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Who makes markets ☆

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Abstract

A dealer needs access to order flow and information to make a market profitably in a Nasdaq stock. Several variables that proxy for the stocks that an individual market maker's brokerage customers trade, including volume, location, underwriting participation and analyst coverage, are significant determinants of market making activity. Informational advantages may also factor in the market making decision as evidenced by dealers specializing in industries. These findings suggest that individual dealers have competitive advantages in making markets in specific stocks, and that potential market making competition comes from the dealers who share those advantages rather than all Nasdaq market makers. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

A common view is that there are dozens, or even hundreds of potential market makers for any Nasdaq stock. This paper makes the point that there may be far fewer dealers who can effectively make a market in a stock because different dealers have competitive advantages in making markets in different stocks. There are two sources for these competitive advantages: access to order flow and access to information. Customer orders in Nasdaq stocks are seldom sent to a market maker

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on the basis of his quoted price for the stock, so market makers must obtain order flow through a brokerage business or by purchasing it from brokers.[1] Informational advantages accrue to market makers through their underwriting activities, their trading in other securities and the work of their analysts.

I use four variables in this paper to proxy for the ease of receiving order flow: the stock's trading volume, whether the market maker provides analyst coverage, the location of the company and whether the market maker was part of the stock's IPO syndicate. A stock's volume is used because a market maker with an institutional brokerage business can expect to receive order flow only in the high volume stocks that their customers trade. Analyst coverage of a stock is needed for order flow because investors usually buy a stock through the broker that provides information about it. For market makers with regional brokerage businesses location matters because their brokerage customers are more likely to invest in local firms than in stocks of more distant companies. Participation in a stock's underwriting syndicate makes it easier to obtain order flow in the stock because some of the market maker's brokerage customers will have purchased the stock in the offering.

Analyst coverage, company location and participation in a stock's underwriting syndicate are also associated with informational advantages. 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. A market maker is also more likely to obtain information about a stock through conversations with the firm's employees or customers if the company is a local one than if it is based in another state. Participation in an underwriting syndicate may confer informational advantages to the market maker as a result of the due diligence process or an ongoing consulting relation with the firm. An additional variable, the firm's industry, is also used as a proxy for informational advantages in market making. Market makers may specialize by industry if information learned in trading one stock provides an advantage in making markets in other stocks in the same industry.

The evidence presented in this paper confirms that sources of order flow and access to information provide competitive advantages to dealers for market making in specific stocks. Market makers with regional brokerage businesses are far more likely to make markets in local stocks than others. Dealers of all types are much more likely to make a market in a stock they helped underwrite or a stock their analysts follow. High trading volume is a particularly important requirement for market making for dealers with institutional brokerage business or national retail businesses. Many market makers do specialize in stocks in particular industries, even after adjusting for the effects of location and IPO syndicate participation.

These results suggest that we need to change the way we look at competition between dealers. It has been said that for a Nasdaq market maker, making a market in a new stock is "as easy as turning on a light". Indeed, Wahal (1997) finds that entry and exit from market making in specific Nasdaq stocks is common. However,

[1] Ellis et al. (1999) note that "Preferencing agreements are particularly prevalent on the Nasdaq, where it is estimated that in some stocks virtually all order flow is preferenced".

making a market profitably requires more than simply quoting a stock. The market maker must find a source of order flow, either through its own brokerage business or by purchasing order flow. The market maker may be required to provide analyst coverage of the stock. The ease or difficulty in making a market in a stock will depend on the nature of the market maker's brokerage business, its other market making positions, and its investment banking business. Dealers who have advantages in market making in particular stocks may appear to earn abnormally large returns trading these stocks, at least in the short-run.

A second implication of these findings is that we need to reconsider the standard assumption that market makers are uninformed. Dealers' preference for making markets in local stocks and stocks that they have underwritten, and especially their tendency to specialize in particular industries suggests that they trade stocks where they have an informational advantage. If this is true, dealers may exploit information by executing orders for their own account selectively. They may attempt to conceal information rather than posting quotes that fully reveal what they know. These elements of dealer behavior are typically ignored in microstructure models.

The rest of the paper is organized as follows. The data used here is described in Section 2. Section 3 provides evidence on the relation between a dealers' sources of order flow and their choices of stocks in which to make markets. Section 4 shows that some dealers specialize in making markets in stocks in particular industries and discusses whether dealers have informational advantages in making markets in some stocks. In Section 5, I examine how different characteristics of a stock determine the probability that a dealer will make a market in the stock. Section 6 offers a summary and conclusions.

2. Data

The sample employed here consists of monthly observations for all Nasdaq stocks over May 1995 through February 1998. Data is obtained from several sources. Nasdaq provided total share volume reported by each dealer in every Nasdaq stock each sample month. The location of the headquarters of every Nasdaq listed stock is also provided by Nasdaq. Daily closing prices of the stocks are obtained from the NYSE's TAQ database. Information on market makers' businesses (institutional, wholesale, national retail, etc.) and on the location of their headquarters is obtained from the Securities Industry Association member directory and the Standard and Poor's Guide to North American Securities Dealers. Data on participation in IPO underwriting syndicates comes from Security Data Corporation (SDC). I/B/E/S provided information on analyst coverage and recommendations.

Table 1 provides summary statistics on the distribution across stocks of the number of market makers in a stock, the stock's Herfindahl index, the daily dollar volume, and the daily number of trades. All stocks with market share data in the Nasdaq market share database and with quote information in the TAQ database are included. The number of stocks during a month varies from 5,669 to 6,340. Statistics are reported for six months that span the sample period: May 1995, December 1995,

Table 1
Summary statistics for Nasdaq stocks over May 1995 through February 1998
Volume and trades per day are obtained from the TAQ data. Nasdaq provided each market maker's share volume in every Nasdaq stock each month of the sample period. The Herfindahl measures and the number of dealers are calculated monthly for each stock from this data. If a dealer reports any trading volume for the month he is counted. Each month, the cross-sectional quartiles and mean of each variable are calculated. This table reports the time-series means of these quartiles. Grand means of the 34 monthly means and quartiles are reported in the last column.

	May 1995	December 1995	June 1996	December 1996	June 1997	February 1998	Mean 5/95–2/98
Panel A. The number of market makers							
Mean	10.6	10.3	10.1	9.8	10.5	11.8	10.4
Third quartile	14	14	13	13	14	16	13.9
Median	9	9	8	8	9	10	8.8
First quartile	5	5	5	5	5	6	5.1
Panel B. Herfindahl indices							
Mean	3,140	3,001	3,049	3,061	3,057	3,038	3,061.4
Third quartile	3,969	3,912	3,915	4,032	3,963	3,955	3,987.2
Median	2,487	2,392	2,439	2,447	2,444	2,443	2,444.5
First quartile	1,593	1,483	1,506	1,521	1,542	1,528	1,524.7
Panel C. Daily dollar volume							
Mean	1,537	2,040	2,184	2,227	2,658	3,434	2,408.0
Third quartile	430.0	642.9	873.6	675.6	691.4	895.8	695.7
Median	81.5	128.7	169.2	146.7	137.3	164.4	137.8
First quartile	18.7	30.7	37.5	34.0	30.9	37.5	31.4
Panel D. Number of trades per day							
Mean	36	52	59	58	63	89	59.9
Third quartile	23	35	41	39	38	54	37.0
Median	8	11	12	13	12	16	11.5
First quartile	3	4	4	4	4	5	4.2

June 1996, December 1996, June 1997 and February 1998. The last column of the table provides the time series average of the statistics over the 34 months.

Panel A reports on the distribution of the number of market makers per stock. While there is some slight variation from month to month, the mean number of market makers is generally about 10.5, the median is about 9, and the first and third quartile are generally around 5 and 14 market makers, respectively. The slight increase in the number of market makers shown in February is a result of including ECN quotes in Nasdaq.

The Herfindahl–Hirschman (henceforth Herfindahl) index is reported in Panel B of Table 1. This is a measure of the concentration of market making. For stock i in month t, it is

$$\text{Herfindahl}_{i,t} = \sum_{n=1}^{N} \pi_{n,i,t}^2, \tag{1}$$

where $\pi_{n,i,t}$ is the percentage of the volume in stock i handled by market maker n. Note that if one market maker had 100% of the volume in stock i, the Herfindahl index would be $100^2 = 10,000$. If four dealers each handled $\frac{1}{4}$ of the total volume, the Herfindahl index value would be $4 \times (25)^2 = 2,500$.

The Herfindahl index increases as the number of market makers decreases or as the proportion of business taken by the leading market maker increases. Thus a high Herfindahl index is associated with a lack of competition.[2] This measure of concentration varies little during the sample period. Table 1 shows that the mean Herfindahl value ranges between 3,001 and 3,140, while the median is always between 2,392 and 2,487. The first and third quartiles are usually around 1,500 and 4,000. When the mean Herfindahl index values are compared with the number of dealers, it is apparent that the number of dealers in a stock tends to overstate the degree of competition. The average number of market makers exceeds ten, but the Herfindahl index is above 2,500, the value that would occur if four market makes split all the volume equally. This is consistent with Ellis et al. (1999), who find that one-third of dealers trade less than once per week.

Panel C shows the distribution of the daily dollar volume (in thousands of dollars) across stocks. Dollar volume increases steadily over the period, with the mean, median and quartiles of the distribution all approximately doubling between May 1995 and February 1998. Dollar volume is right-skewed. For example, the mean daily dollar volume is \$3,433,600 in February 1998, while the median is only \$164,400. Panel D of Table 1 shows that the mean median and quartiles of the number of trades also double between May 1995 and February 1998. It appears that the increase in dollar volume reported in Panel C is a result of more trades, not bigger trades.

3. Sources of order flow and market making

While precise figures are unavailable, it is usually conceded that only a small proportion of orders are sent to a market maker because he has the best quote. Instead, most orders are preferenced. Preferencing can take two forms. First, the market maker can internalize order flow from its brokerage customers. This is the major source of order flow for most Nasdaq market makers. Alternatively, the market maker can pay for order flow from brokers. This is the source of order flow for wholesalers.

Because most Nasdaq order flow is preferenced, differences in dealers' choices of stocks to handle should be generated by differences in their brokerage customers, or

[2] Kremer and Polkovnichenko (2000) find that Nasdaq stocks with higher Herfindahl indices have wider quoted spreads even after adjustment for market capitalization and volatility. However, Dutta and Madhavan (1997) suggest that collusion is most likely when all dealers have equal market shares. Dutta and Madhavan consider a cartel of dealers. In their model, the dealer who undercuts the spread gets all the order flow for one period but the cartel then collapses. The dealer with the smallest order flow has the least to lose, so he would be the one to undercut the spread. Thus tacit collusion is more likely when all have approximately equal market share.

the customers of the firms that sell order flow to them. To examine this, I divide market makers into four categories; institutional brokers, national retail brokers, wholesale market makers, and regional brokerage firms. This last category includes all market makers other than electronic communications networks (ECNs) that do not fit into one of the other classifications. Categorizations are based on the firms' self-descriptions in the Securities Industry Association member directory. The categorizations are not perfect. Merrill Lynch for example is classified as a national retail broker, but has a large institutional business as well. Dain Bosworth is classified as a national retail broker but is concentrated primarily in the midwest.

Table 2 provides information on the market making activities of dealers in the different categories for December 1996, a typical month in the middle of the sample period. Panel A reports the number of markets made by different types of dealers. For each dealer each month, I calculate the number of markets made. I then calculate the cross-sectional mean, median, maximum and first and third quartiles across all dealers and across all dealers with wholesale, national retail, institutional or regional businesses. When all dealers are considered, the median number of markets made is 20. Panel A reveals that regional brokers make up the great majority of Nasdaq market makers. While the number of all dealers is 542, the number of regional brokers is 470. The table also shows that regional brokers make markets in far fewer stocks than others. The median number of markets made by regional brokers is only 17, while the medians for wholesalers, national retail brokers and institutional brokers all exceed 180.[3]

Panel B provides data on the daily dollar volume of trading by different categories of market makers. The median of all dealers' daily volume is $422,000. When dollar volumes are broken down by type of dealer, we see that regional brokers' trading volume is far lower than that of other dealers. While the median regional broker's daily dollar volume is $287,000, the median for wholesalers is $51,916,000 and the median for institutional brokers is $75,799,000.

3.1. Trading volume and market making

Institutions tend to trade large, high-volume stocks that provide sufficient liquidity to allow them to take large positions. Thus we would expect that market makers whose brokerage business is primarily from institutions would receive order flow in large, high volume stocks and would make markets in those stocks. National retail brokers make the same recommendations to thousands of retail clients, and would thus need to recommend stocks that are large and liquid enough to accommodate their many investors. On the other hand, wholesale market makers typically buy order flow from a number of small brokers. Because they are buying orders from many different brokers with different clienteles and different recommended securities, they must make markets in a large number of stocks. Thus they will have a larger share of their market making positions in small stocks than will institutional brokers. Regional brokers, unlike institutional brokers or

[3] Ho and Macris (1985) find a similar distribution of number of markets made in the 1980s.

Table 2

Panel A. The distribution of the number of markets made by dealers during December 1996
The 542 dealers all reported volume from market making in at least one Nasdaq stock during December 1996. Classifications are based on the firm's self-description in the Securities Industry Association member directory. All firms not otherwise described are classified as regional brokers.

		Number of markets made					
	Number of dealers	Mean	Minimum	25th percentile	Median	75th percentile	Maximum
All dealers	542	110	1	8	20	62	4,884
Wholesalers	16	1,273	4	50	295	2,485	4,884
National retail brokers	30	377	12	171	290	570	1,156
Institutional brokers	26	220	2	42	185	342	618
Regional brokers	470	48	1	7	17	45	1,374

Panel B. The distribution of the dollar volume handled by dealers during December 1996
Total daily dollar volume for each dealer is approximated by multiplying the average daily closing share price of each stock over the month by the total share volume reported by the dealer in every Nasdaq stock for the month divided by the number of trading days in the month. Daily dollar volumes are then averaged across all dealers.

	Dollar volume handled					
	Mean	Minimum	First quartile	Median	Third quartile	Maximum
All dealers	$24,113,000	<$1,000	$84,000	$422,000	$2,630,000	$906,673,000
Wholesalers	$170,711,000	$299,000	$2,563,000	$51,916,000	$348,433,000	$656,913,000
National retail brokers	$132,777,000	$8,000	$8,763,000	$38,015,000	$163,043,000	$906,673,000
Institutional brokers	$168,619,000	$4,000	$1,118,000	$75,799,000	$269,260,000	$885,549,000
Regional brokers	$4,193,000	<$1,000	$70,000	$287,000	$1,139,000	$214,680,000

national retailers are not limited to making markets in large stocks. Because they have a small number of clients, the low trading volume in small stocks provides sufficient liquidity for their customers.

To see if the source of the market makers' order flow determines which stocks they handle, I divide stocks into dollar volume quintiles each month. I then calculate the proportion of market making positions by all dealers in each dollar volume quintile. I also calculate the proportion of market making positions in each dollar volume quintile separately for institutional brokers, national retail market makers, wholesale market makers, and regional brokers. Results are reported in Table 3.

The first row of Table 3 shows the proportion of market making positions by dollar volume quintiles for all market makers. The second column gives the number of market makers. The number of market makers is calculated separately for each of the 34 months, and the first number, 530.3, is the average number of market makers across the 34 months. The numbers in parentheses below are the minimum and maximum number of dealers. The number ranges from 480 to 555. In the next columns of the first row we see that the average, across months, of the proportion of market making positions in the smallest dollar volume quintile of stocks is 10.15%. The range is from 9.38% to 10.70%. On average 14.61% of market making positions are in the second dollar volume quintile, 18.70% are in the third quintile, 23.28% are in the fourth quintile and 33.27% are in the largest dollar volume quintile. Not surprisingly, higher volume stocks have more market makers.

When the proportion of market making positions is calculated separately for market makers who obtain order flow from different sources a pattern emerges. Market makers who are institutional brokers have only about 2.5% of their positions in the lowest volume quintile and about 63% of their positions in the highest volume quintile of stocks. This is what we would expect if these market makers chose stocks on the basis of order flow from their clients. National retail brokers have 6.5% of their market making positions in the quintile of stocks with the lowest volume and about 41.4% of their market making positions in the quintile of stocks with the highest volume.

Table 3 also shows that the market makers who receive order flow in the less active stocks are more likely to make markets in them than other dealers. Wholesale market makers have 12.5% of their positions in the quintile of the least active stocks as compared to 10.15% for all market makers. Only 27.9% of their positions are in the most active stocks as compared to 33.3% for all market makers. Similarly, regional brokers have 12.4% of their positions in the quintile of the least active stocks while only 25.4% of their positions are in the most active stocks.

In Panel B of Table 3, relative market shares are shown for each market maker type for each volume quintile. Each month, the relative market share for each market maker type and volume quintile pair is obtained by dividing the average market share of the market maker type in stocks in the dollar volume quintile by the average market share of all dealers in the dollar volume quintile. The table reports the average across all months of each relative market share as well as the minimum and maximum mean relative market share across the 34 months. So for example, the first row in the table shows that the average market share is 6.01% in the quintile of the

Table 3

Panel A. The proportion of market makers' positions in stocks in different dollar volume quintiles
Each month, stocks are sorted into quintiles based on dollar volume. Each dealer is placed in one of four mutually exclusive categories: institutional brokers, national retail brokers, wholesale market makers, and regional brokerage firms. Dealer classifications are obtained from self-descriptions in the Securities Industry Association member directory. The proportion of each dealer's positions that are in each dollar volume quintile is calculated each month, and a cross-sectional average is calculated for each type of dealer. A grand average is then calculated across months from May 1995 through February 1998.The first number in each cell is this grand average. The numbers in parentheses are the minimum and maximum across sample months.

		Proportion of market making positions in each dollar volume quintile				
Market maker type	Number of market makers	Lowest dollar volume	2	3	4	Highest dollar volume
All	530.3	0.1015	0.1461	0.1870	0.2328	0.3327
	(480–555)	(0.0938–0.1070)	(0.1321–0.1549)	(0.1727–0.1969)	(0.2199–0.2439)	(0.3134–0.3633)
Institutional brokers	24.7	0.0257	0.0437	0.0971	0.2052	0.6283
	(22–27)	(0.0167–0.0388)	(0.0371–0.0509)	(0.0823–0.1098)	(0.1755–0.2238)	(0.5934–0.6606)
National retail brokers	29.2	0.0650	0.1102	0.1649	0.2455	0.4144
	(27–30)	(0.0578–0.0729)	(0.0955–0.1206)	(0.1457–0.1750)	(0.2356–0.2617)	(0.3974–0.4457)
Wholesale market makers	15.6	0.1249	0.1667	0.1985	0.2306	0.2794
	(15–16)	(0.1162–0.1321)	(0.1529–.1779)	(0.1835–0.2080)	(0.2207–0.2442)	(0.2584–0.3050)
Regional brokers	459.1	0.1236	0.1765	0.2130	0.2331	0.2538
	(415–478)	(0.1091–0.1428)	(0.1578–0.1891)	(0.1957–0.2253)	(0.2168–0.2467)	(0.2318–0.2783)

Table 3 (*continued*)

Panel B. Relative market shares for different market maker types by trading volume quintile
Average market shares are obtained for each dollar volume quintile by each market maker classification each month by taking a simple average across all positions of all dealers in the category. The relative market share is obtained by dividing the average market share of a dealer type in stocks in a dollar volume quintile by the average market share of all dealers in the dollar volume quintile. Simple average are taken across month in the sample periods. The table shows averages across months with the minimum and maximum monthly averages underneath.

		Market share				
Market maker type	Number of market makers	Lowest dollar volume	2	3	4	Highest dollar volume
All	530.3	0.1926	0.1345	0.1054	0.0851	0.0601
	(480–555)	(0.1761–0.2070)	(0.1284–0.1409)	(0.0960–0.1108)	(0.0732–0.0927)	(0.0470–0.0664)
		Relative market share				
Institutional brokers	24.7	1.386	1.463	1.620	1.710	1.474
	(22–27)	(1.004–1.622)	(1.234–1.732)	(1.350–1.830)	(1.551–1.967)	(1.338–1.800)
National retail brokers	29.2	1.314	1.447	1.438	1.383	1.310
	(27–30)	(1.199–1.446)	(1.358–1.621)	(1.363–1.608)	(1.295–1.638)	(1.206–1.495)
Wholesale market makers	15.6	0.889	0.864	0.854	0.809	0.771
	(15–16)	(0.831–1.015)	(0.792–1.049)	(0.764–1.100)	(0.729–1.055)	(0.683–0.962)
Regional brokers	459.1	1.012	0.976	0.924	0.870	0.751
	(415–478)	(0.964–1.045)	(0.907–1.017)	(0.851–1.004)	(0.783–0.985)	(0.670–0.846)

highest dollar volume stocks. However, as shown in the second row of the table, on average an institutional broker has a market share of 1.474 times as much, or 8.86% in the quintile of stocks with the highest trading volumes.

Results in Panel B indicate that regional brokers' market shares are high relative to other market makers in low volume stocks, but on those occasions when they do make markets in high volume stocks their market share is smaller than that of the average dealer. Similarly, wholesaler's relative market shares are smaller for more active stocks.

To summarize, the results in Table 3 are consistent with dealers making markets in the stocks in which they receive order flow. Market makers with a brokerage clientele that consists mainly of large investors make markets in active stocks. Market makers whose brokerage clientele consists of a small number of small investors are much more likely to make markets in less active stocks.

3.2. Geographic location, order flow, and market making

It has long been known that investors are biased toward holding domestic stocks over foreign shares. Recent work shows that in addition, investors prefer to buy stocks in local companies rather than domestic companies that are located further away. Coval and Moskowitz (1999) find that professional money managers in the U.S. tend to invest disproportionately in local companies. They are particularly likely to exhibit this bias for local businesses when investing in small firms. Similarly, Huberman (1998) finds that investors are much more likely to hold shares in the Regional Bell Operating Company that provides phone service to their area than another Regional Bell. Investors' preference for local companies suggests that Nasdaq market makers with a regional brokerage businesses will get a disproportionate share of their order flow in local stocks and will thus tend to make markets in local stocks.

To examine the relation between location and market making activity, I calculate, for each dealer each month, the number of market making positions in companies located in the same state that would be expected if the decision to make a market was independent of location. This is obtained by multiplying the total number of market making positions by all dealers in in-state stocks by the proportion of all market making positions held by in-state dealers. This number is summed across all regional market makers, along with the actual number of positions taken in stocks of companies located in the state. Results for May 1995, December 1995, June 1996, December 1996, June 1997, and February 1998 are shown in the first two rows of Table 4. In each month, the number of actual market making positions in same-state stocks exceeds 4,300 while the expected number is always less than 1,500. In their choices of stocks, regional market makers display a strong bias toward local companies. In some cases the bias is extreme. There is a 72.5% probability that Hilliard and Lyons will make a market in a stocks from their home state of Kentucky, but only a 1.7% chance that they will make a market in another stock. There is a 72.2% chance that John J. Kinnard will make a market in a stock from

Table 4
Market making activities by regional dealers in stocks located in the same and other states
The location of the stock's headquarters and the location of the market makers's headquarters are their states. For each market maker, the expected number of positions in stocks based in the same state is obtained by multiplying the number of market making positions by all dealers in stocks based in the state by the proportion of all stocks in which the dealer is a market maker.

	May 1995	Dec. 1995	June 1996	Dec. 1996	June 1997	Feb. 1998
Actual number of positions in same-state stocks	4,578	4,341	4,336	4,623	4,883	4,894
Exp. number of positions in same-state stocks	1,249	1,245	1,301	1,392	1,413	1,393
Number of states with regional dealers	32	32	32	34	34	34
Number of states, in-state positions > expected	32	32	32	34	34	33
Number of states, in-state positions > 10× expected	20	21	20	21	20	20
Mean mkt. share in same-state stocks	11.71%	11.84%	12.64%	12.87%	12.36%	11.05%
Mean mkt. share in other state stocks	8.53%	8.94%	9.18%	9.27%	9.05%	8.95%

their home state of Minnesota but only a 3.1% chance that they will make a market in a stock from another state.

There are 34 states, including the District of Columbia, with both regional market makers and Nasdaq listed stocks. I sum the actual and expected number of same-state market making positions separately for dealers in each of these states. I then calculate the number of states whose dealers make markets in more same-state stocks than expected. As shown in the third and fourth rows of the table, dealers in almost all states make markets in more local stocks than would be expected. Furthermore, as shown in the fifth row of the table, for most states the number of positions by dealers in same state stocks is more than ten times the expected number.

The last two rows of the table show the mean market share for regional dealers in same-state stocks, the mean market share for regional dealers in stocks from other states, and the mean market share of all dealers in all stocks. The mean market share of regional dealers in same-state stocks ranges from 11.05% to 12.87%, while the same dealers' market share in stocks from out-of-state ranges from 8.53% to 9.27%.

3.3. Analyst coverage and market making

If order flow from brokerage customers is an important determinant of a dealer's choice of market making positions, we would expect dealers to make markets in the stocks that they are recommending to their brokerage customers. I obtain, from I/B/E/S, the buy/sell recommendations for Nasdaq stocks made by firms that made markets in Nasdaq stocks over the sample period. The data includes the date of each recommendation and whether it was a strong buy, buy, hold, underperform or sell recommendation. Table 5 provides data on the relation between market making and analyst coverage for May 1995, December 1995, June 1996, December 1996, June 1997 and February 1998.

All dealers with analyst recommendations in I/B/E/S are included in the table. For each dealer each month, I calculate the expected number of stocks in which the

Table 5
Market making and analyst coverage
Analyst recommendations are obtained for Nasdaq stocks from I/B/E/S. Recommendations are on a 5-point scale: 1 is a strong buy, 2 is a buy, 3 is a hold, 4 is underperform, and 5 is sell. The mean analyst recommendations, market shares and dollar volumes are calculated for each dealer. Averages across dealers are reported in the table. *t*-Statistics for differences in dealer means are based on cross-sectional standard deviations of differences in means.

	5/95	12/95	6/96	12/96	6/97	2/98
Number of dealers providing analyst reports on I/B/E/S	92	92	93	93	92	91
Mean number of stocks both analyst and dealer	48.1	45.2	39.7	35.6	32.2	25.7
Mean number of stocks market maker only	170.8	169.5	176.7	185.1	195.0	201.3
Mean number of stocks analyst only	10.5	14.0	16.4	17.8	18.4	17.0
Mean expected number both analyst and dealer	2.7	2.6	2.3	2.2	2.1	1.9
Number dealers chi-square test indicates (at 1% level) that are both market maker and analyst more often than if independent	91	92	90	90	89	90
Mean analyst recommendation when the analyst is also a dealer	1.92	1.94	1.91	1.90	1.88	1.92
Mean analyst recommendation when the analyst is not a dealer	2.45	2.43	2.35	2.30	2.27	2.21
t-Statistic for difference in recommendations	− 8.93	− 8.03	− 8.14	− 8.18	− 8.15	− 6.19
Mean market share when both a dealer and analyst	12.0%	11.2%	11.2%	11.1%	10.8%	10.0%
Mean market share when a dealer only	10.9%	11.6%	11.6%	11.9%	11.4%	11.1%
Mean dollar volume when both a dealer and analyst	$7.3m	$8.4m	$8.6m	$10.8m	$12.4m	$13.3m
Mean daily dollar volume when a dealer only	$2.6m	$3.6m	$4.3m	$4.3 m	$4.8m	$5.5m
t-Statistic for difference in volumes	5.26	4.86	3.04	4.57	4.13	3.66

dealer would both make a market and provide analyst recommendations if the two activities were independent. This is obtained by multiplying the total number of Nasdaq stocks during the month by the proportion of stocks that the dealer makes a market in and the proportion of stocks for which the dealer provides analyst recommendations. The expected number, and actual number of stocks in which dealers both made markets and provided analyst coverage is averaged across dealers. As shown in the table, dealers are far more likely to make markets in the stock that their analysts cover. For example, in May 1995 dealers both made markets and provided analyst coverage for an average of 48.1 stocks. The expected number of stocks with both activities is 2.7. Analyst recommendations are also, on average, more favorable when the analyst works for a firm that makes a market in the stock. With 1 as a strong buy, 2 as a buy, and 3 as a hold, the mean recommendation in May 1995 is 1.92 if the firm made a market in the stock and 2.45 if it did not. Similar results are reported for other months. Paired sample *t*-tests for each month indicate that the mean recommendation is always significantly more favorable, at the 1% confidence level, for stocks in which the dealers made markets. Of course, it is not clear whether market makers choose to make markets in stocks their analysts like, or whether their analysts choose to like the stocks in which they make markets.

Interestingly, market share is often lower for stocks in which the dealer both makes a market and provides analyst coverage than for stocks in which the dealer only makes a market. This may be explained by dealers providing analyst coverage in more active stocks and avoiding it in less active stocks. While market shares are similar for stocks in which the dealers do and do not provide analyst coverage, mean dollar volume tends to be more than twice as large when the market maker provides analyst coverage.

The data reported in Table 5 are also compiled separately for institutional brokers, national retail brokers and regional brokers (not shown). Results were similar for each category of market maker. In each case, market makers were far more likely to make markets in stocks their analysts covered. Analysts on average provide more favorable assessments of the stocks that the firm made markets in. Average dollar volume is always larger when the dealer provides analyst coverage than when the dealer only makes a market.

3.4. Underwriting and order flow

Aggarwal and Conroy (2000), Ellis et al. (1999, 2000), and Schultz and Zaman (1994) find that lead underwriters are almost always market makers in the immediately following an IPO. In addition, Ellis et al. (2000) show that the lead underwriter handles a large share of the aftermarket trading volume and that their market making is usually profitable.

In this section of the paper I ask a related question. Rather than seeing if underwriters make markets immediately following an IPO, I examine whether market makers in the five years following an IPO are likely to have been part of the IPO underwriting syndicate. A fundamental advantage that the underwriter has in market making is that he will get order flow. Investors who bought shares in the IPO are the market maker's brokerage customers and are likely to sell their shares through him. Also, during the IPO, it is likely that the underwriter will find investors who will buy in the aftermarket.

I obtain ticker symbols, underwriting syndicate member's names, and the offering date for all IPOs from 1990 on from Securities Data Corporation (SDC). For individual months over the sample time period, I identify all Nasdaq stocks that went public during the previous five years. Then, for every dealer making a market in any of the stocks during the month, I count the number of stocks in which the dealer makes a market and participated in the underwriting and calculate the number of stocks in which each dealer would be expected to be both a market maker and underwriter if the activities were independent. This expected number is obtained as the product of the proportion of stocks in which he makes a market, the proportion that he helped underwrite and the total number of stocks that had IPOs in the previous five years.

Table 6 presents results for six months; May 1995, December 1995, June 1996, December 1996, June 1997 and February 1998 for dealers who made markets in at least 20 stocks and who participated in at least 20 IPOs in the previous five years. The number of dealers who meet the criteria increases over the period from 39 to 95.

Table 6
Summary statistics on the relation between underwriting and market making
For each month, the sample consists of all stocks that went public in the previous five years. For each dealer, the expected number of stocks in which he is both underwriter and market maker is obtained by multiplying the number of stocks in the sample by the proportion of all sample stocks in which the dealer makes a market and the proportion of all sample stocks for which the dealer was a member of the underwriting syndicate. Market share is the proportion of share volume in a stock handled by the market maker.

	5/95	12/95	6/96	12/96	6/97	2/98
Number of dealers who made markets in at least 20 Stocks and underwrote 20+ stocks	39	42	46	51	77	95
Number who are both dealer and underwriter in the same stock more often than expected	39	42	46	51	77	95
Number of dealers χ^2 test rejects no correlation between market making and underwriting	39	42	46	51	77	89
Mean number of stocks in which dealer is also an underwriter	47.0	54.8	59.2	62.3	45.4	37.1
Mean expected number of stocks in which the dealer is also an underwriter	5.7	6.6	6.7	6.8	5.9	6.7
Mean market share (%) when dealer was also an underwriter	24.0	24.7	24.1	24.8	22.6	18.5
Mean market share (%) when dealer was not an underwriter	8.4	9.0	9.4	9.0	8.0	7.5
t-Statistic for difference in mean market shares	18.07	18.76	22.93	20.90	15.85	12.97

This likely reflects the large number of IPOs in the mid-1990s that allowed more dealers to participate in at least 20 offerings. In every month, every one of the dealers makes markets in more underwritten stocks than would be expected if the two activities were independent. In every month except the last, chi-square tests reject independence of market making and underwriting activities for every single dealer. The cross-sectional average number of the stocks in which the dealer is both a market maker and an underwriter shown in the fourth row of the table, ranges from 37 to 62, while the cross-sectional average of the expected number of stocks in which the dealer is both underwriter and market maker, shown in the fifth row of the table, ranges from 5.7 to 6.8. The sixth row shows the cross-sectional average of the dealers' mean market share for stocks in which they acted as an underwriter. It ranges from 18.5% to 24.8%. As shown in the following row, the range is from 7.5% to 9.4% for stocks in which they were not an underwriter. A *t*-statistic testing for differences in the mean market share is highly significant in each month.

To summarize, in this section of the paper, I show that dealers make markets in the stocks in which they are likely to receive order flow. Dealers with institutional brokerage clients are likely to receive order flow in high volume stocks, and those are the types of stocks in which they make markets. Dealers who recommend stocks to their brokerage clients are likely to receive orders in those stocks, and I find they are

more likely to make markets in these stocks. Several studies show that investors like to buy shares in local companies. I find that market makers are likely to make markets in stocks that are located in the same state as the market maker and its customers. Finally, if a market maker was part of the underwriting syndicate for an IPO, it is likely that its customers will be familiar with the stock and will hold shares in the company. This would in turn suggest that the dealer would receive order flow in the stock and I find that dealers are more likely to make markets in stocks if they were part of the underwriting syndicate.

4. Informational advantages and market making

Dealers may also make markets in stocks where they have an informational advantage, and some of the results of the previous section can be interpreted as supporting that hypothesis. A preference for local stocks could reflect an ease of obtaining public or private information about local companies. For example, Hau (2001) finds that professionals who trade German stocks make more money if they are located near the corporate headquarters of the stock they are trading. Likewise, information obtained by analysts may be useful to a market maker as well as to his brokerage clients. Participation in an underwriting syndicate seems a particularly important way to acquire information because dealers may learn non-public information as part of the due-diligence process. In addition, lead underwriters often continue in an advisory role after the offering and are usually used as underwriters in follow-on offerings. This continued relation with the company can provide the market maker with a significant informational advantage over potential rivals.

Another source of informational advantages for market makers may be information obtained from making markets in similar stocks. Information may affect values of all stocks in an industry, and market makers who are made aware of information while trading one stock may use it profitably to trade other stocks in the industry.

In this section, I examine whether market makers specialize by industry. A stock's industry is defined by its two-digit SIC code from the CRSP tapes. To calculate the number of stocks in an industry in which a dealer would be expected to makes markets, I first count the number of market makers in each stock and then create grand totals by summing across stocks in an industry. The grand totals for each industry are then divided by the total number of market making positions in all stocks during that month. This gives the percentage of all market making positions that are in a particular industry. The expected number of stocks in an industry is calculated for each dealer by multiplying the dealer's total number of positions by the percentage of all market making positions in the industry.

For each dealer, I calculate the absolute value of the difference between the percentage of market making positions in an industry and the expected percentage of positions if the dealer does not specialize. The expected number is the percentage of all market making positions by all dealers in the industry times the total number of markets made by the dealer. I then sum across all industries to get the percentage

difference for market maker m. That is, the percentage difference for market maker m is

$$\%\Delta_m = \sum_{i=1}^{I} |o_{i,m} - e_{i,m}|, \tag{2}$$

where $o_{i,m}$ is the observed percentage of dealer m's positions that are in industry i, $e_{i,m}$ is the expected percentage of dealer m's positions in industry i and I is the total number of industries. If a dealer specializes in a particular industry, the observed percentage of positions in that industry will exceed the expected number. The observed percentage of positions in other industries will be less than the expected values and thus the absolute value of the differences will be large and positive. Thus the more a dealer specializes in stocks in a particular industry, the larger the dealer percentage difference.

I sum all dealers' total percentage differences for a month to get the total percentage difference. That is,

$$\%\Delta_{\text{total}} = \sum_{m=1}^{M} \%\Delta_m. \tag{3}$$

I next simulate $\%\Delta_m$ and $\%\Delta_{\text{total}}$ assuming that dealers do not specialize. I randomly assign stocks to each dealer. Each dealer is assigned the number of stocks he makes a market in that month and each stock is assigned to the number of dealers who trade it. The stock is assigned a maximum of once to each dealer. I then calculate the dealer percentage differences for each dealer and the total percentage difference. This process is repeated 100 times for each of six months: May 1995, December 1995, June 1996, December 1996, June 1997 and February 1998.

Table 7 reports results. The second column of Panel A reveals that for each month, the total percentage difference $\%\Delta_{\text{total}}$ is larger than every one of the 100 total differences simulated under the assumption that dealers do not specialize in industries. This rejects the hypothesis that dealers as a whole do not specialize. The next column examines percentage differences for individual dealers. For the average dealer, 74–75% of the simulated percentages are less than the dealer's percentage difference. The next column of the table lists the total number of dealers each month while the last column shows the number of dealers for which the actual percentage difference is greater than each of the 100 simulated differences. Although the totals vary slightly from month to month, we can say that there are usually about 500 market makers and about 145 of them have percentage differences between the expected and observed number of positions in industries that are greater than every one of the 100 simulated differences. It is hard to know whether the dealers' percentage differences reflect widespread specialization by many dealers, or whether a small number of dealers are so specialized that others avoid the industries in which they concentrate. However, the large number of dealers with percentage differences between the expected and observed number of positions in industries that are greater than every one of the 100 simulated differences suggests specialization is widespread.

Table 7
Tests for market maker specialization by industry
A stock's industry is given by its two-digit SIC code. For each market maker each month, I calculate the difference between the actual percentage of market making positions in an industry and the expected percentage. I then sum across industries. The sum is the dealer's percentage difference. The sum of all dealers' percentage differences is the total difference. The expected number of positions in an industry is obtained by dividing the total number of positions in the industry by all dealers by the total number of market making positions. As a test for industry specialization, I assign all market making positions randomly across dealers. Each dealer is assigned the same number of positions as he actually takes. No dealer is assumed to make a market in the same stock more than once. The simulated total difference and the simulated percentage difference for each dealer is then calculated. The simulation is run 100 times.

Date	Percentage of simulated total differences less than the actual	Average across dealers of the percentage of simulated differences less than the actual	Number of dealers	Number of dealers with percentage difference larger than simulated percentage difference every time
5/95	100.0	75.4	482	135
12/95	100.0	74.2	507	145
6/96	100.0	74.3	535	142
12/96	100.0	74.3	532	144
6/97	100.0	74.4	535	149
2/98	100.0	74.1	525	152

While different dealers specialize in different industries, specialization in companies with bank holding and related companies (SIC code 67) seems to be particularly strong. For example, even though these stocks make up only about 7% of Nasdaq listings, 109 of Keefe, Bruyette and Woods 205 market making positions in December 1996 had SIC codes of 67.[4] Similarly, during the same month Sandler, O'Neill and Partners made a market in 204 stocks and 124 of them had an SIC code of 67.

In summary, the evidence is strong that dealers tend to concentrate their market making in particular industries, and that this concentration is far greater than would be expected by chance. It seems unlikely that the decision to concentrate market making in one industry is driven by customer order flow. Brokerage clients will want to hold diversified portfolios. Thus informational advantages that come from making markets in similar stocks may explain the preference for making markets in stocks in the same industry.

5. The probability of making a market

Are the effects of industry, location and underwriting on market making activity really different effects? For example, Hambrecht and Quist underwrites a lot of

[4] An incident involving the CEO of Keefe, Bruyette and Woods suggests that market makers do acquire valuable non-public information. In January 2000, James McDermott was arranged on insider trading charges for passing information on six pending takeovers of small banks to porn actress Marylin Star.

technology stocks. Is their preference for technology stocks in market making merely a reflection of their underwriting activity? Many of these technology companies are based in Northern California where Hambrecht and Quist is located. Can Hambrecht and Quist's tendency to make markets in California companies be explained by their underwriting activities?

To answer these questions, I run a separate logistic regression to determine the likelihood of making a market in stocks with different characteristics for each market maker that made markets in at least 20 stocks, for each of the sample months. The dependent variable in the regressions takes a value of one if the dealer made a market in the stock that month and zero otherwise. The independent variables take values of one if the stock is in a specific volume quintile, if the market maker and stock have headquarters in the same state and if the stock's IPO took place in the previous five years and the market maker was a member of the underwriting syndicate. I also include dummy variables for two digit SIC codes 13, 28, 38, 60, 67 and 73.[5] While individual market makers may specialize in particular industries, we would not expect that a type of market maker, like a national retail broker, would specialize in stocks from certain industries. Thus the median coefficients for industry dummies are not reported in the table.

Results are in Table 8 Panel A presents a summary of the logistic regressions for market makers with national retail brokerage businesses. For each variable, the cross-sectional median of the coefficients is reported. In parentheses below the median coefficients is the Wilcoxin test statistic for the null hypothesis that the median is zero. Asymptotically, it is normally distributed with a mean of zero and standard deviation of one. Below the Wilcoxin statistic, in brackets, I report the number of positive coefficients more than two standard deviations above zero, and the number of negative coefficients at least two standard errors below zero.

The median coefficients on the high volume quintiles are positive, and the great majority of the individual stock coefficients are significantly positive. Positive coefficients in this model indicate an increased likelihood of making a market in a stock, so the results imply that market makers with national brokerage businesses are more likely to make markets in high volume stocks than the stocks in the low volume quintile. The coefficients for other volume quintiles are also positive, but decline with the volume quintile. This indicates that national retail brokers become less and less likely to make a market in a stock for stocks with lower and lower volume.

The following two rows indicate that national retailers are far more likely to make markets in stocks based in the same state and in stocks they underwrote. It is noteworthy that these coefficients and the coefficients on the volume quintiles are all

[5] I use these six industries because they account for 38.5% of market making positions in December 1995 and 39.7% of market making positions in December 1996. Casual examination of the data suggest that firms that specialize in particular industries often specialize in one of these six. A difficulty in using all industries is that the procedure for getting maximum likelihood estimates the logistic regression coefficients may fail to converge.

Table 8
Cross-sectional medians of coefficients of logistic regressions of the determinants of market making
The dependent variable takes a value of one if the dealer made a market in a stock and zero otherwise. Independent variables take on values of one for stocks in specific volume quintiles or industries, or if the dealer and stock are located in the same state or if the dealer underwrote the stock's IPO within the previous five years. Industry dummies are included in the regression (but not shown in the table) for SIC codes 13, 28, 38, 60 , 67, and 73. The probability of making a market is obtained by dividing the number of stocks a dealer makes a market in by the total number of stocks on Nasdaq. The probability of making a market in a large volume quintile underwritten stock, and the probability of making a market in a small volume stock that the dealer did not underwrite are obtained from the logistic regression coefficients. Numbers in parentheses under the coefficient medians are the Wilcoxin statistics for a test of a null hypothesis that the median is zero. Their asymptotic distribution is unit normal. In brackets below the Wilcoxin statistics the number of coefficients significantly positive at the 5% level, and the number significantly negative at the 5% level are reported

	May 1995	Dec. 1995	June 1996	Dec. 1996	June 1997	Feb. 1998
Panel A. National retailers						
Intercept	− 4.40	− 4.61	− 4.69	− 4.87	− 4.84	− 5.03
	(− 4.29)	(− 4.46)	(− 4.54)	(− 4.46)	(− 4.54)	(− 4.37)
	[0, 24]	[0, 26]	[0, 26]	[0, 26]	[0, 27]	[0, 25]
High volume quintile	2.16	2.04	1.78	2.39	2.42	2.39
	(3.31)	(3.62)	(3.80)	(3.52)	(4.20)	(3.13)
	[20, 3]	[24, 2]	[24, 2]	[23, 2]	[25, 2]	[21, 3]
Second volume quintile	1.58	1.54	1.45	1.67	1.77	1.76
	(3.69)	(3.64)	(4.37)	(4.10)	(3.96)	(3.40)
	[22, 1]	[23, 1]	[24, 1]	[24, 2]	[24, 2]	[22, 2]
Third volume quintile	1.14	1.33	1.06	1.32	1.45	1.49
	(4.29)	(3.87)	(3.58)	(4.31)	(4.40)	(4.00)
	[21, 0]	[23, 0]	[21, 0]	[24, 1]	[25, 1]	[23, 1]
Fourth volume quintile	0.44	0.65	0.52	0.77	0.99	1.07
	(3.86)	(3.52)	(3.60)	(4.03)	(4.23)	(3.00)
	[16, 1]	[23, 2]	[20, 1]	[22, 1]	[24, 1]	[20, 2]
Stock and dealer same state	1.62	1.26	1.14	0.80	1.43	1.10
	(2.77)	(3.62)	(4.04)	(3.92)	(3.63)	(2.97)
	[19, 5]	[22, 3]	[23, 2]	[22, 2]	[22, 3]	[18, 1]
Dealer underwrote IPO	6.52	6.45	6.45	5.43	2.84	1.95
	(4.29)	(4.46)	(4.54)	(4.46)	(3.41)	(3.67)
	[14, 0]	[15, 0]	[16, 0]	[23, 0]	[24, 0]	[23, 0]
R^2	0.1594	0.1604	0.1560	0.1654	0.1362	0.1077
Prob. of making a market	4.7%	4.6%	5.0%	4.9%	4.7%	4.9%
Prob. large underwritten	98.6%	98.5%	99.0%	96.3%	58.4%	37.3%
Prob. small not underwritten	1.2%	1.0%	0.9%	0.8%	0.8%	0.7%
Number of market makers	24	26	27	26	27	25
Panel B. Dealers with institutional brokerage businesses						
Intercept	− 5.15	− 5.90	− 5.98	− 5.96	− 5.92	− 5.86
	(− 3.72)	(− 3.72)	(− 3.72)	(− 3.82)	(− 3.92)	(− 3.82)
	[0, 18]	[0, 15]	[0, 17]	[0, 15]	[0, 18]	[0, 16]
High volume quintile	3.54	4.01	3.98	4.20	4.35	4.28
	(3.72)	(3.72)	(3.72)	(3.82)	(3.92)	(3.30)
	[18, 0]	[15, 0]	[17, 0]	[15, 0]	[18, 0]	[15, 0]

Table 8 (*continued*)

	May 1995	Dec. 1995	June 1996	Dec. 1996	June 1997	Feb. 1998
Second volume quintile	1.64	2.39	2.45	2.57	2.55	2.49
	(3.72)	(3.72)	(3.72)	(3.82)	(3.92)	(3.82)
	[16, 0]	[15, 0]	[17, 0]	[15, 0]	[18, 0]	[16, 0]
Third volume quintile	1.07	1.48	1.37	1.57	1.83	1.72
	(3.55)	(3.72)	(3.72)	(3.82)	(3.92)	(3.82)
	[12, 0]	[11, 0]	[13, 0]	[14, 0]	[18, 0]	[15, 0]
Fourth volume quintile	0.17	0.47	0.39	0.89	0.75	0.97
	(0.72)	(1.85)	(2.03)	(3.06)	(2.43)	(2.82)
	[3, 3]	[6, 2]	[5, 1]	[5, 1]	[9, 0]	[10, 0]
Stock and dealer same state	0.08	0.11	− 0.03	− 0.15	0.84	0.02
	(0.20)	(1.24)	(0.89)	(0.28)	(0.63)	(0.36)
	[9, 6]	[7, 6]	[7, 6]	[8, 8]	[8, 7]	[8, 5]
Dealer underwrote IPO	6.02	6.18	6.00	5.92	3.91	2.41
	(3.59)	(3.72)	(3.72)	(3.10)	(3.81)	(3.03)
	[12, 0]	[13, 0]	[13, 0]	[15, 0]	[18, 0]	[16, 0]
R^2	0.1893	0.1913	0.1977	0.2276	0.1895	0.1690
Prob. of making a market	5.3%	5.1%	4.4%	3.9%	4.3%	5.3%
Prob. large underwritten	98.5%	98.6%	98.9%	98.7%	88.5%	70.3%
Prob. small not underwritten	0.6%	0.3%	0.3%	0.3%	0.3%	0.3%
Number of market makers	18	18	18	19	20	19
Panel C. Wholesale market makers						
Intercept	− 5.16	− 1.79	− 2.24	− 1.75	− 1.67	− 2.23
	(− 2.83)	(− 2.98)	(− 3.11)	(− 3.11)	(− 2.82)	(− 3.11)
	[1, 11]	[1, 11]	[1, 12]	[1, 11]	[1, 11]	[1, 12]
High volume quintile	3.01	2.16	1.97	1.86	2.14	2.51
	(3.04)	(2.43)	(1.22)	(1.22)	(2.12)	(2.73)
	[10, 1]	[10, 1]	[9, 3]	[9, 2]	[10, 2]	[10, 1]
Second volume quintile	1.28	1.67	1.32	1.52	1.53	1.80
	(3.18)	(2.59)	(2.90)	(3.04)	(2.12)	(2.73)
	[10, 0]	[10, 1]	[11, 1]	[10, 1]	[11, 1]	[11, 1]
Third volume quintile	1.01	1.19	0.95	0.91	0.91	1.21
	(1.92)	(2.82)	(2.69)	(2.97)	(3.06)	(2.42)
	[9, 0]	[10, 0]	[10, 0]	[10, 0]	[12, 0]	[11, 1]
Fourth volume quintile	0.68	0.69	0.69	0.54	0.64	0.64
	(1.71)	(1.73)	(2.76)	(2.13)	(3.06)	(1.79)
	[8, 0]	[9, 0]	[10, 0]	[10, 0]	[10, 0]	[9, 1]
R^2	0.0594	0.0657	0.0509	0.0561	0.0749	0.0630
Prob. of making a market	1.9%	22.9%	11.7%	15.0%	28.2%	10.5%
Prob. large volume	8.9%	26.8%	14.0%	16.4%	30.4%	24.3%
Prob. small volume	0.6%	14.7%	9.6%	14.8%	16.1%	9.8%
Number of market makers	13	12	13	13	12	14
Panel D. Regional dealers						
Intercept	− 5.43	− 5.73	− 5.86	− 5.75	− 5.90	− 5.91
	(− 7.87)	(− 8.05)	(− 8.46)	(− 8.55)	(− 9.43)	(− 9.35)
	[0, 76]	[0, 72]	[0, 85]	[0, 91]	[0, 106]	[0, 104]
High volume quintile	1.34	1.46	1.17	1.03	1.49	1.32
	(4.08)	(4.99)	(4.48)	(4.64)	(4.03)	(3.95)
	[54, 6]	[46, 6]	[50, 5]	[54, 12]	[62, 13]	[62, 14]

Table 8 (*continued*)

	May 1995	Dec. 1995	June 1996	Dec. 1996	June 1997	Feb. 1998
Second volume quintile	1.13	1.46	1.28	0.98	1.36	1.25
	(4.37)	(5.71)	(6.68)	(5.76)	(5.79)	(6.33)
	[47, 5]	[47, 5]	[54, 5]	[56, 8]	[70, 7]	[74, 11]
Third volume quintile	0.70	1.10	1.16	0.85	1.01	1.02
	(4.22)	(5.87)	(6.86)	(7.34)	(8.40)	(6.90)
	[40, 4]	[42, 4]	[52, 5]	[55, 5]	[65, 5]	[62, 7]
Fourth volume quintile	0.32	0.85	0.81	0.59	0.68	0.66
	(1.73)	(4.55)	(6.18)	(4.63)	(5.89)	(5.83)
	[28, 2]	[35, 4]	[46, 5]	[37, 3]	[50, 5]	[40, 6]
Stock and dealer same state	1.57	1.33	1.17	0.92	1.18	1.09
	(6.63)	(6.02)	(5.99)	(5.51)	(6.94)	(7.28)
	[64, 1]	[65, 1]	[67, 3]	[67, 3]	[89, 4]	[86, 2]
Dealer underwrote IPO	23.30	21.07	7.23	6.90	4.56	3.41
	(7.50)	(7.84)	(7.83)	(7.88)	(7.50)	(8.54)
	[22, 0]	[30, 0]	[44, 0]	[54, 0]	[79, 0]	[90, 0]
R^2	0.1295	0.1223	0.1222	0.1338	0.0962	0.0933
Prob. of making a market	1.4%	1.4%	1.2%	1.2%	1.1%	1.2%
Prob. same state underwritten	100.0%	100.0%	97.7%	94.8%	54.6%	27.8%
Prob. not underwritten or same state	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%
Number of market makers	82	86	95	97	118	116

significant. Location, volume, and underwriting affect the likelihood of making a market separately, as does the stock's industry.

The fourth row from the bottom of the table shows the median unconditional probability of making a market. It ranges across months from 4.7% to 5.0%. In the row below is the logistic regression's median predicted probability of making a market in a stock that the dealer underwrote that is in the high volume quintile. It is over 98% in May 1995, December 1995 and June 1996. The probability falls dramatically to 37.3% at the end of the period. A possible explanation for this is that dealers are more likely to make markets in recent IPOs and the large number of IPOs over this period meant that by February 1998 many market makers had several IPOs they had underwritten several years ago. The second row from the bottom reports the probability of making a market in a low volume stock that the dealer did not underwrite. It ranges from 0.7% to 1.2%.

Panel B of Table 8 reports results for market makers who are also institutional brokers. Results are similar to those obtained for national retail brokers. High volume is a particularly important determinant of market making activity for these dealers. They are also far more likely to make markets in stocks they underwrote. Institutional brokers differ from national retail brokers in that location is not an important determinant of their choices of stocks for market making.

Results for wholesale market makers are presented in Panel C. These market makers do not underwrite stock offerings, so the IPO variable is omitted, as is the variable for market maker and stock headquarters in the same state. The coefficients on volume quintiles indicate that the likelihood that a wholesale market makers will handle a stock increases with the volume.

Panel D provides results for regional dealers. The median coefficients for the high volume quintiles, while positive, are much smaller than their counterparts in the other regressions. Volume is less important in the market making decision of a regional broker than a wholesaler, institutional broker, or national retailer. Results indicate that regional brokers are much more likely to make markets in stocks located in the same state and in stocks they have underwritten.

To summarize, the logistic regressions indicate that trading volume, location and underwriting are all important factors in the underwriting decision. For national retail brokers, trading volume, the stock's location and participation in the underwriting syndicate are particularly important. For institutional brokers, trading volume is critical in the market making decision, as is participation in the underwriting syndicate. For wholesale market makers, volume is the most important factor. For regional brokers, location and underwriting participation are the key determinants of market making activity.

6. Summary and conclusions

In this paper, I posit two explanations for Nasdaq dealers' choices of stocks in which to make markets. The first is that Nasdaq dealers' choices of stocks are dictated by the order flow from their brokerage business or from the businesses of the brokers who sell them order flow. The evidence presented here is consistent with this explanation. Institutional brokers make markets in the high volume stocks that their customers trade while small retail brokers make markets in less active stocks. Regional brokers make markets in the local stocks that their customers own in disproportionate amounts. Dealers are more likely to make a market in a stock if they have sold shares to their customers in an IPO. Finally, if a dealer provides analyst coverage of a stock for its customers, it will be much more likely to make a market in the stock.

A second explanation for Nasdaq dealers' choices of stocks in which to make markets is that they pick stocks in which they have an informational advantage. This hypothesis does not explain why market makers with institutional clients prefer to deal in more active stocks. However, it is consistent with dealers making markets in local stocks, stocks they have underwritten, and stocks that their analysts cover. In addition, it may explain why market makers often specialize in stocks in certain industries or avoid stocks in others. Of course, these hypotheses are not mutually exclusive. It is possible that both sources of order flow and informational advantages play a role in determining the stocks that a dealer trades.

These results should serve to caution researchers against examining Nasdaq market making in isolation rather than as part of an integrated business. Entry and

exit decisions for market making in individual stocks should be considered in the context of the sources of the market makers' order flow. Researchers who want to estimate the profitability of making a market in a stock should consider the costs of obtaining order flow in the stock and the value of any information obtained from the market making that will make trading other stocks more profitable.

An interesting question for further research is why market making is typically bundled with brokerage, analyst coverage and underwriting in the same firm. Why are not these businesses separable? One possibility is that the information generated in one of these activities is valuable in the others, and that the information is not easily sold by, for example, a broker to a market maker. The organization of Nasdaq and other securities markets is clearly an area that calls for additional work.

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