Information, Sell-Side Research, and Market Making*

Leonardo Madureira
Weatherhead School of Management
Case Western Reserve University

Shane Underwood
Jesse H. Jones Graduate School of Management
Rice University

This version: February 27, 2007

Abstract

The interaction between an investment bank's research and market making arms may have important implications for the trading of a firm's stock. We investigate both the timing of the decision to provide market making or research coverage, as well as the impact that research has on the liquidity provided by the bank's market maker. Utilizing a large sample of Nasdaq firms, we find that banks typically initiate market making coverage first, then add on research coverage at a later date. We then show that market makers whose banks also provide research coverage provide more liquidity and contribute more to price discovery than do market makers without such research coverage. Finally, we show that such "affiliated" market makers are much less affected by uncertainty following earnings announcements. Our results provide new evidence on the sources of liquidity improvements for Nasdaq firms, and suggest that the information produced by banks in the sell-side research process is beneficial to their market makers.

JEL classification: G14; G19; G24

Keywords: sell-side analysts; market making; liquidity; price discovery

* Leonardo Madureira is with the Weatherhead School of Management, Case Western Reserve University and Shane Underwood is with the Jesse H. Jones Graduate School of Management, Rice University. We would like to thank Ajai Singh, Sunil Wahal, James Weston, and seminar participants at Case Western University, Rice University and the 2006 European Finance Association Meeting for helpful comments. Please address correspondence to Leonardo Madureira, 364 PBL Building, 11119 Bellflower Rd, Cleveland, OH 44106, tel: 216-368-5003, fax: 216-368-6249, e-mail: leonardo.madureira@case.edu.

1. Introduction

We investigate the relationship between the market making and research arms of investment banks in the secondary market for Nasdaq firms. When securities are brought public, the investment banks market and distribute the securities while also supporting them in secondary trading, but the important role of the banks in the capital markets continues long after the initial public offering. Banks provide liquidity services when they act as market makers (or dealers) in the firm's securities, and, in many cases, banks' sell-side analysts provide research coverage of the firm, producing information about its health and future prospects. While research coverage is aimed at the investment bank's clients, Schultz (2003) suggests that the knowledge embedded in the research department could also be valuable to the market making arm of the same bank. We explore whether information sharing between the two arms leads to a competitive advantage for the market maker in its roles of providing liquidity to the market as well as aiding in the price discovery process.

Prior literature provides some evidence on the impact of analyst coverage on overall liquidity. For example, Brennan and Subrahmanyam (1995), Easley, O'Hara, and Paperman (1998), and Irvine (2003) show that the number of analysts following a firm is positively related to liquidity. What is less clear is precisely how that liquidity improvement comes about. Brennan and Subrahmanyam (1995) interpret their results as being supportive of Admati and Pfleiderer (1988), whose model predicts that an increase in the number of informed traders leads to an increase in liquidity as the informed traders compete aggressively to profit from their information. Meanwhile, the findings of Easley, O'Hara, and Paperman (1998) suggest that the increased number of uninformed traders who are attracted to a stock by analysts leads to the increase in liquidity. We examine the quotation behavior of Nasdaq market makers to provide further evidence on how the improved liquidity comes to fruition. We find that market makers who are likely to be informed – those whose bank provides research coverage of the same firm –

provide more liquidity and contribute more to price discovery than do market makers who are less likely to be informed.

.Prior literature has also analyzed the bank's decision to start coverage or to act as a market maker. Schultz (2003) finds that banks which choose to make a market are also likely to provide research coverage. Chung and Cho (2005) find that banks provide more active research coverage of firms for which they act as a market maker. And Ellis, Michaely, and O'Hara (2005) find that banks provide coverage in an attempt to win investment banking business, but do not compete for investment banking business through their market making activities. We build on this literature by examining the timing of the bank's decision to enter the research and/or market making area for a given firm.

We find that a bank typically begins making a market first, and later adds on research coverage. In addition, when coverage is discontinued, the bank typically continues to function as a market maker for some time afterward. For the sample of institutional brokers and wirehouses defined in Huang (2002), virtually all firms receiving sell-side coverage from a bank also receive market making services from the same bank. We interpret this as evidence that banks choose which firms to provide research coverage for from the universe of firms in which they make a market. That sell-side coverage decisions are made once market making is established confirms the relevance of examining whether the ability of market makers is influenced by sell-side coverage.

We then ask the central question of the paper: Does the provision of sell-side research services for a firm influence how a bank acts in its role as a market maker for that firm's stock? Schultz (2003) argues that Nasdaq market makers may have an informational advantage over other traders through analyst coverage, geographic location, or through their participation in underwriting syndicates. He explores whether these informational advantages dictate which firms a market maker chooses to follow. Here we examine whether the informational advantage gained through analyst coverage

confers a competitive edge to the market maker in terms of reducing the adverse selection risk for the firms they also cover.[1]

Cross-sectional and time-series results indicate that market makers quote smaller bid-ask spreads, larger depths, and spend a greater percentage of time at the inside bid and ask when their banks also provide sell-side coverage for the same firm (henceforth, affiliated market makers). However, consistent with the notion that analyst coverage generates trading (Irvine, 2000), we show that volume traded by the market maker increases significantly following initiations of research coverage by the same bank. Thus, improvements in the affiliated market maker's spreads and depths could also be related to decreased inventory risk, rather than simply due to a reduction in adverse selection risk.

In order to single out the role of the informational advantage as an important determinant of the affiliated market maker's behavior, we examine another dimension of its behavior: The market maker's contribution to the price discovery process. While inventory concerns may lead a market maker to be more aggressive in providing liquidity, and indeed to be more active in moving his quotes, such quote updates should only reflect transitory effects that are unrelated to the full-information value of the stock. If, however, the informational advantage of an affiliated market maker allows her to provide quotes that impound new information into the stock price, then we should observe that she performs better in measures of price discovery than non-affiliated market makers.

In fact, we show that affiliated market makers are more aggressive in this dimension. A market maker contributes more to the price discovery process of a firm's stock when its bank also provide sell-side coverage for the firm – that is, it moves its bid and ask quotes in such a way that they contribute more to permanent price changes in the

[1] Conversation with sell-side analysts confirmed Schultz's (2003) assessment that a "market maker who provides analyst coverage is more likely to have non-public information about the company or to anticipate news releases than a market maker who does not provide coverage". Market makers and the analysts do talk often, with analysts lending their expertise on the firm or on its industry to the bank's market makers. One research director of an investment bank explains how "research and trading are becoming much more intertwined", adding that "research products will continue to be boiled down into content and packaging that can be placed at the fingertips of interested traders prior to and immediately after important stock events" ("Research and Trading", Traders Magazine, December 1st, 2003).

firm's stock. Here, our research is related to that of Huang (2002), who analyzes the relative contributions to price discovery by market makers of different categories. We extend this by actually looking at individual market makers, rather than at brokers as a group, and by looking at the relative behavior of affiliated vs. non-affiliated makers.[2]

Improvement in liquidity and price discovery for affiliated market makers could simply be related to the behavior of market makers who also played a role in underwriting the firm's equity offerings. Schultz and Zaman (1992) and Aggarwal (2000) examine the role of underwriters in stabilizing IPOs immediately following the offering, while Ellis, Michaely, and O'Hara (2000) find that the lead underwriter is the dominant market maker in terms of trading volume for new fims, and that this pattern continues for up to 60 days following the IPO. We find, however, that the improvement in liquidity and price discovery is present even when we restrict the sample to banks which have not participated in an equity offering by the firm in the last 12 months.

Our final examination explores liquidity around earnings announcements. Lee, Mucklow, and Ready (1993) show that firm liquidity worsens around earnings announcements, and Kim and Verrecchia (1993) suggest that this is related to the ability of some traders to better interpret the public information in the earnings. If information is what is behind the more active role of the affiliated market makers, cross-sectional differences should emerge on how different market makers react to earnings announcements. Accordingly, we present evidence that earnings announcements increase information asymmetries among market makers. In the day following announcements, non-affiliated market makers widen their bid-ask spreads to a much greater degree than do affiliated ones. We interpret this as evidence that the affiliated market makers (or their customers) are better able to process earnings news than are market makers with no sell-side coverage provided. This leads to better liquidity overall in the period immediately following earnings announcements.

[2] In addition, we consider a much larger cross-section of Nasdaq firms through time, rather than simply the largest, most actively traded ones. Huang (2002) examines the 30 most actively traded Nasdaq stocks in July 1998 and November 1999.

Our results have important policy implications, given the potential for conflicts of interest to arise in the relationship between research and market making arms of the same bank. The bank's market makers may seek to profit from the sell-side research output at the expense of the general trading public. If market makers trade ahead of the release of research reports, they may be able to earn profits in excess of what might be expected from typical market making operations.[3] Since NASD regulations expressly prohibit market makers from trading ahead of the release of research reports,[4] it might be easy to conclude that no information should be shared between the two divisions of the bank. However, more general information sharing – i.e., away from the release of such reports – could be beneficial if it leads to more efficient prices and a larger pool of liquidity for investors to trade in. Our results indicate this trade-off needs to be considered, in that information sharing between analysts and market makers has a positive impact on the market for a firm's stock.

The rest of the paper is as follows. Section 2 examines the timing of decisions made by banks to be a dealer for a firm and/or to provide sell-side coverage for the same firm. Section 3 analyzes the influence of sell-side coverage on the liquidity provision and price discovery abilities of the market maker. Section 4 concludes.

2. Initiations and Discontinuations of Coverage and Market Making

The positive correlation between the number of market makers and the number of analysts following a firm is well known (e.g., Chung and Cho, 2005). This should come as no surprise, given that the determinants of coverage and of market making often intersect (e.g, size and volume – see Bhushan, 1989; Bhushan and O'Brien, 1990; Brennan and Hughes, 1991; Wahal, 1997). In this section, we tackle the issue of

[3] Green (2004) shows that early access to analyst recommendations is valuable, and Irvine, Lipson, and Puckett (2006) present evidence that institutional traders are "tipped" about the contents of forthcoming analysts' reports. Meanwhile, Heidle and Li (2004) find some evidence that Nasdaq market makers who are aligned with the recommending bank quote more aggressively prior to such releases of information, and Juergens and Lindsey (2006) show that such market makers handle a disproportionate share of sell volume in the days leading up to downgrades.

[4] NASD regulation IM-2110-4 specifically prohibits trading activity "purposefully establishing, increasing, decreasing, or liquidating a position in a Nasdaq security…in anticipation of accommodating investor interest once the research report has been published.".

coverage and market making decisions through a different angle. At the level of each individual bank, we examine the relative timing of the decisions to provide research and/or market making activities. We analyze to what extent a bank's decision to cover a firm is accompanied by that bank's decision to provide market making services for the firm's stock, and, vice-versa, to what extent a bank's decision to be a dealer for the firm's stock is accompanied by that bank's decision to cover the firm. We provide, thus, conditional statements: for example, in the first case we ask, conditional on having decided to cover a firm, what is the bank's decision process regarding becoming a market maker for its stock.[5]

We match the samples of I/B/E/S brokers and Nasdaq market makers, allowing us to recognize the institutions that can provide coverage and act as market makers, and then collect the periods in which these institutions provided coverage and market making for every Nasdaq firm. In terms of sell-side coverage, we identify for each firm and each broker, between 1987 and 2003, the first month in which there is a forecast or recommendation issued by that broker for that specific firm available in the I/B/E/S database (initiation of coverage) and the last month in which forecasts or recommendations were issued (discontinuation of coverage). Initiations and discontinuations of market making are treated in a similar way: We record, for each firm and each market maker, the first and last month in which the market maker acted as a dealer for the firm's stock between January 1999 and December 2003.[6]

Since we are mostly interested in the interaction of market making and coverage activities, we constrain our analysis to banks that indeed provide both services. More generally, we follow Huang (2002) in recognizing the vast diversity within the universe of market makers, adopting his classification of market makers into five broker categories: institutional, wirehouses, wholesalers, ECN's, and others – which consists mainly of smaller regional brokerages. Given our goal of matching market makers with

[5] The examination of the each bank's joint decision on whether to cover a stock and on whether to act as a dealer for the same stock is not feasible, given that a simultaneous bivariate binary model with endogenous variables is not identified. See Maddala (1983).

[6] Our sample period differs for the two main datasets. While analyst coverage is available since the early 1980's, data on Nasdaq market makers starts only in 1999.

analysts, dealers which fall in the wholesalers or ECN category are of little interest since they do not have a research department.

<Insert Table 1 here>

Table 1 shows descriptive statistics on market makers and sell-side brokers, and the firms they do business with. For each broker (market-maker) we average the monthly number of firms (stocks) they cover (act as a dealer for) during the period January 1999 until December 2003. Panel A presents summary statistics on this monthly average for market makers. There are 778 market makers in our sample, with a wide variation in how many stocks they deal with. Dealers on average make a market in 198 stocks per month (median of 21 stocks), but there are market makers dealing with as few as one stock and others dealing with as many as 4,237 stocks per month. Once we break the sample of market makers according to Huang's (2002) classification, we notice that the variation in the distribution of coverage is concentrated in the 'others' category: While they constitute 95% of the sample of market makers, they are mostly minors (median coverage of only 20 stocks). As expected, ECN's and wholesalers include very large market makers. Finally, institutional brokers and wirehouses – the focus of this paper – have similar sizes: Institutional brokers (wirehouses) on average make a market for 642 (710) stocks per month, with the smallest of them making a market for 281 (334) such stocks, and the biggest of them making a market for 1,250 (1,220) stocks. [7]

Panel B presents summary statistics on the monthly coverage for brokers. Our sample includes 553 brokers, with the median monthly coverage of 4 firms suggesting that most of them are very small. There is a wide variation in how many firms per month each one covers, but once we concentrate on the sample of institutional brokers and wirehouses, we find again more uniformity. The institutional brokers, for example, on average cover about 303 firms per month, with the smallest amongst them covering 104 and the biggest covering 392 firms.

[7] The 12 institutional brokers are: Bear Stearns, BT Alex Brown, Deutsche Bank, Donaldson, Lufkin & Jenrette, Credit Suisse First Boston, Goldman Sachs, Hambrecht & Quist, J. P. Morgan, Lehman Brothers, Banc of America, Morgan Stanley, Robertson Stephens, and UBS. The 5 wirehouses are Dean Witter, Merrill Lynch, Prudential, Painewebber and Salomon Smith Barney.

We now turn to the bank's decisions to cover a firm and/or to make a market for its stock. Two events are examined: initiations and discontinuations of services. In the first case, we examine the bank's decision to initiate coverage (market making) for a firm, asking whether and when the same bank will provide market making (coverage) for the same firm. In the second case, we look at the bank's decision to drop a firm from its portfolio, asking whether and when interrupting one type of service is accompanied by interruption of the other service. Each analysis requires a different sampling procedure, which we detail in the following sections.

Initiations

We start with initiations of coverage. We collect all initiations of coverage in the period between January 2000 and Dec 2002,[8] and then apply some simple restrictions to the sample. Since we want to examine whether and how initiation of coverage is accompanied by initiation of market making activities, we need to control for the attractiveness of the firm's stock for the purposes of market making. For this, we only consider observations of initiation of coverage for firms which at that point were receiving market making services from some other bank. We also restrict the sample to initiations of coverage made by brokers that were already making a market in some other stock in the recent past, thus making sure that the broker was a bank having both sell-side research and market making departments.

<Insert Table 2 here>

Results in Panel A of Table 2 indicate that 45% of firms that started receiving sell-side coverage already had a dealer presence by the same bank prior to that month, with the median distance between initiation of market making and initiations of coverage being 3 months. Besides that, 34% of the sample represented initiations of coverage and market making at the same month, and initiations of sell-side coverage preceded

[8] We start our sample of initiations in early 2000 because data availability for market makers starts in 1999, so we need to leave a cushion in order to make sure that the first observation of a dealer making a market is in fact an initiation of market making. For example, observing that dealer *D* makes a market for stock *S* in January 1999 of our sample does not allow us to infer this is an initiation of market making because we do not know whether *D* was already making a market for *S* in the months before January 1999.

initiations of market making in only 7% of the cases. Finally, only 13% of the initiations of coverage were for firms that never had market making from the same bank along the sample period. If we further restrict the sample of banks to include only the institutional brokers and wirehouses, the numbers are even more striking, as only 7% of initiations of sell-side coverage are for firms in which the bank does not eventually make a market. Thus, sell-side coverage seems to be a subset of market making, in the sense that if a firm receives coverage, it is very likely that its stock has already received or it will receive market making services from the same bank.

We now repeat the procedure looking at initiations of market making. In order to control for the attractiveness of the stock for sell-side business, we only look at initiations of market making for stocks whose firms had prior sell-side coverage from another bank. We also only look at banks with the capacity to provide sell-side coverage, by requiring that the bank initiating market making was already providing coverage for some other firm. The results, shown in Panel B of Table 2, substantiate the view that the pool of firms for which each bank provides coverage is a subset of the pool of firms for which the bank acts as a dealer. While only 13% (7%, if we restrict the sample to include only institutional brokers and wirehouses) of initiations of coverage are for firms that never see market making by the same bank, we now see that that 63% (67%, for institutional brokers and wirehouses) of the initiations of market making are for stocks whose firms never receive coverage from the same bank.

Discontinuations

We now examine to what extent discontinuations of coverage and of market making activities are related. We first collect the bank/firm pairs such that at some moment between January 1999 and June 2003 the firm was being serviced by the bank in both research and market making. For each pair, we record whether there was discontinuation of coverage and/or discontinuation of market making activities before June 2003. In order to exclude trivial reasons for discontinuations, we apply some filters to the sample. We require that the firm's stock is present at CRSP in December 2003, thus making sure that the discontinuation was not motivated by delisting of the stock.

Similarly, we require that the bank keeps providing coverage and also keeps acting as a dealer through December 2003, thus guaranteeing that the a discontinuation was not motivated by cessation of either market making or coverage activities by that bank.

Panel C of Table 2 shows the statistics on the discontinuations of coverage and market making. Among the firms that suffered some discontinuation, 44% faced discontinuation of both market making and coverage, 52% faced discontinuation of coverage while still receiving market making services by the broker; and only 4% of them faced discontinuation of market making while still being covered by the bank. Notice, also, that for the subsample of stocks that faced both discontinuations, about 85% of them had discontinuation of coverage preceding discontinuation of market making. (Similar statistics hold if we restrict the sample of banks to include only the institutional brokers and wirehouses.) These results lend further support to the view that coverage decisions are made conditional on decisions to make a market in the firm's stock, as virtually every discontinuation of coverage happens when discontinuation of market making also takes place, and most of them prior to the discontinuation of market making.[9]

3. Making a Market in the Presence of Research Coverage

The results in the previous section confirm our basic intuition: Providing sell-side research coverage is much more costly than providing market making coverage, and hence banks are likely to begin their relationship with a firm through market making. But once they make the commitment to provide research coverage, what effect does information produced by this research have on their market making activities? Given Schultz's (2003) argument that analyst coverage may provide an informational advantage to the market maker from the same bank, we can think of the set of market makers for a given stock consisting of some relatively "informed" traders and some who are relatively

[9] Notice that the observations are not the same between the sample of initiations and sample of discontinuations.

"uninformed".[10] The Nastraq database of individual dealer quotes allows us to test in this section two important hypotheses concerning informational advantages in the Nasdaq market and their effect on liquidity and efficiency.

First, we test whether the information produced by a bank's analyst is useful in terms of reducing the adverse selection problem for that bank's market maker. We test whether several standard measures of liquidity such as quoted spread and depth improve in the presence of analyst coverage. However, if volume traded by the market maker also increases significantly following initiation of research coverage, an improvement in the market maker's spreads and depths may simply be related to decreased inventory risk, rather than to decreased adverse selection risk.

Our second examination explores whether the information produced by the analyst actually influences the market maker to trade aggressively by moving the inside bid and ask quotes. We test whether such behavior is prevalent over a long time period and whether the bank actually plays a larger role in the price discovery process in the presence of analyst coverage. This test has important implications: If by trading on his private information the market maker leads to a more efficient market for the stock (in that the price quickly and fully reflects all available information) without having a detrimental effect on liquidity, then all market participants stand to benefit.

To further disentangle the effects of inventory from those of information, we examine the behavior of affiliated vs. non-affiliated market makers surrounding earnings announcements. Here we examine the hypothesis that affiliated market makers face less uncertainty both prior to and following the announcement. By comparing the behavior of both groups of market makers to their behavior in a control period, we can make stronger statements about the role that information plays in separating the two groups of market makers.

We begin the analysis by discussing the data and the microstructure measures in Section 3.1. Section 3.2 presents univariate statistics on these microstructure measures for

[10] It should be noted, however, that even a market maker with none of these informational advantages could still be viewed as informed. For example, a market maker could gain useful information about future prices due to his ability to observe the order flow of his customers.

affiliated vs. non-affiliated market makers. Section 3.3 presents the event study that allows the analysis of the improvements in microstructure measures after taking care of the endogenous decision about providing sell-side coverage. Finally, Section 3.4 discuss the analysis of liquidity around earnings announcements.

3.1. Data and Microstructure Measures

The Nastraq database contains all quote updates by all dealers and electronic communications networks (ECN's) for stocks traded on the Nasdaq market. These quotes allow the extraction of the liquidity and price discovery measures discussed below.

Liquidity

We construct several standard measures of liquidity which allow us to determine how much liquidity a given dealer is providing in a certain stock. To do this, we first construct a second-by-second time series of all the outstanding quote observations for each dealer.[11] Since dealer quotes on Nasdaq represent firm commitments to trade at the price and quantity indicated, they remain in effect until the dealer replaces them with another quote. We fill in the last valid quote for each second until the next valid quote is submitted by the dealer. We thus have the dealer's outstanding quote for every second of every day during the month. We first calculate the average percentage spread for dealer *i* in stock *j* over the month as

$$PS_{i,j} = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{\left(Ask_{i,j,t} - Bid_{i,j,t}\right)}{\left(\frac{InsideBid_{j,t} + InsideAsk_{j,t}}{2}\right)}\right), \qquad (1)$$

where T is the number of seconds in the month during which the dealer was an active market maker for the stock.

[11] We initially filter the data using the rules given in Heidle and Li (2004). These filters eliminate quote observations which are clearly erroneous.

Our next measures of liquidity for each dealer involve the amount of shares that he is willing to buy at the bid and ask price she has quoted. The calculations are similar to those for the percentage spread, as we average all of the quote observations for the month:

$$\begin{aligned} BidDepth_{i,j} &= \frac{1}{T}\sum_{t=1}^{T}\left(BidDepth_{i,j,t}\right) \\ AskDepth_{i,j} &= \frac{1}{T}\sum_{t=1}^{T}\left(AskDepth_{i,j,t}\right) \end{aligned}, \tag{2a}$$

where the bid and ask depth are given in hundreds of shares. Since the quoted depth in number of shares may not be the most accurate reflection of how much liquidity a dealer is providing, we also calculate the equivalent monthly averages using dollar figures, so that

$$\begin{aligned} DollarBidDepth_{i,j} &= \frac{1}{T}\sum_{t=1}^{T}\left(BidDepth_{i,j,t} * Bid_{i,j,t}\right) \\ DollarAskDepth_{i,j} &= \frac{1}{T}\sum_{t=1}^{T}\left(AskDepth_{i,j,t} * Ask_{i,j,t}\right) \end{aligned} \tag{2b}$$

Finally, we follow Chordia, Roll, and Subrahmanyam (2001) and define the composite liquidity measure as

$$Composite\_Liq_{i,j} = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{PS_{i,j,t}}{\frac{DollarAskDepth_{i,j,t} + DollarAskDepth_{i,j,t}}{2}}\right) \tag{3}$$

This measure may allow us to better measure to the dealer's *overall* contribution to liquidity in the market for a firm's shares.

While the preceding measures provide nice proxies of the amount of liquidity provided by a dealer, they do not take into account the behavior of *other* dealers. That is, while a dealer's quoted spreads and depths may seem quite competitive, this will mean little if several other dealers have even narrower spreads and larger depths. One way to

measure a dealer's relative performance is by calculating the percentage of time he spends at the inside bid or ask. We calculate the percentage of time at each as:

$$\begin{aligned} InsideBid\%_{i,j} &= \frac{1}{T}\sum_{t=1}^{T} InsideBidDummy_{i,j,t} \\ InsideAsk\%_{i,j} &= \frac{1}{T}\sum_{t=1}^{T} InsideAskDummy_{i,j,t} \end{aligned}, \qquad (4)$$

where *InsideBidDummy* (*InsideAskDummy*) = 1 if the dealer is at the inside bid (ask) for that second and 0 otherwise.

Price Discovery

We are especially interested in knowing whether market makers who are affiliated with research analysts contribute more to the informational efficiency of prices than do non-affiliated market makers. Market makers are free to move their quotes at any time of day, and sometimes these quote movements will induce a movement in the inside bid or ask. If this change in the inside quotes is permanent, then microstructure theory tells us that new information has come into the market. In this case, we can attribute that information to a specific participant. Here we follow Huang (2002) in defining the weighted price contribution (WPC) of each dealer as the share of permanent changes in the inside bid and ask prices that can be attributed to a certain dealer.[12] We calculate the WPC for dealer *i* in stock *j* as

$$WPC_{i,j} = \sum_{t=1}^{T}\left(\frac{\left|\Delta p_t^j\right|}{\sum_{t=1}^{T}\left|\Delta p_t^j\right|}\right)\left(\frac{\Delta p_t^{i,j}}{\Delta p_t^j}\right), \qquad (5)$$

where Δp_t^j is the daily inside quote change for stock *j* on day *t*, $\Delta p_t^{i,j}$ is the sum of all inside quote changes for which dealer *i* is responsible, and *T* represents the number of days in the month.

[12] Barclay and Warner (1993) originally proposed the WPC measure to identify which trades are responsible for price movements.

The measure effectively calculates a weighted sum of the dealer's contribution to permanent price movements across the month, where the weights are given by the ratio of that day's absolute price movement to the sum of absolute price movements across the month. We calculate this measure separately for the bid and ask quotes for each market marker in each stock. We also create an absolute version of the measure, $ABS\_WPC_{i,j}$, in which the absolute value of all inside quote movements by each market maker are summed over the day. This alternate measure is less a measure of price discovery than a measure of how often a dealer moves the inside quote; nevertheless, it provides us with another piece of information regarding how aggressive a market maker is in terms of providing liquidity and moving prices during the day.

3.2. Univariate Statistics

In this section, we analyze cross-sectional differences in liquidity and price discovery measures that are associated with whether the market maker is affiliated, i.e., whether its bank also provides sell-side coverage for the same firm. For each month we collect data on pairs of market makers and the stocks for which they act as market makers. We restrict the sample to include the Nasdaq stocks that have at least one institutional broker or wirehouse being a market maker on that month, and that have the CRSP data available regarding size, volume, etc.[13] We also exclude stocks that are priced below $5. Therefore, the unit of observation is a dealer making a market in a stock, and we divide the sample according to whether or not the market maker's bank also provides sell-side coverage for the firm being analyzed. We analyze average firm characteristics as well as average measures of liquidity and price discovery, presenting t-statistics to test the null hypothesis that the measures are the same between the two samples. For the purposes of presentation, we present the statistics for one specific

[13] Results are qualitatively the same if we further restrict the sample to include only stocks that have *at least* one affiliated market maker *and at least* one non-affiliated market marker.

month of our sample, but the qualitative inferences discussed here carry on in general for the other months of the sample.[14]

<Insert Table 3 here>

Table 3 presents the results. The presence of sell-side coverage is *associated* with lower spreads at the level of the market maker: The average spread is 5.8% for the sample in which the bank not only makes a market in the stock but also provides sell-side coverage for it. This is significantly smaller (t-stat of 7.98) than the spread of 7.3% for the sample in which the dealer's bank does not cover the stock. Significant differences also emerge for the other measures of liquidity. Dollar depths, both for bid and ask, are significantly bigger when coverage is provided. Corroborating the statistics on spread and dollar depth, the composite measure of liquidity also improves (gets smaller) for the sample of market makers that provide coverage. However, it is worth noting that these market makers also handle a much larger share of volume than their counterparts. It could be the case that these improved liquidity measures are related to lower inventory risk rather than any special information.

The statistics on price discovery measures provide at least some evidence that information is playing a role. Affiliated market makers contribute more to price discovery, as indicated by the higher values of the WPC measures. For example, the average affiliated market maker is responsible for about 4.36% of the permanent changes in the ask quote, while the average non-affiliated market maker is only responsible for about 3% of such changes. If these market makers are improving liquidity solely because of reduced inventory risk, they would have little motivation – or ability – to post quotes that move the inside bid and ask prices to incorporate new information.

The results seem to confirm our original conjectures in that they reveal improvements on liquidity and price discovery measures for the sample of market markers also providing sell-side coverage. But these are simply univariate statistics.

[14] Aggregating all monthly statistics in a full-sample table can be misleading due to time-series variation in some of the variables analyzed. This time series variation, however, does not change the qualitative inferences discussed in this section. For example, average firm size does change through time, but average firm size is smaller for the sample of brokers providing coverage throughout all months in the sample.

Turning to the summary results on the other characteristics, we observe that many firm characteristics – likely to be determinants themselves of the liquidity and price discovery measures – are also significantly different between the two subsamples: Market makers provide coverage for bigger firms, with bigger volume, bigger analyst following, more market makers, and for firms more likely to have raised equity recently. Moreover, the likelihood that the market maker was an underwriter or lead underwriter increases for the sample of market makers that also provides coverage. Therefore, in order to disentangle these correlations, we turn to an analysis of events in which the sell-side coverage status is changed.[15]

3.3. Time-Series Examination

While the univariate results of the previous section provide useful evidence on the importance of the analyst relationship, we now turn to a time-series analysis in an attempt to draw clearer inferences. We collect monthly data for all firms in which at least one institutional broker or wirehouse was a market maker for the period 1999-2003. This allows us to track the behavior of a market maker through time and observe any change in his behavior surrounding an initiation or discontinuation of coverage. For example, when bank *B*, that already provides market making services for firm *F*, starts research coverage of *F* in month *M*, we can look at the spreads provided by *B* to *F* before and after *M*.

The challenge is to isolate the effects of the coverage decision from all other changes that might also affect the microstructure measures. For example, suppose that banks decide to start coverage of a firm solely because of the firm size: perhaps a shock – either an upward trend on stock price or an equity offering – causes firm size to surpass some threshold leading to the bank's decision to start coverage of that firm. Assume also that an increase in firm size causes liquidity measures to improve due to the reduction of

[15] A multivariate analysis that controls for the endogeneity of the sell-side coverage decision using a Heckman 2-step consistent estimator regression supports the claim of improvements in liquidity for the brokers providing coverage (results available upon request). However, another important endogenous decisions – whether to act as an underwriter and/or lead underwriter – can not be jointly estimated using the Heckman procedure.

information asymmetry. This setup would lead to a spurious association between the coverage decision and improvements in liquidity: We would observe an improvement in liquidity around initiations of coverage, but solely due to the increase in firm size. We thus need to extract the relationship between the coverage decision and microstructure measures *after* cleaning out the coincidental events.

The time-series examination provides a nice control sample mechanism to clean out other determinants of the microstructure measures. Under the assumption that a shock affecting the banks' market making measures will affect not only the bank initiating coverage on the firm's stock but also its peers – i.e., the other banks that also provide market making for that stock –, we can examine the market making behavior of the initiating bank *relative* to its peers. That is, peer market makers behavior provides a benchmark that incorporates all effects influencing microstructure outputs. By looking at the changes in the performance of the initiating bank relative to this benchmark we can better isolate true associations between the coverage decision and market making behavior.

We thus construct relative measures for each of the microstructure variables defined in section 3.1. For example, we define a relative spread measure for dealer *i* in stock *j* over the month as

$$RelativePS_{i,j} = \frac{PS_{i,j}}{\underset{k}{mean}(PS_{k,j})} - 1 \qquad (8)$$

where $PS_{i,j}$ is the mean percentage spread for dealer *i* in stock *j* over the month and the peer measure is the mean of the monthly percentage spread in stock *j* taken from all other banks other than dealer *i*. The relative spread denotes the fraction, in percentage terms, that the spread of the initiating market maker is above or below its peers' average spread. Relative measures for other microstructure measures are defined similarly.

Events of Initiation of Coverage

We first examine initiations of coverage. Sample selection is similar to the one used in Section 2. We collect all initiations of coverage in the period between January

2000 and December 2002,[16] and we apply further filters to this sample. First, since we want to compare microstructure measures before and after the initiation of coverage, we restrict our sample to the initiations of coverage of firms for which the bank was already (continued to) providing market making prior to (after) the initiation of coverage. Second, given that we focus our attention on relative measures, we also require that there are indeed peers making a market in the stock before and after the month of initiation.

We constrain the choice of banks in the sample in order to obtain uniformity between the banks initiating coverage and their peers. Since our interest lies on the interaction of the research and market making arms of the banks, we constrain our analysis to banks that indeed provide both services. In the taxonomy of Huang (2002), this means eliminating the ECN's and wholesalers. We also exclude from our study the market makers in the 'others' category: They form a very diverse mix of market makers, most of them very small in size, and any inference gained from results obtained using the 'others' category would be blurred by the lack of uniformity amongst its components. We opt instead to focus on the banks that are similar in terms of classification of their market making business and also in terms of the scale of their research departments: These are, according to the summary statistics presented in Table 1, the institutional brokers and wirehouses. Therefore, an additional filter on our sample is to include in the examination only the institutional brokers and wirehouses. Finally, we also exclude data for stocks that are priced below $5.

<Insert Table 4 here>

Panel A of Table 4 provides some summary statistics of our final sample of initiations of coverage. There are 889 such initiations: 75 are initiations by lead underwriters, 112 by an underwriter (a syndicate member but not lead underwriter) and 702 by banks that did not provide any underwriting service for the stock whose coverage is being initiated. The table also shows the distribution of the initiations through time,

[16] We want to examine the behavior of the bank initiating coverage for up to 12 months before and 12 months after initiation. Since the microstructure data is available from January 1999 thru December 2003, we constrain our sample to the initiations in the January 2000 thru December 2002 period.

across banks and across firms. Initiations are fairly evenly distributed among different firms: the median number of initiations per firm is 1 and only 5% of the firms receive 5 or more initiations of coverage. Initiations seem also to be evenly spread across the 36 months of our sampling period and amongst the banks.

We now turn to the analysis of the microstructure measures around initiations of coverage. Given that a bank initiated sell-side coverage for a firm at month t=0, we follow the pattern of the raw and relative measures of liquidity and price discovery that the bank provides for that firm's stock, during the 25 months surrounding the month of initiation of coverage – i.e., from t=-12 through t=+12. To introduce the analysis, Table 5 shows the time series of median raw and relative spreads, and Figure 1 plots the median relative spreads, for the pairs (bank, firm) of our sample of initiations of coverage.

<Insert Figure 1 here>

<Insert Table 5 here>

We first notice the absence of any discernible pattern regarding the raw measure of percentage spread between the pre- and post-initiation periods, for each of the subsamples. This is not entirely surprising, given that we are not controlling for any other coincidental effects that might also determine spreads. On the other hand, there is a clear pattern of declining *relative* spread around the initiations of coverage for the overall sample. At exactly 12 months prior to the initiation of coverage, the spread provided by the bank initiating coverage does not differ from its peers' spread, but it then declines in a very steady way as the months progress. At month t=0, when the formal initiation takes place, the spread of the bank initiating coverage is already 15% below the spread of its peers, and by 12 months after initiation, it is around 25% below its peers.

Cross-sectional differences emerge when we divide the sample according to the underwriting status of the bank initiating coverage. Lead underwriters provide a lower spread, relative to their peers, throughout the whole 25 months surrounding the initiation of coverage, but there is no clear pattern of declining spread during the period. Syndicate members tend to provide a spread smaller than their peers, although significantly so only for the months after the initiation of coverage. Finally, banks with no prior underwriting

relationship with the stock being initiated mimic the results of the overall sample, i.e. of declining spread relative to their peers around the initiation of coverage.

We now turn to the formal tests of whether spreads – as well as other microstructure measures – change around initiations of coverage. We focus on relative measures in order to control for other determinants of microstructure outputs. More specifically, for each bank/firm pair in our sample of initiations, we compute the average relative measures for the 12 months after and 12 months before the initiation. We then apply tests of significance (t-test and sign test) for the difference in the relative measure between the post- and pre-initiation period. Table 6 presents the results for all microstructure measures discussed in Section 3.1, and Figure 2 plots the time series of some relative measures of liquidity and price discovery for the sample of non-underwriters.

<Insert Figure 2 here>

<Insert Table 6 here>

The results on spreads corroborate the discussion in Table 5: Spreads significantly decline with initiation of coverage for the sample of non-lead underwriters as well as non-underwriters, but do not change significantly for the sample of lead underwriters. The other measures of liquidity closely track the patterns observed in spreads. Lead underwriters provide greater quoted depth – both bid and ask, in absolute or in dollar terms –, as compared to the other banks making a market in the stock. This is true both before and after initiation, but there is no significant change in these measures between the two periods. On the other hand, quoted depths increase significantly for non-lead underwriters (with the exception of the dollar bid measure) and non-underwriters. The results on total liquidity – which combines spread and quoted depth – simply corroborate the improvements in liquidity as measured by spreads and depths. Finally, the results in Table 5 show improvements also on the volume of data handled by the dealer when it starts coverage, for both non-lead underwriters and non-underwriters sample.

Market makers also change the percentage of time they spend at the inside quote after coverage is initiated. Non-lead underwriters and non-underwriters spend less (more) time at both the inside ask and inside bid prior to (after) the initiation of coverage, and the difference between the two periods is significant. Lead underwriters, on the other hand, do not change their behavior regarding the time at the inside quote in any significant way.

We finally turn to the price discovery measures, WPC and absolute WPC. Overall, we observe that market makers contribute more to price discovery after coverage is initiated. Non-underwriters' contribution to the price discovery both at the ask and the bid quotes is smaller than their peers' prior to the initiation of coverage, but significantly higher post-initiation, and the change is significant. The results are qualitatively the same either looking at WPC or the absolute WPC. On the other hand, no changes are revealed for the sample of lead underwriters, with the exception of a significant improvement on the WPC_Ask measure. For underwriters not in the leading role, the direction of the change in the relative WPC measures suggests improvement, and the change is significant for all measures with the expection of the WPC_Ask.

Events of Discontinuation of Coverage

If the provision of sell-side coverage is what is indeed influencing the market making output, we should expect changes in market making measures not only when banks start coverage but also when they interrupt such services. We thus repeat the analysis of the previous section for the events of discontinuations of coverage. To define our sample of discontinuations, we identify for each pair (bank, firm), the last time a forecast or recommendation is issued as revealed by the I/B/E/S datasets. As before, we require that the bank discontinuing coverage is a market maker for that stock in the periods before and after the discontinuation, and that there are also other dealers in the two periods. Panel B of Table 4 indicates that there are 1,692 such discontinuations, 145 of them from lead underwriters, 221 from other underwriters and the other 1,326 from non-underwriters.

One caveat is that our proxy for discontinuation of coverage tends to be weaker than the proxy we adopted for an initiation of coverage. I/B/E/S strives to record the first

time a forecast/recommendation is issued, but the last time a forecast/recommendation is issued does not mean that coverage was interrupted right away.[19] Nevertheless, we report in Table 7 results of how market makers behave around such proxies for discontinuation of coverage. [20]

<Insert Table 7 here>

While there are no significant changes of spreads around discontinuations, quoted depths seem to get worse for both lead and non-underwriters (changes are not significant for non-lead underwriters), leading also to a worsening of the composite liquidity measure. Trading volume decreases for lead underwriters and for non-underwriters. There is also worsening of the percentage of time that lead underwriters and non-underwriters spend at the inside quotes. Finally, the WPC measures also gets worse around discontinuations for lead underwriters and non-underwriters.

Robustness

We discuss in this section some robustness issues (detailed data available upon request). Results on tables 4 through 7 were reported based on restriction that the bank initiating coverage must have *at least* 3 months of market making data prior to the initiation and 3 months of market making data post-initiation. Results are qualitatively robust to more stringent requirements, such as restricting the sample to the initiations in which the bank has market making data for all 25 months surrounding the month of

[19] I/B/E/S provides a stopped estimates file, reporting when an analyst removes a forecast from the database. This can result from many reasons, such as when the analyst quit coverage (a real stopped record), or when the bank puts the stock in a restricted list due to legal constraints (e.g., underwriting relationships). I/B/E/S does not identify the reason of each stopped estimate, thus making its use as a proxy for discontinuation of coverage more complicated. Moreover, the use of stopped estimates to record when a analyst quits coverage does not seem to be pervasive in the I/B/E/S database.

[20] Results on tables 6 and 7 were based on the winsorization of the data points at a 5% cutoff rate. Using a more stringent winsorization cutoff does not change any inferences regarding the changes in the microstructure variables. (The sign test, for that matter, is not influenced by the winsorization as long as the cuts are done symmetrically.) Using lower cutoffs, however, changes some individual averages, as the presence of outliers provoke skewness on the distribution of the relative measures. For example, when examining the WPC measures, small mean WPC's for the peers (this measure can approach zero without bounds) can cause the relative WPC to increase without bounds – thus, going from a 5% to a 1% winsorization cutoff, the average relative WPC at the ask before (after) the initiation of coverage changes from -18.96% to -7.58% (+7.55% to +30.57%), all measures significantly different from zero. Since this problem affects both pre- and post-initiation samples, it does not affect inferences regarding changes in the relative measure.

initiation of coverage. We also extend the time-series examination in tables 6 and 7 in both directions – e.g., examining 24 instead of 12 months after discontinuation, or before initiation, and all our inferences remain valid. In particular, the patterns of changes in the relative measures tend to subside beyond the 12 months interval.

Since we analyze the behavior of a market maker relative to its peers, there might be a concern that a clustering of initiations of coverage would cloud some inferences. For example, assume that underwriters in fact increase the spread with the initiation of coverage, and that non-underwriters do not change their spread. If underwriters and non-underwriters start coverage at the same time, we could still infer that non-underwriters improve their spreads, since their peers would include the underwriter, which could cause the deflator of the non-underwriter relative spread to decrease over time. To address this concern, we repeat the analysis such that the computation of the peer's benchmark does not include banks that also initiate coverage during the same period; all results reported here are robust to this alternative. (There are few such cases, as suggested by results in Table 4: only 5% of the stocks in our sample have 5 or more initiations of coverage.)

Finally, we examine the possibility that, at least in the context of the percentage time spent at the inside quotes, we are capturing Heidle and Li's (2004) effect of how a market maker is more competitive around the issuance of a recommendation. If the market maker initiating coverage issues more recommendations than its peers in the post-initiation period, then its competitiveness could show up as an increase in the relative measure of the time spent on the inside quote, and given that no recommendation is issued before initiation of coverage, as an increase in the relative measure when comparing pre- and post-initiation periods. This does seem to be the case, though: The average number of recommendations issued by market maker initiating coverage is not significantly different than the average number of recommendations issued by their peers along the 12 months after initiation of coverage takes place.

3.4 Earnings Announcements

While the preceding sections provide compelling evidence on the impact that information sharing has on the behavior of Nasdaq market makers, in this section we consider an event which allows us to better isolate the role that information plays. We analyze liquidity provided by different market makers around earnings announcements. Earnings announcements provide a natural environment to test for for the impact of informational advantages, as such events represent an exogenously determined information shock that should affect all market makers. No single market maker should have advance knowledge of the information in the announcement, although some may have better signals of the earnings news due to the research produced by their analysts. In addition, there may be a difference in how market makers respond to the information in earnings announcements. For example, Kim and Verrecchia (1993) show that information asymmetry may increase following earnings announcements because some traders have superior ability to process the information which has been made public.[21]

For this section of the analysis, we examine a window of 40 days surrounding all quarterly earnings announcements for the firms in the sample. We collect earnings announcement dates/times from the First Call database, and we limit the sample to all announcements made either prior to the open of trading (before 9:30 a.m.) or after the close of trading (after 4:00 p.m.). This allows us to clearly delineate pre-event and post-event periods. In addition, we limit the sample to firm/announcement pairs which involve at least one affiliated and one non-affiliated market maker. The final sample consists of 4,824 announcements for the 1999-2003 period.

We divide the 40-day window into a control period and an event period. The control period is made up of the first 15 days and the last 15 days of the window. The event period runs from five days before to five days following the announcement. The statistics of interest are calculated as follows. First, we find the average behavior for each

[21] In fact, our conversations with analysts suggest that helping traders to better understand the implications of news events, whether anticipated or unanticipated, is a critical part of their communication with market makers.

pair of market maker and stock in each 15 minute interval during the control period. For example, we calculate the average percentage spread quoted by a given market maker in a certain stock for the 10:00-10:15 interval during the control period. Second, for each 15-minute interval in the event period, we calculate the percentage deviation of that microstructure variable to the relevant control period average. Finally, the mean percentage deviation for each stock and for each event period is calculated for both affiliated and non-affiliated market makers, and we then calculate the mean across all stocks. We test for the statistical significance of these measures by building an empirical distribution from the control period observations along the lines of Lee, Mucklow, and Ready (1993).[22]

<Insert Figures 3 and 4 here>

The general results are presented graphically in panel A of Figure 3 and Figure 4. In the day leading up to the announcement (event period -26 to 0), the deviation in spreads for both groups is positive and significant, indicating that they quote slightly larger spreads in the days leading up to earnings announcements relative to regular days. Spreads are slightly higher (relative to the control period) for non-affiliated market makers than they are for affiliated market makers, but the difference between the two groups is not statistically significant. The lack of systematic difference between the two groups end at the announcement, however. Following the announcement, the relative behavior of non-affiliated market makers is much worse than that of affiliated market makers. While affiliated market makers quote spreads that are on average 5% wider than the control period on the first day after the announcement, the non-affiliated market makers quote spreads on the first day that are always at least 10% greater than the control period. This behavior persists into the second day as well, although to a lesser degree. The difference is statistically significant throughout the first two days following the announcements.

[22] Specifically, for each market maker/firm/event observation in the event window, we draw one random observation (of deviation from the control period mean) for the same market maker/firm during the control period in the same time of day interval. We calculate the mean value of these deviations across all market makers in each category, and then repeat the process 100 times. The final empirical distribution is created from these 100 sample means.

When we turn to depths in figure 4,[23] there is less of a difference. Both groups actually perform slightly better on average than the control period, with bid depths around 5-10% higher than during the control period. While there is a short window prior to the announcement during which non-affiliated market makers appear to improve more than affiliated market makers, the biggest difference occurs again immediately after the announcement. When measured relative to the control period, affiliated market makers quote significantly more bid depth than do non-affiliated market makers. This difference also persists throughout the two days following the announcement.

These results are broadly consistent with those of Lee, Mucklow, and Ready (1993), who examine the behavior of the inside spread and depth surrounding earnings announcements. They find that liquidity deteriorates following the announcement and that this deterioration persists through the first day post-event. Kim and Verrecchia (1993) attribute this to "superior information processors", or traders who can better process the information in earnings announcements than others. To more clearly test whether affiliated market makers can better process new public information, we follow Lee, Mucklow, and Ready (1993) and examine a subsample of large earnings surprises (absolute value of the first-day return > 10%). This yields a sample of 1,218 announcements. The results are presented in panel B of Figure 3 and Figure 4. We see that the post-event bid-ask spread gap widens between affiliated and non-affiliated market makers. While the spread quoted by affiliated market makers returns to pre-announcement levels rather quickly, non-affiliated market makers continue to quote relatively wide spreads (between 10 to 30% higher than the control period) into the second day following the announcement. The difference between the two groups remains significant throughout the second day following the announcement. The evidence is less clear with regard to quoted depths, although there is definitely a sharp increase in depth quoted by affiliated market makers immediately following the announcement.

[23] The figures present results concerning dollar bid depths. Results for dollar ask depth are qualitatively similar and can be provided upon request.

Altogether, the results suggest that market makers who have access to information generated by analysts face less of an adverse selection problem following earnings announcements. Alternatively, the results could be driven by the limit orders placed by the customers of the bank who are trading on the bank's interpretation of the earnings announcement. Either interpretation is consistent with the notion that sell-side research produces valuable information which is relevant for the microstructure of the firm's stock trading.

4. Conclusion

In this paper we have explored the link between two separate, but potentially closely related, branches of investment banks. We first seek to better understand the process by which banks determine to provide research coverage for a firm or to make a market in the firm's stock. We find evidence that banks choose which firms to provide research coverage for from the universe of firms in which they make a market. Banks are far more likely to initiate a presence as a dealer first, and that this market making presence is in place for an average of eight months prior to the initiation of research coverage. In only a small number of cases do banks begin their "relationship" with a firm by providing research coverage. Given the low cost of entry and exit in Nasdaq market making (Wahal, 1997; Ellis, Michaely, and O'Hara, 2002), it may be that banks initiate market making coverage even if they have only a small probability of initiating research coverage in the near future. It is likely that banks view market making as a low-cost option they can purchase to establish a relationship with a firm in hopes of winning investment banking business in the future. This could explain why Ellis, Michaely, and O'Hara (2005) find no relationship between market making activity (in terms of volume traded by market makers) and underwriting business just before the offering of securities.

We then examine the extent to which a bank's research presence is associated with differences in its role as a market maker. Using monthly cross-sectional data on Nasdaq firms, we find that banks which provide research coverage for a firm quote narrower bid-ask spreads and provide better overall liquidity as compared to market

makers which have no such research relationship. We also find that banks spend a greater percentage of time at the inside bid and ask quotes when such a relationship exists. In terms of price discovery, we find evidence that dealers affiliated with research divisions are more active in moving the inside bid and ask quotes.

We then turn to an event study of changes in coverage status to get a clearer picture of the impact of sell-side research on market making. We find that virtually all measures of liquidity and price discovery improve (when measured relative to other market makers) following initiation of research coverage. When we examine discontinuations of coverage, these measures deteriorate, although the effect is not as pronounced as for initiations. We also find that the results are especially strong for market makers who have had no recent underwriting relationship with the firm, indicating that our findings are not driven by the institutional features related to the underwriting process which have been documented in the literature.

Finally, we document the behavior of market makers surrounding earning announcements. When compared to their behavior during a control period, affiliated market makers quote significantly narrower spreads in the days immediately following earnings announcements than do non-affiliated market makers. We interpret this as evidence that market makers at banks who provide research coverage for a stock may have an advantage in terms of their ability to process the information in earnings announcements.

Prior literature has found that analyst coverage is generally associated with improved liquidity. The results presented here provide interesting evidence on exactly how that liquidity improvement is realized in the market. Parties in the market which are privy to the information produced by analyst research provide more liquidity and move their quotes more informatively than they would otherwise. Our results are an important step in bridging the gap between the theoretical literature on informed trading and the empirical facts concerning analyst coverage and liquidity that have been documented to this point.

References

Aggarwal, Reena (2000), "Stabilization Activities by Underwriters after Initial Public Offerings," Journal of Finance 55, 1075-1102.

Barclay, Michael J., Terrence Hendershott, and D. Timothy McCormick (2003), "Competition among Trading Venues: Information and Trading on Electronic Communications Networks," Journal of Finance 58, 2637-2665.

Barclay, Michael J., and Jerold B. Warner (1993), "Stealth Trading and Volatility: Which trades Move Prices?" Journal of Financial Economics 34, 281-305.

Bhushan, Ravi (1989), "Firm Characteristics and Analyst Following," Journal of Accounting and Economics, 11, 255-274.

Bhushan, Ravi, and Patricia O'Brien (1990), "Analyst Following and Institutional Ownership," Journal of Accounting Research 28 (Supplement), 55-76.

Brennan, Michael, and Avanidhar Subrahmanyam (1995), "Investment Analysis and Price Formation in Securities Markets," Journal of Financial Economics 38, 361-381.

Brennan, Michael, and Avanidhar Subrahmanyam (1998), "The determinants of average trade size," Journal of Business, 71, 1-25.

Brennan, Michael, and P. J. Hughes (1991), "Stock prices and the supply of information," Journal of Finance, 46, 1665-1691.

Chordia, Tarun, Richard Roll, and Avanidhar Subrahmanyam (2001), "Market Liquidity and Trading Activity," Journal of Finance 56, 501-530.

Chung, Kee H., and Seong-Yeon Cho (2005), "Security Analysis and Market Making," Journal of Financial Intermediation 14, 114-141.

Easley, David, Maureen O'Hara, and Joseph Paperman (1998), "Financial Analysts and Information-Based Trade," Journal of Financial Markets 1, 175-201.

Ellis, Katrina, Roni Michaely, and Maureen O'Hara (2000), "When the Underwriter is the Market Maker: An Examination of After-Market Trading in IPOs," Journal of Finance 55, 1039-1074.

Ellis, Katrina, Roni Michaely, and Maureen O'Hara (2002), "The Making of a Dealer Market: From Entry to Equilibrium in the Trading of Nasdaq Stocks," Journal of Finance 57, 2289-2316.

Ellis, Katrina, Roni Michaely, and Maureen O'Hara (2005), "Competition in Investment Banking: Proactive, Reactive or Retaliatory," Working Paper, University of California, Davis.

Gomes, Armando, Gary Gorton, and Leonardo Madureira (2004), "SEC Regulation Fair Disclosure, Information, and the Cost of Capital," NBER Working Paper No. 10567.

Green, T. Clifton (2006), "The Value of Client Access to Analyst Recommendations," Journal of Financial and Quantitative Analysis 41 1-24.

Heidle, Hans G., and Xi Li (2004), "Information Leakage and Opportunistic Behavior Before Analyst Recommendations: An Analysis of the Quoting Behavior of Nasdaq Market Makers", Working Paper, University of Notre Dame.

Hasbrouck, Joel (1995), "One Security, Many Markets: Determining the Contribution to Price Discovery," Journal of Finance 50, 1175-1199.

Huang, Roger (2002), "The Quality of ECN and Nasdaq Market Maker Quotes," Journal of Finance 57, 1285-1319.

Irvine, Paul (2000), "Do Analysts Generate Trade for Their Firms? Evidence from the Toronto Stock Exchange," Journal of Accounting and Economics 30, 209-226.

Juergens, Jennifer, and Laura Lindsey (2006), "Upgrades, Downgrades, and Trading: Do Analysts Generate Business for Their Market Makers?" Working Paper, Arizona State University.

Irvine, Paul (2003), "The Incremental Impact of Analyst Initiation of Coverage," Journal of Corporate Finance 9, 431-451.

Irvine, Paul, Marc Lipson, and Andy Puckett, "Tipping," forthcoming Review of Financial Studies.

Kadan, Ohad, Leonardo Madureira, Rong Wang, and Tzachi Zach (2005), "Conflicts of Interest and Stock Recommendations – The Effects of the Global Settlement and Related Regulations," Working Paper, Case Western Reserve University.

Kim, Oliver, and Robert E. Verrecchia (1994), "Market liquidity and volume around earnings announcements," Journal of Accounting and Economics 17, 41-67.

Kothari, S. P., 2001. "Capital Markets Research in Accounting," Journal of Accounting and Economics 31, 105-231.

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.

Lipson. Marc L., and Sandra Mortal (2005), "Liquidity and Firm Characteristics: Evidence from Mergers and Acquisitions," Working Paper, University of Virginia.

Ljungqvist. A., Felicia Marston and W. J. Wilhelm (forthcoming), "Competing for Securities Underwriting Mandates: Banking Relationships and Analyst Recommendations," Journal of Finance.

Maddala, G. S. (1983), "Limited-Dependent and Qualitative Variables in Econometrics,." New York: Cambridge University Press.

Madhavan, Ananth (2000), "Market Microstructure: A Survey," Journal of Financial Markets 3, 205-258.

McNichols, Maureen F., and Patricia C. O'Brien (1997), "Self-Selection and Analyst Coverage," Journal of Accounting Research 35, 167-199.

Schultz, Paul, 2003, "Who Makes Markets?," Journal of Financial Markets 6, 49-72.

Schultz, Paul, and Mir Zaman, 1994, "Aftermarket Support and Underpricing of Initial Public Offerings," Journal of Financial Economics 35, 199-219.

Wahal, Sunil, 1997, "Entry, Exit, Market Makers, and the Bid-Ask Spread," Review of Financial Studies

Table 1. Summary Statistics for Brokers and Market Makers

The sample includes market makers (dealers) and brokers, and all Nasdaq firms that they were providing service for at some point during the period between January 1999 and December 2003. For each broker (market-maker) we average the monthly number of firms they cover (act a dealer for) during the period. The table then presents cross-sectional statistics over these time series averages.

Panel A: Dealers and how many stocks they make a market for

		Average monthly # of stocks			
	#	Mean	Median	Min	Max
All MMs	778	197.7	21.5	1.0	4,237.8
Institutional brokers	12	642.5	616.5	281.4	1250.3
Wirehouses	5	710.7	374.5	334.0	1,220.4
ECNs	11	2,803.3	3666.2	163.9	4,071.3
Wholesalers	8	3,136.3	3257.8	1326.7	4,237.8
Others	742	116.5	19.4	1.0	3,443.7

Panel B: Brokers and how many firms they cover

		Average monthly # of firms			
	#	Mean	Median	Min	Max
All brokers	553	28.1	4.3	1.0	388.3
Institutional brokers	12	303.5	319.5	103.6	392.2
Wirehouses	5	285.7	291.6	138.4	409.6

Table 2. Initiations and Discontinuations of Coverage and Market Making

This table analyzes the samples of initiations and discontinuations of sell-side coverage and market making for Nasdaq firms. Panel A includes all initiations of sell-side coverage during 2000-2002 such that: (1) the firm being initiated was already being covered by another broker; and (2) the bank initiating coverage was already a market maker for at least one stock. Panel B includes all initiations of market making activities during 2000-2002 on a stock such that: (1) the stock being initiated already had another dealer providing market making services for it; and (2) the bank initiating market making was already providing sell-side coverage for at least one firm. Panel C includes any discontinuance of coverage and/or market making for firms such that: (1) at some point between January 1999 and June 2003 the firm had both coverage and market making services being offered by the bank deciding on the discontinuation; (2) the stock had not been delisted from CRSP by Dec 2003; and (3) the bank has kept doing coverage and market making for at least some other stock by December 2003. We report results using the whole sample of broker/market makers and using the subsample of 12 institutional brokers and wirehouses defined in Huang (2002).

Panel A: Initiations of sell-side coverage

	All banks		Institutional brokers and wirehouses	
	# of obs	% of total	# of obs	% of total
MM started before coverage	5,131	45%	1,522	57%
MM and coverage started at the same month	3,883	34%	719	27%
MM started after coverage	797	7%	250	9%
Broker had done MM in the past	112	1%	22	1%
Broker would never offer MM	1,464	13%	180	7%
	11,387	100%	2,693	100%
	Mean	Median	Mean	Median
Subsample: MM started before coverage				
# months between initiations	7.27	3	6.83	3
Subsample: MM started after coverage				
# months between initiations	10.72	8	14.45	13

Panel B: Initiations of market making

	All banks		Institutional brokers and wirehouses	
	# of obs	% of total	# of obs	% of total
Coverage started before MM	1,665	6%	225	4%
Coverage and MM started at the same month	3,894	14%	693	12%
Coverage started after MM	3,536	13%	740	13%
Broker had done coverage in the past	1,243	4%	229	4%
Broker would never offer coverage	17,416	63%	3,848	67%
	27,754	100%	5,736	100%
	Mean	Median	Mean	Median
Subsample: coverage started before MM				
# months between initiations	38.35	19	39.99	19
Subsample: coverage started after MM				
# months between initiations	8.27	3	8.31	4

Table 2. (*Continued*)

Panel C: Discontinuations of coverage

	All banks		Institutional brokers and wirehouses	
	# of obs	% of total	# of obs	% of total
Discontinuation of both MM and coverage	3,058	44%	388	29%
Discontinuation of coverage only	3,589	52%	922	69%
Discontinuation of MM only	258	4%	24	2%
	6,904	100%	1,334	100%
For the subsamble of both discontinuations				
MM and coverage discontinued together	287	9%	40	10%
Coverage discontinued first	2,544	83%	299	77%
MM discontinued first	226	7%	49	13%
	3,058	100%	388	100%

Table 3. Market Makers and Stocks: Univariate Statistics

The sample includes pairs of Nasdaq firms and market makers from November 1999 for which the measured variables are available. Only stocks having at least one institutional broker or wirehouse as market maker are included, and we exclude stocks that are priced below $5. Size, volume, and number of trades are measured in the period November 1998 through April 1999. Size is the average daily market value of common equity. Volume is the average daily number of traded shares. Number of trades is the average daily number of trades. Share price is the average daily share price over the month. Volatility of returns is the standard deviation of daily raw returns, and abnormal return is the cumulative market-adjusted return, both measured from May through October 1999. # analysts is the number of sell-side analysts issuing forecast for the stock. # MM's is the number of dealers on the stock in November 1999. IPO/SEO firm is a dummy equal to 1 if the stock raised equity in the past two years. "Broker underwrote stock" is a dummy equal to 1 if the market-maker participated as a syndicate member in an equity offering deal (IPO or SEO) for the stock in the past two years. "Broker was lead underwriter" is a dummy equal to one if the market-maker underwrote an equity offering for the stock as a lead underwriter. All microstructure measures are average daily measures, computed for the pair (stock, market-maker) during November 1999. They are defined in Section 4.1. PS is the spread in percentage terms. BidDepth and AskDepth (DollarBidDepth and DollarAskDepth) represent the depth in number of shares (in number of dollars) for the ask and bid quotes, respectively, and are expressed in multiples of 100. Composite_Liq is the percentage spread divided by the average dollar depth. InsideBid% and InsideAsk% represent the percentage of time the broker spends at the inside bid or ask. WPC_Bid and WPC_Ask (ABS_WPC_Bid and ABS_WPC_ASK) are the (absolute) weighted sum of the dealer's contribution to price movements across the month, calculated using the bid or the ask, respectively. "Volume traded by MM" represents the monthly total number of shares traded by the market maker. The table presents t-statistics for the null that the means are the same for the two subsamples.

Table 3. (*Continued*)

Statistics on pairs of market makers and stocks

	Market maker does not provide coverage (non-affiliated market maker)					Market maker provides coverage (affiliated market maker)					t-test for difference of means
	N	Mean	Std Error	Min	Max	N	Mean	Std Error	Min	Max	
Firm characteristics											
Size (000,000)	1,314	2,315	0,353	10.5	377,000	2,698	5,117	0,535	15.6	377,431	-3.48
Volume (000)	1,314	821	39	3.3	19,419	2,698	1,193	47	1.7	19,400	-5.08
Share price	1,314	34.68	30.56	5.03	329.13	2,698	40.51	36.82	5.00	329.13	-4.98
Number of trades	1,314	1034.7	61.2	3.1	23898.2	2,698	1519.8	67.0	2.6	23898.2	-0.39
Volatility of returns	1,314	0.0422	0.0004	0.0109	0.2005	2,698	0.0423	0.0002	0.0109	0.1167	-0.29
Abnormal return	1,314	0.2381	0.0193	-0.7531	5.9908	2,698	0.2405	0.0136	-0.8534	6.0409	-0.10
# analysts	1,314	9.4	0.2	0.0	41.0	2,698	13.3	0.2	1.0	41.0	-14.39
# MM's	1,314	29.9	0.4	6.0	81.0	2,698	31.0	0.3	7.0	81.0	-2.06
IPO/SEO firm	1,400	0.29	0.01	0	1	2,872	0.35	0.01	0	1	-4.56
Firm & MM characteristics											
Broker underwrote stock	1,400	0.09	0.01	0	1	2,872	0.22	0.01	0	1	-9.70
Broker was lead underwriter	1,400	0.02	0.00	0	1	2,872	0.09	0.01	0	1	-7.67
Liquidity and price discovery											
PS	1,400	7.32	0.155	0.421	46.3	2,872	5.82	0.087	0.31	45.7	7.98
AskDepth	1,400	3.64	0.10	1.00	33.00	2,872	3.69	0.07	1.00	42.78	-0.46
BidDepth	1,400	3.49	0.11	1.00	66.20	2,872	3.47	0.07	1.00	41.19	-0.11
DollarAskDepth	1,400	115.87	4.32	5.21	1344.98	2,872	138.39	3.78	5.19	3253.11	-3.51
DollarBidDepth	1,400	111.62	4.34	5.13	1328.50	2,872	132.44	3.77	5.03	3214.91	-3.31
Composite_Liq	1,400	0.0264	0.0020	0.0000	0.0082	2,872	0.0197	0.0011	0.0000	0.7200	3.46
InsideAsk%	1,400	5.466	0.217	0.000	90.110	2,872	7.816	0.175	0.000	100.000	-7.53
InsideBid%	1,400	5.234	0.196	0.000	72.410	2,872	7.388	0.157	0.000	70.062	-7.68
WPC_Ask	1,373	3.015	0.155	-25.490	57.576	2,842	4.361	0.129	-37.503	59.919	-6.46
WPC_Bid	1,373	2.830	0.151	-15.468	57.143	2,843	4.123	0.131	-52.000	77.778	-5.64
ABS_WPC_Ask	1,373	1.593	0.067	0.000	29.692	2,842	2.331	0.057	0.000	43.374	-7.86
ABS_WPC_Bid	1,373	1.647	0.087	0.000	50.000	2,843	2.234	0.055	0.000	34.408	-5.23
Volume traded by MM (000)	1,312	630	33,73	0.000	15,519	2,811	1,246	54.49	0.000	71,068	-7.41

Table 4. Summary Statistics for the Event of Initiations and Discontinuations of Coverage

This table analyzes the samples of initiations and discontinuations of coverage that will be used in the time-series examination. Panel A includes all initiations of sell-side coverage during 2000-2002 such that: (1) the bank initiating coverage was already providing (continued to provide) market making prior to (after) the initiation of coverage; and (2) there were also other banks making a market in the same stock before and after the month of initiation. Panel B includes any discontinuation of coverage such that: (1) the bank discontinuing coverage was a market maker for that stock in the periods before and after the discontinuation; and (2) there were also other dealers making a market for that firm's stock in the two periods.

Panel A: Initiations of Coverage

	All	By lead underwriter	By underwriter	By non-underwriter
# initiations	893	75	112	706

	Percentile						
	Min	5%	25%	Median	75%	95%	Max
# initiations per MM	11	11	30	73	94	116	116
# initiations per month	8	10	16	24	33	42	44
# initiations per stock	1	1	1	1	2	5	7

Panel B: Discontinuations of Coverage

	All	By lead underwriter	By underwriter	By non-underwriter
# discontinuations	1,715	146	222	1,347

	Percentile						
	Min	5%	25%	Median	75%	95%	Max
# discontinuations per MM	2	2	61	127	177	234	234
# discontinuations per month	12	12	26	45	68	101	102
# discontinuations per stock	1	1	1	1	2	4	10

Table 5. Spread Around Initiations of Coverage

This table presents the median raw and relative measures of spread that the banks initiating sell-side coverage on firm provides for that firm's stock, during the 25 months surrounding the month of initiation of coverage. The results are presented for the sample of all initiations as well as for the subsamples based on the type of bank initiating coverage – a lead underwriter, an underwriter or a non-underwriter. A bank is a lead underwriter if it underwrote in the past two years an equity offering as a lead underwriter for the stock whose coverage is being initiated; a bank is an underwriter if it participated as a syndicate member in an equity offering deal (IPO or SEO) for that stock in the past two years; a non-underwriter is a bank that is classified neither as a lead underwriter nor as an underwriter. Sign tests are provided on the hypothesis that the median relative spread is different from zero at each month: ** indicates significance at 1% level, and * indicates significance at 5% level.

Month relative to initiation	All initiations		Initiations by lead undewriter		Initiations by underwriter		Initiations by non-undewriter	
	PS	Relative PS	PS	Relative PS	PS	Relative PS	PS	Relative PS
-12	5.108	-4.36%	5.852	-42.36%	5.210	-0.36%	5.013	-3.57%*
-11	4.852	-6.79%	5.885	-26.06%	4.919	-12.43%	4.837	-4.25%*
-10	4.797	-9.11%	4.533	-27.52%	4.988	14.00%	4.797	-8.86%
-9	4.767	-9.01%	4.802	-19.68%*	4.648	-0.21%	4.767	-8.40%
-8	4.643	-12.86%	4.821	-37.54%*	5.348	-5.84%	4.640	-12.46%
-7	4.659	-13.27%	4.782	-43.06%**	5.379	-1.22%	4.564	-14.14%
-6	4.713	-12.99%	4.290	-35.74%**	4.892	-15.67%	4.681	-11.03%
-5	4.666	-16.34%	5.064	-39.27%**	4.859	-19.89%	4.614	-13.19%
-4	5.111	-13.33%	4.941	-36.72%**	5.297	-14.87%	5.064	-12.14%
-3	5.431	-11.04%	4.752	-21.22%**	6.505	-4.28%	5.362	-10.23%
-2	5.513	-13.25%	5.397	-31.13%**	6.772	-5.33%	5.476	-13.06%
-1	5.638	-12.08%	5.271	-33.99%**	6.603	-8.44%	5.559	-10.24%
0	5.169	-15.94%	5.530	-26.27%**	5.997	-11.59%	5.025	-14.80%
1	5.462	-15.39%	6.078	-27.76%**	6.718	-10.90%	5.113	-15.35%
2	5.549	-15.05%**	6.194	-29.85%**	6.038	-11.27%	5.332	-14.87%
3	5.382	-16.78%**	5.967	-29.40%**	6.659	-10.65%	5.151	-17.04%
4	5.138	-20.50%**	5.098	-27.71%**	5.757	-19.88%**	4.962	-20.29%
5	5.069	-21.54%**	5.834	-27.04%**	5.632	-22.54%**	4.923	-19.72%**
6	5.345	-19.76%**	4.978	-31.72%**	5.922	-20.87%**	5.164	-19.24%**
7	5.092	-19.99%**	5.397	-34.59%**	6.079	-13.90%**	4.958	-17.84%**
8	5.218	-25.38%**	6.504	-33.58%**	5.654	-25.28%**	4.930	-24.77%**
9	5.285	-24.31%**	5.965	-24.96%**	6.288	-23.17%**	4.980	-25.84%**
10	4.912	-23.41%**	5.404	-38.25%**	6.231	-28.26%*	4.842	-21.78%**
11	4.925	-22.12%**	6.241	-32.32%**	6.701	-18.86%*	4.510	-21.72%**
12	4.967	-23.54%**	5.760	-38.05%**	5.494	-29.49%**	4.751	-20.37%**

Table 6. Market Making Activity Relative to Its Peers Around Events of Initiation of Coverage

This table analyzes changes in liquidity and price discovery measures around initiations of sell-side coverage. The table presents average relative measures the 12 months before and 12 months after the initiation, together with t-test results on the hypothesis that the relative measures are zero: ** indicates significance at 1% level, and * indicates significance at 5% level. Under the "Different?" heading we report one-sided p-values from tests (t-test and sign test) on the null hypothesis that the measures are the same between the pre- and post-initiation periods; more specifically, the alternative hypothesis is that the measure in the post-initiation period is smaller (bigger) than the measure in the pre-initiation period for the spread and composite liquidity (for all other variables). Data is winsorized at 5% before averages are taken and before the tests of significance are performed. The sample of initiations of coverage is as defined in Table 4.

	All sample				Lead				Underwriter				Non-underwriter			
	Average		Different?		Average		Different?		Average		Different?		Average		Different?	
	Before	After	Mean	Median	Before	After	Mean	Median	Before	After	Mean	Median	Before	After	Mean	Median
PS	5.74	-5.86**	<.0001	<.0001	-17.01*	-13.68*	0.2240	0.1410	6.04	-6.36	0.0014	0.0010	7.95	-4.84**	<.0001	<.0001
AskDepth	-0.37**	6.66**	0.00015	0.0005	43.10**	39.57*	0.3380	0.3601	4.45	18.46	0.0073	0.0590	-5.05**	1.40**	0.0009	0.0005
BidDepth	-1.94**	5.36**	<.0001	0.0001	32.46**	40.96**	0.1439	0.2752	-1.57*	22.24	<.0001	0.0001	-5.61**	-0.63**	0.0064	0.0116
DollarAskDepth	-0.39**	5.90**	0.00055	0.0026	44.50*	38.29*	0.2471	0.3177	4.37*	17.84	0.0090	0.0590	-5.11**	0.94**	0.0018	0.0029
DollarBidDepth	-1.90**	5.59**	<.0001	0.0002	34.28**	41.81**	0.1758	0.1410	-1.52*	22.83	<.0001	0.0003	-5.65**	-0.42**	0.0053	0.0086
Composite_Liq	8.81*	-10.92**	<.0001	<.0001	-33.37**	-29.52**	0.2178	0.3177	14.30	-14.21**	<.0001	0.0002	12.57	-8.36**	<.0001	<.0001
InsideAsk%	-10.48**	16.09	<.0001	<.0001	181.25**	153.80**	0.1937	0.2752	-2.46**	14.48	0.0026	0.0335	-21.32**	5.40	<.0001	<.0001
InsideBid%	-12.71**	15.07	<.0001	<.0001	270.06**	161.08**	0.0117	0.1375	-18.83**	13.28	<.0001	<.0001	-23.32**	4.10*	<.0001	<.0001
WPC_Ask	-18.96**	7.55**	<.0001	<.0001	31.68	72.45	0.0106	0.0025	-21.53**	-6.78	0.0909	0.0407	-23.75**	3.85**	<.0001	0.0001
WPC_Bid	-11.27**	10.05*	<.0001	<.0001	92.10	69.18	0.2065	0.2723	-18.27**	12.77	0.0016	0.0010	-17.71**	4.74**	<.0001	<.0001
ABS_WPC_Ask	-11.04**	13.51	<.0001	<.0001	147.78**	113.23**	0.0684	0.4525	0.38*	14.92	0.0187	0.0491	-20.68**	4.08**	<.0001	<.0001
ABS_WPC_Bid	-12.10**	12.16	<.0001	<.0001	165.85**	117.59**	0.0497	0.1142	-3.36*	12.73	0.0133	0.0132	-21.89**	3.47**	<.0001	<.0001
Volume	-23.88**	-4.98**	<.0001	<.0001	53.90**	47.38**	0.1120	0.0843	-38.84**	-13.67**	<.0001	<.0001	-28.94**	-8.49**	<.0001	<.0001

Table 7. Market Making Activity Relative to Its Peers Around Events of Discontinuations of Coverage

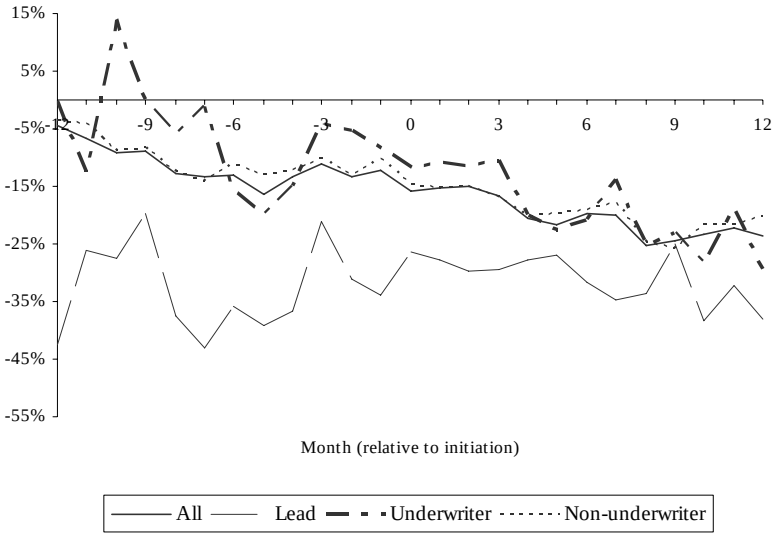
This table analyzes changes in liquidity and price discovery measures around discontinuations of sell-side coverage. The table presents average relative measures the 12 months before and 12 months after the initiation, together with t-test results on the hypothesis that the relative measures are zero: ** indicates significance at 1% level, and * indicates significance at 5% level. Under the "Different?" heading we report one-sided p-values from tests (t-test and sign test) on the null hypothesis that the measures are the same between the pre- and post-initiation periods; more specifically, the alternative hypothesis is that the measure in the post-discontinuation period is bigger (smaller) than the measure in the pre-discontinuation period for the spread and composite liquidity (for all other variables). Data is winsorized at 5% before averages are taken and before the tests of significance are performed. The sample of initiations of coverage is as defined in Table 4.

	All sample				Lead				Underwriter				Non-underwriter			
	Average		Different?		Average		Different?		Average		Different?		Average		Different?	
	Before	After	Mean	Median	Before	After	Mean	Median	Before	After	Mean	Median	Before	After	Mean	Median
PS	-4.19**	-3.12**	0.1528	0.5000	-15.67**	-9.77**	0.0358	0.1948	2.24	-0.31	0.2084	0.4455	-3.88**	-2.83**	0.1870	0.4443
AskDepth	17.12**	5.72**	<.0001	<.0001	61.60**	40.78	0.0012	0.0001	14.44	9.74	0.1105	0.0484	12.78**	1.58**	<.0001	0.0021
BidDepth	15.63**	2.34**	<.0001	<.0001	61.50**	39.03	0.0016	<.0001	9.90	7.24**	0.2413	0.5000	12.56**	-1.45**	<.0001	<.0001
DollarAskDepth	16.77**	5.50**	<.0001	<.0001	61.30**	40.39	0.0010	0.0001	13.91	10.08	0.1557	0.0360	12.47**	1.35**	<.0001	0.0053
DollarBidDepth	15.86**	2.73**	<.0001	<.0001	61.02**	34.88	0.0001	<.0001	9.60	7.35**	0.2782	0.3154	12.66**	-1.16**	<.0001	<.0001
Composite_Liq	-4.54**	2.55**	<.0001	0.0001	-41.39**	-29.46**	0.0008	0.0054	7.99	4.27*	0.2088	0.0959	-2.41**	5.15**	<.0001	0.0001
InsideAsk%	24.14**	15.91	0.0001	<.0001	119.78**	73.32**	0.0004	0.0038	0.74	7.11	0.1028	0.5000	20.06	11.15**	0.0001	<.0001
InsideBid%	26.45	13.13*	<.0001	<.0001	133.93**	77.39**	0.0001	0.0004	-1.20	7.64	0.0385	0.1687	22.53	7.71**	<.0001	<.0001
WPC_Ask	14.24	-2.92**	<.0001	<.0001	59.01**	12.97	0.0006	<.0001	2.61	-9.27**	0.0783	0.0280	11.68*	-3.33**	<.0001	<.0001
WPC_Bid	15.83	0.34**	<.0001	<.0001	90.98**	40.15	0.0005	0.0060	-2.45*	11.05	0.0381	0.4727	12.84*	-4.99**	<.0001	<.0001
ABS_WPC_Ask	21.16	15.50**	0.0053	0.0001	93.60**	56.23	0.0024	0.0225	7.52	7.63	0.4911	0.5000	17.27	12.50**	0.0242	<.0001
ABS_WPC_Bid	24.03	11.89**	<.0001	<.0001	107.96**	52.65*	<.0001	0.0005	4.90	11.00	0.1274	0.2261	19.71	8.11**	<.0001	<.0001
Volume	-4.59**	-13.36**	<.0001	<.0001	39.34**	18.22**	<.0001	0.0001	-19.26**	-19.96**	0.4137	0.3651	-6.77**	-15.67**	<.0001	<.0001

Figure 1. Bid-Ask Spread Around Initiations of Coverage

This figure presents the time series of monthly median and mean relative spread for the sample of initiations of coverage. The time series covers the 25 surrounding the month of initiation, where *t*=0 is the month of initiation of coverage. The results are presented for the sample of all initiations as well as for the subsamples based on the type of bank initiating coverage – a lead underwriter, an underwriter or a non-underwriter. A bank is a lead underwriter if it underwrote in the past two years an equity offering as a lead underwriter for the stock whose coverage is being initiated; a bank is an underwriter if it participated as a syndicate member in an equity offering deal (IPO or SEO) for that stock in the past two years; a non-underwriter is a bank that is classified neither as a lead underwriter nor as an underwriter.

b) Median relative spreads



b) Mean relative spreads

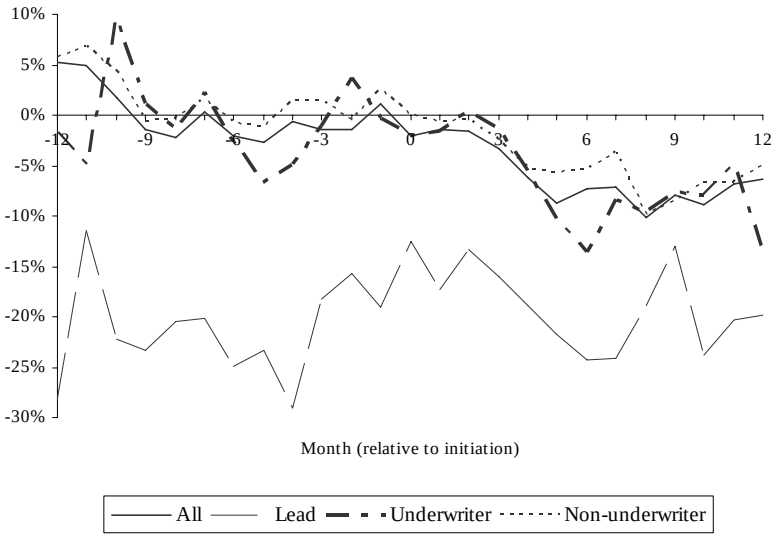
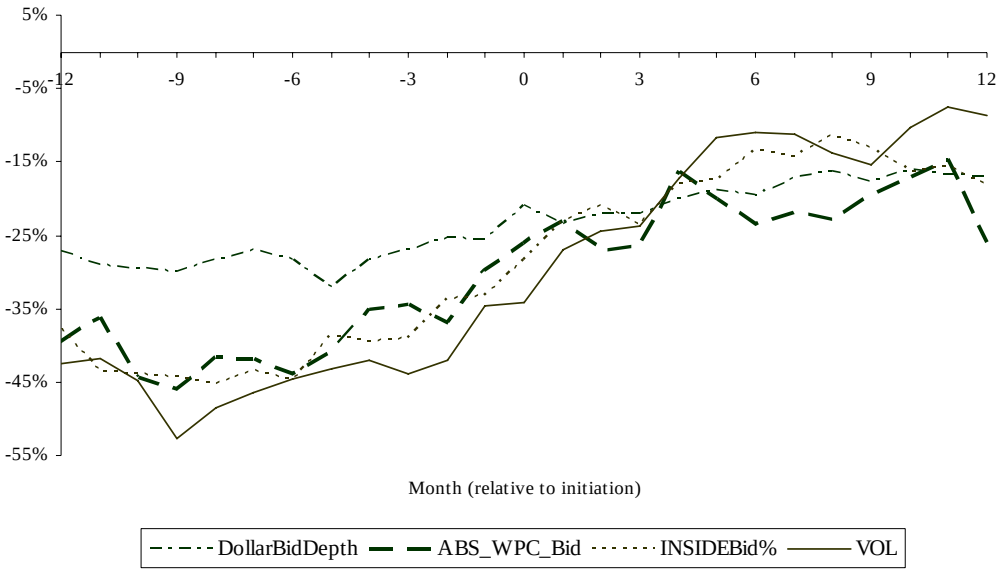


Figure 2. Other Liquidity and Price Discovery Measures Around Initiations of Coverage By Non-Underwriters

This figure presents the time series of monthly median and mean of relative measures for DollarBidDepth, ABS_WPC_Bid, INSIDEBid% and trading volume. The sample includes only initiations by non-underwriters. The time series covers the 25 months surrounding the month of initiation, where *t*=0 is the month of initiation of coverage.

a) Using median



b) Using mean

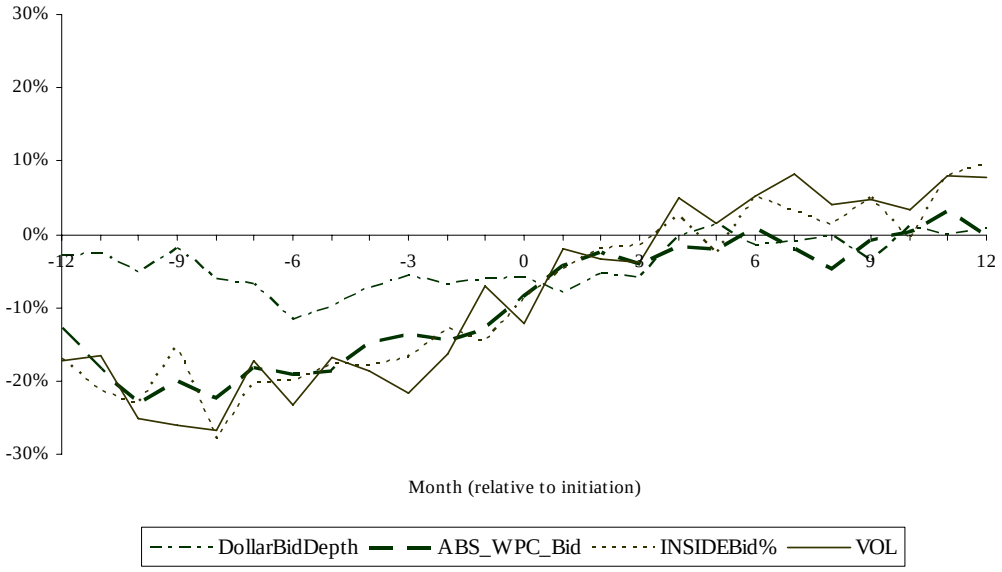
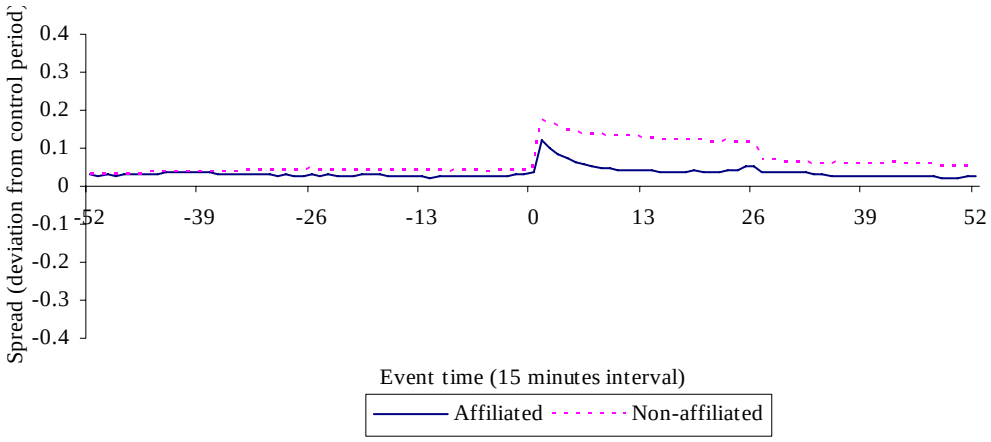


Figure 3. Bid-Ask Spread Around Earnings Announcements

This figure presents the mean percentage deviations from the control period for spreads posted by affiliated and by non-affiliated market makers. An affiliated market marker provides sell-side coverage to the stock, while a non-affiliated does not. The variables are measured in 15 minutes intervals relative to the earnings announcement, where t=0 indicates the last interval prior to the earnings announcement. Figure (a) presents results for the full sample of earnings announcements, and Figure (b) presents results for the subsample of large surprises earnings announcements, i.e., the earnings announcements whose absolute value of the first-day return is above 10%.

(a) Full Sample



(b) Large Surprises Sample

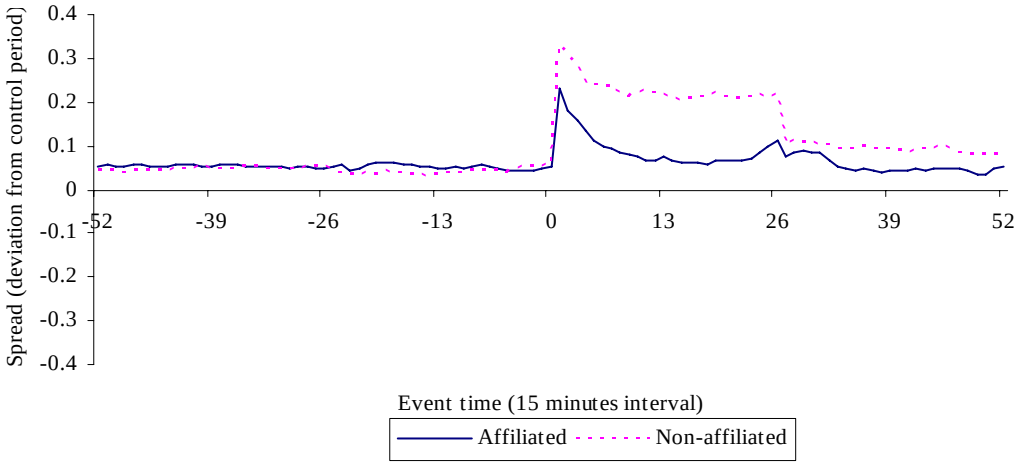
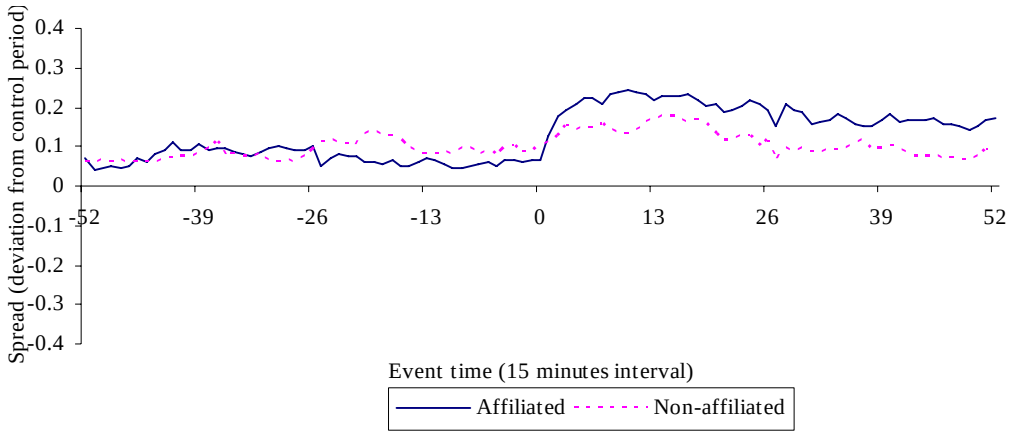


Figure 4. Depth (Dollar Bid) Around Earnings Announcements

This figure presents the mean percentage deviations from the control period for the dollar bid posted by affiliated and by non-affiliated market makers. An affiliated market marker does provide sell-side coverage to the stock, while a non-affiliated does not. The variables are measured in 15 minutes intervals relative to the earnings announcement, where t=0 indicates the last interval prior to the earnings announcement. Figure (a) presents results for the full sample of earnings announcements, and Figure (b) presents results for the subsample of large surprises earnings announcements, i.e., the earnings announcements whose absolute value of the first-day return is above 10%.

(a) Full Sample



(b) Large Surprises Sample