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The Making of a Dealer Market: From Entry to Equilibrium in the Trading of Nasdaq Stocks

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ABSTRACT

This paper provides an analysis of the nature and evolution of a dealer market for Nasdaq stocks. Despite size differences in sample stocks, there is a surprising consistency to their trading. One dealer tends to dominate trading in a stock. Markets are concentrated and spreads are increasing in the volume and market share of the dominant dealer. Entry and exit are ubiquitous. Exiting dealers are those with very low profits and trading volume. Entering market makers fail to capture a meaningful share of trading or profits. Thus, free entry does little to improve the competitive nature of the market as entering dealers have little impact. We find, however, that for small stocks, the Nasdaq dealer market is being more competitive than the specialist market.

DEALER MARKETS ARE WIDELY USED for trading financial assets. In the United States, bonds and foreign exchange trade almost exclusively in dealer markets, and equity trading on the Nasdaq dealer market, at least by some measures, is now greater than it is on the New York Stock Exchange (NYSE). There are more listed securities on the Nasdaq market than on the NYSE, and there are more initial public offerings (IPOs).[1] This latter fact reflects the particular importance that dealer markets have for smaller firms who, while occasionally switching to exchanges as mature firms, typically begin trading in a dealer setting.

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[1] Measured year-to-date as of September 2000, share volume on Nasdaq was 314,563,990,000 shares compared to 190,629,670,000 on the NYSE. Dollar volume over this period was $1,647,408,110,000 on the Nasdaq, and it was $880,044,400,000 on the NYSE. Volume numbers must be interpreted with caution, however, as there can be double-counting on Nasdaq. In terms of listed securities, Nasdaq is clearly larger, with 4,880 listed companies on the Nasdaq, and there are 2,985 on the NYSE. The NYSE is larger if measured by market capitalization of listed firms, with a total NYSE value of $12.7 trillion compared to $5.2 trillion on the Nasdaq. Data is from the NASD web site.

A defining feature of dealer markets is the price-setting competition of multiple market makers. Unlike equity exchange markets where orders accumulate in a central location and liquidity arises from the actions of a designated specialist, equity dealer markets rely on a multiplicity of market makers who electronically post prices at which they will buy or sell. The interaction of these dealers' quotes with orders provides liquidity to traders and firms, and price discovery to the market. Dealer markets also allow for the entry and exit of dealers, in stark contrast to the market-making franchise granted to the single specialist in a stock on the NYSE.[2] In principle, this price-setting structure of the dealer market closely approximates the competitive price formation process depicted by standard economic theory.

Whether in practice this idealized competitive outcome arises is not clear. Several papers (see Christie, Harris, and Schultz (1994), Christie and Schultz (1994), Huang and Stoll (1996), and Kandel and Marx (1997)) have questioned the competitiveness of dealer pricing on the Nasdaq, as has the Department of Justice. Even without illicit activity, divergences from the perfectly competitive outcome can arise due to features particular to equity trading. For example, Dutta and Madhavan (1997) show that even in markets with many dealers who do not cooperate, spreads can be larger than those of competitive equilibrium, and no market maker will have an incentive to deviate.

Market practices such as payment for order flow (see Godek (1996) and Kandel and Marx (1999)) or the fact that not all dealers are created equal in terms of capitalization and geographical and industry specialization (Schultz, 2000) may also contribute to divergences from atomistic price setting. Some dealers act as wholesalers making markets in many stocks, while others limit their activities to a few issues. Some have direct access to retail order flow, while others do not. Some dealers act as underwriters and bring new issues to the market, while others only begin making markets after the furor of the initial offering has abated. These divergences in objectives, information sets, and control over order flow can cause deviation from the competitive outcome. Given these market features, how then do dealer markets actually operate, and are they really different from specialist markets?

In this research, we provide an in-depth analysis of the nature and evolution of a dealer market. We investigate questions such as: Are markets competitive in the sense of many dealers active in the price discovery process, or is there a dominant market maker much like there is on the NYSE? And if so, who is it? Does the market structure coalesce quickly, or does it change slowly over time? How important is the entry and exit of dealers in the market? Does market concentration affect dealer profits, or dealer entry

[2] On the NYSE, there is only one specialist per stock, but he is not the only liquidity provider. Both limit orders and floor brokers compete with the specialist. The specialist is the most important liquidity provider, however, giving him a central role in the market. For an excellent discussion of specialist participation in trading, see Madhavan and Sofianos (1998).

and exit? Addressing these issues provides a way to understand not only the specific properties of dealer markets, but also how these markets evolve over time.

Using a unique data set provided to us by the NASD, we analyze the mechanics of market making by following the behavior of dealers for 313 stocks for the first seven months after their IPO. We highlight three important results of our analysis.

First, despite size differences in sample stocks, there is a surprising consistency to their trading. On any given day, one market maker tends to dominate trading in a stock, executing on average a little more than half of that day's volume, while the largest three dealers combined clear approximately 75 percent of the volume. The dominant dealer is often, but not always, the same dealer every day. At the outset of trading, this dominant dealer is almost always the underwriter, but after seven months of trading, other dealers take this dominant role more than half the time.

Second, markets are concentrated, but not to the point of being monopolistic. Being the dominant dealer is good for the market maker as he makes most of the profits, but it is not so good for the customers: We find that spreads are increasing in the volume and market share of the dominant dealer. Entry and exit are ubiquitous in our sample, and exiting market makers are those with very low (sometimes, even negative) profits on the stock and low trading volume. More surprisingly, we find that, on average, entering market makers fail to capture a meaningful share of the stock's trading volume or trading profits. Thus, free entry does little to improve the competitive nature of the market, as entering dealers have little impact. Particularly intriguing is that a large number of dealers make markets in name only; they do virtually no trading, and they make no (or even negative) profits. These results suggest that the fiction of atomistic dealer markets is just that; for most stocks, there is a dominant liquidity provider, much as would be the case in a specialist market.

Third, markets for newly issued stocks adjust quickly to a permanent equilibrium, with the number of dealers, trading volume, and market concentration all virtually stable after three months. Madhavan and Sofianos (1998) argue that small stocks on the NYSE "essentially trade in a dealer market, with high reliance on the specialist to provide liquidity" (p. 190). We find an important difference between the two market settings. Whereas the dominant Nasdaq dealer and the NYSE specialist handle approximately the same fraction of daily volume, in our Nasdaq stocks it is not always the same dealer who is dominant every day. This results in the most active dealer being less dominant than the specialist, and it is consistent with the dealer market being more competitive than is the specialist market for small stocks.

Our findings complement the developing literature on dealer market behavior. Several researchers (most notably Neuberger (1992) and Reiss and Werner (1996, 1998)) have used London Stock Exchange data to investigate preferencing and interdealer behavior. Wahal (1997), Klock and McCormick (1998), and Schultz (2000) look at the impact of the number of dealers on

Nasdaq behavior. Both Wahal and Klock and McCormick provide evidence that spreads are lower in stocks with more dealers, and Wahal also shows that, on the margin, spreads are affected by entry and exit. Klock and McCormick and Schultz find that spreads are lower in stocks with less concentration, suggesting that how the market makers share the volume affects the cost of trading. Our research is also related to recent papers by Schultz and Zaman (1994), Aggarwal (2000), Aggarwal and Conroy (2000), and Ellis, Michaely, and O'Hara (2000), who highlight the unique role the underwriter plays in trading immediately following an IPO. Because these papers focus on the underwriter during the stabilization period, they do not consider trading beyond the first month.

This paper is organized as follows. In the next section, we discuss our data, the firms in our sample, the participation of dealers across our sample stocks, and their migration over time. Section II then examines the volume and trading activity of dealers. We examine the concentration of trading in stocks, how it relates to the number of market makers, and which market makers tend to dominate trading. In Section III, we examine dealer exit and entry, with a particular focus on the linkage of exit to dealer profits and volumes. We also investigate the determinants of dealer profits more generally. Section IV is a conclusion.

I. Data and Dealers' Distribution across Stocks and Time

A. Data and Sample Firms

The data contain a sample of 313 firms that went public on the Nasdaq market between September 27, 1996, and July 3, 1997. The initial sample was taken from the SDC New Issues database. To avoid problems with very low volume, we excluded IPOs on the SmallCap market, the OTC Bulletin Board, offerings with units (e.g., a stock plus a warrant), REITS, and closed-end funds. Focusing on IPO stocks allows us to analyze a stock's trading from its inception, with the particular advantage of being able to examine how trading evolves from the tumultuous initial days to a more stable long-run pattern. For each sample firm, we obtained transactions data from a proprietary database provided by the NASD Economic Research Department. The transactions data provide the time, price, and volume for each trade, a code identifying both parties involved, and an indicator that tells us who is buying and who is selling. The data also include all quote revisions for all market makers in each stock. Thus, we have complete trade and quote data for each stock, all identified by dealer identities. The transaction data series end in January 1998, providing at least 140 trading days (approximately seven months) of trading data for each stock in the sample.

Table I gives descriptive statistics of the sample firms. The median market capitalization for the sample firms is $112 million. Because the firms' size distribution is skewed, the average sample firm is about half the size of the average Nasdaq firm, but it is well above the median Nasdaq size of $66

Table I

Sample Statistics

This table compares the firm size and daily turnover of our sample firms with all Nasdaq stocks that appear on the CRSP database in the period September 27, 1996, to September 29, 1997, and it provides information on the industry clustering in our sample. Our sample is 313 Nasdaq IPOs, of which 290 appeared on CRSP. The firm size is the average market capitalization from September 1996 to September 1997, calculated using the daily closing midpoint quote price and the number of shares outstanding from CRSP. Daily turnover is the number of shares traded as a percentage of shares outstanding. The medians and percentages in the top and bottom quintiles are given where quintiles are calculated using all Nasdaq stocks. We collected two-digit SIC codes from CRSP and prospectuses for 309 out of the 313 companies.

Panel A: Firm Size

Observations	IPO Sample (290)	All Nasdaq Stocks (4,700)
Mean	\$172 M	\$322 M
Median	\$112 M	\$66 M
% in bottom quintile	8.6%	20%
% in top quintile	17.6%	20%

Panel B: Daily Turnover

	First Month	Months Two to Seven	
Mean	0.83%	0.60%	0.60%
Median	0.73%	0.49%	0.39%
% in bottom quintile	8.3%	9.0%	20%
% in top quintile	39.0%	17.2%	20%

Panel C: Top Ten Industries in Sample

Two-digit SIC code	Frequency	Percent
73 (computer software)	82	26.54
38 (instruments and related products)	23	7.44
28 (chemicals and allied products)	22	7.12
36 (electrical and electronic equipment)	21	6.8
35 (industrial machinery and equipment)	15	4.85
48 (communications)	13	4.21
80 (health services)	12	3.88
87 (engineering and management services)	11	3.56
61 (nondepositary credit institutions)	10	3.24
60 (depositary institutions)	9	2.91
Other (47 SIC codes)	91	29.45

million. Characteristic of IPO firms, we find that trading volume (as measured by turnover) in the first month is much higher than it is in any other month (see Ellis et al. (2000) for more discussion). However, the mean volume of trade in months two through seven for our sample firms is around 0.6 percent per day, a figure identical to the average turnover of Nasdaq stocks. As is typical of Nasdaq stocks, our sample has a high concentration of technology stocks. Computer software firms comprise 26.54 percent of the

sample, and half of the sample firms are found in just five SIC codes (classification is based on a two-digit SIC code). There are 57 SIC codes represented in the total sample.

As noted above, the offer day tends to be unusual, both in terms of market volume and volatility. Additionally Ellis et al. (2000) show that the majority of underwriters' price support occurs during the first 20 days of trading, so this period may also exhibit differences from trading in other time periods. Therefore, we analyze the offer day and the first 20 trading days separately, and we divide the remaining 120-day period into three equal time intervals. These five time intervals (offer day, days 2–20, days 21–60, days 61–100, days 101–140) allow us to investigate how trading and market competitiveness differ across time and firms' maturity.

B. Evolution of Trading Activity and Market Makers' Participation

Unlike on the NYSE where one dealer is *assigned* to be the market maker (the specialist), Nasdaq dealers *choose* to make markets in individual stocks.[3] On the Nasdaq, a listed stock must have at least two market makers, and any registered securities dealer can make a market in any Nasdaq stock following a one-day registration period. A dealer must set a price quote every day to remain registered. A dealer can exit from a stock with a half-hour notice, and he is then precluded from making a market in that particular stock for 30 days.

How many dealers choose to trade the same stock? Table II addresses this question by providing data on the daily average number of dealers (Panel A), the average trading volume (Panel B), the average number of quotes (Panel C), the average dollar spread (Panel D) and average relative spread (Panel E) for each time period (e.g., days 2 to 20). There is substantial variation in dealer participation across stocks, ranging from 22 market makers for one stock on its first day of trading, to only 2 dealers for another offering. Over time, the number of dealers falls to an average of 7.37 after the first month of trading, and it remains relatively constant thereafter (it is 7.22 after five months of trading).

Trading volume (Panel B) and the average number of quotes (Panel C) also plummet from initial levels. The average number of shares traded in days 2 through 20 is roughly seven percent of the trading volume on the first day (an average of 1,960,000 shares traded). After the first month, the average number of shares traded remains stable, with approximately 60,000 shares trading on a typical day. As volume falls and price support activity by the underwriter ceases (see Schultz and Zaman (1994) and Ellis et al. (2000)),

[3] There are, for course, other differences between NYSE specialists and Nasdaq dealers that may affect market performance. For example, the NYSE specialist faces prices continuity rules, while the Nasdaq dealer has trade-through rules. Trading halts are permissible on the NYSE, while they are far less common on the Nasdaq. Our point here is simply that the multiplicity of dealers in Nasdaq is an important difference from the single specialist structure.

Table II

Sample Characteristics over Time

This table shows several sample characteristics over five time periods, starting at the offer day (day 1) and ending 140 trading days later. In Panel A, the number of market makers is the average number of registered market makers per stock for each time period. Panel B reports the average daily trading volume per stock in thousands of shares for each time period, while Panel C shows the average daily number of quote revisions per stock. Panels D and E show the average daily time-weighted dollar spread per stock, and the average daily time-weighted percentage spread per stock.

Trading Days	1	2 to 20	21 to 60	61 to 100	101 to 140
Panel A: Daily Average Number of Market Makers					
No. of stocks	313	313	313	313	313
Mean	9.98	8.81	7.37	6.92	7.22
Median	10.00	8.37	7.10	6.38	6.78
Minimum	2.00	2.00	2.00	2.00	2.00
Maximum	22.00	20.05	17.48	17.50	20.35
Panel B: Average Daily Trading Volume (000s Shares)					
Mean	1,962	118	61	59	62
Median	1,574	93	43	35	36
Minimum	10	7	4	4	3
Maximum	8,610	656	615	1,049	1,767
Panel C: Average Daily Number of Quotes					
Mean	147.59	37.14	35.18	52.83	58.84
Median	81.00	25.21	22.53	22.58	23.08
Minimum	3.00	2.63	3.20	2.43	2.83
Maximum	2,499.00	225.89	470.50	2,677.15	2,016.70
Panel D: Average Dollar Spread					
Mean	0.3090	0.3409	0.4137	0.4457	0.4470
Median	0.2635	0.3218	0.3952	0.3966	0.3996
Minimum	0.0665	0.0833	0.0434	0.1112	0.1327
Maximum	1.8158	0.8470	1.3568	2.2772	1.7296
Panel E: Average Percentage Spread					
Mean	2.83	3.02	3.70	3.86	4.11
Median	2.26	2.66	3.27	3.45	3.52
Minimum	0.61	0.68	0.72	0.37	0.36
Maximum	19.62	9.48	12.40	11.15	18.40

spreads tend to increase (Panels D and E). For example, the median dollar spread is 0.2635 on the first day, 0.3218 in days 2 to 20, and around 0.38 from day 21 through day 140. A similar picture emerges when examining the evolution of percentage spreads. Overall, the evidence in Table II indicates that volume, quote revisions, spreads, and the number of dealers appear relatively stable from day 21 onward.

C. Who Becomes a Market Maker?

Over the sample period, there are 318 different dealers operating in at least one stock. Dealers can be categorized as underwriters (both lead and coleads), wholesalers, or generic dealers. Turning first to the 120 underwriters present in our sample, we find that, on average, the 82 lead underwriters make markets in 10.1 stocks, of which 7.6 are stocks they have either led or comanaged. The lead underwriter is also persistent, as at day 140 all 82 underwriters are still making markets in approximately the same number of stocks. Likewise, the 38 comanager dealers (underwriters who never acted as lead underwriters) make markets in 3.3 stocks, 2.2 of which they are comanaging the underwriting, and their activity is persistent through time.

An increasing trend on Nasdaq is toward ever-larger dealer firms making markets, in some cases, for thousands of stocks.[4] These dealers are known as wholesalers, and they neither underwrite stocks nor do they typically have a retail brokerage operation. Instead, they receive orders from a wide range of sources, including from preferenced order flow sent by retail brokers. In our sample, there are six wholesalers, and, on the first day of trading, each wholesaler makes market in 268.5 stocks. By day 140 (after seven months of trading) the average number of stocks being covered by each wholesaler drops to 139. Thus, wholesalers tend to exit and enter markets over time, an activity we analyze in more detail in Section III.

The remaining generic dealers make markets in, on average, only 5.3 stocks on the first day of trading. The average participation of dealers in this group increases through time: 105 of these dealers are active on the offering day and this increases to 131 dealers by day 140. Of course, some dealers join the fray at different points in time and stay for only a limited time period. Overall, there were 192 dealers in this category making markets in the 313 stocks in our sample at some point during the 140 trading days.

Do dealers select stocks to trade based on factors such as industry specialization? We found little evidence of that in our sample.[5] Of the 105 generic dealers operating on day 1, only 52 are making a market in multiple stocks, and only 21 are trading several stocks in the same industry. By day 140, these numbers have risen slightly to 33 dealers who are making markets in multiple stocks in an industry out of 71 trading multiple stocks. Nonetheless, looking across the three most frequently traded SIC codes shows no obvious patterns to dealer participation.

Over time, two trends in dealer participation are apparent: (1) the overall number of dealers falls for the stocks in the sample, and (2) each wholesaler makes markets in fewer stocks. While the market evolves quickly from its

[4] Obviously, by dealer here we mean dealer firm, as large dealers such as Knight securities employ hundreds of market makers. For an analysis of the growth and consolidation of dealer firms on Nasdaq, see Battalio, Jennings, and Selway (1998). Aggarwal and Conroy (2000) also provide an interesting analysis of wholesaler behavior in the IPO preopening market.

[5] We caution, however, that our data do not give dealer participation in stocks outside of our sample. The low participation rate of some dealers may simply reflect trading activities elsewhere.

initial starting point to a more stable environment, on a dealer level, the situation is much less stable, and individual dealers move into and out of markets. We now analyze the behavior of individual dealers, and in particular, how each dealer contributes to the functioning of the market.

II. The Market Share of Market Makers

Making a market in a Nasdaq stock requires each market maker to post a price at which he will buy (the bid) and sell (the ask) the security. By Nasdaq rules, every dealer in a stock must quote at least once a day, but there is no corresponding requirement that he must actually trade. Whether a dealer trades depends both on the aggressiveness of his quotes and on his involvement in market practices such as preferencing. (Preferencing is the practice of routing the order flow to a particular dealer in exchange for a payment to the broker.) In this section, we investigate the activity of individual dealers, with a particular focus on determining whether there exists a dominant dealer, or group of dealers, in each stock.

A. Market Maker Trade and Quote Activity

Table III provides data on market makers' quote and trade activity averaged across stocks in our sample. Panel A shows that there are large differences in quoting behavior both across market makers and across time. On the issue day, almost 65 percent of dealers are setting more than five quotes per day, while 10 percent only set the requisite opening quote. This pattern changes almost immediately, however, and starting with day 2, there is a marked decrease in dealer activity.[6] Now, more than 40 percent of market makers set only one quote a day, and the fraction of dealers setting more than five quotes drops to around 20 percent. This pattern persists over the next seven months of trading, highlighting the almost immediate transition to a market equilibrium for these stocks.

The data on trade frequency (Panel B) reveal a similar, albeit more gradual pattern. On the first day of trading, fully 97 percent of all dealers trade. As time progresses, the number of dealers trading every day falls, and after the first month, only 10 percent of dealers are active on a daily basis. Part of this decline is undoubtedly due to the fall in trading volume (see Table II). But this volume fall-off does not explain the precipitous rise in the number of dealers not trading even once a week. Indeed, by day 60, almost a third of all dealers are not even active every week. Combined with the fact that more than 40 percent of dealers set only one quote a day, these data suggest that a substantial fraction of dealers are market makers in name only; they do not actively set quotes and they do not execute trades.

[6] One explanation for the change in quoting pattern may be the change in stock volatility. On the offer day, stock prices may be highly volatile, and quotes would be expected to change often. Once prices settle down to lower volatility, quote changes would also lessen.

Table III

The Quoting and Trading Activity of Market Makers

The table shows the quoting and trading activity of market makers. In Panel A, the categories are those market makers that only set one quote per day, those that set two to five quotes per day, and those that update their quotes more than five times a day. Panel B categories are daily active: market makers who trade every day, weekly active: market makers who trade at least once a week (but not every day), and less frequent: market makers who do not trade every week. Panel C gives the equal-weighted percentage of total trading volume done by various market makers. The percent of daily volume is calculated every day and is given by:

$$\textit{Equally weighted percent of daily volume}_{x,j,t} = \frac{(\textit{shares traded by market maker } x \textit{ in stock } j)_t}{(\textit{shares traded in stock } j)_t}.$$

The largest (smallest) volume market maker is the top (bottom) ranked market maker for each stock, with ranking each day based on the equally weighted percent of daily volume. Next, we divide the total number of dealers in a stock into thirds, and we measure volume done by the top third, middle third, and bottom third each day. Volume between market makers is split evenly between the two parties. Averages are calculated across the five time periods, and across stocks. The number of observations is 313.

Trading Day	1	2 to 20	21 to 60	61 to 100	101 to 140
Panel A: Quoting Frequency					
No. market makers per stock	9.98	8.82	7.37	6.92	7.22
% with 1 quote per day	10.22	42.53	43.15	41.96	42.52
% with 2–5 quotes per day	24.92	36.27	37.18	36.02	35.15
% with >5 quotes per day	64.86	21.2	19.66	22.02	22.32
Panel B: Trading Frequency					
% daily active	96.79	22.81	10.64	10.23	9.04
% weekly active	3.21	59.72	60.75	60.44	55.47
% less frequent	0	17.47	28.61	29.33	35.48
Panel C: Volume of Trading					
% volume by largest MM	53.97	56.9	59.11	58.67	58.75
% volume by smallest MM	0.41	0.23	0.67	0.75	0.61
% volume by top third	77.6	82.29	77.7	75.18	76.33
% volume by middle third	13.37	11.75	14.01	15.17	14.44
% volume by bottom third	4.42	2.92	4.51	4.67	3.78

Given that exit is costless, why would a dealer have such low activity? One hypothesis is inactive dealers remain because of other commitments such as acting as the underwriter. Alternatively, some dealers may simply wish to make markets in everything; that being in the market for many stocks (even if they are barely a presence) is a marketing strategy. Given the requirements for being a dealer, this strategy is not expensive, nor it is risky, as the dealer can post wide quotes that are unlikely to be hit. Evidence consistent with this hypothesis would be finding inactive dealers participating in many stocks.

Examining the characteristics of inactive dealers reveals that underwriters are rarely inactive, and wholesalers only occasionally so. This evidence is inconsistent with any functional explanation of inactivity. Instead, we find that inactive market makers are almost always generic dealers. On average over our sample period, these generic dealers only make markets in 2.9 sample stocks,[7] so the portfolio presence hypothesis seems doubtful. A plausible explanation is that these inactive dealers are simply unsuccessful (and stubborn). Regardless of the cause, it appears clear that dealers are not equally active in the market.

Another gauge of dealer activity is trading volume. As volume falls from the frenetic first day and fewer dealers remain active, we might expect large changes in the distribution of trades across dealers. To determine this, we calculate the trading volume measured as turnover (shares traded/shares outstanding) by market maker. The largest (smallest) volume market maker is the top (bottom) ranked market maker for each stock, with ranking each day based on the equally weighted percentage of daily volume. Because we calculate this number every day, the identity of the largest market maker can also vary daily. We also divide the total number of dealers in a stock into thirds, and we measure fraction of trading volume done by the top third, middle third, and bottom third each day.[8] The volume rankings are calculated every day, with subperiod results being the averages over these intervals. These data are given in Panel C of Table III.

We find that despite the dramatic decline in overall volume, the share of volume executed by the largest market maker in each stock remains remarkably constant. The largest dealer routinely handles between 54 and 59 percent of the daily trading volume over the 140 days of our sample, and the share of the smallest dealer even grows from a meager 0.41 percent on the offer day to a still paltry 0.61 percent by day 140. It is interesting to compare these data with the averages reported by Madhavan and Sofianos (1998) for NYSE specialist participation. NYSE stocks on average are much larger than Nasdaq stocks, so the fairest comparison is between our sample stocks and those in their smallest size decile.[9] They find the specialist participates in 52.7 percent of these trades, a number not dramatically different from the volume of the largest dealer we report here. This evidence would suggest little day-to-day difference between the role of the specialist and that of the dominant Nasdaq dealer.

[7] On the first day of trading, 105 generic dealers make markets in an average of 5.3 stocks. Over time, more generic dealers enter the market, so that the 192 generic dealers operating in our sample period handle an average of 2.9 stocks. Of course, these dealers may make markets in stocks not in our sample, but we do not have data on this.

[8] For example, if for a specific stock, there were 6 market makers in total, then there would be 2 in each third, or if there were 22 market makers in total, there would be 7, 7, and 8 market makers in each third.

[9] Madhavan and Sofianos analyze a sample of 200 NYSE stocks drawn from 10 volume deciles. Their analysis employs 21 trading days, so that they calculate the specialist's participation over one month of trading. The numbers cited here are for stocks in their 10th decile.

These data reveal a major skewness in the distribution of trades across dealers, and this is further illustrated by the distribution of trading activity across the top, middle, and bottom third of dealers in each stock. Virtually all trading is concentrated in the top subset of dealers, and this pattern remains essentially unchanged over the sample period. The bottom two-thirds of dealers never account for more than 20 percent of volume, and typically their share is much smaller.[10] Thus, the image of a market with numerous dealers all actively trading is fictitious; actual markets feature concentrated trading.

We now turn to investigating the factors affecting this concentration of volume. Stocks differ with respect to the number of dealers, so one might conjecture that the number of dealers affects the concentration of trading. We calculated the market share for each dealer depending on the number of registered dealers in the stock: (1) stocks with 2 to 5 dealers (little markets), (2) stocks with 6 to 8 dealers (medium markets), and (3) stocks with 9 to 23 dealers (big markets). These cutoffs were selected to split the sample into equal thirds by day 140. For any given day, a stock fits into one category based on the number of registered dealers for the stock on that day; thus one stock may appear in all three categories on different trading days, depending on how many market makers are registered.

These data are depicted in Figure 1. The data reveal three important results. First, dealer dominance is decreasing in the number of dealers. In little markets, the dominant dealer executes approximately 70 percent of trades, while in medium markets this falls to around 60 percent of trades, and in the big markets to approximately 50 percent of trades. We can strongly reject that these markets are the same (F-test = 2635). Second, in stocks with many market makers, volume is not merely being shifted to the second (or third) market maker (ranked by volume share), but rather is filtered down to the smaller-volume dealers. Thus, the dispersion of trade increases somewhat with the number of dealers. Third, market concentration seems to be very high, even in the biggest markets, as the top three market makers dominate trading, executing on average of more than 75 percent of all trades.

B. The Dominant Dealer

An interesting feature of these markets is the stability of the trade patterns over time. Indeed, it appears that a "pecking order" is established early on, with the daily shares of the top, second, and third market makers relatively constant. What has not yet been established, however, is whether the identities of these dealers remain the same. Is the same market maker always the dominant one? The simple answer is no. On average, 7.69 different market makers per stock are the most active in volume on at least one day in our sample period. But this statistic can be a result of isolated days

[10] Notice that a small fraction of volume is executed directly by a broker and not by a market maker. This volume is not included, and therefore the sum of volume does not add up to 100 percent.

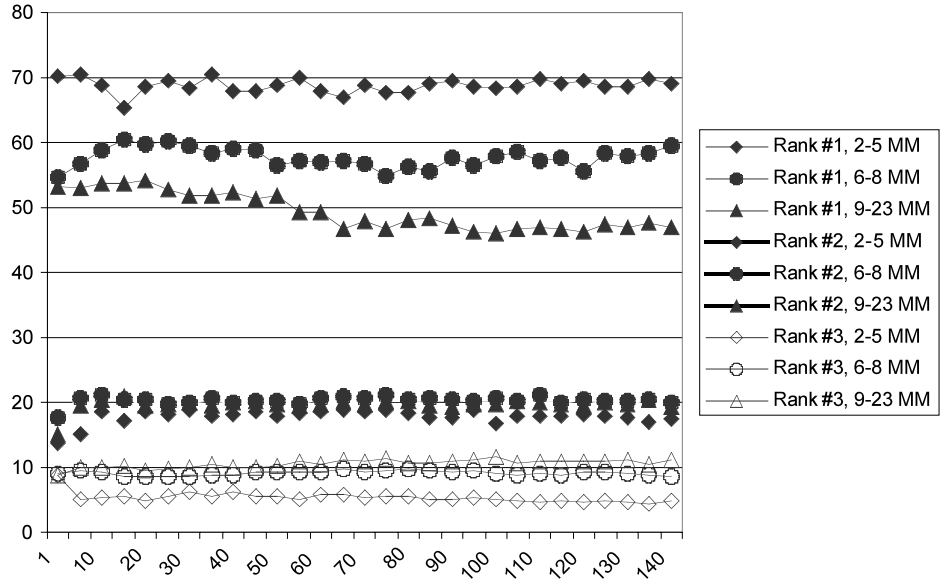

Figure 1. Trading volume by market maker. This figure shows the percentage of daily trading volume that is done by the top three market makers each day. The market makers are ranked every day based on their trading volume, and thus the identity of the Rank #1 market maker (and other ranks) may change from day to day in this figure. The stocks are grouped into three groups each day: (1) in diamonds are the stocks with 2 to 5 market makers, (2) in circles are the stocks with 6 to 8 market makers, and (3) in triangles are the stocks with 9 to 23 market makers.

where a particular market maker has a block to execute, or it can reflect a genuine lack of consistent leadership in volume through time. If so, that would represent a significant departure from the NYSE structure where the same individual (the specialist) is the dominant market maker day in and day out.

To investigate this, we propose three metrics to measure dealer dominance. First, we rank dealers by trading activity and see how frequently over days 2 to 140 each dealer is dominant on a daily basis.[11] This gives a simple measure of the percentage of days in which the same dealer dominates. Second, we calculate rankings based on which market makers are the *most active* in terms of volume over the days in the sample period. We calculate the equal-weighted volume (EVW) average by taking the daily percent of total volume done by each marker maker over days 2 to 140 of the sample period and then averaging by the number of days. Third, we calculate the total-weighted volume (TVW) average by taking the daily percent of total volume done by each market maker as a fraction of the

[11] We excluded the offer day in this calculation because of the high volume and nonrecurring nature of that day's trading.

Table IV

Market Maker Volume

Market makers are ranked on volume done during days 2 to 140, and the top five ranks are displayed. Number of stocks is shown by n (not all stocks have more than two market makers). Average percent of equally weighted daily volume (EVW) is the average over all market makers in each rank of the percent of daily volume done by the market maker, where days are equally weighted:

$$\textit{Equally weighted percent of daily volume}_{x,j} = \sum_{t=2}^{t=140} \left[\frac{(\textit{shares traded by market } x \textit{ in stock } j)_t}{(\textit{shares traded in stock } j)_t} \right].$$

Average percent of total weighted daily volume (TVW) is the average overall market makers in each rank, of the percent of volume done by the market maker. Total volume of trading by the market maker is calculated as a fraction of the total trading in the stock over days 2 to 140.

$$\textit{Total weighted percent of daily volume}_{x,j} = \frac{\sum_{t=2}^{t=140} \textit{shares traded by market maker } x \textit{ in stock } j}{\sum_{t=2}^{t=140} \textit{shares traded in stock } j}.$$

"% days as #1" is the percentage of days the market maker is ranked #1 on volume.

Rank on Trading Volume	n	Average % of Equally Weighted Daily Volume (EVW)	Average % of Total Weighted Daily Volume (TVW)	% days as #1
Rank 1	313	39.95	47.66	52.39
Rank 2	313	18.75	18.64	19.91
Rank 3	313	11.05	9.64	9.89
Rank 4	311	7.22	6.29	5.55
Rank 5	311	5.36	4.43	3.94

total trading in the stock over days 2 to 140. These EVW and TVW measures can differ because on low volume days, a dealer could clear 100 percent of trades on an equal-weighted volume basis, and yet be unimportant in clearing when measured on a total-weighted volume basis. Table IV presents these calculations.

The most active dealer over the first 140 trading days does on average 40 to 47 percent of the volume, depending upon the measures used. These numbers are much lower than the 54 to 59 percent of the volume done by the dominant dealer through time, and the reason, of course, is that the most active dealer is only the dominant dealer on 52.39 percent of the days. For the other 47.61 percent of the days, other dealers predominate. The second most active dealer does, on average, 18 percent of the volume on any given day, and he is the dominant dealer for 19.91 percent of the days on average. Combining the top three ranks, dealers one, two, and three account for 70 to 75 percent of the trading volume, and 82.19 percent

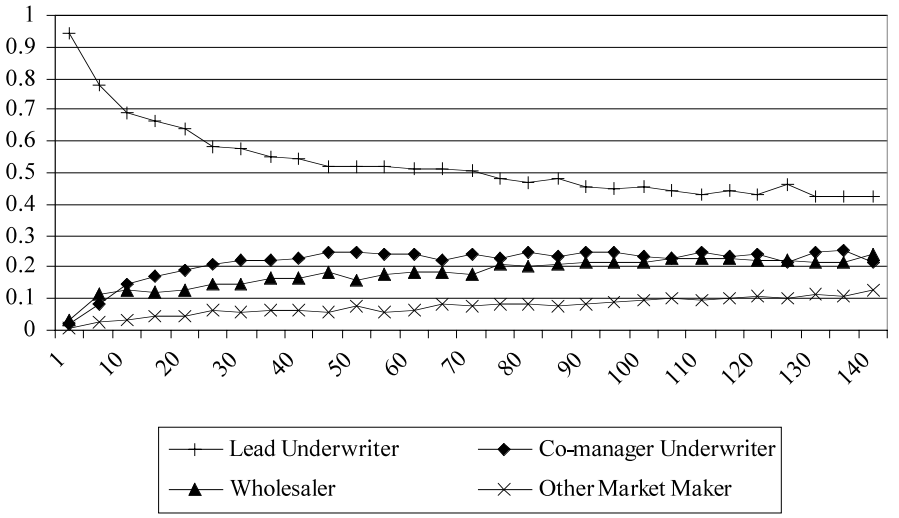

Figure 2. Composition of top market maker. This table gives the probability that the dominant market maker (market maker who does the largest percentage of trading volume on a day) is the underwriter, comanager, wholesaler, or other market maker. The probabilities are calculated by looking at the identity of the dominant market maker across stocks each day. The sample size is 313 stocks and the time horizon is 140 trading days.

of the days as dominant dealer. Note that even the fifth most active dealer is dominant on some days, although it is unusual: Less than 4 percent of the time this dealer was the largest volume dealer on a single day.[12]

Again, it is useful to compare these results on Nasdaq dealers with the Madhavan and Sofianos (1998) results on NYSE specialist participation. Because the specialist is the dominant dealer every day, his market share of 52 percent for the comparable NYSE stocks exceeds the 40 to 47 percent share of the most active Nasdaq dealer. This divergence arises because the multiple dealer structure on Nasdaq does create less dominance by the largest liquidity provider. Thus, while on any given day the markets appear quite comparable, there is a large difference in the role played by the dominant liquidity provider.

But who exactly is this dominant dealer? Figure 2 gives the probability (across stocks, each day) that the dominant dealer belongs to each market maker category (underwriter, wholesaler, and generic market maker). Earlier work (see Aggarwal (2000) or Ellis et al. (2000)) finds that the underwriter dominates trading on the offer day, and this is apparent in Figure 2.

[12] A concern with these averages is that they might be skewed by days of very low volume. To address this, we recalculated Table IV dropping the lowest 25 percent of days in terms of volume. This slightly elevated the averages for ranks one and two, but the effects were too minor to affect our results.

On the first trading day, the dominant dealer is the lead underwriter in 94.6 percent of the cases. What is interesting is the evolution of this role. While the dominant dealer is typically the underwriter over the entire sample period, this outcome occurs with decreasing frequency over time. After three months of trading, the underwriter dominates less than half the time.

Figure 2 also reveals that one of the six wholesalers is the dominant dealer for over 20 percent of the stock in our sample after the first month of trading. This change in the wholesalers' role typifies the evolution that is occurring for the market as a whole; the provision of liquidity shifts away from the underwriter and towards other market participants. The high probability that the dominant dealer is the lead underwriter quickly declines, to an average of 78.1 percent probability for the rest of the first week, and by day 140, the probabilities are 42.3 percent lead underwriter, 23.9 percent wholesaler, 21.5 percent comanager underwriter, and 12.4 percent generic maker.

Does this shift in trading patterns reflect factors specific to the underlying stock? In particular, are the underwriters retaining dominance in stocks that are performing better, or are they "stuck" in poorly performing stocks that other dealers shun? We tested for these selection effects by running univariate regressions where the independent variable is the percent of daily volume done by the underwriter in days 80 to 140, and the dependent variable is the stock's raw return over days 1 to 20 (or days 1 to 79). In general, the results are weak, but it does appear that the underwriter participates more in stocks that have lower four-month returns. Finally, we also investigated whether the wholesaler volume is associated with a particular return pattern (e.g., do they tend to make markets in winners?). Using a linear regression we find no such patterns. We cannot attribute changes in wholesalers' volume to a preference for hot or cold IPOs.

In summary, the data suggest (l) the underwriter is the dominant dealer even after seven months of trading, but his influence is waning; (2) wholesalers become more important through time; and (3) unlike on the NYSE, it is not one dealer who completely dominates trading, but rather it is the top three market makers who account for the majority of trade executions. Overall, it appears that a pecking order in market making volume exists, and it does not change rapidly over time.

C. Market Concentration

For the typical stock, the changing market role of dealers coincides with a general decline in the overall number of dealers. With fewer dealers active in a stock, the market power of the remaining dealers is affected, potentially causing the competitiveness of the market to fall. Offsetting this effect is the declining importance of the underwriter, which could allow other dealers greater competitive opportunities. Thus, how does the competitive nature of the market change over time?

Table V

Concentration Ratio

The Herfindahl index is the sum of the squares of the percentage market share of each market maker (*mmkr*). The percentage market share is measured as the percentage of daily trading volume for each market maker.

$$Herf_{j,t} = \sum_{x=1}^{n} \frac{shares\ traded\ by\ mmkr\ x}{shares\ traded\ in\ stock\ j}.$$

A monopoly results in a Herfindahl index of one, equal sharing of volume results in a Herfindahl index of $1/n$. The Herfindahl index is calculated as the average over the time period. For day 1, it is the Herfindahl index over one day, whereas for days 21 to 60, it is the average Herfindahl index over those 40 days. The number of observations is 313. The next two columns show the concentration ratios for stocks that have average daily trading volume below the median, and for stocks that have average daily trading volume above the median. The median daily trading volume is calculated over the given period (e.g., days 61 to 100). The final two columns show the concentration ratios for stocks that have average number of market makers below the median, and for stocks that have average number of market makers above the median. The median number of market makers is calculated over the given period (e.g., days 61 to 100). An asterisk indicates that a *t*-test of the difference in means is significant at the one percent level.

			Concentration Ratios Across Volume		Concentration Ratios Across # Market Makers	
Trading Days	Average Herfindahl Index	Average 1/No. of Market Makers	Low Volume Stocks	High Volume Stocks	Low No. of Market Makers	High No. of Market Makers
Day 1	0.3542	0.1080	0.3520	0.3563	0.3590	0.3076*
Days 2–20	0.4315	0.1335	0.4608	0.4023*	0.4583	0.3795*
Days 21–60	0.4589	0.1828	0.5034	0.4146*	0.5173	0.3868*
Days 61–100	0.4535	0.1995	0.5144	0.3929*	0.5375	0.3638*
Days 101–140	0.4472	0.1787	0.5114	0.3833*	0.5389	0.3567*

One way to address this question is to look at the concentration of the market. A standard way to measure this is a Herfindahl index, which is given by the sum of the squares of the percentage market share of each dealer (where market share is measured as the percentage of daily traded volume). A monopoly market would have a Herfindahl index equal to one, while a perfectly competitive market in which dealers equally shared volume would yield an index of $1/n$, the number of market makers.

Table V gives Herfindahl indices for the sample stocks over the five time intervals. What is immediately apparent is that the market changes after the first day, with the Herfindahl index increasing substantially (F-test for days 2 to 140 = 5.24). The level of the index suggests that while markets are not monopolistic, they are also not perfectly competitive. This noncom-

petitive finding is perhaps not unexpected given the large role played by the dominant dealer.[13] We also calculated Herfindahl indices separately for the high volume and low volume stocks in our sample, and for the stocks handled by many and few market makers. The results reveal a divergent pattern: Low volume stocks become more concentrated than do high volume stocks. Indeed, we find a statistically significant difference between the two groups from day 2 onward. Thus, while on average the market become less competitive, this is largely driven by the competitive deterioration of low volume stocks (F-test for days 2 to 140 = 17.73). For high volume stocks, the competitiveness of the market remains virtually unchanged over our sample period (F-test for days 2 to 140 = 1.50). Similarly, stocks with an above average number of market makers show no trend towards greater concentration over time. Stocks handled by a low number of market makers become progressively more concentrated.

These results suggest that dealers may enjoy disparate market power in setting prices. To investigate if spreads are affected by market competitiveness, we ran the following cross-sectional regression for five periods in time: day 1, day 20, day 60, day 100, and day 140. Since the results were rather similar, we present below the results for day 140 cross-sectional regression:

$$\begin{aligned} Spread_i = {} & 19.1^* - 075^* \ln(MM) - 0.76^* \ln(Ntrades) - 0.60^* \ln(Tsize) \\ & + 0.4^* \sigma^2 - 3.4^* \ln(Price) + 2.94^* comp \qquad R^2 = 0.71, \end{aligned} \tag{1}$$

where the dependent variable is the time-weighted average relative spread. The independent variables are the number of market makers (MM), the number of trades ($Ntrades$), and trade size ($Tsize$). Following Wahal (1997), volatility is measured as the sum of squared returns. We use the Herfindahl index to capture competitiveness ($comp$). * represents significance at the one percent level.

The regression results clearly indicate that the spread is increasing with market concentration and decreasing in the number of market makers.[14] This suggests that spreads are wider than they would be in a competitive market as dealers benefit from decreased competition by setting wider spreads.

[13] In earlier work (Ellis et al. (2000)), we find that the underwriter typically does about 55 percent of the volume during the first month of trading with only a slight decrease in his relative trading volume during that time period. A back of the envelope calculation shows that his contribution to the index is around 0.275. The increase in the index from day one relative to the rest of the trading days is because of the drop in the activity of the less active market makers. These findings suggest that the fall in volume after the offer day may explain the change in the market competitiveness.

[14] The coefficients on the Herfindahl index range from 2.41 to 3.56 over the five time segments, with t-statistics from 2.20 to 4.57. For complete regression results, please see Ellis, Michaely, and O'Hara (2001), Table VI.

Consistent with prior studies, we also find spreads decreasing in the number of trades, in the average trade size, and in price.

III. The Dynamics of Making a Market: Exit and Entry of Dealers

Our results reveal that liquidity arises from a complex process in which customer orders interact with a diverse and fluid set of dealers. The ability of the population of dealers in a stock to adjust over time to its equilibrium level may have a significant impact on the liquidity process. In this section, we examine this market equilibrium and the factors that influence the dealer population.

A. The Profits of Dealers

A dealer's decision to make a market must depend to some extent on profitability. Dealers' market making revenue arises from trading profits (buying a stock at the bid price and selling it at the ask price) and changes in inventory value. Dealers also face costs in making markets, and these include the cost of the dealer's time, invested capital, and general administrative outlays. We do not have data on these costs, and so our profit calculation is a gross number.[15]

We calculate each dealer's trading profit for day t, $\pi_{TRADE}(t)$, by determining the round-trip trading profits for trades that have an offsetting trade during that day:

$$\pi_{TRADE}(t) = \begin{cases} N_S(t)(\tilde{P}_S - \tilde{P}_B) & \text{if } N_B(t) > N_S(t) \\ N_B(t)(\tilde{P}_S - \tilde{P}_B) & \text{if } N_B(t) < N_S(t). \end{cases} \tag{2}$$

Thus, if there are more buys than sells for a day, $(N_B(t) > N_S(t))$, trading profits arise from the buying and subsequent reselling of $N_S(t)$ shares, with the remaining shares, $(N_B(t) - N_S(t))$, being transferred to inventory. The cumulative trading profit, $\Pi_{TRADE}(t)$, is the sum of the trading profits for each day, $\Pi_{TRADE}(t) = \Sigma_{i=1}^{t} \pi_{TRADE}(i)$.

The calculation of inventory profits is more complicated. The market maker's inventory is marked to market at the end of each day at the midpoint of the closing quote, $P(t)$. He makes profits (losses) from changes in value of his overnight inventory and also from changes to his inventory level.

$$\Pi_{\text{INV}}(t) = \text{INV}(t-1)(P(t) - P(t-1)) + \Delta INV(t)(P(t) - \tilde{P}) \tag{3}$$

[15] We also do not have any data on payments made by dealers for order flow which could be a substantial outlay for some dealers.

where

$$\tilde{P} = \begin{cases} \tilde{P}_B = \dfrac{\sum_{j=1}^{B_t} N_B(j)P(j)}{N_B(t)}, & \text{if } \Delta INV(t) > 0 \\ \tilde{P}_S = \dfrac{\sum_{j=1}^{S_t} N_S(j)P(j)}{N_S(t)}, & \text{if } \Delta INV(t) < 0. \end{cases}$$

Profits due to change in value of the change in inventory, $\Delta INV(t)$, are captured by the difference between the closing price and $\tilde{P}$, the weighted-average purchase (or sale) price. We use the weighted-average price to account for price movements throughout the day. It is calculated as the sum of the value of each purchase (sale) divided by the total number of shares that are bought (sold) during the day.

Because the stocks in our sample are IPOs, some care must be taken in calculating the lead underwriter's profits. As discussed in detail in Ellis et al. (2000), the lead underwriter's profits must be adjusted for the initial overselling of the issue (assumed to be 15 percent) and for the exercise of the overallotment option. We collected data on actual overallotment usage, so our reported profit numbers reflect these adjustments.

Table VI reports the average profit per market maker, as well as profits across the dealers segmented by trading activity. On average, making markets in new issues is profitable. After seven months of trading, the cumulative profit per stock (for all dealers combined) averages \$570,000. Of this total amount, the lion's share is earned by the largest volume dealer (per stock), who makes approximately \$325,000.[16] But even the smallest dealer earns a positive, albeit tiny, profit (an average across stocks of \$1,000). Overall, however, profit levels of dealers are fairly modest, a finding consistent with Hansch et al.'s (1999) result that market making trading revenues in London are small, or in some cases, negative.[17]

We also calculate the average profits for the top, middle, and bottom thirds of market makers, split by trading volume. As expected, dealers in the top third of the trading distribution earn the vast majority of profits, and, not surprisingly, these profits increase over time. Panels B and C of Table VI

[16] The market share rankings of the market makers are calculated as the average market share of trading volume from day 2 to day 140.

[17] While market making on average is profitable, not every dealer makes money. Not unexpectedly, one group faring particularly poorly is the inactive market makers. During the 40-day period from day 101 to day 140, the average inactive market maker has made only \$2,000 in trading profits (or approximately \$50 a day). He has, however, managed to lose \$3,000 on inventory, so that his total profits for the period are negative. The median inactive dealer fares somewhat better; he earns zero over any and all trading horizons. For these dealers, at least, market making is best viewed as a hobby.

Table VI

Profits and Volume

This table looks at the profits for market makers (mmkr) based on their market share of volume. Panel A shows total profits, Panel B shows trading profits, and Panel C shows inventory profits (all reported in thousands of dollars). The market share rankings of the market makers are calculated via the total volume of trading by each market maker, calculated as a fraction of the total trading in the stock over days 2 to 140.

$$\textit{Total weighted percent of daily volume}_{x,j} = \frac{\sum_{t=2}^{t=140} \textit{shares traded by market maker } x \textit{ in stock } j}{\sum_{t=2}^{t=140} \textit{shares traded in stock } j}.$$

The market makers are ranked for each stock based on their volume-weighted percent of daily volume, and then the average cumulative profits are shown for each market maker rank. The largest volume market maker is the market maker with the highest average market share from days 2 to 140. The lowest volume market maker is the market maker with the lowest average market share from days 2 to 140. The top, middle, and bottom thirds split the market makers into three equal groups.

Trading Day	1	20	60	100	140
Panel A: Total Profits (Trading + Inventory)					
Average profit per IPO	71	262	403	454	570
Profit of largest volume mmkr	32	190	255	267	325
Profit of lowest volume mmkr	0	1	3	4	1
Profit of top 1/3 mmkrs	14	60	94	104	136
Profit of middle 1/3 mmkrs	4	4	4	12	11
Profit of lowest 1/3mmkrs	1	4	6	4	4
Panel B: Trading Profits					
Average profit per IPO	113	208	318	414	510
Profit of largest volume mmkr	77	136	199	248	295
Profit of lowest volume mmkr	1	1	1	0	0
Profit of top 1/3 mmkrs	26	47	72	96	120
Profit of middle 1/3 mmkrs	3	5	7	10	13
Profit of lowest 1/3 mmkrs	1	1	1	1	1
Panel C: Inventory Profits					
Average profit per IPO	−42	55	85	41	60
Profit of largest volume mmkr	−45	54	56	18	30
Profit of lowest volume mmkr	0	0	2	4	1
Profit of top 1/3 mmkrs	−12	13	22	8	15
Profit of middle 1/3 mmkrs	2	−1	−3	2	−2
Profit of lowest 1/3 mmkrs	0	2	4	4	3

provide more insight into these dealer profits by looking at trading profits and inventory profits, respectively. On average, the bulk of a dealer's profits arise from trading, contributing \$510,000 of the \$570,000 total over the 140-day sample period. The inventory profits are extremely variable, and for

many dealers are unimportant. One difficulty in interpreting the inventory profits is that they are greatly affected by outliers in our sample. Given this problem, and the greater importance that trading profits have for dealer revenues, we focus on trading profits in our subsequent analyses.

B. Exit of Market Makers

Although dealers on average are profitable, it is not the case that every dealer is making money. Standard economic theory predicts that unprofitable dealers should leave the market, and we now turn to analyzing this exit decision. Certainly, a prominent feature of the markets we examine is the fall in dealer participation over time. Of the 313 stocks in our sample, 293 experience exit of at least one dealer by day 20, with the average stock losing more than 2.5 dealers. Earlier we saw that volume also decreased dramatically over this period, suggesting an economic justification for a smaller number of dealers in equilibrium. However, the fall in volume occurs fairly quickly, yet as Table VII shows, dealers continue to exit from markets over the entire sample period. While the number of dealers exiting over time falls slightly, the typical stock in our sample is still losing 1.72 dealers in the period from five to seven months after the IPO.

What causes these dealers to leave? Two factors seem most likely: (1) individual dealer trading volume, and (2) dealer profit. Table VII, Panel A, shows that, on average, approximately one-third of dealers leaving the market are making negative profits. Departing market makers are also generally low volume dealers, as evidenced by the high proportion of exiting dealers in the bottom third of the volume rank. Nonetheless, not all low volume dealers leave, and it is not generally the case that the lowest volume dealer leaves, or even the least profitable one.

An alternative way to analyze dealer exit is to examine the decision problem facing an individual market maker. As noted earlier, Nasdaq rules impose no costs on dealers wishing to exit. This suggests that a market maker's decision whether to exit at time t may depend upon dealer-specific and stock-specific factors at time $t - 1$. These factors can be determined by running a logistic regression. We look at two specifications, one linking the exit decision to factors defined over the previous month and the other relating it to factors over the previous two weeks.

For our total sample stocks, there are 10,167 market makers per month combinations. There are a total of 1,186 exits after the first 20 trading days, and 8,981 nonexits.[18] Similarly, there are 20,439 market maker per two-week combinations, with 3,003 exits and 17,436 nonexits. We use these numbers to calculate the probability of exit. We include as stock specific-factors the total trading volume, aggregate trading profits for all market makers, the average number of market makers, the Herfindahl index, the size of the

[18] We exclude an additional 716 exits within the first 20 days because there is no previous data for estimation of the independent variables.

Table VII

Who Exits and Who Enters?

Panel A looks at the time pattern of market maker (mmkr) exit. An exit is when the market maker ceases acting as a registered market maker. Market maker excusals (where the market maker is not registered for less than a month and then recommences market making) are not included as exits. The volume rankings are based on the equal-weighted percent trading volume per market maker over the period. The profit rankings are based on the cumulative total profit per market maker over the period. The table shows the percentage of market makers who were ranked in the lower third or ranked as the lowest in terms of trading volume and profits. The sample is 313 stocks. Panel B shows the pattern of market makers entering. The first column gives different time periods for the entry: The first month (day 2 to day 20), the second or third month (days 21 to 60), and so forth. For each of these time periods, the number of stocks with at least one entry is given in the second column. The third column gives the average number of entries per stock. The fourth column gives the percentage of entering market makers that stay for less than one month (20 days) of trading. The next two columns give the percent of entering market makers that are in the bottom third of volume or profits once they enter, and the final column gives the percent of entering market makers that make negative profits. Volume rankings are based on the equal-weighted percent trading volume per market maker over the period. The profit rankings are based on the cumulative total profit per market maker over the period.

Panel A: Exit

			Percentage of Exiting Market Makers				
Mmkrs who Leave During	No. Stocks with Exit	No. Exits per Stock	Rank in Lowest Third in Volume	Rank the Lowest Volume	Rank in Lowest Third in Profit	Rank as the Lowest Profit	Have Negative Profit
Days 2 to 20	293	2.53	80.64	10.27	61.19	2.90	35.73
Days 21 to 60	270	2.43	58.96	0.43	44.80	0.56	24.78
Days 61 to 100	173	1.79	52.80	1.59	43.28	0.34	23.10
Days 101 to 140	127	1.72	62.10	0.52	43.15	0.27	31.29

Panel B: Entry

Entry Period	No. Stocks with Entry	No. Entries per Stock	% Who Stay <1 Month	% Entries in Bottom Third Volume Rank	% Entries in Bottom Third Profit Rank	% Entries with Negative Profits
2 to 20	111	1.50	31.23	55.56	34.53	29.88
21 to 60	119	1.75	26.96	60.28	35.39	25.90
61 to 100	138	1.87	32.59	61.19	45.34	25.91
101 to 140	148	2.18	22.60	56.98	45.74	31.33

issue, and the trading month, all defined over month $t - 1$. Dealer specific factors are the dealer's trading volume, trading profit, volume rank, and trading profit rank, all calculated over the prior month $t - 1$.

The results in Table VIII suggest that recent history (prior two weeks compared to prior month) is more effective in explaining the exit decision. (In our discussion we focus primarily on those results.) They also suggest

Table VIII

Logistic Regressions of Probability of Exit and Entry

This regression models the probability of exit by a market maker in a calendar month (20 trading days) and two weeks (10 trading days) based on variables from the previous month (two weeks). Exit regression is:

$$\begin{aligned}\Pr(&mmkr \times exits\ stock\ j\ in\ period\ t)\\ &= \beta_0 + \beta_1 num\_mkrs_{j,t-1} + \beta_2 tot\_vol_{j,t-1} + \beta_3 tot\_prof_{j,t-1}\\ &\quad + \beta_4 herf_{j,t-1} + \beta_5 size_{j,t-1} + \beta_6 month_{t-1} + \beta_7 mmkr\_vol_{x,j,t-1}\\ &\quad + \beta_8 mmkr\_prof_{x,j,t-1} + \beta_9 mmkr\_vol\_rank_{x,j,t-1} + \beta_{10} mmkr\_prof\_rank_{x,j,t-1}\end{aligned}$$

Entry regression is:

$$\begin{aligned}\Pr(&a\ mmkr\ enters\ stock\ in\ j\ in\ period\ t)\\ &= \beta_0 + \beta_1 num\_mkrs_{j,t-1} + \beta_2 tot\_vol_{j,t-1} + \beta_3 tot\_prof_{j,t-1}\\ &\quad + \beta_4 herf_{j,t-1} + \beta_5 size_{j,t-1} + \beta_6 month_{t-1}\end{aligned}$$

Several variables are per stock: $num\_mkrs_{j,t-1}$ (average number of market makers), $tot\_vol_{j,t-1}$ (total trading volume in 000s shares), $tot\_prof_{j,t-1}$ (profits for all market makers in \$000s), $herf_{j,t-1}$ (Herfindahl index), $size_{j,t-1}$ (market capitalization in \$ millions), and $month_{t-1}$ (trading period). There are also several variables that are per market maker: $mmkr\_vol_{x,j,t-1}$ (equal weighted percent trading volume), $mmkr\_prof_{x,j,t-1}$ (trading profit in \$000s), $mmkr\_vol\_rank_{x,j,t-1}$ (volume rank based on equal weighted percent trading volume), $mmkr\_prof\_rank_{x,j,t-1}$ (profit rank based on total profit.) Parameter values and standard errors are given.

	Probability of Exit		Probability of Entry	
	One Month	Two Weeks	One Month	Two Weeks
Intercept	0.6400	−3.4753	−0.4641	−1.2565
	[0.2317]*	[0.1397]*	[0.3812]	[0.2673]*
Number of market makers	−0.0238	0.0386	0.0074	0.0249
	[0.0166]	[0.0096]*	[0.0210]	[0.0174]
Total volume per stock	−0.0003	0.0011	−0.0003	0.0009
	[0.0005]	[0.0001]*	[0.0008]	[0.0005]***
Total profit per stock	0.0087	0.0237	0.0283	0.0055
	[0.0077]	[0.0172]	[0.0142]**	[0.0093]
Herfindahl index	−0.1603	1.0245	−1.4259	−1.6341
	[0.2430]	[0.1500]*	[0.3768]*	[0.3330]*
Market capitalization	−0.0002	−0.0024	−0.0002	−0.0004
	[0.0002]	[0.0006]*	[0.0003]	[0.0003]
Month	−0.3484	0.2387	−0.0548	0.0066
	[0.0231]*	[0.0065]*	[0.0268]**	[0.0119]
Market maker volume share	−0.0619	−0.0120		
	[0.0088]*	[0.0029]*		
Market maker trading profit	−0.1709	−0.0722		
	[0.0468]*	[0.0434]***		
Market maker volume rank	−1.7615	−1.1858		
	[0.3732]*	[0.1672]*		
Market maker profit rank	−0.1826	−0.1884		
	[0.2491]	[0.0726]*		

*, **, *** Significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

stock characteristics do influence the exit decision. First, the likelihood of exiting is lower for larger capitalization stocks. Thus, larger stocks retain more dealers than do smaller ones. Second, the number of market makers and the level of volume also enter positively in the two-week regression, meaning that markets with more dealers or higher volume have a higher probability of exit. Third, the level of concentration has a positive impact on the exit decision, suggesting that dealers are more likely to leave concentrated markets.

Holding stock characteristics constant, we also find that several individual dealer factors also affect the exit decision. First, dealers with low volumes are most likely to leave. Second, market makers with lower profits are more likely to exit, although this effect is surprisingly weak. The profit and volume results are also supported by the negative coefficients on both the profit and volume ranking. The higher the market maker's profit or volume ranking relative to others, the less likely he is to leave. Overall, the decision to exit appears influenced by the dealer's inability to establish a profitable market share in the stock.

C. Entry of Market Makers

While some dealers are leaving the market, other dealers are entering. Table VII, Panel B, shows the pattern of dealer entry for our sample stocks. Perhaps most striking is that entry occurs for most stocks in our sample. In the first month of trading, approximately 30 percent of stocks have entering dealers, but after seven months of trading, more than 85 percent of the sample has at least one entry (i.e., 285 out of 313 stocks). Do dealers choose to enter stocks based on industry? This would be the case if, for example, dealers choose to specialize in firms in particular industries. We looked at dealer entry by SIC code and found moderate support for this hypothesis. In particular, 54.5 percent of entering market makers chose stocks where the market maker was active in the same SIC code in the month before entering.[19]

An interesting feature of dealer entry is that some of these dealers, in turn, subsequently exit the market. Dealers entering in the first month of trading, for example, stay an average of 63 trading days (not reported). However, approximately 31 percent of these entering dealers stay for one month or less. One might conjecture that these dealers arrive to handle the large initial volume in the issue and then depart for greener pastures (or in this case, newer issues). While this may be true for some dealers, it does not explain why 22 to 33 percent of entering dealers stay for only one month in the low-volume period after the first month of trading.

[19] Of entering dealers, 38 percent entered stocks where the market maker was not active in the SIC code, and 7.5 percent entered stocks that are the only stock in the sample in that SIC code.

Alternatively, entering dealers may leave the market because they fail to achieve a sufficient level of success. In the last three columns of Panel B of Table VII, we calculate the number of entrants who are, on average, in the bottom third in ranking for trading volume or trading profits measured from the time of entry to the end of the sample period. The data show that entering dealers are firmly entrenched in the bottom echelons. Just under half of all entering dealers make negative profits, and over half are in the bottom third of trading volume.

One can think about the entry decision as the flip side of the exit decision discussed earlier. Therefore, we also perform a logistic regression modeling the probability of an entry. However, there is one significant difference. Unlike the exit decision, neither the econometrician nor the dealer can make the entry decision based on his past activity in that stock, and hence no dealer-specific information is included in the regression. We include the following stock-specific variables calculated over the calendar month and the two-week period prior to entry: The average number of registered market makers, the average daily trading volume (thousands of shares traded), the average daily trading profit per stock (the sum of trading profits for all dealers), the concentration of trading (measured by the Herfindahl index), the market capitalization (in millions), and the month of trading.

The last two columns of Table VIII indicate that the likelihood of entry is influenced by three factors. First, entry is more likely to occur in the period closer to the IPO date. The negative and significant coefficient on time (in the one-month regression) implies that entry is decreasing the longer the stock is trading, a result consistent with the transition to a more seasoned environment. Second, entry is more likely for stocks in which dealer profits or volume are higher. These dealer profits are by stock, so this result implies that dealers enter markets in which the overall gains are largest. Note, however, that these effects are quite weak statistically. Third, the regression's strongest result is that an entry is less likely when the Herfindahl index is higher. This result suggests that market makers avoid entry in stocks where the trading activity is very concentrated. Thus, once market concentration is established, entry will not play an important role in changing the market.

Some entering dealers do make positive profits, and they establish reasonable trading volumes. But what constitutes success for a dealer may vary considerably, with the result that even reasonably active dealers may choose to leave a stock. This is particularly true for wholesalers, who are among the most active dealers in our sample with respect to entry and exit. The picture that emerges from our analysis is thus almost a textbook example of a dynamic market in which dealers regularly come and go. These individual dealers' participation decisions change the composition of the dealer population in a stock, but, as we found earlier, the market itself remains quite stable after the first few months of trading.

IV. Conclusion

Liquidity provision in a dealer market is a complex process, involving a wide range of participants who play, at times, very different roles. Over time, a stable market emerges for the newly issued security, and the transition to a mature trading environment is complete. In this final section, we summarize the nature and evolution of this process.

Our first observation is that dealer markets and specialist markets have some interesting similarities, but also some differences. While there are many dealers making markets in a typical Nasdaq stock, on any given day a single market maker typically dominates trading, executing approximately 55 percent of the volume. This number is surprisingly close to the specialist participation rate of 52.7 percent reported by Madhavan and Sofianos (1998) for the smallest NYSE stocks. However, the existence of multiple dealers on Nasdaq means that the same dealer need not be the dominant one every day. Indeed, for our sample, the most active dealer did on average approximately 40 to 45 percent of the total volume. This suggests less domination by a single liquidity provider than is the case on the NYSE for its smaller stocks. Trading on Nasdaq is also remarkably consistent across stocks with the top three dealers handling the vast majority of trades. Market making is profitable, and it is clearly the case that bigger is better: The largest market maker earns more than do all of the other dealers combined. The results suggest that the dealer market is best viewed as a market in which many dealers participate, but only a few really matter.

An interesting feature of these emergent markets is that most stocks do not trade every day. What is more surprising to us is that many dealers do not trade even every week. Indeed, more than a third of all dealers are not active on a weekly basis, and this number increases to closer to half of all dealers for small stocks. These findings suggest an important caution for researchers: The number of dealers in a market may have little economic relevance for market behavior. A more meaningful statistic is the number of active market makers.

We find that markets adjust rapidly to a stable environment, and they stay there. After 20 trading days, the number of dealers in a stock, trading volume, and market concentration remain relatively constant, and after two months of trading, so do market spreads. By virtually every measure of market structure, the market that exists after the first three months of trading is the market that will characterize trading from then on.

An important feature of this transition is that liquidity provision begins to shift from the underwriter to the market. The underwriter plays a dominant role in establishing the market for a security, both in terms of executing trades and in setting prices. And this role continues long past the period when stabilization activities connected with the underwriting would normally cease. But over time the underwriter's influence decreases. In our seven-month sample, the underwriter still remains the most important dealer

in the market. An interesting question for future research is to establish when, if at all, other market participants finally supplant the underwriter.

Finally, we observe that while markets are stable, they are not constant. Entry and exit of dealers is a normal feature of market behavior. New dealers start small in terms of trading volume, and they often stay that way. The failure to thrive results in many market makers leaving the market not long after they enter it. Nonetheless, the outflow of dealers is generally matched by the inflow of dealers, resulting in a stable population of market makers.

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