

Getting Out Early: An Analysis of Market Making Activity at the Recommending Analyst's Firm

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In this paper, we explore how analyst recommendation changes affect a security's trading volume at the market maker of the analyst's own firm. Examining these trading patterns provides new evidence on the timing of information releases and leads to an increased understanding about the relative value of upgrades and downgrades, particularly after recent regulatory changes. Using the Nasdaq PostData, we identify the daily trading activity of each market maker for a sample of Nasdaq-traded securities around recommendation releases. We find a dramatic increase in trading volume for the market maker of the analyst's firm relative to other market makers on upgrade and downgrade event days. For upgrades, trading activity is in line with the direction of the analyst recommendation change on the event day. For downgrades, we find no disproportional sell volume on the day of the recommendation release. Instead, we find evidence of increased selling at the downgrading analyst's firm up to two days prior to the official release date of a downgrade. This paper provides direct evidence of compensation for research production through the market-making channel and also raises questions about the selective release of negative news.

A large literature has examined stock market reactions to changes in analyst opinion. Relatively less attention has been devoted to studying how clients and traders react to analysts of their own firm.¹ Examining these trading patterns provides new evidence on the timing of information releases and leads to an increased understanding about the relative value of upgrades and downgrades, particularly after recent regulatory changes.

In this paper, we address the broad issue of how information is disseminated in fragmented markets. Although it is unclear whether analyst reports represent new information, a synthesis of existing public information, or some combination of the two, the industry devotes substantial resources to analyst opinions, and evidence suggests that investors follow these opinions. Research indicates investors can earn abnormal profits by following analyst recommendations, at least in the short run. (See, for example, Barber, Lehavy, McNichols, and Trueman, 2001; Irvine, 2003; Stickel, 1995; and Womack, 1996) Additional studies have focused not only on returns following analyst recommendations, but also aggregate volume effects. Microstructure theory dictates that if there is no disagreement about new information, prices should adjust without changes in volume. If there is disagreement about the information, however, increases in trading volume as well as subsequent return movements may occur.² We explore the question of how analyst opinions affect the market making volume of the analyst's own firm relative to volume of the market as a whole.

Our focus is on the effect of recommendation changes because there is evidence of larger price and trading responses to recommendations than to other analyst comments such as earnings forecasts or reiterations (Irvine, 2004). If an analyst recommendation is released publicly at the same time to all market participants, there should not necessarily be a systematic pattern to the

¹ Exceptions include studies using data from the Toronto Stock Exchange by Irvine (2001, 2003, 2004) and from the Australian All Ordinaries Index by Jackson (2005), discussed in further detail below.

² Blume, Easley, and O'Hara, 1994; Grossman and Stiglitz, 1980; Harris and Raviv, 1993; Kim and Verrecchia, 1991; Kyle, 1985; and Wang, 1994.

order flow or the trading at the analyst's firm. Alternatively, different subjective assessments of analyst quality, trading in discretionary accounts, brokers "working the phones," or prior soft dollar agreements in exchange for research could all lead to increased trading at the analyst's own firm.

Using Nasdaq PostData, we link the daily trading activity of each market-making firm security by security to analyst recommendation changes emanating from the same firm. We document that, for a broad set of Nasdaq securities, increases in volume in response to analyst upgrades and downgrades are greater for market makers of the affiliated analyst. It does not appear that better execution prices explain these differences. Further, the direction of the volume is generally in line with the direction of the analyst revision, suggesting that either the firm itself, through building a position, or the brokerage firm's clientele believe their own analyst recommendations. This finding is particularly interesting because our sample follows recent regulatory changes affecting the analyst industry (Regulation FD and the Global Research Analyst Settlement Agreement) that well publicized the biases and conflicts of interests for analysts. The implications are that, overall, those closest to the analyst firm are reacting disproportionately to the release of the analyst information. The information channel matters in determining the placement of trades, and the issuing analyst's firm seems to be rewarded with increased order flow or proprietary trading profits.

Moreover, we find differences in the timing of the disproportionate volume effect between upgrades and downgrades. For upgrades, the effect is confined to the event day. For downgrades, proportional sell volume increases for the affiliated market maker up to two days prior to the official recommendation release date. This finding is robust to the potential endogeneity of the analyst recommendation, so that it does not appear that the downgrade is a reaction to an inside look at abnormal sell volume at the firm. Bad news seems to be

disseminated earlier either internally or to presumably more important clients of the firm. We find our results extend to the subsample for which we have block trading information, indicative of institutional trading. We also find evidence that the disproportional increase in sell volume in the two days prior to the downgrade date is increasing with the proportion of revenue a firm derives from proprietary trading, and, that on the day prior to the recommendation, the disproportional sell volume extends to market makers who act strictly in an agency capacity.³

The contributions of this study are fourfold. First, we extend recent findings that analyst coverage or more optimistic opinions can generate trade in a general sense to the specific events of upgrades and downgrades. Irvine (2001), using attributed volume data from the Toronto Stock Exchange, notes that there is a positive relationship between analyst coverage of a security and volume in that security,⁴ while Irvine (2004) and Jackson (2005) document that brokerage firms can increase the amount of trade, and thus trading commissions, through more positive stock recommendations. Agrawal and Chen (2005a, 2005b) also examine the conflict of using analyst recommendations to attract brokerage commissions, which may be linked to analyst compensation. Our paper furthers this literature by documenting attributed volume responses around specific analyst event days.

Second, our event-based approach allows us to examine timing effects of the information release. We also contribute to the literature that suggests informed trading prior to the public release of analyst recommendations. Green (2006) and Kim, Lin, and Slovin (1997) observe an increase in aggregate trading prior to the public release of analyst recommendations, suggesting that some clients have an informational advantage immediately prior to the revision. There is also evidence in the literature that market makers may “front-run” firm clientele by adjusting

³ Proprietary trading is trading on behalf of the brokerage firm’s house accounts separate from market making activities.

⁴ See also Chung and Cho (2005), Madureira and Underwood (2006).

their bid-ask spreads prior to the market-wide announcement of analyst recommendations. Several recent papers, using affiliated quote data, document a shift in inside spreads just prior to the publication of analyst recommendation changes (Green, 2006; Heidle and Li, 2004; and Madureira and Underwood, 2006). From these studies, it is not clear that market makers are front-running their own analyst recommendations or whether they are reacting to publicly available information. We find evidence of abnormal selling at the issuing firm's market maker up to two days prior to a downgrade, and further test that the result is robust to the potential endogeneity of the downgrade.

We view our contribution as complementary to concurrent work by Irvine, Lipson, and Puckett (2006), who document institutional buying imbalances up to five days before the initiation of analyst coverage with a buy or strong buy recommendation. As they note, trading a security in anticipation of the issuance of a research report is prohibited by Nasdaq Rule 2110 for member firms, and many firms have additional policies that prohibit prior dissemination to select clients. The question of legality seems to center on whether the firm has made representations to treat its clients equally (Irvine, Lipson, and Puckett, 2006). Our study extends the evidence of information pre-release to downgrades, and, as a third contribution, provides direct evidence that the analyst's firm is compensated through increased volume. The nature of our data shows the phenomenon holds for a broad set of securities and market participants.

Last, because our time period follows recent regulatory changes that may have changed market perceptions about analyst opinions, we are able to highlight differences in trading patterns around upgrades and downgrades in the current environment that have implications for the relative value of those recommendation changes. Alternate sources for attributed market maker data would not allow us to speak to what effects these regulatory changes may have had on reactions to analyst opinions.

The remainder of the paper is organized as follows. In Section 1, we provide a detailed description of the data. Section 2 presents evidence of disproportional changes in market-making volume for securities on days where a firm's analyst issues a recommendation change. In Section 3, we examine trading prior to the information release date, including the relationship between pre-downgrade trading and possible proprietary trading. Section 4 offers additional discussion and Section 5 concludes.

1. Data

In the next section, we describe the data sources used in the analysis. In Section 1.2, we explain the construction of the sample and motivation behind the variables of interest and controls. We provide definitions of all variables in Section 1.3, and discuss univariate tests in Section 1.4.

1.1 Data Sources

The data are compiled from several sources, including Nasdaq, Thomson/IBES, Yahoo!Finance, SEC Filings, and CRSP. The market maker trading data are taken from Nasdaq PostData, an online source provided by Nasdaq from January 2002 to March 2005. The PostData are not available historically; only 45 calendar days of data were available at any point in time. These data were hand-collected over a period from August 23, 2004 through March 16, 2005.⁵

The key feature of PostData relative to other U.S. sources is that trading data are attributed to particular market makers, which allows us to link market making activity to recommending analysts. The data consist of daily signed volume for agency trades and riskless

⁵ There are four missing dates in the sample period, three of which occurred after Nasdaq announced it was discontinuing service of PostData on March 1, 2005.

principal transactions. For principal transactions, both sides of the trade will be included as volume. In its original form, PostData contained two reports, the daily report which only provides volume data for participating market makers, and the 10-day file, which includes volume data for all registered Nasdaq market makers. We use the 10-day file in order to include all market maker data.

The data files contain the trade date, ticker symbol, the market maker ID and type (including a code for ECNs), the number of shares traded, the dollar volume of trade, the number of trades, and average trade size. Each of the trading metrics is divided into buy, sell, and crossed trades (where market makers match buys and sells internally).⁶ In addition, for a subset of market makers and stocks we have separate information for block trades, again divided into buys, sells, and crosses. In total, we have 136 days of data for 3,874 Nasdaq-traded stocks for all quoting market makers on trading days from August 16, 2004 through March 16, 2005. During our sample period, there are an average (median) of 18 (12) firms making a market in each security. In total, our sample contains 225 uniquely identified market makers.

We collect analyst information from Thomson Financial/IBES for the same time period. One of the primary advantages of the TF/IBES data is that, beginning in 2003, IBES recorded date and time stamps for analyst recommendations. Time stamps allow researchers to track when information first becomes publicly available, even if on a limited basis to own-firm clientele and market makers. Currently, TF/IBES data report both the time when analysts release their opinions as well as when it is first published on the IBES reporting system. Because we are concerned with the initial release of information, we focus our attention on the actual analyst release of a recommendation as opposed to the IBES release date and time.

⁶ PostData requires only that total volume is reported by participants each day; however, 83% of market makers in our sample also report cumulative buy, sell and crossed volume, and corresponding data on dollar volume, average trade size, and the number of trades. These market makers comprise 96% of total volume.

To link the databases, we hand-match IBES brokerage firm codes to Nasdaq market maker identification codes. We then match recommendations for each security to the PostData based on market maker identifier and the date and time stamp. If a recommendation is released after 4pm, the “event” date becomes the trade date after the recommendation release. If the recommendation is released prior to the market open or intraday, the “event” date is the same trade date. Occasionally, analysts release recommendations on non-trading days. For those recommendations, we consider the next trade date to be the “event” date.⁷ When we match the trade data to the analyst recommendations, there are 7,557 recommendation releases (initiations, reiterations, or changes) for 1,590 distinct firms during our sample period, of which 1,918 are upgrades and 3,963 are downgrades. There is some degree of clustering in analyst revisions. Nearly 28% of downgrades have two or more revisions in a 7-day window compared to 16% for upgrades. Over the sample period, there are five recommendation revisions per security on average, although some stocks have substantially more analyst activity; for instance, Google Inc., which went through its IPO shortly before our sample began, had 54 revisions.

We augment these two main data sources with information about share price returns from CRSP. Proprietary trading desk information is collected from Nasdaq, information on brokerage firm revenue composition is collected from SEC filings, and analyst rankings are collected from the October 2004 Institutional Investor All-American Research Team. Yahoo!Finance (data provided by Thomson Financial Network) is the source for the number of analysts covering a particular security, taken as of March 2005.

⁷ As a robustness check, post-4pm revisions (approximately 15% of the sample) are classified with the same trading day. Results are robust to either classification.

1.2 Sample Construction and Methodology

Our approach is to examine market-maker attributed trading in the days surrounding analyst upgrades and downgrades. We consider upgrades to be any recommendation initiated with a strong buy recommendation, or any positive changes in opinion, regardless of whether the level would be considered positive or not. Downgrades are any negative revisions, as well as initiations of strong sells, sells and holds. Numerous studies suggest that hold recommendations are negative due to analysts' reluctance to issue extremely pessimistic opinions (see, for instance, Barber et al., 2006; Womack, 1996). Despite efforts by the NASD and NYSE regulations of 2002 as well as the Global Settlement Agreement to bring analyst recommendations more in line with their true opinions about stocks, recent literature continues to find hold recommendations are primarily negative signals by analysts (Clarke et al., 2006; Kadan et al., 2005). Interestingly, we see a shift in the distribution of recommendations compared to previous studies, which may be driven in part by the new regulations. In our sample, approximately 10% of the recommendations are sell and strong sell (as opposed to fewer than 5% in earlier studies, including Barber et al.), and the ratio of downgrades to upgrades is roughly two to one.

We match analyst upgrades and downgrades with the trading days in the PostData for the security covered by the recommendation change. For our event day analysis, we take all market maker data for security-days on the dates where any analyst issues an upgrade or a downgrade.⁸ We also analyze the full set of market maker data for security-days in the event window around the recommendation change, defined as three days prior through three days following the recommendation release.⁹

⁸ Our results are robust to a wide variety of alternative sample construction methods, which are discussed further in Section 6.

⁹ We further checked up to seven days before and after the recommendation release date and find no significant effect on directional volume beyond the two days before or after upgrades or downgrades.

In order to isolate timing effects, we analyze each trading day separately. An observation is a unique combination of market maker, security, and trading day. Because the research question concerns the effect of analyst recommendations on market making at a particular firm, the dependent variables in the multiple regression framework are various measures of daily volume (for example, total volume or sell volume as a proportion of total volume) for a given market maker in a given security on a given day.¹⁰

The main independent variables of interest are indicator variables for *affiliated* analyst upgrades and downgrades at the market maker's firm for a particular security. Affiliated upgrades and downgrades are indicator variables equal to one if the upgrade or downgrade came from an analyst at the same brokerage firm as the market maker on the event day, zero otherwise.

To control for normal volume patterns for a particular market maker in a particular security, we construct benchmark volume measures from all non-event trading days, defined as days that are not within +/- three days of any recommendation date for a given security-market maker pair. This gives us a baseline measure for "typical" trading in order to test whether trading behavior around analyst ratings changes is different from patterns on non-recommendation days.

We also include controls for the trading environment on the event day and characteristics of the stock, including the total daily volume for a security across all market makers, the number of market makers for the security, and the security's market capitalization. Further, we include total ECN volume for the day and an indicator variable if the market maker is an ECN.

¹⁰ Note that because our data are market maker by market maker, the volume measures used as dependent variables do not suffer from distributional difficulties (right skewness) often associated with analyzing aggregate daily volume or imbalance measures (Cremers and Mei, 2004). Our data for natural log of total volume are distributed approximately normal, with some increased density consistent with clustering around small round numbers in the left tail of the distribution.

A natural concern might be analyst revisions in response to other analyst activity or external news. We control for the number of analysts covering the security and account for other analyst activity in the +/- three days around an affiliated analyst's revision by constructing three indicator variables equal to one if the number of other analyst upgrades (downgrades) is equal to one, two, or more than two within three days on either side of the event date, zero otherwise.¹¹ Because news events may trigger an analyst response, we include return controls for the three days prior to the analyst revisions (or alternate event day) to control for possible news. We also control for price response on the revision day, though all specifications are robust to the exclusion of the returns controls.

1.3 Variable Definitions

Formal variable definitions are listed below. All volume measures used as dependent variables in the analysis also have an associated *Benchmark* measure. The *Benchmark* measures are averages computed for each market maker and security pair for trading days that fall outside of the analyst recommendation release window (± 3 days).

- *Total Volume* is the natural log of the number of shares traded for a given market maker and security on the trading day. It is the sum of buys, sells, and two times the number of internally matched (crossed) trades.
- *Block Volume* is the natural log of total block volume, defined as trades over 10,000 shares, for a given market maker and security on the trading day.
- *Prop Buy (Sell)* is proportional buy (sell) volume, defined as the buy (sell) volume for stock i of market maker j on day t divided by total volume for stock i of market maker j

¹¹ Although the number of upgrades and downgrades by other analysts may be informative, we have no reason to believe that there is a monotonic relation between the number of analyst revisions and volume. In unreported tests, the number of unaffiliated recommendations is used instead of the indicator variables, and the results are qualitatively unchanged.

on day t . We use the logit transformation to map proportional volume, which is bounded by zero and one, to the real line.¹² This measure is computed for all trades as well as for block trades only.

- *Market Share* is a market maker's volume in a given security on a given day divided by the total volume for that security and day. We take the logit transform of this ratio.
- *Affiliated Upgrade (Downgrade)* is an indicator variable set equal to 1 if market maker j issued an upgrade (downgrade) for stock i on day t , 0 otherwise.
- *Aggregate Volume_t* is the natural log of the number of shares traded by all market makers for stock i on day t , 0 otherwise.
- *Market Makers* is the natural log of the average number of market makers for a particular security.
- *Market Cap* is the natural log of the market capitalization of the stock taken from CRSP.
- *ECN Volume (ECN Shr)* is the natural log of the number of shares traded (market share) for all ECNs for stock i on day t .
- *ECN Indicator* is an indicator variable set equal to one if the market maker is an electronic exchange network, 0 otherwise.
- *Analyst Coverage* is the natural log of the number of analysts following the security.
- *Unaffiliated Up(Down)l* is an indicator variable set equal to 1 if an analyst other than market maker j 's analyst issued an upgrade (downgrade) for stock i in the ± 3 day window around day t , 0 otherwise.

¹² The transformation used is $[\ln(x/1-x)]$. Our results are qualitatively unchanged if we used the untransformed proportional volumes.

- *Unaffiliated Up(Down)²* is an indicator variable set equal to 1 if two analysts other than market maker *j*'s analyst issued an upgrade (downgrade) for stock *i* in the ± 3 day window around day *t*, 0 otherwise.
- *Unaffiliated Up(Down)^{>2}* is an indicator variable set equal to 1 if more than two analysts other than market maker *j*'s analyst issued an upgrade (downgrade) for stock *i* in the ± 3 day window around day *t*, 0 otherwise.
- *Prior 3-Day Returns* is the cumulative net of market return (value-weighted CRSP universe) for stock *i* in the three-day window prior to day *t*.
- *Day *t* Return* is the net-of-market (value-weighted CRSP universe) return for stock *i* on day *t*, where *t* is the unit of observation trading day.
- *Event Day Return* is the net-of-market (value-weighted CRSP universe) return for stock *i* on the recommendation day.

1.4 Descriptive Statistics

Summary statistics for all variables on upgrade or downgrade days prior to any natural log or logit transformations can be found in Table 1. We have a total of 158,896 observations for market maker activity in a given security on days where there is an upgrade or downgrade. For block trades, the number is 9,838, which reflects both that not all market makers have trades of over 10,000 shares in all securities and that this more detailed level of reporting is voluntary. While the voluntary reporting of block-trades is likely non-random, those who report block trades do so consistently throughout the sample, so we have no reason to believe that this subsample is biased in a particular way around upgrade or downgrade event days. The average market maker trades approximately 113,600 shares in a security, representing a market share of 2.5%. Approximately 8% of the reporting market makers are ECNs.

While we do not see abnormal returns in the three days before the recommendation for upgrades or downgrades, the event day return for upgrades (downgrades) is 3.13% (-3.21%), which is in line with returns reported by previous studies. Moreover, we find limited evidence of post-event drift in the raw data; returns are marginally different from zero on the day following the event day.

To begin our analysis, we examine market making activity for affiliated and unaffiliated market makers, excluding ECNs, on days with analyst recommendation changes. Table 2 compares volume characteristics to their corresponding benchmarks on and before each event day, with P-values for differences. In addition to the volume metrics used in our multiple regression analysis, total volume and market share, we also report average dollar volume and average trade size. Most notably, regardless of which metric is examined, there is a statistically and economically significant increase in trading activity on recommendation days for both affiliated and unaffiliated market makers, consistent with Harris and Raviv (1993). Average affiliated share volume more than doubles from the benchmark of 47,655 shares to 104,823 shares, with a corresponding increase in dollar volume. Market share increases by more than a percentage point, and average trade size increases from a benchmark of 563 to 655. For unaffiliated market makers, the increased activity is smaller in magnitude, and measurably smaller for total volume and average trade size. Our results suggest that on average there is significant reaction in the market. These statistics suggest that at least some investors still respond to analyst opinions, despite the concerns about analyst impartiality in recent years.

Clearly, the results for unaffiliated market makers indicate that analyst recommendation releases affect the entire market since we find statistically significant increases in volume for all market makers. This is not surprising since investors and market makers from unaffiliated firms would have access to the recommendation change information after the official release. Further,

clientele of affiliated firms may shift order flow away from the recommending firm to others where “soft dollar” agreements may exist (Conrad et al., 2001; Goldstein et al., 2004; Irvine, 2003).¹³ The relative sizes of the volume increases as well as the univariate comparison for market share suggest, however, that the firm issuing the analyst recommendation sees a disproportionate increase in volume. The affiliated market makers see an improvement in market share of up to 30%, whereas unaffiliated market makers show a slight decrease.

When we examine univariate differences in directional volume, we see that proportional buy volume is elevated relative to benchmark measures for both affiliated and unaffiliated firms on the recommendation day. There is also a significant difference across affiliated and unaffiliated firms, with affiliated market makers experiencing relatively more buying. For proportional sell volume on the event day, we see an elevation above benchmark only for unaffiliated firms and no statistical significance across groups.

In the days before the announcement of a recommendation change, there is some evidence of increased trading activity at affiliated firms two days before the recommendation release in the general volume measures, though it is not enough to significantly impact market shares. For directional volume, however, proportional sell volume before downgrade days is higher than benchmark measures for the affiliated analyst’s firm for the three days prior to the release of a recommendation, and this difference is significantly different from increases in proportional sell volume at the unaffiliated firms on days -2 and -1. The multiple regression analysis will further address whether the affiliated firm benefits more from its own recommendations than it does for recommendations in general and explore the directional volume effects prior to announcement releases.

¹³ Broker-dealers typically provide a bundle of services including research and execution of transactions. Because commission dollars pay for the entire bundle of services, the practice of allocating certain of these dollars to pay for the research component has come to be called “softing” or “soft dollars”. (SEC, 1998)

2. Market Making Activity on Event Days

In this section, we investigate in a multiple regression setting whether analyst recommendation changes generate business for their own firm over and above the general increase in volume that may occur on any event day. We examine several measures of attributed volume as dependent variables, including *Total Volume*, *Market Share*, *Proportional Buy Volume*, and *Proportional Sell Volume*.¹⁴ The independent variables of interest are *affiliated* upgrades and downgrades. We control for potential confounding information events with the indicator variables for *unaffiliated* upgrades and downgrades as well as prior returns.

Table 3 presents results of the multiple regressions for the four measures of attributed volume. Both affiliated upgrades and downgrades significantly and positively impact attributed total volume, indicating that affiliated investors and/or market makers actively trade around recommendation releases. The coefficients on the variables suggest that total volume at the affiliated market maker increases roughly 59% on average for downgrades and 72% for upgrades. We do not find consistent evidence that unaffiliated recommendations around the event day significantly affect attributed total volume, though signs on the coefficients are quite intuitive. If a competing analyst also issues a recommendation, the increase in affiliated volume is not as large. The higher the benchmark volume, the lower the total volume on affiliated recommendation days. This is consistent with both a larger percentage increase for smaller market makers as well as the notion that each market maker has a limited capacity for trading. As the aggregate daily volume increases for the stock on the event day, each individual market maker's total volume also increases. Total volume increases as ECN volume increases, and the indicator variable for whether the market maker is an ECN is also highly statistically significant

¹⁴ In unreported regressions, we analyze additional volume metrics such as dollar volume, average trade size, and market share ranking. Results are economically and statistically similar.

and positively related to total volume. These results are consistent with investors shifting trades to ECNs when there is information about stocks that may not be fully revealing to the market.

Since coverage and market making are both choices brokerage houses make based on a security's characteristics, the number of analysts for a security and the number of market makers are highly correlated ($\rho = 0.81$). An increase in the number of analysts and market makers should decrease total volume for each market maker since there are more traders to share the same volume. We find that as the total number of analysts and market makers increase, the total volume attributed to any given market maker declines. Bigger companies, as measured by market capitalization, are associated with larger attributed volume. Lastly, our results on the significance of affiliated upgrades and downgrades hold even after controlling for pre-event window returns and event day returns, which would influence trading. The negative signs on these variables imply that as the return increases, there is less total volume attributed to any market maker, indicating that good news (upgrades) generates less trade than bad news.

Column II of Table 3 presents the results for market share. By investigating market share, we can better gauge whether changes in analyst opinions have an economically meaningful impact on affiliated market makers. We control for benchmark market share to determine whether there are significant changes on recommendation days. As in the volume specification, an affiliated analyst opinion change is associated with a substantial increase in market share. The coefficients on affiliated upgrades and downgrades imply an increase in market share of 85% for upgrades and 65% for downgrades. Unaffiliated upgrades and downgrades reduce the gains to the affiliated market makers' market share. ECN market share increases on recommendation days as further evidence that informative trades may be shifted to anonymous trading platforms.

The volume and market share regressions indicate that there is increased trading activity at the issuing analyst's firm around recommendation changes, but we have not yet examined the direction of trade. We are primarily concerned with whether there is a significant change in the proportional buy volume around affiliated upgrades and an increase in proportional sell volume around affiliated downgrades.¹⁵ We use the same control variables as in the prior specifications, with the exception of the benchmark measure, which is defined according to the dependent variable in each specification. The analysis of proportional buy and sell volume is presented in columns III and IV of Table 3.

Proportional buy volume increases if the affiliated recommendation is an upgrade, but, interestingly, there is no significant relation between downgrades and proportional sell volume. From this specification, it seems the messenger matters for good news, but not for bad. Most of the prior research on analyst recommendations, however, finds that downgrades have a larger impact, as measured by returns, than do positive recommendations. One explanation of our findings may be the differences in institutional versus individual trading. Chen and Cheng (2005) and He, Mian, and Sankaraguruswamy (2005) observe that investors, particularly institutions, trade in the direction of the analyst opinion. Individual investors, on the other hand, are net buyers regardless of the direction of the recommendation (He et al., 2005).¹⁶ Another is that, unlike upgrades, downgrades are more likely to be viewed by the market as new information, since analysts historically have been reticent to lower their investment opinions. Downgrades, therefore, would lead to market-wide trading, affecting total sell volume as much as sell volume at the downgrading firm. Proportional buy (sell) volume is increasing

¹⁵ We also estimated alternative specifications, where we include the effect of upgrades on sell volume and downgrades on buy volume, and results are qualitatively similar.

¹⁶ Malmendier and Shanthikumar (2005) find differences between small and large traders in the information that drives trade, but that both trade in the direction of the information. Hong and Kumar (2002) instead observe that retail investors sell after good news and buy after bad news, which is similar to trading behavior of insiders noted in Coles, Juergens, and Martin (2005) and Hsieh, Ng, and Wang (2005).

(decreasing) in the number of unaffiliated downgrades for the entire sample, but decreasing (increasing) if another single analyst makes an upgrade in the same window.

Overall, the results suggest that both upgrades and downgrades generate increased trade at a given market maker, but only upgrades increase proportional buy volume for the analyst's firm on the event day. This buy volume could stem from investor orders or the market maker itself. Even after the substantial negative publicity surrounding analyst upgrades in recent years, there is significant trading activity in the direction of the recommendation. What is somewhat puzzling is why there is not a similar trading reaction to downgrades. Perhaps analysts are slow to downgrade following bad news even after a period of increased scrutiny and regulatory changes or downgrades provide a more uniform signal to the market, though returns and other downgrade controls account for the information environment to a great extent. It is this issue that we investigate in the next section.

3. Directional Trading Prior to Recommendation Days

In this section, we examine directional trading in the days prior to the recommendation.¹⁷ The regression specifications for prior trading days are the same as reported in Section 2, with the controls for prior stock returns adjusted to control for the prior three trading days from the date examined and the inclusion of an additional return for the trading day examined. Though a forward-looking variable, we keep the return for the recommendation release day as a measure for the relative importance of the information contained in the report. We first investigate the proportional buy and sell volume prior to a revision in analyst opinion, including the possibility of reverse causality. We also examine the patterns in block trading prior to analyst opinions and link the patterns in pre-recommendation trading to brokerage firm characteristics.

¹⁷ In all specifications where there is a directional volume effect, there is also a total volume effect.

3.1 Trading Before Upgrades and Downgrades

In Table 4, we report results for pre-recommendation release trading. In Columns I through III, the dependent variable is proportional buy volume for the days preceding the recommendation release date and the variable of interest is affiliated upgrade. There is no evidence to suggest that there is directional trade (or increased volume) prior to affiliated upgrades as was the case for the event day regressions. The own-firm directional trading response to the information revealed in the affiliated upgrade begins on the recommendation event day. There is some evidence that volume shifts to ECNs prior to an upgrade; however, the negative sign on ECN volume suggests an increase in sell volume. Moreover, rolling three-day prior event returns are significantly negatively related to volume, indicating that as returns increase prior to upgrades, the stock becomes relatively more expensive and volume declines.

Columns IV through VI of Table 4 report the effect of downgrades on pre-event proportional sell volume. In the pre-event period, a significant and positive relation is observed between affiliated downgrades and proportional sell volume beginning two days prior to the recommendation release. This result holds after controlling for other analyst upgrades and downgrades, which are by and large unrelated to proportional sell volume, and other news, as captured by pre-event returns. From these results, it appears that there is an increase in trading at the affiliated firm's market maker prior to the official information release. Two explanations are quite natural. The first possibility is that analysts react to abnormal increases in sell volume at their own firms' market makers. The second is that information is leaked in house or to important institutional clients of the firm. We explore these possible explanations below.

3.2 An Inside Look at Sell Volume?

One possible explanation for the increased selling at the affiliated market maker preceding downgrades is the possibility that analysts have an “inside look” at sell volume and adjust their opinions accordingly. We therefore employ an instrumental variables approach in an attempt to distinguish whether the knowledge about analyst downgrade causes the increased selling or visa versa.

The first challenge in controlling for the potential endogeneity of the analyst downgrade is in finding valid instruments. We identify variables that are correlated with a particular firm’s downgrades for a particular security but that are orthogonal to the affiliated proportional sell volume in that security. It has been shown that analyst coverage is increasing in stock volatility (Bhushan, 1989); we posit that volatility may also be related to the likelihood of a new analyst opinion and calculate the prior one-month stock price volatility for use as an instrument. We have no reason to think that volatility for a stock will be correlated with the order flow for a particular market maker. In addition to this stock specific variable, we need a brokerage specific variable that, with the stock-specific variable of volatility, can aid in predicting an analyst’s downgrade of a given security at a particular firm. Using the notion that analysts may shift opinions to generate trade, we use the prior six-month cumulative upgrades for a given brokerage firm as a second instrument.

Although the potentially endogenous variable, *Affiliated Downgrade*, is binary, estimating the first-stage equation of the model as a probit requires the strong assumption that the first-stage is correctly specified. Since consistency of the instrumental variables estimates does not depend on the functional form of the “first-stage” equation, we employ the standard

non-linear least squares single-equation LIML estimation (See Angrist and Krueger, 2001).¹⁸ In Table 5, we report our results from the instrumental variable estimation.

We examine the relation between affiliated downgrades and proportional sell volume on days -2 and -1 before the recommendation release. We find affiliated downgrades are significantly positively related to proportional sell volume after controlling for potential endogeneity of the analyst downgrade for both days (Columns I and II). Joint tests of significance are well beyond threshold levels for identifying weak instruments described by Staiger and Stock (1997). Further, the (unreported) partial R-square test for the relevance of instruments suggested by Bound et al. (1995) is highly significant. The Anderson-Rubin statistic for overidentification in the two-days before specification is .123 with a P-value of .72, and .109 with a P-value of .74 in the one-day before specification. We fail to reject the joint null that the instruments are uncorrelated with the error term and correctly excluded from the “second-stage” equation.

Our instrumental variables approach suggests that analysts are not simply responding to increasing sell volume in the days prior to a downgrade. Instead, our results indicate a causal effect of an analyst opinion change on the overall proportional sell volume. Our evidence is indicative of an internal or limited pre-release of analyst opinion changes prior to the public release date.

3.3 Block Trading Before Upgrades and Downgrades

If the market maker is alerting important clients to the impending downgrade or the firm itself is trading ahead of the public release, one might expect to see evidence of increased

¹⁸ For robustness, we also estimate the two-stage model where the first stage is a probit predicting affiliated downgrades using all exogenous variables. The fitted value from the probit is then used in the estimation of the second stage equation, which is a regression of proportional sell volume. Results are qualitatively similar.

institutional activity through block trading. Of course, this measure is imperfect since investors may break up their trades in order to “stealth trade” on private information rather than risking any signalling effects from making large trades. (Barclay and Warner, 1993; Chakravarty, 2001; Economides and Schwarz, 1995). We investigate proportional block buy and sell volume for each market maker on days –3 to 0 to determine whether there is evidence consistent with institutional trading for affiliated analyst firms prior to or on the recommendation release day. Results are reported in Table 6.

Interestingly, for upgrades, there does not appear to be increased institutional buying, as measured by block trading, for market makers on days where affiliated analysts issue an upgrade. This result is in contrast to the results reported in Table 3 for all trades, suggesting that the proportional buying effect for affiliated upgrades may be confined to small investors who are clients of the brokerage firm. We also examine, but do not report, proportional block buying on each of the three days prior to the upgrade. We do not find statistical significance on the affiliated upgrade coefficient in the three days prior to the recommendation change.

For downgrades, the pattern is quite different. As in Table 3, Column II of Table 5 shows there is no increase in proportional sell volume for market makers with an affiliated downgrade on the recommendation release day. We do, however, find evidence of elevated institutional selling, as measured by proportional block sell volume, through the market maker whose analyst is about to issue a downgrade in the days prior to the official release date. The coefficient on affiliated downgrade in Column III, three days prior to the downgrade, is not statistically significant. Columns IV and V of Table 5 show that in the two days prior to the release of a downgrade, the market maker of the downgrading firm sees a disproportionate amount of institutional sell volume. The coefficient on affiliated downgrade is highly statistically significant in each specification. There is evidence of block selling, likely by institutions, before

the official downgrade release, and that the market maker whose analyst is about to issue the downgrade is seeing more of this volume than is typical.

3.4 Proprietary Trading Desks and Revenue

Taken together, the instrumental variables approach and block trading analysis implies that analysts may reveal information to either large institutional investors or their own proprietary desks in order to take advantage of advanced knowledge of bad news. In order to test if information about the downgrade is pre-released to clients, we would like to be able to distinguish the trading activity of the firm for its own account from trading volume it processes for clients. Our data do not contain this information, but differences across firms may be able to isolate trading on behalf of clients. Thus far, we have effectively treated all market making firms in our sample equally. Some firms serve in an agency capacity where they engage in trades strictly on behalf of their clientele. Others, in addition to serving as trading intermediaries, place trades for their in-house account on behalf of their own (proprietary) trading desks.

We follow two approaches in identifying volume more likely to be associated with proprietary trading versus client trading. First, we identify firms with proprietary trading desks as identified by Nasdaq and split the affiliated downgrade indicator variable according to whether or not the firm has a proprietary trading desk. Second, for the firms with proprietary desks in our sample who are publicly traded, we collect revenue information from the 2004 10-K filing to calculate what fraction of the firm's revenue is attributed to proprietary trading.¹⁹ Of the 225 unique market makers in our sample, 42 are publicly traded (of which 37 report proprietary trading revenues). These firms account for 41% of the security-market maker pairs in our

¹⁹ Other studies such as Agrawal and Chen (2005a) have used the X-17a-5 filing to identify proprietary revenue for all firms, but reporting revenue breakdowns for this form is voluntary. Upon inspection, we determined that most of the large private firms with known proprietary trading desks chose not to disclose revenue breakdowns.

sample. For the subset of firms where we have the fraction of proprietary revenue or know that proprietary revenue is zero, we interact the revenue fraction with the affiliated downgrade variable. Therefore, the indicator variable for affiliated downgrade becomes the fraction of proprietary trading revenue for the firms that issue downgrades.

Table 7 reports the results for all trades for these two specifications for the three days prior the downgrade release date. Three days before the downgrade, as in previous models, none of the affiliated downgrade coefficients is statistically significant. Interestingly, the day -2 response is isolated to affiliated downgrades of market makers with proprietary trading desks (Column II). If analysts revealed to institutions, we would expect to see commensurate increase in sell volume at firms with non-proprietary desks as well. One day prior to the downgrade, reported in Column III, market makers both with and without proprietary desks have an increase in proportional sell volume in response to their affiliated downgrades. Thus, we see some evidence of early sell volume at firms who are only acting on behalf of clients on the day prior to the information release date. This evidence suggests at least some information dissemination outside of the firm.

In our second specification that interacts affiliated downgrades with the fraction of revenue from proprietary trading, Columns V and VI of Table 7, we see that the disproportional increase in sell volume from affiliated downgrades is increasing with the fraction of proprietary trading revenue the firm reports for the two days prior to the information release. As in the prior specification, firms without proprietary revenue see an increase in sell volume on the day prior to their analyst issuing a downgrade.

In unreported results, we also examine block trading. Two days prior to a downgrade, all block trades occur at firms with proprietary trading desks, so the regression splitting firms according to the existence of proprietary desks reduces to the earlier results for block trading

overall (Table 6 Column IV). One day before the downgrade, only the proprietary trading desk affiliated downgrade variable loads significantly.²⁰ This result, of course, does not mean that block trades must be proprietary trades. The firms with proprietary desks also tend to be the full-service houses with larger market makers. It is possible that market makers without proprietary desks do not process sufficient volume to trade blocks without revealing information to the market. Taken together, these results are consistent with alerting clients to the impending downgrade, though we cannot rule out firms trading for their own account.

4. Further Analysis and Robustness

The results presented above suggest that investors and market makers associated with the revising analyst on average trade in the direction of analyst recommendations and also that some participants may have preferential access to recommendation changes in advance of their public release. In this section, we discuss several additional issues. First, we examine persistence in trading patterns in the days following the release of an analyst opinion. Second, given the recent focus by both academics and the popular press on the conflicts of interest driven by investment banking relationships, in Section 4.2 we examine whether firms fined by the Global Research Analyst Settlement seem to be susceptible to this particular conflict of interest. Lastly, we perform several additional analyses as robustness, detailed in Section 4.3.

4.1 Persistence in Trading

In this section, we highlight some interesting patterns in attributed trading following the release of the analyst opinion change. Both Womack (1996) and Juergens (2002) observe some

²⁰ For the specifications with the fraction of revenue interactions, results are in line with the binary interaction, with sell volume increasing with proprietary revenue for affiliated downgrades on the day before the recommendation release, though statistical significance drops to the 92% confidence level.

evidence of return drift after the release of a recommendation change. We report directional trading analysis for the two days following the release of a downgrade. When we performed similar analyses for upgrades, we found no evidence of increased buy volume at the affiliated market maker after the official upgrade date.

We do find evidence of elevated selling at the issuing analyst's firm in the two days following a downgrade. Columns I and II of Table 8 indicate that a significant and positive relation between affiliated downgrades and proportional sell volume persists in the two days after the opinion release. Although there is some evidence that multiple unaffiliated upgrades and downgrades reduce market maker j 's proportional sell volume, and that post-event returns may capture other public information, increased sell volume persists through two days following the event, suggesting that the analyst opinion is not merely echoing bad news. The asymmetry between buy and sell volume in the days following the recommendation change reinforces the notion that downgrades may be more informative than upgrades.

Two separate forces may drive these results. The first is that some individual traders, who become informed about recommendation revisions later than institutional traders, continue to sell the stock learning the news well after the public release. For example, investors may not trade until they see the downgrade in the popular press, though we note that this would be contrary to results in Lee (1992) and He et al. (2005), where individual traders are net buyers, regardless of the direction of the information. We posit that analysts ranked in the *Institutional Investor (II)* All-American Research Team survey might be more likely to garner such attention since several studies show that these analysts have bigger price impact than other analysts (see, for example, Stickel, 1995). We define ranked analysts as analysts that receive any ranking (first

place through runners-up) in the 2004 *II* poll, and construct interaction variables between affiliated downgrades and an *II*-rank indicator.²¹

Alternatively, the disproportionate sell volume in the days following an analyst report may be delayed selling pressure, perhaps in stocks where trading volume is not sufficient to accommodate all traders on the same day of the opinion release. To check for this possibility, we compute average daily volume for each security over our sample using the trading days outside ± 3 day window of an analyst recommendation change and analyze all stocks above the median average daily volume measure and those in the upper quartile separately. We report results for the upper quartile only.

In Columns III and IV of Table 8, we present results for the full sample where the downgrade variable is split according to analyst reputation. Here, we are checking for evidence consistent with delayed information. All downgrading analyst's firms experience the increased sell volume on day 1, though statistical significance is marginal for firms without ranked analysts. Only firms with ranked analysts show significant persistence in post-downgrade sell volume in the two days following a downgrade.

In Columns V through VIII, we present the same set of results, but limit our analysis to high volume securities. We see in Columns V and VI of Table 8 that increased sell volume does not persist at the downgrading analyst's firm in the two days following the downgrade for highly liquid stocks. For stocks above the median volume measure (unreported), there is some evidence of elevated selling on day +1, but not day +2. Columns VII and VIII present the specifications where the affiliated downgrade measure is split according to analyst ranking. Even for highly

²¹ We constructed rank interactions for all analyses presented in the paper. One additional result deserves mention. Disproportional buying at the affiliated market maker on the upgrade day is driven by unranked analysts, indicating that an upgrade by a ranked analyst, like downgrades, may be regarded as more general news and affect all market makers equally.

liquid stocks, ranked analysts seem to affect selling at their own firm's market maker in the days after a downgrade.

For the full sample, we see increased sell volume for affiliated downgrades for the two days after the recommendation change. The effect is concentrated in the ranked analysts, consistent with delayed information. For the highly liquid sample, there is no evidence of elevated selling associated with the firm's downgrades. This indicates that perhaps the post-recommendation effect is in part driven by low-volume (low liquidity) stocks, since it may take some time to work the (sell) orders for smaller stocks. However, if in the highly liquid subsample, we split affiliated downgrades according to analyst reputation, we find that ranked analysts' downgrades once again load significantly. For high volume stocks, only in instances where the analyst is ranked does the downgrade have a drift component. These results indicate that both analyst reputation and liquidity may play a role in selling in the days after a downgrade.

5.2 Global Research Analyst Settlement Firms and Investment Banker Relations

Given the extensive academic and popular interest about investment banking conflicts of interest,²² we also examined the trading activities of the twelve bulge-bracket multi-function brokerage firms that were identified for their malfeasance in the boom period of the late 1990s, and were cumulatively fined \$1.4 billion in the Global Research Analyst Settlement Agreement (GRAS) of 2002. These firms might be more (due to their history) or less (due to new invited scrutiny) prone to information leakage internally or to institutional clientele. Recommendation day results are in line with the full sample for these firms. Further, we do not find any evidence of pre-event increases in either proportional buy or sell volume for upgrades or downgrades, indicating that it is not the GRAS firms which appear to be disseminating information prior to

²² See, for instance, Dugar and Nathan, 1995; Iskoz, 2002; Lin and McNichols, 1998; Lin, McNichols, and O'Brien, 2005; Michaely and Womack, 1999.

public releases. Because the conflicts of interest stemming from banking relations are pervasive among all banks and not just those cited in the GRAS, we investigate whether prior banking relations affect trading volume around affiliated opinions.²³ We did not find any evidence of pre-event shifts in directional volume around banker-affiliated upgrades and downgrades, indicating that either new regulations have served to alleviate banking conflicts or banking conflicts of interest are not indicative of other potential conflicts of interest that would manifest in volume responses.

5.3 Robustness

We have performed a variety of additional tests to ensure the validity of our empirical findings. Below, we discuss whether timing differentials may explain the volume shifts to the issuing analyst's firm by examining average execution prices. We also rule out the possibility that our results are driven by clustered analyst recommendation changes or trading around earnings release dates. Last, we discuss robustness checks on the methodology.

In order to check whether volume response is driven by improvements to the execution price, we construct a daily average execution price for each market maker from daily dollar volume and daily share volume. This metric is constructed for total, buy, and sell prices. We do not find any significant price improvement for either buys or sells on the recommendation day at the market maker of the recommending firm. Average execution price actually worsens, particularly for sells on and following downgrade days, as investors appear to be willing to dump

²³ Ellis, Michaely, and O'Hara (2000) document that banking relationships affect market making in the case of an IPO, where the lead underwriter becomes the dominant market maker.

the stock at low prices. We do find marginally significant price improvement for sales in the two days prior to downgrades, and the effect is concentrated in firms with proprietary trading desks.²⁴

Our analysis in Section 2 suggests that investors trade through firms of recommending analysts in the direction of the recommendation. When public news announcements occur, a delay between the receipt of information by analysts and their subsequent recommendations may occur, while investors do not face such a delay. It is possible that our results, particularly in the pre-event period, are a manifestation of the lag in the analyst report following a news release, though we proxy for news via unaffiliated analyst opinions and event returns and our instrumental variables approach indicates a causal relationship between downgrades and trading.

Since it is common for analysts to comment on earnings reports, we identify all earnings announcements within ten days around an analyst opinion to determine if our results are driven by this predictable form of public news. In total, we find 353 earnings announcements around the 5,881 upgrades and downgrades (6.0% of the sample), of which 57 occur *after* the analyst opinion. In analyses similar to those performed in Tables 3 and 4, we eliminate those opinions that occur within ten days of an earnings announcement. Our results are qualitatively unchanged when those recommendations are excluded, indicating that the findings presented in prior sections are not driven by volume around earnings announcements.

Further, in order to check that multiple analyst reports are not confounding our measured effects, we perform the same analyses eliminating recommendations for a security that occur subsequent to the first in a series in the event window. We identify independent recommendations as all revisions where there are no other recommendations within +/- three days of the recommendation, and identify first revisions in a cluster as the first opinion in a series

²⁴ While this evidence could be construed as better execution for in-house trading relative to clients who might be paying higher execution prices as compensation for access to early information, the results are not confirmed in the specification where we interact the fraction of proprietary trading revenues with the downgrade instead of the proprietary desk indicator. Therefore, we refrain from this interpretation.

with no other revisions in the prior three days. A series ends when there are at least three days since the last revision. Since all analysts have access to the same public information including prior analyst reports and trading volume, it is possible that analysts exhibit herd behavior (Welch, 2000) and our findings in earlier sections are a manifestation of clustering by analysts. Our results, however, are qualitatively unchanged when we eliminate subsequent recommendation revisions.

In addition, we checked that our data construction methods were not driving our conclusions. Many finance studies eliminate stocks with prices under \$5. Since our methodology controls for many individual stock characteristics and price changes are not our main focus, we saw no reason to exclude them, though results are robust to their exclusion. For the benchmark measures, using medians, instead of means from non-event days to control for normal market making activity across firms, does not change the results. In addition, we construct “abnormal” volume measures as dependent variables by subtracting the benchmark value from each measure rather than including it as control, which is essentially constrains the benchmark coefficient equal to one. The use of abnormal volume measures does not change the results. We also re-estimate our primary tests using the entire sample of trading days (over three million observations) rather than the event day with benchmarks approach. Results are qualitatively similar using this alternative methodology. Also, standard errors presented throughout are White heteroskedasticity-adjusted. Given the structure of our data, clustered errors on any one of three dimensions may be more appropriate (Rogers, 1993). We reran all analyses clustering on trading date, market maker, and security individually. All of the results from the above permutations produce qualitatively similar results to the analyses presented in the paper.

5 Conclusion

In this paper, we examine affiliated market-making activity around analyst recommendation changes. We find an increase in attributed volume around both upgrades and downgrades, after controlling for daily volume, benchmark volume, and other information. We find directionally consistent volume for upgrades and find that the effect is limited to the official recommendation release date. The relationship does not extend to the block analysis, so it is unclear if institutions are also trading in the direction of the upgrade through the issuing analyst's firm or if the effect results from smaller investors at the firm.

We do not find corresponding increases in affiliated sell volume on the downgrade days themselves. Sell volume is significantly and positively related to affiliated downgrades both before and after the actual revision date. We find evidence that the disproportionate sell volume prior to the downgrade date is institutional volume, and at least some of the volume comes from clients of the firm. Although Lee (1992) notes that there is some pre-event purchasing and post-event drift for small investors around earnings announcements, we believe that this is the first paper to identify informed trading prior to downgrades. The results suggest that some investors are aware of analyst downgrades prior to the public release and trade accordingly.

Though prior research has found that analyst information garners attention for the issuing firms more broadly, we document a dramatic effect on trading activity for the issuing brokerage firms around both upgrades and downgrades. This effect has real and significant monetary implications for these firms, as both trading commissions and execution fees from spreads are generated from increased trading volume. While market-making volume is not a measure directly applicable to securities exchanges with other structures, it is likely that proprietary trading, relationships with institutional clients, and client reaction to analyst information releases would be similar across exchanges. Our results are consistent with analyst recommendations still

having value to investors in a post-regulatory environment, though some investors appear to receive more valuable information than others.

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Table 1
Summary Statistics for Analyst Recommendation Days

This table displays descriptive statistics for the variables used in our analyses for the recommendation day. Volume data is reported in as actual number of shares traded and market capitalization of firms is in thousands (as of December 31, 2004). Returns measured -3 to -1 days prior to the recommendation day, on the recommendation day, and the day following the recommendation are reported for Upgrades and Downgrades separately.

| | Num Obs. | Mean | Std. Dev. | Median |
|--------------------------------|-----------------|-------------|------------------|---------------|
| Total Volume | 158,896 | 113,606 | 534,005 | 10,400 |
| Proportional Buy Volume | 158,896 | 0.4779 | 0.2267 | 0.4947 |
| Proportional Sell Volume | 158,896 | 0.5129 | 0.2265 | 0.5000 |
| Block Volume | 9,848 | 344,576 | 660,564 | 145,000 |
| Block Proportional Buy Volume | 9,848 | 0.2061 | 0.1733 | 0.1508 |
| Block Proportional Sell Volume | 9,848 | 0.1968 | 0.1736 | 0.1418 |
| Market Share | 158,896 | 0.0246 | 0.0452 | 0.0065 |
| Affiliated Upgrade | 158,896 | 0.0044 | 0.0663 | 0 |
| Affiliated Downgrade | 158,896 | 0.0107 | 0.1028 | 0 |
| UnaffiliatedUp1 | 158,896 | 0.2650 | 0.4413 | 0 |
| UnaffiliatedUp2 | 158,896 | 0.0460 | 0.2094 | 0 |
| UnaffiliatedUp>2 | 158,896 | 0.0242 | 0.1537 | 0 |
| UnaffiliatedDown1 | 158,896 | 0.4226 | 0.4940 | 0 |
| UnaffiliatedDown2 | 158,896 | 0.1226 | 0.3280 | 0 |
| UnaffiliatedDown>2 | 158,896 | 0.1068 | 0.3089 | 0 |
| AggregateVolume (t) | 158,896 | 8,742,296 | 18,953,122 | 2,157,956 |
| ECN Indicator | 158,896 | 0.0828 | 0.2756 | 0 |
| ECN Volume | 158,896 | 2,537,927 | 7,876,119 | 320,074 |
| Analyst Coverage | 158,896 | 15.3478 | 10.0573 | 13 |
| Market Makers | 158,896 | 34.5296 | 14.8761 | 33 |
| Market Capitalization | 158,896 | 9,228,460 | 26,996,398 | 1,389,804 |
| Event Day Return: upgrade | 1,918 | 3.13% | 9.12% | 1.55% |
| Event Day Return: downgrade | 3,963 | -3.21% | 8.12% | -1.33% |
| Prior 3 Day Return: upgrade | 1,918 | 0.22% | 7.17% | 0.18% |
| Prior 3 Day Return: downgrade | 3,963 | 0.15% | 7.94% | 0.09% |
| Day (+1): upgrade | 1,918 | 0.40% | 3.29% | 0.16% |
| Day (+1): downgrade | 3,963 | -0.28% | 3.08% | -0.24% |

Table 2

Differences in Volume Characteristics for Affiliated and Unaffiliated Market Makers

This table contains volume characteristics for individual firms around analyst recommendations averaged by market maker. The total volume, market share, average dollar volume, and average trade size are reported for affiliated market makers and non-affiliated (non ECN) market makers on days of a recommendation release. Benchmarks are computed as the average across non-event days (-3 to +3 around the recommendation date) for an individual firm-security pair. P-values for a difference of means tests from the benchmark values are included, as are p-values for the differences from benchmarks across groups.

| | | Affiliated | p-val | Unaffiliated | p-val | Diff p-val |
|-------------------------------------|----------------------------------|-------------------|--------------|---------------------|--------------|-------------------|
| Day 0 | Volume | 104,823 | 0.0001 | 95,984 | 0.0001 | 0.0011 |
| | Benchmark Volume | 47,655 | | 59,925 | | |
| | Market Share | 4.32% | 0.0001 | 1.96% | 0.0001 | 0.0001 |
| | Benchmark Market Share | 3.30% | | 2.01% | | |
| | Average Dollar Volume | 2,229 | 0.0001 | 2,339 | 0.0001 | 0.2127 |
| | Benchmark Dollar Volume | 773 | | 1,018 | | |
| | Average Trade Size | 655 | 0.0023 | 546 | 0.0833 | 0.0092 |
| | Benchmark Trade Size | 563 | | 534 | | |
| | Proportional Buy Volume: Upgrade | 0.4842 | 0.0354 | 0.4563 | 0.7269 | 0.0407 |
| | Benchmark Prop Buy Vol | 0.4644 | | 0.4558 | | |
| Proportional Sell Volume: Downgrade | 0.5195 | 0.7034 | 0.5135 | 0.0001 | 0.2983 | |
| Benchmark Prop Sell Vol | 0.5173 | | 0.5174 | | | |
| Day -1 | Volume | 77,441 | 0.0001 | 78,849 | 0.0001 | 0.2816 |
| | Benchmark Volume | 60,616 | | 57,542 | | |
| | Market Share | 3.80% | 0.0227 | 2.15% | 0.0001 | 0.5132 |
| | Benchmark Market Share | 3.55% | | 2.00% | | |
| | Average Dollar Volume | 1,853 | 0.0001 | 2,019 | 0.0001 | 0.3458 |
| | Benchmark Dollar Volume | 997 | | 1,067 | | |
| | Average Trade Size | 577 | 0.7582 | 518 | 0.2146 | 0.9936 |
| | Benchmark Trade Size | 586 | | 526 | | |
| | Proportional Buy Volume: Upgrade | 0.4786 | 0.1320 | 0.4647 | 0.0001 | 0.5197 |
| | Benchmark Prop Buy Vol | 0.4619 | | 0.4551 | | |
| Proportional Sell Volume: Downgrade | 0.5352 | 0.0031 | 0.5220 | 0.0001 | 0.0192 | |
| Benchmark Prop Sell Vol | 0.5160 | | 0.5182 | | | |
| Day -2 | Volume | 80,753 | 0.0003 | 66,869 | 0.0001 | 0.0508 |
| | Benchmark Volume | 64,839 | | 59,530 | | |
| | Market Share | 3.96% | 0.0035 | 2.24% | 0.0001 | 0.3554 |
| | Benchmark Market Share | 3.62% | | 2.01% | | |
| | Average Dollar Volume | 1,967 | 0.0001 | 1,743 | 0.0001 | 0.0616 |
| | Benchmark Dollar Volume | 1,073 | | 1,106 | | |
| | Average Trade Size | 554 | 0.6449 | 510 | 0.4058 | 0.9439 |
| | Benchmark Trade Size | 566 | | 526 | | |
| | Proportional Buy Volume: Upgrade | 0.4643 | 0.4122 | 0.4681 | 0.0001 | 0.7301 |
| | Benchmark Prop Buy Vol | 0.4546 | | 0.4543 | | |
| Proportional Sell Volume: Downgrade | 0.5349 | 0.0082 | 0.5236 | 0.0001 | 0.0703 | |
| Benchmark Prop Sell Vol | 0.5167 | | 0.5180 | | | |
| Day -3 | Volume | 73,447 | 0.1294 | 64,691 | 0.0001 | 0.5912 |
| | Benchmark Volume | 65,800 | | 59,769 | | |
| | Market Share | 3.92% | 0.0277 | 2.24% | 0.0001 | 0.8078 |
| | Benchmark Market Share | 3.65% | | 2.00% | | |
| | Average Dollar Volume | 1,787 | 0.0001 | 1,713 | 0.0001 | 0.4098 |
| | Benchmark Dollar Volume | 1,081 | | 1,113 | | |
| | Average Trade Size | 647 | 0.2792 | 492 | 0.0001 | 0.0969 |
| | Benchmark Trade Size | 590 | | 523 | | |
| | Proportional Buy Volume: Upgrade | 0.4626 | 0.2855 | 0.4674 | 0.0001 | 0.9296 |
| | Benchmark Prop Buy Vol | 0.4495 | | 0.4554 | | |
| Proportional Sell Volume: Downgrade | 0.5298 | 0.0732 | 0.5236 | 0.0001 | 0.2832 | |
| Benchmark Prop Sell Vol | 0.5169 | | 0.5185 | | | |

Table 3
Total Volume and Market Share Effects on Recommendation Days

This table provides estimates from OLS regressions where the dependent variables are attributed volume measures on security-days with recommendation changes. Total Volume is the log total volume for a given market maker on a day that a recommendation is released. Market Share is the logit transformation of percentage total volume attributed to a given market maker on the recommendation day. Proportional Buy (Sell) Volume is the logit transformation of directional proportional volume. Affiliated Upgrade (Downgrade) is equal to 1 if the recommending is affiliated with the market maker (in the same firm). Benchmark is the expected value of the dependent variable (volume, market share or proportional volume) of a given market maker on a non-event day. Aggregate Volume is the total daily volume for all market makers for a given stock on the recommendation day. Unaffiliated Up1, Up2, Up>2 (Down1, Down2, Down>2) are indicators equal to one if one, two, or more than analysts make an upgrade (downgrade) in a +/-3 day event window. Variables for the information environment and shifts in trading to ECNs are also included. White heteroskedasticity-adjusted standard errors are in parentheses.

| | <i>Total Volume</i> | <i>Market Share</i> | <i>Proportional Buy Volume</i> | <i>Proportional Sell Volume</i> |
|-------------------------------|--|--|--|--|
| | <i>I</i> | <i>II</i> | <i>III</i> | <i>IV</i> |
| Intercept | 1.0414^a (0.0596) | -3.9979^a (0.0447) | -1.7918^a (0.0393) | -1.5223^a (0.0392) |
| Benchmark | -0.1819^a (0.0094) | 37.5721^a (0.1577) | 3.4640^a (0.0229) | 3.3733^a (0.0235) |
| Aggregate Volume _t | 0.7174^a (0.0107) | | 0.0164^a (0.0062) | -0.0291^a (0.0062) |
| Affiliated Upgrade | 0.7194^a (0.0742) | 0.3244^a (0.0635) | 0.1261^a (0.0474) | |
| Affiliated Downgrade | 0.5867^a (0.0478) | 0.3555^a (0.0409) | | 0.0180 (0.0306) |
| Unaffiliated Up1 | -0.0061 (0.0124) | -0.0297^a (0.0104) | -0.0244^a (0.0079) | 0.0330^a (0.0079) |
| Unaffiliated Up2 | -0.0123 (0.0252) | -0.0802^a (0.0209) | 0.0016 (0.0161) | 0.0116 (0.0161) |
| Unaffiliated Up>2 | -0.0235 (0.0337) | -0.1370^a (0.0278) | 0.0286 (0.0215) | -0.0257 (0.0216) |
| Unaffiliated Down1 | -0.0071 (0.0123) | -0.0181 ^c (0.0105) | 0.0392^a (0.0078) | -0.0314^a (0.0079) |
| Unaffiliated Down2 | -0.0230 ^c (0.0178) | -0.0934^a (0.0147) | 0.0495^a (0.0111) | -0.0487^a (0.0112) |
| Unaffiliated Down>2 | -0.0050 (0.0204) | -0.1239^a (0.0160) | 0.0411^a (0.0129) | -0.0508^a (0.0129) |
| ECNVolume/ Shr _t | 0.0205^b (0.0087) | 0.0001^a (0.0000) | -0.0360^a (0.0055) | 0.0383^a (0.0055) |
| ECN Indicator | 1.5608^a (0.0178) | 0.3327^a (0.0161) | 0.1550^a (0.0117) | -0.2183^a (0.0117) |
| Analyst Coverage | -0.0887^a (0.0098) | 0.0547^a (0.0080) | -0.0137^b (0.0062) | 0.0053 (0.0062) |
| Market Makers | -0.2729^a (0.0270) | -0.5150^a (0.0154) | 0.0031 (0.0144) | 0.0258 ^c (0.0144) |
| Market Cap | 0.0786^a (0.0049) | -0.0300^a (0.0039) | 0.0179^a (0.0030) | -0.0175^a (0.0030) |
| Event Day Return | -0.0284 (0.0637) | 0.1583^a (0.0540) | -0.7560^a (0.0406) | 0.7484^a (0.0407) |
| Prior 3–Day Returns | -0.1591^b (0.0667) | -0.0565 (0.0570) | -0.0075 (0.0426) | 0.0129 (0.0427) |
| Number of Observations | 158,896 | 158,896 | 158,896 | 158,896 |
| Adjusted R-square | 0.2330 | 0.4261 | 0.1415 | 0.1319 |
| F-value | 2840.38 | 7374.18 | 1637.81 | 1510.14 |

^{a,b,c} represent 1%, 5%, and 10% significance levels, respectively.

Table 4
Pre-Event Directional Volume for Recommendation Releases

This table provides estimates for OLS regressions where the dependent variable is the logit transformation of Proportional Buy Volume or Proportional Sell Volume for a given market maker in the three days prior to a recommendation release. Affiliated Upgrade (Downgrade) is equal to 1 if the recommending analyst is in the same firm as the market maker. Benchmark Proportional Volume is the expected proportional buy (sell) volume of a given market maker on a non-event day. Aggregate Volume is the total daily volume for all market makers for a given stock on the recommendation day. Unaffiliated Up1, Up2, Up>2 (Down1, Down2, Down>2) are indicators equal to one if one, two, or more than analysts make an upgrade (downgrade) in a +/-3 day event window. Variables for the information environment and shifts in trading to ECNs are also included. White heteroskedasticity-adjusted standard errors are in parentheses.

| | <i>Proportional Buy Volume</i> | | | <i>Proportional Sell Volume</i> | | |
|-------------------------------|--|--|--|--|--|--|
| | <i>Day -3</i> | <i>Day -2</i> | <i>Day -1</i> | <i>Day -3</i> | <i>Day -2</i> | <i>Day -1</i> |
| | <i>I</i> | <i>II</i> | <i>III</i> | <i>IV</i> | <i>V</i> | <i>VI</i> |
| Intercept | -1.6823^a (0.0411) | -1.7594^a (0.0407) | -1.6331^a (0.0401) | -1.7376^a (0.0409) | -1.6859^a (0.0406) | -1.7350^a (0.0400) |
| Benchmark Prop Volume | 3.5572^a (0.0252) | 3.5800^a (0.0250) | 3.5028^a (0.0242) | 3.5097^a (0.0259) | 3.5051^a (0.0257) | 3.4411^a (0.0248) |
| Aggregate Volume _t | 0.0001 (0.0066) | 0.0211^a (0.0066) | 0.0022 (0.0063) | -0.0222^a (0.0066) | -0.0331^a (0.0066) | -0.0153^a (0.0063) |
| Affiliated Upgrade | 0.0083 (0.0620) | -0.0280 (0.0612) | 0.0484 (0.0572) | | | |
| Affiliated Downgrade | | | | 0.0435 (0.0367) | 0.0742^b (0.0364) | 0.0899^a (0.0352) |
| Unaffiliated Up1 | 0.0099 (0.0084) | 0.0140 ^c (0.0084) | -0.0049 (0.0082) | -0.0045 (0.0085) | -0.0059 (0.0084) | 0.0071 (0.0082) |
| Unaffiliated Up2 | 0.0088 (0.0172) | -0.0110 (0.0174) | 0.0191 (0.0168) | -0.0091 (0.0172) | 0.0142 (0.0174) | -0.0205 (0.0168) |
| Unaffiliated Up>2 | -0.0251 (0.0231) | -0.0028 (0.0231) | 0.0413 ^c (0.0226) | 0.0255 (0.0232) | 0.0155 (0.0232) | -0.0513^b (0.0226) |
| Unaffiliated Down1 | 0.0098 (0.0085) | 0.0097 (0.0084) | 0.0071 (0.0082) | -0.0016 (0.0085) | -0.0012 (0.0086) | -0.0029 (0.0082) |
| Unaffiliated Down2 | 0.0318^a (0.0119) | 0.0101 (0.0118) | 0.0006 (0.0117) | -0.0331^a (0.0119) | -0.0058 (0.0119) | -0.0017 (0.0117) |
| Unaffiliated Down>2 | 0.0575^a (0.0136) | -0.0065 (0.0135) | 0.0107 (0.0134) | -0.0609^a (0.0136) | 0.0041 (0.0135) | -0.0091 (0.0134) |
| ECN Volume _t | -0.0178^a (0.0060) | -0.0360^a (0.0060) | -0.0222^a (0.0057) | 0.0290^a (0.0060) | 0.0379^a (0.0060) | 0.0241^a (0.0057) |
| ECN Indicator | 0.2065^a (0.0125) | 0.2088^a (0.0124) | 0.1904^a (0.0122) | -0.2599^a (0.0125) | -0.2662^a (0.0124) | -0.2556^a (0.0122) |
| Analyst Coverage | 0.0056 (0.0067) | 0.0016 (0.0066) | -0.0006 (0.0065) | -0.0147^b (0.0067) | -0.0088 (0.0066) | -0.0076 (0.0065) |
| Market Makers | 0.0093 (0.0165) | 0.0150 (0.0164) | 0.0098 (0.0155) | 0.0242 (0.0165) | 0.0103 (0.0165) | 0.0221 (0.0155) |
| Market Cap | 0.0033 (0.0033) | 0.0025 (0.0032) | 0.0051 (0.0031) | -0.0030 (0.0033) | -0.0012 (0.0032) | -0.0045 (0.0031) |
| Event Day Return | -0.0063 (0.0496) | -0.0612 (0.0488) | -0.1259^a (0.0491) | 0.0220 (0.0497) | 0.0531 (0.0489) | 0.1051^b (0.0491) |
| Day t Return | -2.5361^a (0.1019) | -2.5588^a (0.0942) | -1.0879^a (0.0534) | 2.4807^a (0.1020) | 2.5048^a (0.0944) | 1.0676^a (0.0534) |
| Prior 3-day Returns | -0.1984^a (0.0623) | -0.1804^a (0.0617) | -0.1899^a (0.0565) | 0.2111^a (0.0623) | 0.1657^a (0.0618) | 0.2023^a (0.0565) |
| Number of Observations | 139,329 | 140,302 | 147,517 | 139,329 | 140,302 | 147,517 |
| Adjusted R-square | 0.1458 | 0.1490 | 0.1422 | 0.1383 | 0.1398 | 0.1350 |
| F-stat | 1399.95 | 1446.36 | 1439.58 | 1316.51 | 1342.51 | 1355.56 |

^{a,b,c} represent 1%, 5%, and 10% significance levels, respectively.

Table 5
Instrumental Variables Estimation for Trading prior to Downgrades

This table provides instrumental variable estimations (LIML) for Proportional Sell Volume in the days prior to a downgrade. Affiliated Downgrade is equal to 1 if the recommending analyst is in the same firm as the market maker. Benchmark Proportional Volume is the expected proportional sell volume of a given market maker on a non-event day. Aggregate Volume is the total daily volume for all market makers for a given stock on the recommendation day. Unaffiliated Up1, Up2, Up>2 (Down1, Down2, Down>2) are indicators equal to one if one, two, or more than analysts make an upgrade (downgrade) in a +/-3 day event window. Variables for the information environment and shifts in trading to ECNs are also included. The instruments are the number of upgrades from a brokerage firm in the prior six months and the prior one-month stock volatility. White heteroskedasticity-adjusted standard errors are in parentheses.

| | <i>Proportional Sell Vol.</i> | | <i>Affiliated Downgrade</i> | |
|-------------------------------|--|--|--|--|
| | <i>Day -2</i> | <i>Day -1</i> | <i>Day -2</i> | <i>Day -1</i> |
| | <i>I</i> | <i>II</i> | <i>III</i> | <i>IV</i> |
| Intercept | -1.7910^a (0.0593) | -1.8369^a (0.0615) | 0.0248^a (0.0035) | 0.0280^a (0.0035) |
| Benchmark Proportional Sell | 3.4900^a (0.0332) | 3.4422^a (0.0319) | 0.0003 (0.0017) | -0.0005 (0.0017) |
| Aggregate Volume _t | -0.0280^a (0.0075) | -0.0117 ^c (0.0072) | -0.0015^b (0.0006) | -0.0014^b (0.0005) |
| Affiliated Downgrade | 2.0146^b (0.9563) | 2.2296^b (1.0152) | | |
| IV: Brokerage Upgrades | | | 0.0034^a (0.0002) | 0.0031^a (0.0002) |
| IV: Prior-Month Volatility | | | 0.0905^a (0.0195) | 0.0698^a (0.0190) |
| Unaffiliated Up1 | 0.0321 ^c (0.0185) | 0.0356^c (0.0199) | -0.0162^a (0.0008) | -0.0168^a (0.0007) |
| Unaffiliated Up2 | 0.0516^b (0.0234) | 0.0152^b (0.0233) | -0.0145^a (0.0011) | -0.0152^a (0.0011) |
| Unaffiliated Up>2 | 0.0289 (0.0248) | -0.0477 (0.0262) | -0.0085^a (0.0011) | -0.0094^a (0.0011) |
| Unaffiliated Down1 | 0.0475^b (0.0237) | 0.0412 ^c (0.0244) | -0.0229^a (0.0010) | -0.0225^a (0.0010) |
| Unaffiliated Down2 | 0.0442 ^c (0.0241) | 0.0445 ^c (0.0255) | -0.0218^a (0.0011) | -0.0221^a (0.0011) |
| Unaffiliated Down>2 | 0.0483 ^c (0.0258) | 0.0280 (0.0272) | -0.0230^a (0.0013) | -0.0235^a (0.0013) |
| ECN Volume _t | 0.0289^a (0.0072) | 0.0153^b (0.0073) | 0.0024^a (0.0005) | 0.0029^a (0.0005) |
| ECN Indicator | -0.2409^a (0.0184) | -0.2369^a (0.0186) | -0.0110^a (0.0004) | -0.0114^a (0.0004) |
| Analyst Coverage | -0.0089 (0.0074) | -0.0131 ^c (0.0073) | -0.0008 (0.0006) | -0.0003 (0.0006) |
| Market Makers | 0.0365 (0.0201) | 0.0600^a (0.0202) | -0.0082^a (0.0015) | -0.0100^a (0.0015) |
| Market Cap | -0.0015 (0.0035) | 0.0600 ^c (0.0202) | 0.0008^a (0.0003) | 0.0006^b (0.0003) |
| Event Day Return | 0.1415 ^c (0.0782) | 0.2313^a (0.0789) | -0.0573^a (0.0044) | -0.0608^a (0.0047) |
| Day t Return | 2.5577 ^a (0.1091) | 1.0576^a (0.0581) | -0.0073 (0.0081) | -0.0116^b (0.0050) |
| Prior 3-Day Returns | 0.0920 (0.0697) | 0.1817^a (0.0630) | 0.0127^b (0.0055) | -0.0059 (0.0049) |
| Number of Observations | 122,088 | 122,088 | 122,088 | 122,088 |
| Adjusted R-square | 0.1226 | 0.1149 | 0.0251 | 0.0249 |
| F-stat | 977.40 | 1009.99 | 56.65 | 61.11 |

^{a,b,c} represent 1%, 5%, and 10% significance levels, respectively.

Table 6
Directional Block Volume for Recommendation Releases

This table provides estimates for OLS regressions where the dependent variable is the logit transformation of Proportional Block Buy Volume or Proportional Block Sell Volume for a given market maker in the three days prior to and including the recommendation release. Affiliated Upgrade (Downgrade) is equal to 1 if the recommending analyst is in the same firm as the market maker. Benchmark Proportional Volume is the expected block proportional buy (sell) volume of a given market maker on a non-event day. Aggregate Volume is the total daily volume for all market makers for a given stock on the recommendation day. Unaffiliated Up1, Up2, Up>2 (Down1, Down2, Down>2) are indicators equal to one if one, two, or more than analysts make an upgrade (downgrade) in a +/-3 day event window. Variables for the information environment and shifts in trading to ECNs are also included. White heteroskedasticity-adjusted standard errors are in parentheses.

| | <i>Event Day Block Volume</i> | | <i>Proportional Block Sell</i> | | |
|-------------------------------|--|--|--|--|--|
| | Prop Buy | Prop Sell | Day -3 | Day -2 | Day -1 |
| | <i>I</i> | <i>II</i> | <i>III</i> | <i>IV</i> | <i>V</i> |
| Intercept | 0.4083^b (0.1936) | -0.7667^a (0.1940) | 0.1049 (0.2542) | 0.4464 ^c (0.2611) | -0.0158 (0.2165) |
| Benchmark Prop Volume | 0.6925^a (0.0718) | 1.8034^a (0.0778) | 2.0350^a (0.1166) | 1.8752^a (0.1159) | 1.9120^a (0.0957) |
| Aggregate Volume _t | -0.1156^a (0.0272) | -0.0533^b (0.0279) | -0.1242^a (0.0360) | -0.0954^b (0.0388) | -0.1352^a (0.0305) |
| Affiliated Upgrade | 0.1343 (0.1436) | | | | |
| Affiliated Downgrade | | 0.1065 (0.0914) | 0.2368 (0.1542) | 0.2883^b (0.1510) | 0.2753^b (0.1255) |
| Unaffiliated Up1 | -0.0108 (0.0299) | 0.0293 (0.0307) | -0.0425 (0.0401) | -0.0441 (0.0393) | 0.0380 (0.0353) |
| Unaffiliated Up2 | -0.0202 (0.0483) | 0.0290 (0.0496) | 0.0495 (0.0645) | 0.0220 (0.0647) | 0.0726 (0.0557) |
| Unaffiliated Up>2 | -0.1869^a (0.0636) | -0.1740^a (0.0652) | -0.0940 (0.0890) | -0.0628 (0.0845) | -0.2230^a (0.0745) |
| Unaffiliated Down1 | 0.0745^b (0.0332) | 0.0498 (0.0341) | -0.0641 (0.0417) | -0.0211 (0.0417) | -0.0593 (0.0383) |
| Unaffiliated Down2 | 0.0709 ^c (0.0402) | 0.1318^a (0.0413) | -0.0043 (0.0533) | -0.0431 (0.0526) | 0.0402 (0.0471) |
| Unaffiliated Down>2 | 0.1564^a (0.0415) | 0.2002^a (0.0426) | 0.0405 (0.0543) | 0.0647 (0.0538) | 0.1395^a (0.0480) |
| ECN Volume _t | -0.0228 (0.0212) | -0.1012^a (0.0217) | -0.0545 ^c (0.0306) | -0.0907^a (0.0338) | -0.0088 (0.0263) |
| ECN Indicator | -1.4126^a (0.0531) | -1.5023^a (0.0548) | -1.5611^a (0.0830) | -1.4030^a (0.0793) | -1.4839^a (0.0633) |
| Analyst Coverage | -0.0525^b (0.0218) | -0.0826^a (0.0223) | -0.0425 (0.0346) | 0.0249 (0.0334) | -0.0999^a (0.0256) |
| Market Makers | -0.1824^a (0.0699) | 0.0221 (0.0716) | -0.1004 (0.1050) | -0.1325 (0.1110) | -0.0438 (0.0861) |
| Market Cap | 0.0407^a (0.0105) | 0.0422^a (0.0107) | 0.0395^a (0.0150) | 0.0198 (0.0149) | 0.0153 (0.0128) |
| Event Day Return | -0.1813 ^c (0.1028) | 0.1851 ^c (0.1054) | -1.0279^a (0.3385) | -0.7636^a (0.2828) | 0.7203^a (0.2619) |
| Day t Return | | | 0.8046^b (0.3430) | 1.3139^a (0.3280) | 0.2082 *(0.1362) |
| Prior 3–Day Returns | 0.1998 (0.1456) | 0.0182 (0.1492) | 0.2676 (0.2845) | 0.2451 (0.2812) | 1.0930^a (0.2237) |
| Number of Observations | 9,848 | 9,848 | 5,955 | 6,175 | 7,374 |
| Adjusted R-square | 0.1100 | 0.1582 | 0.1583 | 0.1480 | 0.1660 |
| F-stat | 77.07 | 116.70 | 66.89 | 64.09 | 87.35 |

^{a,b,c} represent 1%, 5%, and 10% significance levels, respectively.

Table 7
Pre-Event Sell Volume by Firm Type

This table provides estimates for OLS regressions where the dependent variable is the logit transformation of Proportional Sell Volume for a given market maker in the three days prior to a recommendation release. Affiliated Downgrade is equal to 1 if the recommending analyst is in the same firm as the market maker and is split into two interaction terms depending on whether the brokerage firm has a proprietary trading desk (*I-III*) or if the revenue from proprietary trading is available for publicly-traded brokerage firms (*IV-VI*). Benchmark Proportional Volume is the expected proportional sell volume of a given market maker on a non-event day. Aggregate Volume is the total daily volume for all market makers for a given stock on the recommendation day. Unaffiliated Up1, Up2, Up>2 (Down1, Down2, Down>2) are indicators equal to one if one, two, or more than analysts make an upgrade (downgrade) in a +/-3 day event window. Variables for the information environment and shifts in trading to ECNs are also included. White heteroskedasticity-adjusted standard errors are in parentheses.

| | <i>Proprietary Desk Indicator</i> | | | <i>Fraction Proprietary Revenue</i> | | |
|--|--|--|--|--|--|--|
| | Day -3 | Day -2 | Day -1 | Day -3 | Day -2 | Day -1 |
| | <i>I</i> | <i>II</i> | <i>III</i> | <i>IV</i> | <i>V</i> | <i>VI</i> |
| Intercept | -1.7375^a (0.0409) | -1.6857^a (0.0406) | -1.7353^a (0.0400) | -1.5933^a (0.0487) | -1.5347^a (0.0483) | -1.5814^a (0.0474) |
| Benchmark Prop Sell | 3.5097^a (0.0257) | 3.5051^a (0.0257) | 3.4411^a (0.0248) | 3.2879^a (0.0328) | 3.2907^a (0.0327) | 3.2222^a (0.0314) |
| Aggregate Volume _t | -0.0222^a (0.0066) | -0.0331^a (0.0066) | -0.0153^a (0.0063) | -0.0406^a (0.0079) | -0.0479^a (0.0078) | -0.0302^a (0.0075) |
| Affiliated Downgrade PROPRIETARY DESK/REV | 0.0462 (0.0376) | 0.0843^b (0.0372) | 0.0764^b (0.0362) | 0.0094 (0.0056) | 0.0197^a (0.0059) | 0.0151^a (0.0059) |
| Affiliated Downgrade NO PROPRIETARY TRADING | -0.0073 (0.1634) | -0.1452 (0.1719) | 0.3034^b (0.1431) | -0.0246 (0.1663) | -0.1504 (0.1756) | 0.2816^b (0.1457) |
| Unaffiliated Up1 | -0.0045 (0.0085) | -0.0059 (0.0084) | 0.0071 (0.0082) | -0.0033 (0.0094) | -0.0057 (0.0093) | 0.0017 (0.0092) |
| Unaffiliated Up2 | -0.0091 (0.0172) | 0.0142 (0.0174) | -0.0205 (0.0168) | 0.0036 (0.0189) | 0.0121 (0.0190) | -0.0330^b (0.0184) |
| Unaffiliated Up>2 | 0.0255 (0.0232) | 0.0155 (0.0232) | -0.0513^b (0.0226) | 0.0125 (0.0244) | -0.0042 (0.0244) | -0.0772^a (0.0238) |
| Unaffiliated Down1 | -0.0016 (0.0085) | -0.0012 (0.0084) | -0.0030 (0.0082) | 0.0150 (0.0096) | 0.0120 (0.0096) | 0.0146 (0.0093) |
| Unaffiliated Down2 | -0.0331^a (0.0119) | -0.0057 (0.0119) | -0.0017 (0.0117) | -0.0260 ^c (0.0148) | 0.0012 (0.0145) | 0.0056 (0.0145) |
| Unaffiliated Down>2 | -0.0609^a (0.0136) | 0.0041 (0.0135) | -0.0091 (0.0134) | -0.0451^a (0.0167) | 0.0283 ^c (0.0167) | 0.0322^b (0.0165) |
| ECN Volume _t | 0.0291^a (0.0060) | 0.0379^a (0.0060) | 0.0241^a (0.0057) | 0.0455^a (0.0072) | 0.0529^a (0.0071) | 0.0378^a (0.0068) |
| ECN Indicator | -0.2599^a (0.0125) | -0.2662^a (0.0124) | -0.2555^a (0.0122) | -0.3054^a (0.0167) | -0.3054^a (0.0167) | -0.2928^a (0.0163) |
| Analyst Coverage | -0.0147^b (0.0067) | -0.0088 (0.0066) | -0.0076 (0.0065) | -0.0200^b (0.0082) | -0.0160^b (0.0081) | -0.0072 (0.0079) |
| Market Makers | 0.0242 (0.0165) | 0.0102 (0.0165) | 0.0223 (0.0155) | 0.0379 ^c (0.0196) | 0.0265 (0.0196) | 0.0265 (0.0185) |
| Market Cap | -0.0030 (0.0033) | -0.0012 (0.0032) | -0.0045 (0.0031) | -0.0029 (0.0039) | -0.0046 (0.0039) | -0.0048 (0.0037) |
| Event Day Return | 0.0219 (0.0497) | 0.0532 (0.0489) | 0.1049^b (0.0491) | -0.0754 (0.0590) | 0.0351 (0.0579) | 0.0640 (0.0583) |
| Day t Return | 2.4808^a (0.1020) | 2.5051^a (0.0944) | 1.0673^a (0.0534) | 2.5497^a (0.1256) | 2.4318^a (0.1163) | 1.1168^a (0.0671) |
| Prior 3-Day Returns | 0.2111^a (0.0623) | 0.1656^a (0.0618) | 0.2022^a (0.0565) | 0.2543^a (0.0723) | 0.1919^a (0.0745) | 0.2756^a (0.0686) |
| Number of Observations | 139,329 | 140,302 | 147,517 | 103,092 | 103,753 | 109,005 |
| Adjusted R-square | 0.1383 | 0.1398 | 0.1350 | 0.1095 | 0.1099 | 0.1064 |
| F-stat | 1243.37 | 1268.02 | 1280.40 | 705.10 | 712.90 | 721.95 |

^{a,b,c} represent 1%, 5%, and 10% significance levels, respectively.

Table 8
Persistence in Trading Following Downgrades: Rank/Liquidity

This table provides estimates for OLS regressions where the dependent variable is the logit transformation of Proportional Sell Volume for a given market maker in the two days following a recommendation release. The full sample and firms in the top quartile of average daily volume are examined. Affiliated Downgrade is equal to 1 if the recommending analyst is in the same firm as the market maker (*I, II, V, VI*) and is split into two interaction terms depending on whether the recommending analyst is ranked by Institutional Investor (*III, IV, VII, VIII*). Additional variables are defined as in previous tables. White heteroskedasticity-adjusted standard errors are in parentheses.

| | <i>All Securities</i> | | <i>All Securities</i> | | <i>Top Quartile</i> | | <i>Top Quartile</i> | |
|---------------------------------------|--|--|--|--|--|--|--|--|
| | Day +1 | Day +2 | Day +1 | Day +2 | Day +1 | Day +2 | Day +1 | Day +2 |
| | <i>I</i> | <i>II</i> | <i>III</i> | <i>IV</i> | <i>V</i> | <i>VI</i> | <i>VII</i> | <i>VIII</i> |
| Intercept | -1.6440^a (0.0408) | -1.6788^a (0.0416) | -1.6438^a (0.0408) | -1.6780^a (0.0416) | -1.5750^a (0.0600) | -1.5690^a (0.0615) | -1.5749^a (0.0600) | -1.5686^a (0.0615) |
| Benchmark Prop Sell | 3.5245^a (0.0252) | 3.4826^a (0.0259) | 3.5245^a (0.0252) | 3.4825^a (0.0259) | 3.5097^a (0.0322) | 3.4982^a (0.0329) | 3.5099^a (0.0322) | 3.4983^a (0.0329) |
| Aggregate Volume _t | -0.0437^a (0.0068) | -0.0352^a (0.0068) | -0.0436^a (0.0068) | -0.0352^a (0.0068) | -0.0457^a (0.0091) | -0.0373^a (0.0090) | -0.0457^a (0.0091) | -0.0373^a (0.0090) |
| Affiliated Downgrade | 0.0899^a (0.0337) | 0.0797^b (0.0349) | | | 0.0589 (0.0437) | 0.0627 (0.0454) | | |
| Affiliated Downgrade RANKED ANALYST | | | 0.1993^b (0.0828) | 0.2504^a (0.0851) | | | 0.1849^b (0.0965) | 0.1891^b (0.0985) |
| Affiliated Downgrade UNRANKED ANALYST | | | 0.0687 ^c (0.0368) | 0.0460 (0.0381) | | | 0.0269 (0.0489) | 0.0293 (0.0509) |
| Unaffiliated Up1 | 0.0120 (0.0083) | -0.0083 (0.0085) | 0.0120 (0.0083) | -0.0082 (0.0085) | 0.0161 (0.0099) | -0.0040 (0.0101) | 0.0162 (0.0099) | -0.0040 (0.0101) |
| Unaffiliated Up2 | 0.0380^b (0.0170) | 0.0249 (0.0175) | 0.0381^b (0.0170) | 0.0250 (0.0175) | 0.0468^b (0.0189) | 0.0393^b (0.0195) | 0.0469^b (0.0189) | 0.0394^b (0.0195) |
| Unaffiliated Up>2 | -0.0455^b (0.0225) | -0.0542^b (0.0230) | -0.0454^b (0.0225) | -0.0541^b (0.0230) | -0.0389 (0.0236) | -0.0481^b (0.0240) | -0.0348 (0.0236) | -0.0481^b (0.0240) |
| Unaffiliated Down1 | 0.0049 (0.0083) | -0.0144 ^c (0.0085) | 0.0049 (0.0083) | -0.0143 ^c (0.0085) | 0.0051 (0.0101) | -0.0122 (0.0103) | 0.0052 (0.0101) | -0.0121 (0.0103) |
| Unaffiliated Down2 | -0.0313^a (0.0118) | -0.0319^a (0.0120) | -0.0312^a (0.0118) | -0.0319^a (0.0120) | -0.0256 ^c (0.0137) | -0.0247 ^c (0.0139) | -0.0256 ^c (0.0137) | -0.0246 ^c (0.0139) |
| Unaffiliated Down>2 | -0.0299^b (0.0137) | -0.0401^a (0.0142) | -0.0298^b (0.0137) | -0.0400^a (0.0142) | -0.0310^b (0.0153) | -0.0430^a (0.0158) | -0.0308^b (0.0153) | -0.0429^a (0.0158) |
| ECN Volume _t | 0.0503^a (0.0061) | 0.0400^a (0.0062) | 0.0503^a (0.0061) | 0.0400^a (0.0062) | 0.0500^a (0.0079) | 0.0377^a (0.0082) | 0.0499^a (0.0079) | 0.0377^a (0.0082) |
| ECN Indicator | -0.2569^a (0.0122) | -0.2976^a (0.0124) | -0.2569^a (0.0122) | -0.2976^a (0.0124) | -0.1885^a (0.0160) | -0.2203^a (0.0161) | -0.1885^a (0.0160) | -0.2203^a (0.0161) |
| Analyst Coverage | -0.0130^b (0.0066) | -0.0102 (0.0068) | -0.0130^b (0.0066) | -0.0101 (0.0068) | -0.0130 ^c (0.0079) | -0.0139 ^c (0.0081) | -0.0130 ^c (0.0079) | -0.0139 ^c (0.0081) |
| Market Makers | 0.0428^a (0.0162) | 0.0191 (0.0167) | 0.0426^a (0.0162) | 0.0187 (0.0167) | 0.0146 (0.0260) | -0.0272 (0.0269) | 0.0145 (0.0260) | -0.0274 (0.0269) |
| Market Cap | -0.0118^a (0.0032) | -0.0013 (0.0033) | -0.0118^a (0.0032) | -0.0013 (0.0033) | -0.0071 ^c (0.0037) | 0.0067 ^c (0.0039) | -0.0071 ^c (0.0037) | 0.0067 ^c (0.0038) |
| Event Day Return | 0.1327^b (0.0661) | 0.0182 (0.0758) | 0.1329^b (0.0661) | 0.0187 (0.0758) | 0.0702 (0.0740) | 0.0880 (0.0862) | 0.0707 (0.0740) | 0.0883 (0.0862) |
| Day t Return | 2.5279^a (0.1004) | 2.2243^a (0.0989) | 2.5269^a (0.1004) | 2.2253^a (0.0989) | 2.3555^a (0.1212) | 1.9092^a (0.1098) | 2.3552^a (0.1212) | 1.9103^a (0.1098) |
| Prior 3–Day Returns | -0.0338 (0.0529) | 0.0021 (0.0563) | -0.0342 (0.0529) | 0.0017 (0.0563) | 0.0197 (0.0604) | -0.0592 (0.0641) | 0.0192 (0.0604) | -0.0593 (0.0641) |
| Num. of Observations | 146,359 | 141,466 | 146,359 | 141,466 | 98,280 | 95,152 | 98,280 | 95,152 |
| Adjusted R-square | 0.1394 | 0.1367 | 0.1394 | 0.1367 | 0.1209 | 0.1202 | 0.1209 | 0.1202 |
| F-stat | 1395.80 | 1318.59 | 1318.38 | 1245.64 | 796.01 | 765.73 | 751.92 | 723.31 |

^{a,b,c} represent 1%, 5%, and 10% significance levels, respectively.