THE JOURNAL OF FINANCE • VOL. LVII, NO. 4 • AUGUST 2002

A Review of IPO Activity, Pricing, and Allocations

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ABSTRACT

We review the theory and evidence on IPO activity: why firms go public, why they reward first-day investors with considerable underpricing, and how IPOs perform in the long run. Our perspective is threefold: First, we believe that many IPO phenomena are not stationary. Second, we believe research into share allocation issues is the most promising area of research in IPOs at the moment. Third, we argue that asymmetric information is not the primary driver of many IPO phenomena. Instead, we believe future progress in the literature will come from nonrational and agency conflict explanations. We describe some promising such alternatives.

From 1980 to 2001, the number of companies going public in the United States exceeded one per business day. The number of initial public offerings (IPOs) has varied from year to year, however, with some years seeing fewer than 100 IPOs, and others seeing more than 400. These IPOs raised $488 billion (in 2001 dollars) in gross proceeds, an average of $78 million per deal. At the end of the first day of trading, their shares traded on average at 18.8 percent above the price at which the company sold them. For an investor buying shares at the first-day closing price and holding them for three years, IPOs returned 22.6 percent. Still, over three years, the average IPO underperformed the CRSP value-weighted market index by 23.4 percent and underperformed seasoned companies with the same market capitalization and book-to-market ratio by 5.1 percent.

In a nutshell, these numbers summarize the patterns in issuing activity, underpricing, and long-run underperformance, which have been the focus of a large theoretical and empirical literature. We survey this literature, focusing on recent papers. Space constraints force us to take a U.S.-centric point of view and to omit a description of the institutional aspects of going public. The interested reader can consult Ellis, Michaely, and O'Hara (2000),

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Foerster (2000), Jenkinson and Ljungqvist (2001), and Killian, Smith, and Smith (2001) for descriptions of the institutional process. Ritter (2002) and especially Jenkinson and Ljungqvist give extensive coverage to international patterns and practices.

Averages hide the time trends and year-by-year variation in these phenomena, as shown in Table I. The 1980s saw modest IPO activity (about $8 billion in issuing activity per year). In the 1990s, issuing volume roughly doubled to $20 billion per year during 1990 to 1994, doubled again from 1995 to 1998 ($35 billion per year), and then doubled again from 1999 to 2000 ($65 billion per year), before falling to $34 billion in 2001. Average first-day returns show a similar pattern, increasing from 7.4 percent in the 1980s to 11.2 percent in the early 1990s, to 18.1 percent in the mid-1990s, and to 65.0 percent in 1999 and 2000, before falling back to 14.0 percent in 2001. The long-run performance of IPOs also varies over time. Three-year market-adjusted buy-and-hold returns are negative in every subperiod, but not for every cohort year. Style-adjusted buy-and-hold returns are not as reliably negative, with many cohorts, and some subperiods, having positive style-adjusted buy-and-hold returns.

Our article seeks to review different explanations for these patterns in issuing activity, underpricing, and long-run underperformance. But it also weighs in with our personal perspective on issues that are still contentious. We believe that the time-variation in these phenomena deserves more emphasis. For example, the long-run performance of IPOs is not only sensitive to the widely debated choice of econometric methodology, but also to the choice of sample period, as shown in Table I. Further, we argue that asymmetric information theories are unlikely to be the primary determinant of fluctuations in IPO activity and underpricing, especially the excesses of the Internet bubble period. Instead, we believe that specific nonrational explanations and agency explanations will play a bigger role in the future research agenda. In discussing theories of underpricing, we devote significant attention to the topic of share allocations and subsequent ownership. In our view, how IPO shares are allocated is one of the most interesting issues in IPO research today.

The remainder of this article is organized as follows. In Section I, we survey IPO activity. Section II covers IPO pricing and allocation. Section III presents evidence and analysis on the long-run underperformance of IPOs, and Section IV concludes.

I. IPO Activity: Choosing to Go Public

The first question must be “why do firms go public?” In most cases, the primary answer is the desire to raise equity capital for the firm and to create a public market in which the founders and other shareholders can convert some of their wealth into cash at a future date. Nonfinancial reasons, such as increased publicity, play only a minor role for most firms:

Table I

Number of IPOs, First-day Returns, Gross Proceeds, Amount of Money Left on the Table, and Long-run Performance, by Cohort Year, 1980 to 2001

The equally weighted (EW) average first-day return is measured from the offer price to the first CRSP-listed closing price. Gross proceeds is the amount raised from investors in millions (2001 purchasing power using the CPI, global offering amount, excluding overallotment options). Money left on the table (millions of dollars, 2001 purchasing power) is calculated as the number of shares issued times the change from the offer price to the first-day closing price. EW average three-year buy-and-hold percentage returns (capital gains plus dividends) are calculated from the first closing market price to the earlier of the three-year anniversary price, the delisting price, or September 30, 2001. Buy-and-hold returns for initial public offerings (IPOs) occurring after September 30, 2000 are not calculated. Market-adjusted returns are calculated as the buy-and-hold return on an IPO minus the compounded daily return on the CRSP value-weighted index of AMEX, Nasdaq, and NYSE firms. Style-adjusted buy-and-hold returns are calculated as the difference between the return on an IPO and a style-matched firm. For each IPO, a non-IPO matching firm that has been CRSP listed for at least five years with the closest market capitalization and book-to-market ratio as the IPO is used. If this is delisted prior to the IPO return's ending date, or if it conducts a follow-on stock offering, a replacement matching firm is spliced in on a point-forward basis. IPOs with an offer price below $5.00 per share, unit offers, REITs, closed-end funds, banks and S&Ls, ADRs, and IPOs not listed on CRSP within six months of issuing have been excluded. Data is from Thomson Financial Securities Data, with supplements from Dealogic and other sources, and corrections by the authors.

Year	Number of IPOs	Average First-day Return	Aggregate Gross Proceeds, Millions	Aggregate Money Left on the Table, Millions	Average 3-Year Buy-and-Hold Return		
					IPOs	Market-Adjusted	Style-Adjusted
1980	70	14.5%	$ 2,020	$ 408	88.2%	35.5%	17.1%
1981	191	5.9%	$ 4,613	$ 264	12.8%	−26.2%	−7.4%
1982	77	11.4%	$ 1,839	$ 245	32.2%	−36.5%	−48.7%
1983	442	10.1%	$ 15,348	$ 1,479	15.4%	−38.7%	2.5%
1984	172	3.6%	$ 3,543	$ 86	27.7%	−51.3%	3.0%
1985	179	6.3%	$ 6,963	$ 354	7.6%	−39.5%	7.3%
1986	378	6.3%	$ 19,653	$ 1,030	18.6%	−20.4%	14.3%
1987	271	6.0%	$ 16,299	$ 1,019	−1.8%	−18.9%	4.5%
1988	97	5.4%	$ 5,324	$ 186	55.7%	8.3%	51.3%
1989	105	8.1%	$ 6,773	$ 336	51.1%	16.8%	32.5%
1990	104	10.8%	$ 5,611	$ 454	12.2%	−34.1%	−32.4%
1991	273	12.1%	$ 15,923	$ 1,788	31.5%	−1.7%	5.8%
1992	385	10.2%	$ 26,373	$ 2,148	34.8%	−2.3%	−19.4%
1993	483	12.8%	$ 34,422	$ 3,915	44.9%	−7.8%	−23.9%
1994	387	9.8%	$ 19,323	$ 1,650	74.1%	−8.3%	1.0%
1995	432	21.5%	$ 28,347	$ 5,033	24.8%	−62.3%	−14.1%
1996	621	16.7%	$ 45,940	$ 7,383	25.6%	−57.0%	8.6%
1997	432	13.8%	$ 31,701	$ 4,664	67.7%	6.8%	41.0%
1998	267	22.3%	$ 34,628	$ 5,352	27.1%	9.1%	12.2%
1999	457	71.7%	$ 66,770	$ 37,943	−46.2%	−32.9%	−74.2%
2000	346	56.1%	$ 62,593	$ 27,682	−64.7%	−36.4%	−42.6%
2001	80	14.0%	$ 34,344	$ 2,973	n.a.	n.a.	n.a.
1980–1989	1,982	7.4%	$ 82,476	$ 5,409	20.8%	−24.7%	6.9%
1990–1994	1,632	11.2%	$101,652	$ 9,954	44.7%	−7.2%	−12.7%
1995–1998	1,752	18.1%	$140,613	$ 22,436	36.0%	−32.3%	11.6%
1999–2000	803	65.0%	$129,363	$ 65,625	−53.8%	−34.3%	−61.2%
2001	80	14.0%	$ 34,344	$ 2,973	n.a.	n.a.	n.a.
1980–2001	6,249	18.8%	$488,448	$106,397	22.6%	−23.4%	−5.1%

Absent cash considerations, most entrepreneurs would rather just run their firms than concern themselves with the complex public market process. This still leaves the question of why IPOs are the best way for entrepreneurs to raise capital, and why the motivation to do an IPO is stronger in some situations or times (see Table I) than in others. Stepping outside our own sample, Gompers and Lerner (2001) report that there were fewer U.S. IPOs from 1935 to 1959 than the 683 in 1969 alone, and La Porta et al. (1997) report wide differences in IPO activity across countries.

A. Life Cycle Theories

The first formal theory of the going public decision appeared in Zingales (1995). He observed that it is much easier for a potential acquirer to spot a potential takeover target when it is public. Moreover, entrepreneurs realize that acquirers can pressure targets on pricing concessions more than they can pressure outside investors. By going public, entrepreneurs thus help facilitate the acquisition of their company for a higher value than what they would get from an outright sale.[1] In contrast, Black and Gilson (1998) point out that entrepreneurs often regain control from the venture capitalists in venture-capital-backed companies at the IPO. Thus, many IPOs are not so much exits for the entrepreneur as they are for the venture capitalists.

Chemmanur and Fulghieri (1999) develop the more conventional wisdom that IPOs allow more dispersion of ownership, with its advantages and disadvantages. Pre-IPO "angel" investors or venture capitalists hold undiversified portfolios, and, therefore, are not willing to pay as high a price as diversified public-market investors. There are fixed costs associated with going public, however, and proprietary information cannot be costlessly revealed—after all, small investors cannot take a tour of the firm and its secret inventions. Thus, early in its life cycle, a firm will be private, but if it grows sufficiently large, it becomes optimal to go public.

Public trading per se has costs and benefits. Maksimovic and Pichler (2001) point out that a high public price can attract product market competition. Public trading, however, can, in itself, add value to the firm, as it may inspire more faith in the firm from other investors, customers, creditors, and suppliers. Being the first in an industry to go public sometimes confers a first-mover advantage. The quintessential company often cited as an example is Netscape. However, Spyglass was a browser company that went public two months before Netscape—and quickly faltered under Netscape's competition. Schultz and Zaman (2001) report that many Internet firms that went public in the late 1990s pursued an aggressive acquisition strategy, which they interpret as an attempt to preempt competitors.

[1] Brau, Francis, and Kohers (2002) report evidence on IPOs versus acquisitions in the United States.

B. Market-Timing Theories

Lucas and McDonald (1990) develop an asymmetric information model where firms postpone their equity issue if they know they are currently undervalued. If a bear market places too low a value on the firm, given the knowledge of entrepreneurs, then they will delay their IPOs until a bull market offers more favorable pricing. In Choe, Masulis, and Nanda (1993), firms avoid issuing in periods where few other good-quality firms issue. Other theories have argued that markets provide valuable information to entrepreneurs ("information spillovers"), who respond to increased growth opportunities signaled by higher prices (Subrahmanyam and Titman (1999), Schultz (2000)).

We suggest that in addition to these rational theories for IPO volume fluctuations, a plausible semirational theory without asymmetric information can also explain cycles in issuing activity: Entrepreneurs' sense of enterprise value derives more from their internal perspective, their day-to-day involvement with the underlying business fundamentals, and less so from the public stock market. Sudden changes in the value of publicly traded firms are not as quickly absorbed into the private sense of value held by entrepreneurs. Thus, entrepreneurs adjust their valuation with a lag. As a result, even if the market price is driven by irrational public sentiment or the entrepreneur's price is driven by irrational private sentiment, entrepreneurs are more inclined to sell shares *after* valuations in the public markets have increased.

C. Evidence

For the most part, formal theories of IPO issuing activity are difficult to test. This is because researchers usually only observe the set of firms actually going public. They do not observe how many private firms could have gone public. Pagano, Panetta, and Zingales (1998) escape this criticism with a unique data set of Italian firms. They find that larger companies and companies in industries with high market-to-book ratios are more likely to go public, and that companies going public seem to have reduced their costs of credit. Remarkably, they also find that IPO activity follows high investment and growth, not vice versa. Lerner (1994) focuses on a single U.S. industry, biotechnology. Lerner documents that industry market-to-book ratios have a substantial effect on the decision to go public rather than to acquire additional venture capital financing.

The academic literature has tended to view increases in the valuation of comparable firms as reflecting improved growth opportunities. But more favorable investor sentiment could also play a role in the increased valuations. When investors are overoptimistic, firms respond by issuing equity in a "window of opportunity." Baker and Wurgler (2000) investigate a prediction of this framework. Using annual data starting in the 1920s on aggregate equity issuance relative to debt plus equity issuance, they find that the higher the fraction of equity issuance is, the lower the overall stock market

Table II

Fraction of IPOs with Negative Earnings (Trailing Last 12 Months), 1980 to 2001

IPOs with an offer price below $5.00 per share, unit offers, ADRs, closed-end funds, REITs, bank and S&L IPOs, and firms not listed on CRSP within six months of the offer date are excluded. When available, we use the earnings per share for the most recent 12 months (commonly known as LTM for last 12 months) prior to going public. When a merger is involved, we use the pro forma numbers (as if the merger had already occurred). When unavailable, we use the most recent fiscal year EPS numbers. Missing numbers are supplemented by direct inspection of prospectuses on EDGAR, and EPS information from Dealogic (also known as CommScan) for IPOs after 1991, and Howard and Co.'s *Going Public: The IPO Reporter* from 1980 to 1985. Tech stocks are defined as Internet-related stocks plus other technology stocks, not including biotech. Loughran and Ritter (2001) list the SIC codes in their appendix 4.

Time Period	Number of IPOs	Percentage Tech Stocks	Percentage of IPOs with EPS < 0	Mean First-day Returns	
				EPS < 0	EPS ≥ 0
1980–1989	1,982	26%	19%	9.1%	6.8%
1990–1994	1,632	23%	26%	10.8%	11.4%
1995–1998	1,752	37%	37%	19.2%	17.4%
1999–2000	803	72%	79%	72.0%	43.5%
2001	80	29%	49%	13.4%	14.6%
1980–2001	6,249	34.5%	34%	31.4%	12.5%

return is in the following year. Lowry (2002) finds that investor sentiment (measured by the discount on closed-end funds), growth opportunities, and adverse selection considerations all are determinants of aggregate IPO volume. A glance at Table I also conveys some of the correlation between IPO issuing activity and underpricing, investigated in greater detail in Lowry and Schwert (2002). They and other authors find that high IPO first-day returns lead high IPO activity by about six months.

High IPO activity may follow high underpricing because underwriters encourage more firms to go public when public valuations turn out to be higher than expected and because underwriters discourage firms from filing or proceeding with an offering when public valuations turn out to be lower than expected. For example, in 2000, the Nasdaq Composite index had the lowest return in Nasdaq's 30-year history, and the ratio of withdrawn offerings to completed offerings increased to 38 percent, a proportion much higher than normal (Ljungqvist and Wilhelm (2002b)).

D. The Changing Composition of IPO Issuers

Aggregate numbers disguise the fact that the type of firms going public has changed over the years. Table II shows that the percentage of technology firms increased from about 25 percent of the IPO market in the 1980s and early 1990s to 37 percent after 1995 and an amazing 72 percent during the

Internet bubble, before returning to 29 percent in 2001.[2] The increase in the percentage of technology firms over time is mirrored in the number of firms with negative earnings in the 12 months prior to going public. In the 1980s, only 19 percent of firms had negative earnings before going public. This gradually increased to 37 percent by 1995 to 1998, and then rose precipitously to 79 percent during the Internet bubble. Although we do not show it in our tables, it was unusual for a prestigious investment banker in the 1960s and 1970s to take a firm public that did not have at least four years of positive earnings. In the 1980s, four quarters of positive earnings was still standard. In the 1990s, fewer and fewer firms met this threshold. Still, the investment banking firm's analyst would normally project profitability in the year after going public. During the bubble, firms with no immediate prospect of becoming profitable became common. For example, public forecasts for eToys projected no profits for at least two years. At the time of going public in May 1999, forecasted EPS was −\$0.27 for 1999 and −\$0.55 for 2000. These turned out to be overly optimistic forecasts, as eToys liquidated in 2001.

It is conventional wisdom among both academics and practitioners that the quality of firms going public deteriorates as a period of high issuing volume progresses. Helwege and Liang (2001) provide evidence, however, that in the 1982 to 1993 period, there was little difference in the observable characteristics of firms in low-volume and high-volume markets. Consistent with this, Loughran and Ritter (2001) report that the median age of firms going public has been remarkably stable at about 7 years old since 1980. The exception to this pattern is the Internet bubble period, when the median age fell to 5 years, and 2001, when the median age rose to 12 years.

Table II shows that there is a reasonably strong relation across time between the percentage of firms with negative earnings and the average first-day returns. The last two columns report average first-day returns, conditional on whether the firm had positive earnings or not. Except for the bubble period, there is little difference between the two columns in the average first-day returns. Thus, the relative lack of a cross-sectional pattern suggests that the increase in the fraction of firms with negative earnings is not a primary cause of the increase in underpricing over time.

Remarkably, IPO volume fluctuation in the late 1990s is attributable almost entirely to the tech sector: The number of old-economy stocks going public remained at a level of about 100 firms per year, before, during, and after the bubble. The large number of IPOs by young Internet firms in 1999 to 2000, and their almost complete disappearance in 2001, raises the issue of what determines bubbles. But this is a question that transcends the IPO literature.

[2] Tech stocks are defined as Internet stocks, computer software and hardware, communications equipment, electronics, navigation equipment, measuring and controlling devices, medical instruments, telephone equipment, and communications services, but do not include biotechnology.

E. Summary

We interpret the evidence on the going-public decision as suggesting that firms go public in response to favorable market conditions, but only if they are beyond a certain stage in their life cycle. Perhaps the most important unanswered question is why issuing volume drops so precipitously following stock market drops. Although offer prices are lowered, many firms withdraw their offering rather than proceed with their IPO. In other words, why is there quantity adjustment, rather than price adjustment? This is a puzzle not only for the IPO market, but for follow-on offerings as well.

II. IPO Pricing and Allocation

Stoll and Curley (1970), Logue (1973), Reilly (1973), and Ibbotson (1975) first documented a systematic increase from the offer price to the first day closing price.[3] Academics use the terms first-day returns and underpricing interchangeably. In our sample of 6,249 IPOs from 1980 to 2001 in Table I, the average first-day return is 18.8 percent.[4] Although not shown here, approximately 70 percent of the IPOs end the first day of trading at a closing price greater than the offer price and about 16 percent have a first-day return of exactly zero.[5] We know of no exceptions to the rule that the IPOs of operating companies are underpriced, on average, in all countries. The offerings of nonoperating companies, such as closed-end funds, are generally not underpriced.

A. Theoretical Explanations of Short-run Underpricing

Ibbotson (1975) offered a list of possible explanations for underpricing, many of which were formally explored by other authors in later work. Before going into detail, it is important to understand that simple fundamental market misvaluation or asset-pricing risk premia are unlikely to explain the average first-day return of 18.8 percent reported in our Table I. To put this in perspective, the comparable daily market return has averaged only 0.05 percent. Furthermore, if diversified IPO first-day investors require compen-

[3] The opening market price is close to an unbiased indicator of the closing market price on the first day, so results are insensitive to whether the opening or closing market price is used. The vast majority of empirical work has used the first closing price to measure the first-day return. This is also frequently called the initial return.

[4] The annual volume numbers reported in Table I are lower than those reported in Ritter (1998, Table 2) because of our exclusion of "penny" stocks (defined as IPOs with an offer price of below $5.00 per share) and unit offers. Ritter reports annual volume numbers for IPOs starting in 1960. In the 1960s, 1970s, and 1980s, penny stock IPOs were a major portion of the number of IPOs, although only a small portion of aggregate proceeds.

[5] From 1980 to 1994, only 15 out of 3,614 IPOs doubled in value on their first day of trading. During 1995 to 1998, 34 out of 1,752 IPOs doubled on the first day. In the Internet bubble years of 1999 to 2000, 182 out of 803 offerings doubled in price on the first day, with the last occurrence in November 2000.

sation for bearing systematic or liquidity risk, why do second-day investors (purchasing from first-day investors) not seem to require this premium? After all, fundamental risk and liquidity constraints are unlikely to be resolved within one day. Thus, the solution to the underpricing puzzle has to lie in focusing on the setting of the offer price, where the normal interplay of supply and demand is suppressed by the underwriter.

One way of classifying theories of underpricing is to categorize them on the basis of whether asymmetric information or symmetric information is assumed. The former can, in turn, be classified into theories in which IPO issuers are more informed than investors (perhaps about internal projects) and into theories in which investors are more informed than the issuer (perhaps about demand). Because we believe that recent share allocation- and trading-related explanations offer considerable promise, we take the liberty to discuss these newer theories in their own section, even though they could also be distributed into asymmetric and symmetric information theories.

A.1. Theories Based on Asymmetric Information

If the issuer is more informed than investors, rational investors fear a lemons problem: Only issuers with worse-than-average quality are willing to sell their shares at the average price. To distinguish themselves from the pool of low-quality issuers, high-quality issuers may attempt to signal their quality. In these models, better quality issuers deliberately sell their shares at a lower price than the market believes they are worth, which deters lower quality issuers from imitating. With some patience, these issuers can recoup their up-front sacrifice post-IPO, either in future issuing activity (Welch (1989)), favorable market responses to future dividend announcements (Allen and Faulhaber (1989)), or analyst coverage (Chemmanur (1993)). In common with many other signaling models, high-quality firms demonstrate that they are high quality by throwing money away. One way to do this is to leave money on the table in the IPO. On theoretical grounds, however, it is unclear why underpricing is a more efficient signal than, say, committing to spend money on charitable donations or advertising.

The evidence in favor of these signaling theories is, at best, mixed: There is evidence of substantial postissuing market activity by IPO firms (Welch (1989)), and it is clear that some issuers approach the market with an intention to conduct future equity issues.[6] However, there is reason to believe that *any* price appreciation would induce entrepreneurs to return to the market for more funding.[7] Jegadeesh, Weinstein, and Welch (1993) find that returns after the first day are just as effective in inducing future issuing activity as the first-day returns are. Michaely and Shaw (1994) outright

[6] It is worth noting that there is little controversy about whether issuing firms pursue a dynamic strategy, in which the IPO is just one part. The controversy is whether postissuing activity can explain underpricing, not IPO activity.

[7] Van Bommel and Vermaelen (2001) find that firms with higher first-day returns spend more money on investment after the IPO.

reject signaling: In a simultaneous equation model, they find no evidence of either a higher propensity to return to the market for a seasoned offering or of a higher propensity to pay dividends for IPOs that were more underpriced. Still, aside from the persistence of the signaling explanation on the street, its most appealing feature is that some issuers *voluntarily desire* to leave money on the table to create "a good taste in investors' mouths." As such, it is relatively compatible with higher levels of IPO underpricing.

If investors are more informed than the issuer, for example, about the general market demand for shares, then the issuer faces a placement problem. The issuer does not know the price the market is willing to bear. In other words, an issuer faces an unknown demand for its stock. A number of theories model a specific demand curve.

One can simply assume that all investors are equally informed, and thus purchase shares only if their price is below their common assessment. Observed (successful) IPOs thus are necessarily underpriced. There are, however, some overpriced firms going public, which would not be predicted because all investors are assumed to know that these would be overpriced. A more realistic assumption is that investors are differentially informed. Pricing too high might induce investors and issuers to fear a winner's curse (Rock (1986)) or a negative cascade (Welch (1992)).

In a winner's curse, investors fear that they will only receive full allocations if they happen to be among the most optimistic investors. When everyone desires the offering, they get rationed. An investor would receive a full allocation of overpriced IPOs but only a partial allocation of underpriced IPOs. Thus, his average return, conditional on receiving shares, would be below the unconditional return. To break even, investors need to be underpriced. Koh and Walter (1989) have rationing information and find that an uninformed strategy in Singapore indeed just about broke even.

In an informational cascade, investors attempt to judge the interest of other investors. They only request shares when they believe the offering is hot. Pricing just a little too high leaves the issuer with too high a probability of complete failure, in which investors abstain because other investors abstain. In support, Amihud, Hauser, and Kirsh (2001) find that IPOs tend to be either undersubscribed or hugely oversubscribed, with very few offerings moderately oversubscribed.

Benveniste and Spindt (1989), Benveniste and Wilhelm (1990), and Spatt and Srivastava (1991) argue that the common practice of "bookbuilding" allows underwriters to obtain information from informed investors.[8] With bookbuilding, a preliminary offer price range is set, and then underwriters and issuers go on a "road show" to market the company to prospective investors. This road show helps underwriters to gauge demand as they record "indications of interest" from potential investors. If there is strong demand, the underwriter will set a higher offer price. But if potential investors know that

[8] Benveniste and Busaba (1997) consider whether bookbuilding or cascade creation is more profitable from the issuer's point of view.

showing a willingness to pay a high price will result in a higher offer price, these investors must be offered something in return. To induce investors to truthfully reveal that they want to purchase shares at a high price, underwriters must offer them some combination of more IPO allocations and underpricing when they indicate a willingness to purchase shares at a high price.

Bookbuilding theories lend themselves unusually well to empirical tests with available data. The most commonly cited evidence in favor of bookbuilding theories is the effect of revisions in the offer price during the filing period, first documented by Hanley (1993). She finds that underwriters do not fully adjust their pricing upward to keep underpricing constant when demand is strong. Thus, when underwriters revise the share price upward from their original estimate in the preliminary prospectus, underpricing tends to be higher. Table III shows that this pattern has held throughout 1980 to 2001: When the offer price exceeds the maximum of the original file price range, the average underpricing of 53 percent is significantly above the 12 percent for IPOs priced within their filing range, or the 3 percent for IPOs adjusting their offer price downward. This extra underpricing is interpreted to be compensation that is necessary to induce investors to reveal their high personal demand for shares. Consistent with the information revelation theory of bookbuilding, Lee, Taylor, and Walter (1999) and Cornelli and Goldreich (2001) show that informed investors request more, and preferentially receive more, allocations. In related work, Cornelli and Goldreich (2002) examine orders placed by institutional investors and find that underwriters set offer prices that are more related to the prices bid than to the quantities demanded.

The information-gathering perspective of bookbuilding is certainly useful, but the theory also suggests that the information provided by one incremental investor is not very valuable when the investment banker can canvas hundreds of potential investors. Thus, it is not obvious that this framework is capable of explaining average underpricing of more than a few percent. The average underpricing of 53 percent, conditional on the offer price having been revised upwards, reported in Table III, seems too large to be explained as equilibrium compensation for revealing favorable information.

Baron (1982) offers a different, agency-based explanation for underpricing. His theory also has the issuer less informed, but relative to its underwriter, not relative to investors. To induce the underwriter to put in the requisite effort to market shares, it is optimal for the issuer to permit some underpricing, because the issuer cannot monitor the underwriter without cost. Muscarella and Vetsuypens (1989), however, find that when underwriters themselves go public, their shares are just as underpriced even though there is no monitoring problem. This evidence does not favor the Baron hypothesis, although it does not refute it either. After all, underwriters may want to underprice their own offerings in order to make the case that underpricing is a necessary cost of going public.

Habib and Ljungqvist (2001) also argue that underpricing is a substitute for costly marketing expenditures. Using a data set of IPOs from 1991 to 1995, they report that an extra dollar left on the table reduces other mar-

Table III

Mean First-day Returns for IPOs Conditional upon Offer Price Revision, 1980 to 2001

IPOs are categorized by whether the offer price is below, within, or above the original file price range. For example, an IPO would be classified as within the original file price range of $10.00–$12.00 if its offer price is $12.00. Initial public offerings with an offer price below $5.00 per share, unit offers, ADRs, closed-end funds, REITs, bank and S&L IPOs, and those not listed by CRSP within six months of the offer date are excluded. Eleven IPOs from 1980 to 1989 have a missing file price range, and are deleted from this table.

Time Period	Number of IPOs	Percentage of IPOs with Offer Price Relative to File Range			Mean First-day Returns			% of First-day Returns > 0		
		Below	Within	Above	Below	Within	Above	Below	Within	Above
1980–1989	1,971	27.6%	59.9%	12.5%	0.6%	7.8%	20.5%	32%	62%	88%
1990–1994	1,632	26.1%	54.2%	19.7%	2.4%	10.8%	24.1%	49%	75%	93%
1995–1998	1,752	25.0%	49.1%	25.9%	6.1%	13.8%	37.6%	59%	80%	97%
1999–2000	803	18.1%	36.8%	45.1%	7.9%	26.8%	119.0%	59%	77%	96%
2001	80	25.0%	60.0%	15.0%	7.2%	12.5%	31.4%	70%	83%	92%
1980–2001	6,238	25.2%	52.3%	22.5%	3.3%	12.0%	52.7%	47%	72%	94%

keting expenditures by a dollar. As with almost all other theories of underpricing, however, these trade-off theories do not plausibly explain the severe underpricing of IPOs during the Internet bubble. During the bubble, the IPOs of many Internet firms were the easiest shares ever to sell because of the intense interest by many investors. It is difficult to believe that an underwriter could not have easily placed shares with half the underpricing that was observed.

All theories of underpricing based on asymmetric information share the prediction that underpricing is positively related to the degree of asymmetric information. When the asymmetric information uncertainty approaches zero in these models, underpricing disappears entirely. Consequently, a strategy of selling IPOs only in bundles could reduce the uncertainty about the average value of offerings, and with it, the average underpricing necessary to successfully go public. In other words, because underwriters have discretion regarding whom shares are allocated to, they could insist on selling IPOs only to investors who agree to buy both hot and cold IPOs. For average levels of underpricing that were observed in the 1980s, 7.4 percent, the bundling costs (e.g., waiting for sufficiently many IPOs to become available, taste differences across investors, disagreements among issuers about value) may be higher than the bundling benefits. However, for the 65 percent underpricing in 1999 and 2000, this is not likely to be the case.

A.2. Theories Based on Symmetric Information

There are also theories of underpricing that do not rely on asymmetric information that is resolved on the first day of trading. Tinic (1988) and Hughes and Thakor (1992) argue that issuers underprice to reduce their legal liability: An offering that starts trading at \$30 that is priced at \$20 is less likely to be sued than if it had been priced at \$30, if only because it is more likely that at some point the aftermarket share price will drop below \$30 than below \$20. In spite of this, Drake and Vetsuypens (1993) find that sued IPOs had higher, not lower underpricing, that is, that underpricing did not protect them from being sued. However, Lowry and Shu (2002) point out that this may be because IPOs more likely to be sued later also underpriced more. In our opinion, leaving money on the table appears to be a cost-ineffective way of avoiding subsequent lawsuits. But the most convincing evidence that legal liability is not the primary determinant of underpricing is that countries in which U.S. litigative tendencies are not present have similar levels of underpricing (Keloharju (1993)).

One popular related explanation for the high IPO underpricing during the Internet bubble is that underwriters could not justify a higher offer price on Internet IPOs, perhaps out of legal liability concerns, given the already lofty valuations on these companies. One way of interpreting this is that underwriters were “leaning against the wind” by not taking advantage of temporary overoptimism on the part of some investors. Although this argument has a certain plausibility, we find it unconvincing because investment banking firms were making other efforts to encourage overvaluations during the Internet bubble, such as subsequently issuing "buy" recommendations when market prices had risen far above the offer price.[9]

Boehmer and Fishe (2001) advance another explanation for underpricing. They note that trading volume in the aftermarket is higher, the greater is underpricing. (See Krigman, Shaw, and Womack (1999) and Ellis et al. (2000) for related evidence.) Thus, an underwriter that makes a market in a Nasdaq-listed IPO gains additional trading revenue. Unlike the lawsuit-avoidance explanation of underpricing, it is not clear how the issuing firm benefits from the underpricing, unless the increased liquidity is persistent (Booth and Chua (1996)).

B. Theories Focusing on the Allocation of Shares

In recent years, more attention has been drawn to how IPOs are allocated and how their shares trade. Part of the reason for the increased academic attention on share allocation is related to the increased public attention on perceived unfairness in how shares are allocated, given the large amount of money left on the table in recent years. Specifically, the allocation of shares to institutional investors versus individuals has been a topic of interest. The development of the literature on IPO trading activity has required access to detailed data, information that has only recently become available. We discuss this literature on allocation and trading initiation separately from the previous papers that we have reviewed because we believe that it explores the most interesting open questions today. How do investors decide in which issues to request IPO allocations, and how heavily influenced is this by perceptions of what others are going to do? Who receives IPO allocations? How do allocations relate to other business provided by the investor? How much effective bundling of shares across issues (and thus a reduction of average uncertainty) do subscribers experience? Do large institutions receive preferential treatment based on valuable information, and if so, what is it? Unfortunately, not only do the answers to these questions depend upon the sample period, but underwriters also usually guard information about the specifics of their share allocations, posing significant challenges to empiricists. Still, progress has already been made. Table IV classifies this literature into some popular lines of inquiry and lists some recent representative papers.

[9] For example, Credit Suisse First Boston (CSFB) took Corvis public on July 28, 2000, at an offer price of $36.00. At the closing price of $84.719 on the first day of trading, the first-day return was 135 percent. When the quiet period ended 25 calendar days after the IPO, the five comanaging underwriters all put out "buy" recommendations, and CSFB initiated coverage with a "strong buy" recommendation, even though the price had increased to $90. At $90 per share, Corvis had a market capitalization of $30 billion, despite never having had any revenue. (In December 2001, its market valuation was less than $1 billion.) Bradley, Jordan, and Ritter (2002) report that 87 percent of analyst initiations at the end of the quiet period were "buys" or "strong buys" during 1996 to 2000.

Table IV

Recent Articles Concerning the Allocation and Trading of IPO Shares

Discrimination to induce information revelation	
Benveniste, Busaba, and Wilhelm (1996)	Penalty bids allow discrimination to reward repeat investors
Sherman (2000)	Discretion allows bundling with book building
Sherman and Titman (2002)	Underpricing is the reward to investors for acquiring information
Discrimination due to agency problems between underwriters and issuers	
Loughran and Ritter (2002)	State-contingent issuer psychology boosts underwriter profits
Loughran and Ritter (2001)	Allocations of hot issues boost underwriter profits
Empirical documentation of institutional versus individual investors	
Aggarwal, Prabhala, and Puri (2002)	Institutions receive more hot IPOs than bookbuilding suggests
Cornelli and Goldreich (2001)	Underwriters use discretion to favor repeat investors (bundling)
Hanley and Wilhelm (1995)	Institutions are favored on hot IPOs, but bundling occurs
Lee, Taylor, and Walter (1999)	Institutions ask for more shares on hot IPOs, but suffer discrimination
Ljungqvist and Wilhelm (2002a)	Across countries, there is less underpricing if institutions are favored
Ownership structure: Monitoring and liquidity	
Booth and Chua (1996)	Allocations to many investors increase liquidity
Brennan and Franks (1997)	Underpricing results in many investors, entrenching managers
Field and Sheehan (2001)	Empirically, there is no relation between underpricing and blockholders
Mello and Parsons (1998)	Allocate IPO shares diffusely with a separate offer to blockholders
Stoughton and Zechner (1998)	Underpricing allows creation of a blockholder, inducing monitoring
Trading initiation: Supply and demand effects	
Aggarwal (2000)	Cold issues are overallocated
Cornelli and Goldreich (2002)	Offer price is more related to prices bid than to quantity demanded
Zhang (2001)	Overallocation of cold issues boosts aftermarket demand
Aftermarket trading: Flipping and stabilization	
Aggarwal (2002)	Hot IPOs are commonly flipped, especially by institutions
Aggarwal and Conroy (2000)	Opening trade price follows many quote revisions
Benveniste, Erdal, and Wilhelm (1998)	Penalty bids constrain selling by individuals on cold IPOs
Chowdhry and Nanda (1996)	Stabilization activities reduce the winner's curse
Ellis, Michaely, and O'Hara (2000)	Stabilization activities are a minor cost to underwriters
Fishe (2002)	Flipping creates artificial demand which is sometimes useful
Houge et al. (2001)	IPOs with heterogeneous valuations have worse long-run performance
Krigman, Shaw, and Womack (1999)	Institutions flip IPOs more successfully than individuals do
Ljungqvist, Nanda, and Singh (2001)	Selective flipping allows price discrimination

The seminal model focusing on the allocation of shares was Benveniste and Spindt (1989), which we have previously discussed along with other asymmetric information-based theories. In this model, underwriters use their discretion to extract information from investors, which reduces average underpricing and increases proceeds to the issuers. As Sherman (2000) and others have noted, the average level of underpricing required to induce information revelation is reduced if underwriters have the ability to allocate shares in future IPOs to investors. Sherman and Titman (2002) argue that there is an equilibrium degree of underpricing which compensates investors for acquiring costly information. Many models are at least partly based on the notion that if IPOs are underpriced on average, investors have an incentive to acquire information about the firms to try and discern which will be underpriced the most.

Loughran and Ritter (2002) explore the conflict of interest between underwriters and issuers. If underwriters are given discretion in share allocations, the discretion will not automatically be used in the best interests of the issuing firm. Underwriters might intentionally leave more money on the table then necessary, and then allocate these shares to favored buy-side clients. There is some evidence that underpriced share allocations have been used by underwriters to enrich buy-side clients in return for quid pro quos (Pulliam and Smith (2000, 2001), SEC news release 2002-14), to curry favor with the executives of other prospective IPO issuers in a practice known as "spinning" (Siconolfi (1997)), or even to influence politicians.

The mystery is why issuing firms appear generally content to leave so much money on the table, and more so when their value has recently increased.[10] Loughran and Ritter use prospect theory (Kahneman and Tversky (1979)) to argue that entrepreneurs are more tolerant of excessive underpricing if they simultaneously learn about a postmarket valuation that is higher than what they expected. In other words, the greater the recent increase in their wealth, the less is the bargaining effort of issuers in their negotiations over the offer price with underwriters.

It is interesting to put the magnitude of the underpricing and its possible influence on trading volume into perspective. In Table I, we report that $66 billion was left on the table during the Internet bubble. If investors rebated 20 percent of this back to underwriters in the form of extra commissions, this would amount to $13 billion.[11] At an average commission of 10 cents per

[10] A deeper question is why firms do not choose a different mechanism for selling IPOs altogether. For selling many other items where there is valuation uncertainty, auctions are the dominant mechanism. Worldwide, however, auctions have been losing market share relative to bookbuilding when it comes to selling IPOs (Sherman (2001)). Kandel, Sarig, and Wohl (1999), Biais and Faugeron (2002), and Derrien and Womack (2002) document that auctions result in less underpricing than other methods of selling IPOs.

[11] The $100 million settlement of abusive IPO allocation practices between Credit Suisse First Boston and the SEC and NASD on January 22, 2002, includes the statement that "CSFB allocated shares of IPOs to more than 100 customers who, in return, funneled between 33 and 65 percent of their IPO profits to CSFB. These customers typically flipped the stock on the day

share, this would amount to 130 billion shares traded, or an average of 250 million shares per trading day during 1999 to 2000. Because combined Nasdaq and NYSE volume averaged about 10 times this amount during these years, this would suggest that portfolio churning by investors to receive IPO allocations may have accounted for as much as 10 percent of all shares traded during the Internet bubble. Although 10 percent might be an overestimate of the effect on overall trading volume, the January 22, 2002, SEC settlement with Credit Suisse First Boston states that extra share volume was concentrated in certain highly liquid stocks. Market microstructure empirical work may need to take this trading volume into account, much as "dividend capture" schemes by Japanese insurance companies in the 1980s led to artificially high volume for U.S. stocks paying high dividends around the ex dividend date (Koskie and Michaely (2000)).

At this point, there has been no academic research investigating how the money left on the table during the Internet bubble was split among buy-side participants (individual investors, mutual funds, hedge funds, "friends and family," etc.) and sell-side participants (the stockholders of investment banking firms through higher profits; and analysts, traders, and corporate finance employees through bigger bonuses). Ljungqvist and Wilhelm (2002b) document that the frequency of directed share programs (friends and family shares) increased dramatically between 1996 and 1999. They argue that this reduced the opportunity cost of underpricing for firm managers.

Both the Benveniste and Spindt bookbuilding theory and the Loughran and Ritter conflict of interest theory predict sluggish price adjustment: The final offer price is not fully adjusted from the midpoint of the file price range when underwriters receive favorable information. Although the information revelation theory can explain underwriters' sluggish price adjustment to private information, it does not predict that there should be anything less than full adjustment to public information. In contrast, the prospect theory explanation predicts that there will be sluggish adjustment to both private and public information, because prospect theory makes no distinction about the source of good news. Bradley and Jordan (2002), Loughran and Ritter (2002), and Lowry and Schwert (2002) present evidence that when the overall stock market rallies during the road show period, underwriters do not fully adjust their pricing. However, this alone cannot fully explain the relationship between price adjustment and first-day returns, pointing to a role for private information extraction, too.

of the IPO, often gaining tremendous profits. They then transferred a share of their flipping profits to CSFB by way of excessively high brokerage commissions . . . The customers paid these commissions on uneconomic, limited-risk trades in highly liquid, exchange-traded shares unrelated to the IPO shares—trades that they effected for the sole purpose of paying IPO flipping profits back to CSFB" (SEC News Release 2002-14). The NASD specifically mentions churning of Compaq and Disney stock for the purpose of generating commission payments. A number of hedge fund managers have told us that they generated commissions by churning massive numbers of shares in highly liquid stocks without ever paying more than eight cents per share.

The prospect theory explanation of the partial adjustment phenomenon predicts that all IPOs that are in the road show stage of going public when there is an overall market rally will have higher expected underpricing, because offer prices are not raised as much as they could be in this scenario. Because the bookbuilding period is typically about four weeks in length, the first day returns of these IPOs will be correlated. This provides a partial explanation for the phenomenon of hot issue markets. Empirically, the autocorrelation of monthly average first-day returns is 0.60 from 1960 to 1997 (Lowry and Schwert (2002)). The autocorrelation is even higher if 1998 to 2001 is included in the sample period, due to the extremely high first-day returns during the Internet bubble. Every single month from November 1998 to April 2000 had an average first-day return of more than 30 percent.

Many empirical papers examining IPO allocations focus on the distinction between institutional and individual (or retail) investors. Institutions are different from retail clients, in that their scale should make it more likely that they are both better informed and more important clients. The evidence to date suggests that where bookbuilding is used, institutions do receive preferential allocations. Using U.S. data, Hanley and Wilhelm (1995) and Aggarwal, Prabhala, and Puri (2002) find that institutions are favored, as do Cornelli and Goldreich (2001) using U.K. data. Cornelli and Goldreich (2001) also find that more information-rich requests are favorably rewarded. Future research is likely to further distinguish among different classes and characteristics of institutional investors.

Institutions are also naturally blockholders, potentially capable of displacing poorly performing management. *Who* purchases an IPO's shares may in turn influence IPO activity, underpricing, and long-run performance. A good number of companies begin implementing takeover defenses as early as the IPO (Field and Karpoff (2002)). Booth and Chua (1996), Brennan and Franks (1997), Mello and Parsons (1998), and Stoughton and Zechner (1998) all point out that underpricing creates excess demand and thus allows issuers and underwriters to decide to whom to allocate shares. Stoughton and Zechner argue that underpricing is needed to create an incentive to acquire a block of stock and then monitor the firm's management, creating a positive externality for atomistic investors. Mello and Parsons point out that a two-part issuing strategy may be more efficient, with the IPO aimed at atomistic investors and a private placement aimed at a blockholder. In the United States, large blockholders are common prior to the IPO in the form of venture capitalists and leveraged buyout financiers, but the venture capitalists typically distribute shares to their limited partners as soon as the lockup period ends. Furthermore, the general partners typically also relinquish control via open market sales, rather than selling a strategic block. This suggests that corporate control considerations related to blockholders may not be of primary importance for many of these companies.

In a sample of 69 British IPOs, Brennan and Franks (1997) find that when shares are placed more widely rather than placed with just a few powerful large shareholders, the entrepreneur is less easy to oust from the company. Brennan and Franks also find that directors continue to hold onto shares more than other investors, again presumably trying to retain control of the company.

In contrast to models in which big investors add value, Booth and Chua (1996) link allocation to aftermarket trading and argue that small investors are more valuable. Issuers like the increased liquidity associated with more aftermarket trading brought about by more investor dispersion.

In all of these models, underpricing results in excess demand, which permits underwriters to place shares with specific clienteles. To raise the same amount of capital, if the shares offered are underpriced, the issuing firm must sell more shares, diluting the existing shareholders. It is not at all obvious that the benefits of placing shares with specific clienteles outweigh the control benefits of insiders retaining a larger fraction of the firm. Field and Sheehan (2001) find that clienteles are rather temporary, casting doubt on the usefulness of explanations based on future services from investors who receive allocations of shares at the time of the IPO.

A number of articles focus on the actions of the lead underwriter when aftermarket trading begins. Underwriters can influence the aftermarket price not only by their pre-IPO decisions on pricing and allocation, but also through actively participating in the aftermarket themselves.

Underwriters not only have price discretion, but also quantity discretion. In allocating shares, they control not only who gets shares, but how many shares in the aggregate are allocated. Almost all IPOs contain an overallotment option for up to 15 percent of the shares offered.[12] In allocating shares, if there is strong demand, the underwriter will allocate 115 percent of the shares. Then, if the price weakens in aftermarket trading, the underwriter can buy back up to the extra 15 percent and retire the shares, as if they had never been offered in the first place.

Aggarwal (2000) and Zhang (2001) focus on the number of shares that are allocated. Aggarwal reports that if the underwriter anticipates weak demand, it will typically allocate up to 135 percent of the offering, taking a naked short position. The underwriter then buys back the incremental 20 percent, and has the option of buying back the other 15 percent, treating the shares as if they were never issued in the first place. Zhang argues that the allocation of these extra shares boosts the aftermarket demand for the stock. This is because institutional investors who are allocated shares are likely to continue holding them, whereas if they had not received any shares in the first place, they would have been unlikely to buy them in the aftermarket. The extra buy-and-hold demand that results from the overallocation boosts the aftermarket price and increases the price at which issuers can offer shares. If the demand for an IPO is strong, underwriters do not take a naked short position because covering it would be too costly.

Once trading commences, if there is weak demand, the lead underwriter might attempt to “stabilize” the price through various activities aimed at

[12] The overallotment option is also called a “Green Shoe” option, after the first company that included one in its 1963 IPO.

reducing selling pressure. Price stabilization is the only instance in which the SEC permits active attempts at stock price manipulation. Price stabilization activities include pre-IPO allocation policy, post-IPO purchases of shares by the lead underwriter, and the discouragement of selling.

Flippers are temporary investors who purchase shares at the IPO and quickly turn around to sell their shares. Underwriters have a quixotic view towards flippers: On the one hand, the new conflict-of-interest theories of underpricing argue that underwriters sometimes allocate shares specifically to investors so that these investors can make a quick profit. Furthermore, underwriters desire liquid aftermarket trading, if only because they are usually the prime market maker. On the other hand, the "artificial" demand of flippers can make it difficult both to gauge the buy-and-hold demand for shares pre-IPO and to properly price shares.

For IPOs with weak demand, underwriters discourage flipping through moral suasion (i.e., the threat of withholding future allocations on hot issues) and the imposition of penalty bids. A penalty bid occurs when the lead underwriter takes back the selling concession (the commission) from a broker who has allocated shares that are flipped. The existence of penalty bids gives a broker an incentive to allocate shares to clients who are likely to be buy-and-hold investors. More controversially, after the shares have been allocated, a penalty bid also gives a broker a financial incentive to discourage a client from selling shares. For IPOs where there is strong demand and a price jump, penalty bids are rarely imposed, and flipping may even be encouraged in order to keep market demand from pushing the price to unsustainable levels. The practice of encouraging sales in this scenario explicitly assumes that there is a negatively sloped demand curve, and that the market price is not exogenous.

Many investment banking practices can be interpreted as attempts to create demand. Marketing or certification activity may occur after the time of the IPO as well. If bullish analysts can later seduce other investors to purchase, both entrepreneurs and aftermarket investors would value such a service (Aggarwal, Krigman, and Womack (2002)). Issuers view the choice of the lead underwriter as important.

The choice of underwriter is typically determined by the issue's size and industry on one hand and the underwriter's prestige and expertise on the other (Logue et al. (2002)). One strand of research has focused on the effect of an underwriter's pricing record on subsequent market share. Beatty and Ritter (1986) find that underwriters that underprice or overprice excessively subsequently lose market share, although Tinic (1988) argues that penny stock underwriters may drive their results. Nanda and Yun (1997) find that the market price of an underwriters' own stock does best when offerings are moderately underpriced. Dunbar (2000) widens this view towards long-run IPO performance and other measures, and finds that established underwriters are especially vulnerable to missteps. On the other hand, Krigman, Shaw, and Womack (2001), in a questionnaire sent to firms that switched underwriters for a follow-on offering after their IPO, report that the amount of money left on the table in the IPO was not an important factor in deciding to switch lead underwriters. Instead, underwriter prestige or the desire to increase analyst coverage for the stock are the two most important determinants of switching.

Carter and Manaster (1990) and Carter, Dark, and Singh (1998) uncovered yet another interesting pattern, namely that high-quality underwriters seem to have left less money on the table for their investors—at least in the 1980s. Beatty and Welch (1996) and Cooney et al. (2001) find that this relation reversed in the early 1990s, and Loughran and Ritter (2001) report that during the Internet bubble period, prestigious underwriters were egregious in leaving huge amounts of money on the table.

Underwriters are prohibited from initiating analyst coverage for 25 calendar days after an IPO (the "quiet period"). Typically, the managing underwriters (lead and comanagers) initiate research coverage at the end of the quiet period, usually with a "buy" or "strong buy" recommendation. Michaely and Womack (1999) provide evidence that the investment bank's analysts regularly provide "booster shots" in the form of buy recommendations which are greeted with a positive stock market reaction, even though these IPOs subsequently underperform. Oddly, the market does not seem to recognize the full extent of this bias, so that this service remains valuable to the issuer. However, the underwriters' analysts are not unique in being optimistic: Rajan and Servaes (1997) find that analysts of investment banking firms that did not comanage the IPO tend to disproportionately follow underpriced IPOs and also are overly optimistic on average. Bradley et al. (2002) find that IPOs from 1996 to 2000 rise an average of three percent when their quiet period ends. For IPOs where analyst recommendations occur, the market-adjusted return is four percent. For other IPOs, the market-adjusted return is close to zero. The positive average effect of three percent is difficult to reconcile with market efficiency, because the fact that positive recommendations will be forthcoming 25 days after going public is not a surprise.

For shares not sold in the offering, preissue shareholders commit to a specified lockup period, during which they agree not to sell any shares without the written permission of the lead underwriter. Although there is no statutory minimum, most lockup periods are 180 calendar days in length and almost none are less than 90 days (Field and Hanka (2001)).

Eventually, IPOs transition to become ordinary stocks. Ellis et al. (2000) and Aggarwal and Conroy (2000) document that the lead underwriter is typically the dominant market maker for Nasdaq-listed IPOs. The underwriter knows with whom shares are placed, and thus has a comparative advantage at contacting investors if there is an order imbalance. Ellis et al. report that market making is a profitable activity for the lead underwriter, with the profits during the first three months amounting to about two percent of the issue size. Ellis, Michaely, and O'Hara (2002) further report that market making activity in Nasdaq-listed IPOs continues to be concentrated long after the offering. For smaller IPOs, the lead underwriter's market share declines from almost 100 percent at the inception of trading to less than 50 percent on average about half a year after the offering.

C. Valuation

An immediate question raised by the difference between the offer price and the first-day market price is whether issuers or the stock market is pricing offerings in line with a firm's fundamentals. The most common method for valuing firms going public is the use of comparable firm multiples. But unfortunately, accounting data are in many cases too unreliable a measure of valuation to facilitate powerful tests, especially because many firms going public are being valued on the basis of their growth options, not their historical financials. As a result, the power of tests to explain pricing relative to some "true fundamental value" is too low to make much headway in testing whether IPO pricing or aftermarket valuation better reflects the IPOs' fundamental valuations unless the sample is large. Kim and Ritter (1999) find only a modest ability to explain the pricing of IPOs using accounting multiples, even when using earnings forecasts.

Purnanandam and Swaminathan (2001) construct a measure of intrinsic value based on industry-matched Price/Sales and Price/Ebitda from comparable publicly traded firms ("comps") for a sample of over 2,000 IPOs from 1980 to 1997. They find that, when offer prices are used, IPO firms are priced about 50 percent above comparables, which is an enormous difference. They also find that this initial overpricing with respect to comparables helps predict long-run underperformance.

Although it is difficult to come up with accurate valuation measures for IPOs, this literature is promising. The next step may involve the use of earnings forecasts with more detailed corporate information to enhance the power of these tests.

D. Summary

As readers of this literature, we come away with the view that underpricing is a persistent feature of the IPO market, and, while cyclical, may have increased in magnitude over time. While asymmetric information models have been popular among academics, we feel that these models have been overemphasized. In our view, there is no single dominant theoretical cause for underpricing. Thus, it is not so much a matter of which model is right, but more a matter of the relative importance of different models. Furthermore, one reason can be of more importance for some firms and/or at some times. To date, there has been little empirical work attempting to quantify the relative importance of different explanations of underpricing.

III. Long-run Performance

Perhaps the facet of IPOs that has attracted the most interest from academics in recent years is the stock price performance of IPOs in the years after the offering. Efficient markets proponents would argue that once an IPO is publicly traded, it is just like any other stock and thus the aftermarket stock price should appropriately reflect the shares' intrinsic value. Consequently, risk-adjusted post-IPO stock price performance should not be predictable. In this sense, post-IPO long-run performance is less of an IPO (or corporate finance) issue than it is a standard asset-pricing issue. Still, many IPO shares have been difficult to sell short and thus have retained some peculiarity even post-IPO.

In measuring long-run performance, one can focus either on raw (absolute) performance, or performance relative to a benchmark (abnormal returns). Table I shows that investing in an equal-weighted portfolio of IPOs over a three-year horizon did not lose money in absolute terms, but an investment in the value-weighted market portfolio would have yielded about twice the return, resulting in a three-year market-adjusted return of −23.4 percent. Still, there is far from a consensus with respect to the proper measurement technique. We believe that the sample used, both in terms of the sample period and the sample selection criteria, is also an important determinant of the difference in findings across studies.

A. Long-run Performance Evidence

Statistical inference is problematic when the returns on individual IPOs overlap, as they do when multiyear buy-and-hold returns (as in Table I) are used. Indeed, this is a problem for all long-term performance studies, not just those examining IPO performance. These measurement issues have been addressed in Brav (2000) and other papers. Nevertheless, Table I highlights one important issue plaguing this literature: When publicly traded firms similar in market capitalization and book-to-market values are used as a benchmark, it becomes clear that the poor long-run performance of firms “similar to IPO firms” extends beyond the IPO market. IPOs are strongly tilted towards small growth firms, and this has been the worst-performing style category of the last several decades. In Table I, the three-year average market-adjusted return on IPOs is −23.4 percent, whereas the average style-adjusted return is −5.1 percent.[13] In other words, seasoned firms matched

[13] A careful reader may wonder about the accuracy of the style-adjusted three-year buy-and-hold return of −74.2 percent for the IPOs going public in calendar year 1999 that we report in Table 1. Since the average buy-and-hold return on IPOs is −46.2 percent, this implies an average matching firm return of +28.0 percent, even though growth stocks did very poorly in 2000 and 2001. Part of the high benchmark return is due to chance: One IPO was matched with a seasoned firm that had a 2,200 percent return in the four months after the date of the IPO, at which point the matching firm conducted a follow-on stock offering and was replaced on a point-forward basis by another matching firm. This second firm then had a return of over 100 percent before being delisted, at which point it was replaced on a point-forward basis by another firm that had a 36 percent return until the end of September 2001, when our returns data ended. The compounded return for these three matching firms was 6,300 percent, which boosts the average benchmark return for the 457 firms in the 1999 cohort by 14 percent. A few other matching firms in this cohort also had relatively high returns. The 6,300 percent outlier affects the average style-adjusted return for the 6,249 IPOs from 1980 to 2001 by only 1.0 percent. Note that for IPOs from October 1998 and later, the three-year buy-and-hold return is actually less than three years, since our returns end on September 2001. Our returns end in September 2001 because this was the most recent available version of returns data from CRSP as of January 2002.

Table V

Multifactor Regressions with an Equally Weighted Portfolio of U.S. IPOs

All regressions use 345 observations when the sample period is from January 1973 to September 2001. The dependent variable is the equally weighted monthly percentage return on a portfolio of IPOs that have gone public during the prior 36 months. A coefficient of −0.32 represents underperformance of 32 basis points per month, or −4 percent per year. $r_{pt} - r_{ft}$ is the excess return over the risk-free rate on a portfolio in time period t, $r_{mt} - r_{ft}$ is the realization of the market risk premium in period t, SMB_t is the return on a portfolio of small stocks MINUS the return on a portfolio of big stocks in period t, and VMG_t is the return on a portfolio of value stocks minus the return on a portfolio of growth stocks in period t. Value and growth are measured using book to market ratios, and *VMG* is denoted HML in the literature (high book-to-market (value) minus low book-to-market (growth) stocks). The factor returns are supplied by Kenneth French, using "research factors" with annual rebalancing, as distinct from "benchmark factors" with quarterly rebalancing. *T*-statistics are in parentheses.

$$r_{pt} - r_{ft} = a + b_t(r_{mt} - r_{ft}) + b_{t-1}(r_{mt-1} - r_{ft-1}) + s_t SMB_t + s_{t-1} SMB_{t-1} + v_t VMG_t + v_{t-1} VMG_{t-1} + e_{pt}$$

	a	b_t	b_{t-1}	s_t	s_{t-1}	v_t	v_{t-1}	R^2_{adj}
Panel A: Sensitivity of Intercepts to Expanding the Number of Factors								
(1) Jan 73–Sept 01	−0.32	1.40						63.1%
	(−1.17)	(24.25)						
(2) Jan 73–Sept 01	−0.47	1.39	0.34					66.6%
	(−1.82)	(25.22)	(6.08)					
(3) Jan 73–Sept 01	−0.21	1.11		1.16		−0.23		86.1%
	(−1.23)	(27.01)		(22.16)		(−3.76)		
(4) Jan 73–Sept 01	−0.20	1.10	0.11	1.13	0.10	−0.22	−0.15	87.5%
	(−1.22)	(28.12)	(2.85)	(22.07)	(2.01)	(−3.80)	(−2.50)	
Panel B: Sensitivity of the Intercepts to Different Sample Periods								
(5) Jan 73–Dec 89	−0.15	1.02		1.33		−0.17		89.7%
	(−0.83)	(23.83)		(20.20)		(−2.36)		
(6) Jan 90–Dec 99	−0.14	1.11		1.23		−0.17		91.3%
	(−0.77)	(20.79)		(18.88)		(−2.24)		
(7) Jan 90–Dec 00	−0.48	1.17		0.96		−0.25		88.2%
	(−2.01)	(17.39)		(13.80)		(−2.76)		
(8) Jan 00–Sept 01	0.62	1.45		0.60		−0.68		75.9%
	(0.29)	(3.13)		(1.59)		(−2.24)		

by market capitalization and book-to-market underperform the broader market by almost as much as IPOs do.

An alternative statistical approach that avoids the overlap problem with buy-and-hold returns is to measure returns in calendar time rather than event time. In Table V, we report time-series regression results using the Fama–French (1993) three-factor model. The intercepts reported in Table V are measures of abnormal performance. An intercept of −0.32 is −32 basis points per month, or about −4 percent per year. Row 1 reports the results of a simple one-factor regression, with the market excess return as the explanatory variable. Row 2 reports the results of a regression that includes a lagged market return. The lagged beta is significantly positive, and the summed beta is 1.73, indicating that IPOs have a high level of systematic risk. This accords with the common sense notion that IPOs tend to be risky stocks. The Row 2 intercept is −47 basis points per month, suggesting that the Row 1 intercept is underestimated due to the underestimation of systematic risk when the lagged effect is ignored.

Row 3 of Table V reports regression results with the three traditional Fama–French (1993) regressors, and Row 4 adds the lagged Fama–French factors. The intercepts in Rows 3 and 4 return to a value of about −2.5 percent per year. As Brav and Gompers (1997) note, Fama–French three-factor regressions tend to have negative intercepts for portfolios of small growth firms, whether or not the portfolio is composed of IPOs. Brav and Gompers show that a large fraction of IPOs fall in the extreme small growth firm category, so this is an important concern. In our Table V, we have excluded most of the smallest firms by screening out IPOs with an offer price below $5.00 per share. There is another bias in multifactor regressions, as normally implemented. Loughran and Ritter (2000) point out that the right-hand side variables, the Fama–French factor returns, are themselves partly composed of the returns on IPOs. Because IPOs tend to be small growth stocks, a small firm portfolio will have more IPOs than a large firm portfolio, especially after periods of heavy issuing volume. Similarly, a portfolio of value stocks will have fewer IPOs than a portfolio of growth stocks. Thus, SMB will have a low return and VMG will have a high return following heavy IPO issuance if IPOs underperform. This "factor contamination" biases the intercept towards zero. Table VI of Loughran and Ritter (2000) reports that the effect of this bias is 18 basis points per month during the period 1973 to 1996.

Rows 5 through 8 split the sample into different time periods. The underperformance in the 1990 to 1999 period is virtually identical to that in the 1973 to 1989 period, a statistically insignificant −14 or −15 basis points per month. The estimates, however, are very sensitive to the ending date. While the Internet bubble was inflating in the late 1990s, post-IPO returns were exceptionally good. If the sample is extended by just one year, from December 1999 to December 2000, the Row 6 intercept of −14 basis points for 1990 to 1999 changes in Row 7 to −48 basis points for 1990 to 2000.

Most remarkably, however, are the Row 8 subperiod results from January 2000 to September 2001. This time period shows how methodology and time period matter in a most startling fashion. Table I showed that IPOs from 1999 and 2000 performed poorly by any measure during the well-known collapse of the Internet bubble. For IPOs from calendar year 2000, the average return from the closing price on its first day of trading until September 2001 was −64.7 percent. From January 2000 to September 2001, our dependent variable in Table V, the equally weighted portfolio of IPOs from the prior 36 months, had an average monthly return of −355 basis points. Yet, Row 8 of Table V shows a *positive* intercept of 62 basis points per month! The reason is that the regression attributes the collapse to the negative market returns and concurrent collapse of technology stocks, which is reflected in positive realizations on VMG.

This evidence suggests two areas of caution: First, one must be careful comparing papers which attribute a weakening or disappearance of the IPO effect to novel measurement techniques; instead, the sample period may be responsible for some of the conclusions. Second, unless one is comfortable concluding that IPOs with −64.7 percent returns offered investors positive risk-adjusted returns, one should be wary of considering the Fama–French factors to be equilibrium risk factors and using them as controls. When using either a multifactor model or matching firms to examine abnormal performance, these tests should be regarded as testing "similarity to certain public firms," rather than as tests of IPO mispricing.

Furthermore, long-run returns, even if remarkably low, are sufficiently noisy to make any statistical inference difficult. For example, in Brav (2000), it can require an abnormal return of −40 percent (depending upon specification) to reject the hypothesis that long-run buy-and-hold returns are not underperforming. After controlling for the poor performance of size and book-to-market matched non-IPO firms, "similarity" between IPO and non-IPO firms can no longer be rejected for some sample periods. Eckbo and Norli (2001) use size and liquidity matching, and find that similar publicly traded firms also performed poorly.[14]

Because the asset-pricing literature itself has failed to provide an accepted model of risk-adjusted performance against which one can measure post-IPO performance, it still remains unclear how abnormally poor post-IPO performance is. Many papers have argued that the magnitude of long-run abnormal performance is sensitive to the procedure employed.

Comparing the market-adjusted buy-and-hold returns in Table I with the style-adjusted buy-and-hold returns in Table I demonstrates this sensitivity. The three-year market-adjusted returns on IPOs are −23.4 percent, versus just −5.1 percent for the style-adjusted returns. Relative to other firms with similar size and book-to-market characteristics, IPOs have had very modest underperformance. Whether one uses buy-and-hold returns or Fama–French regressions matters less: The underperformance of −21 basis points per month in Row 3 of Table V is equivalent to about −7.6 percent over a three-year period. Thus, it is clear that IPOs and firms with characteristics similar to IPOs had rather unappealing performance at a time when the overall stock market performed exceptionally well. It is not in dispute that equally weighted

[14] Barber and Lyon (1996), Barber and Lyon (1997), and Lyon, Barber, and Tsai (1999) consider various statistics used in the literature, and propose some good intuitive measures of long-run performance. Teoh, Welch, and Wong (1998) suggest a Fama–MacBeth type procedure. Loughran and Ritter (2000) and Schultz (2001) discuss the influence of weighting schemes.

post-IPO returns have been low relative to broad market indices during recent decades.

B. Sources of Long-run Underperformance

We know of only two semirational explanations for the long-run underperformance of IPOs. Miller (1977) assumes that there are constraints on shorting IPOs, and that investors have heterogeneous expectations regarding the valuation of a firm. The most optimistic investors buy the IPO. Over time, as the variance of opinions decreases, the marginal investor's valuation will converge towards the mean valuation, and its price will fall. This argument works better when the float is small and not too many investors are required. This is consistent with the drop in share price at the end of the lockup period (when more public shares become available to the public), as documented by Bradley et al. (2001), Field and Hanka (2001), and Brav and Gompers (2002). Bradley et al. show that the negative effect is much more pronounced for venture-capital-backed IPOs. Typically with these IPOs, the VCs distribute shares to their limited partners on the lockup expiration date, and many limited partners immediately sell. This shows up not only in negative returns, but exceptionally high volume.

Schultz (2001) offers a second explanation: He argues that more IPOs follow successful IPOs. Thus, the last large group of IPOs would underperform and be a relatively large fraction of the sample. If underperformance is being measured weighting each IPO equally, the high-volume periods carry a larger weight, resulting in underperformance, on average. Although this is a logical argument, it cannot predict underperformance when each time period is weighted equally, as is done in Table V or the time-series regressions of Loughran, Ritter, and Rydqvist (1994) and Baker and Wurgler (2000).

Other papers are less ambitious, and simply attempt to find variables that result in cross-sectional predictability. Jain and Kini (1994) and Mikkelson, Partch, and Shah (1997) document that long-run return performance is also accompanied by poor financial accounting performance post-IPO relative to pre-IPO performance and/or industry conditions. So, what drives this long-run underperformance and can it be predicted?

Several papers address whether flipping by institutions can be used to predict long-term returns on IPOs. That is, do institutions succeed in identifying IPOs that are being overvalued when trading commences? Krigman et al. (1999) and Houge et al. (2001) find evidence suggesting that indeed they do.

Heaton (2002) argues that managers tend to be overoptimistic, and thus prone to overinvestment if the funds are available. Teoh, Welch, and Wong (1998) attribute some of the poor post-IPO stock performance to "optimistic" accounting early in the life of the firm. It is not surprising that firms are eager to look good when they conduct their IPO, and that the market has difficulties in disentangling carefully hidden warning signals. This suggests that at least a part of the poor long-run performance is due to a market that is unduly optimistic and unable to properly forecast tougher times ahead. Similarly, Purnanandam and Swaminathan (2001) find that IPOs that are priced high relative to public market comparables tend to perform worse in the long run, even though they show higher first-day returns. Both papers point towards overconfidence, perhaps by both entrepreneurs (Bernardo and Welch (2001)) and investors (Daniel, Hirshleifer, and Subrahmanyam (1998)).

There have been some other less successful attempts to correlate long-run performance to pre-IPO characteristics. For example, there is no reliable relationship between short-run underpricing and long-run performance, although this evidence is sensitive to whether penny stock IPOs are included or not. These IPOs, which were common before the 1990s, frequently had high first-day returns and exceptionally low long-run returns. Many of these issues involved stock price manipulation. For samples excluding penny stock IPOs, whether there is a reversal of the highest first-day returns in the long run depends mostly on whether the Internet bubble period is included in the sample. Almost all of the IPOs from 1999 to 2000 with large first-day returns have subsequently collapsed. Since most of these were Internet related, the number of independent observations is limited.

The recent bubble has made it amply clear that even if there is systematic long-run underperformance, it is difficult or impossible to exploit it in a reliable manner. Many short sellers lost a great deal of money on Internet bubble IPOs, and had to close out their shorts before they would have paid off. Still, we hope to see further work to tell us which subsamples are particularly prone to poor post-IPO performance, both in the United States and in other countries.

IV. Conclusions

This paper has focused on three areas of current research on IPOs: reasons for going public, the pricing and allocation of shares, and long-run performance.

There are myriad theoretical reasons for firms wanting to go public, but only sparse evidence due to a general lack of data on the pool of private firms. Still, the evidence of large variation in the number of IPOs suggests that market conditions are the most important factor in the decision to go public. The stage of the firm in its life cycle seems to be the second important factor.

The underpricing of IPOs has been a topic of theoretical investigations for decades. Recently, this topic has enjoyed a resurgence of activity, motivated by the astonishingly high first-day returns on IPOs during the Internet bubble. We argue that theories based on asymmetric information are unlikely to explain average first-day returns of 65 percent. Underwriters did not bundle multiple offerings together, which would have lowered the average uncertainty and the need for underpricing in the context of information models. Thus, we believe that future explanations will need to concentrate on agency conflicts and share allocation issues on one hand and behavioral explanations on the other hand. The challenge for such theories will be to explain the dramatic variations in underpricing over the last few decades.

The allocation of shares by underwriters is perhaps the most active area of current IPO research. Share allocation has an impact on many topics, including theories of underpricing, post-issue ownership structure, and underwriter compensation. To date, empirical research has been limited due to the lack of microlevel data on share allocations in the United States. As this data becomes available, we expect that it will be able to shed light on many questions. Microlevel trading data has already resulted in light being shed on some of these important issues.

Long-run performance may be the most controversial area of IPO research, with some researchers lining up behind an efficient markets point of view and others lining up behind a behavioral point of view. Although we tend to favor the behavioral point of view, our main perspective is that caution is advisable. First, the results are sensitive not only to methodology, but also to the exact time period chosen. Depending on whether and how one includes 1999, 2000, and 2001, one can come to rather different conclusions. Second, Fama–French multifactor regressions can produce very odd results. They indicate that the period during which the Internet bubble collapsed were great years for recent IPOs, even though an equally weighted portfolio of recent IPOs lost on average 355 basis points per month.

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