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ABSTRACT

This paper examines aftermarket trading of underwriters and unaffiliated market makers in the three-month period after an IPO. We find that the lead underwriter is always the dominant market maker; he takes substantial inventory positions in the aftermarket trading, and co-managers play a negligible role in aftermarket trading. The lead underwriter engages in stabilization activity for less successful IPOs, and uses the overallotment option to reduce his inventory risk. Compensation to the underwriter arises primarily from fees, but aftermarket trading does generate positive profits, which are positively related to the degree of underpricing.

INITIAL PUBLIC OFFERINGS OF SECURITIES are among the most important events in capital markets. By providing access to public markets, the IPO is both the conduit for new capital to flow to fledgling companies and the mechanism for the existing owners to realize a return for their efforts.[1] The lead underwriter plays an important role in pricing and distributing an IPO, certifying the quality of the issue by his past performance in IPO underwriting.[2] However, the importance of the underwriter continues beyond the IPO date, when he becomes a market maker for the newly traded stock. This paper is the first direct examination of the trading activity of the lead underwriter in the IPO aftermarket.

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[1] That IPOs are typically underpriced, for example, is a well-known phenomenon, as is the fact that IPOs are often oversubscribed. See, for example, Rock (1986), Allen and Faulhaber (1989), Welch (1989), and Benveniste and Spindt (1989) for theoretical treatments of the issue, and Ibbotson (1975), Ritter (1991), and Hanley (1993), among many others, for empirical evidence. For an excellent review of general IPO issues, see Ibbotson and Ritter (1995).

[2] For evidence on the relation between the reputation of the underwriter and IPO performance see Beatty and Ritter (1986), Carter and Manaster (1990), and Michaely and Shaw (1994).

Other research has examined aspects of the post-issuance activities by underwriters and other market participants. Schultz and Zaman (1994) examine the quotes of lead underwriters in the first three trading days after the IPO. They find that underwriters generally quote the highest bids and so actively support the price of less successful IPOs. Hanley, Kumar, and Seguin (1993) also find evidence that the lead underwriter engages in stabilization.[3] Using a proprietary database on short covering transactions by syndicate members, Aggarwal (1998) provides evidence that underwriters use extensive short positions to provide price support for new issues. Michaely and Womack (1999) investigate the linkage between underwriting activity and post-issuance buy recommendations, finding that underwriters issue more buy recommendations than nonunderwriters and that those recommendations are positively biased. These papers provide compelling evidence that the components of the IPO process are not distinct entities, and that the underwriter has a role that goes beyond the offer date.

In this paper we investigate the aftermarket trading of Nasdaq IPOs. Of particular importance for IPOs brought to the market on Nasdaq is that the underwriter can become a market maker, providing a potential link between the before-market pricing and syndication functions with the aftermarket trading and stabilization activities.[4] Our research is made possible by a unique database of all trading data for 306 IPOs on Nasdaq for the period September 1996 to July 1997. These data provide time-stamped bid and ask quotes, signed trades, trade sizes, and dealer identities, allowing us to calculate who sets the market quotes, who trades with whom, how much inventory each dealer takes, the prices at which he trades, and the profits each dealer makes. Combining this information with data on fees and underwriter and co-manager identities from the Securities Data Company (SDC) Global New Issues Database, along with data on overallotment usage from issuers' 10Q and 10K filings, we are able to investigate the particular roles played by the underwriter and the co-managers in the aftermarket behavior of an IPO.

An implicit, and at times even explicit, part of the contract between underwriters and issuers in an IPO is that the underwriter will provide liquidity in the post-issuance trading of the newly traded security. We examine this aftermarket trading with three questions in mind: First, how do the underwriters and the co-managers behave in the aftermarket trading of the IPO? Do underwriters and co-managers indeed provide liquidity for the newly traded IPO? Who else makes markets for IPOs? Second, how much inven-

[3] See also Prabhala and Puri (1999). Evidence on the use of the overallotment option can be found in Carter and Dark (1990), Muscarella, Peavy, and Vetsuypens (1992), Hanley, Lee and Seguin (1996), and Aggarwal (1998).

[4] Nasdaq (for the National Association of Securities Dealers Automated Quotation system) is the traditional venue for the taking public of smaller companies, and in 1996 a total of 655 IPOs took place on the Nasdaq. By comparison, in 1996 the New York Stock Exchange had 279 original new listings. For IPOs on the NYSE, the underwriter may still exercise a price support role, but since he is not the stock's specialist, this is accomplished through his submitting limit and market orders. Unfortunately, our data contain only Nasdaq IPOs so a comparison of underwriters' behavior between IPOs issued on the two exchanges is not feasible.

tory risk does the lead underwriter (and other market makers) take in the period after the IPO has began trading? Fundamental to this analysis is the role of inventory, and our research here provides the first in-depth picture of the inventory positions taken by the underwriter and other market makers over the first 60 trading days of an IPO. The inventory exposure of the market maker can entail substantial risk, particularly for new issues. Our data set allows us to examine this risk, and in particular how the underwriter/market maker's inventory exposure and actions differ with respect to the size of the issue, with its subsequent performance in the market, and with the use of the overallotment option.

Third, is post-IPO trading a cost center, subsidized by the fees generated from the underwriting activities, or is it a significant profit activity that makes underwriting even more lucrative? By analyzing all of the trades of each syndicate member, we are able to determine the cash inflows and outflows for each account, and thus the trading and inventory profits, of the underwriter and the other market makers.

Our research provides a number of new results on the IPO process. We highlight four of them here. First, we find that the lead underwriter *always* becomes a market maker in the issue, and in fact becomes the most active dealer. On average, the lead underwriter handles about 60 percent of the trading volume in the first few days after the stock begins trading, and about 50 percent of the total volume when measured over the first few months of trading. This result establishes an important link between the premarket and aftermarket behavior of the underwriter. We also find that co-managers are not active liquidity providers for the IPO, and that their trading and inventory position are not significantly different from those of other market makers. Thus their role as market makers is small.

Second, we find that the lead underwriter/market maker takes substantial inventory positions in the stock, accumulating on average four percent of the stock offered in the issue after the first day of trading. The inventory accumulation by the underwriter is especially large when the newly traded security has been trading below the offer price. In those instances, the average inventory position of the underwriter can reach over 22 percent of the issue. Thus, price support activity potentially exposes the underwriter to a significant amount of inventory risk. However, we also show that institutional features such as the standard 15 percent overselling of the issue at the offering day, combined with the overallotment option, greatly reduce these inventory risks. Thus, features like the overallotment option not only give flexibility to the firm and the underwriter in determining the issue size, but also facilitate stabilization activities and liquidity provision by the lead underwriter.

Third, we find that most of the compensation for the IPO arises from underwriting fees, with trading profits and inventory profits contributing less than 23 percent of the underwriter's overall profits after three months of trading. Thus, in the period immediately following the offering, aftermarket trading is not a significant source of profits to the underwriter relative to the fees generated from underwriting. It is not the case, however, that providing liquidity and stabilizing the issues in the aftermarket are "subsi-

dized" by the underwriting activities. Both trading revenues and fees contribute to underwriter profits, so on average the aftermarket trading activities cannot be viewed as a cost to the underwriter connected with the IPO process. These findings are in contrast to the assumption made by Benveniste, Busaba, and Wilhelm (1996) and Chowdhry and Nanda (1996) that stabilization activity is costly to underwriters.[5]

Fourth, we find a significant link between underwriters' trading profits and IPO underpricing. This link suggests that IPO underpricing may be at least partially due to the integrated nature of the IPO process in that the underwriter directly benefits from underpricing the issue. We interpret these results as showing that the economic linkages of the IPO process give underwriters an added incentive to underprice issues.

The paper is organized as follows. In Section I we briefly outline the mechanics of the IPO process, with particular attention given to the differing activities of the underwriter after the IPO has begun trading. In Section II we describe our database and investigate the basic issues of who underwrites and who makes markets in IPOs. We examine the trading volume and turnover of new issues with a particular focus on the trades of the underwriter and other syndicate members. In Section III, we examine this trading behavior in more detail by calculating inventory and trading profits and losses of IPO underwriters and market makers. We also investigate the link between these variables and IPO characteristics and performance, allowing us to investigate potential price stabilization activities by the underwriter. In Section IV we consider the profitability of IPO underwriters and market makers, and we investigate how IPO performance affects this profitability. The paper's final section summarizes our results, discusses their implications for IPO and market maker behavior, and outlines areas for future research.

I. An Overview of the Public Offering Process

Table I briefly outlines the steps involved in the going public process. The first step involves the choice of the deal "book-running" manager and the co-managers (if any). The lead manager is also responsible for assembling the syndicate to assist in the sale of the shares to the public. One of the lead underwriter's first-agenda items is to draft a letter of intent. Among other issues, the letter contains clauses protecting the underwriter against any uncovered expenses in the event the offer is withdrawn, the percentage of gross spread as a function of the proceeds (almost always seven percent, see Chen and Ritter (2000)), and a commitment by the company to grant a 15 percent overallotment option to the underwriter. At this stage the underwriter starts the due diligence process in which the underwriter reviews the issuer's financial statements, talks with management, customers, and suppliers, and starts to plan the structure of the deal.

[5] It is important to note, however, that our profits' calculations are for the entire market trading activities and not for the stabilizing bids in isolation.

Concurrent with the due diligence process, the company and its counsel draft the registration statement for filing with the SEC. The Securities Act of 1933 makes it illegal to offer or sell securities to the public unless they have first been registered. Once the registration statement is filed with the SEC, it is transformed into the preliminary prospectus (or "Red Herring"). The preliminary prospectus is one of the primary tools in marketing the issue. The marketing of the offering begins following the filing of the registration statement with the SEC. The Red Herring is sent to the sales people as well as to institutional investors around the country, and at the same time the company and the underwriter promote the IPO through the road show. As the road show progresses, the underwriter receives indications of interest from investors. At this stage, prior to the effective day, no shares can be officially sold, so any orders submitted are only indications of interest and are not legally binding.

On the day prior to the issuance date, after the market closes, the firm and the lead underwriter meet to discuss the final offer price and the exact number of shares to be sold. Particular attention during the pricing decision is given to the order books where institutions and other investors' indications are recorded. After those final terms are negotiated, the underwriter and the issuer execute the Underwriting Agreement, the final prospectus is printed, and the underwriter files a "price amendment" on the morning of the chosen effective date. Only at this point is the underwriter committed to sell the securities at the agreed upon price. Once approved, the distribution of the stocks begins. The lead underwriter and the rest of the syndicate members distribute the stock to their customers. In most cases, the managing underwriter overallots the issue, creating a short position by accepting more orders than there are shares to be sold. On this morning, the company's stock opens for trade for the first time.

But the IPO is far from being completed. Once the issue is brought to market, the underwriter has several additional activities to complete. These include the decision on whether to use the overallotment option, the aftermarket stabilization obligations, and the provision of analyst recommendations. The overallotment option (known as the "green shoe") grants an option to the underwriter to purchase from the company, within 30 days, an additional 15 percent of the shares sold in the IPO at the offer price. (The NASD sets the 15 percent limit for the green shoe option.) With this option, an underwriter can (and virtually always does) sell 115 percent of the firm's shares at the offering.[6] The motivation for this option is to provide buying support for the shares without exposing the underwriter to excessive risk. If the offering is strong and the price goes up, the underwriter covers his short position by exercising the green shoe option at the offering price (and receives an additional gross margin of typically seven percent on the proceeds from the overallotted shares). If the offering is weak and the price goes down, the underwriter does not exercise the option, and instead buys back all or part of the extra 15 percent of shares in the market, thereby support-

[6] Note that this option can be exercised solely to cover overallotted shares at the offering.

Table I
Description of the IPO Process

Major Stages and Main Events	Role of the Underwriter in the Main Events
1. Initial step	
Select book-running manager and co-manager	Selection is a function of the investment banker's reputation, expertise, and quality of research in the specific industry. The book-running manager's role includes forming the syndicate and being in charge of the entire process.
Letter of intent	This initial agreement between the underwriter and the issuer protects the underwriter against any uncovered expenses in the event the offer is withdrawn, it specifies the gross spread (usually seven percent), and it contains a commitment by the company to grant a 15 percent overallotment option to the underwriter. There is no guarantee of the final offering price or the number of shares to be issued in the letter of intent. The letter of intent remains in force until the Underwriting Agreement is executed at pricing.
2. Registration process	
Registration statement and due diligence	The Securities Act of 1933 mandates that the company and its counsel draft a registration statement for filing with the SEC. The purpose of the registration and disclosure requirements is to ensure that the public has adequate and reliable information regarding securities that are offered for sale. To achieve this, the underwriter has a "due diligence" requirement to investigate the company and verify the information it provides about the company to investors. The Securities Act also makes it illegal to offer or sell securities to the public unless they have first been registered.
Red Herring	Once the registration statement is filed with the SEC, it is transformed into the preliminary prospectus (or "Red Herring"). The preliminary prospectus is one of the primary tools in marketing the issue.
3. Marketing	
Distribute prospectus; road show	The Red Herring is sent to sales people and institutional investors around the country. Concurrently, the company and the underwriter promote the IPO through a road show in which company officers make numerous presentations to (mainly) institutional investors. A typical road show lasts three to four weeks and includes two or more meetings per day with both retail salespeople and institutional investors. As the road show progresses, the underwriter receives indications of interest from investors. However, regardless of the source of the indication of interest, at this stage, prior to the effective day, no shares can be officially sold, so any orders submitted are only indications of interest and are not legally binding.

Table I—*Continued*

Major Stages and Main Events	Role of the Underwriter in the Main Events
4. Pricing and allocation	
Pricing; allocation	Once the registration statement has SEC approval, the underwriter files with the SEC an acceleration request, asking the SEC to accelerate the effective date of the registration statement. On the day prior to the effective date, the firm and the lead underwriter meet to discuss the offer price and the exact number of shares to be sold. Particular attention during the pricing decision is given to the order books. Shortly thereafter share allocation is decided.
5. Aftermarket activities	
Stabilization; overallotment option	Stabilization activities essentially require the underwriter to support the stock by buying shares if order imbalances arise. This price support can be done only at or below the offering price, and it is limited to a relatively short period of time after the stock has begun trading. Typically the underwriter sells 115 percent of the issue at the offering. If stock price goes up, it uses the overallotment option to cover the short position. If stock price goes down it covers the overallotment option by buying stocks in the open market.
Research coverage	The final stage of the IPO process begins 25 calendar days after the IPO when the so-called "quiet period" ends. It is only after this point that underwriters (and other syndicate members) can comment on the valuation and provide earnings estimates on the new company.

ing the stock price. The overallotment option thus provides the underwriter with buying power in the aftermarket, enabling him to support the price of the newly traded security. The underwriter typically has 30 days to decide to exercise all or part of this option.

The underwriter's use of the overallotment option is part of his larger responsibility to support the price of the issue. Price support refers to stabilizing bids, trades, and penalty bids made by the underwriter to influence the price by slowing price declines (see Regulation M SEC release #34-38067, December 1996). Although there is no legal restriction about the price level at which stabilizing trades can be made, stabilizing bids can be made only at or below the offering price.[7] Stabilization is intended to be temporary in nature, in order to facilitate the distribution of the securities, and typically only lasts for a short time period after the registration becomes effective.

[7] For an excellent discussion of the revised legal restrictions (Regulation M) on stabilization, see Aggarwal (1998).

The final stage of the IPO begins 25 calendar days after the IPO when the so-called "quiet period" ends. It is only at this point that underwriters (and other syndicate members) can comment on the valuation and provide earnings estimates on the new company. The SEC mandates this "quiet period," and it marks a transition from investor reliance solely on the prospectus and disclosures mandated under security laws to a more open, market environment where research analysts interpret information, and provide estimates and recommendations to their clients regarding the new firm. An underwriter's role thus evolves in this aftermarket period into an advisory and evaluatory function.

Despite the myriad activities in the offering process, the underwriter's compensation essentially comes from only two sources: fees and trading revenues. This paper focuses on examining the second source, the trading revenues. Of particular interest is whether the underwriter's aftermarket trading activities are a profit center or are subsidized by the underwriting process.

II. Underwriting and Market Making in Initial Public Offerings

We begin our analysis by examining the market making activity of the lead underwriter and the co-managers of initial public offerings. Our ability to analyze these activities derives from our use of a new and unique data set, and we first describe the sample of IPOs we use in our study and the properties of our data.

A. Data and Sample

We obtained an initial sample of 559 firm commitment IPOs, issued between September 27, 1996 and July 3, 1997, from the Securities Data Company (SDC) new issues database. The SDC database includes offer date, amount issued, offer price, number of shares offered, management fees, and the lead underwriter and co-managers.[8] The proprietary nature of our data (to be discussed below) restricts us to Nasdaq IPOs. Therefore, we exclude from our sample IPOs on the NYSE or AMEX, ADRs, offerings with units (e.g., a stock plus a warrant), REITs, closed-end funds, and IPOs on the SmallCap Market or on the OTC Bulletin Board. We also deleted one firm that was erroneously classified as an IPO. This left a final sample of 306 IPOs.

As Table II indicates, the average offer size for firms in our sample is \$37.2 million (\$41 million after the overallotment option exercise) which aligns closely to the average offer size of \$35.2 for all IPOs on Nasdaq in 1996. The distribution of these offerings is skewed, with 251 offerings for

[8] The SDC database also gives information on overallotment usage, but we found that their reported data are not accurate with respect to the actual takedown of the option. We therefore did not use these data but instead gathered data from each issuing firm's 10K and 10Q filings with the SEC.

Table II

Descriptive Statistics of Sample

The sample is 306 Nasdaq IPOs from September 27, 1996 to July 3, 1997. The sample is split on offer amount excluding the overallotment option (OAO) exercise, with small IPOs ranging from $5 million to $50 million; medium IPOs from $50 million to $100 million; and large IPOs from $100 million to $297 million. The offer price is the average price at which the IPOs were offered. Shares offered is the number of shares offered in millions excluding the OAO. Offer amount is the gross proceeds from the offering both excluding and including proceeds from the exercise of the OAO. The initial return is measured from NASD transaction data as the return from the offer price to the last trade of the IPO day. Panel B shows details about the underwriting fees. The number of observations drops to 301 IPOs due to missing data on lead underwriter fees. The gross spread is the total fee paid to underwriters in millions of dollars and as a percentage of the offer amount. Shares distributed by the lead underwriter is the percentage of shares allocated to the lead underwriter as reported in the prospectus. Lead underwriter fee is the portion of the gross spread allocated to the lead underwriter. It is the sum of the management fee (which is only paid to the lead underwriter and co-managers), the underwriting fee (which we allocate solely to the lead underwriter), and the selling concession on the lead underwriter's share of the offering. If there were co-managers, then half of the management fee is allocated to the lead underwriter.

	Whole Sample	Small IPOs $5M–$50M	Medium IPOs $50M–$100M	Large IPOs >$100M
Panel A: Description of Offering				
No. of IPOs	306	251	39	16
Mean offer price	$11.16	$10.20	$15.26	$16.09
Shares offered (millions)	3.1	2.5	4.4	9.9
Offer amount	$37.2 M	$25.8 M	$64.9 M	$148.9 M
Offer amount including OAO exercise	$41.0 M	$28.3 M	$70.9 M	$167.0 M
Initial return	11.0%	10.4%	12.3%	17.3%
Panel B: Description of Fees				
Gross spread	$2.57 M	$1.82 M	$4.48 M	$9.64 M
Gross spread incl. OAO exercise	$2.83 M	$2.0 M	$4.89 M	$10.81 M
Gross spread (% of proceeds)	7.10%	7.17%	6.91%	6.57%
Shares distributed by lead underwriter (no. of obs.)	36.73% (301)	38.15% (246)	31.28% (39)	28.17% (16)
Lead underwriter fee (no. of obs.)	$1.34 M (301)	$0.98 M (246)	$2.22 M (39)	$4.66 M (16)
Lead fee incl. OAO exercise (no. of obs.)	$1.47 M (301)	$1.08 M (246)	$2.43 M (39)	$5.24 M (16)
Lead underwriter fee (% proceeds) (no. of obs.)	3.90% (301)	4.02% (246)	3.45% (39)	3.17% (16)

amounts between 5 and 50 million, 39 for amounts between 50 and 100 million, and 16 for amounts over 100 million. The average offer price in our sample is $11.16, which is slightly above the 1996 average IPO price of $10.84. The IPOs in our sample occurred regularly throughout our sample period. As

is typically the case with IPOs, the firms in our sample experience substantial gains on the offer day. The initial return measured from the offer price to the last trade on the first trading day averages 11.00 percent.[9]

For each firm in our sample we then obtained transactions data from a proprietary database provided by the NASD Economic Research Department. These transaction data provide the time, price, and volume for each trade, as well as a code identifying both parties involved and an indicator that tells us who was buying and who was selling. The data also include all quote revisions for all market makers in each stock. Thus, we have full quote schedules at all times for all of the stocks, with each quote identified by the market maker who set that quote.

We can track the behavior of the lead underwriter and other market participants by using the code identifying the name of the market maker setting a quote or the trader involved in the trade. There are three classifications of market participants corresponding to the level of access that each participant has to the Nasdaq market. There are market makers: (i) firms registered to set quotes for the stock on a given day (e.g., Merrill Lynch, BT Alex Brown); (ii) order entry firms: NASD members who are not market makers in the stock but who can enter orders for the stocks either directly with a market maker via SelectNet or via one of the Electronic Communications Networks (Instinet, Island, B-Trade, or Terra Nova); and (iii) non-NASD members, or customers, who cannot trade directly on the Nasdaq but must trade via a market maker or an order entry firm. We have precise identities for the participants in the first two categories; for the third type of participant the code in our data is blank.[10]

B. Who Underwrites IPOs?

Each of the IPOs in our sample is brought to market via a firm commitment underwriting. This process involves a lead underwriter (the book manager), sometimes one or more co-managers of the offering, and a large syndicate of investment banks that aid in the distribution of shares.

For the 306 IPOs in our sample, there are 80 different lead underwriters. Table III reports the number of IPOs underwritten by the top 15 investment banks (in terms of the frequency of the offering). Leading the pack is Montgomery Securities, which was the book running manager for 27 IPOs with an average deal size of $36.3 million, followed by Alex Brown with 19 IPOs, and Goldman Sachs with 16. Not surprisingly, the average deal of the bulge-

[9] This level of underpricing is consistent with previous underpricing noted by numerous authors (see Ibbotson and Ritter (1995) for a survey).

[10] During this period, the SEC introduced the new order-handling rules that allow for the public display of limit orders. These rules were initially extended to a subsample of the largest Nasdaq firms, and so did not apply to the firms in our sample. Consequently for most of the stocks during our sample period it was not possible for customers to transact directly with market makers. Currently, it is possible for customers to submit limit orders, and spreads have fallen as a result. This suggests that trading profits for the underwriter may now be lower than they are in our sample. For a discussion of these changes see Schultz (1997) and Barclay et al. (1998).

Table III

Frequency of Investment Banks as Underwriters

This table provides the underwriting frequency of the 80 lead underwriters in our sample of 306 Nasdaq IPOs from September 27, 1996 to July 3, 1997. The third column gives the average deal size (excluding the overallotment option exercise) in millions of dollars for each investment bank. Underwriters of at least 6 deals are listed individually; the other 65 underwriters are grouped together in the second to last row.

Investment Bank	Number of IPOs Underwritten	Average Deal Size ($M)
Montgomery Securities	27	36.3
Alex Brown	19	33.9
Goldman Sachs	16	79.4
Cowen	13	27.3
Hambrecht and Quist	13	25.3
Friedman, Billings, Ramsey	12	54.1
Smith Barney Shearson	12	40.8
Morgan Stanley	11	66.8
Lehman Brothers	11	40.5
Donaldson, Lufkin and Jenrette	95	1.3
CS First Boston	8	76.5
UBS Securities	8	21.5
Bear Sterns	7	42.8
Piper Jaffrey	6	20.7
Robertson Stephens	6	36.7
65 others (5 or fewer deals each)	128	24.2
Total	306	

bracket (top-tier) firms is much larger than that of the other investment banks: Goldman's average deal size is $79.4 million, Morgan Stanley's is $66.8 million, and CS First Boston's is $76.5 million. Although the majority of underwriting business is concentrated in 15 investment banks, which underwrite at least six IPOs each, most investment banks act as lead in only a few offerings, with 65 underwriters underwriting fewer than six IPOs. The average number of co-managers in our sample is 1.32, with the majority of offerings (254, or 83 percent of the sample) having one or two co-managers. Thirty-five IPOs do not have any co-managers.[11]

C. Who Makes Markets in IPOs?

Who exactly makes markets in newly issued securities? For the purposes of our study, an obvious starting point is to determine the role of the underwriter in market making. Here an interesting result emerges: in every IPO, the lead underwriter *always* acts as a market maker. To gauge the importance of the underwriter as a market maker, it is important to investigate

[11] In all of these cases the lead underwriter is a regional rather than a national investment bank.

what, if any, role is played by other market makers. NASD rules allow dealers relatively free entry to make markets in stocks, so the number of dealers can vary considerably across stocks. Exit from market making is also relatively unconstrained, and changes in the population of dealers in a particular stock are very common.

We calculate the average number of market makers for each IPO over the first three months of trading. For our sample as a whole, there are on average just under 10 (9.95) market makers quoting bid and ask prices on the offering day. The number of dealers varies with the size of the offering, ranging from 9.55 dealers on the first day for issues below $50 million, to 12.3 dealers on the first day for offer amounts greater than $100 million.[12] The average Nasdaq stock in 1996 had 9.5 market makers, and so our IPO stocks seem quite typical. When we adjust for size, however, it is clear that IPOs have far more dealers than is typical. The 317 Nasdaq stocks with three or fewer market makers in 1996 had an average market value of $56 million, and the 1657 stocks with three to five market makers had an average capitalization of approximately $93 million.[13] Finally, each IPO is losing about three market makers in the first three months of trading. This is consistent with a "clientele" effect among dealers in which some dealers make markets in the first active days of an offering and then permanently leave the market.

Given that the lead underwriter is only one market maker with nine other market makers on the first day of trading, we need to determine the relative importance of the market makers. Figure 1 and Table IV show that the lead underwriter takes a very significant role in the aftermarket market making activity.

Figure 1 depicts the daily average turnover per IPO, calculated as shares traded as a percentage of the shares offered in the IPO. The turnover is extremely high on the first day: an average of 61.9 percent turnover in one day. By way of comparison, this is equal to approximately one-third of the average *annual* stock turnover on the Nasdaq in 1997.[14] The trading volume drops dramatically after the first day. The average turnover on day 60 is 2.0 percent, which it is still higher than a typical Nasdaq stock's daily turnover. Figure 1 also shows the cumulative order imbalance, calculated as the share volume due to sell classified trades minus the share volume due to buy classified trades, reported as a percentage of the shares offered in the IPO. The order imbalance is positive, suggesting that there is more sell-initiated volume in IPO trading than buy-initiated trading, and it is on the order of 10 percent of the issue on the first day of trading. The order imbalance accumulates for the first four days, suggesting strong seller-initiated trade. Beyond the first week of trading, the cumulative order imbalance

[12] Statistically, there is no significant difference in the number of market makers across the different size groupings.

[13] Information on the Nasdaq market is taken from the 1996 *Nasdaq Fact Book*.

[14] According to the 1997 *Nasdaq Fact Book*, the average annual turnover on the Nasdaq in that year was 181 percent.

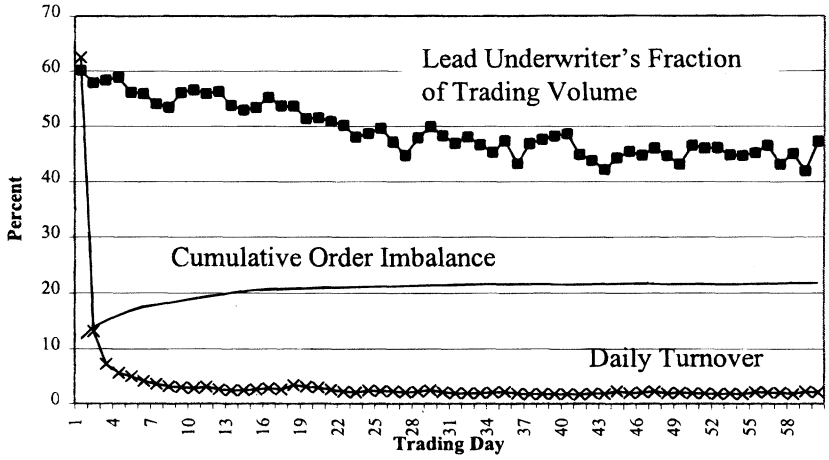

Figure 1. Mean daily turnover, cumulative order imbalance, and the lead underwriter's fraction of trading. The average daily turnover is shown for the sample of 306 IPOs. Average daily turnover is measured as the number of shares traded as a fraction of the number of shares offered in the IPO (not including overallotment shares). The cumulative order imbalance is the cumulative sell-initiated volume minus the cumulative buy-initiated volume, as a fraction of the shares offered in the IPO. Buy/sell direction is given directly in the NASD transactions data for 80 percent of the trades, and the Lee and Ready (1991) algorithm is used for the remaining 20 percent. The lead underwriter's trading volume is the number of shares traded by the lead underwriter as a liquidity provider, as a fraction of the total daily trading volume. The lead underwriter is a liquidity provider in a trade when he sells (buys) in a buyer (seller) initiated trade.

remains flat, as the daily order imbalance is less than one percent of the shares issued. The order imbalance suggests that liquidity providers will on average be net buyers of IPOs.

To examine the trading volume of the market makers we need to consider the passive side of trading: market makers acting as liquidity providers. The third line in Figure 1 shows the fraction of the trading volume where the lead underwriter acts as a market maker. On the first day, for example, the lead manager assumes 58.8 percent of the trading volume. The lead manager's share of the trading volume slowly declines, but it still remains greater than 40 percent even three months after the IPO has begun trading.

Table IV provides the trading volume of all the liquidity providers, given both as fractions of the daily trading volume, and in thousands of shares. The table shows that the lead underwriter's percentage of the trading volume decreases gradually, but in terms of his number of shares the decline is drastic—plummeting from 1.155 million on trading day 1 to 81,000 shares on day 5 and to 27,000 on day 60.

We also find that 95 percent of the co-managers in our sample (1.25 co-managers per IPO) make a market in the issue, although their activities in

Table IV

Trading Volume in the First Three Months after an IPO

This table shows the trading activity of the liquidity providers in the first three months of trading after an IPO. Panel A examines all types of liquidity providers and shows the trading volume in thousands of shares and as a percentage of total volume for four categories of liquidity provider: the lead underwriter for the IPO, co-managers, unaffiliated market makers, and order entry firms. Unaffiliated market makers are NASD registered market makers for the IPO that are not the managers of the deal. Order entry firms are NASD members who can provide liquidity by placing limit orders on an electronic communications network, but are not market makers for the stock. The sample is 306 Nasdaq IPOs and averages are calculated per IPO, rather than per trader. We use the trader identities from the NASD transactions database to categorize trades by liquidity provider. Panel B focuses on the lead underwriter's activity as a market maker, splitting the sample on initial return (the last trading price on the offer day minus the offer price). Daily turnover is the average total volume per IPO given as a percentage of the shares offered. The fraction of trading volume done by the lead underwriter is given as a percentage and in number of shares.

Panel A: Trading Volume by Liquidity Providers

	Lead Underwriter		Co-Managers		Unaffiliated Market Makers		Order Entry Firms	
	Volume (%)	Shares (000s)	Volume (%)	Shares (000s)	Volume (%)	Shares (000s)	Volume (%)	Shares (000s)
Day 1	58.8	1155	8.7	180	29.9	531	3.9	74
Day 5	53.8	81	16.2	25	27.9	43	2.5	3
Day 10	53.8	47	16.2	16	28.0	23	2.2	1
Day 20	47.1	40	18.7	22	31.9	24	2.4	2
Day 60	42.5	27	21.5	13	33.1	16	2.7	1

Panel B: Lead Underwriter Trading Volume, by IPO Performance

	Initial Return											
	<0% (n = 24)			0% (n = 55)			<10% (n = 104)			>10% (n = 123)		
	Daily Turnover (% of shares)	Volume (%)	Shares (000s)	Daily Turnover (% of shares)	Volume (%)	Shares (000s)	Daily Turnover (% of shares)	Volume (%)	Shares (000s)	Daily Turnover (% of shares)	Volume (%)	Shares (000s)
Day 1	46.0	57.1	790	43.6	60.1	757	50.0	58.4	891	83.3	58.9	1627
Day 5	2.0	57.6	37	3.8	55.5	52	4.1	56.0	69	6.9	50.4	113
Day 10	3.0	50.5	49	1.7	57.3	35	2.0	55.1	33	4.0	51.7	64
Day 20	1.4	47.0	19	2.2	50.4	32	3.0	47.8	43	3.5	45.2	45
Day 60	0.9	41.2	12	1.6	49.4	18	1.7	41.0	22	2.5	41.2	39

this regard are rather limited. On average, co-managers handle 8.7 percent of the trading volume on the first day and 21.5 percent of the trading volume after three months of trading.

Besides the lead underwriters and co-managers, there are on average 7.7 other market makers per IPO on the first day of trading. Their share of the volume remains around 30 percent of the daily volume throughout the first 60 trading days. Order entry firms handle an insignificant portion of the daily trading volume.

Finally, we also examine the dominance of the lead manager conditional on the IPO first-day performance. This is of particular importance for investigating the role of stabilization in market making activity in the post-IPO time period. The results are presented in Panel B of Table IV for four performance categories: those IPOs that experience negative first-day return (24 IPOs), those with a zero return (55 IPOs), IPOs with a first-day return between zero and 10 percent (104 IPOs), and IPOs with a return greater than 10 percent (123 IPOs). Though the trading volume of the "hot" IPOs is more than double that of the other IPOs, the share of trades by the lead manager is almost the same—hovering around 58 to 60 percent of the trading volume. There does not seem to be any distinct pattern in the share of the lead volume across IPOs with different performance.

In summary, we find that the underwriter always becomes a market maker in an IPO, along with an average of nine other market makers. The underwriter handles the lion's share of the trading volume both for the successful and less successful IPOs. Given the trading dominance of the lead manager, it is quite likely that he will also be the one accumulating most of the order imbalance, an issue we analyze in more detail in the next section.

III. The Aftermarket Trading of IPOs

We now turn to the issue of how much inventory risk is taken by the underwriter and other market makers. Because our data set gives the price, size, and time of each trade identified by buyer and seller, we can determine the exact trades of each market maker for each IPO in our sample. This allows us to calculate the inventory position of every market maker, as well as his trading profits and losses. In this section, we focus on the inventory positions, with particular attention given to how the IPO price performance, the impact of stabilization, and the overallotment option affect the underwriters' trading positions. In the next section, we focus on the overall profitability of trading and underwriting activities.

A. Market Makers' Inventory

We begin our analysis by calculating the inventory positions taken by market makers for the 306 IPOs in our sample. For each market maker we calculate the number of shares bought on day t, $N_B(t) = \sum_{j=1}^{B_t} N_B(j)$, where B_t is the number of buy trades for the market maker on day t, and $N_B(j)$ is

the number of shares bought in the jth trade, at price $P(j)$. Similarly, the number of shares sold is $N_S(t) = \sum_{j=1}^{S_t} N_S(j)$. The change in inventory position on day t is the market maker's trading imbalance:

$$\Delta\text{INV}(t) = N_B(t) - N_S(t). \tag{1}$$

The market maker's cumulative inventory position at the close on day t, $\text{INV}(t)$, is the sum of the opening inventory on day t and the change in inventory over the day:

$$\text{INV}(t) = \text{INV}(t-1) + \Delta\text{INV}(t). \tag{2}$$

Table V reports the mean and median inventory of the lead underwriter, as well as the mean inventory of the co-managers, and market makers unaffiliated with underwriting the IPO throughout the first 60 trading days.[15] What is immediately striking is the large inventory position taken by the lead underwriter on the offer day. On average, the lead underwriter buys back 3.77 percent of the offering on the first day (109,000 shares). The underwriter continues to buy stock heavily over the first week, reaching an inventory position of 6.21 percent of the offering by the end of the first week of trading. After 20 trading days, the market maker has bought 7.82 percent of the offering on average, and over the next 40 trading days his position recedes slightly to a 7.56 percent inventory position. This latter behavior is consistent with the underwriter supporting the stock only for about 20 days after the offer date. However, the large differences between the means and medians suggest evidence of outliers; this dictates caution in interpretation of the data at this stage. We address this problem in the next section when we adjust the lead underwriter's inventory position for the overallotment option.

The co-managers in the underwriting play virtually no role in the aftermarket inventory accumulation and price support of the issue. On the first day, the co-managers acquire in inventory only 0.07 percent of the issue on average. Hence, although a co-manager may play an important role in the distribution of the offering, his role in the aftermarket activity is negligible. This limited role continues throughout the first 60 trading days of the issue.

The role of the other market makers in trading the new issue is also extremely limited. Again, on average, each market maker acquires just 0.10 percent of the issue on the offer day. As a group, this amounts to only 0.77 percent of the issue as there are 7.7 unaffiliated market makers per IPO on the first trading day. By day 60, the role of the other market makers is even smaller than on the offer day.

[15] The sum of all the market makers' inventories does not add up to the order imbalance in Figure 1 because of trade between market makers. The order imbalance in Figure 1 is the total order imbalance, whereas the sum of all the market makers' inventories equals only the order imbalance due to trades with non–market makers. Trade between market makers nets to zero in the market makers' inventories.

Table V

Market Makers' Inventory Position

This table shows the cumulative inventory positions for the market makers, calculated as $INV(t) = INV(t-1) + \Delta INV(t)$ where $\Delta INV(t) = N_B(t) - N_S(t)$ is the change in inventory on day t due to trading. $N_B(t)$ ($N_S(t)$) is the number of shares bought (sold) on day t, and $INV(t-1)$ is the inventory carried over from the previous trading day. The sample is 306 Nasdaq IPOs from September 27, 1996 to July 3, 1997. There are three market maker categories: the lead underwriter, co-managers, and unaffiliated market makers. The mean inventory position is given for each category (and the median is given for the lead underwriter). For the co-managers and unaffiliated market makers, the mean and median are per dealer. The number of unaffiliated market makers changes across trading days, and the average number of observations per IPO is given for the unaffiliated market makers. The average inventory position per IPO for co-managers and unaffiliated market makers can be calculated by multiplying the mean inventory position per market maker by the average number of market makers. The inventory position is reported in thousands of shares and also as a percentage of the shares offered in the IPO. This is the inventory position divided by the number of shares in the offering (not including the overallotment option).

Market Maker	Lead Underwriter		Co-Managers (1.25 obs. per IPO)	Unaffiliated Market Makers	
	Mean	Median	Mean per Co-Manager	Mean Obs. per IPO	Mean per Market Maker
Cumulative inventory in thousands of shares					
Day 1	109***	44***	3*	7.70	3***
Day 5	176***	97***	3*	6.88	2***
Day 10	202***	123***	3	6.51	2***
Day 20	223***	127***	8***	6.02	1**
Day 60	219***	121***	12***	4.65	−1
Cumulative inventory as percentage of shares offered					
Day 1	3.77***	1.54***	0.07*	7.70	0.10***
Day 5	6.21***	3.66***	0.07	6.88	0.06***
Day 10	7.15***	4.21***	0.07	6.51	0.05***
Day 20	7.82***	4.54***	0.21**	6.02	0.02
Day 60	7.56***	4.56***	0.29***	4.65	−0.04

*, **, and *** indicate that the entry is significantly different from zero at the 10, 5, and 1 percent levels, respectively, under a t-test for the mean, and a Wilcoxon signed rank test for the median.

That the lead underwriter takes on a substantial inventory position on the first day of the offer is an interesting, but perhaps not unexpected, result. Implicit in the underwriting process is the guarantee of price stabilization, and this would require the market maker to purchase the stock if the price would otherwise fall. This suggests that inventory accumulation by the underwriter gives a direct measure of price stabilization activities. Specifically, while simply buying and selling securities over the course of a trading day is not unusual for any market maker on any stock, accumulation of a significant inventory position is. For example, it is possible for the lead manager to post the inside bid (and ask) and not to accumulate inventory. But

stabilizing prices requires the lead underwriter to intervene in the market in ways that he otherwise would not, and this results in accumulating inventory. Inventory accumulation thus gives a direct perspective on his price stabilization activities.[16]

Many IPOs experience large price gains however, negating any need for market maker purchases. This suggests the hypothesis that the inventory position of the lead underwriter depends on the subsequent return of the IPO, with greater purchases the lower the trading price relative to the offer price.

To test this hypothesis, we stratify our sample into three categories based on the frequency with which the IPO has been trading above and below the offer price in the first 20 days of trading. The first subsample contains all IPOs that traded strictly above the offer price (153 "hot" IPOs), the second subsample contains those IPOs that traded both above and below the offer price (139 "tepid" IPOs), and the third subsample contains those IPOs that traded only at or below the offer price in the first 20 days (14 "cold" IPOs). Figure 2 demonstrates the dramatic effect of the trading range on inventory accumulation.

While the average first-day inventory position is 3.77 percent, the position across the subsamples varies from 0.4 percent for the hot IPOs to 15.6 percent for the cold ones on the first day. That is, the poorer the performance of the IPO, the more shares the lead underwriter accumulates. After 60 days of trading, the underwriter has accumulated only three percent of the offering for the hot IPOs, but 16.5 percent and 11.7 percent for the cold and tepid IPOs respectively.

Using the relationship between inventory accumulation and price stabilization, we can also calculate the length of the price support period. For the group of IPOs that consistently trade below the offer price, the inventory peaks at day 21. In other words, since price support is directly reflected in the inventory position, for these stocks price support lasts for 21 days on average. After that, the level of inventory declines, suggesting that not only does the underwriter stop buying to support the price but he also attempts to reduce his inventory exposure by selling. For the overall sample, price support lasts on average for 15 days, as can also be seen from Figure 2.[17] The differences in the inventory position between the hot, cold, and tepid

[16] There are, of course, other ways to examine stabilization and to measure its impact. Schultz and Zaman (1994) consider the fraction of time the underwriter sets the inside bid as evidence of stabilization, while Hanley et al. (1993) focus on changes in the time-series pattern of prices to determine when stabilization ends. We look at inventory changes because they allow us to observe direct provision of liquidity, which should be complementary to the analyses noted above.

[17] Factors other than return may also affect the underwriter's inventory position. The reputation of the underwriter may impact his market making activity; highly reputable underwriters may be more active in the aftermarket than less reputable underwriters, resulting in higher inventory positions. The offer size may affect the underwriter's inventory as the underwriter faces capital constraints and may not be able to buy the same amount of a large issue as of a small issue. Another factor may be the first day's turnover of the issue, as it is generally the case that "hot" issues have greater volume than do "cold" offerings. However, none of these hypothesized effects appear strongly in the data.

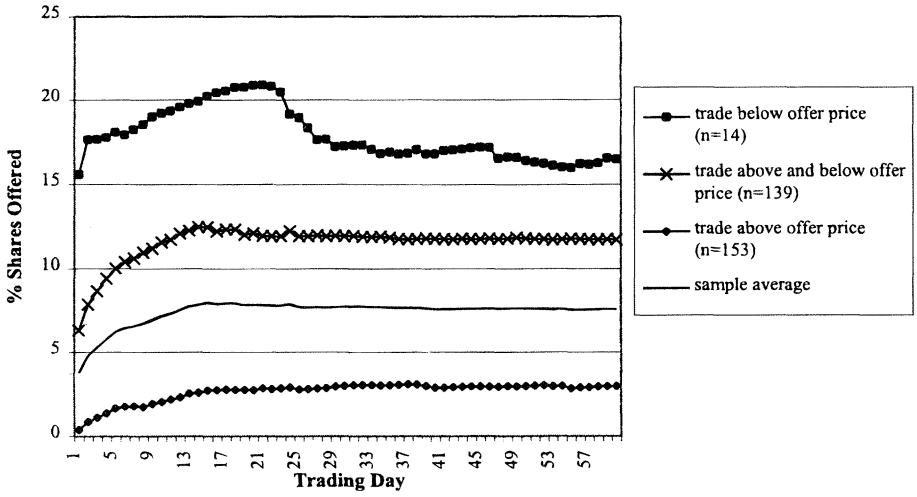

Figure 2. Relation between the lead underwriter's total inventory accumulation and IPO performance. This figure shows the lead underwriter's cumulative inventory position given by $\text{INV}(t) = \text{INV}(t-1) + N_B(t) - N_S(t)$, where $N_B(t)$ ($N_S(t)$) is the number of shares bought (sold) by the lead underwriter on day t. The inventory position is given as a percentage of the shares offered in the IPO (not including the overallotment shares). The plain line gives the sample average for the 306 IPOs. The sample is split into three subsamples based on the average trading price during the first 20 trading days. If the average daily trading price is at or below the offer price for every day in the first 20 days, then the IPO is in the first category (14 IPOs, squares). If the average daily trading price is above the offer price for every day in the first 20 trading days, then the IPO is in the third category (153 IPOs, diamonds). All other IPOs are in the middle category (139 IPOs, crosses).

IPOs that are visible from Figure 2 are also statistically significant. We tested for differences between the means using an F-test, and for differences between the medians via a Kruskal–Wallis test.

During the first 20 days of trading, the mean and median (not reported) inventory positions are different at the one percent level between the three subsamples, and also between all pairings of the subsamples. After the 20th trading day, the significance of the difference between the cold and tepid IPOs declines, and by day 60 there is no difference between this pair of subsamples. However, the overall difference between the three subsamples remains significant at the one percent level through day 60.

The analysis thus far attests to the important role played by the underwriter in the aftermarket trading of an issue. What is particularly striking is the large inventory position of the underwriter. Since IPOs traditionally lose value after the initial offer period, such extensive purchases of stock would expose the market maker to substantial risk.[18] However, as noted in

[18] Krigman, Shaw, and Womack (1999) show that IPOs that are "cold" on the first day tend to continue to decline in the period after the offering, and those that are "hot" continue to increase. These would tend to exacerbate the inventory problems facing the underwriter.

Section I, underwriters typically sell an additional 15 percent beyond the offer amount, dictating that the market maker actually goes into the aftermarket period holding a short position in the stock. The market maker then covers the short position by purchasing the shares in the market, or by exercising the overallotment option, or by some combination of the two.

On occasion, the underwriter may sell short even more than the 15 percent overallotment amount. Such "naked shorts" expose the market maker to price risk, but can be profitable if the stock falls in price. Aggarwal (1998) notes that most investment banks impose limits on the size of these short positions, but that such positions are sometimes taken in the IPOs in her sample. She finds an average short position of 17.1 percent (i.e. a naked short position of 2.1 percent). However, since we do not have the data on short positions, and since the amount of the naked short position (above the 15 percent that can be covered by the overallotment option) may vary across IPOs we assume no naked short position. That is, our working assumption is that each lead manager does not sell more than 115 percent of the issue.[19] We then determine how much of the overallotment option was exercised, and we examine the impact of these activities on the inventory risk exposure.

B. Overallotment Options, Stabilization, and Aftermarket Behavior

To calculate the actual overallotment amount used by the underwriter for each of our sample IPOs, we examined the firms' SEC filings after the IPO. The SDC database also provides a number for overallotment usage, but spot-checking our data by calling several firms in our sample revealed that this number was unreliable. For each firm we examined the first 10Q or 10K filing[20] after the IPO date which mentioned the details of the IPO. If there was no mention of the overallotment option having been exercised, we examined the next 10Q filing. We also cross-checked these details with the number of shares outstanding, and if secondary shares were offered in the IPO, we examined Schedule 13G filings and the firm's proxy statement for insider shareholdings. Thus, we have the full details of the overallotment option exercise for each firm in the sample. (Having an accurate database on actual use of overallotment options, we compare it to the data available on SDC. We find that a staggering 41 percent of the entries in SDC are incorrect.)

Every firm in our 306 sample IPOs had an overallotment option (OAO) as part of the underwriting agreement. For 295 of the firms, this overallotment was for 15 percent of the issue; for the other 11 it ranged from 10 to 14.5 percent. As the first row of Table VI indicates, usage of the overallotment option is common but not universal. Ninety-three firms in our sample did

[19] Our approach will thus understate the short position for firms with "naked" positions. To the extent that firms take such positions to speculate on the stock, then we would expect to understate profits as well. However, Aggarwal (1998) finds that firms in her sample actually lose on these positions, so the direction of bias is not clear.

[20] The SEC filings were collected from the SEC EDGAR web page, and also Disclosure's web page.

Table VI
Overallotment Option Usage

The first panel in this table shows how many firms used the overallotment option (OAO). The sample is 306 Nasdaq IPOs from September 27, 1996 to July 3, 1997. The second panel shows the average inventory position accumulated by the lead underwriter after 20 days of trading, split by the overallotment option exercise. The allowed maximum is 15 percent of the original offer size. In our sample, 11 firms had options for less than the allowable 15 percent, and the rest had an overallotment option of 15 percent. Partial exercise of the overallotment option means that some but not all of the overallotment option was exercised. Full exercise means that the whole overallotment option was exercised. The data are stratified by trading range which splits the sample based on the daily average trading price over the first 20 trading days. If the daily average price was always at or below the offer price, then the issue is in the first category. If the daily average price was always at or above the offer price, then the issue is in the third category. All other issues are in the middle category. The inventory positions in Panel B are cumulative inventory position of the lead underwriter by the end of trading on day 20 after the IPO. The inventory position is the number of shares bought minus the number of shares sold, and it is reported as a percentage of the shares offered in the IPO. The last column in Panel B shows *F*-tests for differences in the mean level of inventory across the overallotment exercise categories.

Panel A: Frequency of Overallotment Option Exercise

	Zero	Partial	Full	Percentage that Fully Exercised OAO	Total
Whole sample	93	39	174	56.9%	306
By trading range over first 20 days					
Always at or below offer price	12	1	1	7.1%	14
Traded above and below offer price	72	24	43	30.9%	139
Always at or above offer price	9	14	130	85.0%	153

Panel B: Average Inventory Position by Day 20

	Zero	Partial	Full	Total	*F*-Test for Difference in Means across Categories
Whole sample	19.03	8.60	1.66	7.82	135.3***
By trading range over first 20 days					
Always at or below offer price	22.56	22.30	−0.45	20.90	1.7
Traded above and below offer price	18.90	8.71	2.57	12.09	50.4***
Always at or above offer price	15.30	7.44	1.37	2.74	17.9***

*** indicates significance at the 1 percent level.

not use the OAO at all, 39 firms only used partial amounts. Just under 57 percent of our sample (174 of 306 firms) exercised the full amount. For the entire sample the average overallotment exercised is 9.5 percent. For those firms who exercised part or all of the overallotment, the mean is 13.7 percent.

As noted earlier, the underwriter typically goes into the offer day short the stock. If the issue is "hot," the price will rise and the underwriter will cover his short position by exercising the overallotment option. Conversely, if the issue is "cold," the fall in price means the underwriter will benefit by buying shares at the new lower price to cover his short position. This suggests that overallotment usage should depend on the IPO price relative to the initial price, with greater usage of the overallotment option predicted for better performing IPOs.

Stratifying our sample in Table VI by the IPO trading range over the first 20 days reveals an interesting pattern in OAO usage. Our hypothesis that OAO usage is more likely the higher the return is confirmed. Of the 14 IPOs that always traded at or below the offer price, 12 did not use the OAO. Conversely, of the 153 IPOs that always traded at or above the offer price, 130 (85 percent) fully used the overallotment option.[21]

The connection between the use of the overallotment option and price stabilization can also be seen in Panel B of Table VI, which shows the inventory position accumulated by the underwriter after 20 days of trading. Large inventory positions are concentrated exactly in those IPOs where the overallotment was not exercised at all or only partially exercised. For example, for the nine IPOs that always traded at or above the offer price but the overallotment option was not exercised, the accumulated inventory position is 15.3 percent compared with an inventory position of 1.37 percent for the 130 IPOs where the overallotment option was fully exercised. This suggests that when the underwriter engages in price support, the short position due to the overallotment option is covered by trading, but when no price support is done, the overallotment option is used. Hence, the role of the overallotment option in the IPO process is critical to the price stabilization activities by the underwriter.

Of particular importance for our study is how the overallotment amount affects the underwriter's inventory position. Because we do not have preissue short positions by the underwriters, we must make some assumptions regarding their initial positions. As noted earlier, it is standard practice to sell the overalloted shares, N_{OAO}, and we assume this was done for each of our IPOs. We then netted against this short position the amount of the num-

[21] We examined the price pattern and lead underwriter inventory position for each of the firms that did not use the OAO as we predicted. For the nine IPOs that traded above the offer price during the first month but did not exercise, we have the following explanation. Although trading remained at or above the offer price, prices consistently declined over the first month. The lead underwriter gradually covered his short position (often above the offer price) until he reached zero inventory, thus there was no need to exercise the OAO. In the case of the two IPOs that traded below the offer price but exercised the OAO, the underwriter did not accumulate enough inventory through trading to cover his short.

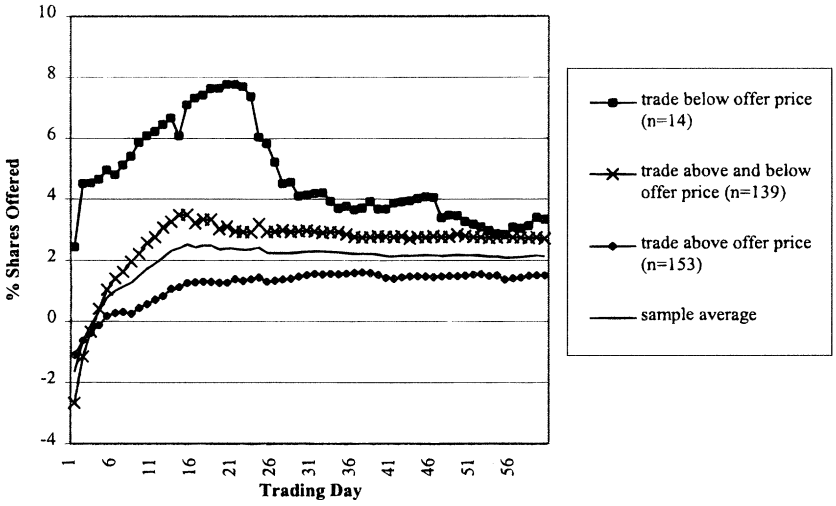

Figure 3. Relation between the lead underwriter's net inventory position and IPO performance. This figure shows the lead underwriter's cumulative net inventory position given by $\text{INV}_{\text{NET}}(t) = N_{\text{OAOSOLD}} - N_{\text{OAO}} + \text{INV}(t)$. The net inventory position is the inventory accumulation plus the underwriter's net short position due to the overallotment option (the difference between the number of shares in the overallotment option and the number of shares exercised in the overallotment option). The plain line gives the sample average for the 306 IPOs. The sample is split into three subsamples based on the average trading price during the first 20 trading days. If the average daily trading price is at or below the offer price for every day in the first 20 days, then the IPO is in the first category (14 IPOs, squares). If the average daily trading price is above the offer price for every day in the first 20 trading days, then the IPO is in the third category (153 IPOs, diamonds). All other IPOs are in the middle category (139 IPOs, crosses).

ber of shares sold when the OAO was exercised, N_{OAOSOLD}. Hence, we assume that the underwriter starts the offer day with a short position equivalent to the portion of the OAO that was not exercised. The cumulative net inventory position, $\text{INV}_{\text{NET}}(t)$ is given by

$$\text{INV}_{\text{NET}}(t) = (N_{\text{OAOSOLD}} - N_{\text{OAO}}) + \text{INV}(t). \tag{3}$$

Figure 3 gives the mean OAO-adjusted inventory position of the lead underwriter. The data now tell a very different story of the underwriter's inventory exposure. For the sample as a whole, the average underwriter's holdings never exceed 2.53 percent, as opposed to 7.95 percent without the OAO. Indeed, despite the large purchases by the underwriter over the first days of trading, his overall position is negative on the offer day and remains so over the first week. This suggests a much lower level of risk for the underwriter in that most of his purchases are used to offset his initial short

position. The results are also more robust after adjusting for the overallotment option. The medians (not reported) are now close to the means, suggesting that outliers are not driving the results.

For successful issues, the underwriter holds relatively small inventory positions throughout the 60-day trading period examined. Since the OAO is more likely to be exercised for these issues, the underwriter essentially uses the OAO to cover his short position. The underwriter's position for weak IPOs is even more interesting. In Figure 2 we found that the underwriter purchased more than 15 percent of the issue on the first day, but after incorporating the OAO in Figure 3, we see that the net inventory position is 2.4 percent. Although he is long inventory over the whole period, the underwriter's inventory exposure is greatly reduced by the strategy of overselling. This suggests that the overallotment option facilitates fulfilling the underwriter's obligation to stabilize weak issues.

Although accounting for the overallotment option greatly reduces the inventory positions held by the lead underwriters, we still find that IPO performance results in statistically significant differences in these inventory positions held over the first 20 trading days. This coincides with the underwriters supporting the price for the weakest IPOs during the first month of trading. After stabilization is ended, the underwriters reduce their inventory positions, and by the end of three months of trading, there is no statistical difference in inventory holdings between the hot, cold, and tepid IPOs.

There is some evidence that the underwriters are selling short more than the overallotment, consistent with Aggarwal (1998). The average inventory position at the end of 60 days of trading is 2.1 percent, suggesting that the underwriters are purchasing more than is necessary to cover the short position created by the overallotment option. If we assume that after three months of trading the lead underwriter behaves as any other market maker, then we can extrapolate that his average net short position is about two percent.

Three important conclusions emerge from Figure 3. First, the underwriter stabilizes the weakest IPOs by buying shares during the first 21 days of trading. Second, the inventory exposure of the underwriter is dramatically reduced by the use of the overallotment option. Third, the overallotment option is critical in reducing the risk from the price support activities. We now consider how these trading and inventory positions affect the overall profitability of underwriting IPOs.

IV. The Profitability of Underwriting and Market Making

The extensive trading activity of the underwriter examined in the previous section illustrates the important supportive role of the underwriter once the IPO starts trading. In this section, we investigate the profitability of the underwriter in the aftermarket. Our focus here is on determining whether

IPO market making is profitable on its own or whether it is a cost center associated with the underwriting process whereby the fees from underwriting offset the costs of aftermarket trading.

The profitability of the aftermarket trading activities has some implications for the underpricing literature as well. Specifically, Benveniste et al. (1996) and Chowdhry and Nanda (1996) argue that when the underwriter commits to price support, underpricing is reduced. Central to their argument is the assumption that price support is costly. Our investigation sheds light on this issue as well.

To assess the relative importance of the profits (or losses) from aftermarket activities, we first have to measure the lead underwriter profits from fees received from the issuing firm. The fees connected with underwriting are called the gross spread—the difference between the price at which the securities are bought from the issuer, and the price for which they are delivered to the public. The gross spread is generally seven percent of the issue size (see Chen and Ritter (2000)). We find this to be the case for 181 of the sample IPOs, with fees for the other firms in our sample ranging from five to 10 percent of the offer amount. Panel B in Table II gives information on these fees, and it shows that the average gross spread for our sample issues was $2.57 million ($2.83 million after fees from the exercise of the overallotment option are included).

The gross spread is further divided into an underwriting fee, a management fee, and a selling concession. Typically, the underwriting fee goes to the lead underwriter, half of the management fee goes to the lead underwriter and the other half is split among the co-managers, and the selling concession is shared by all members of the underwriting syndicate in proportion to the amount of shares they sell. For the 306 firms in our sample we were able to obtain data from prospectuses on distributions for 301 offerings. This allowed us to determine the lead underwriters complete fee income (underwriting fees, management fees, and selling concession) for these 301 offerings. This is reported in Panel B of Table II. In our sample, the lead underwriter typically placed 37 percent of the shares, though this does depend on the offer size, with the lead underwriter placing more shares in smaller issues. On average, the underwriter fee income is $1.34 million for our sample of 301 IPOs ($1.47 million after the exercise of the OAO).[22]

Because the underwriting fee is negotiated before the IPO is taken to the market, it is not related to IPO performance. The profits the underwriter makes in the aftermarket may be affected by performance, however, and in particular by the potential need to stabilize the stock. The market making profits of the underwriter include both the trading profits due to buying and selling at his quotes, and the profits (or losses) on his inventory position.

[22] The average gross spread for the 301 IPOs used in the lead underwriter fee calculation was $2.59 million, slightly higher than the average for the entire sample. Also, the entire management fee was allocated to the lead underwriter for 32 cases where there were no co-managers.

The inventory positions, in turn, are largely determined by the stabilization activity. Thus, it is important to separate the inventory profits from the trading profits.

The market maker's inventory is marked to market at the end of each day at the midpoint of the closing quote, $P(t)$. The daily profit (loss) comes from changes in the value of his overnight inventory and also from changes to his inventory level. The cumulative inventory profit or loss is the sum of these daily profits and losses:

$$\Pi_{\text{INV}}(t) = \sum_{i=1}^{t} [\text{INV}(i-1)(P(i) - P(i-1)) + \Delta\text{INV}(i)(P(i) - \tilde{P}) \tag{4}$$

where

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

Profits due to change in value of the change in inventory, $\Delta\text{INV}(t)$, 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.

A more revealing picture of the lead underwriter inventory profits should account for the fact that he enters that first day of trading with a short position of 15 percent which he has the option to cover through the use of the overalloted shares. We adjust the cumulative inventory profits by adding the change in value of the net short position (the difference between the overallotment shares exercised and the overallotment shares available) to the cumulative inventory profits calculated in equation (4):

$$\Pi_{\text{NET INV}}(t) = (N_{\text{OAOSOLD}} - N_{\text{OAO}})(P(t) - P(t-1)) + \Pi_{\text{INV}}(t). \tag{5}$$

Because the market maker generally buys at the bid and sells at the ask, there is a potential trading profit on each trade. We calculate this trading profit for day t, $\pi_{\text{TRADE}}(t)$, by determining the round trip trading profits for trades that have an offsetting trade during that day:

$$\pi_{\text{TRADE}}(t) = \begin{cases} N_S(t)(\tilde{P}_S - \tilde{P}_B) & \text{if } N_B(t) > N_S(t) \\ N_B(t)(\tilde{P}_S - \tilde{P}_B) & \text{if } N_B(t) < N_S(t). \end{cases} \tag{6}$$

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, $\Pi_{\text{TRADE}}(t)$, is the sum of the trading profits for each day, $\Pi_{\text{TRADE}}(t) = \sum_{i=1}^{t} \pi_{\text{TRADE}}(i)$.

The cumulative trading and inventory and total market-making profits (the sum of trading and inventory profits) of the various market makers are given in Table VII. Note that in calculating the profits here we assume that the lead underwriter starts with a short position.

In general, market making is profitable, particularly on the offer day.[23] Total market-making profits are positive for all market makers, and are generally significantly greater than zero. Looking at the inventory and trading profits separately, we see that the average lead underwriter inventory loss on the first trading day is \$55,000, which is significantly negative. This is because the lead underwriter is still short on average at the end of the first day, and we have a positive initial return. The inventory profits are not statistically different from zero from day 5 through the first 20 days of trading, and although by trading day 60 the average profit is \$80,000, it is only weakly statistically greater than zero. Given the very small inventory position taken by the co-managers and the other market makers, it is not surprising that their inventory profits on the first day are practically zero. There is not much change in the inventory profits of the co-manager and the other market maker in the first three months of trading.

The impact of the lead underwriter's short position can be seen in Figures 4 and 5. Figure 4 shows the inventory profits for the lead underwriter without making the adjustment for the overallotment option.

Here there is a clear relationship between price performance and the inventory profits: Large losses occur for the weak IPOs during the stabilized period. It seems that some of the losses on these IPOs are recovered later in the period, and this corresponds to the underwriter reducing his inventory position after stabilization activities cease. Once we include the adjustment for the overallotment option in Figure 5 it is evident that inventory profits are positively affected. Indeed, the data reveal an intriguing result: When we split the sample on price performance, there is no significant difference

[23] Although we find that on average the lead underwriters make money from their market making activities, there were 79 (66, 81) IPOs for which the underwriter lost money after 1 day (20 days, 60 days) of trading. For the losers, the average loss by the 60th day was \$673,000 (with a maximum loss of \$4 million). As a percentage of the fees, the average loss was 50 percent of the fees. We examined the losers on day 60 to determine whether there is any pattern to the 81 losing deals versus the 225 profitable deals. We found no difference in deal size, initial return, or mean inventory positions. All types of underwriters lost money: the deals were not concentrated in a few hands. Although there was no difference in the mean inventory position, it appears that the underwriters take more extreme inventory positions in the losers (both long and short) compared to the other IPOs. This suggests that the underwriters are more exposed to price movements, and this contributes to the losses.

Table VII

Market Makers' Profits

This table shows the market-making profits for the market makers in the first three months of trading after an IPO. The sample is 306 Nasdaq IPOs during September 27, 1996 to July 3, 1997. There are three categories of market maker: the lead underwriter (one per IPO), co-managers (on average, 1.25 per IPO), and unaffiliated market makers. The first panel is cumulative inventory profit. For the co-managers and unaffiliated market makers it is calculated as $\Pi_{\text{INV}}(t) = \sum_{i=1}^{t}[\text{INV}(i-1)(P(i) - P(i-1)) + \Delta\text{INV}(i)(P(i) - \tilde{P})]$, where $\tilde{P}$ is the weighted average price at which the change in inventory was purchased (or sold) during the day. For the lead underwriter the inventory profits include the short position due to the overallotment option; that is, $\Pi_{\text{NETINV}}(t) = (N_{\text{OAOSOLD}} - N_{\text{OAO}})(P_t - P_{t-1}) + \Pi_{\text{INV}}(t)$. The second panel is the cumulative trading profit, given by $\Pi_{\text{TRADE}}(t) = \sum_{i=1}^{t}[N(i)(\tilde{P}_S - \tilde{P}_B)]$, where $N(t)$ is the number of round-trip shares traded on day t. The third panel is the total market-making profits (the sum of inventory and trading profits). For the lead underwriters, the means and medians for each variable are given. The means per market maker are given for the co-managers and unaffiliated market makers.

Market Maker	Lead Underwriter		Co-Managers	Unaffiliated Market Makers	
	Mean	Median	Mean per Co-Manager	Mean Obs. per IPO	Mean per Market Maker
Cumulative inventory profit ($ 000s)					
Day 1	−55***	0	−2	7.70	1***
Day 5	2	3	−5	6.88	1
Day 10	0	7*	−3	6.51	1*
Day 20	59	25***	−14**	6.02	1
Day 60	80*	33***	4	4.65	2
Cumulative trading profit ($ 000s)					
Day 1	83***	43***	9***	7.70	3***
Day 5	109***	67***	13***	6.88	4***
Day 10	122***	79***	16***	6.51	5***
Day 20	144***	96***	23***	6.02	6***
Day 60	208***	160***	45***	4.65	12***
Cumulative total profit ($ 000s)					
Day 1	28	35***	7***	7.70	4***
Day 5	111***	67***	8*	6.88	5***
Day 10	122***	84***	14***	6.51	6***
Day 20	203***	130***	9	6.02	7***
Day 60	288***	183***	49***	4.65	14***

*, **, and *** indicate significant differences from zero at the 10, 5, and 1 percent levels, respectively. t-tests are used for the means and Wilcoxon signed rank tests for the medians.

between the inventory profits of underwriters of successful and unsuccessful IPOs. This suggests that the OAO is successful in reducing inventory risks for underwriters.

The other component of the market making profits is trading profits, which are also reported in Table VII. The average lead underwriter's trading profits on the first day are $83,000 compared with $9,000 for the co-manager and an average of $3,000 for each of the other market makers. Consistent

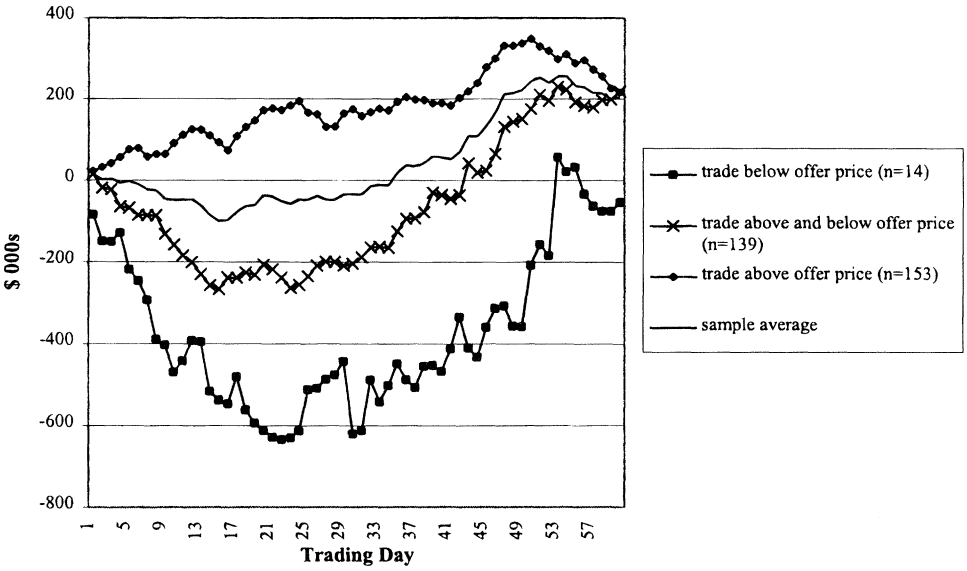

Figure 4. Lead underwriter's inventory profit using raw inventory position. This figure shows the lead underwriter's cumulative profits due to changes in value of the cumulative inventory position. The inventory position is raw inventory: no adjustment is made for the overallotment option, given by $\Pi_{\text{INV}}(t) = \sum_{i=1}^{t}[\text{INV}(i-1)(P(i) - P(i-1)) + \Delta\text{INV}(i)(P(i) - P)]$. $P(t)$ is the midpoint of the closing quote on day t. P is the weighted average price at which the change in inventory was accumulated during day t. $\text{INV}(t-1)$ is the end of day inventory on day $t-1$, and $\Delta\text{INV}(t)$ is the change in inventory due to trading on day t. Inventory profits are given in thousands of dollars. The plain line gives the sample average for the 306 IPOs. The sample is split into three subsamples based on the average trading price during the first 20 trading days. If the average daily trading price is at or below the offer price for every day in the first 20 days, then the IPO is in the first category (14 IPOs, squares). If the average daily trading price is above the offer price for every day in the first 20 trading days, then the IPO is in the third category (153 IPOs, diamonds). All other IPOs are in the middle category (139 IPOs, crosses).

with their small inventory positions, the trading profits of the co-managers and the other market makers are positive but rather small throughout the first 60 trading days. (As these profits come from intraday profits, the inclusion of the overallotment option will not affect the results.)

From our earlier results we know that the lead manager aftermarket trading behavior differs dramatically depending on the return of the IPO. This suggests segmenting trading profits by IPO performance. Figure 6 shows that trading profits are significantly larger for IPOs with a positive initial return. However, this result may be driven by the larger turnover for hot IPOs.

To examine the link between IPO profitability and initial return, we use a cross-sectional multiple regression. We used trading and inventory profits as two separate dependent variables. We scale profits by the size of the offering to avoid heteroskedasticity. The dependent variables are turnover (the cumulative number of shares traded as a percentage of the number of

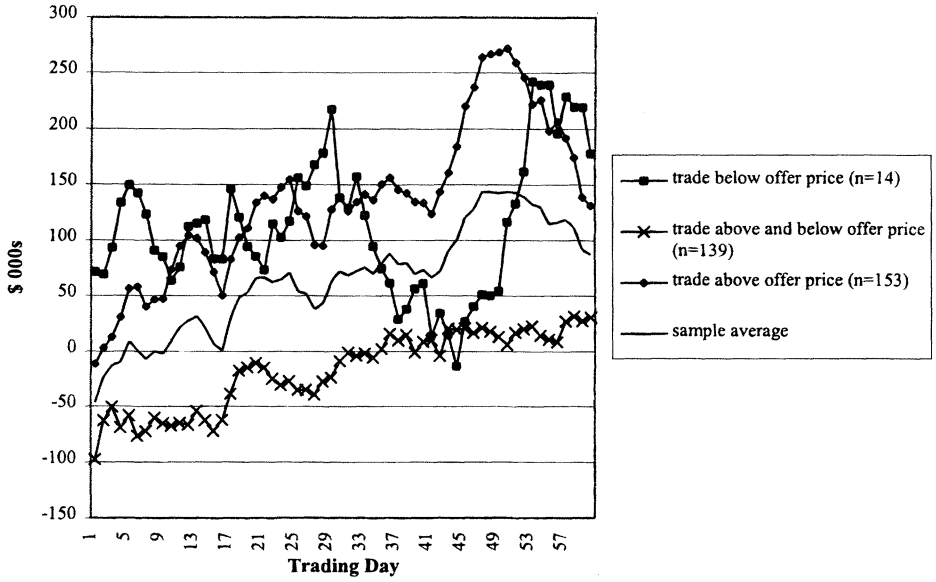

Figure 5. The relation between the lead underwriter's net inventory profits after adjusting for the overallotment option, and IPO performance. We adjust for the overallotment option by starting each underwriter with a short position equal to the unexercised portion of the overallotment option ($N_{\text{OAOSOLD}} - N_{\text{OAO}}$). Inventory profits are calculated as the cumulative change in value of inventory $\Pi_{\text{NET INV}}(t) = \sum_{i=1}^{t}[(N_{\text{OAOSOLD}} - N_{\text{OAO}} + \text{INV}(t-1))(P(t) - P(t-1)) + \Delta\text{INV}(t)(P(t) - P)]$. $P(t)$ is the midpoint of the closing quote on day t. P is the weighted average price at which the change in inventory was accumulated during day t. $\text{INV}(t-1)$ is the end of day inventory on day $t-1$, and $\Delta\text{INV}(t)$ is the change in inventory due to trading on day t. Inventory profits are given in thousands of dollars. The plain line gives the sample average for the 306 IPOs. The sample is split into three subsamples based on the average trading price during the first 20 trading days. If the average daily trading price is at or below the offer price for every day in the first 20 days, then the IPO is in the first category (14 IPOs, squares). If the average daily trading price is above the offer price for every day in the first 20 trading days, then the IPO is in the third category (153 IPOs, diamonds). All other IPOs are in the middle category (139 IPOs, crosses).

shares offered in the IPO) and return.[24] The regression was calculated for trading days 1, 20, and 60 to determine if the relationship changed over the first three months of trading. The return is the initial return for the first-day regression, and the raw 20-day (60-day) return for the day 20 (day 60) regression:

$$\frac{\Pi_t}{\text{SIZE}} = \alpha + \beta_1 \cdot \text{TURNOVER}_t + \beta_2 \cdot \text{RETURN}_t + \varepsilon. \tag{7}$$

[24] We also used an interaction variable that was the return multiplied by a dummy variable of zero if the return was negative and one if the return was positive, to capture whether the significance of the return variable was due only to those IPOs that had positive returns. The interaction variable was insignificant, and the results were otherwise unchanged.

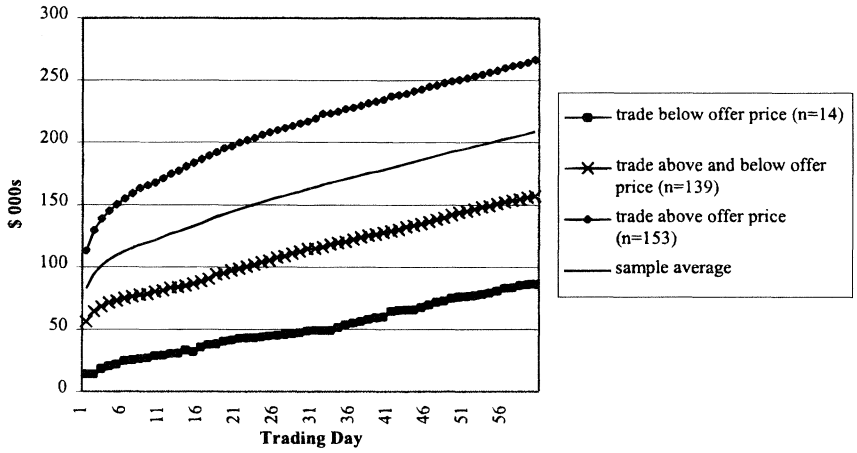

Figure 6. The relation between the lead underwriter's trading profits and IPO performance. This figure shows the cumulative trading profits in thousands of dollars for the lead underwriter, splitting the sample by the performance of the IPO. The cumulative trading profits are $\Pi_{\text{TRADE}}(t) = \sum_{i=1}^{t} N(i)(P_S - P_B)$, where $N(i) = \min(N_B(i), N_S(i))$, where P_S (P_B) is the weighted average sell (buy) price during day i, and $N_B(i)$ ($N_S(i)$) are the number of shares bought (sold) by the lead underwriter on day i. $N(i)$ is the number of shares traded round trip during day i. The plain line gives the sample average for the 306 IPOs. The sample is split into three subsamples based on the average trading price during the first 20 trading days. If the average daily trading price is at or below the offer price for every day in the first 20 days, then the IPO is in the first category (14 IPOs, squares). If the average daily trading price is above the offer price for every day in the first 20 trading days, then the IPO is in the third category (153 IPOs, diamonds). All other IPOs are in the middle category (139 IPOs, crosses).

The results are given in Table VIII. We find that the positive relationship between trading profits and return continues to hold at the five percent level, even after controlling for size and trading activity. This result suggests that underwriters make greater trading profits for successful issues. Since the underwriter sets the price, this intriguing result may give the underwriter an added incentive to underprice.

Table VIII also shows that there is no relationship between performance and inventory profits on the first day. After 20 days, underwriters make more inventory profits on IPOs that have lower cumulative turnover and higher raw day-20 return. By day 60 the relationship between inventory profits and turnover and return are weaker. This result is interesting because it suggests that underwriters do not use their potential unique knowledge about the quality of the IPO to speculate on their inventory position.

To gauge the importance of inventory and trading profits in the overall underwriting process, Figure 7 presents the profits as a percentage of the lead underwriter's fees.[25] In our profit calculation we have incorporated the

[25] We may expect that the underwriting fees may be related to the underwriter's profitability as a market maker, due to superior underwriters charging higher fees for their market making ability. However, given that the gross spread is seven percent for the majority of the

Table VIII

Relation between Trading and Inventory Profits and IPO Performance

We performed OLS regressions with trading profits and inventory profits as separate dependent variables:

$$\frac{\Pi_t}{\text{SIZE}} = \alpha + \beta_1 \cdot \text{TURNOVER}_t + \beta_2 \cdot \text{RETURN}_t + \epsilon.$$

The sample is 306 Nasdaq IPOs from September 27, 1996 to July 3, 1997. The regressions are performed using the profits after trading days 1, 20, and 60 to capture any variation as trading progresses. Trading profits are the cumulative profits (in millions of dollars) due to round trip trades within a day. Inventory profits are cumulative profits (in millions of dollars) due to the change in value of accumulated inventory. The inventory is adjusted for the overallotment option. The profits are scaled by the size of the IPO (in millions of dollars) to adjust for heteroskedasticity. The independent variables are turnover (cumulative number of shares traded after days 1, 20, and 60 as a fraction of the shares offered in the IPO), and return. The return on the first day is the initial return (offer price to the last trade price on the first day), and the return on day 20 (60) is the raw return from the offer price to the last trade price on day 20 (60). White (1980) heteroskedasticity-consistent t-statistics are given in parentheses.

Dependent Variable	Intercept	Turnover	Return	R^2
Trading profits				
Day 1	0.000157	0.000027	0.004269	17.56%
	[0.655]	[6.128]***	[2.192]**	
Day 20	0.000595	0.000022	0.0041	21.93%
	[0.839]	[3.561]***	[3.182]***	
Day 60	0.001166	0.000022	0.001437	17.38%
	[0.945]	[3.407]***	[2.004]**	
Inventory profits				
Day 1	0.000138	−0.00002	−0.003911	2.06%
	[0.133]	[−1.009]	[−0.683]	
Day 20	0.004483	−0.000041	0.015259	6.77%
	[2.359]**	[−2.750]***	[2.472]***	
Day 60	0.001891	−0.000016	0.013878	3.60%
	[0.409]	[−0.829]	[1.777]*	

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

underwriter's short position and overallotment option exercise, and we used the portion of the gross spread allocated to the lead underwriter (see Table II). We find that the average profit (fees plus trading and inventory profits) from bringing an issue to market is approximately \$1.5 million as measured at the end of the offer day. After three months of trading, the total profits of the underwriter average \$1.8 million.

Underwriting fees provide most of the profits. Total profits from market making are positive over the first three months of trading, but this is largely due to trading profits. In the first few days of trading, the underwriter ac-

IPOs, regardless of the underwriter, there does not seem to be any relation between fees and aftermarket profitability.

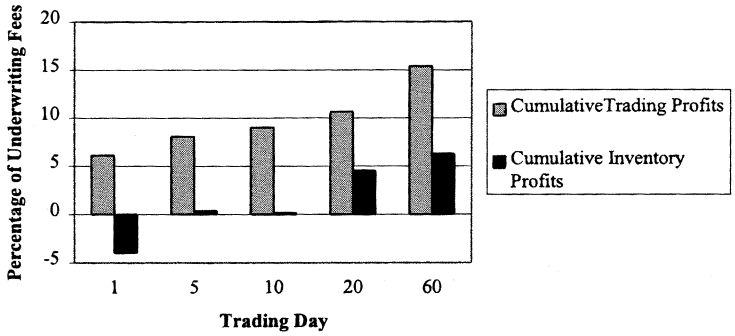

Figure 7. Mean lead underwriter's profits as a percentage of underwriting fees. The lead underwriter's underwriting fees (the lead underwriter's portion of the gross spread) are $1.34 million on average. The fees are calculated by adding the selling concession on the lead underwriter's fraction of the shares for distribution, the management fee, and the underwriting fee. If there are co-managers, then half of the management fee is allocated to the lead underwriter. This figure shows the mean lead underwriter's cumulative trading profits (profits from round trip trades within a day) and mean cumulative inventory profits (profits due to the change in value of inventory that is carried over from one day to the next) as a percentage of the mean lead underwriter's underwriting fees. To give the variation across the trading period, the cumulative profits for days 1, 5, 10, 20, and 60 are shown. The sample size is 301 IPOs.

tually loses money on his inventory (assuming an initial short position of 15 percent). But this trend reverses itself after the first week of trading. During the first three months of trading, more than 77 percent of the underwriter's compensation derives from fees.[26] Naturally, as time goes by the portion of total profits due to market making increases, as is illustrated in Figure 7.

Overall, we find that market making is not a cost to underwriters, that total market making profits are positive on the first day, and that they remain positive throughout the first month of trading. Underwriters derive most of their profits from underwriting fees, and a much smaller profit from market making. Successful IPOs appear to be more profitable for the underwriter in terms of trading profits.

Moreover, through the analysis of inventory profits we have shown that, with the exception of the first day of trading, price support, on average, is not costly to the underwriter. This finding suggests that the assumption of costly price support underlying the Benveniste et al. (1996) and Chowdhry and Nanda (1996) models may not be valid.

[26] Strictly speaking, we have calculated market making revenues, not profits. We do not know the costs of underwriting, salaries, marketing, and so forth, but the average cash outlay for trading over the first 60 trading days is −$2,390,000. The cash outlay is calculated as the cost of purchased shares minus the gains from sold shares. Given the average revenues of $288,000 after three months (trading plus inventory profits), the return to market making is approximately 12 percent over three months, or 58 percent annualized.

V. Conclusions

In this paper we analyze the role of the underwriter as a market maker in the aftermarket trading of IPOs. We address several issues concerning the post-issuance trading activities. First, what is the role played by the underwriter relative to other market makers? Implicit in the underwriting contact is the promise by the underwriter to maintain a market in the newly traded security. Is the commitment to maintain a market and support the stock when needed binding? Second, is aftermarket trading activity a profit center to the underwriter, or is it a cost associated with the process of taking a company public? Third, what are the risks involved in such activities? Through his activity as a market maker, does the underwriter put a significant amount of capital at risk while maintaining a market for the stock and while supporting its price? Fourth, are the profits or losses from the aftermarket trading activities related to IPO characteristics, and especially to the IPO performance?

We find that, relative to Nasdaq firms of similar size, more market makers initially trade the IPOs in the aftermarket but the role of those market makers is minimal. At least in the time period we investigate, we find that the underwriter always becomes a market maker, and he does most of the trading activity. Other market makers, including the co-managers of the offer, are minor players. Why do we then see relatively high numbers of market makers in the post-IPO period? Perhaps the reason is that the price support activities of the underwriter reduce the risk of making markets in those stocks. Since most Nasdaq dealers make markets in several stocks simultaneously, adding a low-risk stock entails little cost. Indeed we report that the underwriter accumulates on average a relatively large inventory position in the stock (about seven percent of the shares offered), and it is much larger when the stock is reeling (17 percent). The typical inventory position of the other market makers is close to zero.

These results suggest that underwriters do actively support new issues. We find that for stocks trading below their offer price the underwriter accumulates substantial inventory positions, but this is not the case for stocks trading above the offer price. This inventory accumulation appears to continue for 21 days, suggesting a particular time dimension for his stabilization activities.

By analyzing the inventory position and trading profits of the underwriter we find that the market making activity is a stand-alone profit center. Average cumulative inventory profits are modest, $80,000 in the first three months of trading, but trading profits add another $208,000 to profits after three months. The median inventory and trading profits are somewhat lower but still account for more than 15 percent of total profits.

Interestingly, we find that the trading profits increase as the issue is more underpriced. This may reflect a conscious pricing decision by the underwriter, or it may arise for more benign reasons not captured in our regression. We find positive relationships between trading profits and size and

turnover of the IPO. But there is no relationship between the inventory profit of the lead underwriter and these variables. Overall, making markets in the first three months after the IPO accounts for less than 23 percent of the lead underwriter's compensation; 77 percent of the compensation comes from the underwriting fees.

Not accounting for the overallotment option, and the fact that in most IPOs the underwriter starts trading with a net short position of about 15 percent, the risk exposure of the underwriter's position is large. However, incorporating these institutional features, we show that the inventory risk is greatly reduced. When the stock price goes down, the underwriter merely covers his short position and does not exercise his option, and when the stock price goes up, he covers his short position by exercising the overallotment option.

Our results thus suggest that the underwriter plays an active and complex role in the bringing of new issues to market. Our work here resolves a number of puzzles regarding the IPO process, but many more remain. Of particular interest is the economic linkage between the underwriter's pricing and trading decisions, an issue we hope to address in future work.

REFERENCES

Aggarwal, Reena, 1998, Stabilization activities by underwriters after new offerings, Working paper, Georgetown University.

Allen, Franklin, and Gerald Faulhaber, 1989, Signaling by underpricing in the IPO market, *Journal of Financial Economics* 23, 303–323.

Barclay, Michael, William Christie, Jeffrey Harris, Eugene Kandel, and Paul Schultz, 1998, Effects of market reform on the trading costs and depths of Nasdaq stocks, *Journal of Finance* 54, 1–34.

Beatty, Randolph, and Jay Ritter, 1986, Investment banking, reputation and the underpricing of initial public offerings, *Journal of Financial Economics* 15, 213–232.

Benveniste, Lawrence, Walid Busaba, and William Wilhelm, 1996, Price stabilization as a bonding mechanism in new equity issues, *Journal of Financial Economics* 42, 223–255.

Benveniste, Lawrence, and Paul Spindt, 1989, How investment bankers determine the offer price and allocation of new issues, *Journal of Financial Economics* 24, 343–362.

Carter, Richard, and Frederick Dark, 1990, The overallotment option and initial public offerings of equity: risks and underwriter prestige, *Financial Management* 19, 55–64.

Carter, Richard, and Steven Manaster, 1990, Initial public offering and underwriter reputation, *Journal of Finance* 45, 1045–1067.

Chen, Hsuan-Chi, and Jay Ritter, 2000, The seven percent solution, *Journal of Finance* 55, 1105–1131.

Chowdhry, Bhagwan, and Vikram Nanda, 1996, Stabilization, syndication and pricing of IPOs, *Journal of Financial and Quantitative Analysis* 31, 25–42.

Hanley, Kathleen, 1993, The underpricing of initial public offerings and the partial adjustment phenomenon, *Journal of Financial Economics* 34, 231–250.

Hanley, Kathleen, Arun Kumar, and Paul Seguin, 1993, Price stabilization in the market for new issues, *Journal of Financial Economics* 34, 177–196.

Hanley, Kathleen, Charles Lee, and Paul Seguin, 1996, The marketing of closed-end fund IPOs: Evidence from transaction data, *Journal of Financial Intermediation* 5, 127–159.

Ibbotson, Roger, 1975, Price performance of common stock new issues, *Journal of Financial Economics* 2, 235–272.

Ibbotson, Roger, and Jay Ritter, 1995, Initial public offerings, in Robert Jarrow, Vojislav Maksimovic, and William Ziemba, eds.: *Handbooks of Operations Research and Management Science: Finance* (North-Holland, Amsterdam).

Krigman, Laurie, Wayne Shaw, and Kent Womack, 1999, The persistence of IPO mispricing and the predictive power of flipping, *Journal of Finance* 54, 1015–1044.

Lee, Charles, and Mark Ready, 1991, Inferring trade direction from intraday data, *Journal of Finance* 46, 733–746.

Michaely, Roni, and Wayne Shaw, 1994, The pricing of initial public offerings: tests of adverse selection and signaling theories, *Review of Financial Studies* 7, 279–319.

Michaely, Roni, and Kent Womack, 1998, Conflict of interest and the credibility of underwriter analyst recommendations, *Review of Financial Studies,* forthcoming.

Muscarella, Chris, John Peavy, and Michael Vetsuypens, 1992, Optimal exercise of the overallotment option in IPO, *Financial Analysts Journal* 48, 76–84.

Prabhala, N. R., and M. Puri, 1999, How does underwriter price support affect IPOs? Empirical evidence, Working paper, Yale University.

Ritter, Jay, 1991, The long-run performance of initial public offerings, *Journal of Finance* 46, 3–27.

Rock, Kevin, 1986, Why new issues are underpriced, *Journal of Financial Economics* 15, 187–212.

Schultz, Paul, 1997, Regulatory and legal pressure and the costs of Nasdaq trading, Working paper, Ohio State University.

Schultz, Paul, and Mir Zaman, 1994, Aftermarket support and underpricing of initial public offerings, *Journal of Financial Economics* 35, 199–219.

Welch, Ivo, 1989, Seasoned offerings, imitation costs and the underpricing of initial public offerings, *Journal of Finance* 44, 421–449.