Who Are the Beneficiaries When Insiders Trade? An Examination of Piggybacking in the Brokerage Industry

Christopher C. Geczy and Jinghua Yan*

First Draft: December 1, 2004
This version: March 15, 2006

ABSTRACT

We study the impact of brokerage relations with company insiders on insider-affiliated market makers' quoting behavior and the possibility of information leakage via piggybacking when insiders trade. We find that market makers affiliated with the brokers used by insiders post more aggressive ask quotes vis-à-vis their peers during periods when insiders trade. This aggressiveness is partially attributable to the pressure to complete sell orders for their company insider clients. However, we also find that this behavior is dependent on the management role of the insider and the degree of information asymmetry as measured by a) the number of analysts following the company, b) analyst forecast dispersion, c) bid-ask spread of the stock and d) post-event stock return. In addition, piggybacking diminishes when the firm of the broker-dealer making markets has had a prior investment banking business relationship with the company. The findings suggest that in addition to the volume of insider trades, the potential information content of insider trades also affects insider-affiliated market makers' abnormal quoting behavior. We find that this information leakage through insiders' brokers results in trading based on information signaled by those insiders.

* Both authors are from The Wharton School, University of Pennsylvania, 2300 SH-DH, 3620 Locust Walk, Philadelphia, PA 19104. Email: geczy@wharton.upenn.edu and jyan@wharton.upenn.edu. We are grateful to Marshall Blume, Ed Butowsky, Nicolae Gârleanu, Gary Gorton, Frank Hatheway, Jeff Jaffe, Judit Montoriol, David Musto, Patrik Sandas, Shane Underwood, Daken Vanderburg, Brian Vargo, Ayako Yasuda, and seminar participants at the Wharton School and the 2005 European Finance Association Meetings for their comments. Michael Boldin and Wharton Research Data Services provided data access and support. Jason Lee, Paul Lee, and Michelle Zhang provided excellent research assistance. All errors are our own.

I. Introduction

Who are the beneficiaries of insider trading? Numerous studies have demonstrated that corporate insiders trade on their private information about their companies and are able to profit as a result.[1] This paper documents that brokers who handle those trades likewise may use inside information obtained from knowledge of the identities of insiders and their management roles to engage in or generate abnormally aggressive trading. Hence, brokers are also potential beneficiaries of insider trading.

Insiders at public firms often hire brokers to trade their shares in the open market, making it possible for those brokers to identify the trades as from an insider and potentially informative trades. Such information is typically private until the public discovers the trade via regulatory filings. So, in this sense, a broker may possess privileged information not available to the general public at the time of a trade. If the trade is indeed informed, then the broker's information has content, and the broker can profit. In a famous recent example, Peter Bacanovic, at the time a broker for Merrill Lynch, communicated that his client, Sam Waksal, had traded to another client, Martha Stewart. The latter profited as a result[2].

The goal of this paper is to test for the existence of such an information effect in the brokerage business. We detect the presence of information "leakage" by comparing affiliated market makers' quotes with those of their peers; and we provide measures of its impacts on bid/ask quotes (see Figure 1). We find that when insiders sell their shares to the market, market makers with brokerage affiliation ("insider-affiliated market makers" hereafter) post their ask quotes at the inside ask significantly more frequently than their peers. This abnormal quoting behavior cannot be entirely explained by market makers' efforts to complete transactions for their clients and is opposite from the unconditional predictions of some models of informed trade (e.g., Glosten and Milgrom, 1985). We also find that this aggressiveness is dependent on the number of analysts following the firm, analyst earnings forecast dispersion, and bid-ask spread of the stock, all of which

[1] For example, Jaffe (1974), Seyhun (1998), Jeng et al (2003), and Geczy and Yan (2004).
[2] See *New York Times* June 7, 2002.

proxy for the degree of information asymmetry present, and the management roles of insiders, which proxy for the informativeness of insider trades. In addition, this aggressiveness is also associated with low post-insider-trading returns and diminishes when there exists a prior investment banking relationship between the firm of the broker handling the trades and the insider's company. These results taken together suggest that that insider-affiliated market makers use their private information to profit for themselves or their clients.

We also find that when insiders sell a large volume of stock, insider-affiliated market makers become the leading market makers during the following days. For instance, they quote more frequently not only at the inside ask but also at the inside bid. One interpretation of this finding is that they play a role in stabilizing the post-insider-trading market, analogous to the phenomenon documented by Ellis, Michaely, and O'Hara (2000) in the IPO aftermarket. Moreover, Meulbroek (1992) documents the quick price discovery process following insider trades. Our results offer a potential explanation for such quick price discovery in the market: Information about insider trading leaks out to the market through brokerage affiliation, thus facilitating the price discovery process. Fishe and Robe (2004) and Garfinkel and Nimalendran (1998) found that insider trading widens the bid-ask spread, thus lowering the market liquidity. This study demonstrates a new and distinct aspect on the social cost of insider trading. Finally, Green (2004) and Heidle and Li (2004) both document internal information leakage from equity research analysts to stock traders within the same brokerage house. Our paper adds a new dimension to the research and regulation questions of business ethics within investment banks in the same light.

The rest of the paper is structured as follows: Section II provides an overview of data. Section III describes in detail the methodology. Section IV presents the results and discussions. Section V briefly addresses market stabilization and Section VI concludes.

II. Identifying Insider Trades and their Brokers

All insiders defined as officers and directors, and any beneficial owners of more than ten percent of a class of the company's equity securities registered under Section 12

of the Securities Exchange Act of 1934 have to file Form 4 (or Form 5[3]) for all their trades. For sales of restricted securities, insiders also need to file Form 144, in which they are asked to disclose the name of the broker they hire to trade their shares[4]. We focus on Form 144 trades from March 1999 through November 2003 due to data availability issues detailed below. A broker hired by an insider can be a pure retail broker, such as Charles Schwab, or a "bulge bracket" brokerage house, such as Goldman Sachs. Pure retail brokers may not have in-house market-makers, so for tractability purposes, we focus on "bulge bracket" investment banks with broker-dealers only[5]. Accordingly, we study the quoting behavior of the following brokers: Merrill Lynch, Morgan Stanley, Saloman Smith Barney, DLJ, Credit Suisse First Boston, Goldman Sachs, JP Morgan, Deutsche Bank/Alex Brown, Robertson Stephens, Bear Stearn, Lehman Brothers, RBC Dain Rauscher, CIBC, and Herzog Heine Geduld. These firms have brokered at least 1000 Form 144 insider trades during the period from March 1999 to November 2003[6]. To identify the affiliated market maker for each insider trade, we match broker names appearing on Forms 144 filed between March 1999 and November 2003 and which appear in Thompson Financial's database to NASTRAQ's market maker's names. By using Form 144, we necessarily study a subset of insider trades for the following two reasons: a) restricted stock may not be all of an insider's holdings[7]; b) the filing of Form 144 has not been enforced well[8]. However, neither of these two

[3] If a transaction is eligible for deferred reporting, then only Form 5 needs to be filed. See the SEC rules about Form 3, 4, 5 at http://www.sec.gov/answers/form345.htm.

[4] Anecdotally, brokers tell us that Form 4's include more insider trades than Form 144's, as insiders sometimes fail to file Form 144 when they should. However, it is not clear that using Form 144 trades only would lead to bias in our results one way or the other.

[5] We assume that brokers within "bulge bracket" investment banks use their in-house traders to trade their clients' shares. Pure retail brokers do not have in-house traders and the outside traders they hire are intractable.

[6] In the calculations that follow, we use the trading day -40 to day -11 relative to a given insider trade as a control period and trading day -10 to day +10 as our event period. Hence, events during the first two months and the last month in the sample period are not used.

[7] The SEC's definition of restricted securities is that they are securities acquired in unregistered, private sales from the issuer or from an affiliate of the issuer. Investors typically receive restricted securities through private placement offerings, Regulation D offerings, employee stock benefit plans, as compensation for professional services, or in exchange for providing "seed money" or start-up capital to the company. Rule 144(a)(3) identifies what sales produce restricted securities.

[8] For a small pilot sample, we matched Form 4 filings with Form 144 filings. We found that some insider trades reported via Form 4 are not reported in Form 144. This is confirmed by anecdotal evidence from brokers.

aspects leads us to believe that our results may be biased one way or the other. For each insider trade brokered by bulge bracket brokers, we consider two types: those that are insider-affiliated and the remaining bracket members representing a peer group, and we focus on insider trades for which the affiliated broker is also a market maker for that stock.

We wish to examine two distinct propositions. First, if an insider-affiliated broker does indeed make use of the information he possesses merely by his knowledge of the identity of an insider who is trading, a direct consequence is that the associated market-maker will quote more frequently at the inside ask for a period around the time the insider trades and, presumably, for a period during which the information has the greatest content[9]. Following the odd-eighths controversy sparked by Christie and Schultz (1994) and Christie, Harris, and Schultz (1994), the NASD has introduced in 1997 Order Handling Rules, which require NASDAQ market makers to display customer limit orders. With privileged knowledge that the stock price may fall after insider sales, insider-affiliated brokers' clients or traders may place limit sell orders that have lower limit prices.[10] We call this the Information Hypothesis[11]. Second, when insiders trade in large quantities, the market making roles of affiliated market makers may become important in the stabilization of the market for the stock being traded. For such high-volume insider trades, we examine whether insider-affiliated market makers quote more frequently at the inside bid so as to stabilize this post-sale market. We call this the Market Stabilization Hypothesis.

[9] In an exchange with more than one market maker, inside ask is defined as the lowest ask whereas inside bid is defined as the highest bid among all market makers.

[10] Alternatively, the insider-affiliated traders (or their clients) may put in market orders to sell, in which case we may not be able to observe them directly through changes in insider-affiliated market makers' quotes. However, we may view a market order as a special type of limit order, the price of which equals the highest bid price. However, market-orders may be less prevalent as Heidle and Li (2004) points out that quotes bring order flow and it is effective for a market maker to adjust his quotes in order to change his inventory position. In addition, recent literatures such as Harris (1998) and Bloomberg, O'Hara, and Saar (2005) have shown that informed trader may not only demand but also supply liquidity in the market.

[11] Our Information Hypothesis is consistent with theory work in Kyle (1989). When informed traders are trading against uninformed and noise traders, they incorporate their information into their demand schedules. If an insider-affiliated trader has proprietary bad information, then given the price, he has a larger sell demand vis-à-vis his peer market makers. Hence, ceteris paribus, the affiliated market maker is likely to remain quoting at the inside ask when his peer market makers' sell demands have been fulfilled.

Table 1 describes the sample selection result based on the selection criteria described, and shows that there are 500,105 insider trades from the Form 144 dataset provided by Thomson Financial, and consolidating trades by the same insider on the same trading day gives 285,284 trades. After merging with CRSP-COMPUSTAT, 229,511 trades match. Among them, we find 131,181 trades for which the broker is also a market maker in the NASDAQ NASTRAQ dataset, and 109,994 trades for which the broker is among the fifteen bulge bracket brokers we focus on. There are 40,388 trades whose brokers are among this group and also trade that stock. The final data sample consists of 3,043 trades for which there are non-missing quoting data for every day during the trading (event) and control periods (from trading days -40 to day +10 with respect to a given insider trade) [12].

There are a few limitations with this sample. First, we do not know the exact time of the day at which insider trades took place. In fact, many regulatory filings aggregate several trades on the same day[13]. When this happens, the price reported in the filing is a weighted-average of all prices at which transactions are executed. Hence, even if transaction prices are available, it is impossible to infer the time of trades from the transaction prices as reported by insiders. Secondly, we do not have information on inventory positions taken by each broker at the end of each day, which would allow us to test both our hypotheses of interest. In addition, we do not have daily volume traded by each broker in each stock. The closest alternative we have is monthly volume by broker and stock provided by NASTRAQ, which would denude too much power for our tests. Thus, we have to infer broker's trading pattern from their quoting behavior. By doing so, we share the same criticism of other work (e.g., Heidle and Li, 2004, and Green, 2004) that takes a similar approach and thus do not have a clear measure of the economic significance of our findings like a credible estimate of the profit insider-affiliated brokers make vis-à-vis their peers by quoting more aggressively when affiliated insiders trade. Finally, thanks to the NBBO (National Best Bid and Offer) trading protocol, it is

[12] Note that for the same company, insider trades (by the same or different insiders) may be brokered by more than one broker on the same day. In our sample, they are treated as independent events. This conservative assumption may reduce our test power, but increases the significance of our results.
[13] Moreover, some filings aggregate trades that are completed over a number of days, typically when the volume of trade is large. A common practice among brokers is that the first trading day is reported as the transaction day in the SEC Filing.

common that market makers complete trading orders without actually posting quotes (Smith, 2000). In addition, a trader may trade via Electronic Communication Networks like Archipelago or INET, in which case we are not able to observe their orders[14]. The bottom line is that these data limitations reduce our power to detect differences between the behavior of insider-affiliated market makers and their peers. On the other hand, it increases the practical significance of differences we do observe in the behavior of affiliated and unaffiliated market makers.

Table 3 demonstrates key characteristics of the 3,043 trades in our final sample. There is a large spread in firm size, book to market ratio, and the number of analysts. On average, there is no significant price movement in the market: the average event day return is about 0.7%. Trades from top executives consist of a very small percentage of our sample (less than 5%)[15]. Almost 34% of our sample are trades from uninformed traders, a group that include owners of more than 10% of a class of security, beneficial owners as custodian, beneficial owners as trustee, affiliated investors, controlling persons, indirect shareholders, founders, former insiders, retired executives, company shareholders, unknown, voting trustees, or deceased[16]. The median of the size of insider transaction, or the number of shares sold, relative to average daily volume (by all brokers) is 1.5%. The median of the size of insider transaction relative to average monthly volume by affiliated market maker is 1.7%. Almost 15% of the insider trades are executed according to 10b5-1 plans[17].

III. Measuring the impact of insider information on the behavior of market makers of affiliated brokers

Like Green (2004) and Heidle and Li (2004), we measure the percentage of time that any given brokerage house's bid (ask) is at the inside bid (ask) quote. We measure aggressiveness of quoting as the average difference in the percentage of time quotes are

[14] Garfinkel and Nimalendran (2003) found that compared with NYSE, the NASDAQ market exhibits a smaller change in proportional effective spread on insider trading days due to a higher degree of anonymity.
[15] Past studies such as Jeng et al (2003) found that insider trades from top executives are as informative as trades from other insiders, no more and no less.
[16] These are classified by TFN as the lowest level of ranking for insider position.
[17] SEC Rule 10b5-1 allows insiders to trade according to pre-committed trading plans which they filed with their brokers prior to the trades so as to obtain affirmative defenses.

at the inside bid (ask) between the affiliated market makers and the non-affiliated market makers, %Ask Diff and %Bid Diff respectively hereafter. We calculate these measures daily in event time as mentioned above. The event date is the date on which an insider trades according to his regulatory filing, and the event period is from -1 to +10 (trading) days relative to the that date. We utilize a control period ranging from -40 to -11 days prior to the trading date[18]. For each event day, we measure %Ask (Bid) Diff on that event day less the mean of %Ask (Bid) Diff over control period. Since we do not have data on inventory positions taken by each market maker, we use the %Ask (Bid) Diff as an index for insider-affiliated market makers' aggressiveness in selling (buying) vis-à-vis that of their peers. For example, if on an insider trading day, an insider-affiliated market maker quotes at the inside ask for 2.5 hours whereas his peers on average quote at the inside ask for 1.2 hours, and there is no difference between the two groups during the control period, then the %Ask Diff equals (2.5 – 1.2)/6.5 = 0.2, or 20%. We assume there are 6.5 trading hours per trading day. It is conservative to take the maximum trading hours per day as our common denominator as a given market maker may not be actively trading a stock every second. Hence, our results likely understate the economic significance of the difference in quoting behavior.

These variables have clear implications from the two propositions we examine. The Information Hypothesis, implying that that insider-affiliated market makers quote more frequently at the insider ask during the insider trading time period, suggests that abnormal values of %Ask Diff > 0. In addition, the Market Stabilization Hypothesis, implying that when insiders trade in large volume, insider-affiliated market makers quote more frequently at the inside bid in order to stabilize the post-sale market for the stock, suggests that %Bid Diff > 0.

The statistical significance of %Ask Diff and %Bid Diff is measured by Monte-Carlo simulations following Lee, Mucklow, and Ready (1993). For each trade, we randomly draw a day from the control period and calculate the value of the %Ask and %Bid on that day. By averaging them across all trades, we obtain a "random sample mean" for the control period. We simulate the above procedure 1000 times to obtain the

[18] We exclude day -10 to day -2 to allow the possibility that information may leak out before a given insider's trade.

distribution of the control period mean for each variable of interest. Finally, we calculate the p-values by comparing the event-period averages for each quoting measure with the 1000 randomly-drawn control-period average values.

IV. Results

The results in Table 4 report the p-values for the differences in quoting behavior between affiliated and non-affiliated market makers during our designated insider trading period. They show that affiliated market makers ask more aggressively on, before and after insider sales days; the ask difference measure is significant at the 5% level for day -1 to day +6 (Probability (Event > Control) > 0.95). On insider trading days, affiliated market makers on average quote at the inside ask more frequently than their peers by 2% of the time (or 8.5 minutes). There is no significant abnormal quoting behavior in bid prices. Although these results are strongly suggestive, they do not necessarily serve as direct evidence in support of the Information Hypothesis since under pressure to fill sell orders for their clients, affiliated market makers may have to ask more aggressively in order to complete their trade orders.

We can distinguish even more directly between this possibility and the information-based proposition by invoking a further control. In Table 5, we divide all 3,043 trades into twenty quantiles by sorting by the ratio of insider trading volume to monthly trading volume brokered by insider-affiliated market maker at t-1. This variable serves as a proxy for the size of the trade relative to the market-making ability of an insider-affiliated market maker. Table 5 reports abnormal differences in percentage of time at the inside ask between insider-affiliated market makers and their peer group over the insider trade event period (-1 to +10 days). As we conjecture, large-size trades do indeed result in more aggressive asking from affiliated market makers. Both the economic and statistical significance increases as relative size increases. On the insider trading day (Day 0), % Ask Diff goes up from 0.854% for the smallest quantile to 2.984% for the largest quantile, whereas Prob (Event > Control) increases from 0.973 to 1.000. In addition, the number of days during which affiliated market makers continue to ask aggressively increases to five days for the largest three quantiles. In other words, in order to execute these large-

sized orders from insiders, insider-affiliated market makers ask more aggressively than normal over a longer period of time. For example, for the trades in the largest quantile, aggressive asking by affiliated market makers persists for 7 days. What is most striking, however, is that trade size does *not* seem to explain all the abnormal quoting behavior. For the smallest trade size quantile, the average relative size of trades in which it is 0.0001 of an affiliated market maker's monthly volume at t-1 (i.e., about 0.2% of the daily volume), the insider-affiliated market maker asks abnormally aggressively on day 0 (the trading day) with a p-value less than 0.03 (Probability (Event > Control) = 0.973). Hence, we conclude that while the size of the trade helps explain the abnormal quoting behavior by insider-affiliated market makers, it is not the sole reason why insider-affiliated market makers ask more aggressively than their peers on the trading day.

What matters besides size? Information content is the leading candidate. In Table 6, we again sort all trades by insider trading volume scaled by monthly trading volume brokered by insider-affiliated market maker at t-1, but this time into five quintiles. For each quintile, we then break down the trades into two groups, trades by informed insiders and trades by uninformed insiders. We follow Seyhun (1998), Lakonishok and Lee (2001) and Jeng et al. (2003) by classifying uninformed insiders as insiders who are owners of more than 10% of a class of security, beneficial owner as custodian, beneficial owner as trustee, affiliated investors, controlling person, indirect shareholder, founder, former, retired, shareholder, unknown, voting trustee, or deceases. These insiders have to report their trades to the SEC, even though they most likely do not have material inside information. This classification scheme follows Thomson Financial's categorization of insiders (this is their lowest level of ranking for insider position). We calculate the abnormal differences in the percentage of the time at the inside ask between insider-affiliated market makers and their peer group on insider trading days. With the exception of the largest quintile, Table 6 shows that trades from informed insiders coincide with greater magnitudes of aggressiveness in asking from insider-affiliated market makers. Most importantly, in the smallest relative size quintile, we find that when insiders are uninformed, the difference between insider-affiliated market makers and their peers becomes small and insignificant (Probability (Event > Control) = 0.842). This evidence

supports the Information Hypothesis in that the information content of the insider trades is a determinant of the aggressiveness of insider-affiliated market makers' quoting behavior. Insider affiliated market makers do not post abnormally aggressive quotes when the trade size is small and when the trade is from an uninformed insider.

Direct measures of information asymmetry also characterize the correlation between informed trading and the behavior of brokers. In Table 7a, we first sort all trades by insider trading volume scaled by monthly trading volume brokered by insider-affiliated market maker at t-1 into 3 quantiles. For each quantile, we then sort by the number of analysts – a proxy for (the inverse of) information asymmetry[19] – following the company to form 3 quantiles. Table 7 reports the abnormal differences in the percentage of time at the inside ask between insider-affiliated market makers and their peer group on insider trading day. The probability that the Event day %Ask Diff is greater than during the control period average %Ask Diff is shown in parentheses. With the exception of the largest quantile, Table 7a shows that insider-affiliated market makers ask more aggressively when the number of analysts following the company is small or when the degree of information asymmetry is high. Most importantly, in the smallest quantile sorted by shares over affiliated market maker's monthly volume at t-1, trades from the high-analysts-following firms' insiders are not associated with significantly abnormal asking behavior from insider-affiliated market maker, supporting the Information Hypothesis. When the degree of information asymmetry is low and the trade size is small, insider-affiliated market makers do not post significantly more aggressive quotes vis-à-vis their peers.

Recent literatures have had success in using the dispersion of analysts' earnings forecasts to measure the degree of information asymmetry. Following Diether, Malloy, and Scherbina (2004), we calculate the dispersion value of each stock as the ratio of standard deviation of analysts' current-fiscal-year annual earnings per share forecasts to the absolute value of the mean forecast. In Table 7b, we follow the same methodology to perform a 3 by 3 double-sort on insider trading volume scaled by affiliated market maker's normal monthly volume and the dispersion value of the stock. In support of the

[19] In analyses not reported, we also use research and development costs (adjusted by sales) in lieu of degree of information asymmetry. The results are similar.

Information Hypothesis, higher dispersion, or higher degree of information asymmetry, draws more aggressive quoting from insider-affiliated market maker. For small-sized trades on low-dispersion stocks, the difference in quoting behavior between affiliated and non-affiliated market makers becomes statistically insignificant (Probability (Event > Control) = 0.923).

Lastly, following Kyle (1985) and Glosten and Milgrom (1985), we use the bid-ask spread to measure information asymmetry. We calculate the spread as the difference between ask price and bid price from NASTRAQ Inside Quote dataset averaged from Day -20 to Day -11. The results shown in Table 7c further support the preceding results As the degree of information asymmetry increases, the aggressiveness of insider-affiliated market makers' quotes increases. When the size of insider trade is small relative to the affiliated-broker's normal trading volume and when the bid-ask spread is low, the difference in quoting behavior between affiliated and non-affiliated market makers becomes insignificant (Probability (Event > Control) = 0.819).

Besides these ex ante measures of information asymmetry, we also use post-event stock returns to measure the ex post information content of the insider trades. We calculate post-event stock return as the stock return from Day 2 to Day 10 relative to the insider trading date. The results in Table 7d show that when size of the insider trade is small relative to the affiliated market maker's normal trading volume, only the quantile with the lowest post-event returns exhibits aggressive quoting from insider-affiliated market makers vis-à-vis their peers. In contrast, quantiles with higher post-event return quantiles show no such difference (Probability (Event > Control) is 0.275 and 0.361, for Medium and High, respectively), suggesting further support of the previous results.

This examination of information asymmetry leads to the question of whether the information content in insider trading is new to insider-affiliated market makers. In other words, can there be other channels through which the insider-affiliated market makers acquire the information? To answer this question, we subdivide our sample into two groups on the basis of whether insider-affiliated market makers' investment banks have had prior investment banking business relationships with the firms of the insiders who are trading. We find that when the size of the insider trade is small and when the bank has had prior investment banking business with the firm, the aggressive asking behavior

completely diminishes (Abnormal Difference in % = -0.261). This too is consistent with the Information Hypothesis in that when there are other channels available for an investment bank to acquirer information from the company, the insider brokerage affiliation becomes less important. We view this as indirect evidence that information may leak from investment banking (or corporate finance) division to traders within the same brokerage house. This raises new concerns about the strength of the Chinese Wall in brokerage houses.

V. Market Stabilization

If insider affiliated market makers wish to stabilize the market in the sense of Ellis, Michaely, and O'Hara (2000), they should bid more aggressively for large-sized sell trades. To examine this possibility, in Table 9 we divide all 3,043 trades into twenty quantiles by sorting the variable insider shares traded scaled by monthly volume of trade by insider-affiliated market maker at t-1 as in Table 5. The results support the Market Stabilization Hypothesis and are consistent with the IPO aftermarket phenomenon that Ellis, et al (2000) document. They can be interpreted as reflecting efforts by insider-affiliated market makers to stabilize the insider-trading aftermarket by becoming the dominant market makers in the market. Anecdotally, brokers tell us that stabilizing post-insider-trading market is applauded by the company insiders, especially executives and directors, and brokers and their investment banks are more likely to receive business mandates from these company insiders in the future. Without knowing the inventory position taken by each broker, however, we cannot estimate the inventory risk they are taking or the reward they receive by being the leading market-maker in the market.

VI. Robustness Checks

A. Pre and Post NASDAQ Decimalization

During our sample period, there was a major change in the Nasdaq Stock Market. In an effort to lower trading cost and to make stock prices easier to understand for the

investors, decimal quotes were implemented on the NASDAQ Stock Market. Beginning in March to April 2001, all stocks traded on Nasdaq Stock Market were converted to penny increments. NASDAQ Economic Research (2001) finds that the number of dealer quote updates thereafter increased by 12-20% and the number of inside quote updates increased by 90%. In this section, therefore, we re-do our analysis during the pre-decimalization and post-decimalization periods. Since decimalization took effect for most but not all of the NASDAQ stocks in April 2001, the pre-decimalization period in our paper ends in December 2000 and the post-decimalization period starts in January 2002.

Table 10 shows the difference in quoting behavior for pre- and post-decimalization sub-periods. Table 10a displays the ask quotes whereas Table 10b displays the bid quotes across trades of stocks with different degree of information asymmetry (proxied by the number of analysts following the company) controlling for the size of the trade[20]. Table 10a shows that while the results during the pre-decimalization period are robust, the patterns on the ask quotes are quite different during the post-decimalization period: when the size of the insider trade is small, none of the three information-asymmetry quantiles are associated with statistically significant aggressiveness from insider-affiliated market makers at the 5% level. There are several potential explanations.

First, Electronic Communication Networks (ECN) became prominent in recent years. Therefore, we lose power in detecting abnormal asking behavior as market makers put their informative trades through ECNs. Secondly, the Sarbanes-Oxley Act took effect in August 2002. Therefore, the insider trades during the post-decimalization period are disclosed in a more timely fashion than pre-decimalization period. This may also decrease test power in detecting information-motivated trades from market makers. Because the two regime switches took place within just over a year, it is difficult to disentangle these two effects within our limited sample.

Thirdly, the adoption of SEC Rule 10b5-1 in August 2002 further complicates our analysis. Rule 10b5-1 allows brokers to execute trades on behalf of their company insider clients according to trading plans, known as 10b5-1 plans, which act as an

[20] Results using other aforementioned proxies, such as earnings forecast dispersions, bid-ask spreads, or post-trading stock returns, are qualitatively identical.

affirmative defense against possible insider trading allegations. These plans are submitted by insiders to their brokers prior to the trade. Typically, the date of plan adoption is at least 30 days prior to the actual trading date. In other words, brokers are informed of the impending insider trades weeks before the actual trades take place. Hence, as the length of time during which the brokers holds proprietary information about insider trades increases, our test power is further reduced.

Finally, the patterns on the bid-quotes during the post-decimalization period are consistent with the information hypothesis. Table 10b Panel B demonstrates that for trades in the smallest quantile, the quantile with the smallest number of analysts, or highest degree of information asymmetry, receives *less* aggressive behavior from insider-affiliated market makers (Probability (Event > Control) = 0.002). This result is consistent with information hypothesis: Insider-affiliated market makers tend to lower their bid quotes so as to be less frequently hit for unfavorable trades.

B. Criteria of Inclusion

In Table 1, we imposed "non-missing data on each of the days during both event period and control period" as one of the selection criteria. As a result, we were left with a relatively small final sample for our analysis above. In this section, we re-do our analysis using a larger subsample by loosening our selection criteria. If we allow up to 12 missing days, that is, at least 40 non-missing days, during both event period and control period, we will have a larger sample of 7,362 insider trades. Table 11 demonstrates that controlling for the size of the trades, trades of stocks with high degree of information asymmetry, or smallest number of analysts following, are associated with more aggressive asking quotes from insider-affiliated market makers. The results are both economically and statistically significant. The results with other measures of information asymmetry, such as bid-ask spread and post-trading returns, are qualitatively identical.

V. Conclusion

This paper is the first to our knowledge to document the impact of brokerage affiliation with company insiders on investment banks' trading behavior. From a sample of 3,043 insider trades brokered by the biggest 15 "bulge bracket" brokers, we find that insider-affiliated market makers post more aggressive ask quotes when insiders trade vis-à-vis their peers. This pattern is partly attributable to the pressure to complete orders.

However, the degree of aggressiveness also correlates with proxies for the potential information content of the insider trades, such as type of insiders trading and degree of information asymmetry for the company. We also find that for large-volume insider trades, insider-affiliated market makers post more aggressive bid quotes vis-à-vis their peer group for similar trades. On rank, the results suggest that brokerage affiliation with company insiders brings value to brokers because information advantages useful for trading arise from it. Thus, it is possible that the type of information leakage (or piggybacking) present in the Martha Stewart case may actually be more generally present in the brokerage business than that single case may imply.

In fact, our results suggest that current regulations or at least their enforcement may not fully contemplate this sort of information transfer. In the unsettled debate about whether insider trading should be tightly regulated or not, those who endorse a laissez-faire approach may believe that insider trading improves market efficiency. However, the insider information leakage documented in this paper leads to almost no improvement in market efficiency through insider-affiliated market makers, because the public discovers the information about insider trading within a few days[21].

[21] Sarbanes-Oxley Act of 2002 requires insiders to report their trades to SEC within 2 business days.

Bibliography

Aboody, David, and Baruch Lev, 2000, Information Asymmetry, R&D, and Insider Gains, *Journal of Finance* 55, 2747-2766.

Bloomberg, Robert, Maureen O'Hara, and Gideon Saar, 2005, The "make or take" decision in an electronic market: Evidence on evolution of liquidity. *Journal of Financial Economics* 75, 165-199.

Christie, William G., Jeffrey H. Harris, and Paul H. Schultz, 1994, Why did NASDAQ market makers stop avoiding odd-eighth quotes? *Journal of Finance* 49, 1841-1860.

Christie, William G. and Paul H. Schultz, 1994, Why do NASDAQ market makers avoid odd-eighth quotes? *Journal of Finance* 49, 1813-1840.

Diether, Karl B., Christopher J. Malloy, and Anna Scherbina, 2002, Differences of opinion and the cross-section of stock returns, *Journal of Finance* 57, 2113–2141.

Ellis, K., R. Michaely and M. O'Hara (2000). "When the Underwriter Is the Market Maker: An Examination of Trading in the IPO Aftermarket." *Journal of Finance* 55(3):1039-1074.

Fishe, Raymond and Michel Robe. "The impact of illegal insider trading in dealer and specialist markets: evidence from a natural experiment" *Journal of Financial Economics*, 71(3), March 2004, 461-488.

Harris, L., 1998. Optimal dynamic order submission strategies in some stylized trading problems. Financial Markets, Institutions, and Instruments 7, 26–74.

Geczy, Chris and Jinghua Yan, 2004. An empirical study of 10b5-1 insider trades. Unpublished working paper. The Wharton School of University of Pennsylvania.

Green, T. Clifton, 2004, The value of client access to analyst recommendations, Working Paper, Emory University.

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

Garfinkel, Jon, and M. Nimalendran, 2003, Market structure and trader anonymity: an analysis of insider trading, Journal of Financial and Quantitative Analysis 38 (3), 2003.

Heidle, H. and Li, X., 2003. Is there evidence of front-running before analyst recommendations? An analysis of the quoting behavior of Nasdaq market makers. Unpublished Working Paper. Notre Dame University.

Jaffe, Jeffrey F., 1974, Special information and insider trading, *Journal of Business* 47, 410-428.

Jeng, Leslie, Andrew Metrick, and Richard Zeckhauser, 2003, Estimating the Returns to Insider Trading: A Performance-Evaluation Perspective, Review of Economics and Statistics 85 (2): 453-471 May 2003.

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

Lakonishok, Josef and Inmoo Lee, 2001, Are insiders' trades informative?, *Review of Financial Studies* 14, 79-111.

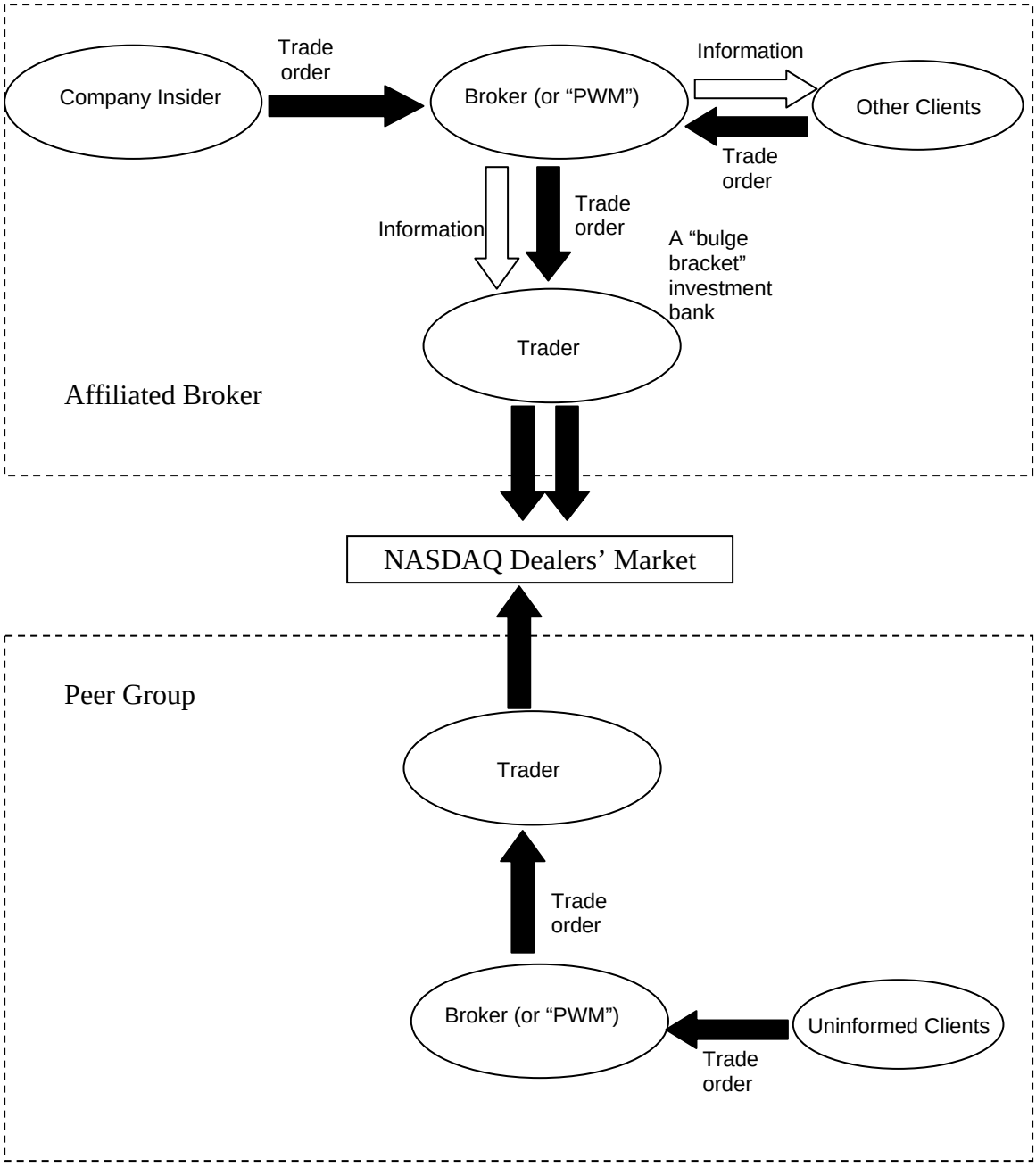
Lee, Charles M. C., Belinda Mucklow, and Mark J. Ready, 1993, Spreads, depths, and the impact of earnings information: An intraday analysis, *Review of Financial Studies* 6, 345-374.

Nasdaq Economic Research, 2001, The Impact of Decimalization on the Nasdaq Stock Market.

Seyhun, H. Nejat, 1998, *Investment Intelligence from Insider Tradin*g, MIT Press, Cambridge, MA.

Smith, J. W., 2000. The role of quotes in attracting orders on the Nasdaq interdealer market. Unpublished Working Paper. Nasdaq Economic Research

Figure 1


Company Insider
Trade order
Broker (or "PWM")
Information
Other Clients
Trade order
Information
Trade order
A "bulge bracket" investment bank
Trader
Affiliated Broker
NASDAQ Dealers' Market
Peer Group
Trader
Trade order
Broker (or "PWM")
Uninformed Clients
Trade order

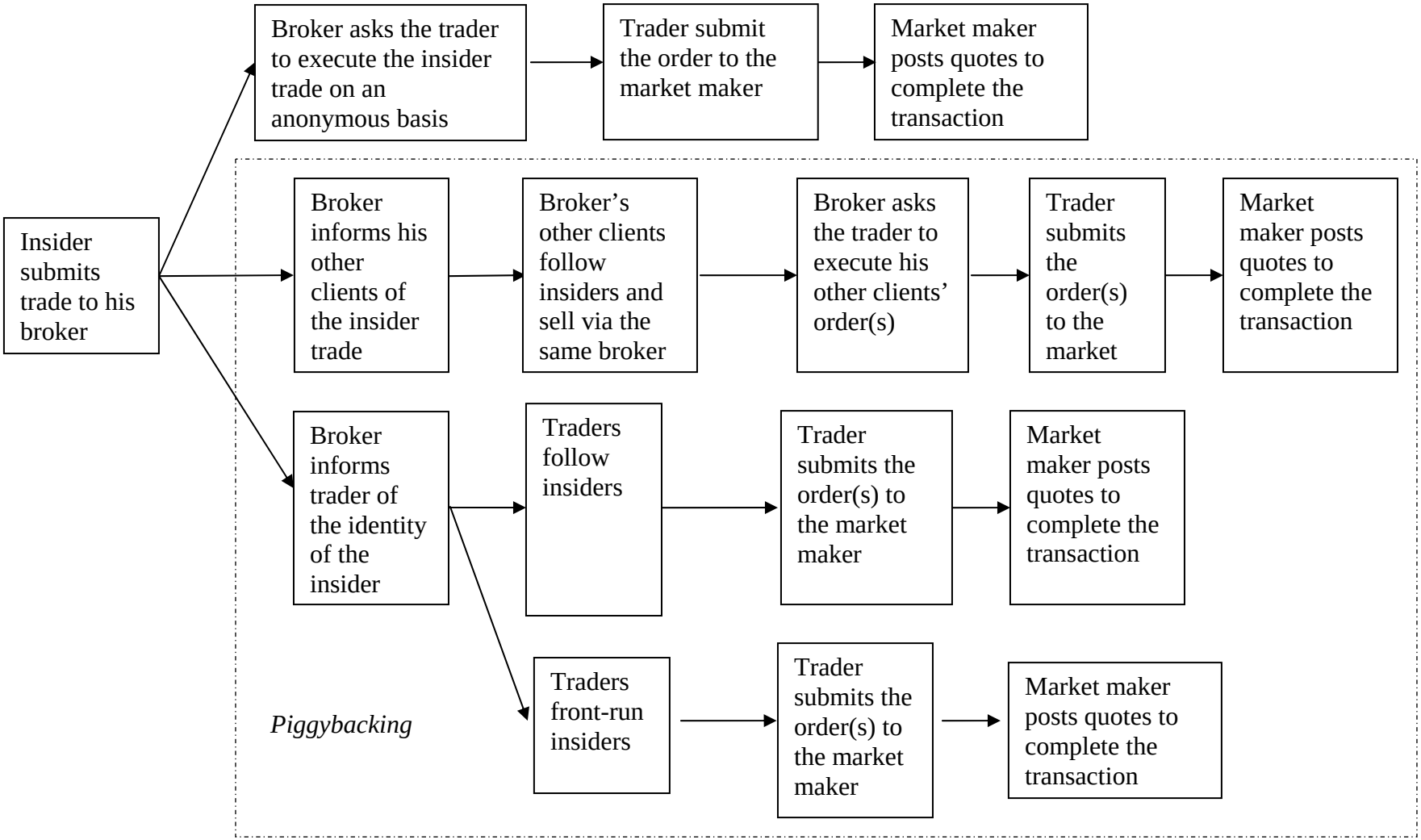

Broker asks the trader to execute the insider trade on an anonymous basis
Trader submit the order to the market maker
Market maker posts quotes to complete the transaction
Insider submits trade to his broker
Broker informs his other clients of the insider trade
Broker's other clients follow insiders and sell via the same broker
Broker asks the trader to execute his other clients' order(s)
Trader submits the order(s) to the market
Market maker posts quotes to complete the transaction
Broker informs trader of the identity of the insider
Traders follow insiders
Trader submits the order(s) to the market maker
Market maker posts quotes to complete the transaction
Traders front-run insiders
Trader submits the order(s) to the market maker
Market maker posts quotes to complete the transaction
Piggybacking

Table 1 - Data Cuts

From 500,105 records in TFN Form 144, we consolidate to 285,284 trades by distinct trader, broker, transaction date, and company. Matching with COMPUSTAT and CRSP leaves us with 229,511 trades. Among them, the brokers of 131,381 trades are also market makers on NASDAQ, and 109,994 trades are brokered by the "Big 15" brokers (see Table 2). Among them, 40,388 trades' brokers also have quotes on the company stock on the insider trading date. Finally, 3,043 trades have non-missing insider-affiliated broker and its peer group's quote data for every day during event-period (-10, 10) as well as control period (-40, -11).

	Year[1]					
Action/Step	**1999**	**2000**	**2001**	**2002**	**2003**	**Total**
Total Number of Form144 Data Records[2]	84,992	147,791	116,639	66,432	84,251	500,105
Trades by distinct *personid, broker, psaledate, cusip6*	48,171	91,862	69,951	36,718	38,582	285,284
Matched with COMPUSTAT by 6-digit CUSIP	43,079	80,863	62,385	32,636	35,431	254,394
Matched with CRSP by GVKEY	38,262	72,879	57,233	29,275	31,862	229,511
Where broker is a market maker	21,676	44,865	34,123	16,036	14,681	131,381
Where broker is also in the *Big 15*	18,463	38,070	28,853	13,253	11,355	109,994
Where the affiliated brokerage house also trades the stock on the trading day	5,028	13,228	12,398	4,948	4,786	40,388
Non-missing data on each day of both event-period and control-period	378	709	548	642	766	3,043

1. Year 1999 starts from March and Year 2003 ends at November.

2. Clean, non-amended, and with a non-missing 6-digit CUSIP.

Table 2a Number of insider trades brokered

List of brokers that have brokered more than 1,000 insider trades during the period from March 1999 to November 2003.

MPID	Broker Name	1999	2000	2001	2002	2003	Total
BEST	Bear Stearn	402	929	968	544	643	3,486
BTAB	DB Alex. Brown	2,558	1,906	242	28	14	4,748
CIBC	CIBC World Markets	186	290	276	173	147	1,072
DAIN	RBC Dain Rauscher	502	799	559	435	409	2,704
DBAB	Deutsche Bank	53	3,101	3,094	976	845	8,069
DLJ	Donaldson, Lufkin & Jenrette	1,654	2,365	956	680	135	5,790
FBCO	Credit Suisse First Boston	288	1,814	1,764	569	529	4,964
GSCO	Goldman Sachs	1,848	3,832	2,821	1,232	1,300	11,033
HRZG	Herzog Heine Geduld	665	1,984	1,040	39	0	3,728
JPMS	J.P. Morgan Securities Inc.	183	859	1,541	604	447	3,634
LEHM	Lehman Brothers	456	915	1,003	431	479	3,284
MLCO	Merrill Lynch	2,234	4,139	3,720	2,471	3,204	15,768
MSCO	Morgan Stanley	2,203	5,350	3,293	1,678	1,677	14,201
RSSF	Robertson Stephens	2,015	4,110	2,860	257	0	9,242
SBSH	Citigroup	3,216	5,677	4,716	3,136	1,526	18,271

Table 2b Number of insider trades brokered and traded

MPID	Broker Name	1999	2000	2001	2002	2003	Total
MSCO	Morgan Stanley	845	2,434	1,298	718	833	6,128
RSSF	Robertson Stephens	1,236	2,656	2,013	204	0	6,109
SBSH	Citigroup	726	1,963	1,761	1,081	502	6,033
MLCO	Merrill Lynch	328	1,214	1,098	791	1,354	4,785
GSCO	Goldman Sachs	488	1,663	1,319	567	707	4,744
DBAB	Deutsche Bank	0	0	1,759	563	559	2,881
FBCO	Credit Suisse First Boston	76	829	1,161	243	252	2,561
HRZG	Herzog Heine Geduld	476	1,171	766	17	0	2,430
LEHM	Lehman Brothers	175	372	555	236	263	1,601
DAIN	RBC Dain Rauscher	153	344	280	247	63	1,087
BEST	Bear Stearn	61	249	215	199	149	873
CIBC	CIBC World Markets	77	123	151	82	87	520
BTAB	DB Alex. Brown	375	0	0	0	0	375
JPMS	J.P. Morgan Securities Inc.	12	210	22	0	17	261
DLJ	Donaldson, Lufkin & Jenrette	0	0	0	0	0	0

Table 3 - Firm/Trade/Insider Characteristics

Firm/Insider/Trade Characteristics	Mean	Median	Std Dev
Firm size (in $mn)	14,722	2,521	51,879
Book to market	0.277	0.167	0.611
Trading-day return	0.007		0.054
R&D/Sales ratio	0.533	0.177	3.212
Number of Analysts	7.2	9.0	5.9
Shares/Monthly trading volume ratio by insider-affiliated broker at t-1	0.143	0.015	0.741
Shares/Average daily trading volume (average from -40 to -11)	0.159	0.017	1.072
Number of days between insider trading date and SEC filing date	10.0	6.0	24.1
% Uninformed insiders[1]	0.336		
% Top executives (CEO or CFO)	0.053		
% 10b5-1 Plan[2]	0.148		

1. Classified by TFN as the lowest level of ranking for insider position; including owners of more than 10% of a class of security, beneficial owner as custodian, beneficial owner as trustee, affiliated investors, controlling person, indirect shareholder, founder, former, retired, shareholder, unknown, voting trustee, or deceases.
2. For subsample October 2000 to November 2003.

Table 4 Abnormal difference in percentage of time at the inside ask and bid between insider-affiliated market maker and peer group

For all 3,043 qualified insider trades, we report the abnormal difference in percentage of time a given market maker quotes at the inside ask between insider-affiliated market maker and peer group. The period from day -40 to day -11 is used as control period. Probability (difference on a given event day > difference during control period) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1993).

	Ask		Bid	
Day (trading day = 0)	Abnormal Difference (%)	Prob (Event>Control)	Abnormal Difference (%)	Prob (Event>Control)
-1	**0.349**	**1.000**	-0.067	0.273
0	**1.942**	**1.000**	-0.043	0.353
1	**0.649**	**1.000**	0.158	0.914
2	**0.360**	**1.000**	0.141	0.886
3	**0.466**	**1.000**	-0.064	0.282
4	**0.191**	**0.966**	-0.054	0.311
5	**0.258**	**0.995**	-0.001	0.505
6	**0.312**	**1.000**	-0.146	0.093
7	0.155	0.928	-0.120	0.144
8	0.028	0.581	-0.039	0.373
9	0.088	0.790	-0.123	0.133
10	-0.075	0.224	0.019	0.566

Table 5 - Difference in percentage at the inside ask between affiliated market maker and non-affiliated market maker

We sort 3042* trades into 20 equal-sized quantiles based on variable "shares over insider-affiliated market maker's monthly volume at t-1." We report the abnormal difference in percentage of time a given market maker quotes at the inside ask between insider-affiliated market maker and peer group. The period from day -40 to day -11 is used as control period. Probability (difference on a given event day > difference during control period) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1993). They are shown in parentheses.

Day	Quantile (sorted by shares over affiliated market maker's monthly volume at t-1)																			
(trading day = 0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
-1	-0.401	-0.606	-0.039	**1.525**	-0.197	0.310	**1.413**	**0.833**	**1.058**	0.276	-1.030	**1.018**	-0.183	**1.323**	0.391	-0.135	-0.304	0.428	**1.113**	0.263
	(0.171)	(0.083)	(0.487)	**(0.995)**	(0.348)	(0.729)	**(1.000)**	**(0.963)**	**(0.976)**	(0.723)	(0.014)	**(0.978)**	(0.344)	**(0.993)**	(0.811)	(0.405)	(0.222)	(0.816)	**(0.990)**	(0.782)
0	**0.854**	-0.074	0.380	**0.688**	**1.098**	**1.191**	**1.082**	**1.756**	**2.985**	**1.846**	**1.262**	**1.722**	**1.536**	**2.237**	**3.179**	**2.853**	**3.360**	**3.168**	**4.786**	**2.984**
	(0.973)	(0.397)	(0.755)	**(0.936)**	**(0.978)**	**(0.980)**	**(0.994)**	**(1.000)**	**(1.000)**	**(1.000)**	**(0.993)**	**(0.999)**	**(1.000)**	**(1.000)**	**(1.000)**	**(1.000)**	**(1.000)**	**(1.000)**	**(1.000)**	**(1.000)**
1	0.325	-0.469	-0.314	0.360	0.539	-0.450	0.219	0.571	**1.129**	-0.581	0.280	0.344	**1.303**	**0.998**	0.595	**1.343**	**0.750**	**1.913**	**1.724**	**2.461**
	(0.792)	(0.147)	(0.299)	(0.804)	(0.859)	(0.198)	(0.687)	(0.891)	**(0.979)**	(0.072)	(0.712)	(0.761)	**(0.998)**	**(0.982)**	(0.911)	**(0.996)**	**(0.956)**	**(1.000)**	**(0.999)**	**(1.000)**
2	0.492	-1.440	-0.548	1.125	-0.077	-0.224	1.606	0.107	0.513	-1.366	0.772	-0.041	-0.054	-0.260	0.588	0.531	0.389	**2.216**	**1.121**	**1.901**
	(0.878)	(0.000)	(0.173)	(0.987)	(0.456)	(0.344)	(1.000)	(0.596)	(0.836)	(0.000)	(0.940)	(0.473)	(0.443)	(0.319)	(0.909)	(0.869)	(0.830)	**(1.000)**	**(0.990)**	**(1.000)**
3	0.211	0.140	-0.463	0.652	-0.040	1.421	0.679	0.743	0.535	1.301	0.715	0.690	-0.622	-0.037	-0.033	1.300	-0.026	**1.025**	0.312	**0.893**
	(0.704)	(0.579)	(0.213)	(0.922)	(0.482)	(0.992)	(0.939)	(0.939)	(0.847)	(0.997)	(0.927)	(0.910)	(0.079)	(0.499)	(0.497)	(0.995)	(0.477)	**(0.977)**	(0.749)	**(0.986)**
4	-0.368	-0.487	-1.109	1.008	-0.668	0.578	1.062	-0.376	0.932	0.602	-0.227	0.134	-0.708	-0.449	0.203	1.391	0.301	**1.209**	0.146	**0.665**
	(0.201)	(0.144)	(0.010)	(0.980)	(0.072)	(0.849)	(0.991)	(0.208)	(0.959)	(0.905)	(0.321)	(0.599)	(0.060)	(0.181)	(0.671)	(1.000)	(0.772)	**(0.989)**	(0.628)	**(0.955)**
5	-0.211	0.318	-0.710	0.922	-0.706	1.357	0.371	0.548	0.731	0.293	-1.014	-0.314	-0.059	-0.558	0.167	0.484	1.343	0.704	-0.105	**1.643**
	(0.319)	(0.758)	(0.082)	(0.969)	(0.057)	(0.991)	(0.796)	(0.879)	(0.909)	(0.737)	(0.014)	(0.275)	(0.436)	(0.122)	(0.647)	(0.845)	(0.999)	(0.931)	(0.437)	**(1.000)**
6	-0.169	0.113	-0.070	0.921	-0.429	-0.248	0.675	-0.361	0.056	-0.377	-0.600	0.662	0.705	0.300	0.818	0.681	0.949	0.527	1.237	**0.988**
	(0.343)	(0.566)	(0.469)	(0.971)	(0.184)	(0.324)	(0.938)	(0.218)	(0.559)	(0.177)	(0.086)	(0.902)	(0.929)	(0.751)	(0.958)	(0.910)	(0.983)	(0.865)	(0.996)	**(0.996)**
7	-0.032	-0.133	-0.075	0.410	-0.258	0.038	0.001	0.807	0.678	-0.425	0.222	0.308	-0.234	-0.777	0.187	0.381	0.008	0.887	0.442	**0.780**
	(0.468)	(0.381)	(0.464)	(0.818)	(0.296)	(0.556)	(0.519)	(0.958)	(0.897)	(0.144)	(0.667)	(0.733)	(0.306)	(0.041)	(0.662)	(0.797)	(0.500)	(0.965)	(0.829)	**(0.975)**
8	0.129	-0.595	-0.637	0.368	-0.869	-0.420	-0.183	-0.534	0.611	-0.581	-0.633	0.739	0.140	0.497	0.270	-0.263	0.913	0.435	0.804	0.498
	(0.638)	(0.095)	(0.113)	(0.795)	(0.030)	(0.218)	(0.346)	(0.116)	(0.879)	(0.072)	(0.072)	(0.921)	(0.599)	(0.850)	(0.723)	(0.297)	(0.980)	(0.821)	(0.950)	(0.914)
9	-0.664	-0.908	0.145	1.163	-0.359	-0.796	-0.536	0.744	1.318	0.534	-0.812	0.749	0.493	-0.517	0.196	0.781	-0.441	-0.307	0.392	0.764
	(0.055)	(0.022)	(0.599)	(0.988)	(0.231)	(0.057)	(0.101)	(0.940)	(0.990)	(0.887)	(0.033)	(0.924)	(0.855)	(0.144)	(0.667)	(0.949)	(0.130)	(0.272)	(0.805)	(0.974)
10	-0.591	-1.076	-0.020	-0.197	-0.392	-0.083	0.732	0.025	0.217	-0.453	-0.589	0.207	0.656	-0.461	0.372	-0.575	0.149	1.260	-0.609	0.034
	(0.083)	(0.005)	(0.497)	(0.353)	(0.208)	(0.463)	(0.961)	(0.520)	(0.665)	(0.135)	(0.089)	(0.659)	(0.914)	(0.172)	(0.799)	(0.088)	(0.645)	(0.993)	(0.107)	(0.559)
Shares over monthly volume by affiliated market maker	**0.0001**	**0.0004**	**0.0011**	**0.0019**	**0.0029**	**0.0039**	**0.0053**	**0.0072**	**0.0094**	**0.0126**	**0.0163**	**0.0214**	**0.0284**	**0.0375**	**0.0513**	**0.0706**	**0.1014**	**0.1650**	**0.3353**	**1.9444**

* Number of observations with non-missing "shares over affiliated market maker's monthly volume."

Table 6 Abnormal difference in percentage of time at the inside ask between insider-affiliated broker and peer group on insider trading day - Informed insiders vs. uninformed insiders

We sort all 3042* insider trades into quintiles by variable "shares over monthly trading volume by insider-affiliated trader at t-1." For each quintile, we then break down the trades into two groups, trades by informed insiders and trades by uninformed insiders. Uninformed insiders are insiders holding lowest ranked positions according TFN's classification. These positions include: owners of more than 10% of a class of security, beneficial owner as custodian, beneficial owner as trustee, affiliated investors, controlling person, indirect shareholder, founder, former, retired, shareholder, unknown, voting trustee, or deceases. We report the abnormal difference in percentage of time at the inside ask between insider-affiliated broker and peer group on insider trading day. Probability (Event > Control) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1973).

Quantile sorted by shares over affiliated trader's monthly trading volume	Informed Insiders		Uninformed Insiders	
	Abnormal Difference (%)	Prob (Event>Control)	Abnormal Difference (%)	Prob (Event>Control)
1	**0.609**	**0.949**	0.347	0.842
2	**1.395**	**1.000**	**1.046**	**0.990**
3	**1.984**	**1.000**	**1.868**	**0.999**
4	**2.625**	**1.000**	**1.936**	**1.000**
5	**3.065**	**1.000**	**4.954**	**1.000**

* Number of observations with non-missing "shares over affiliated trader's monthly volume."

Table 7a Abnormal difference in percentage of time at the inside ask between insider-affiliated market maker and peer group on insider trading day - The Effect of Number of Analysts

We sort all 3042* insider trades into 3 quantiles by variable "shares over monthly trading volume by insider-affiliated market maker at t-1." For each quantile, we then sort by the number of analysts following the company. Number of analysts is measured by the number of distinct analysts that posted at least one recommendation during the 200 days prior to the insider trading day. We report the abnormal difference in percentage of time at the inside ask between insider-affiliated market maker and peer group on insider trading day. Probability (Event > Control) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1973). Average number of analysts for each portfolio is shown in brackets.

Quantile sorted by shares over affiliated market maker's monthly trading volume	Quantile sorted by number of analysts following the company		
	Low	Medium	High
Low	**1.542** **(1.000)** [3.1]	0.380 (0.881) [11.8]	0.182 (0.825) [23.9]
Medium	**2.218** **(1.000)** [2.6]	**1.619** **(1.000)** [9.3]	**0.954** **(1.000)** [20.0]
High	**4.285** **(1.000)** [1.9]	**3.372** **(1.000)** [8.2]	**2.803** **(1.000)** [18.9]

* Number of observations with non-missing "shares over affiliated market maker's monthly volume."

Table 7b Abnormal difference in percentage of time at the inside ask between insider-affiliated market maker and peer group on insider trading day
- The Effect of Analysts' Earnings Forecast Dispersions

We sort all 2467* insider trades into 3 quantiles by variable "shares over monthly trading volume by insider-affiliated market maker at t-1." For each quantile, we then sort by the dispersion of analysts' earning forecasts on the company. Following Deither, Malloy, and Scherbina (2004), dispersion is calculated as the ratio of standard deviation of analysts' current-fiscal-year annual earnings per share forecasts to the absolute value of the mean forecast. For any given insider trade event, we first identify from I/B/E/S Detail History dataset all analysts' earnings-per-share forecasts on that firm that are outstanding as of that date. Then we calculate the mean value and the standard deviation of these forecasts. The ratio of the standard deviation to the absolute value of the mean would be the dispersion. If the number of analysts is fewer than two, then we set the dispersion value to be missing. If the mean forecast is zero or if the dispersion value is greater than 100, then we set the dispersion value to be 100.

Probability (Event > Control) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1973). Average dispersion value for each portfolio is shown in brackets.

Quantile sorted by shares over affiliated trader's monthly trading volume	Quantile sorted by dispersion of analysts' earning forecasts		
	Low	Medium	High
Low	0.448 (0.923) [0.030]	**1.010** **(0.994)** [0.091]	**0.771** **(0.987)** [0.863]
Medium	**1.665** **(1.000)** [0.028]	**1.876** **(1.000)** [0.098]	**1.290** **(1.000)** [0.774]
High	**3.515** **(1.000)** [0.024]	**2.576** **(1.000)** [0.081]	**3.784** **(1.000)** [0.753]

* Number of observations with non-missing "shares over affiliated market maker's monthly volume" and "dispersion"

Table 7c Abnormal difference in percentage of time at the inside ask between insider-affiliated market maker and peer group on insider trading day - The Effect of Bid-Ask Spread

We sort all 3042* insider trades into 3 quantiles by variable "shares over monthly trading volume by insider-affiliated market maker at t-1." For each quantile, we then sort by the average bid-ask spread on the company stock. Spread is calculated as the difference between ask price and bid price from NASTRAQ Inside Quote dataset averaged from Day -20 to Day -11. We report the abnormal difference in percentage of time at the inside ask between insider-affiliated broker and peer group on insider trading day. Probability (Event > Control) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1973). Average spread for each portfolio is shown in brackets.

Quantile sorted by shares over affiliated market maker's monthly trading volume	Quantile sorted by bid-ask spread on the stock		
	Low	Medium	High
Low	0.147 (0.819) [0.030]	**0.580** **(0.982)** [0.091]	**1.446** **(0.999)** [0.863]
Medium	**0.701** **(1.000)** [0.028]	**1.434** **(1.000)** [0.098]	**2.651** **(1.000)** [0.774]
High	**1.972** **(1.000)** [0.024]	**3.142** **(1.000)** [0.081]	**5.413** **(1.000)** [0.753]

* Number of observations with non-missing "shares over affiliated market maker's monthly volume" and "spread"

Table 7d Abnormal difference in percentage of time at the inside ask between insider-affiliated market maker and peer group on insider trading day - Post Insider-Trading Returns

We sort all insider trades into 3 quantiles by variable "shares over monthly trading volume by insider-affiliated market maker at t-1." For each quantile, we then sort by stock returns after insiders trade. Post-trading returns are calculated as stock return from Day 2 to Day 10. We report the abnormal difference in percentage of time at the inside ask between insider-affiliated broker and peer group on insider trading day. Probability (Event > Control) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1973). Average post-trading return for each portfolio is shown in brackets.

Quantile sorted by shares over affiliated market maker's monthly trading volume	Quantile sorted by post-trading stock return		
	Low	Medium	High
Low	**1.548** **(1.000)** [-15.3%]	0.275 (0.831) [-1.7%]	0.361 (0.850) [11.2%]
Medium	**1.629** **(1.000)** [-13.5%]	**1.664** **(1.000)** [-0.9%]	**1.473** **(1.000)** [10.6%]
High	**4.047** **(1.000)** [-11.2%]	**2.959** **(1.000)** [-0.2%]	**3.542** **(1.000)** [9.8%]

* Number of observations with non-missing "shares over affiliated market maker's monthly volume" and "post-event returns"

Table 8 Abnormal difference in percentage of time at the inside ask between insider-affiliated market maker and peer group on insider trading day - Banks with/without historical investment-banking affiliation

We sort all 3042* insider trades into quintiles by variable "shares over monthly trading volume by insider-affiliated market maker at t-1." For each quintile, we then break down the trades into two groups by whether or not the investment bank has had prior investment banking business with the firm. Investment banking business includes Initial Public Offerings or Seasoned Equity Offerings. We report the abnormal difference in percentage of time at the inside ask between insider-affiliated broker and peer group on insider trading day. Probability (Event > Control) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1973).

Quantile sorted by shares over affiliated market maker's monthly trading	Without prior IB business		With prior IB business	
	Abnormal Difference (%)	Prob (Event>Control)	Abnormal Difference (%)	Prob (Event>Control)
(Low) 1	**0.438**	**0.983**	-0.261	0.301
2	**1.132**	**1.000**	**2.269**	**1.000**
3	**1.267**	**1.000**	**1.847**	**1.000**
4	**2.916**	**1.000**	**2.954**	**1.000**
5 (High)	**3.484**	**1.000**	**3.849**	**1.000**

* Number of observations with non-missing "shares over affiliated market maker's monthly volume."

Table 9 - Difference in percentage at the inside bid between affiliated market maker and non-affiliated broker

We sort 3042* trades into 20 equal-sized quantiles based on variable "shares over insider-affiliated market maker's monthly volume at t-1." We report the abnormal difference in percentage of time a given market maker quotes at the inside bid between insider-affiliated market maker and peer group. The period from day -40 to day -11 is used as control period. Probability (difference on a given event day > difference during control period) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1993). They are shown in parentheses.

Day	Quantile (sorted by shares over affiliated market maker's monthly volume at t-1)																			
(trading day = 0)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
-1	0.655	0.352	-0.557	-0.925	-0.778	-0.266	-0.266	0.337	0.732	-1.101	0.279	-0.448	0.529	-0.163	0.357	-0.143	0.509	0.092	-0.081	-0.400
	(0.919)	(0.732)	(0.149)	(0.034)	(0.052)	(0.338)	(0.293)	(0.743)	(0.915)	(0.008)	(0.721)	(0.183)	(0.865)	(0.368)	(0.766)	(0.382)	(0.880)	(0.607)	(0.436)	(0.110)
0	0.496	-1.140	-0.130	-0.207	-0.603	-0.328	-0.279	-0.128	0.349	0.174	0.431	-0.121	-0.577	-0.593	-0.340	0.339	0.184	0.403	**1.144**	0.099
	(0.853)	(0.004)	(0.414)	(0.361)	(0.108)	(0.298)	(0.280)	(0.431)	(0.743)	(0.647)	(0.818)	(0.401)	(0.097)	(0.101)	(0.251)	(0.770)	(0.677)	(0.801)	**(0.988)**	(0.644)
1	-0.277	-0.320	0.384	0.126	0.095	-0.033	0.867	0.296	1.248	-0.130	-0.532	-0.394	-0.182	0.051	-0.187	-0.353	-0.182	-0.223	**1.497**	**1.343**
	(0.293)	(0.242)	(0.756)	(0.665)	(0.573)	(0.492)	(0.961)	(0.721)	(0.985)	(0.402)	(0.146)	(0.212)	(0.362)	(0.538)	(0.354)	(0.235)	(0.333)	(0.347)	**(0.995)**	**(0.999)**
2	0.125	-0.267	-0.462	0.162	-0.152	-0.200	0.205	0.743	0.678	0.364	-0.459	0.180	0.818	-0.388	0.139	-0.056	-0.654	0.405	**1.321**	0.395
	(0.636)	(0.266)	(0.195)	(0.666)	(0.371)	(0.386)	(0.663)	(0.919)	(0.894)	(0.768)	(0.192)	(0.644)	(0.945)	(0.197)	(0.627)	(0.460)	(0.047)	(0.802)	**(0.994)**	(0.868)
3	-0.653	-0.178	-0.617	-0.338	-0.652	-1.133	-0.213	-0.685	1.891	-0.543	0.417	1.205	0.109	-0.805	-0.281	0.272	-0.312	0.187	**1.070**	0.224
	(0.072)	(0.314)	(0.125)	(0.286)	(0.093)	(0.019)	(0.336)	(0.090)	(1.000)	(0.126)	(0.807)	(0.992)	(0.620)	(0.033)	(0.284)	(0.710)	(0.231)	(0.685)	**(0.982)**	(0.754)
4	0.356	-0.432	-0.276	-0.699	-1.028	-0.100	1.228	0.409	0.515	-0.209	-0.600	-0.320	0.081	-0.906	-0.807	-0.084	-0.082	0.371	**1.480**	0.113
	(0.781)	(0.167)	(0.317)	(0.088)	(0.009)	(0.446)	(0.995)	(0.780)	(0.829)	(0.346)	(0.115)	(0.261)	(0.593)	(0.023)	(0.052)	(0.434)	(0.422)	(0.781)	**(0.995)**	(0.654)
5	-0.585	-0.740	0.407	-0.716	-0.275	-0.919	1.090	-0.474	1.104	-0.120	0.286	0.910	0.833	-0.362	-0.085	-0.428	-0.324	-0.078	0.482	0.288
	(0.096)	(0.054)	(0.766)	(0.088)	(0.279)	(0.045)	(0.992)	(0.194)	(0.975)	(0.407)	(0.725)	(0.964)	(0.946)	(0.212)	(0.443)	(0.190)	(0.220)	(0.470)	(0.843)	(0.797)
6	-0.284	-0.084	-0.528	0.255	-0.770	-0.382	-0.347	0.598	0.101	-0.210	0.160	0.293	1.490	-0.715	-1.081	-0.437	-0.480	-0.254	-0.508	**0.685**
	(0.285)	(0.420)	(0.159)	(0.724)	(0.054)	(0.261)	(0.236)	(0.862)	(0.577)	(0.344)	(0.654)	(0.721)	(0.999)	(0.054)	(0.008)	(0.185)	(0.119)	(0.324)	(0.120)	**(0.969)**
7	0.118	-0.373	-0.788	0.109	0.090	-0.970	-0.277	0.402	-0.043	-0.990	-1.103	0.507	0.302	-0.340	-0.403	0.603	-0.305	0.746	-0.269	**0.836**
	(0.629)	(0.213)	(0.068)	(0.643)	(0.571)	(0.035)	(0.280)	(0.778)	(0.476)	(0.012)	(0.008)	(0.864)	(0.770)	(0.228)	(0.200)	(0.895)	(0.239)	(0.937)	(0.263)	**(0.988)**
8	0.104	0.369	-0.586	0.153	-0.535	-0.412	-0.030	-0.356	0.168	-0.537	-0.016	0.388	0.334	0.037	-0.258	0.001	-0.259	0.096	0.471	0.305
	(0.611)	(0.770)	(0.137)	(0.676)	(0.143)	(0.239)	(0.482)	(0.252)	(0.628)	(0.128)	(0.511)	(0.791)	(0.789)	(0.526)	(0.296)	(0.507)	(0.277)	(0.612)	(0.838)	(0.806)
9	-0.268	-0.263	-0.434	-0.321	-0.685	-0.324	0.242	-0.463	0.302	0.355	-1.118	0.178	0.459	**0.918**	-0.498	-0.697	-0.661	-0.029	0.236	**0.748**
	(0.300)	(0.277)	(0.215)	(0.279)	(0.079)	(0.301)	(0.689)	(0.198)	(0.711)	(0.764)	(0.008)	(0.641)	(0.834)	**(0.973)**	(0.155)	(0.063)	(0.047)	(0.501)	(0.706)	**(0.980)**
10	0.570	0.090	-0.003	0.117	-0.715	-0.930	0.198	-0.437	0.711	-0.142	-0.558	-0.363	0.722	-0.531	0.687	0.285	-0.555	0.401	0.677	0.339
	(0.888)	(0.542)	(0.495)	(0.632)	(0.075)	(0.043)	(0.656)	(0.209)	(0.909)	(0.396)	(0.128)	(0.231)	(0.926)	(0.118)	(0.909)	(0.724)	(0.079)	(0.800)	(0.924)	(0.828)
Shares over monthly volume by affiliated market maker	**0.0001**	**0.0004**	**0.0011**	**0.0019**	**0.0029**	**0.0039**	**0.0053**	**0.0072**	**0.0094**	**0.0126**	**0.0163**	**0.0214**	**0.0284**	**0.0375**	**0.0513**	**0.0706**	**0.1014**	**0.1650**	**0.3353**	**1.9444**

* Number of observations with non-missing "shares over affiliated market maker's monthly volume."

Table 10a Abnormal difference in percentage of time at the inside ask between insider-affiliated market maker and peer group on insider trading day - The Effect of Number of Analysts

We sort insider trades during each period into 3 quantiles by variable "shares over monthly trading volume by insider-affiliated market maker at t-1." For each quantile, we then sort by the number of analysts following the company. Number of analysts is measured by the number of distinct analysts that posted at least one recommendation during the 200 days prior to the insider trading day. We report the abnormal difference in percentage of time at the inside ask between insider-affiliated market maker and peer group on insider trading day. Probability (Event > Control) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1973). Average number of analysts for each portfolio is shown in brackets.

Nasdaq decimalization was implemented during the first half of 2001. Pre-Decimalization ends in December 2000; Post-Decimalization starts in January 2002.

Panel A: Pre-decimalization

Quantile sorted by shares over affiliated market maker's monthly trading volume	Quantile sorted by number of analysts following the company		
	Low	Medium	High
Low	**1.879**	**1.665**	0.094
	(0.976)	***(0.992)***	*(0.581)*
Medium	**3.490**	**2.483**	**1.641**
	(1.000)	***(0.995)***	***(0.998)***
High	**7.281**	**6.719**	**4.143**
	(1.000)	***(1.000)***	***(1.000)***

Panel B: Post-Decimalization

Quantile sorted by shares over affiliated market maker's monthly trading volume	Quantile sorted by number of analysts following the company		
	Low	Medium	High
Low	-0.084	0.103	0.391
	(0.411)	*(0.661)*	*(0.932)*
Medium	**2.025**	**1.052**	**0.502**
	(1.000)	***(0.998)***	***(0.967)***
High	**3.368**	**2.751**	**1.959**
	(1.000)	***(1.000)***	***(1.000)***

Table 10b Abnormal difference in percentage of time at the inside bid between insider-affiliated market maker and peer group on insider trading day - The Effect of Number of Analysts

We sort insider trades during each period into 3 quantiles by variable "shares over monthly trading volume by insider-affiliated market maker at t-1." For each quantile, we then sort by the number of analysts following the company. Number of analysts is measured by the number of distinct analysts that posted at least one recommendation during the 200 days prior to the insider trading day. We report the abnormal difference in percentage of time at the inside bid between insider-affiliated market maker and peer group on insider trading day. Probability (Event > Control) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1973). Average number of analysts for each portfolio is shown in brackets.

Nasdaq decimalization was implemented during the first half of 2001. Pre-Decimalization ends in December 2000; Post-Decimalization starts in January 2002.

Panel A: Pre-decimalization

Quantile sorted by shares over affiliated market maker's monthly trading volume	Quantile sorted by number of analysts following the company		
	Low	Medium	High
Low	-0.126	-0.678	-0.909
	(0.436)	*(0.201)*	*(0.039)*
Medium	-1.149	-0.586	-0.035
	(0.091)	*(0.225)*	*(0.481)*
High	1.981	0.987	-0.023
	(0.976)	*(0.882)*	*(0.489)*

Panel B: Post-Decimalization

Quantile sorted by shares over affiliated market maker's monthly trading volume	Quantile sorted by number of analysts following the company		
	Low	Medium	High
Low	**-0.827**	-0.240	0.001
	(0.002)	*(0.233)*	*(0.520)*
Medium	-0.605	-0.131	-0.303
	(0.101)	*(0.368)*	*(0.104)*
High	-0.131	0.185	0.524
	(0.385)	*(0.742)*	*(0.990)*

Table 11 Abnormal difference in percentage of time at the inside ask between insider-affiliated market maker and peer group on insider trading day - The Effect of Number of Analysts

We sort all 7,362* insider trades into quintiles by variable "shares over monthly trading volume by insider-affiliated market maker at t-1." For each quintile, we then sort by the number of analysts following the company. Number of analysts is measured by the number of distinct analysts that posted at least one recommendation during the 200 days prior to the insider trading day. We report the abnormal difference in percentage of time at the inside ask between insider-affiliated broker and peer group on insider trading day. Probability (Event > Control) is estimated using a Monte-Carlo simulation following Lee, Mucklow, and Ready (1973). Average number of analysts for each portfolio is shown in brackets.

Quintile sorted by shares over affiliated market maker 's monthly trading volume	Quintile sorted by number of analysts following the company				
	(Low) 1	2	3	4	5 (High)
(Low) 1	**1.850**	0.923	**1.076**	0.379	0.121
	(1.000)	*(0.911)*	***(0.985)***	*(0.839)*	*(0.737)*
	[0.2]	[4.7]	[8.7]	[14.8]	[25.3]
2	**2.359**	**2.452**	**2.467**	**1.494**	**0.691**
	(1.000)	***(0.998)***	***(1.000)***	***(1.000)***	***(0.999)***
	[0.1]	[3.6]	[7.4]	[12.1]	[22.0]
3	**1.953**	**3.381**	**3.252**	**2.577**	**1.105**
	(1.000)	***(1.000)***	***(1.000)***	***(1.000)***	***(1.000)***
	[0.1]	[3.9]	[7.0]	[10.2]	[19.6]
4	**5.593**	**4.584**	**4.677**	**3.430**	**2.439**
	(1.000)	***(1.000)***	***(1.000)***	***(1.000)***	***(1.000)***
	[0.2]	[3.1]	[5.5]	[8.7]	[18.5]
5 (High)	**5.177**	**5.197**	**4.399**	**5.336**	**4.174**
	(0.990)	***(1.000)***	***(1.000)***	***(1.000)***	***(1.000)***
	[0.0]	[2.1]	[5.0]	[7.9]	[15.3]

* Number of observations with non-missing "shares over affiliated market maker's monthly volume."