.55	3.51	4.08
% Effective spread (bps)	17.36	13.18	11.19	11.77	18.45	13.80	12.53	11.77	15.05	11.25	10.30	9.74

Table 2: Specialist Panel-level Variable Correlations

Pooled correlations are presented for the sample of 470 panels from June 1, 2006 to May 31, 2007. *Effective spread* $^{non-EA}$ is the effective spread for non-announcement stocks on the panel; *Participation rate* $^{non-EA}$ is the specialist participation rate for non-announcement stocks on the panel; *Earnings ann'ment %* is the percentage of stocks on the panel having earnings announcements; *Earnings surprise* is the average earnings surprise for stocks on the panel; *Hybrid %* is the percentage of panel stocks that have gone Hybrid; *Inventory* ^{sfirm} is the absolute value of aggregate dollar inventory for stocks handled by the specialist firm; *Volatility* is market-wide volatility measured by the opening level of the VIX index; *Stocks per panel* is the number of stocks on the panel; *Price* $^{non-EA}$ is the average price of non-announcement stocks on the panel; *Trades* $^{non-EA}$ is the average number of trades for non-announcement stocks on the panel; *Trade size* $^{non-EA}$ is the average trade size for non-announcement stocks on the panel; and *Absolute return* $^{non-EA}$ is the average absolute return for non-announcemnt stocks on the panel.
Data are from TAQ, CRSP, SPETS, IBES, and the NYSE Symbol Trading Location file. Correlations in bold are significant at the 1% level; correlations in italics are significant at the 5% level.

	Effective spread^{non-EA}	Participation rate^{non-EA}	Earnings ann'ment %	Earnings surprise	Hybrid %	Inventory^{sfirm}	Volatility	Stocks per panel	Price^{non-EA}	Trades^{non-EA}	Trade size^{non-EA}	Absolute return^{non-EA}
Effective spread^{non-EA}	1.00											
Participation rate^{non-EA}	**0.24**	1.00										
Earnings ann'ment %	**-0.04**	**-0.10**	1.00									
Earnings surprise	0.00	**-0.02**	**0.15**	1.00								
Hybrid %	**-0.13**	**-0.21**	**0.03**	**0.01**	1.00							
Inventory^{sfirm}	**-0.02**	**0.56**	**-0.06**	**-0.02**	0.00	1.00						
Volatility	**0.10**	**0.04**	**-0.03**	0.00	**-0.14**	**0.06**	1.00					
Stocks per panel	**0.32**	**-0.01**	**-0.03**	**0.03**	**0.16**	-0.01	**-0.01**	1.00				
Price^{non-EA}	**-0.12**	**0.17**	0.00	**-0.01**	**0.07**	**0.11**	**-0.03**	**-0.22**	1.00			
Trades^{non-EA}	**-0.45**	**-0.38**	**0.07**	0.00	**0.20**	**-0.14**	**0.04**	**-0.37**	**0.11**	1.00		
Trade size^{non-EA}	**0.11**	**0.25**	**-0.05**	**-0.01**	**-0.21**	**0.16**	**0.04**	0.00	**-0.10**	**-0.01**	1.00	
Absolute return^{non-EA}	**-0.02**	**-0.07**	**0.04**	0.00	**-0.10**	**-0.02**	**0.24**	**-0.18**	-0.01	**0.17**	*0.01*	1.00

Table 3: Regressions of Liquidity on Earnings Announcements

Analysis periods are from June 1, 2006 through May 31, 2007 (first four columns) and two sub-periods: before each panel's Hybrid activation (next four columns), and after each panel's Hybrid activation (last four columns). *Effective spread* (in basis points) for non-announcement stocks on each panel, calculated as the residual from a first-stage regression of the effective spread of non-announcement stocks on specialist-firm inventory, is regressed on one of four earnings announcements measures: *Earnings ann'ment %* is the percentage of stocks on the panel having earnings announcements on that day; *High Earnings ann'ment %* is an indicator variable equal to one for panel-days with earnings ann'ment in the top quartile, else zero; *Earnings surprise* is the average earnings surprise for stocks on the panel; *High Earnings surprise* is an indicator variable equal to one for panel-days with earnings surprise in the top quartile, else zero.

Control variables include: *Hybrid %,* the percentage of panel stocks that have gone Hybrid; *Volatility,* market-wide volatility measured by the opening level of the VIX index; *Stocks per panel,* the number of stocks on the panel; *Trades* $^{non\text{-}EA}$*,* the log of the average number of trades for non-announcement stocks on the panel; *Trade size* $^{non\text{-}EA}$*,* the log of the average trade size for non-announcement stocks on the panel; *Absolute return* $^{non\text{-}EA}$*,* the average absolute return for non-announcement stocks on the panel; and *Day number,* a time trend. T-statistics, reported in parentheses below coefficient estimates, are robust to time-series and cross-sectional correlation.

	Full Year				Pre-Hybrid				Post-Hybrid			
	Earn Ann'ments		Earn Surprises		Earn Ann'ments		Earn Surprises		Earn Ann'ments		Earn Surprises	
Earnings ann'ment %	2.71				3.03				2.12			
	(4.8)				*(4.2)*				*(2.4)*			
High Earnings ann'ment %		0.88				0.94				0.74		
		(3.6)				*(2.9)*				*(2.2)*		
Earnings surprise			9.04				12.82				6.43	
			(1.5)				*(1.2)*				*(1.0)*	
High Earnings surprise				0.59				1.09				-0.03
				(1.8)				*(2.4)*				*(-0.1)*
Hybrid %	0.36	0.36	0.35	0.36								
	(0.8)	*(0.8)*	*(0.7)*	*(0.7)*								
Volatility	0.25	0.25	0.25	0.25	0.34	0.34	0.34	0.34	0.37	0.36	0.36	0.36
	(4.7)	*(4.7)*	*(4.7)*	*(4.7)*	*(4.2)*	*(4.2)*	*(4.2)*	*(4.2)*	*(4.5)*	*(4.5)*	*(4.4)*	*(4.4)*
Stocks per panel	0.37	0.37	0.37	0.37	0.35	0.35	0.35	0.35	0.33	0.33	0.33	0.33
	(3.9)	*(3.9)*	*(3.9)*	*(3.9)*	*(2.6)*	*(2.7)*	*(2.6)*	*(2.6)*	*(4.0)*	*(4.0)*	*(4.0)*	*(4.0)*
Trades $^{non\text{-}EA}$	-4.04	-4.04	-4.03	-4.04	-4.68	-4.68	-4.67	-4.67	-3.34	-3.34	-3.33	-3.33
	(-8.5)	*(-8.5)*	*(-8.5)*	*(-8.5)*	*(-6.7)*	*(-6.7)*	*(-6.7)*	*(-6.7)*	*(-9.9)*	*(-9.9)*	*(-9.9)*	*(-9.8)*
Trade size $^{non\text{-}EA}$	-0.03	-0.05	-0.05	-0.04	0.36	0.34	0.34	0.35	-0.31	-0.32	-0.33	-0.33
	(-0.1)	*(-0.1)*	*(-0.1)*	*(-0.1)*	*(0.6)*	*(0.5)*	*(0.5)*	*(0.6)*	*(-0.4)*	*(-0.4)*	*(-0.4)*	*(-0.4)*
Absolute return $^{non\text{-}EA}$	109.10	109.34	109.86	109.89	121.28	121.56	122.19	122.19	92.68	92.93	93.20	93.26
	(4.3)	*(4.3)*	*(4.3)*	*(4.3)*	*(3.7)*	*(3.7)*	*(3.7)*	*(3.7)*	*(5.5)*	*(5.5)*	*(5.5)*	*(5.5)*
Day number	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.03	-0.03	-0.03	-0.03
	(-7.7)	*(-7.7)*	*(-7.7)*	*(-7.7)*	*(-2.6)*	*(-2.6)*	*(-2.6)*	*(-2.6)*	*(-5.5)*	*(-5.4)*	*(-5.4)*	*(-5.4)*
Intercept	22.91	22.98	23.02	22.99	21.89	21.98	22.01	21.93	21.63	21.69	21.73	21.74
	(4.6)	*(4.6)*	*(4.6)*	*(4.6)*	*(3.6)*	*(3.6)*	*(3.6)*	*(3.6)*	*(3.6)*	*(3.6)*	*(3.6)*	*(3.6)*
Observations	76,690	76,690	76,690	76,690	46,965	46,965	46,965	46,965	29,866	29,866	29,866	29,866
R^2	34%	34%	34%	34%	35%	35%	35%	35%	32%	32%	32%	32%

Table 4: Regressions of Liquidity on Earnings Announcements by Panel Size

Analysis periods are from June 1, 2006 through May 31, 2007 (first two columns) and two sub-periods: before each panel's Hybrid activation (next two columns), and after each panel's Hybrid activation (last two columns). *Effective spread* (in basis points) for non-announcement stocks on each panel, calculated as the residual from a first-stage regression of the effective spread of non-announcement stocks on specialist-firm inventory, is regressed on one of two earnings announcements measures: *Earnings ann'ment %*, the percentage of stocks on the panel having earnings announcements on that day, or *High Earnings ann'ment %*, an indicator variable equal to one for panel-days with earnings ann'ment in the top quartile, else zero.

Regressions also include the following control variables: the percentage of panel stocks that have gone Hybrid; market-wide volatility measured by the opening level of the VIX index; the number of stocks on the panel; the log of the average number of trades for non-announcement stocks on the panel; the log of the average trade size for non-announcement stocks on the panel; the average absolute return for non-announcement stocks on the panel; and a time trend. Coefficients for the control variables and constant are not reported. Quartile 1 comprises the panels containing the most stocks in each period or subperiod. T-statistics, reported in parentheses below coefficient estimates, are robust to time-series and cross-sectional correlation.

	Full Year		Pre-Hybrid		Post-Hybrid	
Quartile 1						
Earnings ann'ment %	4.96		6.41		5.93	
	(3.2)		*(2.5)*		*(2.0)*	
High Earnings ann'ment %		0.30		0.64		-0.62
		(0.5)		*(0.7)*		*(-1.5)*
Quartile 2						
Earnings ann'ment %	2.21		3.39		1.98	
	(2.1)		*(2.6)*		*(2.2)*	
High Earnings ann'ment %		0.41		0.49		0.37
		(1.5)		*(1.0)*		*(1.2)*
Quartile 3						
Earnings ann'ment %	3.32		2.28		1.91	
	(3.5)		*(1.6)*		*(1.5)*	
High Earnings ann'ment %		-0.04		-0.77		-0.19
		(-0.1)		*(-1.0)*		*(-0.5)*
Quartile 4						
Earnings ann'ment %	2.26		2.19		2.15	
	(2.7)		*(2.2)*		*(1.5)*	
High Earnings ann'ment %		1.04		1.05		0.94
		(3.5)		*(3.0)*		*(1.6)*
Observations per quartile	19,173	19,173	11,741	11,741	7,467	7,467
Average R^2	23%	23%	27%	27%	20%	20%

Table 5: Regressions of Liquidity on Earnings Announcements, Controlling for Market-Wide Effects

Analysis periods are from June 1, 2006 through May 31, 2007 (first column) and two sub-periods: before each panel's Hybrid activation (next column), and after each panel's Hybrid activation (last column). *Effective spread* (in basis points) for non-announcement stocks on each panel, calculated as the residual from a first-stage regression of the effective spread of non-announcement stocks on the average off-panel (market-wide) effective spread, is regressed on *Earnings ann'ment %*, the percentage of stocks on the panel having earnings announcements on that day, and *Off-panel Earnings ann'ment %*, the percentage of stocks off the panel (market-wide) having earnings announcements on that day.

Second-stage regressions also include the following control variables: the percentage of panel stocks that have gone Hybrid; market-wide volatility measured by the opening level of the VIX index; the number of stocks on the panel; the log of the average number of trades for non-announcement stocks on the panel; the log of the average trade size for non-announcement stocks on the panel; the average absolute return for non-announcement stocks on the panel; and a time trend. Coefficients for the control variables and constant are not reported. T-statistics, reported in parentheses below coefficient estimates, are robust to time-series and cross-sectional correlation.

	Full Year	Pre-Hybrid	Post-Hybrid
Earnings ann'ment %	2.34	2.73	1.28
	(3.6)	*(3.2)*	*(1.4)*
Off-panel Earnings ann'ment %	1.20	0.48	6.35
	(0.9)	*(0.3)*	*(1.8)*
Observations	76,690	46,965	29,866
R^2	32%	33%	32%

Table 6: Regressions of Specialist Participation on Earnings Announcements

Analysis periods are from June 1, 2006 through May 31, 2007 (first two columns) and two sub-periods: before each panel's Hybrid activation (next two columns), and after each panel's Hybrid activation (last two columns). *Specialist participation rate* (expressed as a log odds ratio) for non-announcement stocks on each panel is regressed on *Earnings ann'ment %*, the percentage of stocks on the panel having earnings announcements on that day, or *High Earnings ann'ment %*, an indicator variable equal to one for panel-days with earnings ann'ment in the top quartile, else zero.

Control variables include: *Hybrid %,* the percentage of panel stocks that have gone Hybrid; *Volatility,* market-wide volatility measured by the opening level of the VIX index; *Stocks per panel,* the number of stocks on the panel; $Price^{non\text{-}EA}$, the inverse of the average price for non-announcement stocks on the panel; $Trades^{non\text{-}EA}$, the log of the average number of trades for non-announcement stocks on the panel; $Trade\ size^{non\text{-}EA}$, the log of the average trade size for non-announcement stocks on the panel; $Absolute\ return^{non\text{-}EA}$, the average absolute return for non-announcement stocks on the panel; and *Day number,* a time trend. T-statistics, reported in parentheses below coefficient estimates, are robust to time-series and cross-sectional correlation.

	Full Year		Pre-Hybrid		Post-Hybrid	
Earnings ann'ment %	-0.22		-0.09		-0.32	
	(-4.5)		*(-1.9)*		*(-4.1)*	
High Earnings ann'ment %		-0.04		-0.01		-0.07
		(-2.5)		*(-0.4)*		*(-2.7)*
Hybrid %	-0.29	-0.29				
	(-9.0)	*(-9.0)*				
Volatility	0.00	0.00	0.01	0.01	0.03	0.04
	(0.2)	*(0.4)*	*(1.8)*	*(1.8)*	*(4.9)*	*(5.1)*
Stocks per panel	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01
	(-3.7)	*(-3.6)*	*(-3.2)*	*(-3.2)*	*(-2.7)*	*(-2.7)*
$Price^{non\text{-}EA}$	-12.50	-12.63	-10.39	-10.40	-20.06	-20.08
	(-5.8)	*(-5.8)*	*(-5.3)*	*(-5.3)*	*(-9.1)*	*(-9.1)*
$Trades^{non\text{-}EA}$	-0.42	-0.43	-0.42	-0.43	-0.42	-0.42
	(-24.7)	*(-24.7)*	*(-22.3)*	*(-22.3)*	*(-22.9)*	*(-23.0)*
$Trade\ size^{non\text{-}EA}$	0.32	0.32	0.24	0.24	0.53	0.53
	(6.8)	*(6.8)*	*(5.5)*	*(5.5)*	*(7.6)*	*(7.6)*
$Absolute\ return^{non\text{-}EA}$	3.90	3.91	3.30	3.28	4.49	4.44
	(5.2)	*(5.1)*	*(4.8)*	*(4.8)*	*(3.5)*	*(3.5)*
Day number	0.00	0.00	0.00	0.00	0.00	0.00
	(-6.5)	*(-6.3)*	*(-2.4)*	*(-2.4)*	*(-9.4)*	*(-9.6)*
Intercept	-0.78	-0.81	-0.54	-0.55	-2.05	-2.06
	(-2.7)	*(-2.7)*	*(-1.9)*	*(-1.9)*	*(-4.5)*	*(-4.5)*
Observations	76,690	76,690	46,965	46,965	29,866	29,866
R^2	60%	60%	55%	55%	54%	54%

Table 7: Regressions of Specialist Participation on Earnings Announcements by Panel Size

Analysis periods are from June 1, 2006 through May 31, 2007 (first two columns) and two sub-periods: before each panel's Hybrid activation (next two columns), and after each panel's Hybrid activation (last two columns). *Specialist participation rate* (espressed as a log odds ratio) for non-announcement stocks on each panel is regressed on one of two earnings announcement measures: *Earnings ann'ment %*, the percentage of stocks on the panel having earnings announcements on that day, or *High Earnings ann'ment %*, an indicator variable equal to one for panel-days with earnings ann'ment in the top quartile, else zero.

Regressions also include the following control variables: the percentage of panel stocks that have gone Hybrid; market-wide volatility measured by the opening level of the VIX index; the number of stocks on the panel; the inverse of the average price for non-announcement stocks on the panel; the log of the average number of trades for non-announcement stocks on the panel; the log of the average trade size for non-announcement stocks on the panel; the average absolute return for non-announcement stocks on the panel; and a time trend. Coefficients for the control variables and constant are not reported. Quartile 1 comprises the panels containing the most stocks in each period or subperiod. T-statistics, reported in parentheses below coefficient estimates, are robust to time-series and cross-sectional correlation.

	Full Year		Pre-Hybrid		Post-Hybrid	
Quartile 1						
Earnings ann'ment %	-0.17		0.13		-0.13	
	(-1.5)		*(1.2)*		*(-0.6)*	
High Earnings ann'ment %		-0.05		0.03		-0.05
		(-1.2)		*(0.8)*		*(-0.8)*
Quartile 2						
Earnings ann'ment %	-0.11		-0.11		-0.16	
	(-1.3)		*(-1.6)*		*(-1.6)*	
High Earnings ann'ment %		-0.03		-0.04		-0.03
		(-1.4)		*(-1.9)*		*(-0.8)*
Quartile 3						
Earnings ann'ment %	-0.23		-0.10		-0.27	
	(-3.4)		*(-1.2)*		*(-2.2)*	
High Earnings ann'ment %		-0.08		-0.10		-0.06
		(-2.7)		*(-2.3)*		*(-1.6)*
Quartile 4						
Earnings ann'ment %	-0.27		-0.12		-0.47	
	(-3.8)		*(-1.8)*		*(-4.0)*	
High Earnings ann'ment %		-0.08		-0.03		-0.10
		(-3.7)		*(-1.7)*		*(-2.6)*
Observations per quartile	19,173	19,173	11,741	11,741	7,467	7,467
Average R^2	57%	57%	57%	57%	55%	54%

Table 8: Regressions of Stock-Level Specialist Participation on Earnings Announcements
Analysis periods are from June 1, 2006 through May 31, 2007 (first column) and two sub-periods: before each stock's Hybrid activation (middle column), and after each stock's Hybrid activation (last column). *Specialist participation rate* (expressed as a log odds ratio) for each stock is regressed on *Earnings ann'ment*, an indicator variable equal to one on days when the stock has an earnings announcement, else zero.

Regressions also include stock fixed effects and the following control variables: *Hybrid,* an indicator variable equal to one if the stock has gone Hybrid, else zero; *Volatility,* market-wide volatility measured by the opening level of the VIX index; *Price,* the inverse of the average stock price; *Trades,* the log of the stock's average number of trades; *Trade size,* the log of the stock's average trade size; *Absolute return,* the stock's average absolute return; and *Day number,* a time trend. T-statistics, reported in parentheses below coefficient estimates, are robust to time-series and cross-sectional correlation.

	Full Year	Pre-Hybrid	Post-Hybrid
Earnings ann'ment	0.13	0.10	0.18
	(14.5)	*(12.2)*	*(12.9)*
Hybrid	-0.59		
	(-31.1)		
Volatility	-0.01	0.00	0.02
	(-3.3)	*(0.3)*	*(3.7)*
Price	-0.26	0.00	0.01
	(-4.1)	*(-0.1)*	*(0.2)*
Trades	0.00	0.00	0.00
	(0.6)	*(-1.2)*	*(-2.0)*
Trade size	0.01	0.00	0.00
	(0.8)	*(0.1)*	*(-0.3)*
Absolute return	1.54	0.02	-0.10
	(3.5)	*(0.1)*	*(-0.3)*
Day number	0.00	0.00	0.00
	(-14.3)	*(-4.1)*	*(-15.5)*
Intercept	0.60	0.06	0.64
	(8.0)	*(0.8)*	*(7.5)*
Observations	612,279	351,158	261,121
R^2	51%	58%	44%

Appendix A: Correlations between Earnings Announcements and Trade-based Attention Measures

Pooled correlations are presented for the sample of 470 panels from June 1, 2006 to May 31, 2007. Attention measures are calculated for each stock each day and then summed across stocks on the panel having earnings announcements on that day. Attention measures are defined as follows:

$Attention1_{i,t}$ = number of trades/standard deviation of number of trades across all stock/day periods

$Attention2_{i,t}$ = absolute return in basis points/standard deviation of absolute return in basis points across all stock/day periods

$Attention3_{i,t}$ = $Attention1_{i,t}$ x $Attention2_{i,t}$

Earnings ann'ment % is the percentage of stocks on the panel having earnings announcements on that day. *Earnings surprise* is the average earnings surprise for all stocks on the panel having earnings announcements on that day. Data are from TAQ, IBES, and the NYSE Symbol Trading Location file. All correlations are significant at the 1% level.

	$Attention1^{EA}$	$Attention2^{EA}$	$Attention3^{EA}$	Earnings ann'ment %	Earnings surprise
$Attention1^{EA}$	1.00				
$Attention2^{EA}$	0.46	1.00			
$Attention3^{EA}$	0.70	0.56	1.00		
Earnings ann'ment %	0.56	0.61	0.33	1.00	
Earnings surprise	0.07	0.16	0.05	0.15	1.00

Figure 1: Specialist Panels and Average Number of Stocks per Panel
This chart graphs the number of specialist panels and the average number of stocks per panel from June 1, 2006 to May 31, 2007. Data are from the NYSE Symbol Trading Location file.

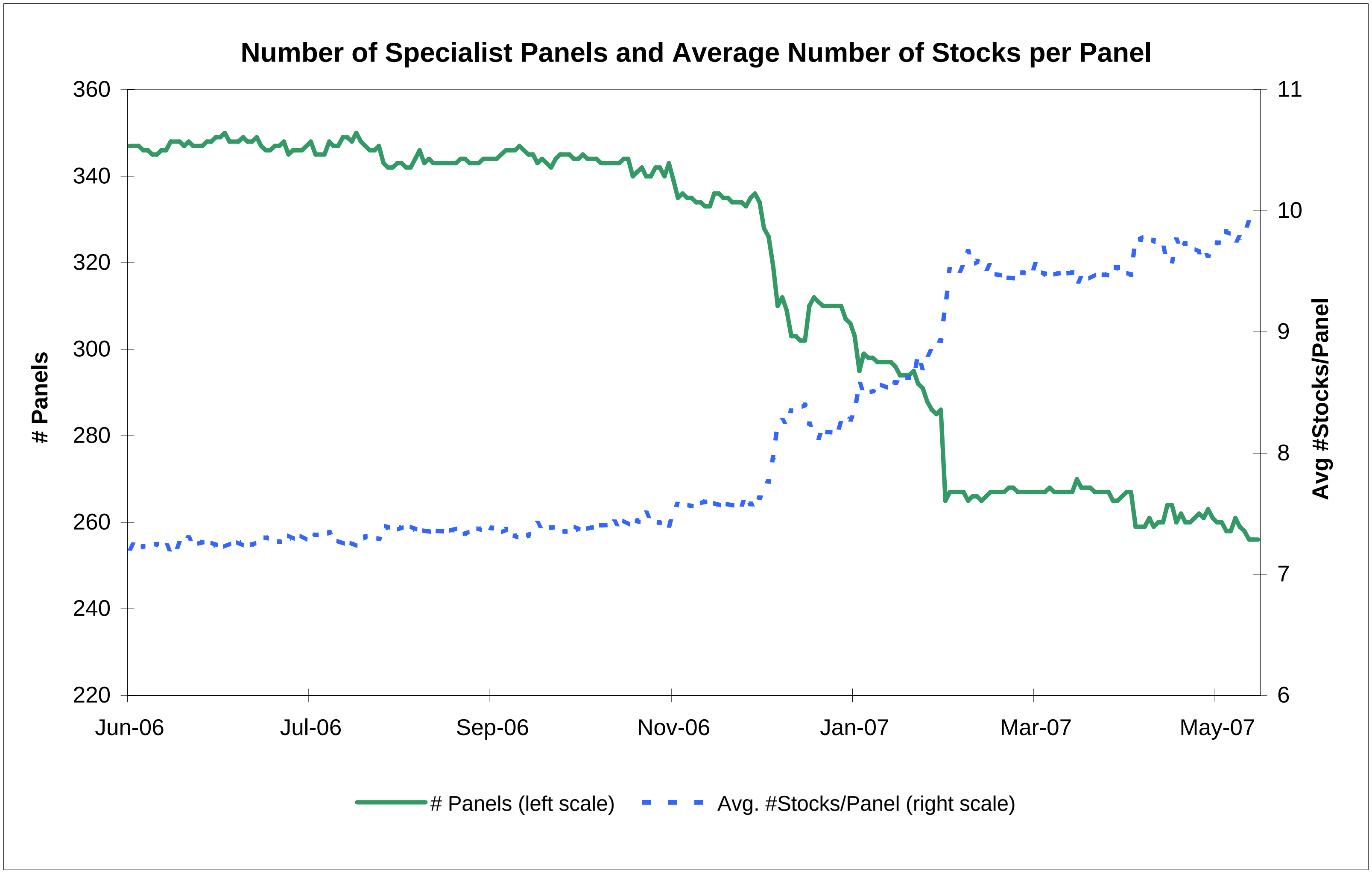

Figure 2: Earnings Announcements per Specialist Panel
This chart graphs the average and maximum percentages of earnings announcements per specialist panel, from June 1, 2006 to May 31, 2007, excluding single-stock panels. Data are from IBES and the NYSE Symbol Trading Location file.