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Analyst Recommendations and Nasdaq Market Making Activity

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Abstract:

I investigate the linkage between liquidity provision by Nasdaq market makers and analysts in the same firm. Using three measures of market activity, I find that Nasdaq firms are more likely to provide buy side liquidity in anticipation of upgrades in the period 1999-2000. ECN activity supports this pattern. Firm level evidence shows that 15 of 42 market makers studied engage in significant pre-recommendation activity. I estimate cumulative abnormal returns of more than 75% and profits of almost \$600 million in a sample of 47 large capitalization stocks.

JEL: G14; G24.

Keywords: analyst; Nasdaq; market maker.

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Stock analysts became celebrities in the bull market of the 1990s. In the bear market that followed, they became the focus of retail investor outrage, especially after regulatory investigations revealed widespread conflicts of interest. In December 2002, ten of the leading investment banks paid fines totalling \$1.4 billion dollars to settle civil claims brought by Eliot Spitzer, the New York Attorney General.

This paper looks at another potential conflict of interest in the stock market, the one between market making activity and analyst recommendations. I find compelling evidence that at many security firms, market making activity is influenced by analyst recommendations. For both 1999 and 2000, I find that market makers tended to accentuate their bid activity in anticipation of analyst upgrades. I estimate the potential profits from this activity to be substantial, approaching \$600 million in a group of 47 large capitalization Nasdaq stocks.

The academic literature has focused on both the market power and bias of analysts. It has been well known since Womack's (1996) pioneering work that individual analysts do impact stock returns. Analyst recommendation changes not only produce large daily changes in security prices, but these effects also persist, for as long as six months in the case of downgrades. Barber, Lehavy, McNichols and Trueman (2001) also show that there is investment value in the consensus recommendations.

Well before the Spitzer investigation, research had documented serious bias in analyst recommendations. Analysts have been too bullish overall. In June 2001, 15 months into the bear market, First Call reported that only 2% of all security analyst recommendations were sells. Part of this bias reflects potential revenues from investment banking activities. According to Michaely and Womack (1999), lead underwriter analysts issued 50% more buy recommendations. Their recommendations under performed picks by unconflicted analysts by more than 25% per year for two years.

Spitzer's investigation brought into plain view what the statistical evidence could only hint at. There was direct pressure within firms for analysts to slant coverage in cases where other profitable (generally investment banking) relationships existed. These links are illustrated by an e-mail from Kirsten Campbell to Henry Blodget, both Internet analysts at Merrill Lynch: "... we are putting half of merrill retail into this stock... i don't think that's the right thing to do. We are losing people money and i don't like it. john and mary smith are losing their retirement because we don't want todd [Tappin, GoTo CFO] to be mad at us."¹ GoTo.com (now known as Overture and

recently acquired by Yahoo) was an Internet company that Merrill hoped to win investment banking business from. Large sums of money helped to blur the ethical lines: between December 1999 and November 2000, the Internet group at Merrill produced \$115 million in investment banking fees for the firm.

Additional conflicts of interest may arise in firms that sponsor sell-side research and make markets in securities. Analyst recommendations create profit opportunities on an agency basis through brokerage commissions and on a principal basis through proprietary trading. Weiss (2003) notes that for the 10 firms cited by Spitzer, their aggregate share of revenues from commissions (9%) and trading (10.8%) exceeded those from investment banking (8.4%).

The academic literature has found indirect evidence of these conflicts. Ellis, Michaely and O'Hara (2000) find that the lead underwriter typically becomes the most active market maker in the stock and that 23% of profits come from inventory gains and trading. Aggarwal and Conroy (2000) highlight the important role underwriters play in price discovery in the aftermarket for IPOs. Irvine (2003) finds that trading activity in Toronto Stock Exchange issues increases at the analysts' firm in the two weeks following earnings and recommendation changes. Chung, McInish, Wood, and Wyhowski (1995) demonstrate that analysts are more likely to cover stocks on the NYSE and Nasdaq with wide bid-ask spreads. Schultz (2003) also notes that a Nasdaq firm is more likely to make markets in stocks in which they have analyst coverage.

This paper finds empirical evidence of market maker-analyst conflicts in the period leading up to a recommendation change. Section I begins by describing principal and agent relationships that influence liquidity. There is also a discussion of rules and ethical standards regulating these associations.

The Nasdaq² limit order book, described in Section II, allows me to observe liquidity from all market makers. Historical data from the order book is collected in Nasdaq's Nastraq database.

Section II also develops a variety of measures of bid or ask pressure. The first relies on the frequency with which a market maker provides the best available price in the marketplace. A second measure takes into account depth on these occasions. A final measure looks at trading activity.

I cross reference, in Section III, the Thomson First Call database of analyst recommendations with data from the order book. I have three complete years of overlap in both data sets, 1999 to 2001. In total, I examine nearly 1,600 recommendations and the corresponding market making

activity.

For all three liquidity measures, I find evidence of increased bid activity prior to upgrades in the years 1999 and 2000 in Section IV. For downgrades in all years, and for upgrades in 2001, this pattern is not in evidence. In Section V, I find that 7 of the 10 firms fined by Spitzer and 15 of 42 overall show statistically significant links between their analysts and market makers.

An analysis of the ex-post returns in Section VI suggests that the potential profits from this activity are large. I compute a very conservative measure that suggests abnormal profits of \$1.8 million per recommendation in just a single week. The aggregate abnormal returns for the 42 firms are 75%.

I conclude with some general comments in Section VII on the Nasdaq and the functioning of a marketplace in which market makers act as both principal and agent.

I. Principal and Agent Conflicts

When a Nasdaq market maker displays a quote to the market, there are two possible sources for the liquidity. The market maker may be acting on an agency basis, representing a customer order or trading as a principal from the firm's inventory. Conflicts³ can arise in either case, but their empirical implications are similar.

Sell-side research is provided to clients in return for commission business⁴. These arrangements are legal under the SEC Exchange Act of 1934 Section 28(e). A conflict of interest could arise, however, if the information concerned the timing of an analyst's recommendation change. This would violate the Association for Investment Management and Research's Standards of Professional Conduct. Section B.3 requires that "...members shall deal fairly and objectively with all clients and prospects when disseminating investment recommendations..." Section B.8 would also require disclosure of any fees the firm earns for providing such information. NASD's Rule 2711, which took effect in July 2002, now clearly prohibits pre-release access of the content of the firm's research report.

A Nasdaq firm accumulating (selling) shares prior to the public release of the analyst upgrade (downgrade) presents an obvious conflict of interest. This kind of trading would be a violation of NASD Rule 2110.4 which prohibits "...purposefully establishing, creating or changing the firm's inventory position...in anticipation of the issuance of a research report..."

Both principal and agent conflicts should result in changes in the bid or ask behavior of market

makers *prior* to their recommendation changes. The next section develops several quantitative measures of market maker activity.

II. Buying and Selling Interest

The National Association of Security Dealers Automated Quote System (Nasdaq) has a unique microstructure conducive to our analysis. Nasdaq has no trading floor and provides a decentralized network of broker dealers and automated quote and execution systems. In the absence of a centralized auction as in the New York Stock Exchange, traders on the Nasdaq receive a comprehensive display of limit order prices and depth⁵ known as the Level II. This enables the public to view the behavior of distinct market makers and their electronic competitors⁶ known as ECNs (Electronic Communication Networks). Because of the ability to identify liquidity provision from specific market participants in the order book, my study is limited to Nasdaq stocks. Historical data from the Level II is obtained from the Nastraq database.

While all quotes on the Nasdaq are firm, one way to express buying (selling) interest is to provide the best bid (offer). I can illustrate this idea by discussing Figure 1.

[INSERT Figure 1 HERE]

In the figure⁷, there are five tiers of liquidity for the Nasdaq National Market (NNM) stock Cisco Systems (CSCO). On the left side of the color coded display, one can see five liquidity providers at the best bid of 19.98. These include four market makers, GVR Company (GVRC), Morgan Stanley (MSCO), Spear Leeds and Kellog (SLKC), and Soundview Technology (SNDV), and one ECN, the Nasdaq-owned ECN (SIZE). ECNs are distinguished by a # in the display. The best offer is just a penny away at 19.99 with liquidity from a market maker, U.S. Bancorp Piper Jaffray (PIPR), and the ECN Size.

These quotes make up what is called the *inside market* in the stock. In the aggregate, Cisco's national best bid and offer (NBBO) is 19.98×19.99 with a depth of $6,100 \times 1,500$. These depths should be construed as minimums. In many cases, market makers will refresh their quotes automatically to provide greater depth at that price.

Under the Nasdaq's new SuperMontage system, which was fully implemented in December 2002, market makers may offer depth at more than one price level. For example, Morgan Stanley (MSCO) is bidding for 2,100 shares at 19.98 and for another 500 shares at 19.97. The multiple quotes are not relevant for our study which only spans 1999-2001.

A key decision for a market maker is how to represent his own buying and selling interest and those of his clients. I turn to this decision in the next section.

II.A Inside market appearances

The first measure of buying and selling interest I will tabulate is the willingness of a market maker to provide a quote to the inside market. Simaan, Weaver and Whitcomb (2003) note that Nasdaq market makers are less likely to enter the inside market than ECNs. ECN quotes of all kinds are nearly three times as likely to improve the inside market than market maker quotes. They conclude that market makers place a value on anonymity. A decision to take the inside bid (ask) may be informative and consistent with a desire to accumulate (decumulate) shares or raise (lower) the share price.

I count the number of times⁸ a market participant provides a price quote in the inside market. I compute average counts for the bid and the ask for the market maker in a period from 4 weeks (-16 to -20 days) before the recommendation change to 4 weeks after (+16 to +20). For clarity, I will discuss the results for one upgrade by Goldman Sachs of Qualcomm, Inc. (QCOM) on April 21, 1999.

Qualcomm Upgrade on April 21, 1999
Inside Market Appearances by Goldman Sachs

| Days | Date | Bid Count | Ask Count |
|-------------|-------------|------------------|------------------|
| -10 | 7-Apr-1999 | 82 | 172 |
| -9 | 8-Apr-1999 | 85 | 345 |
| -8 | 9-Apr-1999 | 192 | 3 |
| -7 | 12-Apr-1999 | 97 | 283 |
| -6 | 13-Apr-1999 | 420 | 337 |
| -5 | 14-Apr-1999 | 40 | 79 |
| -4 | 15-Apr-1999 | 295 | 172 |
| -3 | 16-Apr-1999 | 228 | 174 |
| -2 | 19-Apr-1999 | 910 | 229 |
| -1 | 20-Apr-1999 | 179 | 243 |

Two weeks prior to the analyst's upgrade (days -6 to -10), the Goldman Sachs market maker was more often on the inside offer than on the inside bid. The average inside ask count for the week was 228.00 versus a 175.20 average for the inside bid count. In the week prior to the upgrade this pattern reverses, with an average inside bid count of 330.40 versus 179.40 average inside ask appearances.

If the average bid (ask) side count rises in a week prior to an upgrade (downgrade) from the

average 2, 3 or 4 weeks prior, this will be evidence of market maker analyst conflicts.

II.B Inside depth

A market maker could also accumulate (decumulate) shares without altering their inside frequency counts. They could simply increase the number of shares bid (offered) whenever they take the inside. To capture this possibility, I aggregate the depth of a market maker every time they take the inside bid or ask. For upgrades, I compute a ratio of the number of times average aggregate inside bid depth exceeds aggregate inside ask depth. I compute the converse ratio for downgrades. As before, I use rolling 5 day periods before and after the downgrade.

In practice, this measure is highly correlated with our prior measure because many market makers offer a constant bid or ask size. Goldman Sachs, for example, shows a constant bid size of 1,000 shares more than 99% of the time. It is worth recalling that quoted depth and true depth are not the same on the Nasdaq because market makers can set a reserve depth not visible⁹ in the Level II display.

II.C Matched trades

Quotation activity represents only an intention to buy or sell a security. My third measure looks at trading activity to see if it is consistent with the quotes.

I assign trades to the bid or ask based on the standard assignment mechanism, distance from the quote midpoint. A trade that goes off above (below) the midpoint is considered to be a buyer (seller) initiated trade. I then assign the buyer (seller) initiated trades equally to all the market participants on the inside bid (ask). I aggregate these throughout the trading day and compare weekly averages. A pattern of increased buyer (seller) initiated trades in the week prior to an upgrade (downgrade) will provide evidence of possible conflicts.

III. Data

III.A Liquidity in the Nasdaq marketplace

The large capitalization stocks in the Nasdaq are aggregated into the Nasdaq 100 index. The individual stocks are extremely liquid; futures, options, and exchange traded funds based on the index contribute to trading volume. To maintain a consistent sample, I chose to analyze the 47

listings that remained¹⁰ in the Nasdaq 100 during the four years of 1999-2002¹¹. This group and some of their characteristics are listed in Data Appendix A.1.

The 47 stocks had capitalizations ranging from \$268.7 billion at the end of 2000 (CSCO: Cisco Systems) to \$2.3 billion (CPWR: Compuware). The sample average is \$34.18 billion. The stocks traded an average of 13.79 million shares per day in December 2000.

On average, 68 market makers and ECNs provide liquidity in the 47 issues. All ten of the investment banks that settled with New York Attorney General Spitzer also make markets in Nasdaq securities. I list each of the ten, their Nasdaq market participant identity symbols, and their Nasdaq national market share of volume from December 2000. (1) Bear Stearns and Co. (BEST: 1.80%); (2) Credit Suisse First Boston LLC (CSFB: 3.38%); (3) Deutsche Bank Securities Inc. (DBKS, DBAB: 1.83%); (4) Goldman, Sachs & Co. (GSCO: 3.50%); (5) J. P. Morgan and Chase Co. (JPMS, JPHQ: 0.68%); (6) Lehman Brothers, Inc. (LEHM: 2.32%); (7) Merrill Lynch and Co. (MLCO: 4.63%); (8) Morgan Stanley & Co. (MSCO: 4.48%); (9) Salomon Smith Barney (SBSH: 5.42%); (10) UBS Warburg (WARR, UBSW: 1.54%);

ECNs had approximately 17% of the market¹² in December 2000, so the ten banks cited by Spitzer had 30% of the overall national market volume and 36% of the non-ECN share¹³. The 42 market maker-investment bank pairs I study had 41% of the total market and 49% of the non-ECN share.

III.B Details on the First Call database

Thomson Financial is now the publisher of the industry standard database of earnings estimates and analyst recommendations that were originally offered by First Call and I/B/E/S. The data set covers over 9,700 securities with information from 1990. I will be using only a small portion of the data set that intersects with my data on Nasdaq liquidity.

There are 808 entities providing security recommendations. Thomson translates the qualitative recommendations of brokerage firms into a five point scale, with one the strongest buy recommendation. I exclude recommendations that are not issued in real time, reiterations of previous recommendations, and initial ratings.

For the 47 stocks, there are 747 upgrades by 82 entities in the three years from 1999 to 2001. There are 852 downgrades by 90 entities between 1999 and 2001 in the Nasdaq 100 sample.

In 1999, during the tech stock boom, upgrades outnumber downgrades, 297 versus 198. In 2000, as tech stocks began to decline, downgrades became the majority. The ratio of upgrades to

downgrades was 203 to 276. In 2001, in the second year of a tech stock bear market, the downgrades dominate the upgrades, 377 to only 245.

In the upgrade group, I can match a subset of these 82 entities to 42 market making firms in the Nasdaq. For a listing of these pairs, see Data Appendix A.2. Within my 42 pairs are all of the top ten underwriting firms of tech IPOs for 1999, and 21 of the top 25.

Limiting myself to these market making-analyst matched pairs, my sample retains 636 upgrades. In about 80% of these cases, the analyst firms also make markets in the stock that they upgrade. After excluding unmatched combinations, I am left with 536 events in the three year period. For each Nasdaq stock, there is a median of 10 upgrades, with a range from 28 (Applied Materials: AMAT) to 0 for Compuware (CPWR). Only Compuware (CPWR) has no upgrades from 1999-2001 in the matched set.

For the downgrades, I search for matches among the same 42 market maker analyst pairs in a sample of 720 recommendations. Again, in about 80% of the cases, the market maker does provide liquidity in the stock. There are then 586 events in the three year downgrade sample from 1999 to 2001. Each Nasdaq stock has a median of 12 downgrades, ranging from 30 for Oracle (ORCL) to 0 for Compuware, which is again the only stock with no downgrades.

In all, I have a large sample of analyst ratings changes and a set of affiliated market makers representing nearly half of the market maker share on the Nasdaq.

IV. Aggregate Results

This section aggregates the recommendation changes across analysts and stocks in two sub-periods, 1999-2000 and 2001. Tables I to VI show the results for upgrades and downgrades for the three liquidity measures before and after the recommendation change.

The inside counts, such as those in the Goldman Sachs example in Section II, are summed over five days and treated as a single binomial event. Begin and end indicate the range of days relative to the public release by the analyst. For an upgrade (downgrade), if the average bid (ask) activity for the week exceeds ask (bid) activity, I assign a value of 1. The column labeled frequency is the fraction of times that the recommending market maker provided more liquidity in the direction of the recommendation change.

I have chosen a binomial test of count frequency for two reasons apart from its simplicity: (1) the data come from a variety of market makers, large and small; (2) the stocks are also heterogenous

in terms of market capitalization, quote, and trade activity. I will examine later in this section whether this heterogeneity matters for the results.

In Tables I to VI, I report a p -value of the probability that the observed count frequency in the week prior to the recommendation change is consistent with the count frequency in some other week. A small p -value indicates that bid (ask) pressure increases significantly for that upgrade (downgrade) with respect to the reference week.

IV.A Upgrades - inside bid activity

In the first two lines of Table I, for example, I observe that inside bid counts exceed inside ask counts 181 out of 327 times -6 to -10 days prior to upgrades in 1999 and 2000. That is a relative frequency of 55.4%. In the week prior to the upgrade, the firm's market maker is more often on the inside bid 63.6% of the time, or 208 out of 327 cases. This increase in inside bid activity is significant at the 99.9% confidence level. I note that this increase in inside bid presence is significant with respect to 3 and 4 weeks prior¹⁴ (-11 to -15 and -16 to -20 days) as well.

[INSERT Table I HERE]

Looking at 1999 and 2000 separately reveals this pattern to be stable. In 1999, there are 189 upgrades. 54.0% of the time from day -10 to -6 prior to the upgrade, market makers are more frequently on the inside bid than ask. This rises to 61.4% the week prior. Bid count prevalence rises from 57.3% to 65.9% from two weeks to one week prior to upgrades in 2000.

The upgrades in 2001 do not show the pattern of increased bid side activity. Bid count appearances are steady in the two weeks prior to the upgrade at 56.4%.

In all three years, it appears that bid side activity persists after the upgrades. In 1999-2000, inside bid frequency is still above 60% four weeks after the upgrade. In 2001, bid side activity returns to normal after three weeks.

IV.B Downgrades - inside ask activity

The downgrades in Table II show no distinct pattern of prior week selling pressure. Market makers are on the inside ask more frequently two weeks prior than one week, 40.0% versus 39.1%. The symmetric pattern to the upgrades is just not present in the downgrades.

[INSERT Table II HERE]

In 2001, inside ask counts for the downgrades are similar to 2000 at a 39% average. There is

again no evidence of pre-recommendation ask side pressure.

After the downgrades are released, the inside ask side pressure in 1999-2000 is not very protracted, returning to normal after a week. In 2001, after a downgrade, the inside ask pressure stays high for three weeks.

IV.C Other liquidity measures

Inside depth

This pattern of pre-upgrade bid activity is also supported by the inside depth measure. In Table III, market makers have a larger aggregate inside bid depth 52.9% of the time two weeks prior to upgrades. This jumps to 61.2% in the week prior. The proportional increase in bid pressure is almost identical to the inside bid counts, and the resulting binomial test rejects at the same significance level, 99.9%. The upgrades in 2001 show a rise when I compare the week prior to two weeks prior, but not when I compare it to the aggregate liquidity earlier in the month.

[INSERT Table III HERE]

Inside bid depth remains very strong in the week following the upgrade, and stays above pre-upgrade levels for the rest of the month in 1999-2000. Aggregate bid liquidity stays elevated for only a week after the upgrade in 2001.

[INSERT Table IV HERE]

The same two sample periods for downgrades are in Table IV. Downgrade ask depth exceeds bid depth between 41 and 44% of the time in the month prior to the recommendation change during 1999 and 2000. It is stable throughout the month, and betrays no overt signs of a market maker decumulating (or shorting) shares. There is a one week surge in ask pressure after the downgrade. The pattern in 2001 is similar, although average sell side liquidity appears a bit lower. There is a strong surge in ask pressure after the downgrade, exceeding 50% for the only time in the sample, but it falls back to pre-downgrade levels after three weeks.

Matched trades

The trade data is also supportive of the pattern of pre-upgrade accumulation in the period 1999 to 2000. Buyer initiated trades, as reported in Table V, exceed seller initiated trades 53.8% of the time from -6 to -10 days prior to the upgrade in 1999-2000. This jumps to 61.8% in the week prior to the upgrade. I can then reject this increase as random at the 99.5% level or better with respect

to any of the three preceding weeks. Again, in 2001, there is no statistically significant pattern.

[INSERT Table V HERE]

Strong buyer initiated trading continues for (at least) a full month after upgrades in 1999-2000. In 2001, there is only a one-week surge in buyer initiated trading.

[INSERT Table VI HERE]

The downgrades show no pre-recommendation pattern in either 1999-2000 or 2001 in Table VI. There is a sustained increase in seller initiated trades after the downgrades in both samples, but the relative increase is larger in the 1999-2000 period.

IV.D Do analyst firm market makers differ?

One possible explanation for my pre-upgrade results is that buyers enter the market because of good news. Analysts then react to bullish news with upgrades. If the signal or information were public though, a randomly selected market maker would on average also be more eager to buy the stock. In this section, I examine and reject this explanation for my results.

For every security that undergoes a recommendation change, I construct a list of market makers who are present every day in a one month window before and after the announcement. I then select a market maker randomly from this list and compute the inside bid and ask counts. Results for this randomly selected group are in the first panel of Table VII.

[INSERT Table VII HERE]

I do not find any statistically significant pattern of inside bid counts prior to upgrades in either sample period. In reporting the results in Table VII, I show the p -value for a test that the 63.6% bid frequency from Table I is random based on the count for the corresponding time period. In all cases, I reject at the 99.9% level or more. Interestingly, the random market makers also do not provide post recommendation change bid pressure either. They reduce their bid side presence to under 50% for three of the next four weeks. I will examine post-upgrade performance in greater detail in Section VII.

It might be the case that analyst firms may have an informational advantage¹⁵, and they receive some news not available to other market makers. I take a second random selection among all the firms that have a rating on the stock and also make markets in it. This group, in the second panel, shows a slightly higher average bid side frequency of 56.9% versus 53.0% for a purely random market

maker. In the week prior to the recommendation change though, the analyst market making firms decrease their inside bid presence, unlike the firms about to upgrade. This differs from the pattern in Table I at the 99.8% level.

I also reject that our pattern from Table I is random at the 99% level in 8 of the 10 weeks, and at the 90% level for all 10 weeks, including those after the upgrade. Based on the average frequency for the four weeks prior to the upgrade, I can reject a market wide analyst informational advantage at the 99% level.

IV.E Initial summary of evidence

Measured by inside market presence, inside depth or trade initiation, there is a strong pattern of pre-upgrade market maker buying activity in the first two years of our sample. The pattern is almost certainly not random or common across all analysts.

The downgrades for all three years from 1999-2001 show no significant patterns. By disaggregating the results, I hope to better understand where this pre-upgrade pattern is coming from.

V. Disaggregate Findings

I now examine several cross sectional breakdowns of the results. I provide results for individual market makers, ECNs and market making subsidiaries, and provide frequency counts by stock.

V.A By market maker

I examine one dimension of the heterogeneity in the data set by breaking down the results for individual market makers. My tests here are limited by sample size. For only four market makers, Merrill Lynch (MLCO), Prudential (PRUS), Morgan Stanley (MSCO) and ABN Amro (ABNA), do I have more than 20 upgrades in the sub-sample 1999-2000. For 16 market makers, though, I do have 10 or more. Table VIII shows the sample sizes for upgrades, and tests of the their inside bid count activity.

[INSERT Table VIII HERE]

Merrill Lynch, our most active market maker analyst pairing, also provides the strongest evidence in support of our hypothesis. In only 12 of 29 upgrades does their inside bid count exceed the ask count two weeks prior to an upgrade. In the week prior though, their inside bid counts surge and exceed the ask counts 62.1% of the time, or 18 of 29 times. Despite a relatively small

sample, I can reject that Merrill's behavior is random at the 98.8% level.

There is one other market maker I can reject at the 98% level, Credit Suisse First Boston (FBCO) which raises its inside bid prevalence from 46.2% to 76.9%. I can reject two other market makers at the 95% level, William Blair (WBLR) and J.P. Morgan (JPMS), and three others at the 90% level, U.S. Bancorp Piper Jaffray (PIPR), A.G. Edwards (AGED), and Donaldson, Lufkin and Jenrette (DLJP).

This group is certainly heterogenous with three industry titans, Merrill, J.P. Morgan, and First Boston, all of whom were cited by Spitzer and were among the top ten tech underwriters during the Internet boom. There are also three mid-tier players, Piper Jaffray, A.G. Edwards and Donaldson, Lufkin. Finally, a very small firm also makes it into the group, William Blair.

It should be noted that the other three of our most active pairings do not display any pattern of buying pressure (p -values are in parentheses): Morgan Stanley (0.34), Prudential (0.50), ABN Amro (0.50). The largest Nasdaq market maker by share in our group, Salomon Smith Barney (0.32), also does not demonstrate pre-upgrade accumulation.

[INSERT Table IX HERE]

In 2001, while there appears to be no market wide pattern of pre-upgrade activity, individual market makers in Table IX show significant increases in their bid presence. First Boston (0.00), A.G. Edwards (0.01), and J.P. Morgan show continuations of their prior market making activity. Morgan Stanley is significant at the 95% level, and Dain Rauscher (DAIN) at the 92% level.

[INSERT Table X HERE]

For the downgrades, my tests were unable to detect any market wide selling interest. Individual market makers, however, do demonstrate a pattern of increased inside ask activity. For 1999-2000, as shown in Table X, A.G. Edwards and Hambrecht and Quest (HAMR) are significant at the 98% level, and Lehman Brothers (LEHM) and Piper Jaffray are at the 95 and 90% levels, respectively. Merrill Lynch at the 99% level, Legg Mason (LEGG) at the 98% level, and Robertson Stephens (RSSF) at the 95% level are the only statistically significant rejections in 2001 in Table XI. As with the upgrades, this is a diverse group, ranging from boutique size, Hambrecht and Quest, to financial supermarket, Merrill Lynch.

[INSERT Table XI HERE]

Merrill Lynch is noteworthy for appearing in three of our four samples (all but the downgrades

in 1999-2000). Their size alone is clearly not the determining factor. Salomon Smith Barney has about 80% of the events of Merrill Lynch (35 versus 46 downgrades, and 30 versus 41 upgrades), but it never shows a statistically significant market making pattern. A.G. Edwards, a much smaller firm, also appears in three of four samples at the 10% level or better (all but the downgrades in 2001). J. P. Morgan and First Boston appear in both upgrade samples.

V.B Market making subsidiaries

There are many investment firms which do market making through subsidiaries as well. Because of the indirect linkage, it may be possible that some firms use their subsidiary market making relationships to avoid the appearance of a conflict. There are six linked firms in my sample: (1) Goldman Sachs and Spear Leeds and Kellog (SLKC) which merged on September 11, 2000; (2) Morgan Stanley which acquired Dean Witter (DEAN) back in 1997; (3) Deutsche Bank which acquired National Discount Brokers (SHWD, NDBC) in June of 2000; (4) Merrill Lynch acquired Herzog, Heine Geduld, LLC (HRZG) on June 6, 2000; (5) First Boston has an IPO sharing relationship with Charles Schwab (MASH, SCHB) that started in 1997. (6) J.P. Morgan has the same IPO sharing relationship and is a minority shareholder in Schwab Capital Markets (MASH, SCHB).

[INSERT Table XII HERE]

I look at upgrade and downgrades during the entire period of the company's linkage and find strong evidence for our upgrade pattern in Table XII across these subsidiaries. The Morgan Stanley-Dean Witter pairing is a strong one, and can be rejected as random at the 99.8% level. The Goldman Sachs-Spear Leeds relationship is also strong and can be rejected at the 95% level. At the 89% level or better, I can also identify a pattern in both Deutsche Bank and National Discount Brokers and Credit Suisse First Boston and Charles Schwab's Mayer Schweitzer. What is especially interesting about these results is that they include upgrades into 2001 as well. I found no significant links in the downgrade group, so these are not reported.

Including the subsidiary relationships, 15 of 42 market makers and 7 of the Spitzer 10 show significant market making analyst linkages: A. G. Edwards (AGED); Dain Rauscher (DAIN); Deutsche Bank (DBAB); Donaldson, Lufkin, Jenrette (DLJP); First Boston (FBCO); Goldman Sachs (GSCO); Hambrecht and Quest (HAMR); J.P. Morgan (JPMS); Legg Mason (LEGG); Lehman (LEHM); Merrill Lynch (MLCO); Morgan Stanley (MSCO); Piper Jaffray (PIPR); Robert-

son Stephens (RSSF); and William Blair (WBLR).

V.C By stock

I find the market making pattern prior to upgrades is present across a wide variety of stocks. Even though the analysis is restricted to large cap stocks in the Nasdaq 100, they are still a diverse group, with market capitalization from \$2 to \$200 billion. Trading activity also displays a wide range from an average of a half million shares a day in Panamsat Corp. (SPOT) to 107 million for Microsoft, (MSFT). Market maker competition is also diverse, from 32 for Paccar Inc. (PCAR) to 111 for Oracle (ORCL) and Cisco (CSCO).

[INSERT Table XIII HERE]

In 1999-2000, our significant bid pressure group from Table XIII includes Microsoft, Applied Materials (AMAT) and Yahoo (YHOO) among the larger caps, and Staples (SPLS), Biogen (BGEN), and Linear Technology (LLTC) among the smaller caps. Across the entire sample, I find bid pressure unrelated to market capitalization, number of market makers, or trading volume. The total number of recommendations does matter, so a more frequently covered stock is more likely to enter the group.

[INSERT Table XIV HERE]

In 2001, the significant upgrade group in Table XIV is entirely new with the exception of Applied Materials, our most frequently upgraded stock. Oracle is also highly significant. The only other stock at the 95% level is Chiron (CHIR). There is no significant relationship with any stock characteristics.

There are five stocks in Table XV which display significant ask pressure in 1999 and 2000 at the 95% level: Yahoo, Fiserv (FISV), Xilinx (XLNX), Apple (AAPL) and Linear Technology. Yahoo, Linear Technology and Applied Materials (which is significant at the 93% level) are notable, because they also appear on the upgrade bid pressure list for the same time period.

[INSERT Table XV and XVI HERE]

Linear Technology appears yet again in the downgrade list in Table XVI for 2001 at the 99.9% level. The other repeat stock is Microsoft at the 95% level. Microchip Technology (MCHP), Biogen (BGEN), Dell (DELL) and ADC Telecommunications (ADCT) appear for the first time and are significant at the 95% level or higher. None of the stock characteristics matter for the ask pressure

frequency in either time period.

I next turn to an analysis of the anonymous trading outlets available to Nasdaq market makers.

V.D ECN activity

One surprising aspect of these results is that Nasdaq market makers have the ability to quote anonymously through ECNs. The majority of institutional ECN trading takes place on the Instinet (INCA) network, even though Island¹⁶ had more liquidity during our sample period. This is partly due to Instinet's long term presence in the market, and because their order book is only visible in its entirety to subscribers. Archipelago (ARCA) which is owned partly by Goldman Sachs, J.P. Morgan and Merrill Lynch, among others, is the other ECN with substantial institutional liquidity.

Selling interest is more likely to be expressed through an ECN than through a market maker. INCA is unconditionally more likely to be an inside ask participant 55.14% of the time in 1999-2000. Conversely, our 42 market makers are more likely to be on the inside ask 50.1% of the time in 1999-2000.

[INSERT Table XVII HERE]

Despite having an ask side bias, Instinet appears to respond to upgrades in 1999 and 2000, although not as strongly as the market makers. Three and four weeks prior to an upgrade in Table XVII, INCA is more often on the inside bid than ask only 41.3% of the time. This increases to 46.5% two and one week prior to the upgrade. Comparing the later two weeks (-1 to -10) to the prior two weeks (-11 to -20), I detect the presence of inside bid pressure at the 99.8% level. Bid pressure remains strong for a month after the upgrade. The pre-upgrade pattern is not repeated in 2001.

[INSERT Table XVIII HERE]

There is some evidence for an increase in ask pressure in 1999 and 2000 for downgrades in Table XVIII. The inside ask presence increases from 52.9% to 56.9% from two weeks to one week prior, which is significant at the 92.5% level. This surge, however, is not statistically significant compared to the 58.5% inside ask presence four weeks prior. After a downgrade, there is some persistent inside ask activity. For two weeks, sell side pressure is over 61%. The pattern both before and after is not repeated in 2001.

A similar analysis for both Island and Archipelago revealed no significant patterns for either upgrades or downgrades.

I will devote the rest of my discussion now to what happens to the stock price and market making activity *after* the recommendation change has been made public.

VI. Returns

Given all of the recent publicity about analyst's conflict of interest, it may be surprising that Womack (1996) finds substantial investment value to brokerage industry recommendations in his 1989-1991 sample. Abnormal returns from the day before the event to one month after are 5.93% for upgrades and -5.38% for downgrades. Perhaps more surprising is that, especially for the downgrades, the returns are persistent. In the six months following the recommendation change, abnormal returns are 2.42% for upgrades and -6.42% for downgrades.

[INSERT Table XIX HERE]

Abnormal returns in my sample are summarized in Table XIX. My ex-post returns are similar to Womack's but less persistent for the downgrades. From one day before to four days after (-1 to 4) the recommendation change, upgrades have an abnormal return of 5.73% in 1999 and 2000. Even in the bear market year of 2001, these returns are positive, 5.00%. Downgrades also have a strong impact in the bull market years of 1999 and 2000, -7.24% . The downgrade returns in 2001 are nearly symmetric to the upgrades, -5.01% .

For the downgrades, I find that the entire return is in the first week. During the next three weeks, there is an abnormal *positive* return of 1.69% in 1999-2000. Even in the bear market of 2001, the three week abnormal return after one week is 0.86%. There are positive abnormal returns from 1 to 3 weeks after the upgrades, 0.32% in 1999-2000 and 1.70% in 2001.

VI.A Profitability analysis

There is little evidence that *ex-ante* market maker activity impacts *ex-ante* returns. In three of four cases though (with the exception of the upgrades in 1999 to 2000), stock prices do move in the direction of the recommendation change in the week prior.

I do find substantial evidence though that ex-ante market making activity does effect *ex-post* returns. In three cases (the exception are the downgrades in 1999-2000), pre- and post-change returns have the opposite sign. I also find that market maker bid activity raises ex-post returns for the upgrades. Finally, a sub-group of market makers that display significant pre-upgrade increases in inside bid frequency produce large abnormal returns.

I regress the abnormal return from one day before to four days after on the recommendation change on three explanatory variables and a constant. The results for the two upgrade and downgrade samples are in Table XX.

[INSERT Table XX HERE]

The first explanatory variable is the prior return from -5 to -1 days before. The two upgrade samples show mean reverting returns. A 1% increase in the week prior is associated with a -0.10% reduction in the ex-post return in 1999-2000, and -0.26% in 2001. Only the latter estimate is statistically significant though. Both downgrade prior return coefficients are insignificant as well.

To test the impact of market maker activity, I sum the difference between inside bid and ask counts in the five days prior to the recommendation change and use this as an excess demand regressor. The estimates for upgrades and downgrades in 1999 and 2000 are statistically significant. The upgrade regression suggests that if a market maker is on the inside bid 234 times more often than on the ask, there is a 1% higher ex-post return. The downgrade regression has the wrong sign: 148 net inside ask appearances *raise* the stock price ex-post by 1%. The sample estimates for upgrades and downgrades in 2001 for this variable are insignificantly different from zero.

Finally, I include a dummy variable for whether the market maker was significant at the 95% level in Tables VIII to XI. In the first case, I assign a dummy if the upgrading market maker is Merrill Lynch, First Boston, J.P. Morgan or William Blair. Their presence in 1999-2000 is associated with a 3.29% higher ex-post return. In 2001, the upgrade group is First Boston, A. G. Edwards Morgan Stanley and J.P. Morgan. They raise ex-post returns by 3.26%. The downgrade group, A.G. Edwards, Hambrecht Quest and Lehman Brothers in 1999-2000, and Merrill Lynch, Legg Mason, and Robertson Stephens in 2001, have a very small (under 0.5%) positive and insignificant impact on abnormal returns.

The last estimate I compute from this regression are the abnormal profits from market maker accumulation in the 1999-2000 time period. First, I compute the marginal abnormal return due to market maker activity by multiplying inside frequency counts times the elasticity in Table XX. I report aggregate results by market maker in Table XXI. The average marginal abnormal return for all market makers is 0.23%. The range is from 20.47% at the high for Robertson Stephens (RSSF) and to -5.86% at the low for Salomon Smith Barney (SBSH).

[INSERT Table XXI HERE]

I construct the dollar profitability estimates by first calculating bid or ask share¹⁷ in the security

from relative inside frequency counts. I then multiply that by the trading volume over the five days. Finally, I multiply by the five day return in the security times the dollar price on the close the day before the announcement. In total, I show profitability estimates of \$592 million for the 327 upgrades, or an average of \$1.81 million per upgrade.

The profits for individual firms in Table XXI present a slightly different picture than our statistical results in Tables VIII to XI. Most of our statistically important market makers also show large profits: First Boston with \$192 million and CIBC with \$65.5 million are among them. Our most active analyst-market making pair, Merrill Lynch, is actually estimated with a loss of -\$47.17 million¹⁸. Robertson Stephens, which is on the bid and offer in equal frequencies overall, instead shows a profit estimate of \$292 million.

VII. Conclusion

This paper looks at Nasdaq market making activity in the most liquid stocks in the month before and after analyst recommendation changes. I reject the null hypothesis that analysts and market makers act independently. On a given week before an upgrade in 1999-2000, I find that buying interest by market makers accelerates. This is true whether I measure how often a market maker enters the inside market, from the aggregate depth they provide on the inside, or whether trades tend to go off on the ask when they bid for shares. This is not a market wide phenomenon. A randomly selected market maker or analyst tends not to display a similar uptick in buying interest. Evidence from ECNs and market making subsidiaries reinforces these results. 15 of the 42 market makers studied show significant changes in their pre-recommendation liquidity provision.

The pre-upgrade activity influences ex-post returns. Aggregate stock returns are cumulatively more than 75% higher due to market maker activity in the upgrade events, an average of 0.23% per upgrade. I estimate aggregate market maker profits of almost \$600 million.

I can only speculate why the results appear to weaken in 2001. There are at least three possible explanations: (1) The bear market. Barber, Lehavy McNichols and Trueman (2003) note that returns to analysts picks deteriorated drastically in 2000-2001; (2) Regulation Fair Disclosure¹⁹ (Reg FD), which appears to increase the quantity of public information; (3) The Spitzer investigation. All three explanations are intermingled, but each would reduce the benefits of pre-upgrade accumulation.

The fact that conflicts appear to be present primarily on upgrades is consistent with the buy-

side bias on Wall Street. It seems reasonable to conclude, as do Michaely and Womack (1999, p.654) that “implicit pressure on analysts to ... maintain positive recommendations” may extend to market makers as well.

Overall this statistical evidence, while certainly not a smoking gun, questions the impartiality of both analysts and market makers. It merits further investigation by the appropriate regulatory agencies.

Paul Schultz (2003, p.72) questions in his analysis of the Nasdaq “why market making is typically bundled with brokerage, analyst coverage and underwriting in the same firm. Why are not these businesses separable?” He suggests that “one possibility is that the information generated in one of these activities is valuable in the others...” Our analysis supports this explanation and points to inherent problems in the Nasdaq microstructure that regulation alone may not be able to eliminate.

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Notes

¹The e-mail exchange is dated November 16, 2000, and was made public by the initial Spitzer investigation into conflicts just at Merrill Lynch. See <http://www.oag.state.ny.us/press/2002/apr/MerrillL.pdf>, exhibit (ML 09045). Blodgett gained notoriety for his bullish recommendations of Amazon.com. He left Merrill in December 2001, and was barred from the securities industry for life by the SEC.

²The reason for looking at Nasdaq stocks has nothing to do with a possible ethical gap between New York Stock Exchange specialists and Nasdaq market makers but rather the transparency of the Nasdaq microstructure.

³Michaely and Womack (1999) also note that proprietary trading can come into conflict with a market maker's best execution responsibility. This seems to be an inherent problem of the Nasdaq microstructure.

⁴It is also common practice for some of the commission revenue to be returned to the institutional client in the form of "soft dollars." This conflict between the mutual fund shareholders and management has recently come under scrutiny as well.

⁵For a discussion of the mechanics of the Level II display and short-run price discovery on the Nasdaq, see Mizrach (2002).

⁶Additional information on ECNs may be found in Hasbrouck and Saars (2002), Weston (2002), and Barclay, Hendershott, and McCormick (2001).

⁷This graphic is from the Nasdaq's TotalView display which provides the full order book of liquidity. It can be found at <http://viewsuite.nasdaqtrader.com/total.asp>. The Nasdaq database provides only the top market maker quote.

⁸A market maker who appears most frequently on the bid or ask is known among daytraders as "the ax."

⁹Mizrach (2002) shows that the number of market makers on the inside bid or offer matters more than the quoted depth for short term price discovery.

¹⁰There was substantial turnover during this time period though because of the dramatic rise and collapse of the technology stock market.

¹¹ATML and VTSS were dropped on December 23, 2002, but were included in the sample. USAI became IACI on June 23, 2003.

¹²ECNs have a much higher share of trades, around 35%, than of volume, because the ECNs, especially Island (ISLD), the largest ECN in our sample period and a favorite of daytraders, handle many small trades.

¹³The remaining market share is highly concentrated in retail oriented market makers like Knight-Trimark (NITE) which had market share of 7.188% in December 2000.

¹⁴The number of cases sometimes drops off with longer lags because the dealer may not have made markets in the security in the prior weeks. Some of the recommendations from January 1999 may also extend outside my sample of dealer quotes.

¹⁵I thank Roberto Rigobon for this suggestion.

¹⁶In May of 2001, Reuters took Instinet public and in September 2002, they acquired Island. The two ECNs continued to operate independently with different clienteles during the rest of my sample. In 2002, Archipelago (ARCA) became the second most liquid ECN.

¹⁷This is measured as percentage of the time on inside bid less the percentage on the inside ask, relative to all other market participants, summed over the 5 days prior to the recommendation change.

¹⁸The loss is due to two upgrades of Amazon.com on August 18, 1999 and February 3, 2000 which are estimated to have cost the firm -\$24.48 and -\$35.94 million, respectively.

¹⁹You can read more of the details on Reg FD at the SEC web site: <http://www.sec.gov/rules/final/33-7881.htm>. It was implemented on October 23, 2000. Heflin, Subramanyam and. Zhang (2003) find that post-earnings announcement price changes are smaller. Bailey, Li, Mao, and Zhong (2003) find that the quantity of public information increases.

Data Appendix A.1
Market Characteristics for Nasdaq 100 Stocks²⁰

| Company Name | Ticker | Market Cap | Daily Close | MMs | Volume |
|------------------------------|--------|------------|-------------|-----|---------|
| APPLE COMPUTER INC | AAPL | 4.9962 | 14.875 | 86 | 7.528 |
| ADOBE SYSTEMS INC | ADBE | 13.9850 | 58.188 | 59 | 4.371 |
| ADC TELECOMMUNICATIONS INC | ADCT | 13.9916 | 18.125 | 79 | 11.756 |
| ALTERA CORP | ALTR | 10.4310 | 26.313 | 73 | 7.121 |
| APPLIED MATERIALS INC | AMAT | 30.9752 | 38.188 | 88 | 34.581 |
| AMGEN INC | AMGN | 65.7216 | 63.938 | 77 | 6.687 |
| AMAZON.COM INC | AMZN | 5.5430 | 15.563 | 87 | 9.622 |
| ATMEL CORP | ATML | 5.4194 | 11.625 | 82 | 9.679 |
| BED BATH BEYOND INC | BBBY | 6.3232 | 22.375 | 57 | 4.108 |
| BIOGEN INC | BGEN | 9.0518 | 60.063 | 65 | 2.440 |
| BIOMET INC | BMET | 7.0599 | 26.458 | 70 | 2.272 |
| CHIRON CORP | CHIR | 7.9955 | 44.5 | 58 | 1.629 |
| COSTCO WHOLESALE CORP | COST | 17.8959 | 39.938 | 69 | 6.785 |
| COMPUWARE CORP | CPWR | 2.2823 | 6.25 | 57 | 3.496 |
| CISCO SYSTEMS INC | CSCO | 268.6623 | 38.25 | 111 | 75.053 |
| CINTAS CORP | CTAS | 8.9505 | 53.188 | 37 | 1.571 |
| CITRIX SYSTEMS INC | CTXS | 4.1787 | 22.5 | 73 | 4.236 |
| DELL COMPUTER CORP | DELL | 45.6299 | 17.438 | 100 | 41.356 |
| ERICSSON (L M) TEL -ADR | ERICY | 80.1665 | 11.188 | 84 | 1.346 |
| ELECTRONIC ARTS INC | ERTS | 5.5373 | 42.625 | 45 | 2.031 |
| FISERV INC | FISV | 5.8464 | 47.438 | 45 | 1.884 |
| GENZYME GENERAL | GENZ | 7.8442 | 44.969 | 49 | 3.937 |
| INTEL CORP | INTC | 202.3206 | 30.063 | 97 | 58.297 |
| INTUIT INC | INTU | 8.1601 | 39.438 | 59 | 5.744 |
| KLA-TENCOR CORP | KLAC | 6.2660 | 33.688 | 68 | 5.156 |
| LINEAR TECHNOLOGY CORP | LLTC | 14.6483 | 46.25 | 57 | 4.038 |
| MICROCHIP TECHNOLOGY INC | MCHP | 2.6048 | 21.938 | 47 | 3.187 |
| MOLEX INC | MOLX | 5.9723 | 35.5 | 38 | 0.823 |
| MICROSOFT CORP | MSFT | 231.2902 | 43.375 | 99 | 107.893 |
| MAXIM INTEGRATED PRODUCTS | MXIM | 13.6383 | 47.813 | 54 | 3.672 |
| NEXTEL COMMUNICATIONS | NXTL | 17.9611 | 24.75 | 70 | 9.991 |
| ORACLE CORP | ORCL | 162.6758 | 29.063 | 111 | 43.358 |
| PAYCHEX INC | PAYX | 18.0544 | 48.625 | 55 | 3.914 |
| PACCAR INC | PCAR | 3.7684 | 49.25 | 32 | 1.209 |
| PEOPLESOFT INC | PSFT | 10.6151 | 37.188 | 63 | 4.707 |
| QUALCOMM INC | QCOM | 61.5120 | 82.188 | 82 | 17.809 |
| STARBUCKS CORP | SBUX | 8.2097 | 22.125 | 65 | 4.117 |
| STAPLES INC | SPLS | 5.3508 | 11.813 | 65 | 6.613 |
| PANAMSAT CORP | SPOT | 5.1907 | 34.688 | 40 | 0.505 |
| SMURFIT-STONE CONTAINER CORP | SSCC | 3.6379 | 14.938 | 37 | 1.953 |
| SUN MICROSYSTEMS INC | SUNW | 89.7116 | 27.875 | 96 | 67.308 |
| TELLABS INC | TLAB | 23.1714 | 56.5 | 75 | 5.488 |
| USA NETWORKS INC | USAI | 5.8017 | 19.438 | 50 | 2.654 |
| VERITAS SOFTWARE CO | VRTS | 35.7567 | 87.5 | 67 | 11.584 |
| VITESSE SEMICONDUCTOR CORP | VTSS | 9.9353 | 55.313 | 72 | 6.758 |
| XILINX INC | XLNX | 15.2074 | 46.125 | 77 | 9.747 |
| YAHOO INC | YHOO | 16.5144 | 30.063 | 86 | 18.016 |

²⁰ Market capitalization is in billions of dollars. The average price is the monthly average of the daily closes.

The number of market makers is the total for the entire month. Volume is in millions of shares. All data are for December 2000.

Data Appendix A.2
Nasdaq Market Makers²¹

| Company | MMID | Merger date | Share | Up | Down |
|---|-------------|--------------------|--------------|-----------|-------------|
| ABN Amro Securities LLC | AANA | | 0.274 | 37 | 42 |
| Adams, Harkness Hill, Inc. | ADAM | | 0.242 | 6 | 7 |
| Advest, Inc. | ADVS | | 0.059 | 3 | 1 |
| A. G. Edwards Sons, Inc. | AGED | | 0.264 | 31 | 36 |
| Brown Brothers Harriman Co. | BBHC | | 0.000 | 3 | 4 |
| Sanford C. Bernstein Co., Inc. | BERN | | 0.000 | 6 | 6 |
| Bear, Stearns Co. Inc. | BEST | | 1.799 | 18 | 15 |
| C.E. Unterberg, Towbin | CEUT | | 0.131 | 3 | 6 |
| CIBC World Markets Corp. | OPCO, CIBC | 3-May-1999 | 0.910 | 23 | 17 |
| SG Cowen Securities Corporation | COWN | | 0.501 | 19 | 30 |
| RBC Dain Rauscher Inc. | DAIN | | 0.560 | 4 | 3 |
| Deutsche Bank Securities Inc. | DBKS, DBAB | 16-Jan-2001 | 1.832 | 19 | 23 |
| Donaldson, Lufkin, Jenrette | DLJP | | 0.072 | 11 | 7 |
| Dresdner Kleinwort Wasserstein Securities | DKNA, DRKW | 29-Jan-2001 | 0.003 | 2 | 11 |
| First Albany Corporation | FACT | | 0.059 | 9 | 4 |
| Credit Suisse First Boston LLC | FBCO | | 3.379 | 26 | 39 |
| Goldman, Sachs Co. | GSCO | | 3.502 | 20 | 13 |
| W.R. Hambrecht + Co., LLC | HAMR | | 0.063 | 22 | 24 |
| Investec Inc. | ITEC | | 0.000 | 2 | 3 |
| J. P. Morgan Securities | JPMS, JPHQ | 5-Jan-2001 | 0.680 | 20 | 27 |
| Kaufman Bros., L.P. | KBRO | | 0.019 | 2 | 2 |
| Legg Mason Wood Walker, Incorporated | LEGG | | 0.202 | 3 | 5 |
| Lehman Brothers Inc. | LEHM | | 2.319 | 14 | 21 |
| Merrill Lynch and Co. | MLCO | | 4.626 | 43 | 46 |
| Banc of America Securities LLC | MONT | | 1.958 | 23 | 32 |
| Morgan Stanley Co., Incorporated | MSCO | | 4.481 | 36 | 45 |
| Needham Company, Inc. | NEED | | 0.135 | 24 | 19 |
| U.S. Bancorp Piper Jaffray Inc. | PIPR | | 0.707 | 13 | 16 |
| Prudential Securities Incorporated | PRUS | | 1.034 | 36 | 26 |
| UBS PaineWebber Inc. | PWJC | | 0.861 | 12 | 10 |
| RBC Dominion Securities Corporation | RBCD | | 0.031 | 13 | 17 |
| Robertson Stephens, Inc. | RSSF | | 1.912 | 24 | 20 |
| The Seidler Companies Incorporated | SASI | | 0.009 | 1 | 1 |
| Citigroup Global Markets Inc. | SBSH | | 5.419 | 30 | 36 |
| Sands Brothers Co., Ltd. | SNDS | | 0.027 | 1 | 2 |
| Soundview Technology Corporation | SNDV | | 0.435 | 16 | 19 |
| Tucker Anthony Cleary Gull | TGUL | | 0.000 | 6 | 9 |
| Thomas Weisel Partners LLC | TWPT | | 0.737 | 7 | 15 |
| UBS Warburg | WARR, UBSW | 7-May-2001 | 1.540 | 24 | 26 |
| William Blair Company L.L.C. | WBLR | | 0.197 | 8 | 9 |
| Wachovia Securities, Inc. | WCHV | | 0.000 | 5 | 12 |
| Wells Fargo Securities, LLC | WELS | | 0.000 | 11 | 14 |

²¹ These are the 42 firms for whom I have analyst recommendations and market making combinations. MMID is the market maker identity observed in the Nasdaq database. Merger dates are the days in which the MMID changes in the Nasdaq database. Share is the market share of volume for that market maker in all Nasdaq national market securities for the month of December 2000. Up (Down) is the number of upgrades (downgrades) in the sample from the analyst firm.

Table I
Inside Market Maker Counts - Upgrades²²

| 1999-2000 | | | | | |
|------------------|------------|--------------|--------------|------------------|----------------|
| Begin | End | Press | Total | Frequency | p-value |
| -5 | -1 | 208 | 327 | 0.6361 | |
| -10 | -6 | 181 | 327 | 0.5535 | 0.0013 |
| -15 | -11 | 180 | 317 | 0.5678 | 0.0023 |
| -20 | -16 | 179 | 312 | 0.5737 | 0.0030 |
| 0 | 5 | 210 | 336 | 0.6250 | 0.5449 |
| 6 | 10 | 208 | 336 | 0.6190 | 0.4553 |
| 11 | 15 | 216 | 336 | 0.6429 | 0.7873 |
| 16 | 20 | 203 | 336 | 0.6042 | 0.2516 |
| 2001 | | | | | |
| Begin | End | Press | Total | Frequency | p-value |
| -5 | -1 | 101 | 179 | 0.5642 | |
| -10 | -6 | 101 | 179 | 0.5642 | 0.5000 |
| -15 | -11 | 108 | 177 | 0.6102 | 0.9173 |
| -20 | -16 | 109 | 177 | 0.6158 | 0.9389 |
| 0 | 5 | 121 | 179 | 0.6760 | 0.9993 |
| 6 | 10 | 109 | 178 | 0.6124 | 0.9169 |
| 11 | 15 | 113 | 178 | 0.6348 | 0.9785 |
| 16 | 20 | 96 | 178 | 0.5393 | 0.2738 |

²² The frequency is the ratio of market makers whose inside bid counts trades exceed inside ask counts. The p -value is the probability of observing the inside frequency counts in the week prior to the recommendation change given the frequency for the reference week.

Table II
Inside Market Maker Counts - Downgrades²³

1999-2000

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 128 | 327 | 0.3914 | |
| -10 | -6 | 131 | 327 | 0.4006 | 0.6325 |
| -15 | -11 | 133 | 321 | 0.4143 | 0.8461 |
| -20 | -16 | 118 | 318 | 0.3711 | 0.2808 |
| 0 | 5 | 153 | 334 | 0.4581 | 0.9860 |
| 6 | 10 | 126 | 334 | 0.3772 | 0.2147 |
| 11 | 15 | 134 | 333 | 0.4024 | 0.5445 |
| 16 | 20 | 137 | 333 | 0.4114 | 0.6720 |

2001

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 93 | 259 | 0.3591 | |
| -10 | -6 | 100 | 259 | 0.3861 | 0.8142 |
| -15 | -11 | 107 | 259 | 0.4131 | 0.9614 |
| -20 | -16 | 104 | 259 | 0.4015 | 0.9184 |
| 0 | 5 | 128 | 259 | 0.4942 | 1.0000 |
| 6 | 10 | 105 | 257 | 0.4086 | 0.9505 |
| 11 | 15 | 116 | 257 | 0.4514 | 0.9987 |
| 16 | 20 | 93 | 255 | 0.3647 | 0.5518 |

²³ The frequency is the ratio of market makers whose inside ask counts exceed inside bid counts. The p -value is the probability of observing the inside frequency counts in the week prior to the recommendation change given the frequency for the reference week.

Table III
Inside Market Maker Liquidity - Upgrades²⁴

1999-2000

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 201 | 327 | 0.6147 | |
| -10 | -6 | 173 | 327 | 0.5291 | 0.0010 |
| -15 | -11 | 171 | 317 | 0.5394 | 0.0012 |
| -20 | -16 | 162 | 312 | 0.5192 | 0.0001 |
| 0 | 5 | 206 | 336 | 0.6131 | 0.6729 |
| 6 | 10 | 190 | 336 | 0.5655 | 0.0933 |
| 11 | 15 | 197 | 336 | 0.5863 | 0.2898 |
| 16 | 20 | 196 | 336 | 0.5833 | 0.2534 |

2001

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 105 | 179 | 0.5866 | |
| -10 | -6 | 92 | 179 | 0.5140 | 0.0259 |
| -15 | -11 | 108 | 177 | 0.6102 | 0.7795 |
| -20 | -16 | 105 | 177 | 0.5932 | 0.6202 |
| 0 | 5 | 117 | 179 | 0.6536 | 0.9703 |
| 6 | 10 | 100 | 178 | 0.5618 | 0.2728 |
| 11 | 15 | 106 | 178 | 0.5955 | 0.6200 |
| 16 | 20 | 91 | 178 | 0.5112 | 0.0256 |

²⁴ The frequency is the ratio of market makers whose aggregate inside bid depth exceeds their inside ask depth. The p -value is the probability of observing the inside frequency counts in the week prior to the recommendation change given the frequency for the reference week.

Table IV
Inside Market Maker Liquidity - Downgrades²⁵

1999-2000

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 134 | 327 | 0.4098 | |
| -10 | -6 | 139 | 327 | 0.4251 | 0.7120 |
| -15 | -11 | 140 | 321 | 0.4361 | 0.8698 |
| -20 | -16 | 138 | 318 | 0.4340 | 0.8457 |
| 0 | 5 | 159 | 334 | 0.4760 | 0.9858 |
| 6 | 10 | 133 | 334 | 0.3982 | 0.2512 |
| 11 | 15 | 148 | 333 | 0.4444 | 0.8395 |
| 16 | 20 | 141 | 333 | 0.4234 | 0.5878 |

2001

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 99 | 259 | 0.3822 | |
| -10 | -6 | 99 | 259 | 0.3822 | 0.5000 |
| -15 | -11 | 112 | 259 | 0.4324 | 0.9485 |
| -20 | -16 | 104 | 259 | 0.4015 | 0.7369 |
| 0 | 5 | 136 | 259 | 0.5251 | 1.0000 |
| 6 | 10 | 125 | 257 | 0.4864 | 0.9996 |
| 11 | 15 | 124 | 257 | 0.4825 | 0.9994 |
| 16 | 20 | 108 | 255 | 0.4235 | 0.8975 |

²⁵ The frequency is the ratio of market makers whose aggregate inside ask depth exceeds their inside bid depth. The *p*-value is the probability of observing the inside frequency counts in the week prior to the recommendation change given the frequency for the reference week.

Table V
Trading Activity - Upgrades²⁶

1999-2000

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 202 | 327 | 0.6177 | |
| -10 | -6 | 176 | 327 | 0.5382 | 0.0020 |
| -15 | -11 | 176 | 317 | 0.5552 | 0.0047 |
| -20 | -16 | 164 | 312 | 0.5256 | 0.0001 |
| 0 | 5 | 210 | 336 | 0.6250 | 0.7134 |
| 6 | 10 | 199 | 336 | 0.5863 | 0.2527 |
| 11 | 15 | 202 | 336 | 0.6012 | 0.3691 |
| 16 | 20 | 216 | 336 | 0.6429 | 0.8948 |

2001

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 102 | 179 | 0.5698 | |
| -10 | -6 | 92 | 179 | 0.5140 | 0.0674 |
| -15 | -11 | 107 | 177 | 0.6045 | 0.8218 |
| -20 | -16 | 98 | 177 | 0.5537 | 0.3251 |
| 0 | 5 | 113 | 179 | 0.6313 | 0.9558 |
| 6 | 10 | 91 | 178 | 0.5112 | 0.0669 |
| 11 | 15 | 95 | 178 | 0.5337 | 0.1837 |
| 16 | 20 | 98 | 178 | 0.5506 | 0.3256 |

²⁶ The frequency is the ratio of market makers whose buyer initiated trades exceed seller trades. The p -value is the probability of observing the inside frequency counts in the week prior to the recommendation change given the frequency for the reference week.

Table VI
Trading Activity - Downgrades²⁷

1999-2000

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 116 | 327 | 0.3547 | |
| -10 | -6 | 120 | 327 | 0.3670 | 0.6769 |
| -15 | -11 | 119 | 321 | 0.3707 | 0.7560 |
| -20 | -16 | 113 | 318 | 0.3553 | 0.5926 |
| 0 | 5 | 146 | 334 | 0.4371 | 0.9986 |
| 6 | 10 | 129 | 334 | 0.3862 | 0.8695 |
| 11 | 15 | 139 | 333 | 0.4174 | 0.9869 |
| 16 | 20 | 126 | 333 | 0.3784 | 0.7855 |

2001

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 94 | 259 | 0.3629 | |
| -10 | -6 | 92 | 259 | 0.3552 | 0.3976 |
| -15 | -11 | 103 | 259 | 0.3977 | 0.8734 |
| -20 | -16 | 96 | 259 | 0.3707 | 0.6015 |
| 0 | 5 | 109 | 259 | 0.4208 | 0.9705 |
| 6 | 10 | 102 | 257 | 0.3969 | 0.8744 |
| 11 | 15 | 108 | 257 | 0.4202 | 0.9710 |
| 16 | 20 | 109 | 255 | 0.4275 | 0.9786 |

²⁷ The frequency is the ratio of market makers whose seller initiated trades exceed buyer trades. The p -value is the probability of observing the inside frequency counts in the week prior to the recommendation change given the frequency for the reference week.

Table VII
Random Market Maker Inside Bid Counts - Upgrades 1999-2000²⁸

All Market Makers

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 179 | 327 | 0.5474 | 0.0006 |
| -10 | -6 | 176 | 327 | 0.5382 | 0.0002 |
| -15 | -11 | 161 | 316 | 0.5095 | 0.0000 |
| -20 | -16 | 163 | 311 | 0.5241 | 0.0000 |
| 0 | 5 | 167 | 336 | 0.4970 | 0.0000 |
| 6 | 10 | 158 | 336 | 0.4702 | 0.0000 |
| 11 | 15 | 181 | 336 | 0.5387 | 0.0002 |
| 16 | 20 | 165 | 336 | 0.4911 | 0.0000 |

Market Maker Analyst Pairs

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 177 | 317 | 0.5584 | 0.0023 |
| -10 | -6 | 179 | 317 | 0.5647 | 0.0046 |
| -15 | -11 | 168 | 305 | 0.5508 | 0.0010 |
| -20 | -16 | 182 | 303 | 0.6007 | 0.0957 |
| 0 | 5 | 187 | 327 | 0.5719 | 0.0095 |
| 6 | 10 | 175 | 327 | 0.5352 | 0.0001 |
| 11 | 15 | 180 | 327 | 0.5505 | 0.0009 |
| 16 | 20 | 196 | 327 | 0.5994 | 0.0878 |

²⁸ The frequency is the ratio of market makers whose inside bid counts exceed inside ask counts. The *p*-value is the probability of observing the inside frequency counts from Table I in the week prior to the recommendation change using the randomly selected market maker bid frequencies.

Table VIII
Inside Quote Activity by Market Maker Upgrades 1999-2000²⁹

| MM | Total | Bid Press | Control | p-value |
|------|-------|-----------|---------|---------|
| MLCO | 29 | 18 | 12 | 0.0118 |
| FBCO | 13 | 10 | 6 | 0.0130 |
| JPMS | 6 | 4 | 2 | 0.0416 |
| WBLR | 6 | 4 | 2 | 0.0416 |
| PIPR | 6 | 5 | 3 | 0.0512 |
| AGED | 7 | 6 | 4 | 0.0633 |
| DLJP | 10 | 8 | 6 | 0.0984 |
| GSCO | 10 | 7 | 5 | 0.1030 |
| FACT | 3 | 3 | 2 | 0.1103 |
| CIBC | 12 | 8 | 6 | 0.1241 |
| SBSH | 19 | 10 | 8 | 0.1764 |
| NEED | 11 | 8 | 7 | 0.2654 |
| BEST | 12 | 7 | 6 | 0.2819 |
| MSCO | 24 | 15 | 14 | 0.3394 |
| ABNA | 24 | 17 | 17 | 0.5000 |
| ADAM | 3 | 2 | 2 | 0.5000 |
| COWN | 13 | 8 | 8 | 0.5000 |
| HAMR | 5 | 3 | 3 | 0.5000 |
| LEHM | 10 | 6 | 6 | 0.5000 |
| MONT | 16 | 10 | 10 | 0.5000 |
| PRUS | 26 | 17 | 17 | 0.5000 |
| PWJC | 10 | 6 | 6 | 0.5000 |
| TWPT | 2 | 1 | 1 | 0.5000 |
| RSSF | 17 | 11 | 12 | 0.7027 |
| SNDV | 12 | 4 | 5 | 0.7209 |
| UBSW | 9 | 5 | 6 | 0.7602 |
| DBAB | 5 | 2 | 3 | 0.8193 |
| ADVS | 1 | 1 | 1 | 1.0000 |
| BBHC | 0 | 0 | 0 | 1.0000 |
| BERN | 0 | 0 | 0 | 1.0000 |
| CEUT | 2 | 1 | 0 | 1.0000 |
| DAIN | 2 | 1 | 0 | 1.0000 |
| DRKW | 0 | 0 | 0 | 1.0000 |
| ITEC | 0 | 0 | 0 | 1.0000 |
| KBRO | 0 | 0 | 0 | 1.0000 |
| LEGG | 1 | 0 | 1 | 1.0000 |
| RBCD | 0 | 0 | 0 | 1.0000 |
| SASI | 1 | 0 | 0 | 1.0000 |
| SNDS | 0 | 0 | 0 | 1.0000 |
| TGUL | 0 | 0 | 0 | 1.0000 |
| WCHV | 0 | 0 | 0 | 1.0000 |
| WELS | 0 | 0 | 0 | 1.0000 |

²⁹ Total is the total number of upgrades. Bid Press is the number of times the inside bid count exceeds the inside ask count in the week prior to the upgrade. Control is the same count in the period two weeks prior. The *p*-value is the probability of observing the first count given the frequency in the control group week.

Table IX
Inside Quote Activity by Market Maker Upgrades 2001³⁰

| MM | Total | Bid Press | Control | p-value |
|------|-------|-----------|---------|---------|
| FBCO | 11 | 10 | 4 | 0.0001 |
| AGED | 7 | 7 | 4 | 0.0110 |
| MSCO | 11 | 7 | 4 | 0.0300 |
| JPMS | 13 | 8 | 5 | 0.0436 |
| DAIN | 2 | 2 | 1 | 0.0786 |
| ABNA | 3 | 2 | 1 | 0.1103 |
| CIBC | 9 | 6 | 6 | 0.5000 |
| FACT | 5 | 3 | 3 | 0.5000 |
| MLCO | 12 | 5 | 5 | 0.5000 |
| MONT | 5 | 3 | 3 | 0.5000 |
| PRUS | 10 | 5 | 5 | 0.5000 |
| RSSF | 7 | 4 | 4 | 0.5000 |
| SBSH | 11 | 5 | 6 | 0.7276 |
| GSCO | 10 | 7 | 8 | 0.7854 |
| UBSW | 11 | 3 | 5 | 0.8871 |
| NEED | 13 | 8 | 10 | 0.9060 |
| COWN | 5 | 0 | 3 | 0.9969 |
| ADAM | 1 | 0 | 1 | 1.0000 |
| ADVS | 0 | 0 | 0 | 1.0000 |
| BBHC | 0 | 0 | 0 | 1.0000 |
| BERN | 0 | 0 | 0 | 1.0000 |
| BEST | 6 | 1 | 5 | 1.0000 |
| CEUT | 1 | 0 | 1 | 1.0000 |
| DBAB | 2 | 1 | 2 | 1.0000 |
| DLJP | 0 | 0 | 0 | 1.0000 |
| DRKW | 1 | 0 | 1 | 1.0000 |
| HAMR | 2 | 1 | 2 | 1.0000 |
| ITEC | 0 | 0 | 0 | 1.0000 |
| KBRO | 1 | 0 | 0 | 1.0000 |
| LEGG | 2 | 1 | 2 | 1.0000 |
| LEHM | 4 | 1 | 4 | 1.0000 |
| PIPR | 5 | 4 | 3 | 1.0000 |
| PWJC | 0 | 0 | 0 | 1.0000 |
| RBCD | 0 | 0 | 0 | 1.0000 |
| SASI | 0 | 0 | 0 | 1.0000 |
| SNDS | 0 | 0 | 0 | 1.0000 |
| SNDV | 3 | 2 | 3 | 1.0000 |
| TGUL | 0 | 0 | 0 | 1.0000 |
| TWPT | 5 | 5 | 0 | 1.0000 |
| WBLR | 1 | 0 | 0 | 1.0000 |
| WCHV | 0 | 0 | 0 | 1.0000 |
| WELS | 0 | 0 | 0 | 1.0000 |

³⁰ Total is the total number of upgrades. Bid Press is the number of times the inside bid count exceeds the inside ask count in the week prior to the upgrade. Control is the same count in the period two weeks prior. The p -value is the probability of observing the first count given the frequency in the control group week.

Table X
Inside Quote Activity by Market Maker Downgrades 1999-2000³¹

| MM | Total | Ask Press | Control | p-value |
|------|-------|-----------|---------|---------|
| AGED | 11 | 8 | 4 | 0.0061 |
| HAMR | 8 | 3 | 1 | 0.0163 |
| LEHM | 12 | 6 | 3 | 0.0228 |
| PIPR | 7 | 5 | 3 | 0.0633 |
| MSCO | 25 | 13 | 10 | 0.1103 |
| ABNA | 18 | 6 | 4 | 0.1284 |
| TWPT | 6 | 2 | 1 | 0.1367 |
| DBAB | 7 | 2 | 1 | 0.1400 |
| CIBC | 5 | 3 | 2 | 0.1807 |
| SBSH | 21 | 10 | 9 | 0.3296 |
| MLCO | 26 | 15 | 14 | 0.3470 |
| CEUT | 4 | 2 | 2 | 0.5000 |
| COWN | 17 | 8 | 8 | 0.5000 |
| DLJP | 7 | 2 | 2 | 0.5000 |
| JPMS | 10 | 4 | 4 | 0.5000 |
| NEED | 9 | 2 | 2 | 0.5000 |
| SNDV | 12 | 7 | 7 | 0.5000 |
| BEST | 11 | 4 | 5 | 0.7276 |
| PWJC | 10 | 2 | 3 | 0.7549 |
| GSCO | 7 | 2 | 3 | 0.7775 |
| FBCO | 18 | 6 | 8 | 0.8286 |
| PRUS | 14 | 3 | 5 | 0.8677 |
| UBSW | 9 | 1 | 3 | 0.9214 |
| RSSF | 8 | 1 | 3 | 0.9279 |
| WBLR | 7 | 2 | 4 | 0.9367 |
| MONT | 26 | 5 | 14 | 0.9998 |
| ADAM | 2 | 1 | 2 | 1.0000 |
| ADVS | 0 | 0 | 0 | 1.0000 |
| BBHC | 0 | 0 | 0 | 1.0000 |
| BERN | 0 | 0 | 0 | 1.0000 |
| DAIN | 3 | 0 | 3 | 1.0000 |
| DRKW | 0 | 0 | 0 | 1.0000 |
| FACT | 0 | 0 | 0 | 1.0000 |
| ITEC | 0 | 0 | 0 | 1.0000 |
| KBRO | 1 | 0 | 0 | 1.0000 |
| LEGG | 1 | 0 | 0 | 1.0000 |
| RAJA | 2 | 2 | 0 | 1.0000 |
| SASI | 1 | 0 | 0 | 1.0000 |
| SNDS | 1 | 1 | 0 | 1.0000 |
| TGUL | 1 | 0 | 1 | 1.0000 |
| WCHV | 0 | 0 | 0 | 1.0000 |
| WELS | 0 | 0 | 0 | 1.0000 |

³¹ Total is the total number of upgrades. Ask Press is the number of times the inside ask count exceeds the inside bid count in the week prior to the upgrade. Control is the same count in the period two weeks prior. The *p*-value is the probability of observing the first count given the frequency in the control group week.

Table XI
Inside Quote Activity by Market Maker Downgrades 2001³²

| MM | Total | Ask Press | Control | p-value |
|------|-------|-----------|---------|---------|
| MLCO | 20 | 11 | 5 | 0.0010 |
| LEGG | 4 | 3 | 1 | 0.0105 |
| RSSF | 12 | 7 | 4 | 0.0331 |
| BEST | 3 | 2 | 1 | 0.1103 |
| NEED | 9 | 2 | 1 | 0.1444 |
| MSCO | 20 | 9 | 7 | 0.1742 |
| LEHM | 8 | 4 | 3 | 0.2326 |
| JPMS | 17 | 6 | 6 | 0.5000 |
| SNDV | 6 | 2 | 2 | 0.5000 |
| UBSW | 16 | 8 | 8 | 0.5000 |
| ABNA | 12 | 4 | 5 | 0.7209 |
| CIBC | 9 | 3 | 4 | 0.7488 |
| TWPT | 9 | 3 | 4 | 0.7488 |
| MONT | 5 | 1 | 2 | 0.8193 |
| SBSH | 14 | 3 | 5 | 0.8677 |
| DRKW | 4 | 0 | 1 | 0.8759 |
| FACT | 4 | 0 | 1 | 0.8759 |
| PRUS | 12 | 2 | 4 | 0.8897 |
| FBCO | 21 | 8 | 11 | 0.9050 |
| PIPR | 9 | 2 | 4 | 0.9101 |
| GSCO | 6 | 1 | 3 | 0.9488 |
| COWN | 12 | 5 | 8 | 0.9669 |
| HAMR | 4 | 0 | 2 | 0.9772 |
| DBAB | 9 | 1 | 4 | 0.9779 |
| ADAM | 4 | 1 | 3 | 0.9895 |
| ADVS | 0 | 0 | 0 | 1.0000 |
| AGED | 7 | 4 | 0 | 1.0000 |
| BBHC | 0 | 0 | 0 | 1.0000 |
| BERN | 0 | 0 | 0 | 1.0000 |
| CEUT | 1 | 0 | 0 | 1.0000 |
| DAIN | 0 | 0 | 0 | 1.0000 |
| DLJP | 0 | 0 | 0 | 1.0000 |
| ITEC | 0 | 0 | 0 | 1.0000 |
| KBRO | 0 | 0 | 0 | 1.0000 |
| PWJC | 0 | 0 | 0 | 1.0000 |
| RBCD | 0 | 0 | 0 | 1.0000 |
| SASI | 0 | 0 | 0 | 1.0000 |
| SNDS | 0 | 0 | 0 | 1.0000 |
| TGUL | 0 | 0 | 0 | 1.0000 |
| WBLR | 1 | 0 | 1 | 1.0000 |
| WCHV | 1 | 1 | 0 | 1.0000 |
| WELS | 0 | 0 | 0 | 1.0000 |

³² Total is the total number of upgrades. Ask Press is the number of times the inside ask count exceeds the inside bid count in the week prior to the upgrade. Control is the same count in the period two weeks prior. The *p*-value is the probability of observing the first count given the frequency in the control group week.

Table XII
Bid Pressure by Market Making Subsidiaries: Upgrades³³

| Analyst | Subsidiary | Date Eff. | Pairs | Pressure | p-value |
|----------------|-------------------|------------------|--------------|-----------------|----------------|
| MSCO | DEAN | 01-01-1999 | 14 | 9 | 0.0015 |
| DBAB | NDBC | 01-07-2000 | 2 | 2 | 0.0787 |
| JPMS | MASH | 01-01-1999 | 19 | 13 | 0.3172 |
| FBCO | MASH | 01-01-1999 | 24 | 17 | 0.1071 |
| MLCO | HRZG | 06-06-2000 | 16 | 11 | 0.0668 |
| GSCO | SLKC | 11-09-2000 | 11 | 10 | 0.0300 |

³³ Date effective is January 1, 1999 if the merger took place before our sample started. Pairs is the number of upgrades in which the subsidiary made markets. Pressure is the number of times the inside bid count exceeded the inside ask count for the subsidiary market maker. The p -value is based on the two weeks prior frequency of the market maker being on the inside.

Table XIII
Inside Quote Activity by Stock: Upgrades 1999-2000³⁴

| Stock | Total | Bid Press | Control | p-value |
|-------|-------|-----------|---------|---------|
| SPLS | 7 | 5 | 1 | 0.0000 |
| QCOM | 7 | 6 | 2 | 0.0004 |
| BGEN | 5 | 3 | 1 | 0.0127 |
| LLTC | 8 | 6 | 3 | 0.0142 |
| AMAT | 15 | 13 | 9 | 0.0175 |
| MSFT | 5 | 4 | 2 | 0.0339 |
| YHOO | 7 | 4 | 2 | 0.0471 |
| TLAB | 6 | 5 | 3 | 0.0512 |
| ORCL | 16 | 10 | 7 | 0.0653 |
| CTAS | 2 | 2 | 1 | 0.0786 |
| PSFT | 9 | 5 | 3 | 0.0786 |
| PAYX | 3 | 2 | 1 | 0.1103 |
| SBUX | 12 | 8 | 6 | 0.1241 |
| VTSS | 4 | 4 | 3 | 0.1241 |
| SSCC | 5 | 5 | 4 | 0.1318 |
| SPOT | 6 | 6 | 5 | 0.1367 |
| ERICY | 16 | 8 | 6 | 0.1508 |
| DELL | 16 | 11 | 9 | 0.1568 |
| INTC | 18 | 13 | 11 | 0.1668 |
| ADBE | 5 | 3 | 2 | 0.1807 |
| PCAR | 6 | 3 | 2 | 0.1932 |
| KLAC | 8 | 5 | 4 | 0.2398 |
| ATML | 5 | 3 | 3 | 0.5000 |
| BMET | 4 | 3 | 3 | 0.5000 |
| CHIR | 4 | 3 | 3 | 0.5000 |
| COST | 5 | 3 | 3 | 0.5000 |
| FISV | 4 | 3 | 3 | 0.5000 |
| INTU | 4 | 3 | 3 | 0.5000 |
| MCHP | 7 | 4 | 4 | 0.5000 |
| MOLX | 3 | 2 | 2 | 0.5000 |
| MXIM | 4 | 3 | 3 | 0.5000 |
| NXTL | 6 | 4 | 4 | 0.5000 |
| VRTS | 6 | 3 | 3 | 0.5000 |
| SUNW | 10 | 5 | 6 | 0.7407 |
| GENZ | 8 | 4 | 5 | 0.7674 |
| AAPL | 13 | 10 | 11 | 0.7790 |
| BBBY | 5 | 3 | 4 | 0.8682 |
| XLNX | 11 | 2 | 4 | 0.8950 |
| ADCT | 8 | 4 | 6 | 0.9488 |
| AMGN | 6 | 1 | 3 | 0.9488 |
| AMZN | 9 | 3 | 6 | 0.9831 |
| ALTR | 13 | 6 | 10 | 0.9958 |
| CPWR | 0 | 0 | 0 | 1.0000 |
| CSCO | 1 | 0 | 0 | 1.0000 |
| CTXS | 4 | 4 | 4 | 1.0000 |
| ERTS | 0 | 0 | 0 | 1.0000 |
| USAI | 1 | 1 | 1 | 1.0000 |

³⁴ Total is the total number of upgrades. Bid press is the number of times the inside bid count exceeds the inside ask count in the week prior to the upgrade. Control is the same count in the period two weeks prior. The *p*-value is the probability of observing the first count given the frequency in the control group week.

Table XIV
Inside Quote Activity by Stock: Upgrades 2001³⁵

| Stock | Total | Bid Press | Control | p-value |
|-------|-------|-----------|---------|---------|
| ORCL | 8 | 8 | 3 | 0.0001 |
| AMAT | 13 | 12 | 7 | 0.0027 |
| CHIR | 4 | 4 | 2 | 0.0228 |
| CTAS | 2 | 2 | 1 | 0.0786 |
| PAYX | 2 | 2 | 1 | 0.0786 |
| INTC | 10 | 6 | 4 | 0.0984 |
| AMGN | 3 | 2 | 1 | 0.1103 |
| GENZ | 3 | 2 | 1 | 0.1103 |
| CTXS | 4 | 3 | 2 | 0.1587 |
| NXTL | 5 | 4 | 3 | 0.1807 |
| DELL | 10 | 4 | 3 | 0.2451 |
| AAPL | 2 | 1 | 1 | 0.5000 |
| COST | 3 | 1 | 1 | 0.5000 |
| LLTC | 2 | 1 | 1 | 0.5000 |
| MCHP | 2 | 1 | 1 | 0.5000 |
| MXIM | 2 | 1 | 1 | 0.5000 |
| PCAR | 2 | 1 | 1 | 0.5000 |
| USAI | 4 | 1 | 1 | 0.5000 |
| VRTS | 6 | 3 | 3 | 0.5000 |
| VTSS | 10 | 6 | 6 | 0.5000 |
| PSFT | 7 | 3 | 4 | 0.7775 |
| QCOM | 7 | 2 | 3 | 0.7775 |
| MSFT | 6 | 2 | 3 | 0.7929 |
| BBBY | 5 | 3 | 4 | 0.8682 |
| BMET | 5 | 3 | 4 | 0.8682 |
| INTU | 3 | 1 | 2 | 0.8897 |
| KLAC | 9 | 4 | 6 | 0.9214 |
| ALTR | 5 | 1 | 3 | 0.9661 |
| ERTS | 4 | 0 | 2 | 0.9772 |
| CSCO | 9 | 4 | 7 | 0.9919 |
| YHOO | 6 | 2 | 5 | 0.9995 |
| ADBE | 2 | 1 | 2 | 1.0000 |
| ADCT | 0 | 0 | 0 | 1.0000 |
| AMZN | 2 | 1 | 2 | 1.0000 |
| ATML | 1 | 1 | 0 | 1.0000 |
| BGEN | 1 | 1 | 1 | 1.0000 |
| CPWR | 0 | 0 | 0 | 1.0000 |
| ERICY | 1 | 1 | 1 | 1.0000 |
| FISV | 1 | 1 | 1 | 1.0000 |
| MOLX | 0 | 0 | 0 | 1.0000 |
| SBUX | 0 | 0 | 0 | 1.0000 |
| SPLS | 1 | 0 | 0 | 1.0000 |
| SPOT | 0 | 0 | 0 | 1.0000 |
| SSCC | 0 | 0 | 0 | 1.0000 |
| SUNW | 4 | 3 | 4 | 1.0000 |
| TLAB | 0 | 0 | 0 | 1.0000 |
| XLNX | 3 | 2 | 3 | 1.0000 |

³⁵ Total is the total number of upgrades. Bid press is the number of times the inside bid count exceeds the inside ask count in the week prior to the upgrade. Control is the same count in the period two weeks prior. The p -value is the probability of observing the first count given the frequency in the control group week.

Table XV
Inside Quote Activity by Stock: Downgrades 1999-2000³⁶

| Stock | Total | Ask Press | Control | p-value |
|-------|-------|-----------|---------|---------|
| YHOO | 11 | 5 | 2 | 0.0095 |
| FISV | 5 | 3 | 1 | 0.0127 |
| XLNX | 12 | 6 | 3 | 0.0228 |
| AAPL | 14 | 7 | 4 | 0.0380 |
| LLTC | 6 | 4 | 2 | 0.0416 |
| ERICY | 9 | 4 | 2 | 0.0544 |
| AMAT | 15 | 4 | 2 | 0.0644 |
| SSCC | 3 | 2 | 1 | 0.1103 |
| BBBY | 4 | 4 | 3 | 0.1241 |
| CTAS | 4 | 4 | 3 | 0.1241 |
| SUNW | 9 | 2 | 1 | 0.1444 |
| INTC | 18 | 7 | 5 | 0.1463 |
| DELL | 21 | 9 | 7 | 0.1773 |
| AMGN | 6 | 4 | 3 | 0.2071 |
| VTSS | 7 | 4 | 3 | 0.2225 |
| ADCT | 5 | 1 | 1 | 0.5000 |
| AMZN | 12 | 3 | 3 | 0.5000 |
| BGEN | 10 | 6 | 6 | 0.5000 |
| NXTL | 4 | 2 | 2 | 0.5000 |
| ORCL | 12 | 6 | 6 | 0.5000 |
| SBUX | 14 | 7 | 7 | 0.5000 |
| VRTS | 3 | 1 | 1 | 0.5000 |
| ALTR | 12 | 4 | 5 | 0.7209 |
| MSFT | 9 | 2 | 3 | 0.7602 |
| SPLS | 9 | 2 | 3 | 0.7602 |
| MCHP | 6 | 2 | 3 | 0.7929 |
| ERTS | 5 | 2 | 3 | 0.8193 |
| COST | 3 | 0 | 1 | 0.8897 |
| PAYX | 3 | 1 | 2 | 0.8897 |
| SPOT | 10 | 3 | 5 | 0.8970 |
| QCOM | 7 | 2 | 4 | 0.9367 |
| PCAR | 6 | 2 | 4 | 0.9584 |
| KLAC | 11 | 3 | 6 | 0.9654 |
| CHIR | 5 | 0 | 2 | 0.9661 |
| GENZ | 6 | 2 | 5 | 0.9995 |
| CTXS | 4 | 0 | 3 | 0.9997 |
| MXIM | 4 | 0 | 3 | 0.9997 |
| ADBE | 3 | 2 | 3 | 1.0000 |
| ATML | 3 | 1 | 0 | 1.0000 |
| BMET | 2 | 1 | 0 | 1.0000 |
| CPWR | 0 | 0 | 0 | 1.0000 |
| CSCO | 1 | 1 | 1 | 1.0000 |
| INTU | 3 | 0 | 3 | 1.0000 |
| MOLX | 2 | 0 | 2 | 1.0000 |
| PSFT | 1 | 0 | 0 | 1.0000 |
| TLAB | 6 | 3 | 0 | 1.0000 |
| USAI | 2 | 0 | 2 | 1.0000 |

³⁶ Total is the total number of downgrades. Ask press is the number of times the inside ask count exceeds the inside bid count in the week prior to the upgrade. Control is the same count in the period two weeks prior. The *p*-value is the probability of observing the first count given the frequency in the control group week.

Table XVI
Inside Quote Activity by Stock: Downgrades 2001³⁷

| Stock | Total | Ask Press | Control | p-value |
|-------|-------|-----------|---------|---------|
| LLTC | 4 | 4 | 1 | 0.0003 |
| MCHP | 3 | 3 | 1 | 0.0072 |
| BGEN | 6 | 3 | 1 | 0.0142 |
| DELL | 6 | 3 | 1 | 0.0142 |
| ADCT | 12 | 8 | 5 | 0.0395 |
| MSFT | 7 | 4 | 2 | 0.0471 |
| CSCO | 20 | 10 | 7 | 0.0798 |
| AMAT | 5 | 2 | 1 | 0.1318 |
| ALTR | 8 | 2 | 1 | 0.1425 |
| ADBE | 2 | 1 | 1 | 0.5000 |
| AMGN | 5 | 3 | 3 | 0.5000 |
| ATML | 6 | 2 | 2 | 0.5000 |
| CTAS | 3 | 1 | 1 | 0.5000 |
| INTC | 5 | 1 | 1 | 0.5000 |
| INTU | 3 | 1 | 1 | 0.5000 |
| KLAC | 5 | 2 | 2 | 0.5000 |
| PAYX | 2 | 1 | 1 | 0.5000 |
| VTSS | 15 | 6 | 6 | 0.5000 |
| TLAB | 14 | 4 | 5 | 0.7115 |
| NXTL | 11 | 4 | 5 | 0.7276 |
| XLNX | 6 | 2 | 3 | 0.7929 |
| PSFT | 6 | 1 | 2 | 0.8068 |
| USAI | 6 | 1 | 2 | 0.8068 |
| SPOT | 4 | 1 | 2 | 0.8413 |
| SBUX | 4 | 0 | 1 | 0.8759 |
| SUNW | 4 | 0 | 1 | 0.8759 |
| ERICY | 11 | 4 | 6 | 0.8871 |
| AMZN | 12 | 2 | 4 | 0.8897 |
| MXIM | 3 | 0 | 1 | 0.8897 |
| ORCL | 18 | 5 | 8 | 0.9226 |
| YHOO | 13 | 4 | 8 | 0.9887 |
| VRTS | 7 | 1 | 4 | 0.9890 |
| AAPL | 1 | 0 | 1 | 1.0000 |
| BBBY | 3 | 1 | 0 | 1.0000 |
| BMET | 3 | 0 | 3 | 1.0000 |
| CHIR | 3 | 1 | 0 | 1.0000 |
| COST | 1 | 0 | 0 | 1.0000 |
| CPWR | 0 | 0 | 0 | 1.0000 |
| CTXS | 2 | 1 | 2 | 1.0000 |
| ERTS | 1 | 1 | 1 | 1.0000 |
| FISV | 1 | 0 | 0 | 1.0000 |
| GENZ | 1 | 0 | 1 | 1.0000 |
| MOLX | 4 | 2 | 0 | 1.0000 |
| PCAR | 0 | 0 | 0 | 1.0000 |
| QCOM | 2 | 1 | 2 | 1.0000 |
| SPLS | 1 | 0 | 0 | 1.0000 |
| SSCC | 0 | 0 | 0 | 1.0000 |

³⁷ Total is the total number of downgrades. Ask press is the number of times the inside ask count exceeds the inside bid count in the week prior to the upgrade. Control is the same count in the period two weeks prior. The p -value is the probability of observing the first count given the frequency in the control group week.

Table XVII
Inside Instinet ECN Counts - Upgrades³⁸

1999-2000

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | 1 | 152 | 327 | 0.4648 | |
| -10 | -6 | 152 | 327 | 0.4648 | 0.5000 |
| -15 | -11 | 131 | 317 | 0.4132 | 0.0435 |
| -20 | -16 | 126 | 312 | 0.4071 | 0.0324 |
| 0 | 5 | 172 | 336 | 0.5119 | 0.9682 |
| 6 | 10 | 167 | 336 | 0.4970 | 0.9048 |
| 11 | 15 | 172 | 336 | 0.5119 | 0.9682 |
| 16 | 20 | 166 | 336 | 0.4940 | 0.8850 |

2001

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | 1 | 74 | 179 | 0.4693 | |
| -10 | -6 | 88 | 179 | 0.4916 | 0.9818 |
| -15 | -11 | 71 | 177 | 0.4011 | 0.3795 |
| -20 | -16 | 78 | 177 | 0.4407 | 0.7755 |
| 0 | 5 | 87 | 179 | 0.4860 | 0.9741 |
| 6 | 10 | 74 | 178 | 0.4157 | 0.5000 |
| 11 | 15 | 88 | 178 | 0.4944 | 0.9821 |
| 16 | 20 | 92 | 178 | 0.5169 | 0.9965 |

³⁸ The frequency is the ratio of Instinet ECN inside bid counts exceeding inside ask counts. The p -value is the probability of observing the inside frequency counts in the week prior to the recommendation change given the frequency for the reference week.

Table XVIII
Inside Instinet ECN Counts - Downgrades³⁹

1999-2000

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | 1 | 186 | 327 | 0.5688 | |
| -10 | -6 | 173 | 327 | 0.5291 | 0.0749 |
| -15 | -11 | 181 | 321 | 0.5639 | 0.4110 |
| -20 | -16 | 186 | 318 | 0.5849 | 0.6755 |
| 0 | 5 | 208 | 334 | 0.6228 | 0.9789 |
| 6 | 10 | 205 | 334 | 0.6168 | 0.9641 |
| 11 | 15 | 181 | 333 | 0.5435 | 0.1610 |
| 16 | 20 | 178 | 333 | 0.5345 | 0.0937 |

2001

| Begin | End | Press | Total | Frequency | p-value |
|--------------|------------|--------------|--------------|------------------|----------------|
| -5 | -1 | 154 | 259 | 0.5946 | |
| -10 | -6 | 150 | 259 | 0.5792 | 0.3073 |
| -15 | -11 | 146 | 259 | 0.5637 | 0.1581 |
| -20 | -16 | 168 | 259 | 0.6486 | 0.9658 |
| 0 | 5 | 159 | 259 | 0.6139 | 0.7383 |
| 6 | 10 | 170 | 257 | 0.6615 | 0.9875 |
| 11 | 15 | 155 | 257 | 0.6031 | 0.6006 |
| 16 | 20 | 146 | 255 | 0.5725 | 0.1878 |

³⁹ The frequency is the ratio of Instinet ECN inside ask counts exceeding inside bid counts. The *p*-value is the probability of observing the inside frequency counts in the week prior to the recommendation change given the frequency for the reference week.

Table XIX
Abnormal Returns Pre- and Post-Recommendation Change⁴⁰

| Sample | 5 to 20 | -1 to 4 | -1 to 20 | -1 to -5 | -6 to -10 | N |
|----------------------|----------------|----------------|-----------------|-----------------|------------------|----------|
| Upgrades 1999-2000 | 0.32 | 5.73 | 6.11 | -0.17 | -0.06 | 327 |
| Upgrades 2001 | 1.70 | 5.00 | 6.99 | 0.94 | -0.16 | 179 |
| Downgrades 1999-2000 | 1.69 | -7.24 | -5.23 | -1.14 | -0.02 | 327 |
| Downgrades 2001 | 0.86 | -5.01 | -4.14 | -1.16 | 0.60 | 259 |

⁴⁰ The abnormal return is the stock return over the time period listed less the return on the Nasdaq 100 index.

Table XX
Regression Results Ex-Post Returns⁴¹

| Dep. Var. | Constant | R(-1,-5) | ED | PushDum | N | R² |
|------------------|-------------------|-------------------|-------------------|-----------------|----------|----------------------|
| Up 1999-2000 | 4.939 (8.47) | -0.096 (-1.66) | 0.004 (2.37) | 3.290 (2.32) | 327 | 0.041 |
| Up 2001 | 4.738 (6.89) | -0.256 (-2.77) | -0.001 (-0.44) | 3.256 (1.91) | 179 | 0.066 |
| Down 1999-2000 | -7.163 (-7.17) | -0.150 (-1.43) | -0.007 (-2.18) | 0.035 (0.01) | 327 | 0.021 |
| Down 2001 | -5.012 (-6.41) | 0.044 (0.52) | 0.000 (0.18) | 0.434 (0.21) | 259 | 0.001 |

⁴¹ The dependent variable is the 5 day abnormal return, relative to the Nasdaq 100 index, from 1 day prior to the upgrade to 4 days after. $R(-1, -5)$ is the abnormal return from -5 to -1 days before the recommendation change. Excess demand is the net difference between inside bid and ask appearances in the week prior. PushDum is a dummy for market makers with significant patterns of pre-recommendation activity.

Table XXI
Profitability Estimates for 1999-2000⁴²

| Market Maker | Marginal Abnormal Return % | Excess Profits (\$mn) |
|--------------|----------------------------|-----------------------|
| RSSF | 20.5238 | 292.4179 |
| FBCO | 13.0812 | 192.1587 |
| MSCO | -0.4189 | 79.9783 |
| CIBC | 6.1482 | 65.5510 |
| LEHM | 6.0789 | 64.1398 |
| MONT | -2.0767 | 44.1134 |
| PWJC | 1.2739 | 32.5183 |
| DBKS | 2.0400 | 27.9919 |
| AGED | 2.4726 | 23.2679 |
| AANA | 5.8994 | 20.7097 |
| NEED | 1.3740 | 9.5520 |
| WBLR | 1.0208 | 5.8297 |
| SNDV | 2.0126 | 2.8218 |
| TWPT | 0.5002 | 2.0518 |
| ADAM | 0.1522 | 1.2954 |
| FACT | 0.3240 | 1.1239 |
| PIPR | 4.8802 | 1.0372 |
| ADVS | 0.0453 | 0.5702 |
| CEUT | 0.0068 | 0.0531 |
| DAIN | -0.0103 | -0.0421 |
| JPMS | 2.5307 | -0.3619 |
| HAMR | 0.6028 | -0.3849 |
| SASI | -0.1103 | -1.7760 |
| LEGG | -0.3300 | -3.0309 |
| COWN | 2.0562 | -3.4683 |
| DLJP | 5.9276 | -4.2401 |
| BEST | -1.4885 | -6.0906 |
| WARR | -0.4318 | -27.0480 |
| GSCO | -0.8550 | -31.6505 |
| MLCO | -2.9027 | -47.1708 |
| PRUS | 10.5838 | -62.1068 |
| SBSH | -5.8617 | -87.7342 |
| Total | 75.0492 | 592.0770 |

⁴² Marginal abnormal returns are based on the estimates from Table XX for market making excess demand.

Profitability estimates are computed from market maker inside bid and ask frequencies, daily volumes, and 5-day ex-post abnormal returns.

Figure 1: Nasdaq SuperMontage Level II Display

| Symbol: CSCO Cisco Systems, Inc. | | | | | |
|----------------------------------|-----------|-------------|--------------------|-------------|---------------|
| NBBO: 19.98 Q | | 19.99 Q | | 61 - 15 | |
| NNM | | | Last Sale: 19.99 Q | | UPC 11830: No |
| Level | Bid Price | Total Depth | Ask Price | Total Depth | |
| 1st | ▼ 19.98 | 61 | 19.99 | 15 | |
| 2nd | 19.97 | 58 | 20.00 | 83 | |
| 3rd | 19.96 | 82 | 20.01 | 108 | |
| 4th | 19.95 | 51 | 20.02 | 38 | |
| 5th | 19.94 | 81 | 20.03 | 59 | |
| MPID | Bid Price | Bid Size | MPID | Ask Price | Ask Size |
| GVRC | 19.98 | 10 | PIPR | 19.99 | 10 |
| MSCO | 19.98 | 21 | SIZE# | 19.99 | 5 |
| SIZE# | 19.98 | 10 | CHIP | 20.00 | 1 |
| SLKC | 19.98 | 10 | DAIN | 20.00 | 10 |
| SNDV | 19.98 | 10 | FBCO | 20.00 | 10 |
| MKXT# | 19.97 | 5 | MWSE | 20.00 | 7 |
| PRUS | 19.97 | 10 | PIPR | 20.00 | 15 |
| MSCO | 19.97 | 5 | MSCO | 20.00 | 10 |
| SBSH | 19.97 | 1 | SCHB | 20.00 | 5 |
| SIZE# | 19.97 | 25 | SIZE# | 20.00 | 20 |
| SLKC | 19.97 | 10 | UBSW | 20.00 | 4 |
| WCHV | 19.97 | 1 | WCHV | 20.00 | 1 |
| MLCO | 19.97 | 1 | ABNA | 20.01 | 50 |
| BRUT# | 19.96 | 11 | FBCO | 20.01 | 15 |
| NITE | 19.96 | 1 | MSCO | 20.01 | 9 |
| SLKC | 19.96 | 5 | SCHB | 20.01 | 10 |
| PRUS | 19.96 | 10 | SIZE# | 20.01 | 24 |
| SIZE# | 19.96 | 55 | BRUT# | 20.02 | 7 |
| BARD | 19.95 | 10 | FBCO | 20.02 | 10 |
| GSCO | 19.95 | 10 | SCHB | 20.02 | 5 |
| NDBC | 19.95 | 10 | SIZE# | 20.02 | 16 |
| PRUS | 19.95 | 5 | BRUT# | 20.03 | 10 |
| SIZE# | 19.95 | 10 | FBCO | 20.03 | 5 |
| SLKC | 19.95 | 6 | GSCO | 20.03 | 10 |
| BARD | 19.94 | 10 | NITE | 20.03 | 1 |
| BRUT# | 19.94 | 5 | PIPR | 20.03 | 7 |
| GSCO | 19.94 | 5 | SBSH | 20.03 | 1 |
| JPHQ | 19.94 | 10 | SIZE# | 20.03 | 15 |
| PRUS | 19.94 | 10 | WCAI | 20.03 | 10 |
| MSCO | 19.94 | 10 | ... | | |
| SIZE# | 19.94 | 26 | SNDV | 20.13 | 1 |
| SLKC | 19.94 | 5 | BARD | 20.15 | 1 |
| ... | | | PRUS | 20.17 | 10 |
| DAIN | 19.50 | 10 | SLKC | 20.25 | 8 |