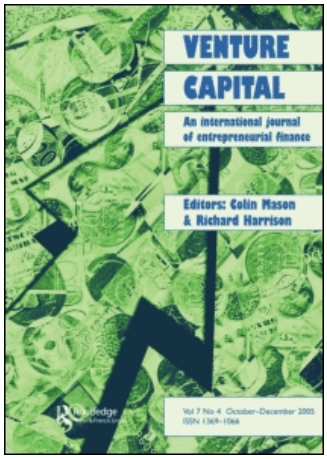

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Bookbuilding versus auction selling methods: A study of US IPOs

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Bookbuilding versus Auction Selling Methods: A Study of US IPOs

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ABSTRACT *This study documents differences between two widely known IPO selling methods: the auction method and bookbuilding method for a sample of US IPOs. We employ a matched firm technique to compare the two IPO selling methods and empirically test hypotheses relating to the two selling methods. Our sample comprises all auction IPOs in the US between January 1999 and December 2004. Our results indicate that in comparison to matched bookbuilding IPOs, auction IPOs are less underpriced and thus leave less money on the table for the issuers, and have lower underwriter spreads. Relative to auction IPOs, bookbuilding IPOs are more likely to be followed and positively recommended by analysts and they receive more coverage by lead analysts, i.e. analysts affiliated with lead underwriters. Moreover, bookbuilding IPOs tend to outperform auction IPOs up to 18 months post-IPO, exhibit lower aftermarket volatility, and insiders of auction IPOs agree to lock up a higher fraction of their shares and hold them for a longer period of time.*

KEY WORDS: Initial public offerings, IPO auctions

Introduction

Our study is motivated by two recent events: (1) the successful and highly publicized IPO of Google which was only the eleventh firm in recent US history to choose to sell its shares through an auction rather than through a traditional bookbuilding arrangement; and (2) the recent surge in IPO-related securities class action filings, alleging misconduct on behalf of underwriters in the selling of IPO shares under bookbuilding arrangements. In the bookbuilding method, the underwriter selects investors to whom IPO shares will be allocated at the offer price; the underwriter thus controls investor selection and share allocation. In the auction method, however, any investor can bid for the price and quantity of shares sought in the IPO. After all bids have been collected, the underwriter (in conjunction with the issuer)

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can determine the offer price at which the quantity of shares offered will equal the quantity of shares demanded by investors.

In recent years, almost all of the leading Wall Street investment banks have been accused of unfair IPO allocation schemes in connection with more than 300 IPOs.[1] In these lawsuits, plaintiffs contend that the underwriters engaged in illegal tactics by soliciting and receiving kickbacks in exchange for allocations of portions of a company's shares sold in the IPO, required tie-in purchases creating an artificial demand for the stock, and artificially inflated the price of the stock through 'laddering' (requiring purchases by IPO share recipients of additional stock in the aftermarket at escalating prices). The proliferation of these laddering schemes has led to calls by government agencies and regulatory bodies, including the SEC and NASD, to seek modifications or alternatives to the bookbuilding method to sell IPO shares to the public.

While IPO auctions have been gradually disappearing around the world and have been replaced by the bookbuilding method in many countries, IPO auctions first emerged in the US in 1999. Although in recent years only a handful of US firms have decided to use auctions as their preferred choice of going public, the most celebrated IPO auction has been that of Google in 2004. Given Google's success, is it likely that auctions may gain additional market share and may at some point again become a viable alternative to the bookbuilding method in the US?

There is a substantial body of literature that has empirically examined the benefits and disadvantages of IPO auctions vis-à-vis the bookbuilding method. More recently, a number of studies have developed theoretical models that describe a firm's choice of IPO selling methods – fixed price offer, bookbuilding and auction methods. These three methods have been frequently used internationally. Fixed price offers and bookbuilding methods are the two non-auction IPO selling methods. The recent emergence of IPO auctions in the US provides a unique setting to evaluate the predicted impacts of models of IPO selling method design. Specifically, our study addresses the following questions:

- Do auction IPOs raise more money? Do they leave less money on the table, i.e. were they less underpriced? If so, were there any other costs associated with the auction? What was the underwriter spread? Were there any reputational effects, i.e. did the IPO auction firms receive poorer analyst coverage?
- How did the auction IPO firms perform in the long-run? Does the stylized long-term underperformance that has been documented for bookbuilding IPOs also apply to auction IPOs?
- Do auction IPOs succeed in retaining longer-term investors? Do auction shares have a lower turnover and less return volatility in the IPO aftermarket? Do auction IPOs have more moral hazard problems?

Despite our small sample size our results provide interesting insights into the US IPO market and into the differences between the two selling methods. We employ a matched firm technique and a series of univariate tests to investigate the differences between auction and bookbuilding IPOs. In addition, our small sample size allows for a firm-by-firm discussion of special circumstances that affected some of our sample IPOs and special events that occurred in the IPO aftermarket.

Our results indicate that, compared to bookbuilding IPOs, auction IPOs exhibit lower underwriter spreads, smaller underpricing, smaller IPO proceeds and higher trading turnover. We also find weak evidence that bookbuilding IPOs outperform auction IPOs over an 18-month post-IPO period, and that bookbuilding IPOs exhibit lower return volatility. We further find that bookbuilding IPOs exhibit greater and more positive analyst coverage. Additionally, auction IPOs exhibit a longer lockup period, and a higher percentage of insider shares under lockup than bookbuilding IPOs.

The remainder of this paper is organized as follows. In the next section, we discuss the related literature. In the third section, we describe the data collection process, discuss our variable selection and provide descriptive statistics. In the fourth section, we present our methodology and discuss our empirical results. The final section provides concluding remarks.

Literature Review

Auctions Are Less Popular around the World

Over time, IPO auctions have been used in many different countries but almost all countries eventually abandoned them (Sherman, 2005). In France, for example, auctions have been virtually abandoned, even though their use was at par with bookbuilding methods in the early 1990s (Degeorge *et al.*, 2006). In Japan, regulatory requirements that were in place between April 1989 and September 1997 required all IPO shares to be sold via auctions. When Japanese lawmakers made the bookbuilding method available to Japanese start-ups in late 1997, IPO auctions almost instantaneously disappeared (Kutsuna and Smith, 2004; Degeorge *et al.*, 2006; Degeorge and Maug, 2006). Similar changes can be observed in many other countries around the world. For instance, auctions were used in Italy, Portugal, Switzerland and the UK in the 1980s, in Singapore in the 1990s, in Argentina before 1992 and in Taiwan before 2003, but in all of these countries they ceased to be used or lost significant market share once bookbuilding was made available to issuers (Sherman, 2000; Chiang *et al.*, 2006).

Israel is the only country in which auctions are currently the primary IPO selling method. Bookbuilding is not allowed in Israel, so we cannot tell what method issuers would choose if they were given a choice. Apart from Israel, auctions continue to be used in Chile owing to government regulations that require a hybrid bookbuilding/auction method in which part of the shares to be issued are made available to the public by means of an auction tranche. Nevertheless, Sherman (2000) predicts that auctions may re-emerge in Peru and other parts of South America when the local economies recover. Sherman examines 40 countries that allow for both types of selling methods and notes that in every country in her sample, the bookbuilding method dominates the auction method.

Although limited in scope, the recent reappearance of auctions in the US, as well as in Australia and South Korea, represents a notable exception. In the US, W.R. Hambrecht & Co. has distributed IPO auction shares for about a dozen companies via the Internet, and Ord Minnett's eCapital used a similar method for two Australian IPOs in recent years. In South Korea, Internet auctions have been used

for several smaller offerings, whereas regulators prohibit firms that want to list on the KSE or KOSDAQ from using auction methods.[2]

Why Is Bookbuilding so Widely Used?

Sherman (2000 and 2005) argues that the bookbuilding method reduces the risk for both issuers and investors because it provides underwriters with direct control over the allocation of shares. She notes that underwriters can use this mechanism to provide investors with an incentive to reveal their interest in a given issue, thus reducing the risk of excessively underpricing or overpricing it. In addition, the bookbuilding method allows underwriters to support comparatively weak IPOs. Specifically, it allows investment banks to reward the investors who participate in such unwanted IPOs by including them in future deals and to threaten investors who do not participate in unwanted IPOs with the exclusion from subsequent offerings.

In bookbuilding, underpricing must be sufficient to compensate investors for their costs of evaluating an IPO firm. To induce investors to carefully appraise an issue and to reward them for the information they provide, underwriters deliberately underprice shares before offering them to their clients. Compared to auction methods, bookbuilding allows the underwriter to coordinate who will participate in an IPO, thus guaranteeing sufficient interest in the IPO. As a result, it is less likely that bookbuilding IPOs are undersubscribed. Finally, given the reduced likelihood of undersubscription, Sherman (2000) argues that expected IPO proceeds tend to be higher under the bookbuilding method than for auctions.

Chemmanur and Liu (2003) develop a theoretical model of IPO selling method choice between fixed price offers and auctions. In a two period model the firm seeks to maximize expected proceeds from sale of a fraction of the equity at the beginning of the first period and the remaining equity in a secondary market offering in the second period. Insiders have private information and investors must incur costs to evaluate the true quality of an IPO firm. Their model predicts that low quality firms will use fixed price offers, and that high quality firms (associated with low information costs) will use the auction method. For the latter group of firms, the auction method results in a lower mean and variance of underpricing than that for fixed price offers.

In a more recent study of French IPOs, Leleux and Paliard (1996) examine a sample of 108 French IPOs using the fixed price or auction method for the period 1984–1991. Their key findings are that auctions exhibit smaller underpricing than fixed price offers; auctions exhibit greater long-term underperformance; and the presence of venture capitalists and 'high reputation' investment banks and underwriters is associated with IPO auctions rather than fixed price offers. Degeorge *et al.* (2006) observe that auction IPOs exhibit lower underpricing than bookbuilding IPOs. They hypothesize that the higher costs of bookbuilding IPOs are a quid pro quo for favourable post-IPO analyst coverage and find that bookbuilding IPOs are more likely to be followed by analysts of their lead-underwriters and obtain better recommendations from them. Moreover, bookbuilding IPOs tend to receive better post-IPO price support from their underwriters. Interestingly, even unaffiliated analysts appear to promote bookbuilding issues more. The authors note, however, that this is the case only when their underwriters stand to gain from acquiring shares

in future issues from the recommended firm's lead underwriter. Finally, even the press appears to cover bookbuilding IPOs more than auction IPOs. Yet, despite the additional promotion, Degeorge *et al.* find no evidence that would suggest that bookbuilding IPOs outperform auction IPOs in the long run. Rather, they find that bookbuilding IPOs tend to be priced at lower multiples and tend to display a poorer stock price performance following favourable recommendations.[3]

Beierlein and Kato (2006) examine if bidder experience with IPO auction formats affects the degree of underpricing. They examine IPO auctions in Israel (uniform price auctions in which all winning bidders pay the same price) and Japan (discriminatory price auctions in which winning bidders pay their bids), whether underpricing is affected when a new auction design is introduced or auction rules are changed. They find that underpricing increases immediately following rule changes (removals of maximum price limits) in discriminating price auctions; over time, however, underpricing falls. Contrastingly, no such effects are observed for uniform price auctions following removals of maximum price limits. Kerins *et al.* (2006) examine a sample of Japanese hybrid IPO auction method offerings – each IPO had a discriminatory auction tranche followed by a fixed price public offer tranche. Rules and regulations governing these hybrid offers – severe limitations on number of shares obtained by any investors, excluding investors with any private information, preventing underwriters from providing information beyond that in the prospectus – argued against underpricing in the public offer tranche. Yet the public offer tranche was routinely underpriced. The study reports that a broad range of competing hypotheses based on asymmetric information or pricing to reflect long-term value cannot explain the observed underpricing and concludes that the evidence is consistent with prospect theory arguments.

Advantages of Auctions

Derrien and Womack (2003) use French data and report that both the mean and the variance of underpricing are lower for IPOs sold via auctions compared to those sold through bookbuilding. Jenkinson and Mayer (1988) show that, in British privatizations, the extent of underpricing was much lower in the auction sample than in the non-auction sample. Jenkinson (1990) and Kaneko and Pettway (1996, 2003) compare underpricing for Japanese IPO auctions and non-auctions and find that underpricing in IPO auctions is much lower. Lin and Sheu (1997), Liaw *et al.* (2001) and Ritter (2003) study IPOs in Taiwan; Aggarwal *et al.* (1993) and Celis and Maturana (1998) consider IPOs in Chile; MacDonald and Jacquillat (1974), Jacquillat (1986) and Derrien and Womack (2003) examine IPOs in France; and Kandel *et al.* (1999) evaluate IPOs in Israel. All of these studies document that the extent of IPO underpricing in IPO auctions is much lower than under non-auction mechanisms. Auctions are designed to put more shares into the hands of most individual investors and eliminate the near-certain first-day gains for 'hot' IPOs that became a central feature of recent IPO-related litigation. The auction approach would minimize the key role that investment bankers have played in deciding who gets highly coveted IPO shares. It leaves issuers and underwriters with little or no control because the allocation of shares depends on demand and supply and not on any previous relationship between underwriters and their clients (Sherman, 2000).

Why Have Auctions Been so Unpopular for New Issues?

Sherman (2005) suggests two major problems with IPO auctions. The underwriter cannot control entry to the auction, therefore guaranteeing the 'right' number of participants, and cannot give an appropriate number of investors an incentive to carefully evaluate the offering.

Undersubscription. Jagannathan and Sherman (2006) argue that auction IPOs frequently fail because of too many or too few bidders participating in the auction. In an earlier study (see Jagannathan and Sherman, 2005), the authors document several instances of severe under- and oversubscription among auction IPOs in Singapore and Taiwan. For example, Sunright – the last IPO auction in Singapore which took place in 1994 – was so severely undersubscribed that bids equalled only 18% of available shares, even though the public offer tranche was highly oversubscribed just a few days earlier. Similarly, the August 2000 IPO auction of Chunghwa Telecom in Taiwan left 28% of shares unsold. In the UK, Jenkinson and Mayer (1988) and Jagannathan and Sherman (2005) report that 50% of all the privatization tenders during 1982 and 1987 were undersubscribed whereas one tender had 500% oversubscription.

One would think that the risk of undersubscription would more or less disappear with a large number of prospective bidders. However, the number of bids must be compared to the number of eligible bidders. For Taiwan's discriminatory IPO auctions, the average number of bidders is around 1150 (Liaw *et al*., 2001). More than 16 million adults are eligible to bid in each auction. Hence, if the participation rate of the eligible population shifts by just seven 1/1000ths of 1% in either direction, bids will either almost double or almost vanish. Moreover, a large average number of bidders will not eliminate the risk of undersubscription if there is some coordination or 'leakage' of information (Chowdhry and Sherman, 1996). Sherman (2005) argues that in IPO auctions both issuers and investors incur a higher risk because underwriters cannot control the number of participating investors. As a result, demand may be too low, causing the issue to fail. Alternatively, demand may be too high, causing the price to be bid up too high and eliminating all of the potential profits for investors (see also Levin and Smith, 1994).

Free-riders. Too many entrants in an auction will not be a problem if each of the bidders has carefully evaluated the offering and chosen a reasonable bid price. Since auctions such as the W.R. Hambrecht 'Open IPO' are open to all, including free-riders with little understanding of the value of the offering, too many entrants can greatly distort the offering price, leading to overpricing and the subsequent first week crash that has been observed in IPO auctions. Under bookbuilding, underwriters devote substantial time and effort to withholding shares from those who will 'flip' or 'stag' them. Although the underwriter wants liquidity in the aftermarket, flippers are a problem, not primarily because they are willing to sell shares quickly, but because they are trying to take advantage of the high average initial returns of IPOs without giving the underwriter anything in exchange. In other words, they are free-riders, and much of the investment bank's effort is devoted to weeding them out of the investor pool.

Unlike in bookbuilding, where investment bankers can employ underpricing as an incentive for investors to reveal their true interest in an issue, Sherman (2005) claims

that, in auctions, underwriters have no control over share allocations and thus have no means of extracting reliable demand and price information from informed investors. Although investment bankers can also do road shows for auction IPOs and ask for indications of interest, she argues that investors have no incentive to provide the underwriter with accurate information. Moreover, Sherman (2000) argues that auctions suffer from a serious free-rider problem. Specifically, if investors believe that an issue will be underpriced, they have an incentive to place their bids at a very high price to ensure that they will receive shares in the issue. In uniform price auctions, this will guarantee that they get shares at the market clearing price. As a consequence, the offer price is bid up very high and overpricing occurs.

One prominent example for the free-rider problem occurred in Argentina in March 1992 when the firm, Argentinean Telecom, was privatized. Shares in the privatized firm were sold via a 'Dutch' auction. Expecting that the shares would be underpriced, free-riders placed excessively high bids to ensure that they would receive shares. Not surprisingly, given the distorted demand indications free-riders had put on the issue, the opposite came true. Many retail investors were upset at losing money at what they had considered a sure bet, and pulled out of the market altogether. As a result, Argentina's stock market crashed, volatility went sky-high, and 20 other equity issues that had already been scheduled for subsequent months had to be withdrawn.

Overpricing. In contrast to bookbuilding, in which a majority of IPOs are underpriced, it is common for IPO auctions to be overpriced. For instance, IPOs that were auctioned off in the UK between 1983 and 1986 had an average first-day return of -2.2% (Jenkinson and Mayer, 1988). Lee *et al*. (2003) relate overpricing in auctions to the involvement of different types of bidders and show that in Taiwan, auctions with low institutional participation have had large negative initial returns and fewer bidders, relative to auctions with more institutional participation and positive initial returns. Taken together, investment bankers have control over share allocation under bookbuilding and can use this control either to maximize IPO proceeds or to provide investors with an incentive to evaluate the IPO more carefully, making the aftermarket price more accurate.

Volatile trading. IPO auctions can lead to more volatile trading. The risk is that the pricing could be determined by 'crowd psychology', complicating the underwriters' traditional system of stabilizing a new issue's price by bidding for shares that come up for sale in the first few days of trading. Underwriters often pledge to buy shares of an IPO if the stock begins trading down. If selling gets out of hand, it could be very costly for the underwriters. For example, Salon.com came to market in a 1999 Dutch auction. Without underwriter efforts to prop up the stock, Salon fell 50 cents a share, to $10, on the first day of trading, and eventually declined by more than 40% over the next several months.

The Proceeds Puzzle

Sherman (2005) argues that expected IPO proceeds under the bookbuilding method are strictly higher because auctions sell fewer shares on average and have a higher

probability of undersubscription. In contrast, in the Chemmanur and Liu (2003) model, the issuer is maximizing the sum of expected proceeds from selling a fraction of the firm in the primary (IPO) offering in the first period and proceeds from selling the remainder of the firm in the secondary market in the second period. They show that for high quality firms that will use the auction method IPO proceeds from the primary offering will be greater since the auction will ensure a higher offering price and lower underpricing. For a fixed price offer that will be used by lower quality firms, the offer price and proceeds will be lower and underpricing will be higher in the primary offering.

In summary, the literature on auction and bookbuilding methods for IPOs thus offers the following generalizations:

(1) Auctions are likely to exhibit less underpricing than bookbuilding methods for IPOs.
(2) Auctions are likely to exhibit more return volatility than bookbuilding methods for IPOs.
(3) Auctions are likely to exhibit smaller long-run returns than bookbuilding IPOs.
(4) Auctions are likely to involve lower quality IPO firms relative to the bookbuilding method.

In this study we examine the evidence relative to the above generalizations for US firms that have elected to use either the auction method or the bookbuilding method to conduct their IPO.

Data

Sample Selection and Description

We start our sampling process by constructing a comprehensive dataset that includes information on all US IPOs filed between January 1999 and December 2004 as listed in the Securities Data Company (SDC) New Issues database. For each IPO we collect the date of the IPO filing, company identification information, the firm's SIC code, the initial exchange on which the firm was listed, the lead underwriter, the underwriter spread, the number of shares issued, the offer price and the initial pricing range. We access the SEC 'Edgar' database to collect information from the firms' S-1 filings and prospectuses to confirm and complete our dataset.

First-day closing prices, adjusted daily returns, volume and shares outstanding from the IPO date to December 2004 are obtained from the Center for Research in Security Prices (CRSP). We measure IPO underpricing as the percentage return from the SDC offer price to the first closing price on CRSP. We exclude ADRs, reverse LBOs, spin-offs, IPOs by financial firms, limited partnerships, real estate investment trusts (REITs), closed-end funds and unit offerings. Finally, we exclude firms that have no closing prices within three days of the SDC issue date.

We collect information on analyst recommendations for a one-year period following each IPO from Thomson Financial's I/B/E/S-Firstcall analyst-by-analyst database. For each recommendation, we collect the date, the type of

recommendation (classified by I/B/E/S as strong buy, buy, hold, underperform and sell), and the name of the analyst who issued the recommendation.

To determine lead and non-lead analysts, we accessed the SDC database to identify the lead and co-lead underwriter(s) for each offering and then used Thomson Financial's I/B/E/S database to determine to what extent an issuer was covered by (1) analysts affiliated with these lead- or co-lead underwriters; (2) analysts affiliated with other institutions; or (3) no analysts at all. Because the standard I/B/E/S data files do not provide the required information for this type of analysis, we contacted Thomson Financial and they graciously provided us with a broker identification file that contained specific information on analyst affiliations.

Information on trades and quotes is taken from the New York Stock Exchange Trade and Quote (TAQ) database, which also provides information on intraday price and volume data. We access press releases from Bloomberg, the *Wall Street Journal* and Lexis/Nexis to identify all IPO auctions during our sample period. Each of these sources identified the same 11 US IPOs as being sold via auctions.

Information on venture capitalist identity is from VentureXpert. We identify the lead VC as the one that made the biggest investment in an IPO firm. In addition, we calculate a company's age as the difference in years between its founding date and its IPO date. We hand-fill gaps in the SDC's coverage of company founding dates, and manually check all firms that according to the SDC were zero to three years old at the time of their IPO, because Loughran and Ritter (2004) note that SDC frequently reports the most recent incorporation date rather than the founding date.[4]

Before we present the results of our empirical analysis, we take an initial look at the IPO auctions that have taken place in recent years and ultimately comprise our auction sample. With the exception of Google, all of the 11 firms that chose to go public via auctions[5] chose W.R. Hambrecht & Co. as a lead underwriter for their IPO.[6] Founded in 1998 by William R. Hambrecht, W.R. Hambrecht & Co. has been a pioneer in IPO auctions and underwrites IPOs through the so-called Open IPO system, which it describes as 'an innovative auction process for distributing stock to individuals and institutions through a more efficient and equitable process'.[7]

An Open IPO auction is generally open for bids by prospective investors for one or two weeks prior to the effective date of the offering. The prospectus for an Open IPO offering will include the number of shares being sold and a suggested price range for the shares. Once the bidding has concluded, the Open IPO auction assembles the bids and, starting from highest to lowest, finds the first bid price that will sell all of the shares in the offering; this is the market clearing price. The issuing company and underwriters then decide the price at which the company will offer the shares, taking a number of business and economic factors into account in addition to the clearing price. The company may choose to sell shares at the clearing price, or it may offer the shares at a lower offering price. If the number of shares bid for exceeds the number of shares in the offering, the shares are allocated on a pro rata basis.[8]

Table 1 provides an overview of our IPO auction sample. An initial look reveals no apparent time or industry trends, i.e. the number of IPOs that chose to go public via auctions over time has been relatively constant since the initiation of the Open IPO process. As in the 'mainstream' IPO market, technology firms make up the majority of our sample.

Table 1. Our IPO auction sample

Issuer	Issue date	Ticker symbol	Lead underwriter(s)	Co-manager(s)	Shares offered (mill.)	Offer price ($)	Initial offer range ($)	Total raised ($ mill.)	Spread	Firm age (years)	SIC code	Industry	Acquisitions
Ravenswood Winery	9/4/1999	RVWD	W.R. Hambrecht & Co	–	1.0	10.5	10.5 – 13.5	10.5	4%	23	2084	Wines, brandy, and brandy spirits	Acquired by Constellation Brands (STZ) on 2 July 2001.
Salon.com	22/6/1999	SALN	W.R. Hambrecht & Co	Daiwa Securities (New York)	2.5	10.5	10.5 – 13.5	26.3	5%	4	7372	Prepackaged software	
Andover.net	8/12/1999	ANDN	W.R. Hambrecht & Co	Advest Inc DLJdirect	4	18.0	12 – 15	72.0	7%	7	7379	Computer-related services	Acquired by VA Linux Systems (LNUX) on 3 February 2000.
Nogatech	17/5/2000	NGTC	W.R. Hambrecht & Co	ING Barings DLJdirect	3.5	12.0	16 – 16	42.0	6.5%	7	3674	Semiconductors & related devices	Acquired by Zoran (ZRAN) on 24 October 2000.
Peet's Coffee & Tea	25/1/2001	PEET	W.R. Hambrecht & Co	Pacific Growth Equities Inc	3.3	8.0	10 – 14	26.4	6.5%	5	2095	Roasted coffee	
Briazz	2/5/2001	BRZZ	W.R. Hambrecht & Co	–	2	8.0	8 – 12	16.0	6%	6	5812	Eating places	
Overstock.com	29/5/2002	OSTK	W.R. Hambrecht & Co	Cantor Fitzgerald	3	13.0	12 – 16	39.0	4%	5	5999	Miscellaneous retail stores	
redEnvelope	25/9/2003	REDE	W.R. Hambrecht & Co	Pacific Crest Securities	2.2	14.0	12 – 16	30.8	6%	6	5947	Card and gift shops/museum stores	
Genitope	30/10/2003	GTOP	W.R. Hambrecht & Co	Punk, Ziegel & Co Brean Murray & Co	3.7	9.0	11 – 11	33.3	7%	7	2830	Drugs	
New River Pharmaceuticals	5/8/2004	NRPH	W.R. Hambrecht & Co	First Albany Capital Wells Fargo Securities Punk, Ziegel & Co	4.2	8.0	10 – 14	33.6	7%	8	2834	Pharmaceutical preparations	

(*continued*)

Table 1. (*Continued*)

Issuer	Issue date	Ticker symbol	Lead underwriter(s)	Co-manager(s)	Shares offered (mill.)	Offer price ($)	Initial offer range ($)	Total raised ($ mill.)	Spread	Firm age (years)	SIC code	Industry	Acquisitions
Google	19/8/2004	GOOG	Morgan Stanley Credit Suisse First Boston	Goldman, Sachs & Co Citigroup Lehman Brothers Allen & Company JP Morgan UBS Investment Bank WR Hambrecht & Co Thomas Weisel Partners	19.61	85.0	108–135	1666.4	2.8%	7	7375	Information retrieval services	

This table provides an overview of the 11 IPO auctions that were filed during our 1999–2004 sample period. For each firm, we report the IPO date, ticker symbol, the composition of the underwriting syndicate, the number of shares offered, the offer price, the initial offer range, the total amount of capital raised, the underwriter discount (spread), and information on the firm's industry. In addition, the last column provides updates on acquisitions that took place until December 2004. Information in the last column is based on news releases on Bloomberg and in LEXIS/NEXIS. The information in all other columns is based on data from IPO prospectuses or data provided by the SDC New Issues database.

We note that a large number of the auction sample firms (three out of 11) were acquired within only a short period after their IPO. Andover.net was acquired by VA Linux on 3 February 2000, within less than two months after its IPO in 8 December 1999. Similarly Nogatech, a producer of semiconductors, was listed for only five months before being acquired by Zoran on 24 October 2000. Finally, Ravenswood Winery, the first firm to go public via Hambrecht's Open IPO process, was acquired approximately 27 months after its IPO by Constellation Brands. Although the timing of the latter acquisition is not unusual, the almost immediate acquisitions of Andover and Nogatech are highly uncommon.[9]

Finally, we note that the underwriting spreads, i.e. the underwriting discounts, for our sample are relatively low. While Chen and Ritter (2000) observe a clustering of spreads around the 7% mark, most IPOs in our sample have lower spreads, particularly Google which offered an underwriter spread of only 2.8%. Although we will investigate this issue in more detail below, it appears that IPO auctions are also cheaper in terms of these spreads than traditional bookbuilding IPOs.

Methodology and Results

Matching Technique

We perform a series of univariate tests for various variables in our dataset. We define variables as they arise. A comprehensive list of the variables used in this study, together with data sources, is provided in the Appendix. To ensure that our results are not driven by variations in IPO characteristics over time or across industries, we employ a matched firm technique following the approach by Kim and Ritter (1999). For each firm that went public via an auction, we identify similar firms that went public under the traditional bookbuilding method.[10] To be included in our matched sample, a bookbuilding firm must have had its IPO during the same year as the auction firm and must belong to the same industry.[11] We match by industry because firms in the same industry are more likely to have similar operating risks, profitability and growth prospects. In addition, using an industry match allows us to control for cross-sectional differences in underpricing and other IPO characteristics. By matching firms by IPO year, we control for variations in IPO characteristics and market conditions over time. Among other things, this allows us to avoid comparing firms that went public during the 'hot' IPO market of 1999 – 2000 with firms that went public during the relatively cold 2001 – 2004 market.[12]

Univariate Comparison of Auction and Bookbuilding IPO Firms

We characterize auction and bookbuilding IPOs along various dimensions in Table 2. We examine the relation between choice of auction method and underwriter reputation using the Carter and Manaster (1990) and Carter *et al.* (1998) reputation rankings as revised by Ritter.[13] Ritter's rankings range from 1.1 (lowest) to 9.1 (highest). Compared to W.R. Hambrecht's ranking of 7.1 we observe that comparable firms that choose to go public via bookbuilding do so through somewhat higher-ranked underwriters (median = 8.1). If underwriter ranking serves as a

Table 2. Univariate comparison of auction and bookbuilding IPO firms

Variable	Auction IPOs mean median	Matched bookbuilding IPOs mean median	Tests of differences means (p-value) medians (p-value)	Auction IPOs without Google mean median	Matched Bookbuilding IPOs without Google mean median	Tests of differences means (p-value) medians (p-value)
Underwriter rank	7.30	7.80	0.0695	7.10	8.10	0.0027
	7.10	8.10	0.0153	7.10	9.10	0.0091
% of tech firms	54.55%	74.25%	0.0265	50.00%	64.44%	0.0118
Offer price revision	−14.43%	2.85%	0.0208	−12.87%	10.42%	0.1105
	−18.18%	−5.00%	0.0077	−15.34%	7.42%	0.0312
Firm age	7.70	6.45	0.1172	7.80	6.21	0.1804
	6.67	5.32	0.2336	6.50	5.17	0.2118
Underwriter spread	5.62%	7.03%	0.0029	5.90%	7.04%	0.0044
	6.00%	7.00%	0.0011	6.25%	7.00%	0.0022
Turnover	0.79	0.55	0.0217	0.66	0.41	0.0334
	0.74	0.51	0.0169	0.59	0.32	0.0521
Pre-IPO market	1.42%	−0.87%	0.2905	1.76%	−1.15%	0.2750
run-up (1 month)	2.31%	0.68%	0.4478	2.36%	0.68%	0.3890
Pre-IPO market	0.34%	1.54%	0.6402	0.42%	1.46%	0.7126
run-up (3 months)	0.80%	2.35%	0.9571	1.85%	2.46%	0.9095

We consider firms that went public in the US between January 1999 and December 2004. We compare the characteristics of 11 firms which went public under an IPO auction arrangement with a sample of matched firms that went public via a bookbuilding contract. To be included in our matched sample, a bookbuilding firm must have had its IPO during the same year as the auction firm and must belong to the same industry. We use three-digit SIC codes to distinguish between industries. In one case in which there are no matching firms with the same three-digit SIC code, we relax our industry classification and use a two-digit SIC code. For each variable, we report means and medians. For dummy variables, we report percentage distributions. In the last column, we present p-values for a t-test of differences in means and a Wilcoxon test of differences in medians.

certification of IPO firm quality, then the results suggest that bookbuilding IPOs ought to be of higher quality than auction IPOs.[14]

To investigate whether technology companies preferably choose to go public via auctions or bookbuilding, we adopt the breakdown of Loughran and Ritter (2004) and Cliff and Denis (2004) and categorize firms as technology (tech) focused or not.[15,16] We observe that technology firms are significantly more likely to choose bookbuilding as a going-public method.

To examine pre-IPO pricing decisions, we calculate the offer price revision from the midpoint of the initial filing range to the final offer price for each firm. We observe that auction firms show a higher propensity for downward offer price revisions (average equal to -14.43%) than bookbuilding firms (2.85%). The difference is particularly significant in the median (p-value $= 0.0077$). This is interesting as it suggests that the demand for auction firms may, on average, have been lower than was initially expected. Another reason for the downward price revisions may be that the firms and their underwriters wait for the auction clearing prices to be determined and then decide to create some artificial underpricing. However, the median underpricing reported in Table 3 does not appear to be consistent with the -18.18% median offer price revision we observe here.

We also examine underwriter spreads for auction and bookbuilding IPOs. Our results suggest a significant difference in underwriter spreads between auction and bookbuilding IPOs. Consistent with Chen and Ritter (2000), we observe that for bookbuilding IPOs most underwriter spreads are clustered around 7%. The underwriter spreads for auction IPOs tend to be significantly lower. In fact, only three of our 11 auction IPOs have underwriting spreads of 7%. The underwriting spreads for all other IPOs are lower, with Google paying an underwriting discount of only 2.8%. Besides leaving less money on the table (see Table 3 below), this means that firms that choose to go public via an auction also save on underwriting fees, making auctions financially appealing for the issuer in terms of both direct and indirect costs.

Furthermore, we consider stock turnover, measured as the proportion of shares traded at least once during a given period. As noted earlier, we hypothesize that auction IPOs display higher volatility in secondary market trading as the pricing could be determined by crowd psychology that impedes the underwriters' traditional system of stabilizing a new issue's price by bidding for shares that come up for sale in the first few days of trading. We use stock turnover to proxy for this volatility. Our calculations are similar to those of Lowry and Shu (2002), and Turtle and Walker (2005) in that we calculate turnover as the proportion of shares traded during the one-year period starting one month after the IPO.[17] Indeed, we observe a significantly higher turnover for auction IPOs.

Finally, in the last two rows of Table 2, we provide information on the market run-up, measured as the percentage return on the CRSP NYSE/AMEX/NASDAQ value-weighted market index, during a period of one month and three months immediately preceding our sample IPOs. While these figures are unrelated to the IPO characteristics presented in the remainder of the table, they are of interest because they allow us to examine whether the market conditions that the IPO firms in our two subsamples faced at the time they went public were comparable. A result that suggests that the market conditions were significantly different for the firms in our

Table 3. Underpricing

Issuer	Underpricing	Matched firm underpricing (N, mean, median)
Ravenswood Winery	3.62%	5
		0.20%
		0.00%
Salon.com	−4.19%	210
		76.73%
		46.51%
Andover.net	252.11%	210
		76.73%
		46.51%
Nogatech	−21.58%	47
		47.73%
		15.06%
Peet's Coffee & Tea	17.25%	3
		0.12%
		0.00%
Briazz	0.37%	9
		10.69%
		8.57%
Overstock.com	0.23%	13
		9.19%
		5.26%
redEnvelope	3.93%	13
		9.19%
		5.26%
Genitope	11.11%	73
		19.75%
		4.00%
New River Pharmaceuticals	−11.25%	73
		19.75%
		4.00%
Google	18.04%	137
		62.06%
		33.36%
Mean underpricing	24.51%*	35.00%
Median underpricing	3.62%	8.57%
t-test (p-value)	0.8206**	
Wilcoxon test (p-value)	0.0878	

*Mean underpricing without Andover.net: 1.75%; mean underpricing without Andover.net and Google: −0.06%.

**p-value without Andover.net: 0.0326; p-value without Andover.net and Google: 0.0330.

We examine first-day underpricing returns for IPO auctions and matched bookbuilding IPOs. To be included in our matched sample, a bookbuilding firm must have had its IPO during the same year as the auction firm and must belong to the same industry. We use truncated three-digit SIC codes to distinguish between industries. In one case in which there are no matching firms with the same three-digit SIC code, we relax our industry classification and use a two-digit SIC code. We calculate first-day underpricing as the percentage return from the SDC offer price to the first-day closing price reported on CRSP. In the last four rows, we report the mean and median underpricing for both groups and provide test results for a t-test for the significance of differences in means and a Wilcoxon test for the significance of differences in medians.

two subsamples could reflect a potential bias that remained unaccounted for in our matching procedure and may affect our subsequent results. The results in Table 2 suggest no such bias as the market returns during the examined pre-IPO periods are not significantly different.[18]

A Detailed Look at Underpricing and IPO Proceeds

In Table 3, we provide a detailed analysis of underpricing returns for auction and matched bookbuilding IPOs. Interestingly, we observe that firms like Ravenswood Winery and Peet's Coffee & Tea, which – at least for IPO investors – belong to industries that under the traditional bookbuilding method are rarely underpriced (the median underpricing percentage of the matched samples for both firms are zero), they provided investors with reasonable returns (3.62% and 17.25%). With the exception of Andover.net, whose performance could be viewed as an anomaly, every other firm that went public via an auction exhibited lower underpricing than the average of its matches, and in many cases they were even overpriced.[19] As a result, the mean and median underpricing percentage for our sample of auction firms lies considerably below the sample average for matched bookbuilding firms, particularly if we exclude Andover from our analysis.[20]

Our results are consistent with Derrien and Womack (2003) who use French IPO data and find that mean underpricing in auctions is lower than for bookbuilding IPOs, and with Jenkinson and Mayer (1988) who observe similar results for British privatizations. Thus, for our sample the sum of the median underwriting spread and median underpricing is 9.62% for auction IPOs; the corresponding figure for bookbuilding IPOs is 15.60%.

Given the magnitude of this difference, the question naturally arises whether bookbuilding issuers that incur higher issuer costs also receive greater benefits relative to issuers in auction IPOs. Cliff and Denis (2004) find that underpriced issues are more likely to receive analyst coverage; Lowry and Shu (2002) argue that underpricing serves to reduce a firm's litigation risk or provide easier access to capital in secondary equity offerings. Finally, higher underpricing allows for an increased use of spinning, the practice whereby investment bankers allocate underpriced IPOs to high profile customers to garner potential future business. With the exception of litigation risk, which we briefly discuss here, we examine these factors in our subsequent analysis.

Despite the relatively lower underpricing (or indeed overpricing) of most auction IPOs, not a single issuer has been sued under Section 11 of the 1933 Securities Act to date.[21] In our matched bookbuilding sample, on the other hand, we observe a litigation rate of 7.2%. While our auction IPO sample is too small to make any inferences with respect to litigation risk, we conjecture that as long as an issuer chooses an offering price that falls at or below the auction clearing price it will be harder for potential plaintiffs to allege deliberate mispricing under the auction mechanism. Other allegations, including the misrepresentation or omission of material information, however, can be equally brought under both types of selling methods.

As discussed earlier, the extant literature is divided when it comes to the question of which IPO firms – auction or bookbuilding – should command higher offering proceeds. On the one hand, Sherman (2005) argues that IPO proceeds should be

higher under the bookbuilding method because there is a greater chance of undersubscription in an auction. Chemmanur and Liu (2003) argue that for high quality firms (those with lower firm evaluation costs), auctions will lead to lower underpricing and higher proceeds. For low quality firms (those with high firm evaluation costs) there will be larger underpricing and smaller IPO proceeds. Chemmanur and Liu do not directly address bookbuilding IPOs in their paper.

To provide some US evidence for this puzzle, Table 4 presents a detailed comparison of offering proceeds by industry. We aggregate firms by three-digit SIC codes and calculate mean and median offering proceeds for each industry.[22] Again, we distinguish between auction and matched bookbuilding IPOs and test for the significance of differences in means and medians between the two groups.

With the exception of one industry (computer and data processing services) we observe that proceeds for auction IPOs are always smaller than for matched bookbuilding IPOs. Indeed, the only firm that breaks the pattern is Google. Not surprisingly, our aggregate sample statistics suggest that median proceeds are significantly lower for auction IPOs (p-value = 0.0028). Mean proceeds also become significantly different if Google is excluded.

While Google's IPO seems to suggest otherwise, the consistently lower proceeds we observe in the remainder of our auction sample are highly consistent with Sherman's (2005) model. It remains to be seen whether undersubscription remains a problem in future offerings or whether Google's success has – at least temporarily – opened up the auction market for larger firms and has sparked investor interest in future auction IPOs.

Long-Term Performance and Return Volatility

Sherman (2005) predicts that auctions open to greater numbers of potential bidders may lead to inaccurate pricing and high aftermarket volatility. The bookbuilding method enables the issuer to control entry to the auction and allow investors to earn a reasonable return to compensate them for their evaluation efforts. Thus the bookbuilding method should lead to higher long-term returns and lower aftermarket volatility than the auction method.

Table 5 presents detailed long-term return and volatility statistics for each firm in our auction sample. The table contains unadjusted raw returns for the auction IPO firms and unadjusted returns for the matched bookbuilding IPO firms. In addition, we provide aggregate results for our auction and bookbuilding sample.[23] While the performance differences in the long term are insignificant, we observe that within a time frame of 18 months, auction IPOs significantly underperform their matched bookbuilding peers. The underperformance is particularly obvious and significant when examining arithmetic mean returns but is less apparent when examining geometric mean (not reported here) or median returns. In line with the turnover statistics we reported in Table 2 that suggested higher aftermarket volatility for auction IPOs, we also generally observe a higher return standard deviation for them. While the differences are generally insignificant, together with our turnover results they do suggest that the lack of price stabilization measures (that are common for bookbuilding IPOs) for auction IPOs increases their price risk after the IPO. These results are thus consistent with Sherman's predictions.[24]

Table 4. Comparison of offering proceeds

Truncated SIC code	Industry description	Auction IPOs (N, mean, median)		Matched bookbuilding IPOs (N, mean, median)
208	Beverages	1		5
		10.50		127.16
		10.50		91.40
209	Misc. food and kindred products	1		3
		26.40		140.46
		26.40		132.00
283	Drugs	2		73
		33.45		71.36
		33.45		63.00
367	Electronic components and accessories	1		47
		42.00		156.67
		42.00		84.00
581	Eating and drinking places	1		9
		16.00		177.63
		16.00		72.00
59	Retail stores	2		13
		34.90		89.64
		34.90		80.40
737	Computer and data processing services	3		347
		588.23		70.48
		72.00		51.20
Entire sample		11		497
		181.48		82.19
		33.30		89.64
t-test (p-value)			0.6034	
Wilcoxon test (p-value)			0.0028	
Entire sample without Google		10		360
		32.99		80.79
		32.05		54.30
t-test (p-value) without Google			0.0003	
Wilcoxon test (p-value) without Google			0.0022	

We examine differences in offering proceeds for IPO auctions and matched bookbuilding IPOs by industry. Offering proceeds are reported in $ million. To be included in our matched sample, a bookbuilding firm must have had its IPO during the same year as the auction firm and must belong to the same industry. We use truncated three-digit SIC codes to distinguish between industries, with the exception of SIC codes 5947 and 5999 for which we use two-digit SIC codes due to a lack of matching firms with the same three-digit SIC code. For each industry we report the number of observations (N), as well as mean and median proceeds for both auction and bookbuilding IPOs. In the last three rows, we report aggregate sample statistics for both groups and provide test results for a t-test for the significance of differences in means and a Wilcoxon test for the significance of differences in medians.

Table 5. Long-term performance and volatility statistics

Issuer	Issue date	1-month return	3-month return	6-month return	12-month return	18-month return	24-month return	36-month return
Ravenswood Winery	9/4/1999	−2.94%	−3.49%	−2.30%	−2.30%	25.28%	166.45%	n.a.
		(0.92%)	(0.67%)	(0.61%)	(1.01%)	(1.64%)	(3.44%)	
Salon.com	22/6/1999	13.80%	−41.20%	−39.40%	−86.20%	−93.70%	−97.70%	−99.40%
		(6.93%)	(5.93%)	(6.41%)	(7.51%)	(7.18%)	(10.10%)	(10.81%)
Andover.net	8/12/1999	−38.47%	−40.83%	n.a.	n.a.	n.a.	n.a.	n.a.
		(10.84%)	(8.96%)					
Nogatech	17/5/2000	−26.57%	−37.51%	n.a.	n.a.	n.a.	n.a.	n.a.
		(8.60%)	(7.12%)					
Peet's Coffee & Tea	25/1/2001	−9.38%	3.30%	−15.67%	27.29%	41.58%	44.24%	88.06%
		(12.29%)	(8.14%)	(6.07%)	(4.84%)	(4.49%)	(4.19%)	(3.69%)
Briazz	2/5/2001	−37.86%	−70.73%	−89.91%	−83.44%	−89.54%	−97.88%	−98.51%
		(6.15%)	(7.47%)	(8.01%)	(7.68%)	(8.59%)	(10.73%)	(11.21%)
Overstock.com	29/5/2002	−9.22%	−57.72%	−2.73%	−0.77%	32.98%	155.49%	n.a.
		(3.16%)	(4.70%)	(6.41%)	(7.51%)	(7.18%)	(10.10%)	
redEnvelope	25/9/2003	−10.24%	9.35%	−37.11%	−41.51%	n.a.	n.a.	n.a.
		(3.29%)	(4.08%)	(4.71%)	(4.09%)			
Genitope	30/10/2003	25.00%	20.30%	−5.00%	30.00%	n.a.	n.a.	n.a.
		(6.66%)	(5.50%)	(4.50%)	(3.82%)			
New River Pharmaceuticals	5/8/2004	2.67%	89.60%	n.a.	n.a.	n.a.	n.a.	n.a.
		(3.90%)	(3.65%)					
Issuer	Issue date	1-month return	3-month return	6-month return	12-month return	18-month return	24-month return	36-month return
Google	19/8/2004	17.10%	66.99%	n.a.	n.a.	n.a.	n.a.	n.a.
		(2.54%)	(3.65%)					
Auction firms (Arithmetic mean return, median return, average standard deviation)		−6.92%	−5.63%	−27.45%	−22.42%	−16.68%	34.12%	−36.62%
		−9.22%	−3.49%	−15.67%	−2.30%	25.28%	44.24%	−98.51%
		(5.93%)	(5.57%)	(5.13%)	(4.93%)	(5.46%)	(6.73%)	(8.57%)
Matched bookbuilding firms (Arithmetic mean return, median return, average standard deviation)		4.52%	3.96%	−6.86%	10.91%	13.41%	9.80%	9.10%
		2.61%	7.19%	−12.74%	23.33%	31.86%	21.77%	0.74%
		(5.27%)	(5.35%)	(4.96%)	(5.14%)	(4.76%)	(5.04%)	(4.30%)

(*continued*)

Table 5. (*Continued*)

Issuer	Issue date	1-month return	3-month return	6-month return	12-month return	18-month return	24-month return	36-month return
t-test (p-value) for mean returns		0.0573	0.0377	0.0224	0.0159	0.0843	0.5298	0.7701
Wilcoxon test (p-value) for median returns		0.1577	0.2501	0.7491	0.4057	0.7540	0.9168	0.5127
F-test (p-value) for standard deviations		0.1190	0.2567	0.0767	0.1802	0.5540	0.2828	0.6203
Auction firms without Google		−9.32%	−12.89%	−27.45%	−22.42%	−16.68%	34.12%	−36.62%
(Arithmetic mean return, median		−9.30%	−20.50%	−15.67%	−2.30%	25.28%	44.24%	−98.51%
return, average standard deviation)		(6.27%)	(5.76%)	(5.13%)	(4.93%)	(5.46%)	(6.73%)	(8.57%)
Matched bookbuilding firms without		5.45%	12.08%	−4.66%	10.91%	13.41%	9.80%	9.10%
Google (Arithmetic Mean Return,		2.75%	9.82%	−11.95%	23.33%	31.86%	21.77%	0.74%
Median Return, Average standard deviation)		(5.09%)	(5.36%)	(5.47%)	(5.14%)	(4.76%)	(5.04%)	(4.30%)
t-Test (p-value) for mean returns without Google		0.0593	0.1480	0.1621	0.2396	0.5511	0.5513	0.6810
Wilcoxon test (p-value) for median returns without Google		0.0890	0.0890	0.5244	0.2716	0.7453	0.8710	0.3619
F-test (p-value) for standard deviations without Google		0.0537	0.0386	0.7724	0.3489	0.3963	0.1276	0.6936

n.a. = not available.

We examine the long-term performance and return volatility of issuing firms over various time horizons after their IPO for both IPO auctions and matched bookbuilding IPOs. Returns are calculated relative to the first-day closing price. Return volatility is based on daily closing price data during the period and is reported in brackets below. To be included in our matched sample, a bookbuilding firm must have had its IPO during the same year as the auction firm and must belong to the same industry. We use three-digit SIC codes to distinguish between industries. In one case in which there are no matching firms with the same three-digit SIC code, we relax our industry classification and use a two-digit SIC code. For each auction IPO we report long-term performance measures over various time horizons, ranging from 1 to 36 months after the firm's IPO. In the bottom half of the table, we calculate the arithmetic mean return, median return and the standard deviation of returns for both auction and matched bookbuilding firms. In addition, we provide test results for a t-test and Wilcoxon test for the significance of differences in mean and median returns, respectively, and for an F-test for the significance of differences in standard deviations. Note that in some cases long-term returns could not be calculated because the firms have not traded long enough at the time of our study or because they have been acquired.

Analyst Coverage

Degeorge *et al.* (2006) study IPOs in France (where both auction and bookbuilding sales methods in IPOs coexisted) and hypothesize that issuers are willing to pay the higher documented direct and indirect costs of bookbuilding in exchange for increased and more favourable research coverage when they choose to go public via bookbuilding rather than an auction. To examine if their argument applies to US auction IPOs, we examine the number of analyst recommendations and the type of recommendations among US auction IPOs and their matched bookbuilding IPOs during periods of 1 month, 1 to 3 months, 3 to 6 months, 6 to 12 months, 12 to 18 months, 18 to 24 months and 24 to 36 months after the issue. Our results in Table 6 show that Degeorge *et al.*'s arguments also apply in the US IPO market. Specifically, we observe that bookbuilding IPOs are more likely to be followed (and positively recommended) by analysts compared to auction IPOs, with median (mean) differences being significant at the 5% level in five (four) of the time periods we examine.

Although our results suggest that bookbuilding IPOs receive more analyst coverage, they could also be caused by their higher first-day underpricing (relative to auction IPOs), which in itself has been associated with greater analyst coverage (see Aggarwal *et al.* (2002a) and Cliff and Denis (2004)).

Analyst Coverage by Lead and Non-lead Analysts

In the previous section, we observed that bookbuilding IPOs are followed by a larger number of analysts than auction IPOs. Yet, even though the number of analysts following the issue may be large, the credibility of some of these analysts may be low if they are affiliated with the IPO underwriters. To control for this, we now measure the percentage of auction IPOs and bookbuilding IPOs that are recommended by lead- and non-lead-underwriter affiliated analysts and provide the results for a t-test and a Wilcoxon test to test for the significance of differences in means and medians between the two groups. Thus for each IPO – auction or bookbuilding – we classify analysts as lead or non-lead from the set of analysts following each IPO firm (for the 36-month post-IPO period). To distinguish between lead and non-lead analysts, we follow the classification scheme employed by Cliff and Denis (2004) and James and Karceski (2006). Lead analysts are analysts affiliated with the lead or co-lead underwriter for the IPO, and non-lead analysts include all other analysts.

We account for mergers when determining affiliations. For instance, if an investment bank that was the lead underwriter for an IPO merged with another bank and if an analyst who is affiliated with either one of the banks provided coverage within a year of the IPO, that analyst is regarded as a lead analyst. We do not treat co-managers as lead underwriters because these underwriters are not book-runners, leaving the lead manager (and, in some cases, the co-lead manager) to allocate the vast majority of shares (see Chen and Ritter, 2000; Cliff and Denis, 2004). For IPOs that have joint lead managers or that have more than one underwriter that helps manage the book (i.e. issues with SDC codes BM, JB or LM) we treat all lead managers as one.[25]

Our results, reported in Table 7, suggest that, relative to auction IPOs, bookbuilding IPOs are significantly more likely to be followed by lead analysts.

Table 6. Analyst coverage post-IPO

	Number of analyst recommendations Period after IPO (months)							Type of recommendation Period after IPO (months)						
	0–1	1–3	3–6	6–12	12–18	18–24	24–36	0–1	1–3	3–6	6–12	12–18	18–24	24–36
Ravenswood Winery			1		2					2		2		
Salon.com			1	3	1					1	2.7	2		
Andover.net		3	1						1.3	4				
Nogatech		2							1.5					
Peet's Coffee & Tea	1	1		3	5	4	7	2	1		1.7	2	1.5	2
Briazz				2							2.5			
Overstock.com		1	1	2	3	2	13	2	2	1.5	3.7	3	2.2	
redEnvelope		3	4	1	6		n.a.		2.3	3.2	3	2		n.a.
Genitope		4	2	1		n.a.	n.a.		1.25	1.5	1		n.a.	n.a.
New River Pharmaceuticals		4		2	n.a.	n.a.	n.a.		1.5		2	n.a.	n.a.	n.a.
Google	10	25	20	6	n.a.	n.a.	n.a.	2.8	3	2.6	2.7	n.a.	n.a.	n.a.
Mean	1.00	3.91	2.73	1.82	1.89	0.75	2.86	2.27	1.70	2.25	2.40	2.20	1.83	2.00
Mean of matched firms	2.23	4.63	3.89	3.56	2.14	2.09	3.67	1.68	2.05	3.21	2.44	1.92	2.36	1.83
t-test (p-value)	0.053	0.044	0.054	0.057	0.047	0.015	0.126	0.238	0.064	0.246	0.153	0.174	0.039	0.177
Mean without Google	0.10	1.80	1.00	1.40	1.89	0.75	2.86	2.00	1.56	2.20	2.36	2.20	1.83	2.00
Mean of matched firms without Google	1.50	3.88	2.20	2.50	2.00	2.67	3.00	1.40	1.72	2.55	2.12	1.64	2.03	1.51
t-test (p-value) without Google	0.026	0.038	0.021	0.023	0.041	0.014	0.125	0.232	0.070	0.254	0.156	0.062	0.043	0.051
Median	0.00	2.00	1.00	2.00	1.00	0.00	0.00	2.00	1.50	2.00	2.58	2.00	1.83	2.00
Median for matched firms	2.00	5.00	4.00	4.00	2.00	2.00	3.00	1.80	1.76	3.48	2.66	1.76	2.12	1.60
Wilcoxon test (p-value)	0.054	0.050	0.035	0.068	0.159	0.175	0.092	0.082	0.045	0.070	0.298	0.241	0.035	0.193

(*continued*)

Table 6. (*Continued*)

	Number of analyst recommendations Period after IPO (months)							Type of recommendation Period after IPO (months)						
	0–1	1–3	3–6	6–12	12–18	18–24	24–36	0–1	1–3	3–6	6–12	12–18	18–24	24–36
Median without Google	0.00	1.50	1.00	1.50	1.00	0.00	0.00	2.00	1.50	1.75	2.50	2.00	1.83	2.00
Median for matched firms without Google	1.00	3.00	3.00	3.00	1.00	1.00	3.00	1.60	1.42	2.96	2.07	1.35	1.72	1.41
Wilcoxon test (p-value) without Google	0.039	0.052	0.029	0.052	0.140	0.161	0.104	0.054	0.022	0.045	0.207	0.210	0.136	0.116

We examine analyst coverage during various time periods after a firm's IPO. We present results for IPO auctions and matched bookbuilding IPOs. To be included in our matched sample, a bookbuilding firm must have had its IPO during the same year as the auction firm and must belong to the same industry. We use truncated three-digit SIC codes to distinguish between industries. In one case in which there are no matching firms with the same three-digit SIC code, we relax our industry classification and use a two-digit SIC code. For each group we report the average number and type of analyst recommendations measured on a scale of 1 (strong buy), 2 (buy), 3 (hold), 4 (underperform), and 5 (sell) over various time horizons, ranging from 1 to 36 months after the firm's IPO. Data on analyst recommendations are based on Thomson Financial's I/B/E/S-Firstcall database. Test results for a t-test and Wilcoxon test for the significance of differences in means and medians, respectively, are reported in the last row. Note that some long-term statistics are based on fewer observations because the firms have not traded long enough or because they have been acquired.

Table 7. Analyst coverage by lead vs. non-lead analysts

Issuer	Issue date	Percentage of auction IPOs with lead analysts	Percentage of bookbuilding IPOs with lead analysts	Percentage of auction IPOs with non-lead analysts	Percentage of bookbuilding IPOs with non-lead analysts
Ravenswood Winery	9/4/1999	0.00%	43.21%	100.00%	56.79%
Salon.com	22/6/1999	20.00%	75.66%	80.00%	24.34%
Andover.net	8/12/1999	100.00%	78.41%	0.00%	21.59%
Nogatech	17/5/2000	0.00%	48.41%	100.00%	51.59%
Peet's Coffee & Tea	25/1/2001	76.19%	69.23%	23.81%	30.77%
Briazz	2/5/2001	0.00%	62.57%	100.00%	37.43%
Overstock.com	29/5/2002	11.76%	73.08%	88.24%	26.92%
redEnvelope	25/9/2003	13.64%	55.92%	86.36%	44.08%
Genitope	30/10/2003	46.15%	65.17%	53.85%	34.83%
New River Pharmaceuticals	5/8/2004	7.69%	41.14%	92.31%	58.86%
Google	19/8/2004	73.47%	87.18%	26.53%	12.82%
Mean		31.72%	63.63%	68.28%	36.37%
t-Test (p-value)		0.0277		0.0136	
Mean without Google		27.54%	61.28%	72.46%	38.72%
t-test (p-value) without Google		0.0105		0.0111	
Median		13.64%	65.17%	86.36%	34.83%
Wilcoxon test (p-value)		0.0757		0.0488	
Median without Google		12.70%	63.87%	87.30%	36.13%
Wilcoxon test (p-value) without Google		0.0211		0.0312	
Standard deviation		36.12%	15.02%	36.12%	15.02%
F-test (p-value)		0.0094		0.0104	
Standard deviation without Google		35.17%	13.52%	35.17%	13.52%
F-test (p-value) without Google		1.0000		0.0089	

We examine the distribution of different types of analyst coverage across our sample firms. We present results for IPO auctions and matched bookbuilding IPOs. To be included in our matched sample, a bookbuilding firm must have had its IPO during the same year as the auction firm and must belong to the same industry. We use truncated three-digit SIC codes to distinguish between industries. In one case in which there are no matching firms with the same three-digit SIC code, we relax our industry classification and use a two-digit SIC code. For each IPO, we distinguish between lead analysts, defined as analysts who are affiliated with the lead or co-lead underwriter for the IPO, and non-lead analysts, defined as all other analysts. Test results for a t-test, a Wilcoxon test, and an F-test for the significance of differences in means, medians, and standard deviations, respectively, are reported in the bottom half of the table.

Our results are significant in both the mean and median and are robust to excluding Google.

Lockup Length and Percentage of Post-IPO Insiders Shares Locked

Brav and Gompers (2003) argue that lockup agreements exist as a commitment device to alleviate moral hazard problems. Given firm quality, a firm whose moral hazard incentives in the aftermarket are likely to be large would have to accept a longer lockup and have more insider shares locked in order to convince the public to buy shares in the offering. During the period of time in which insiders are prohibited from selling equity, information about the firm's future prospects will be known through SEC filings, analyst reports and the media. Therefore, investors would be more willing to buy into the offering knowing that the insiders will not take advantage of them. In this section, we examine if auction IPOs have greater moral hazard problems than bookbuilding IPOs.

In Table 8, we find that the lockup period length of auction IPOs (mean 164 days; median 180 days) is significantly greater than that of matched bookbuilding IPOs (mean 88 days; median 66 days). Moreover, the percentage of insider shares locked for auction IPOs (mean 73%; median 69%) is significantly higher than that of bookbuilding IPOs (mean 63%; median 61%). Our results suggest that if auction IPOs are potentially more plagued by moral hazard problems, insiders in auction IPOs appear to be willing to have longer lockups in order to sell equity to the public. If auction IPO firms are potentially subject to greater information asymmetry problems, they utilize longer lockup periods and have a higher fraction of insiders' shares locked. Brav and Gompers (2003) also argue that IPOs that are backed by higher ranking investment bankers and venture capitalists will not need longer lockups because insiders of these firms are less likely to engage in opportunistic insider sales. Their argument is consistent with our earlier results showing that auction IPOs are underwritten by lower ranking investment banks than bookbuilding IPOs.

Venture-Capital Backed IPOs and the Certification of Venture Capitalists

The choice of IPO mechanism may be related to the certification of venture capitalists. We conjecture that venture capitalists influence issuers and underwriters to adopt the bookbuilding method for IPOs in response to the 'fee retrocession' they receive from underwriters as a 'compensation' for being subject to the lockup period (if they are considered insiders). To test this hypothesis, we report the percentage of VC-backed and non-VC-backed IPOs under the auction and bookbuilding methods. The results in Table 9 show that about 55% of our sample of auction IPOs and 52% of their matched bookbuilding IPOs are VC-backed. The difference is not significant in the mean and median and the result is consistent with and without Google. The difference is not large presumably because of the small sample size of auction IPOs.

In addition, we investigate the difference in VC certification between auction and bookbuilding IPOs. Gompers and Lerner (1996) show that only lead VCs take an active role whereas syndicated VCs typically take a passive role. They argue that the quality of an IPO firm is higher when it is backed by a lead VC. Therefore, we focus

Table 8. Lockup length and post-IPO insider shares locked

		Percentage of insider shares locked		Lockup days	
Issuer	Issue date	Auction IPOs	Matched bookbuilding IPOs	Auction IPOs	Matched bookbuilding IPOs
Ravenswood Winery	9/4/1999	78.02	55.14	90	65.74
Salon.com	22/6/1999	76.70	63.37	90	75.00
Andover.net	8/12/1999	125.22	65.43	180	59.16
Nogatech	17/5/2000	56.88	61.25	180	87.84
Peet's Coffee & Tea	25/1/2001	55.33	43.87	180	135.00
Briazz	2/5/2001	56.46	49.16	180	85.41
Overstock.com	29/5/2002	67.18	54.12	180	72.18
redEnvelope	25/9/2003	74.13	69.32	180	63.96
Genitope	30/10/2003	77.21	65.97	180	125.78
New River Pharmaceuticals	5/8/2004	69.38	74.12	180	133.42
Google	19/8/2004	65.19	55.19	180	110.56
Mean		72.88	63.07	163.64	88.38
t-test (p-value)			0.0544		0.0001
Mean without Google		73.65	64.95	171.00	83.07
t-test (p-value) without Google			0.0720		0.0002
Median		69.38	61.25	180.00	65.52
Wilcoxon test (p-value)			0.0215		0.0006
Median without Google		71.76	62.31	180.00	80.21
Wilcoxon test (p-value) without Google			0.0312		0.0010

We examine the length of the lockup period and the proportion of insider shares locked up during the lockup period. We present results for IPO auctions and matched bookbuilding IPOs. To be included in our matched sample, a bookbuilding firm must have had its IPO during the same year as the auction firm and must belong to the same industry. We use truncated three-digit SIC codes to distinguish between industries. In one case in which there are no matching firms with the same three-digit SIC code, we relax our industry classification and use a two-digit SIC code. The percentage of insider shares locked is the fraction of shares held by insiders after the IPO that are subject to lockup restrictions. Lockup days are the length of the lockup period. Test results for a t-test and a Wilcoxon test for the significance of differences in means and medians, respectively, are reported in the last two rows.

primarily on the presence of such a lead VC. Our empirical approach follows that of Dolvin and Pyles (2006), who provide evidence that suggests that the use of a simple binary variable that captures prior experience as a lead manager of an IPO's VC syndicate is better than employing a continuous variable that measures the percentage of total investments a VC made in which the VC held the lead position over a given time period.

We follow their approach and use a binary variable that is equal to one if the VC served as the lead of a venture capital syndicate in any prior IPO during a period of four years prior to the IPO issue date, and zero otherwise. For instance, Salon.com went public on 22 June 1999, and one of its VCs was JP Morgan Partners, which was

Table 9. Venture capital backing

Issuer	Issue date	Presence of lead VC in auction IPOs		Percentage of lead VC-backed bookbuilding IPOs	Presence of non-lead VC in auction IPOs		Percentage of non-lead VC-backed bookbuilding IPOs	Presence of non-VC in auction IPOs		Percentage of non-VC-backed bookbuilding IPOs
Ravenswood Winery	9/4/1999	0.00%		20.00%	0.00%		0.00%	100.00%		80.00%
Salon.com	22/6/1999	100.00%		38.57%	0.00%		26.19%	0.00%		35.24%
Andover.net	8/12/1999	100.00%		38.57%	0.00%		26.19%	0.00%		35.24%
Nogatech	17/5/2000	0.00%		23.40%	100.00%		40.43%	0.00%		36.17%
Peet's Coffee & Tea	25/1/2001	0.00%		0.00%	0.00%		0.00%	100.00%		100.00%
Briazz	2/5/2001	0.00%		0.00%	0.00%		33.33%	100.00%		66.67%
Overstock.com	29/5/2002	0.00%		23.08%	0.00%		15.38%	100.00%		61.54%
redEnvelope	25/9/2003	100.00%		23.08%	0.00%		15.38%	0.00%		61.54%
Genitope	30/10/2003	0.00%		27.40%	100.00%		60.27%	0.00%		12.33%
New River Pharmaceuticals	5/8/2004	0.00%		27.40%	0.00%		60.27%	100.00%		12.33%
Google	19/8/2004	100.00%		44.53%	0.00%		27.01%	0.00%		28.47%
Mean		36.36%		24.18%	18.18%		27.68%	45.45%		48.14%
t-test (p-value)			0.4501			0.4949			0.8821	
Mean without Google		33.33%		22.39%	22.22%		30.83%	44.44%		46.78%
t-test (p-value) without Google			0.6252			0.6111			0.9956	
Median		0.00%		23.40%	0.00%		26.19%	0.00%		36.17%
Wilcoxon test (p-value)			0.5545			0.0569			0.6224	
Median without Google		0.00%		23.24%	0.00%		26.19%	50.00%		48.85%

(*continued*)

Table 9. (*Continued*)

Issuer	Issue date	Presence of lead VC in auction IPOs	Percentage of lead VC-backed bookbuilding IPOs	Presence of non-lead VC in auction IPOs	Percentage of non-lead VC-backed bookbuilding IPOs	Presence of non-VC in auction IPOs	Percentage of non-VC-backed bookbuilding IPOs
Wilcoxon test (p-value) without Google		0.3447		0.1041		0.8798	
Standard deviation		50.45%	14.28%	40.45%	20.39%	52.22%	27.99%
F-test (p-value)		0.0004		0.0414		0.0618	
Standard deviation		48.30%	13.26%	42.16%	21.49%	52.70%	28.69%
F-test (p-value) without Google		0.0007		0.0574		0.0845	

We examine the distribution of different types of venture capital backing across our sample firms. We distinguish between IPO auctions and matched bookbuilding IPOs. To be included in our matched sample, a bookbuilding firm must have had its IPO during the same year as the auction firm and must belong to the same industry. We use truncated three-digit SIC codes to distinguish between industries. In one case in which there are no matching firms with the same three-digit SIC code, we relax our industry classification and use a two-digit SIC code. We identify lead VC-backed IPOs by means of a binary variable that is equal to one if the IPO has a lead VC that has served as the lead VC in any prior IPO during our sample period, and zero otherwise. Test results for a t-test, a Wilcoxon test, and an F-test for the significance of differences in means, medians, and standard deviations, respectively, are reported in the bottom half of the table.

the lead VC in a number of other IPOs that went public during the period 22 June 1995 to 22 June 1999. Thus, we classify Salon.com as being backed by a lead VC in our study.

We collect the specific structure and size of the VC syndicate from VentureXpert and identify the lead VC as the one that made the biggest investment in an IPO firm. The results in Table 9 suggest that the difference in the mean proportion of lead VC-backed and non-lead VC-backed IPOs employing the bookbuilding or auction mechanism (either with or without Google) is insignificant. The difference in medians between lead VC-backed auction and bookbuilding IPOs is also insignificant. On the other hand, the median of non-lead VC-backed bookbuilding IPOs is significantly higher than that of auction IPOs. This latter difference becomes insignificant, however, when we exclude Google. Yet, the differences in the mean and median standard deviation for these measures are consistently significant (see the last two rows of the table).

Conclusions

The recent history of IPO selling methods clearly reveals that the bookbuilding method has become the dominant international IPO selling method. Concerns regarding bookbuilding relate to the often significant underpricing (issuers leaving too much money on the table), and the reported abuses associated with the ability of underwriters to allocate IPO shares to selected investors. In recent years almost all of the leading Wall Street investment banks have been accused of unfair IPO allocation schemes in connection with more than 300 IPOs. For example, it was reported in the *Wall Street Journal* in 2002 that the SEC had asked NASD and the NYSE to 'look not just at how IPOs are allocated, but also how they are priced'.[26] While the bookbuilding method remains the dominant IPO selling method in the US, the recent revelations of bookbuilding IPO abuses led to calls for greater use of the auction method in IPOs.

Sherman (2005) develops a model of choice among IPO selling methods and concludes that this choice depends on information collection and evaluation costs of the IPO firm, and whether bidding for IPO shares can be controlled. Her model shows that the bookbuilding method is associated with higher underpricing, greater IPO proceeds and smaller aftermarket volatility relative to the auction method. She also concludes that IPO selling methods cannot be judged solely on the basis of the extent of underpricing.

We study all of the 11 auction IPOs in the US between January 1999 and December 2004; with the exception of Google all these IPOs chose to go public through W.R. Hambrecht's Open IPO system. We examine the performance of these IPOs relative to that of a sample of matched bookbuilding IPOs over this same time period. Our results indicate that relative to bookbuilding IPOs, auction IPOs exhibit lower underwriter spreads, smaller underpricing, have smaller average IPO proceeds and greater trading turnover. There is weak evidence that bookbuilding IPOs outperform auction IPOs over an 18-month period following the IPO, and that bookbuilding IPOs may also exhibit lower return volatility than auction IPOs. Consistent with the French evidence in Degeorge *et al.* (2006), we also find that, relative to auction IPOs, bookbuilding IPOs are more likely to be followed and

positively recommended by analysts and that they receive more coverage by lead analysts, i.e. analysts affiliated with lead underwriters. Additionally, we find that the lockup period length of auction IPOs is significantly greater than that of matched bookbuilding IPOs, and that the percentage of insider shares locked up in auction IPOs is significantly higher than for bookbuilding IPOs.

From the viewpoint of persistence of selling methods, the bookbuilding method has 'won' relative to the auction method (or fixed price offers). More recently, the *Wall Street Journal* reported on Morningstar Inc.'s IPO and the firm's rationale for choosing W.R. Hambrecht's Open IPO auction method for its market debut. Steve Kaplan, Professor of Finance at the University of Chicago and a director of Morningstar, suggested that one of the rationales for Morningstar Inc.'s choice of the auction method was that the observed IPO underpricing, together with the 7% underwriter spread in the standard bookbuilding IPO, enabled underwriters and their 'customers collectively to keep as much as 20% or more off the top of every IPO'.[27] The tangible benefits resulting from these higher direct and indirect costs appear to be uncertain, however. On the one hand, our study does document greater and more positive post-IPO analyst coverage for bookbuilding IPOs. However, given the well-known long-run underperformance of bookbuilding IPOs, the superior price discovery properties of the bookbuilding IPO method may be problematic.

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Notes

1 See Stanford University's Securities Class Action Clearinghouse (http://securities.stanford.edu).
2 For a detailed discussion about IPO auctions around the world, see Sherman (2005), and Jagannathan and Sherman (2005 and 2006).
3 On the one hand, Dunbar (2000) shows that issuers tend to steer clear of investment banks that underprice too much. On the other hand, Beatty and Welch (1996) and Krigman *et al.* (2001) document that in the 1990s, IPOs underwritten by the largest and most reputable investment banks tended to have the highest underpricing. In addition, Krigman *et al.* find that firms that switch underwriters when conducting their first secondary equity offering have far lower underpricing than those that do not switch. For additional discussion of this agency cost, see Derrien and Womack (2003). Also, see Cliff and Denis (2004) who provide evidence that suggests that issuers use IPO underpricing to 'purchase' analyst coverage.
4 A detailed discussion of some of the errors in the SDC database can be found on Alexander Ljungqvist's website at http://pages.stern.nyu.edu/~aljungqvist.htm
5 Note that Instinet, in its IPO of 23 May 2001, sold 17.5% of its total offering of $464 million through an auction tranch. The auction process was managed by W.R. Hambrecht and was employed solely for the purpose of determining the allocation among prospective investors of the shares to be distributed through the auction process. The majority of shares (82.5%) were sold under the traditional bookbuilding method which was managed by Credit Suisse First Boston. Because the auction tranch represents only a small portion of Instinet's total offering and because the bookbuilding process was used for the actual price discovery, we exclude Instinet's IPO from our sample.

6 The lead underwriters for Google were Morgan Stanley and Credit Suisse First Boston. W.R. Hambrecht was only part of the underwriter syndicate.
7 As stated on W.R. Hambrecht's website www.Open IPO.com (accessed May 2005).
8 For detailed information about the Open IPO auction mechanism, see W.R. Hambrecht's website at http://www.wrhambrecht.com/ind/auctions/openipo/faq.html
9 Firms that know or anticipate that they will be acquired have little incentive to use underpricing and may choose IPO auctions to avoid leaving too much money on the table. While Andover's case may be special as we discussed before, Nogatech fits the picture very well. The firm went public in May 2000, at the height of the hot IPO market. But while similar semiconductor firms had a first-day return of more than 80% during that year, Nogatech was *overpriced* by more than 21%.
10 Contrary to studies that use a one-on-one matching procedure in which each auction firm is matched with a single bookbuilding firm, we compare each auction firm with a group of bookbuilding firms that have similar characteristics. The approach is similar to the comparable firm technique used by Kim and Ritter (1999) who match a single IPO firm with a group of similar firms in the same industry.
11 We use three-digit SIC codes to distinguish between industries. To ensure that our results are independent of our choice of industry classification schemes (see the discussion in Weiner (2005)) we also performed tests in which we match firms by using the 12-sector industry classification proposed by Breeden *et al*. (1989) as well as the 16-sector classification used by Ljungqvist *et al*. (2003). Our results are highly robust to changes in the underlying classification scheme.
12 To further ensure the robustness of our results, we performed a series of robustness checks in which we varied our existing matching criteria or included additional matching variables. For instance, we also considered matching firms by quarter instead of year to ensure that our results are unaffected by medium-term variations in market conditions and IPO characteristics over time. In addition, we examined the sensitivity of our results to including additional matching criteria such as size, market-to-book ratio, sales, or pre-IPO market momentum. While the combination and/or substitution of our matching variables with these additional matching criteria left our empirical results largely unaffected it frequently resulted in missing matches, that is, auction IPOs for which no comparable bookbuilding IPO could be identified. With a small exception (a three-digit SIC code match that had to be reduced to a two-digit match), our current matching approach overcomes this problem and provides a comparison group for every IPO in our sample period.
13 We thank Jay Ritter for making this data available on his website (http://bear.cba.ufl.edu/ritter/rank.pdf). If there is more than one lead underwriter, we calculate the average reputation of the lead underwriters. The same data have been used in Loughran and Ritter (2004).
14 Beatty and Ritter (1986) provide evidence that high quality underwriters are able to more accurately price an IPO and minimize uncertainty surrounding the offering. Interestingly, this expectation is not fulfilled when comparing the underpricing returns for auction and bookbuilding IPOs (presented in Table 3), i.e. despite the higher ranking of their underwriters, the bookbuilding IPOs in our sample show a significantly higher degree of underpricing and have a higher standard deviation of underpricing returns (not reported).
15 Loughran and Ritter (2004) and Cliff and Denis (2004) categorize firms with the following SIC codes as tech firms: 2833, 2834, 2835, 2836, 3571, 3572, 3575, 3577, 3578, 3661, 3663, 3669, 3674, 3812, 3823, 3825, 3826, 3827, 3829, 3841, 3845, 4812, 4813, 4899, 7370, 7371, 7372, 7373, 7374, 7375, 7377, 7378, 7379.
16 Note that for this comparison we relax our matching criteria and only match by year, not by industry.
17 We divide NASDAQ volume by a factor of two to adjust for the NASDAQ volume definition. For more detail, please refer to the Appendix.
18 We thank an anonymous referee for pointing this potential bias out. As noted in note 12, we further addressed this issue by conducting a robustness check in which we added pre-IPO market momentum, measured over either a one-month or three-month period, as an additional matching criterion. Our results were only marginally affected and are not reported here for brevity.
19 Andover.net, a developer of Linux software, experienced a first-day run-up of more than 252%. Surely, an issuer may choose an offering price below the clearing price to leave a 'good taste in the mouth of investors' and receive some positive news coverage, but Andover's 252% underpricing seems vastly misaligned with the concept of maximizing an issuer's proceeds. Boehmer and Fishe (2004) address the very same question and discuss some of the exceptional circumstances surrounding Andover's IPO. In their opinion, the reason for Andover's large run-up was the fact that although the auction revealed a

market-clearing price that was considerably higher than the maximum offer price the firm had indicated in its prior filing with the SEC, it did not amend its registration statement, which would have postponed its IPO until the amendment would have been approved by the SEC. VA Linux, another Linux software company, was scheduled to go public the next day, and Boehmer and Fishe argue that the fear of directly competing with VA Linux prompted Andover to go ahead with its IPO and leave more money on the table than it would have otherwise.

20 Note that in Table 3 and later tables we calculate aggregate sample means and medians by equally-weighing the means and medians of the individual matching groups.

21 Based on information provided by Stanford Law School's Securities Class Action Clearinghouse (http://securities.stanford.edu).

22 Note that for redEnvelope (SIC code: 5947) and Overstock.com (SIC code: 5999) we use two-digit SIC codes owing to a lack of matching firms with the same three-digit SIC code.

23 For brevity, we do not report detailed statistics for the individual IPO firm matched samples.

24 We note, however, that the returns in Table 5 are unadjusted returns. Since the auction IPOs have a short post-IPO history it would have been difficult to compute risk-adjusted returns. While the mean returns are generally positive for the matched bookbuilding firms, a risk adjustment would cause them to resemble the long-run underperformance exhibited by bookbuilding IPOs. However, risk-adjusted auction IPOs would still underperform matched bookbuilding IPOs.

25 For instance, Credit Suisse First Boston (CSFB) acquired Donaldson Lufkin & Jenrette (DLJ) in 2000. If DLJ served as the lead underwriter in a 1999 IPO, any IPO in 2000 recommended by a CSFB analyst would be classified as being affiliated with the lead underwriters.

26 See Murray (2002).

27 See Smith (2005).

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Appendix

Variable definitions

Variable	Data sources	Description
Underpricing	SDC, CRSP	Percentage return from the offer price (SDC) to the first-day closing price (CRSP)
Proceeds	SDC	IPO proceeds, calculated as number of IPO shares issued * offer price
Underwriter rank	Ritter	Scale for underwriter reputation following Ritter, ranging from 1.1 (worst) to 9.1 (best)
Tech dummy	SDC	Tech dummy (=1 if the firm is a technology firm); we follow Loughran and Ritter (2004) and Cliff and Denis (2004) who categorize firms with the following SIC codes as tech firms: 2833, 2834, 2835, 2836, 3571, 3572, 3575, 3577, 3578, 3661, 3663, 3669, 3674, 3812, 3823, 3825, 3826, 3827, 3829, 3841, 3845, 4812, 4813, 4899, 7370, 7371, 7372, 7373, 7374, 7375, 7377, 7378, 7379
Offer price revision	SDC, prospectuses	Percentage revision in offer price from midpoint of initial filing range to final offer price
Underwriter spread	SDC, Prospectuses	Gross underwriter spread, in percent
Non-exchange-traded dummy	SDC	Exchange dummy (=1 if the firm does *not* trade on the NYSE, AMEX or NASDAQ)

(*continued*)

Appendix. (*Continued*)

Variable	Data sources	Description
Turnover	CRSP	$1 - \prod_{t=1}^{365}\left(1 - \frac{\text{volume traded}_t}{\text{total shares}_t}\right)$, i.e. the proportion of shares traded, computed for a one-year period after the IPO. If the firm was acquired during that period or if the firm traded for less than one year, we calculate the annualized turn over between the firm's IPO date and its last available trading day. We divide NASDAQ volume by a factor of two to adjust for the NASDAQ volume definition
Block sale ratio	TAQ	The sell-signed trading volume on the first two days of trading after the issue, divided by the number of shares offered in the IPO where the sell volume is executed in blocks of 3500 shares or more
Firm age	SDC, prospectuses	Number of years between the firm's founding year and the year it went public
Pre-IPO market run-up	CRSP	Percentage return on the CRSP NYSE/AMEX/NASDAQ value-weighted market index during a period of one month (three months) immediately preceding the IPO
Number of analyst recommendations	I/B/E/S-Firstcall	Number of analyst recommendations during a given period, as reported by I/B/E/S-Firstcall
Analyst recommendation	I/B/E/S-Firstcall	Analyst recommendation for the firm ranging from 1 (strong buy) to 5 (sell). Average analyst recommendations are calculated as $\overline{REC_{i,t}} = \sum_{j=1}^{N} REC_{i,j,t}$ where $REC_{i,j,t}$ is the recommendation for firm i by analyst j at time t, as reported by I/B/E/S-Firstcall
Lead analyst dummy	SDC, I/B/E/S-Firstcall	Lead analyst dummy (=1 if an analyst is affiliated with the lead or co-lead underwriter for the IPO)
Lead venture capitalist dummy	VentureXpert	Lead analyst dummy (=1 if the IPO has a lead VC that has served as the lead VC in any prior IPO during our sample period). We identify the lead VC as the VC firm that made the biggest investment in an IPO firm