Do Underwriters Encourage Stock Flipping?
A New Explanation for the Underpricing of IPOs

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Current Draft: May 8, 2000

This work was completed while Pat Fishe was a Visiting Scholar at the Securities and Exchange Commission. The authors wish to thank Larry Bergmann, James Brigagliano, Todd Houge, Anita Klein, Jonathan Sokobin, Dave Sparks and representatives at several investment banks and at the Depository Trust Company for helpful discussions. We also thank participants in a workshop presentation at the SEC. All errors are our own responsibility.

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Abstract

Disagreement persists about why IPOs are underpriced on average, in part because the popular theories are difficult to test. We develop an alternative theory based on the issuer's need for liquidity in the aftermarket that provides a simple and testable explanation for underpricing. The underwriter creates aftermarket trading by underpricing the issue to attract low-valuation investors, who flip shares to higher-valuation investors that are rationed. As the primary market maker in the IPO, the underwriter gains trading profits from this arrangement. We test this theory using proprietary data on stock flipping and find significant support for this explanation of underpricing.

Keywords: Initial Public Offerings, Stock Flipping, Underpricing

JEL classification: G12, G24

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> "The aim of the underwriters is to thwart those nefarious types known as 'flippers,' who buy a new issue and dump it quickly if it moves up a point or two."[1]

This quote reflects the popular view that underwriters of initial public offerings (IPOs) discourage quick selling by those receiving shares in the initial allocation because flipping adversely affects after-market price performance. Certainly, too much flipping poses a problem for underwriters. Both flippers and underwriters are looking for buyers. If the underwriter places shares only with flippers, the underwriter will have failed to find any buyers, which would certainly disappoint the issuer. However, too little flipping also presents a problem. If the IPO is only allocated to investors who choose to hold it for the long term, there will be no trading in the after-market, no price movement from the offer price, and no role for market makers. The stock will be in the hands of the public, but it will be illiquid. This is also not the outcome that issuers desire. As Cornell and Shapiro (1993) note, issuers seek access to public capital, not on a one-time basis, but on a continuing basis if their growth opportunities materialize as planned. An illiquid secondary market for their IPO stock would likely be as poor an outcome for issuers as a declining after-market price. Thus, issuers expect underwriters to encourage some stock flipping activity in order to help develop a liquid secondary market for the IPO.

The focus that underwriters have on liquidity in the secondary market is emphasized in the IPO diary of Mike Mills, who was a reporter for the *Washington Post* before he joined an

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[1] Correra, Anthony J., "Block that Sale! War on IPO Flippers Hurts Little Guy," *Barrons*, June 1, 1992, p. 43.

Internet start-up company. After his company went public in 1999, he wrote a detailed account of the road show and offering. He provides the following discussion of the book-building process:

> On to Philadelphia for the final three presentations. On the way up, the Merrill regional sales guy tells me a little more about the delicate act of balancing “the book” with the right kinds of institutional investors. The reason we’ve crisscrossed the country and are trying to visit as many institutional investors as possible is clear to me: We want to spread out the shares as widely as possible so that too many shares don’t get concentrated in the hands of too few institutions. Thinly traded stocks have great volatility. But it’s also true that you want some flippers—investors who quickly sell their shares—otherwise, on the first day of trading nothing would happen. So the Merrill desk tries to create a syndicate of investors that includes a few who will immediately sell while also favoring those institutions that plan to keep the shares for the longer run.[2]

The purpose of this paper is to investigate the implications of underwriters encouraging a limited amount of stock flipping. We focus on how underwriters accomplish this goal and why it is likely to increase underwriting profits. The “how” provides an explanation for the average underpricing observed in IPOs. To illustrate, suppose that the underwriter has finished the book-building process and finds that there is excess demand for the issue at the offer-price range filed with the Securities and Exchange Commission (SEC). This process reveals that some investors place a higher value on the company’s shares than other investors by virtue of their willingness to subscribe at higher prices. In other words, the demand curve for the company’s stock is downward sloping.[3] The underwriter could ration available shares to estimated demand by raising the price to its market-clearing level. This approach places all of

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[2] Mills, Mike, “A Digital Age Rite: The IPO Roadshow,” *The Washington Post*, November 28, 1999, p. H1. Mills also notes that he was “surprised” to learn that the institutions revealed whether they planned to flip or hold the issue. Thus, Merrill Lynch had an estimate of the demand from flippers at the time that they priced the issue.

[3] Loderer, Cooney, and Van Drunen (1991), Kandel, Sarig, and Wohl (1999), Hodrick (1998), and Kaul, Mehrotra, and Morck (1999) find evidence that demand curves for common stocks are negatively sloped.

the shares in the hands of investors who have the higher valuations of the company. When the stock is available for trading in the after-market, however, these investors cannot expect to find many buyers willing to pay a high enough price for them to sell because only the lower valuation investors are left without stock. Thus, there will be little trading activity in the secondary market and the stock will be relatively illiquid until news arrives to induce current holders and non-holders to revise their valuations. The initial liquidity problem is solved if the underwriter allocates some shares to investors with lower valuations and restricts supply to investors with higher valuations. Now, these two groups have an incentive to trade with each other in the secondary market and, depending on the allocation scheme, there may be significant volume when the stock first starts trading. To induce these lower valuation investors to accept the shares, the underwriter must price them below the market-clearing price, which gives rise to underpricing of the IPO and makes flipping endogenous to the pricing decision.

Although this allocation technique solves the initial liquidity problem, which helps the issuer, one may question how the underwriter gains from the resulting underpricing. Underwriters using firm-commitment contracts purchase the shares from the issuer at a negotiated discount from the offer price. Thus, the underwriter, *ceteris paribus*, would desire a higher offer price so that the revenue received from the discount is greater. However, there is an offset to this higher offer-price incentive when the underwriter's after-market activities are introduced into the process. Specifically, by allocating IPO shares to encourage an active secondary market, the underwriter gains profits from market making.[4]

[4] We do not find market making in the issue covered explicitly in the contractual agreements between the underwriters and the issuer. The reason is that since July 1997 the National Association of Security Dealers (NASD) conduct rules prohibit such payments. NASD rule 2460 states that no "…member shall accept any payment or other consideration, directly or indirectly, from an issuer of a security, or any affiliate or promoter thereof, for publishing a quotation, or acting as a market maker in a security." Underwriters may be paid for their

Ellis, Michaely, and O'Hara (1999) provide empirical support for the view that the lead underwriter has an incentive to promote after-market trading. They find that the Lead is always a market maker in Nasdaq IPOs, and that the Lead "handles the lion's share of the trading volume both for the successful and less successful IPOs (p. 14)."[5] They report that the Lead's trading profits for the first 60 days are 16 percent of the Lead's *gross* underwriting fees on average. Thus, the Lead has an interest in higher trading volume in the after-market.

Our analysis is related to other research on IPO underpricing that focuses on the secondary market.[6] Specifically, Mauer and Senbet (1992) develop a model in which the issue is underpriced to compensate initial investors for the risk of purchasing stock that does not have a perfect substitute in the secondary market (i.e., incomplete spanning). The primary and secondary markets are segmented in their model, so a market-clearing price does not develop until all investors can trade in the secondary market. Booth and Chua (1996) develop a model in which IPOs are underpriced to encourage a dispersed ownership structure that increases liquidity in the secondary market. To achieve a dispersed ownership, more investors must incur the cost of collecting information about the IPO. The underpricing arises to compensate investors for these additional costs. Stoughton and Zechner (1998) suggest that issuers gain from allocating shares to large block holders, because their monitoring activities can increase

investment-banking services, but these are considered different from on-going market making. Prior to this rule, such arrangements were questionable because the NASD rules only allowed "one-time" fees not related to a transaction, provided that these fees were "minimal" and not tied to the opening of an account.

[5] Aggarwal and Conroy (2000) also support the view that the Lead is active in the after-market. They report that the Lead always enters the first bid in the pre-open of an IPO.

[6] The underpricing of IPOs has generated an extensive literature. Ritter (1998) provides a comprehensive discussion of the theoretical and empirical evidence on underpricing. The various approaches taken to explain underpricing include asymmetric information models (Baron and Holmstrom 1980, Rock 1986), investor revelation/feedback models (Benveniste and Spindt 1989, Sherman 1992), signaling models (Allen and Faulhaber 1988, Grinblatt and Hwang 1989, Welch 1989), lawsuit avoidance arguments (Ibbotson 1975, Tinic 1988, Drake and Vetsuypens 1993), information cascades (Welch 1992), segmentation between the primary and secondary market (Mauer and Senbet 1992), ownership dispersion arguments (Booth and Chua 1996, Brennan and Franks 1997) and prospect theory of incremental rewards (Loughran and Ritter 1999).

firm value.[7] Underpricing causes over-subscriptions, which then allows the issuer to discriminate between buyers. Such discrimination increases firm value when some buyers provide valuable *ex post* monitoring. [8]

In our model, the market is not segmented. The underwriter could choose the market-clearing price for the IPO, but intentionally sets a lower price because it offers higher profits. Underpricing does not compensate for information costs, but rather creates allocations so that there is liquidity in the secondary market. Such information costs may be zero or negligible and the issue will still be underpriced to encourage aftermarket trading. Underwriters discriminate among buyers in their allocations, but such discrimination is determined by the buyers' revealed willingness to pay. In contrast to the ownership-based models, we assume the underwriter's first concern is the buyers' demand curve and not whether monitoring is likely to increase firm value.

Rock (1986) and Benveniste and Spindt (1989) developed two classic models of underpricing, but these do not focus directly on secondary market trading. In Rock's model, uninformed investors face the winner's curse because informed investors only invest in issues that they know to be underpriced. The issuer can only overcome this problem by underpricing the IPO.[9] In Benveniste and Spindt's model, underwriters collect information from informed investors during the book-building process. Informed investors have no incentive to reveal their private information unless the issue is underpriced. This model predicts that underwriters favor

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[7] Brennan and Franks (1997) find evidence that issuers want to limit the allocations to larger shareholders, which works against this hypothesis.

[8] Mello and Parsons (1998) also find that it is optimal to encourage over-subscriptions for the purpose of favoring "active investors," who provide a public good to all shareholders.

[9] Using subscription and allocation data from Singapore, Lee, Taylor, and Walter (2000) provide evidence that allocation decisions favor smaller investors who they suggest are less informed. Evidence on U.S. offerings between 1984 and 1988 is also consistent with Rock's model (Michaely and Shaw, 1994).

long-term clients, which are likely to be institutions.[10] In addition, this model predicts that the reward to investors depends on the extent of positive information in the market.[11]

Our model is structured differently from those of Rock and Benveniste and Spindt. It may be easier to test because we do not impose asymmetric information on the model. No single investor or group of investors is perfectly informed before the IPO, and the price in the secondary market is determined by supply and demand. Although investors may have heterogeneous information, only the marginal investor determines the market price. In addition, the underwriter does not need to underprice the IPO to compensate investors to ensure their participation in the offering. Instead, all investors may subscribe although not everyone will receive shares because rationing is used to encourage flipping. The underpricing in our model allows the issuer, underwriter, and investors to gain when the latter flip shares in the secondary market in response to the underwriter's pricing and allocation decisions.

We also show that underwriters may gain (flippers may lose) from over-selling some issues so that they hold a naked short in the after-market. Covering this short position is a form of aftermarket price support, which may also be a profit-maximizing action. To derive this result we introduce a given level of exogenous flipping, which the underwriter cannot control.[12] If the underwriter could control all flipping, there would be no incentive for a naked short

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[10] Hanley and Wilhelm (1995) find that institutions receive larger allocations than retail investors, but these are "largely independent of the degree to which an issue is underpriced (p. 247)." Lee, Taylor, and Walter (2000) argue that these results "may simply reflect an absence of superior information among institutional investors, so that they cannot be expected to discriminate between overpriced and underpriced issues (p. 427)."

[11] A proxy for positive information is the number of subscriptions. Underwriters may signal over-subscriptions by raising the offer price range during the book-building process. Hanley (1993) shows that IPOs with upward revisions in the offer price range are more underpriced than IPOs with downward revisions. Loughran and Ritter (1999) argue, however, that pricing adjustments are made in response to *private* information gathered during book building. Thus, subsequent underpricing should not be related to *public* information, such as overall market movements before the IPO goes public or new articles about the company. Loughran and Ritter report a significant positive correlation between overall market movements three weeks prior to the IPO and first-day returns and Reese (1998) reports a positive relationship between news citations before the issue date and IPO returns.

[12] See Fishe (1999) for a model that deals exclusively with exogenous flipping.

position. With both endogenous and exogenous flipping, we show that the underwriter faces a trade off between profits from the gross underwriting spread and profits gained from short covering in issues where there is less incentive to ration.

The empirical implications of this model are that underpricing in the IPO is related to the underwriting discount, profitability of after-market trading and the extent of flipping/rationing in the IPO. Additionally, flipping is determined endogenously and we predict that it is positively related to the underwriter's trading revenues and negatively related to the underwriting discount. We test these predictions using average bid-ask spreads and the underwriter's market-making market share to estimate the profits from after-market trading, and using a proprietary dataset that documents shares flipped during the first 30 days of trading. These flipping data are derived from the Depository Trust Company’s (DTC) IPO tracking system. They allow us to estimate the average rationing fraction in the IPO, which we show has a significant positive effect on underpricing. We also document a significant positive relationship between the underwriter’s aftermarket trading revenues and both initial returns and the fraction of shares flipped. These basic results are similar in univariate, multivariate, and simultaneous-equations estimation and support our theory that liquidity in the after-market is an important reason for IPO underpricing.

The remainder of this paper is organized as follows. Section I discusses the regulatory environment of the book-building process, focusing on the details of SEC review and the registration process that may limit price adjustments, and why investors may have an incentive to reveal their demand for the IPO. Section II develops the model of how underwriters ration investors to provide liquidity in the after-market. We also discuss the testable implications of this model. Section III discusses our IPO sample and related data. Section IV presents the empirical results and the final section offers our conclusions.

I. INVESTOR DEMAND AND PRICING IN THE BOOK-BUILDING PROCESS

Because our model focuses on the price-setting behavior of the underwriter, it is useful to explain the regulatory environment for IPO pricing. In addition, it is central to our model that underwriters can observe market demand before pricing and selling the issue. In this section, we discuss both of these subjects.

A. Outline of Bookbuilding

The book-building process begins after a registration statement is filed with the SEC.[13] The underwriter can sell shares to the public only after the issue is priced and declared "effective" by the SEC, which usually takes between 60 to 90 days. After filing the issuer and underwriter may contact potential investors and collect "offers" or "indications of interest" in the issue. The written and broadcast information presented at "road shows" must be limited to the contents of the preliminary prospectus, including amended filings. Oral representations may, and frequently do, offer additional information to investors attending these shows, which is why they are well attended. After the underwriter receives sufficient information from the road shows and other contacts with investors to determine that the issue can be sold, and the filing requirements of the SEC are met, the issue is priced and sold to the public. The final pricing and allocation of the IPO conclude the book-building process.

[13] The book-building process is described in Hanley (1993), Benveniste and Wilhelm (1997) and Cornelli and Goldreich (1999).

B. *Constraints on Setting the Offer Price*

Before the offer price is set, the issuer must file a price range and issue size with the SEC, which is used to compute filing fees.[14] According to Regulation S-K §501(b)(3), this is "a bona fide estimate of the range of the maximum offering price and the maximum number of securities offered." To change the range during the book-building process, the issuer must file either pre- or post-effective amendments or a prospectus supplement to the registration statement, and notify investors of the change. Pre-effective amendments are fairly common in IPOs as the underwriter acquires more information about market demand, which lead to changes in the maximum price range or offer size. Post-effective filings are more critical to the success of the issue, because they may delay the public offering.

A prospectus supplement is used when the post-effective changes fit within pre-specified limits and/or are not substantive. Generally, an issuer has 15 days to complete the IPO and file the missing information with the SEC once the issue is declared effective. Post-effective changes that allow the issuer to file a prospectus supplement do not delay the offering. A post-effective amendment is used when the change does not allow a prospectus supplement.[15] Depending on the materiality of the change in the amendment, the notification requirements could mean that investors must receive a new prospectus with the amended information or simply a telephone call. Thus, post-effective amendments have the potential to cause significant delays in the IPO.

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[14] Regulation C, §430A (a) of the Securities Act allows the IPO registration to be declared effective even though the offer price and information based on the offer price are omitted from the prospectus.

[15] The issuer may file a post-effective amendment pursuant to Regulation C §424(b) or §497(h). If the notification requirements cause the underwriter to miss the 15-day deadline, the issuer cannot sell stock to the public until the SEC declares that the post-effective amendment is itself effective, a potentially long delay.

The underwriter has the most price flexibility before the issue is declared effective, because pre-effective amendments may be filed to change the maximum price range. After the issue is declared effective, there is still some flexibility beyond the maximum price range but it depends on the issuer's choice when paying filing fees. If the issuer pays fees under §457(a), then the number of shares registered is initially "fixed," but there is price flexibility beyond the maximum price range.[16] Generally, the underwriter may set the offer price up to 20 percent above the maximum price range.[17] However, the underwriter may exceed this limit if the SEC does not view the price change as "substantive," because this allows the issuer to file a prospectus supplement instead of a post-effective amendment. Offer price changes of 30-40 percent may possibly be non-substantive.

Alternatively, if the issuer pays filing fees under §457(o), the total proceeds of the offering are limited, subject to the 20-percent flexibility provided for in §430A. This 20-percent flexibility applies to the total proceeds of the issue, so the underwriter may change offer price or issue size after the IPO is declared effective as long as the total proceeds are within the 20 percent limit. In this case, the underwriter has greater flexibility over the issue size than under §457(a). Issue size may change, for example, by 25-30 percent if the offer price adjusts down sufficiently.

Even under §457(a) the issuer can change the number of shares registered by filing a post-effective amendment. Normally, this would delay the offering, but under §462(b), this type of post-effective amendment can become immediately effective if the additional shares and offer price keep the proceeds of the IPO within 20 percent of the maximum proceeds in the

[16] The computation of filing fees can be fairly complex. Regulation C, §457(a) – (o) describes the different possibilities. Note that an offer price range is required even if the issuer pays fees based on the number of shares.

[17] See "Instruction to Paragraph (a)" in Regulation C, §430A of the Securities Act.

“effective” registration statement.[18] This rule appears to make the issuer indifferent between filing under §457(a) or §457(o). However, the difference between these two rules arises not when total proceeds increase as shares increase, but rather when they are constant. Under §457(a), once the issue is declared effective, the issuer cannot exceed the shares registered without a post-effective amendment. This requires a notice to investors. Under §457(o), shares can increase as long as total proceeds do not change. Thus, the fraction of the company sold may change under §457(o) without prior notice to investors.

Another factor that discourages waiting and revisions to the prospectus after the issue becomes effective is the potential for investor lawsuits (cf., Tinic, 1988). Depending on the materiality of the changes, the notification requirements could mean that some investors can claim they were not fully informed of any changes. If the IPO performs poorly, investors might sue claiming that a material misrepresentation occurred in the prospectus or that they were not notified properly before the purchase. Whether such suits would be successful largely depends on the facts of the case. Several changes in the original prospectus, however, give the appearance that there was incomplete information, which may bolster such claims. To help avoid such suits, underwriters may keep the offer price within the range filed in the prospectus.

What should be clear from the above discussion is that the issuer and underwriter face additional constraints on pricing after the IPO is declared effective, unless they are willing to accept a delay in the offering process.[19]

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[18] To become immediately effective under §462(b), the post-effective amendment must be filed prior to the time that any confirmations are sent to investors.

[19] At first glance, these rules may not seem too limiting. The case of the IPO for Andover.net, however, shows that they may prove quite restrictive. Andover.net is a developer of Linux software and chose to use a Dutch auction to bring their shares to the public market. Andover.net filed its registration statement with the SEC on September 16, 1999, which indicated that 4,000,000 shares would be sold and another 600,000 shares could be offered in the underwriter’s over-allotment option. The maximum proceeds were to be $69 million at the maximum offer price of $15 per share. Andover.net paid registration fees of $19,182 at this time. On December

C. *Truth-Revealing Investors help Establish Demand*

With an offer price range known to potential investors, the order book for the issue is constructed from two types of information. First and most common, the potential investor will indicate the number of shares desired if the price is within the range filed in the prospectus.[20] If the underwriter changes the offer price range, either up or down, potential investors will be contacted to reconfirm their interest in the issue. Such re-confirmations provide the underwriter with additional information about the willingness-to-pay of investors, which helps estimate the market demand curve, but it may also provide investors with information. Investors may reasonably assume that the issue is over-subscribed at the initial offer price range and issue size if the range moves up and under-subscribed if the range moves down. By changing the range, the underwriter confirms that many others have a positive (negative) view of the company's prospects, which may cause an increase (decrease) in willingness-to-pay and demand for shares. Hanley (1993) shows that adjustments to the offer price range provide information about expected returns in the after-market. She finds that an increase in the offer price range is positively related to first-day initial returns, consistent with the view that investors react to the new information provided by the underwriter.

3rd, Andover.net filed pre-effective Amendment #4 that raised the maximum price to $18 per share, revised maximum proceeds to $82,800,000, and paid additional filing fees of $2,678. W.R. Hambrecht & Co. was the lead underwriter and conducted the Dutch auction using its *OpenIPO* Internet platform on December 8, 1999. The Dutch auction produced a market-clearing price of $24. The issuer chose to conclude the auction at $18 rather than reduce the number of shares sold to remain within the maximum proceeds in the December 3rd filing. The alternative would have been to change the price range in a post-effective amendment and then wait for SEC to approve the new filing. The reason they did not wait was reportedly that another Linux software company, VA Linux, was scheduled to go public *on the next day*, so rather than compete directly for investors with VA Linux, W.R. Hambrecht and Andover.net chose to close the auction at a below-market price. On December 9, its first trading day, Andover.net closed at $77.50 after 4.579 million shares changed hands.

[20] Many institutional investors will regularly request 10 percent of the allocation, which is the commonly imposed allocation limit that underwriters set. These indications of interest are less informative because actual demand is censored.

Second and less common is that investors provide the underwriter with a schedule of prices and purchase intentions. These investors provide more pricing information to the underwriter, which Cornelli and Goldreich (1999) claim is rewarded with larger allocations. In addition, underwriters supplement these indications of interest with questions about after-market intentions. Surprisingly, as the quote from Mike Mills and our conversations with underwriters indicate, institutions will often inform underwriters whether and at which price they intend to hold, increase, or decrease their position in the aftermarket.[21]

There are two reasons to believe that investors provide truthful and informative data on their demand for the issue. Because underwriters can exclude investors from future allocations if they renege on their promise to buy, excessive claims for stock during the book-building period are discouraged.[22] Second, while most IPOs are not formally Dutch auctions, they share one of the features of these auctions. Namely, investors who receive shares do not expect to pay a price based on their individual willingness-to-pay. Each investor pays the same price and none can reasonably assume that his indication of interest is at the margin determining the offer price. Thus, investors have little incentive to understate their willingness-to-pay.[23] In the following we assume that the book-building process is sufficiently informative to underwriters so that they can estimate the market demand for the issue.

[21] The popular press has also detected a shift away from criticizing flippers. See Tam, Pui-Wing and Terzah Ewing, "Here's a Flip: Buying and Then Quickly Selling an IPO Stock is No Longer Such a Bad Thing," Heard on the Street, *The Wall Street Journal*, February 2, 2000.

[22] Smith, Randall and Suzanne McGee, "Major Institutions, Led by Fidelity, Get Most of Hot IPOs, Lists Show," Heard on the Street, *The Wall Street Journal*, January 27, 2000.

[23] In Benveniste and Spindt's (1989) model each investor has a marginal effect of price, so they must be compensated for truthful information.

II. MODEL OF THE IPO ENVIRONMENT

The book-building process provides an estimate of the market demand for the issue. With market demand, the underwriter can estimate profits from the IPO and decide on an optimal price and allocation. With firm-commitment contracts, the first sale of stock is between the issuer and the underwriter immediately after the offer price is set. The underwriter then proceeds to confirm orders for these shares from investors. If investors choose to buy less than the entire issue, the underwriter must find new investors or try to sell the shares in the after-market, possibly at a substantial loss. We use this section to develop a model of this process.

A. Market Demand and Rationing

The underwriter uses the information in the "book" to estimate the market demand, $q(P)$, for the IPO as a function of the offer price, P. In our analysis, we assume that $q(P)$ is continuous and twice differentiable, with $\partial q(P)/\partial P < 0$.[24] The empirical evidence of Kandel, Sarig, and Wohl (1999) indicates that the demand for IPO shares is highly elastic. Thus, we will treat $q(P)$ as price-elastic in the neighborhood of the optimal offer price. This assumption has little effect on our model, except that it rules out pricing the IPO above the market-clearing price. With a firm-commitment contract, setting an offer price such that the issue is under-sold causes the underwriter to lose profits on the under-sold shares because the after-market price is expected to decrease below the offer price. With elastic demand, revenues to the issuer (and proportionately to the underwriter) are higher at the market-clearing price than at any higher

[24] The "book" may have small or large discontinuities because of the discreteness of orders. This may complicate the choice of an optimal offer price, particularly if an institution's demand is a function how much it is rationed. That is, an institution may be willing to hold the stock in its portfolio if it receives a sufficient number of shares to justify the cost of monitoring the company. Placing too few shares in the hands of these institutions leads them to flip in the secondary market, which changes the structure of our model.

price that causes an under-sold condition. Thus, underpricing or selling at the market-clearing price are the only feasible solutions that the underwriter must consider.

The underwriter controls the information structure in this environment. Individual subscribers are assumed to act atomistically if the underwriter does not provide them with additional information about the market demand for the IPO. In other words, subscribers do not think that they can affect the market-clearing price or the underwriter's optimal offer price. In this setting, the underwriter has no reason to share information on the market demand curve, except when it may send a signal that increases demand, such as an increase in the filing range or offer size. When after-market trading begins, information is revealed to all participants as price adjusts to clear the market.

The issuer desires to sell *A* shares of stock to investors. (Without altering our results, we could also represent this problem as the sale of an ownership fraction τ with A equal to the total number of shares in the firm. In this case, each occurrence of "A" below would need to be replaced by "τA.") Shares in the over-allotment option are included as part of *A*.[25] In this environment, the market-clearing price (P^*) is defined by solving $A = q(P^*)$. The underwriter could set this price for the offering and allocate shares accordingly, but then there would be little trading in the after-market until new information caused a re-sorting of investors' willingness-to-pay in the market demand curve. Because the underwriter may profit from after-market trading, we expect that the issue will be rationed such that some investors have an

[25] Evidence provided by Aggarwal (2000) is consistent with this assumption. In a proprietary sample, she finds that the median IPO is oversold to the extent of the over-allotment option. This condition also describes the mode in her sample. In addition, she finds that underwriters typically exercise the over-allotment option.

incentive to trade in the after-market. If there is rationing, we assume that all investors are rationed proportionately.[26]

The underwriter chooses an optimal offer price (P_0) at which investors receive only a fraction α of their demand for the issue; that is, the issue is priced such that $A = \alpha q(P_0)$. The underwriter sets α by choosing an offer price. In this model, $\alpha = 1$ implies that the market-clearing price is the optimal offer price. Offer prices lower than the market-clearing price imply that $\alpha < 1$. This arrangement is shown in Figure 1.

Figure 1

Figure 1 illustrates the case in which the underwriter sets an offer price below the market-clearing price. In this case, shares in the issue are allocated to some investors whose willingness-to-pay is less than the market-clearing price. To induce these investors to buy shares, the underwriter lowers the offer price to P_0, where $P_0 < P^*$. At this price, there is excess demand, so shares are rationed. The optimal rationing fraction is given by:

$$a = \frac{A}{q(P_0)}, \tag{1}$$

By rationing in this manner, the underwriter creates a quantity demanded in the after-market equal to $(1-\alpha)q(P^*)$ and a quantity supplied equal to $\alpha[q(P_0) - q(P^*)]$. This offer price guarantees that there is trading in the after-market, so that the IPO exhibits after-market

[26] Hanley and Wilhelm (1995) find that institutions and retail customers receive about the same percentage of the issue in both good and bad offerings. If both institutions and retail customers distinguish between good and bad offerings so that they adjust their demand proportionately, then these data would imply that underwriters equally ration institutions and retail customers.

liquidity, and that some shares are flipped. In effect, the underwriter is choosing an optimal amount of flipping for the IPO. To accomplish this, the issue must be underpriced, so the issuer must leave some money on the table.[27] In this model, the "money left on the table" may be interpreted as the cost of creating an after-market for the issue.

D. Underwriter's Profit Function

The underwriter's contract with the issuer provides that the underwriter purchases the issue at a discount to the offer price. Let γ represent the underwriter's discount, then $\gamma P_0 A$ represents the total proceeds received from buying the issue at a discount and selling it to investors at the offer price. We focus on total revenues to define the underwriter's profits because the costs of marketing the issue are sunk at the time the IPO is priced. In addition, the underwriter receives profits from market making. Let θ equal the percentage effective bid-ask spread associated with the new issue. The after-market is assumed to be a dealer market, so that the underwriter earns the effective spread on a "round trip" transaction.[28] To avoid double counting, we only apply the spread to the demand side of the market. Thus, with rationing at the equilibrium price, we expect after-market demand for shares to equal $(1-\alpha)q(P^*)$. As such, profits from market-making activities are equal to $\theta P^*(1-\alpha)q(P^*)$. The total profit function of the underwriter may now be written as:

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[27] See Loughran and Ritter (1999) for a discussion of how much money issuers leave on the table because of underpricing.

[28] We model the underwriter's after-market activities as if it was the only market maker. A market share adjustment reduces the size of θ, but does not change the structure of our model, so we exclude market share as a nuisance parameter, but include it in our empirical analysis. We could also assume that the after-market was a specialist market. In this case, the underwriter would act as a market maker using limit orders to set the bid and ask prices or internalize trades to earn the spread. This friction is likely to lower the profitability of after-market trading to the underwriter.

$$p(P_0) \quad = \quad g\, P_0 A + qP^*(1\text{-}a)q(P^*), \tag{2}$$

where $a = A/q(P_0)$ according to the rationing rule discussed above.

The underwriter maximizes equation (2) with respect to the offer price, P_0. This solution may be expressed in terms of the gross underpricing of the issue, which we define as P^*/P_0. The first-order condition for maximizing profit implies the following underpricing result:

$$\frac{P^*}{P_0} = \frac{g}{a_0 q(-h_0)}, \tag{3}$$

where $h_0 < 0$ is the price elasticity of demand at the optimal offer price and $a_0 = A/q(P_0)$ is the optimal amount of rationing across subscribers.

Equation (3) is an equilibrium result. Unfortunately, it is not a reduced-form equation, so we cannot extract empirical predictions directly because the optimal offer price appears on both sides of this equation. It implies that the degree of underpricing in an IPO is a function of the underwriter's discount, the effective spread in the after-market, the equilibrium amount of rationing, the price elasticity of demand for the IPO and other factors that affect demand. We can derive how certain parameters affect the offer price in this optimization problem, and from these results make inferences about underpricing.[29] Proposition 1 summarizes these results.

Proposition 1: The optimal offer price (P_0) exhibits the following comparative statics:

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[29] Our model does not imply that IPOs are always underpriced. If $-\eta_0\theta$ approaches γ as P_0 approaches P^*, then the issue may be optimally priced at its market-clearing level. As there is no obvious economic reason for this to

$$\frac{\partial P_0}{\partial g} > 0\,, \qquad \frac{\partial P_0}{\partial q} < 0\,, \qquad \frac{\partial P_0}{\partial A} < 0$$

Proof: The first-order condition for optimization of equation (2) implies $\gamma A + \theta P^* \alpha^2 \frac{\partial q(P_0)}{\partial P_0} = 0$. Applying the Implicit Function Theorem to this equation and rearranging terms yields the derivatives and their signs. *Q.E.D.*

Proposition 1 establishes that the offer price varies directly with γ, the underwriter's discount. Combining this result with equation (3), we can see that the effects of γ and θ on underpricing depend on the elasticity of demand. If demand is highly elastic, then underpricing varies inversely with γ and directly with the effective spread θ.[30] Intuitively, underpricing serves the purpose of establishing an after-market in which the underwriter earns trading profits. If the underwriter earns more profits directly from the issuer, there is reduced incentive to lower these profits by underpricing, so we would expect an inverse relationship to hold with γ and a direct relationship to hold with θ.

Miller and Reilly (1987) provide some evidence on the role of bid-ask spreads in IPOs. They study a sample of 510 IPOs sold during 1982-83 and find that first-day bid-ask spreads

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occur, we consider it a remote possibility. Thus, underpricing will be the average tendency of IPOs described by this model.

[30] Specifically, in a constant elasticity of demand model, underpricing varies inversely with γ if $-\eta_0 > P_0/[\gamma(\partial P_0/\partial\gamma)]$ and directly with θ if $-\eta_0 > P_0/[\theta(-\partial P_0/\partial\theta)]$. For our sample we find these threshold values are 1.64 and 32.24, respectively. These estimates are based on the regression Offer price = -33.33 + 12.14 (Underwriting fees per share) – 5.31 (Total trading revenue per share) + 2.55 (Log issue size) + 0.07 (15-day pre-issue CRSP return) + 4.73 (% change offer price to initial filing midpoint), evaluated at the mean of offer price, underwriting,

are higher on underpriced versus overpriced issues. After controlling for other factors—price, volume, and a measure of risk—known to affect bid-ask spreads, Miller and Reilly report that percentage bid-ask spreads are 42.4 percent higher on underpriced issues. This result is consistent with the expected effect of θ on underpricing in our model.

Our model also predicts that the underwriter will lower the offer price if the issue size increases. However, a larger size issue also implies a lower market-clearing price in the after-market. Thus, within the confines of this model, we cannot say how changing the issue size affects underpricing. Generally, the underwriter increases the issue size in response to substantial interest in the IPO. If the preliminary prospectus is amended to increase the offering size, this sends a signal to investors that the issue is over-subscribed, at least over-subscribed more than usual. Investors may incorporate this new, positive information in their own valuation assessments. It would be reasonable to observe more underpricing in this circumstance, which is what Hanley (1993) finds, if all investors increase their demand for the issue. We do not include investors' expectation process in this model except to the extent that it is embedded in the market demand function; certainly, expectations are likely to be an important determinant of underpricing when the issue size changes, so we control for these effects by including information on filing-range adjustments in our empirical analysis.

We can also infer how the elasticity of demand affects the optimal offer price and underpricing for the class of demand functions that have constant price elasticity. In this class, the optimal offer price varies inversely with the elasticity of demand, which is likely to increase underpricing if demand is more elastic. The intuition here is that a given reduction in the offer price results in greater rationing with a more elastic demand curve. Greater rationing causes

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and trading revenue, respectively. Because Kandel, Sarig, and Wohl (1999) find an average elasticity of 37 for more trading in the after-market, which increases underwriter profits. Although the underwriter loses profits on the discounted purchase price when price decreases, a more elastic demand curve works to offset these losses with trading profits. Kandel, Sarig, and Wohl (1999) find support for this hypothesis using data on 28 IPO auctions in Israel. They estimate a significant positive correlation between first-day abnormal return and the elasticity of the auction demand schedule.

E. Optimal Flipping Activity

In our model, an optimal amount of rationing implies an optimal amount of flipping in the after-market. Because we know how the parameters in the model affect the offer price, we can use the rationing relationship, $\boldsymbol{a}_0 = A/q(P_0)$, to define how $\boldsymbol{a}_0$ is affected by these parameters and accordingly how flipping is affected. Proposition 2 describes these results.

Proposition 2: Define F^*/A as the ratio of flipped shares to the issue size. Then, at the profit-maximizing solution, $F^*/A = 1-\boldsymbol{a}_0$, $\frac{\partial(F^*/A)}{\partial g} < 0$ *and* $\frac{\partial(F^*/A)}{\partial q} > 0$.

Proof: At the profit-maximizing solution, shares flipped (F^*) are equal to $(1-\boldsymbol{a}_0)q(P^*)$. Because $A = q(P^*)$, then the flipping ratio, $F^*/A = 1-\boldsymbol{a}_0$. The derivatives are then $\partial(F^*/A)/\partial\gamma = -[\partial\alpha_0/\partial P_0][\partial P_0/\partial\gamma]$ and $\partial(F^*/A)/\partial\theta = -[\partial\alpha_0/\partial P_0][\partial P_0/\partial\theta]$. Combining the results in Proposition 1 with the fact that $\partial\alpha_0/\partial P_0 > 0$ gives the signs above. *Q.E.D.*

Israeli IPOs, our estimates imply that it is likely that demand is indeed sufficiently elastic.

Proposition 2 provides predictions that we can use to directly test our model. Specifically, it establishes that the flipping ratio is equal to one minus the fraction of the issue rationed (i.e., $1-\alpha_0$). If more of the issue is rationed, then we expect more flipping.[31] In "hot" IPOs, which are often over-subscribed by a multiple of 10 or more, we expect to find the largest flipping ratios. From equation (3), we see that underpricing varies inversely with α_0 and thus directly with $1-\alpha_0$. With data on flipping, we can estimate α_0 and use this variable in our underpricing regressions. In addition, the higher the underwriter's discount (γ), the lower the flipping ratio in our model. The underwriter encourages less flipping because more profits are obtained from a higher offer price. Alternatively, if the after-market spread (θ) increases, then the underwriter sets the offer price to encourage a higher flipping ratio because more after-market trading increases profits.

Reese (1998) provides some evidence that is consistent with the model's predictions. He analyzes trading volume in a large sample of IPOs between 1983 and 1993 and documents higher first-week trading volume for more underpriced issues. Additionally, he finds higher volume for Nasdaq IPOs. This is also consistent with our model, because trading profits should be higher in a dealer market.

It is reasonable to examine whether flipping, *per sé*, is predictive of IPO returns. We see from equations (1) and (3) that if P_0 decreases then a_0 decreases and there is more underpricing. A decrease in a_0 implies more rationing of subscriptions, so there is more demand at the market-clearing price in the after-market, and also more flipping. In this sense, flipping is predictive of immediate or contemporaneous after-market returns.

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[31] Without further restrictions on the model, we cannot determine the effect of issue size on the flipping ratio.

However, our model implies no obvious relationship between flipping and longer-run IPO returns. Krigman, Shaw, and Womack (1999) and Houge, Loughran, Suchanek, and Yan (1999) find empirical support for the proposition that IPOs with more flipping have lower long-run performance. They use the ratio of seller-originated block dollar volume (trades larger than 10,000 shares) to total dollar volume to estimate flipping.[32] The Krigman, Shaw and Womack view is that flippers are predictive of long-run performance because they are optimally reacting to *mispricing* by the underwriter. In other words, if the underwriter has priced the issue too high, there will be more flippers and lower long-run returns. Flippers are thus acting to take advantage of the underwriter's mistake. In our model, the underwriter and flippers have both acted optimally and no one has made a mistake, at least from an *ex ante* point-of-view.

F. Over-Selling the Issue

In the present model, the underwriter does not have an incentive to sell more than the issue size plus shares in the over-allotment option to investors. Because demand is price-elastic, the offer price will not exceed the market-clearing price. Thus, selling additional shares can only cause losses when price increases in the after-market. However, we know from Aggarwal (2000) that underwriters may take naked short positions in issues that are priced above the aftermarket price. These "weak" issues provide a profit opportunity for underwriters holding naked short positions.[33]

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[32] This ratio may not correspond to 'true' flipping as used in our model for two reasons. First, we don't know if all block sellers received initial allocations. Second, we find that in our sample of 'true' flips on the first trading day more than 92 percent of all flipping transactions are smaller than 10,000 shares.

[33] Many issues offer such profit opportunities. Reese (1998) finds that 36.5 percent of all IPOs in the 1973-93 period closed at or below the offer price on the first day of trading. Krigman, Shaw, and Womack (1999) show that the figure is about 25 percent for a sample of IPOs between 1985 and 1995.

We can introduce the incentive to hold a naked short by modifying the model to include *exogenous* flipping. The current structure allows only endogenous flipping. As the quote from Mike Mills (see footnote 2) suggests, subscribers may tell the underwriter that they intend to flip shares before they know the offer price, so there appears to be some level of exogenous flipping in IPOs. Underwriters may facilitate such behavior if they give allocations to favored clients knowing that they intend to flip shares, and in return receive future trading business.

Let q_f represent the exogenous level of flipping, which the underwriter estimates during the book-building process. The market-clearing price is now determined by solving $q(P^*) - q_f = A$. The optimal offer price may exceed the market-clearing price because the underwriter earns profits from covering the short position at the lower after-market price. We illustrate this result in Figure 2.

Figure 2

In Figure 2, exogenous flipping is sufficiently large to cause the price at which $q(P^*) - q_f = A$ to fall below the price at which $a q(P_0) = A$. Thus, even without a naked short position by the underwriter, after-market price is expected to decrease. In this situation, the underwriter must decide whether it is profitable to hold a naked short, which is addressed in Proposition 3.

Proposition 3: Define P_A implicitly from $A = q(P_A)$, where $P_A > P_0 > P^*$. Then, the underwriter will hold a naked short of size $N_0 = q(P_0) - A$ at offer price P_0 if

$$[(P_0 - P^*) - qP^*]N_0 > g\,(P_A - P_0)\,A$$

otherwise, the price P_A with $a = 1$ is preferred.

Proof: Profits at P_A are $\pi_A = g\, P_A A + qP^* q_f$ and at the naked short are $\pi_0 = g\, P_0 A + qP^*[q(P^*) - q(P_0)] + (P_0 - P^*)N_0$. Comparing the difference, $\pi_0 - \pi_A$, gives the inequality above. Also, maximizing p_A with q_f replaced by $[(q(P^*) - q_f) - a(q(P_0) - q_f)]$, which is the after-market demand when there is rationing and $P_0 > P^*$, gives the result that the optimal offer price is increased (to P_A) such that there is no rationing of demand. *Q.E.D.*

With a naked short the underwriter faces a trade off between earning profits from underwriting fees and covering the short at a lower after-market price. Proposition 3 reduces this trade off to a comparison of two terms: revenue from short covering net of trading profits foregone on the short position, versus earning additional profits on the underwriter's discount with a higher offer price. If the former term exceeds the latter, then the underwriter increases profits by holding the naked short.

There are two empirical predictions for issues that generate naked short positions. First, the flipping ratio is expected to be less for a naked short position.[34] The underwriter with a naked short gains from covering it in the after-market, so trading profits and flips play a less important role. Second, the comparative statics of the naked short model yield the same sign predictions in Proposition 1, except that $\frac{\partial P_0}{\partial q} > 0$. With $P_0 > P^*$, the underwriter increases flipping by raising the offer price. This has the effect of reducing the size of the naked short position, which shifts profits towards after-market trading.

[34] Shares flipped with a naked short equal $A - [q(P_0) - q_f]$ which is less than flips with rationing at P_0, $A - a[q(P_0) - q_f]$. Dividing both terms by A implies that the flip ratio is greater with rationing.

III. DATA

We have collected extensive data on 110 IPOs issued between May 1997 and June 1998. Nine well-known investment banks acted as the lead underwriters for these IPOs. These data include the standard information available from the Securities Data Corporation (SDC) Global New Issues database, selected information on allocations and short positions, and information on the actual flips by original investors. We verified that the SDC data was correct for the over-allotment option in each IPO, and filled in any missing information from Edgar Online and SEC records.[35] Each lead underwriter provided us with proprietary summary information on flipping transactions in these 110 IPOs. Also, our sample excludes ADRs, REITs, and closed-end funds.

Since early 1997, underwriters may request flipping reports from the Depository Trust Company (DTC). The IPO tracking system at the DTC can provide daily flipping reports to lead underwriters and syndicate members for a period up to 90 days, although most underwriters terminate tracking after 30 days. The calculation of flipped shares is based on clearance and settlement information, so it is expected to be highly accurate.

The IPO tracking system provides two types of reports. The Lead Manager Report provides aggregate information on flips by customers of each syndicate member, including the lead underwriter. The Syndicate Member Report provides more detail. It shows trade-by-trade data on the flips for each customer who received shares in the offering. These reports show the quantity of shares flipped, trade price, trade date, and a unique customer identifier, so that underwriters can track flippers across offerings. We present flipping ratio information for both

[35] Ellis, Michaely, and O'Hara (1999) and Aggarwal (2000) find that the SDC is often missing information on over-allotment options.

the Lead's institutional and retail customers. Because the lead underwriter allocates most of the shares to institutional subscribers, who on average receive a majority of the shares in any IPO, the Lead's flips typically account for about 70 percent of all IPO flips.[36]

We also collected trade and quote data from the Securities Industry Automation Corporation (SIAC). We computed volume-weighted effective bid-ask spreads for each trade during the first two days following the IPO. This computation is based on the inside quotes that prevail at the time of each trade. In addition, we obtained market share data on trading from AutEX BlockDATA for the first month of trading in the IPO. These market shares are computed from trades of 5,000 shares or more. Assuming they are also representative of market shares for smaller trade sizes, we computed a measure of trading revenue for the lead underwriter over the first two days following the IPO. Specifically, the Lead's 2-day trading revenue equals its market share times total shares traded times the average volume-weighted effective half-spread. Table 1 provides summary statistics for the various variables in our sample.

Table 1

In Table 1, we see that the offer price in our sample lies in the range from $6 to $29, with the total proceeds between $16.5 and $1,140 million. The median gross underwriting spread (not reported) is 7.0 percent and the median proceeds are $57 million (including the exercised portion of the over-allotment option), which is consistent with Chen and Ritter's (2000) observation that IPOs with proceeds between $20 to $80 million have gross spreads

[36] The Lead's Syndicate Member Report shows flips of shares that were allocated by the Lead only and typically include the entire institutional allocation. Other syndicate members may also allocate some of their "retention" to institutional customers, but these are generally a small fraction of the institutional pot.

concentrated at 7 percent. Institutional investors receive 76 percent of the primary allocation, which is slightly higher than Hanley's (1993) range of 65-70 percent. The average first-day return is 20 percent (median 13 percent), with about 33 percent of these issues being offered above the initial filing range.

Underwriting fees are computed using the SDC information for each IPO. The Lead's fee revenue averages $5.4 million. This is computed as the sum of underwriting fee, management fee divided by the number of co-managers, and the selling concession on the Lead's share of the offering (67 percent on average). In addition to fees, the Lead earns income from trading the IPO in the secondary market. Brokers affiliated with the Lead hold a market share of about 53 percent in the first month of aftermarket trading, and only in four out of 110 IPOs is the Lead not the largest market maker. We estimate the lead's trading revenue as described above and estimate that the Lead earns an average of $330,742 during the first two trading days. On average, the Lead's trading revenues for only the first two trading days account for about 7 percent of total revenues.

Underwriters also provided data on whether the Lead over-sells the issue to hold a naked short. We find that this occurs in about 39 percent of our sample. Closer inspection reveals that many IPOs are over-sold by a relatively small fraction of shares, possibly because the Lead is making allocations to favored clients and is willing to bear some trading losses to help these particular investors. The naked short position exceeds 5 percent of the initial issue size only in 11 percent of the issues. We use this threshold in our empirical tests to represent a genuine intent by the Lead to short the issue.

Finally, over the first two trading days, shares flipped by the Lead's customers account for about 17 percent of issue size including the over-allotment option, and for 25 percent of total trading volume. Institutional flips account for 15 and 21 percent of issue size and volume, respectively. Most shares are flipped within the first two days of trading as shown in Figures 3 and 4.

Figure 3
Figure 4

Figure 3 shows total shares flipped per day for the first twenty trading days after the IPO, and Figure 4 shows the corresponding number of trades. There are flips of primary shares after twenty days, but these trades are a small percentage of total volume. A total of about 86 million shares are flipped on the first trading day alone, with 72 million of these by institutions. The second trading day also shows large flipping volume of about 14 million shares (10 million by institutions). These amounts compare to total trading volumes of 370 million and 58 million, respectively. Taken together, the first two days of flips represent 36 percent of all flips during the IPO tracking period. Figure 4 reveals a similar picture. Almost 33,000 flips occur on the first two trading days, but afterwards most days show a total between 500 and 2,500 flips. We confine our analysis to flipping during the first two days of trading. Expanding the number of trading days beyond this introduces noise due to company news and investor reactions to other market factors.

IV. EMPIRICAL ANALYSIS

The theoretical model developed above implies that the offer price and rationing are simultaneously determined. Equivalently, we can state that underpricing and the flipping ratio are determined endogenously in our model. Equation (1) specifies the structural relationship between α_0 and the offer price and equation (3) represents the same for gross (or, by implication, net) returns and α_0, which equals one minus the flipping ratio according to Proposition 2. With a functional form for $q(P_0)$ we could estimate these structural relationships using non-linear simultaneous equation methods. As we have no theory to guide this choice, we use the following strategy. First, we provide a univariate analysis of the important variables in the model. Second, we use OLS to estimate reduced-form equations for IPO returns and the flipping ratio. Although we do not have unambiguous predictions for the sign of variables affecting IPO returns unless demand is highly elastic, we do have clear results for the flipping ratio. Thus, reduced-form estimates for the flipping ratio provide a direct test of our model. Lastly, we consider the effects of endogeneity on our estimates in a simultaneous-equations framework.

A. Univariate Analysis

The flipping ratio and initial returns are the two endogenous variables in our model. The Lead's underwriting fees and trading revenues are the primary exogenous variables. In Table 2, we present the relationships between these variables conditional on flipping quartiles using both institutional flips (Panel A) and all flips (Panel B) of the Lead's customers to estimate the flipping ratio.

Table 2

We expect a positive relationship between the flipping ratio and trading revenue, and a negative relation between flipping and underwriting fee revenue. For each variable except underwriting fee revenue, the means and medians in Table 2 are significantly different across flipping quartiles and increase significantly with the flipping ratio at the 1 percent level.[37] While underwriting fee revenues have no clear monotonic relation with flipping, the distribution of trading revenue is consistent with our model. From the lowest to the highest flipping quartile, trading revenues increase from 2 to 11 cents per share for institutional flips and from 3 to 12 cents per share for all flips. The fraction of revenue generated by initial trading increases from 3 percent to 12 percent for institutional flips and from 4 percent to 13 percent for all flips. In equilibrium, more rationing in equation (3) implies more flipping and higher initial returns. These quartile results show that as the flipping ratio increases, two-day returns increase from 7 percent to 45 percent using institutional flips and from 8 percent to 47 percent using all flips. Except for underwriting fees, these univariate results support the predictions of our model.

Table 3

Our model also implies that issues where the Lead initially engages in a naked short position are associated with lower flipping and likely lower underpricing (this follows from Proposition 3). Additionally, underwriting and trading revenues are lower, because they are traded off against short covering profits. The results presented in Panel A of Table 3 are significant and consistent with these predictions. Moreover, trading revenues are likely to be higher for issues trading on Nasdaq, so our model predicts higher underpricing and flipping for these issues. The evidence in Panel B is consistent with this prediction, because trading revenue, flipping, and initial returns are significantly higher for Nasdaq issues.

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[37] To determine whether a variable changes monotonically with the flipping ration, we regress each variable on

B. Reduced-Form Analysis

To analyze reduced-form equations, we estimate the following regressions for IPO returns (R) and the flipping ratio (F^*/A):

$$R_i = b_0 + b_1(Lead\ Underwriting\ Fee\ Revenue)_i + b_2(Lead\ Trading\ Revenue)_i + b_3(Issue\ Size)_i + b_j(Demand\ Factors)_{ij} + e_i \quad (3)$$

$$(F^*/A)_i = d_0 + d_1(Lead\ Underwriting\ Fee\ Revenue)_i + d_2(Lead\ Trading\ Revenue)_i + d_3(Issue\ Size)_i + d_j(Demand\ Factors)_{ij} + n_i \quad (4)$$

where i = 1,...,N observations in our sample, ε_i and ν_i are independent and identically distributed random variables, and "j" is an index of demand factors that affect the market demand for the i^{th} offering. We measure R_i from the offer price to the second-day closing price to conform to our two-day measurements of spreads and flipping (using the respective one-day measures does not alter the results presented below). We define the Lead's underwriting fee revenue and trading revenue in per share terms.[38] We also use three variables to control for market demand factors: a dummy variable if the filing range was increased from the initial range, a dummy if it was decreased, and the fifteen-day pre-issue return on the value-weighted combined CRSP index. The last control variable is used to be consistent with Loughran and

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the flipping ratio. Table 2 reports the significance levels of the slope coefficients in these univariate regressions.

[38] Specifically, the latter variable is constructed as the product of market-making market share and the volume-weighted effective spread. We do not multiply by trading volume as in Table 1 to avoid spurious results due to the potential endogeneity of trading volume.

Ritter (1999). The results do not change for different choices of a market index and so we only report estimates using the CRSP index.

According to our theory, if demand is highly elastic, returns are negatively related to underwriter fees and positively related to after-market trading revenue, except in the case of a naked short position, which causes a negative relationship. We control for naked short positions using a dummy variable to introduce an interaction term for both trading revenue and rationing variables. The relationship between returns and issue size is ambiguous. More importantly, we predict that the flipping ratio varies directly with trading revenue and inversely with underwriter fees. Again the effect of issue size is ambiguous. We expect that the flipping ratio is lower for IPOs with naked short positions, which we control for using the naked short dummy variable.[39]

Table 4

Table 4 presents the reduced-form estimation results for both the flipping ratio and initial returns. We find that underwriting fee revenue is statistically significant and negatively related to both the flipping ratio and initial returns. This differs somewhat from the univariate analysis, which implies that controlling for other factors that affect these variables is important for proper inferences. The results for the underwriter's trading revenue variable are also consistent with our predictions. We find that trading revenue is statistically significant and

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[39]An alternative explanation for lower flipping in IPOs with lower returns is that underwriters may use penalty bids in these IPOs to deter flippers (cf. Aggarwal, 2000). As a check on this possibility, we estimated our flipping model with IPOs that did not assess penalty bids. This did not qualitatively alter our basic results, but increased their significance. In an additional robustness check, we included a dummy variable for penalty bids that were actually assessed (i.e., a syndicate member had to reimburse part of its selling concession to the Lead). When we

positively related to the flipping ratio and initial returns. In addition, the size of the coefficient on this variable is very similar between the all flips and institutional flips equations, which is also true for the coefficient on underwriter fee revenue. Thus, it makes little difference whether we measure the flipping ratio using institutional flips or all IPO flips.

We find little support for the naked-short prediction. Model A excludes the naked short dummy variables and model B includes them for comparison. There are *de minimis* differences in the size of the coefficients between these two models. Although the coefficient is negative for the interaction term in the regression for initial returns, which is the sign we expected, this variable is not statistically significant. In fact, in all regressions, the naked short dummy and the interaction term with trading revenue are not statistically significant.

These results also show that issue size and the filing adjustment dummies have significant effects on the flipping ratio and initial returns. The issue size has a negative effect in all regressions, which does not change when the filing range dummies are excluded (not shown). Larger IPOs offer lower initial returns and have a lower flipping ratio compared to smaller IPOs. One interpretation of these results is that larger issues face a more elastic demand curve. Thus, a smaller price adjustment is needed to reach an equilibrium for any given amount rationing. The filing-range dummy variables are highly significant, and consistent with Hanley's (1993) results.[40] Hanley finds a positive relationship between the initial return and deviations from the original filing price range. In addition to the filing range dummies, we use the CRSP combined index return for 15-days prior to the offer date to capture demand-related

interact this dummy with the other variables in the model, we find that penalties affect only the coefficient of the filing-range adjustment, but none of the others.

[40] We avoid using the percentage adjustment of the offer price relative to the initial filing range, because the offer price is endogenous in our model. Results using this continuous variable in place of the dummies are qualitatively identical.

factors. Unlike the results in Loughran and Ritter (1999), this variable is not significant in any of our regressions.[41]

Each of the reduced-form equations has good explanatory power with adjusted R^2 ranging from 37 percent for initial returns to 43 percent for the flipping ratio. This is largely due to the significantly positive coefficient on trading revenue in each equation, which is robust to alternative specifications, and the filing range dummy variables. In comparison, a review of other IPO research explaining initial returns finds that adjusted R^2 is typically less than 10 percent and almost never greater than 30 percent (Cornelli and Goldreich (1999) are an exception). The relative explanatory power of these equations provides additional evidence in support of our theory.

C. Simultaneous-Equations Analysis

As a more specific test of the model, we explicitly recognize the structural nature of equations (1) and (3) and estimate them simultaneously using limited information maximum likelihood (LIML). We rearrange the specification of equation (1) as $1 - \alpha$, so that we can use the flipping ratio as our endogenous variable. This equation includes the issue size, demand factors, and the offer price, which is endogenous. For initial returns, we include underwriting fee revenue, trading revenue, issue size and demand factors as exogenous variables and the flipping ratio as an endogenous variable. We use four variables as instruments for first-stage estimation of the endogenous variables. These are the log of issue proceeds, CRSP value-weighted combined index returns for 15 days prior to the offer date, the total number of IPOs

[41] To address potential differences between Nasdaq and NYSE/AMEX issues, we estimated each equation separately for the two trading venues. We find that both sets yield the predicted signs, although the NYSE

during the previous three months, and average first-day returns for IPOs during the previous three months. To identify the system, we use the logarithm of initial returns as the dependent variable for the second equation and add the identity $\log(P^*/P_0) = \log(P^*) - \log(P_0)$. The estimation results are shown in Table 5.[42]

Table 5

The LIML estimates in Table 5 further corroborate the results above. Consistent with our predictions, trading revenue retains its significantly positive effect on initial returns. Underwriter fee revenue is also negative as we found before. As predicted in equation (3), the sign of the flipping ratio $(1 - \alpha)$ is positive in the returns equation, but it is not significant. We find that issue size has a significant negative effect on the flipping ratio after controlling for the offer price, which is consistent with equation (1). The offer price also has a negative sign, but its effect is not significant. Overall, the simultaneous equations model explains about 43 percent of the variation in 2-day returns and about 38 percent of the variation in the flipping ratio.

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coefficients are not significant. Additionally, for each equation in Table 4, a dummy variable indicating Nasdaq was positive, but not significantly different from zero when interacted with our measure of trading revenue.

[42] We obtain qualitatively similar results when we use two-stage least squares to estimate the system. Because both equations are overidentified, we cannot apply three-stage least squares or full-information maximum likelihood without imposing further restrictions. The results are not sensitive to the specification of instruments for the right-hand side endogenous variables, as long as the revenue variables are not used; when all exogenous variables are used as instruments, the first-stage estimation explains the flipping ratio very well (see Table 4). When the predicted values are then substituted into the returns equation, the second-stage estimation suffers from high multicollinearity and is not useful.

V. CONCLUSIONS

We have developed a theory of underpricing in which the underwriter encourages flipping to develop after-market liquidity in the IPO. The underwriter, issuer, and investors gain from after-market liquidity. By underpricing to induce flipping, the underwriter increases his aftermarket trading profits; the issuer's shares trade in an active market; and IPO investors realize capital gains on their shares. The underpricing may thus be considered the "cost" of providing liquidity in the issue. In this model, the underwriter faces a trade-off between generating higher underwriting fees (less underpricing) and higher trading revenues (more underpricing). We developed specific testable predictions from this model, and used a unique, proprietary data set on flipping for 110 IPOs to test these predictions. We found strong support for the prediction that underwriters face such a trade off; specifically, we found that underwriting fees were negatively related to the flipping ratio and initial returns and that after-market spreads were positively related to initial returns and the flipping ratio. Overall, the empirical results show that the profitability of after-market trading affects the underpricing decision, which is the key insight of the model.

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Figure 1

Underwriter Sets the Offer Price and Rations Demand to Create Trading in the After-Market

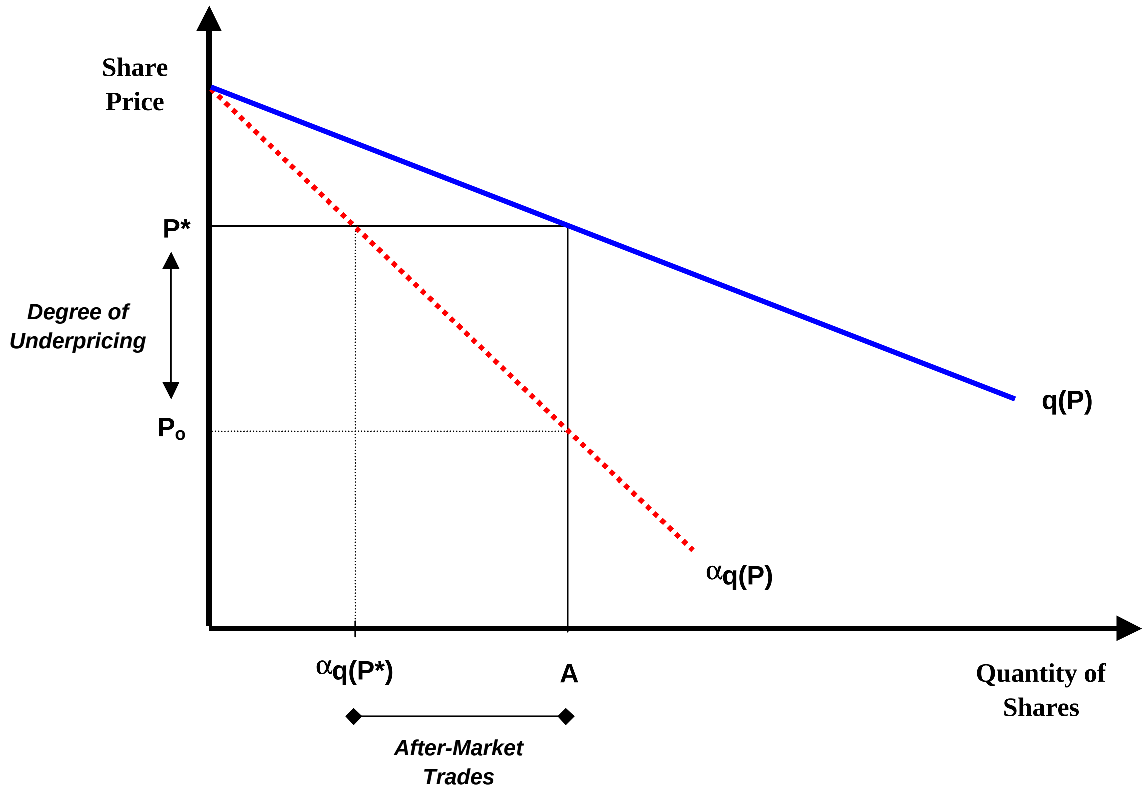

Figure 1: The underwriter determines the market demand, q(P), for the IPO from the bookbuilding process. With the issue size equal to A, the market-clearing price of the issue is solved from the equation, $A = q(P^*)$. Because the underwriter desires to create after-market trading, the issue is rationed by the fraction a to all participants in the IPO. The optimal offer price is set such that $A = \alpha q(P_o)$. At this offer price, after-market trading equals $A - \alpha q(P^*)$ or equivalently, $\alpha[q(P_o) - q(P^*)]$, which is the same as shares flipped in the initial allocation. Note that $(1-\alpha)q(P^*)$ is the demand for shares in the after-market.

Figure 2

Exogenous Flipping May Cause the Underwriter to Hold a Naked Short Position

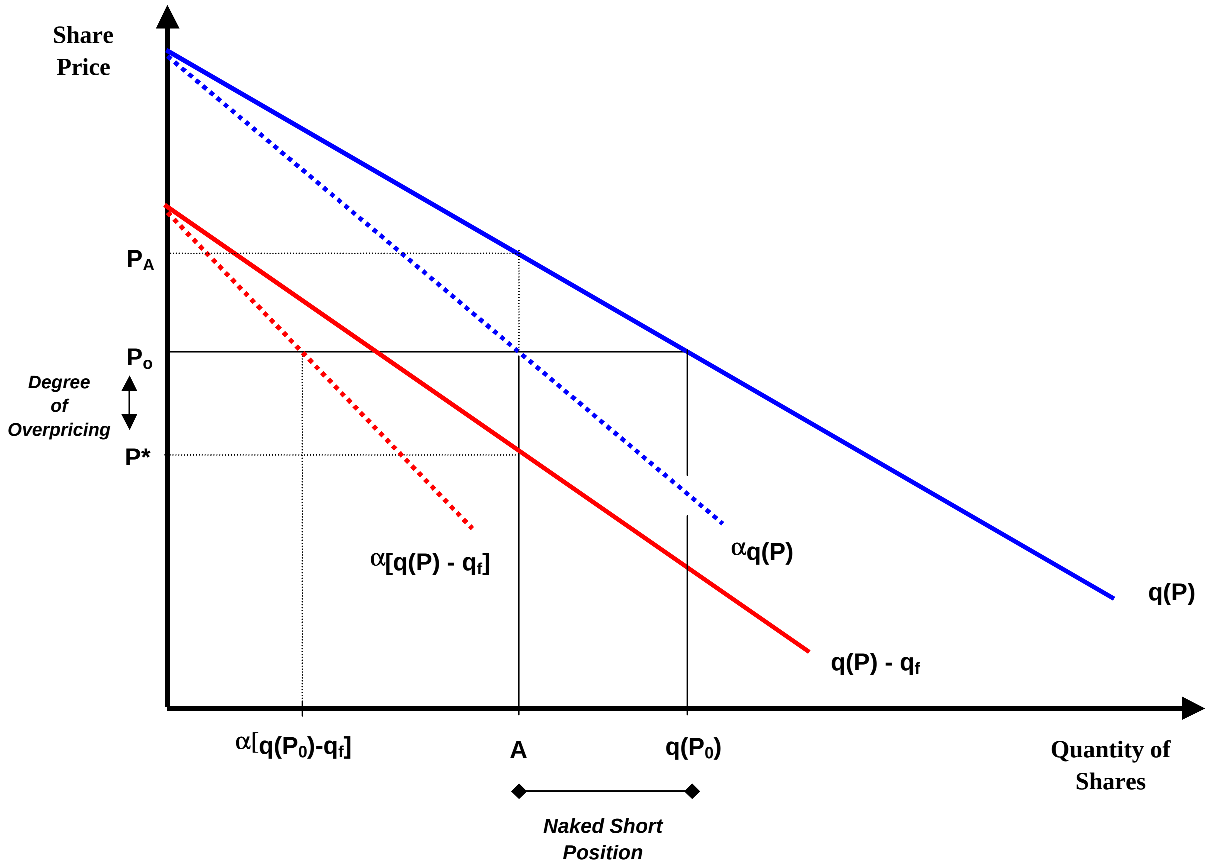

Figure 2: The underwriter determines the quantity of flipping, q_f, during the bookbuilding process. The demand for the issue is such that it is not as profitable to under-price as it is to over-price the issue. With the issue size equal to A, the market-clearing price is now solved from the equation, $A = q(P^*) - q_f$. The optimal offer price is set at P_0 to maximize profits. At this offer price, the underwriter must determine whether it is more profitable to sell all shares and hold a naked short position equal to $q(P_0) - A$ or to ration shares such that $A = \alpha q(P_0)$.

Figure 3
Number of Shares Flipped in 110 IPOs between May 1997 and June 1998

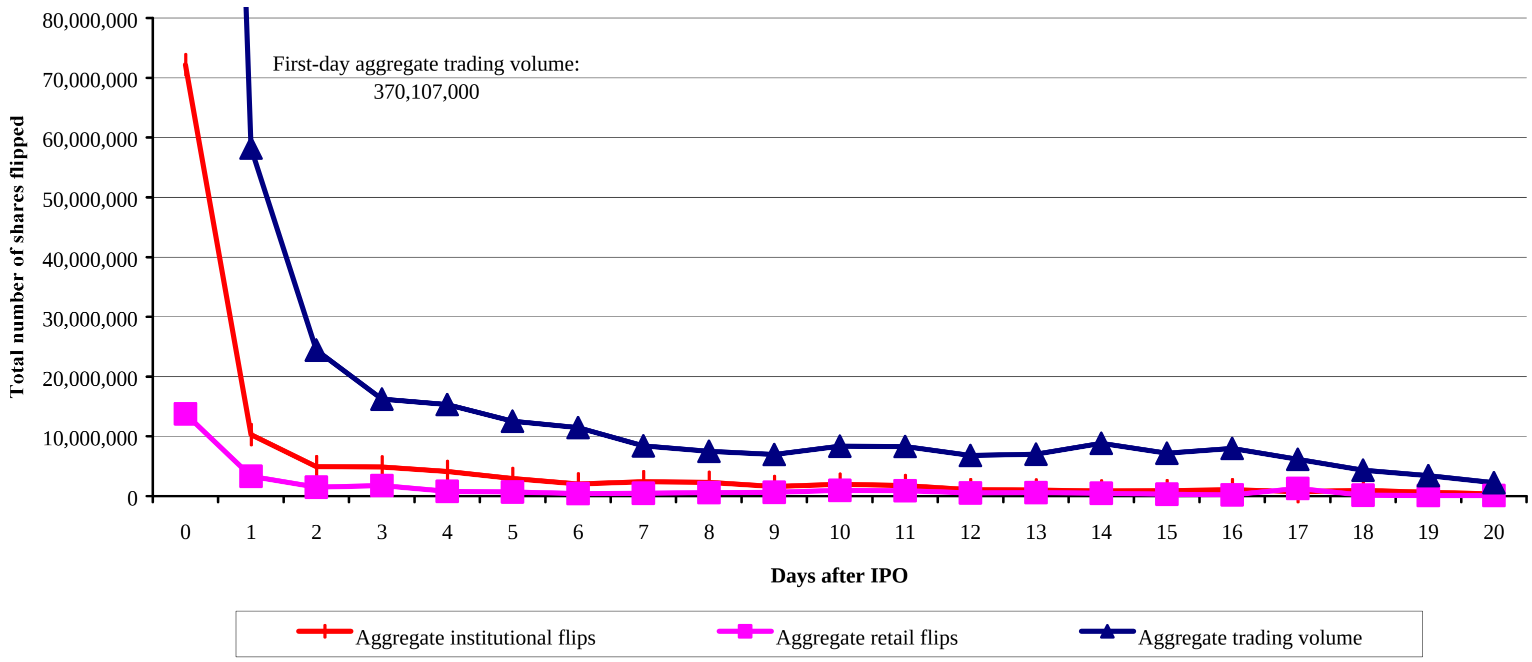

Figure 4
Number of Flipping Transactions in 110 IPOs between May 1997 and June 1998

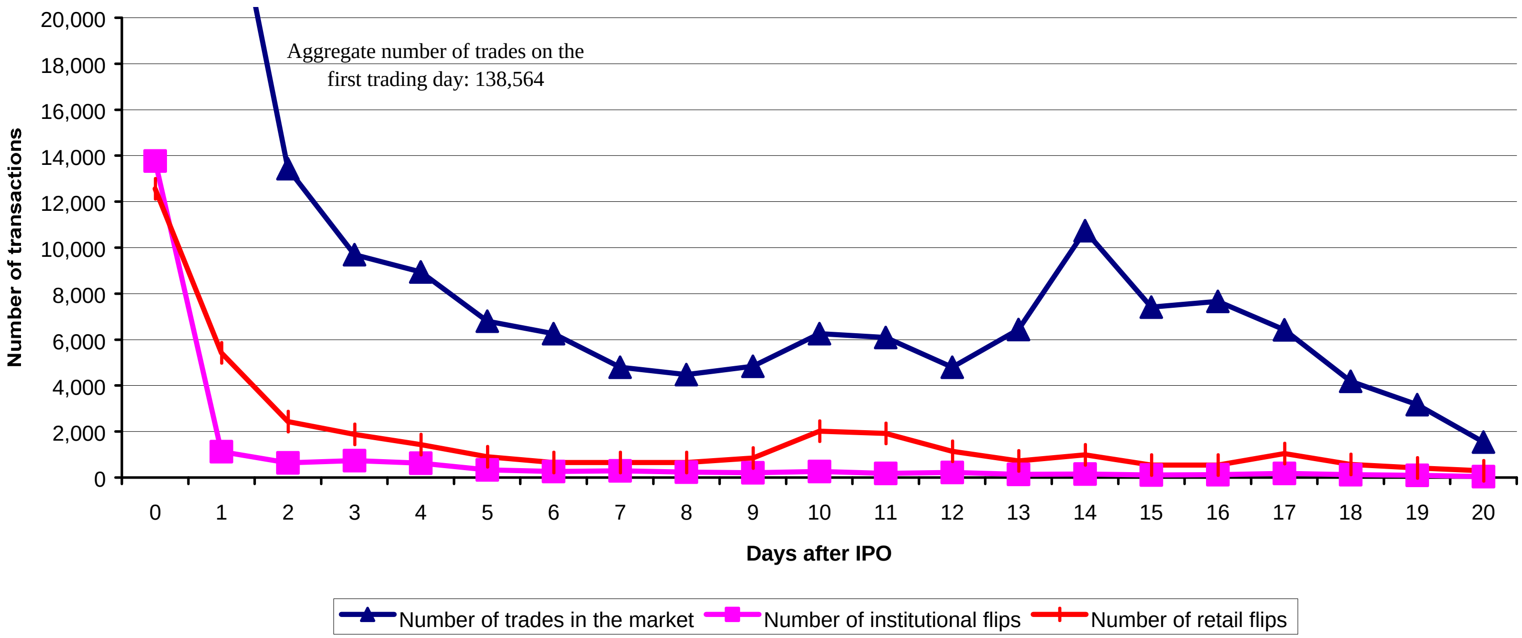

Table 1

Descriptive Statistics of the IPO Sample, May 1997 - June 1998

This table shows the mean, median, minimum and maximum values for the 110 IPOs in our sample. The estimated underwriting revenue equals the sum of total underwriting fees, selling concession times the Lead's percentage allocation in the issue, and the management fee divided by the number of co-managers. Lead trading revenue equals the product of the Lead's market share in block trades (5,000+ size) in the month following the IPO, one-half the average volume-weighted effective spread, and total trading volume during the first two days. Flipping refers to shares allocated to the Lead's institutional customers that are sold during the first two trading days.

Variable	Mean	Median	Minimum	Maximum
Offer price	$14.72	$14.00	$6.00	$29.00
Total proceeds excluding over-allotment option	$118,188,960	$55,750,000	$15,000,000	$1,026,000,000
Total proceeds including exercised over-allotment option	$129,543,254	$56,663,750	$16,531,893	$1,140,000,000
Issue size (including over-allotment option)	7,481,064	4,600,000	2,000,000	40,000,000
Issue size (including over-allotment option and short)	7,892,886	4,777,500	2,300,000	40,000,000
Allocation to institutional investors	75%	76%	41%	96%
First-day return (offer to close)	20%	13%	-50%	102%
Two-day return (offer to close)	20%	14%	-18%	125%
Offer price exceeds original filing range	33%			
Offer price less than original filing range	18%			
Percent of shares offered by lead underwriter	67%	64%	24%	111%
Gross underwriting spread	$6,335,146	$3,830,750	$1,050,000	$40,702,500
Estimated lead underwriting revenue	$5,407,409	$2,855,988	$806,892	$39,375,585
Lead's share in aftermarket trading	53%	55%	4%	86%
Lead's rank in aftermarket trading	1.06	1	5	1
Volume-weighted effective bid-ask spread (first two trading days)	0.22	0.21	0.04	0.97
Trading volume (first two trading days)	4,833,409	3,792,950	402,700	27,071,200
Lead trading revenue (first two trading days)	$330,742	$167,819	$7,466	$4,205,698
Lead trading revenue / Total lead revenue (first two trading days)	7%	6%	0%	35%
Fraction of issues with naked short position	39%			
Fraction of issues with naked short position >= 5% of issue size	11%			
Number of shares flipped (first two trading days)	988,032	722,353	4,000	7,277,978
Flipping ratio (first two trading days, as % of issue size)	15%	14%	0%	41%
Flipped shares as % of trading volume (first two trading days)	21%	20%	0%	76%

Table 2
Initial Returns and Underwriter Revenue by Flipping-Ratio Quartile

This table shows the means for initial returns, underwriting revenue, and trading revenue for the 110 IPOs in our sample. Underwriting trading revenue is estimated as the sum of total underwriting fees, selling concession times the Lead's percentage allocation in the issue, and the management fee divided by the number of co-managers. Lead trading revenue equals the product of the Lead's market share in block trades (5,000+ size) in the month following the IPO, one-half the average volume-weighted effective spread, and total trading volume during the first two days. Flipping refers to shares allocated to the Lead's institutional customers that are sold during the first two trading days. For the hypothesis tests, * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level. We use a t-test for equality of means, a Wilcoxon signed-rank test for equality of medians. The test of no linear relation to flipping is based on the p-values of the coefficients in a univariate regression on the flipping ratio.

	Exogenous			**Endogenous**		
Flipping-Ratio Quartile	Estimated lead underwriting fee revenue per share	Lead trading revenue (first two trading days) per share	Lead trading revenue / Total lead revenue (first two trading days)	First-day return (offer to open)	First-day return (offer to close)	Two-day return (offer to close)
Panel A: Institutional Flips						
1 (lowest)	$ 0.60	$ 0.02	3%	7%	5%	7%
2	$ 0.72	$ 0.04	6%	12%	14%	14%
3	$ 0.82	$ 0.06	7%	17%	16%	16%
4 (highest)	$ 0.77	$ 0.11	12%	34%	44%	45%
Mean is equal	**	***	***	***	***	***
Median is equal	**	***	***	***	***	***
No linear relation to the flipping ratio	**	***	***	**	***	*
Panel B: All IPO Flips						
1 (lowest)	$ 0.57	$ 0.03	4%	7%	6%	8%
2	$ 0.76	$ 0.04	6%	13%	14%	14%
3	$ 0.86	$ 0.06	6%	17%	17%	17%
4 (highest)	$ 0.75	$ 0.12	13%	37%	47%	47%
Mean is equal	***	***	***	***	***	***
Median is equal	***	***	***	***	***	***
No linear relation to the flipping ratio	**	***	***	**	***	*

Table 3

The Effect of Naked Short Positions and Exchange Listing on Issue Characteristics

This table compares means for lead underwriting fee revenue, trading revenue, and initial returns across IPOs with and without naked short positions and between trading venues; that is, Nasdaq versus the NYSE. Underwriting trading revenue is estimated as the sum of total underwriting fees, selling concession times the Lead's percentage allocation in the issue, and the management fee divided by the number of co-managers. Lead trading revenue equals the product of the Lead's market share in block trades (5,000+ size) in the month following the IPO, one-half the average volume-weighted effective spread, and total trading volume during the first two days. Flipping refers to shares allocated to the Lead's institutional customers that are sold during the first two trading days. The flipping ratio is flipping divided by the number of shares offered. For the hypothesis tests, * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

	Exogenous			**Endogenous**				
	Estimated lead underwriting fee revenue per share	Lead trading revenue (first two trading days) per share	Lead trading revenue / Total lead revenue (first two trading days)	First-day return (offer to open)	First-day return (offer to close)	Two-day return (offer to close)	Institutional flipping ratio	Total flipping ratio
Panel A: Lead Underwriters' Naked Short Positions (12 issues have naked short positions of at least 5%)								
No naked short > 5% of issue size	$ 0.74	$ 0.06	7%	19%	23%	23%	15%	17%
Naked short >= 5%	$ 0.58	$ 0.02	3%	2%	-4%	-2%	9%	11%
Mean is equal	***	***	***	***	***	***	**	**
Median is equal	*	***	***	***	***	***	**	**
No linear relation to the naked short dummy	*	**	**	***	***	***	**	**
Panel B: Exchange Listing (73 issues trade on Naasdaq, 37 are exchange listed)								
Exchange listed	$ 0.77	$ 0.04	4%	11%	10%	11%	12%	14%
Nasdaq	$ 0.70	$ 0.07	8%	21%	25%	25%	16%	16%
Mean is equal	-	***	***	***	***	***	***	**
Median is equal	-	***	***	**	**	*	**	*
No linear relation to the exchange dummy	-	***	***	***	***	***	**	**

Table 4

Reduced-Form Regression Analysis of the Flipping Ratio and Initial Returns

This table shows OLS reduced-form regression results for 110 IPOs between May 1997 and June 1998. The flipping ratio is the number of shares flipped divided by issue size. Issue size is the number of shares offered. Initial returns are calculated from the offer price to the closing price on the second trading day. Two regressions are shown, one for the flipping ratio and one for initial returns. For the flipping ratio, the model is estimated using all flips and only institutional flips of the lead underwriter's customers, respectively. Flips are aggregated over the first two days of trading. The estimated underwriting fee revenue equals the sum of total underwriting fees, selling concession times the Lead's percentage allocation in the issue, and the management fee divided by the number of co-managers, all divided by the total shares in the offering. Average effective spreads are measured over the first two trading days. The market share for the Lead's trading is based on trades of 5,000 shares or more. The appropriate p-values are shown in parentheses below each estimated coefficient.

	Flipping Ratio				**2-Day Initial Returns**	
	All Flips		*Institutional Flips*			
Independent Variable	Model A	Model B	Model A	Model B	Model A	Model B
Intercept	0.758	0.748	0.731	0.725	1.482	1.509
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.002)*	*(0.002)*
Log (Est. lead underwriting fee revenue per share)	-0.041	-0.040	-0.059	-0.059	-0.127	-0.124
	(0.091)	*(0.097)*	*(0.012)*	*(0.013)*	*(0.070)*	*(0.077)*
Log (Market share times effective spread)	0.029	0.026	0.026	0.023	0.094	0.090
	(0.004)	*(0.012)*	*(0.007)*	*(0.020)*	*(0.001)*	*(0.003)*
Log (Market share times effective spread) * Naked short dummy		0.034		0.018		-0.138
		(0.484)		*(0.705)*		*(0.333)*
Log (Issue size including short position)	-0.034	-0.034	-0.034	-0.034	-0.071	-0.073
	(0.001)	*(0.002)*	*(0.001)*	*(0.001)*	*(0.019)*	*(0.016)*
Dummy if naked short position >= 5% of issue size		0.118		0.054		-0.600
		(0.522)		*(0.764)*		*(0.260)*
15-day pre-offering CRSP combined index return	0.128	0.136	0.064	0.071	-0.409	-0.383
	(0.529)	*(0.508)*	*(0.746)*	*(0.720)*	*(0.491)*	*(0.518)*
Initial price range revised upwards	0.072	0.071	0.080	0.078	0.289	0.275
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
Initial price range revised downwards	-0.110	-0.108	-0.108	-0.107	-0.113	-0.113
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.070)*	*(0.070)*
p-value for the F-statistic	0.000	0.000	0.000	0.000	0.000	0.000
Adjusted R-squared	0.431	0.423	0.429	0.421	0.373	0.377

Table 5

Simultaneous-Equation Model of IPO Flipping and Two-Day Returns

This table shows the results of joint LIML estimation of the two structural equations in the model. The endogenous variables are the flipping ratio and the gross return on the issue calculated over the first two trading days. The sample includes 110 IPOs between May 1997 and June 1998. This table shows the results of joint LIML estimation of the two structural equations in the model. The endogenous variables are the flipping ratio and the gross return on the issue calculated over the first two trading days. The sample includes 110 IPOs between May 1997 and June 1998. We use four instrumental variables to provide first-stage estimates of the endogenous variables: log of issue proceeds, 15-day pre-offering CRSP value-weighted combined index returns, the number of IPOs and the average first-day returns, each calculated during the three months preceding the issue.

Flipping refers to shares allocated to the Lead's institutional customers that are sold during the first two trading days. Issue size is the number of shares offered. The flipping ratio is the number of shares flipped divided by issue size. The estimated underwriting revenue equals the sum of total underwriting fees, selling concession times the Lead's percentage allocation in the issue, and the management fee divided by the number of co-managers. Initial returns, flipping, and effective spreads are measured over the first two trading days. To identify the system, we use the identity log(2-day gross return) = log(2nd-day closing price) - log(offer price). Because we use LIML, the flipping equation is identical for models A and B and is only reported once. p-values are reported in parentheses.

Independent Variable	Flipping Ratio	Log (2-Day Gross Return)	
		Model A	***Model B***
Intercept	0.713	0.896	0.806
	(0.000)	*(0.014)*	*(0.031)*
Log (Est. lead underwriting fee revenue per share)		-0.082	-0.085
		(0.102)	*(0.090)*
Log (Trading market share times mean effective spread)		0.067	0.062
		(0.001)	*(0.004)*
Log (Market share times effective spread) * Naked short dummy			-0.069
			(0.531)
Log (Issue size including short position)	-0.030	-0.042	-0.036
	(0.029)	*(0.059)*	*(0.106)*
Dummy if naked short position >= 5% of issue size			-0.269
			(0.546)
15-day pre-offering CRSP combined index return	0.027	-0.350	-0.378
	(0.894)	*(0.406)*	*(0.367)*
Initial filing range revised upwards	0.075	0.207	0.194
	(0.000)	*(0.000)*	*(0.000)*
Initial filing range revised downwards	-0.102	-0.070	-0.069
	(0.000)	*(0.134)*	*(0.135)*
Endogenous Variables:			
Institutional flipping ratio		0.285	0.340
		(0.238)	*(0.159)*
Log (offer price)	-0.040		
	(0.281)		
Flipping Ratio * Naked short dummy			-0.807
			(0.310)
p-value F-statistic	0.000	0.000	0.000
Adjusted R-squared	0.378	0.411	0.428