Multiple Bookrunners in IPOs*

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ABSTRACT

In the last decade, there has been a dramatic change in syndicate structure for Initial Public Offerings (IPOs), with the frequency of multiple bookrunners increasing from zero to over 50 percent. We posit that the primary benefit of multiple bookrunners to an issuer is improved bargaining power with regard to the offer price. This is reflected in a relatively high file price range and high offer price relative to the first-day closing market price. The increasing number of multiple bookrunners in the IPOs of recent years can be explained by (1) larger issue size, (2) the significantly reduced amount of available IPO business after 2000, (3) the decreased importance of all-star analyst coverage, and (4) the increased number of buyout-backed IPOs.

Keywords: bookrunners, initial public offerings, underwriting syndicate

JEL classifications: G24, G12

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I. Introduction

In the last decade, initial public offering (IPO) underwriting syndicates have undergone substantial changes. Syndicate size has shrunk, although the number of managing underwriters has increased. In 1996, every single U.S. IPO had a sole bookrunner responsible for collecting indications of interest from institutional investors and allocating shares to institutions. In 2005, over 50% of U.S. IPOs had multiple bookrunners. In contrast to these changes, gross spreads, controlling for inflation-adjusted proceeds, have not changed, in spite of dramatically fluctuating deal volume.

Almost all studies of IPO syndicates in recent years are based on the Benveniste and Spindt (1989) information acquisition framework, which suggests that underwriters acquire information from investors, which is then incorporated into the offer price. For instance, Corwin and Schultz (2005) posit that more co-managers result in more information generation, as well as more subsequent analyst coverage and more market makers. They test the information generation hypothesis by relating the adjustment of the final offer price from the midpoint of the original file price range to the number of co-managers, finding a positive relation.

In contrast to the information generation rationale for the existence of syndicates, we posit that syndicates today exist primarily as a mechanism to compensate investment banking firms for providing research or, in the case of commercial bank underwriters, providing loans to the issuing firm. We focus on an important feature of IPO syndicate structure: the choice of one versus multiple bookrunners. As in Loughran and Ritter (2002, 2004), we assume that bookrunners leave more money on the table than the amount needed to induce adequate demand for the issue because of the soft dollar commission revenue they expect to receive from investors receiving allocations of underpriced IPOs.[1] We posit that multiple bookrunners exist to prevent an issuer from being "held up" after the managing underwriters have been hired. We present a bargaining model of the choice of single versus joint bookrunners by an issuing company in which the equilibrium of a non-cooperative game determines the amount of IPO underpricing.

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[1] Money left on the table is calculated as the difference between the offer price and the first closing market price, multiplied by the number of shares sold. Soft dollars are commission payments in excess of direct execution costs.

When a company decides to make a public equity offering using bookbuilding, it first selects one or more investment banks that will be managing underwriters. One or more managers are selected as the lead underwriters. In most cases, lead underwriters are bookrunners. Lead underwriters/bookrunners take on most of the responsibilities of the managing underwriters, which might include due diligence, marketing of the issue, pricing, price stabilization, market making, and analyst research coverage of the stock. Other managers (known as co-managers) are expected to provide analyst coverage, and they may be allocated some shares to distribute to retail clients or, in the case of a cold deal, additional shares to allocate to institutional investors.

Although all bookrunners are lead underwriters, occasionally there is a co-lead that is not a bookrunner. Bookrunners generally have more responsibilities and receive more benefits than lead underwriters if there are co-leads that are not one of the bookrunners.[2] In this situation, the bookrunner or bookrunners are responsible for the institutional share allocations and receive the highest proportion of the gross spread revenues. In a single bookrunner IPO, the bookrunner typically allocates the majority of the shares and collects at least half of the gross spread revenue.[3] The rest goes to the co-managers and other syndicate members, with diminishing proportions. The bookrunner also collects the IPO league table credits from Thomson Financial, Dealogic, and other sources.[4] In joint bookrunning IPOs, league table credit is shared equally among the bookrunners.

Lead underwriters/bookrunners also help select other non-managing syndicate members with the issuers. Non-managing underwriters (other syndicate members) may, in some situations, help sell the stock and provide analyst coverage. In the last decade, however, non-managing underwriters seldom have gotten the chance to allocate any shares except for cold IPOs. They play almost no role in the IPO process and, since 2003, they have become an endangered species; in 2004, for the first time, the majority of IPOs had syndicates with only managing underwriters.

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[2] A handful of IPO issues have three or even four bookrunners. Some of the bookrunners may not do any work on a deal, but collect fees and league-table credits. They are called “phantom” bookrunners. The phantom bookrunners exist only in large IPOs with proceeds of more than $400 million, according to Britt Erica Tunick’s article “Phantom Bookrunners Surface in IPOs,” in the Dec. 13, 2004, *Investment Dealers Digest*.

[3] For example, CSFB, the sole bookrunner, allocated 3.4 million of the 4.025 million share (including the overallotment option) Gadzoox IPO on July 20, 1999. CSFB also allocated 7.2 million of the 10.35 million MP3 shares offered on July 21, 1999 according to the U.S. SEC’s complaint regarding CSFB’s IPO allocation practices on January 22, 2002. The link is available through Jay Ritter’s IPO links, http://bear.cba.ufl.edu/ritter/ipolink.htm.

[4] The league table is the ranking of investment banks in terms of the total gross spreads of IPOs credited to bookrunners. It is a market share ranking.

Each bookrunner in a joint bookrunner IPO typically receives 30% to 40% of the total gross spread revenue and the bookrunners may or may not allocate the IPO shares jointly. Given the higher percentage of gross spread revenues and shares for allocation received by a sole bookrunner in single bookrunner IPOs, investment banks prefer being a single bookrunner to being a joint bookrunner.

After a bookrunner or bookrunners are chosen, the issuing firm and its underwriters submit a preliminary prospectus to the U.S. Securities and Exchange Commission (SEC) that contains a file price range. Our bargaining model predicts that competition among multiple bookrunners will result in a higher file price range relative to the subsequent market price than if there was a single bookrunner, a prediction not generated by the information generation model. According to the information generation model, the file price range will not be affected by the number of bookrunners, because it is decided on prior to the roadshow process during which information is collected from investors.

Our empirical analysis using U.S. IPOs from 2001-2005 confirms the prediction of the bargaining model that the original file price range is higher, relative to the subsequent market price, when there are multiple bookrunners. Our point estimate is that each incremental bookrunner raises the file price range midpoint by 2.8%, although this number is not statistically significant at conventional levels. We also show that there is a greater responsiveness of the offer price to positive market returns when there are multiple bookrunners, consistent with our bargaining model. The combination of these effects results in a point estimate of 1% less underpricing per additional bookrunner, although this number is not reliably different from zero.

Our framework is also supported by anecdotal evidence. As quoted in the *Wall Street Journal*, "'They (investment banks) really competed continually to deliver value (in multiple bookrunner IPOs),' says Greg Stanger, CFO of Expedia Inc, 'It was a nice change: Typically, a bank will work hard to win a piece of business then, once they've been hired, they sometimes feel demonstrating their ability isn't as crucial.'"[5]

We also address the willingness of investment banks to accept joint bookrunning positions. A bookrunner gets less revenue in multiple bookrunner IPOs both because it has to share the revenue with other bookrunners, and because there is less soft dollar commission revenue since

[5]McGee, Suzanne "Deals & Deal Makers: As 'Joint Bookrunning' Grows, The Complications Rise as Well," *Wall Street Journal*, April 13, 2000.

less money is left on the table in equilibrium. We show that an investment bank is more likely to accept joint bookrunning when the issue size is large and when there is less deal volume, which lowers the opportunity cost of participating. The larger issue sizes and reduced activity levels in 2001-2005 relative to earlier years make an increasing percentage of the issues profitable for joint-bookrunners. Our data analysis shows that the willingness to accept a multiple bookrunning deal for an investment bank is negatively related to the ratio of the amount of available IPO business to a bank's underwriting capacity.

We assume that it is more costly for an underwriter to provide coverage from an all-star analyst than from a non-all-star. Underwriters with an all-star analyst are willing to be a bookrunner only if they receive sufficient revenue from the IPO to cover the higher costs. We assume that coverage from an all-star analyst boosts the future market price of an issuing firm, with the effect stronger for high-risk companies. If issuers value analyst coverage, we posit that some high-risk issuing companies would trade a higher offer price provided by multiple bookrunners for all-star analyst coverage from a single bookrunner. Some small issuers, however, will not be able to convince multiple bookrunners to run the book jointly and provide all-star analyst coverage.

From the issuers' perspective, our model predicts that an increasing number of companies will hire multiple bookrunners when the relative importance of all-star analyst coverage decreases. We posit that the combination of structural change in analyst coverage after the Global Settlement in April 2003 and the dramatically decreased number of IPOs and the changed composition of issuers reduced the importance of analyst coverage in the post-bubble period. We attribute part of the increased use of multiple bookrunners to these changes.

A crucial assumption in our model is that multiple bookrunners compete for business on the basis of analyst coverage, file prices, and offer prices, rather than the fees that they charge. Consistent with this assumption, the gross spreads for multiple bookrunner IPOs are indistinguishable from those on single bookrunner IPOs after controlling for issue size. For moderate size single and multiple bookrunner IPOs, the gross spreads remain at 7%.

Buyout-backed IPOs are companies going public for which a private equity (PE) firm is a pre-issue owner.[6] If a buyout firm-backed issuer does choose multiple bookrunners, the

[6] The buyout-backed IPOs that we study here overlap with traditional leveraged buyout (LBO) IPOs. The traditional LBO company is defined as a publicly held company or entire division that goes back to private ownership, with a

relationship between the financial sponsors of buyout-backed companies and commercial banks will help commercial banks to be invited as one of the multiple bookrunners. Another consideration in choosing a bookrunner for PE-backed IPOs is the existence of relationship banks. Relationship banks might bring buyout deals to the attention of the private equity firm and help the PE firm finance the buyout deal. The PE firm wants to reward the relationship bank with an IPO mandate. We document that buyout firm-backed IPOs are disproportionately likely to use multiple bookrunners.

The rest of the paper is as follows. In Section II, we build an analytical model of the costs and benefits of multiple bookrunners. In Section III, we provide supporting empirical analysis. Readers interested in the empirical findings can skip directly to Section III without reading Section II. We present the conclusions in Section IV.

II. Analytical Model

1. The Time Line

We assume that the IPO process has four stages, as shown in Figure 1. To simplify the model, we restrict the underwriting syndicate analysis to the choice of the number of bookrunners and their ability to provide all-star analyst coverage. Furthermore, in the multiple bookrunner analyses, we only discuss IPOs with two bookrunners.

In the first stage, issuers shop around for bookrunners. Underwriters and issuers collect information on each other and choose each other mutually as modeled by Fernando, Gatchev, and Spindt (2005). Issuers compare the expected combined proceeds from the IPO and selling retained shares in the future, conditional on whether they have one or two bookrunners, and conditional on whether a bookrunner has an all-star analyst, subject to the constraint that each bookrunner must earn non-negative expected profits.

In deciding whether to hire one or two bookrunners, the issuer simultaneously chooses whether to request all-star analyst coverage or not, after considering both the possibility of getting it and the costs and benefits involved in all-star analyst coverage. A bookrunner that can

large amount of debt financing involved. The buyout-backed IPOs that we analyze here may have neither been publicly held nor had a large amount of debt. They are partly or fully owned by private equity (buyout, not including venture capital) firms. Their leverage ratios before the IPOs are usually high, which is similar to the traditional LBO. "This particular pool of IPO candidates [buyout-backed IPOs] has more than one financial sponsor, and each shop has its own favorite investment bank," according to Colleen M. O'Connor's article, "Investment Banks Contend with Intensifying Valuation Disagreements", in the August 22, 2005, *Investment Dealers Digest*.

offer all-star analyst coverage (based on whether it has an all-star analyst in the company's industry) requires higher compensation. During the selection process, potential bookrunners discuss feasible file price ranges with the issuer. This discussion continues even after bookrunners are chosen.[7]

In the second stage, a preliminary prospectus that contains a file price range is issued. In multiple bookrunner IPOs, a bookrunner that insists on setting a low file price range faces the threat of being kicked out of the syndicate by the issuer or demoted to being a co-manager.

In the third stage, bookrunners then exert effort during the roadshow process. Although the effort level is not observable to the issuers, they can estimate the effort of bookrunners via the difference between the offer price and the file price midpoint, conditional on changes in general market conditions. The probability of being a bookrunner in follow-on offerings is determined by the effort level a bookrunner exerts during the IPO process and the file price range it provides. In multiple bookrunner IPOs, the bookrunner with a low effort and a low file price range is more likely to be excluded from the follow-on offering than a bookrunner in a single bookrunner IPO. This is because the competing bookrunner may provide a high effort and a high file price range, and the issuer will prefer the bookrunner that exerted more effort for the follow-on offering.

Finally, in the fourth stage, shares are distributed. In our model, we assume that the bookrunner allocates all of the shares with one bookrunner and half of the shares when there are two bookrunners. Underwriters subsequently provide (or do not provide, if an underwriter does not have an all-star analyst) all-star analyst coverage as was agreed to in advance.

In winning the IPO mandate and maximizing its own net revenue, a bookrunner has two choice variables, and two discrete choices for each variable: a high or low file price range, and a high or low effort level. The offer price is endogenously determined. Exogenous company characteristics discussed in this paper are (a) the size and (b) the risk of the issuing company. In our model, we do not consider the reputations of the bookrunners and the effect of their behavior in this deal on the ability to win underwriting mandates from other issuers. We also do not consider changes in market conditions during the roadshow process in our model, although we do control for market returns in our empirical tests.

[7] In general, the file price range is not given in the registration statement (usually, SEC form S-1). It is usually given in an amended filing (S-1/A).

2. The Objective Functions

To investigate how the number of bookrunners and the IPO offering price are decided, we adopt the Nash bargaining solution concept. In an IPO process, neither the issuer nor the bookrunner can get the IPO done by only maximizing its objective without considering the other's interests. The issuer has different bargaining powers facing one or two bookrunners, while the bookrunner has different market power at the price negotiation depending on whether it has an all-star analyst. Both the issuer and the bookrunner have to consider the benefit of the other participants while maximizing its own objective function. The relative importance of the proceeds of the issuer and the net revenue of the bookrunner is decided by the bargaining power (or the market power) of each participant. We assume that the issuer and bookrunners are risk neutral.

(1) Issuer's Objective

We assume that the issuer wants to maximize the combined undiscounted value of short-term and long-term proceeds:

$$U_{issuer} = \underbrace{OP \times N_{IPO}}_{\text{IPO Proceeds}} + \underbrace{\left(N_{post} - N_{IPO}\right)\left(\text{Future Market Price}\right)}_{\text{Proceeds from Future Sales}} \quad (1)$$

where U_{issuer} is the utility of the issuer.[8] N_{post} is the total shares outstanding after the issue and N_{IPO} is the number of shares issued in the IPO, and OP is the offer price.

We assume that the future market price is given by:

$$\text{Future Market Price} = \text{Close} + \text{Risk} \times \left(\text{AnalystCoverage-1}\right) \quad (2)$$

Following Chemmanur (1993) and Loughran and Ritter (2004), we assume that the future market price is affected by analyst coverage. Furthermore, we assume that all-star analyst coverage has a higher impact on the future market price than does non-all-star analyst coverage, and its impact on the future market price takes one of two discreet values, which are interacted with the risk of the issuer.

[8] Because we are taking gross spreads and the number of shares issued in the IPO, N_{IPO} as fixed, maximizing the gross proceeds is equivalent to maximizing the net proceeds, which is presumably what the issuer really cares about. We assume that the undiscounted sum is maximized rather than applying a discount factor to future proceeds in the interests of mathematical tractability.

$$\text{AnalystCoverage}=\begin{cases}AC_{high} \\ AC_{low}\end{cases} \quad 1>AC_{high}>AC_{low}>0 \tag{3}$$

Risk measures the valuation uncertainty of the issuing company. If the issuing company has high uncertainty, risk would be high given market conditions and underwriter characteristics. If the issuing company is of low uncertainty, risk would be low. High risk will reduce the future market price because risk is multiplied by a negative number in our specification. AnalystCoverage reduces the negative effect of Risk on the future market price. Thus, the effect of all-star analyst coverage on a particular issuer depends not only on the value of analyst coverage (AC_{high} or AC_{low}), but also on the risk of the issuing company. The benefit of all-star analyst coverage is larger for the high risk company than for the low risk company.

We use close to stand for the first closing market price, which is exogenous and reflects the true value of the issuing company if there is no research coverage.

After substituting equation (2) for the future market price into equation (1), the issuer's objective function is as follows:

$$U_{issuer}=\underbrace{OP\times N_{IPO}}_{\text{IPO Proceeds}}+\underbrace{\left(N_{post}\text{-}N_{IPO}\right)\left(\text{Close+Risk}\times\left(\text{AnalystCoverage-1}\right)\right)}_{\text{Proceeds from Future Sales}} \tag{4}$$

There are two rounds of competition among bookrunners after the issuer has chosen its underwriters. In the first round, the issuer discusses the file price range with the bookrunners. In multiple bookrunner IPOs, the number of shares that each bookrunner allocates depends on the midpoint of this file price range, P_{mid}, that each bookrunner provides. A bookrunner that recommends the lower P_{mid} will be kicked out of the syndicate if the other bookrunner recommends the higher P_{mid}. The bookrunner that provides the higher P_{mid} becomes the single bookrunner in this scenario.

In the second round of competition, the bookrunners exert their effort and the issuer discusses the offer price with the bookrunners. The offer price, OP, is endogenously determined as a function of the midpoint of the file price range, P_{mid} , and Effort.

$$OP=P_{mid}+\text{Effort}+\varepsilon \tag{5}$$

where ε is a zero-mean noise term that represents exogenous uncertain factors and follows a uniform distribution from –b to b, i.e., $\varepsilon\sim U(-b,b)$. This noise makes it difficult for the issuer to infer the actual effort level from the offer price that is negotiated.

Effort is the effort provided by a bookrunner during the road show process. A bookrunner can either give high or low effort.

$$\text{Effort} = \begin{cases} a_H \\ a_L \end{cases} \quad (a_H > a_L) \tag{6}$$

We assume that high effort will result in a higher offer price than low effort will produce. If there are multiple bookrunners exerting different effort levels, the offer price is determined by the maximum of the two effort levels.

We study the efforts of the underwriters after they are selected as the bookrunners. Pichler and Wilhelm (2001) study the effort exerted after the underwriting team is chosen but before the selection of the lead underwriter. They posit that managing underwriters have to exert some effort to win the lead underwriting business. In practice, lead underwriters/bookrunners are typically selected first or simultaneously with other managing underwriters. In our model, we focus on the effort of bankers after they are selected as bookrunners. The continuous competition between bookrunners after they are selected as the leads/bookrunners results in a higher effort level in equilibrium relative to the single bookrunner IPOs, as discussed in our following analysis.

(2) Bookrunners' Objective:

We assume that bookrunners are risk neutral. Consequently, they want to maximize their net revenue. The two bookrunners in the multiple bookrunner IPO pursue symmetric strategies, although they may differ in whether they possess an all-star analyst. Each bookrunner in the two bookrunner IPO has a net revenue function as follows:

$$\begin{aligned} U_{\text{bookrunner}}^{\text{Multiple}} &= \text{TotalUnderwriterRevenue} \times \text{Allocation} - \text{EffortCost} - \text{AnalystCost} + B_{SEO} \\ \text{TotalUnderwriterRevenue} &= \text{GrossSpread} + \text{Softdollars} \end{aligned} \tag{7}$$

where B_{SEO} is the benefit from follow-on offerings (also known as seasoned equity offerings (SEOs)) of this company that the bookrunner expects to receive. Allocation is the fraction of shares that each bookrunner allocates, which is determined by the issuer based on the P_{mid} that each bookrunner provides. To avoid additional complexity, we assume that the gross spread revenue is split proportionally in the same ratio as the share allocation in equilibrium, although this need not be the case in practice (See Chen and Ritter (2000)). Furthermore, since we are not directly including due diligence costs, etc., we are implicitly bundling them into the minimum effort cost and analyst cost.

Since we omit other syndicate members in our model (co-managers as a group generally receive a constant proportion of the gross spread revenue, and receive few shares to allocate to clients, except for cold IPOs), for simplicity we assume that all underwriter revenue goes to the bookrunners. It will not significantly change the analytical results by adding a parameter to indicate that only a constant fraction of total underwriter revenue is received by the bookrunners. The "GrossSpread" plus the "Softdollars" are the total revenues of the bookrunners. Since we are discussing the representative issuer and bookrunners in our model, we assume that the gross spread is 7% of proceeds.[9] Thus, the gross spread revenue is

$$\text{GrossSpread} = 0.07 \times \text{OP} \times \text{N}_{\text{IPO}} \tag{8}$$

"Softdollars" is the commission income received in return for hot IPO allocations, which is a function of underpricing. Consistent with our framework, Jenkinson and Jones (2007) report that institutional investors view the amount of brokerage business that they do with an underwriter as the single most important determinant of their IPO allocations. The fraction of the money left on the table that flows back to the underwriter through soft dollar commission revenue is a constant number β $(0<\beta<1)$. During the bubble period, practitioners have told us that this number was about 0.3 (30%) in practice.

$$\text{Softdollars}=\beta\times(\text{Close-OP})\times\text{N}_{\text{IPO}} \tag{9}$$

After substituting (8) and (9) back into (7) and simplifying, we get

$$U^{\text{Multiple}}_{\text{Bookrunner}}=[0.07\times\text{OP}+\beta\times(\text{Close-OP})]\times\text{N}_{\text{IPO}}\times\text{Allocation-EffortCost-AnalystCost}+\text{B}_{\text{SEO}} \tag{10}$$

EffortCost is the cost to the bookrunners for providing effort. We assume bookrunners are effort averse. A high effort level results in high EffortCost.

$$\text{Effort} = \begin{cases} a_H \leftrightarrow \text{EffortCost}_{\text{high}} \\ a_L \leftrightarrow \text{EffortCost}_{\text{low}} \end{cases} \tag{11}$$

AnalystCost depends on the type of analyst. The cost of an all-star analyst ($\text{AnalystCost}_{\text{high}}$) will be higher for a bookrunner than the cost of a non-all-star analyst ($\text{AnalystCost}_{\text{low}}$).

[9] For deals with proceeds greater than $100 million (2006 purchasing power), the gross spread is typically less than 7% for U.S. IPOs.

$$\text{AnalystCoverage} = \begin{cases} AC_{high} \leftrightarrow \text{AnalystCost}_{high} \\ AC_{low} \leftrightarrow \text{AnalystCost}_{low} \end{cases} \tag{12}$$

In the single bookrunner IPO, the net revenue of the bookrunner is as follows:

$$\begin{aligned} U^{single}_{Bookrunner} &= \text{TotalUnderwriterRevenue-EffortCost-AnalystCost+}B_{SEO} \\ &= [(0.07\times OP+\beta\times(\text{Close-OP})]\times N_{IPO}\text{-EffortCost-AnalystCost+}B_{SEO} \end{aligned} \tag{13}$$

3. The Expected Proceeds and Net Revenues

(1) The Expected Proceeds of the Issuer

The expected proceeds of the issuer is the expectation of the proceeds from the IPO plus the future market value of retained shares:

$$\text{Expected}(U_{issuer}) = E\left[OP\times N_{IPO} + \left(N_{post} - N_{IPO}\right)\left(\text{Close+Risk}\times\left(\text{AnalystCoverage-1}\right)\right)\right]$$

After substituting equation (5), the offer price as a function of the effort level, into equation (4), we have the following formula:

$$\text{Expected}(U_{issuer}) = E\left[N_{IPO}\times\left(\begin{array}{l} P_{mid} + \left(\dfrac{1}{\text{Float}} - 1\right)\left(\text{Close+Risk}\times\left(\text{AnalystCoverage-1}\right)\right) \\ +\text{Effort}+\varepsilon \end{array}\right)\right]$$

where Float is a proportion of N_{post} , which is defined as:

$$\text{Float} = \frac{N_{IPO}}{N_{post}}$$

After integration, we have:

$$\text{Expected}(U_{issuer}) = N_{IPO}\times\left(\begin{array}{l} P_{mid} + \left(\dfrac{1}{\text{Float}} - 1\right)\left(\text{Close+Risk}\times\left(\text{AnalystCoverage-1}\right)\right) \\ +\text{Effort} \end{array}\right) \tag{14}$$

(2) The Expected Net Revenue of Each Bookrunner in Multiple Bookrunner IPOs

The expected net revenue of each multiple bookrunner is

$$\text{Expected}(U^{Multiple}_{Bookrunner}) = E\left\{[0.07\times OP+\beta\times(\text{Close-OP})]\times\text{Allocation}\times N_{IPO}\text{-EffortCost-AnalystCost-}B_{SEO}\right\}$$

As shown in Appendix A, each bookrunner allocates one half of all shares issued in equilibrium. After substituting equation (5) in, we have the expected net revenue of each multiple bookrunner:

$$\begin{aligned}\text{Expected}(U^{\text{Multiple}}_{\text{Bookrunner}})=&\left[0.07\times P_{\text{mid}}+(0.07\text{-}\beta)\times \text{Effort}+\beta\times(\text{Close-}P_{\text{mid}})\right]\times\frac{1}{2}\times N_{\text{IPO}}\\&\text{-EffortCost-AnalystCost}+E\left[B_{\text{SEO}}\right]\end{aligned} \tag{15}$$

(3) The Expected Net Revenue of the Single Bookrunner

The expected net revenue of a sole bookrunner is

$$\text{Expected}(U^{\text{single}}_{\text{Bookrunner}}) = E\left\{[(0.07\times \text{OP}+\beta\times\left(\text{Close}-\text{OP}\right)]\times N_{\text{IPO}}\text{-EffortCost}-\text{AnalystCost}+B_{\text{SEO}}\right\}$$

After simplification, we have

$$\text{Expected}(U^{\text{single}}_{\text{Bookrunner}})=E\left\{\begin{aligned}&(\frac{7}{100}\times P_{\text{mid}}+(\frac{7}{100}\text{-}\beta)\times\text{Effort}+\beta\times(\text{Close-}P_{\text{mid}}))\times N_{\text{IPO}}\\&\text{-EffortCost-AnalystCost}+E\left[B_{\text{SEO}}\right]\end{aligned}\right\} \tag{16}$$

The difference in expected net revenues between the single bookrunner and multiple bookrunners is attributable to four aspects. First, two bookrunners split the total bookrunner revenue, whereas the single bookrunner gets all of the bookrunner revenue, including the expected SEO underwriting revenue. Second, the expected underwriting revenue is different for single bookrunner IPOs and multiple bookrunner IPOs. The offer price will be higher in equilibrium for single versus multiple bookrunner IPOs, resulting in less money being left on the table. Thus, less soft dollar commission revenue will be received, although with a higher offer price there will be more gross spread revenue. Third, more effort will be expended in equilibrium in the multiple bookrunner case, raising the costs. Fourth, there is duplication of costs with multiple bookrunners, lowering the expected net revenue of each bookrunner.

4. Propositions

In this section, we develop three propositions regarding the relation between multiple bookrunners and underpricing, issuing shares, and all-star analyst coverage.

(1) The Availability and the IPO Pricing of Multiple Bookrunners

Proposition 1: *Each bookrunner provides a higher level of the file price midpoint and inputs a higher level of effort in the joint-bookrunning IPO than in the sole-bookrunning IPO, holding* *constant issuing company and bookrunner characteristics. There is less expected underpricing in multiple bookrunner IPOs.*

When a bookrunner faces competition, it cannot suggest a low file price range without risking being demoted to a co-manager. In equilibrium, it will offer a higher file price range in order to get more shares to allocate. The higher final offer price is a result of the competition of multiple bookrunners in the pricing meeting, not as a result of the cooperation between two bookrunners in generating information.

Proof of Proposition 1:

The two choice variables for the single bookrunner are P_{mid} and the level of effort. The offer price is endogenously generated from P_{mid} and the level of effort. First we demonstrate that a sole bookrunner will choose the low midpoint of the file price range, P^{L}_{mid}, rather than the high midpoint, P^{H}_{mid}, where for simplicity we are assuming a choice of two discrete values. We then determine the level of effort. Second we demonstrate that each multiple bookrunner will choose P^{H}_{mid} rather than P^{L}_{mid}. We then determine the level of effort for each of multiple bookrunners.

From the expected net revenue expression equation (16) for a sole bookrunner, the coefficient on P_{mid} is $\left(\frac{7}{100}-\beta\right)\times N_{IPO}$. As long as the proportion of money left on the table that flows back to the underwriters (β) is higher than the gross spread of 7%, we will have a negative coefficient on P_{mid}. Since β is about 0.3 in practice, the single bookrunner will prefer P^{L}_{mid}. Soft dollar commissions paid by rent-seeking investors if the IPO is underpriced remove the incentive of the sole bookrunner to recommend a higher file price range.

The other choice of the single bookrunner is the effort level. The bookrunner is effort averse. If the bookrunner increases the effort level, both Effort and EffortCost will increase. According to (16), we have

$$\Delta\text{Expected}(U^{single}_{Bookrunner}) = (\frac{7}{100}-\beta)\times N_{IPO}\times\Delta\text{Effort}-\Delta\text{EffortCost}$$

Since $\left(\frac{7}{100}\text{-}\beta\right)<0$ according to our assumption, the coefficients on both ΔEffort and ΔEffortCost are negative. The increasing Effort and EffortCost will decrease the net revenue of the bookrunner. In equilibrium, the single bookrunner chooses a_L. Thus, the offer price will be low (and underpricing high) both because of a low file price range midpoint and low effort.

In multiple bookrunner IPOs, there is a two-stage competition between bookrunners after they are chosen. The first stage is the competition on P_{mid}. If a bookrunner chooses the low file price while the opponent chooses the high file price, the one that chooses the low file price is facing the risk of being kicked out of the syndicate and losing out on follow-on offerings. As shown in Appendix A, if one bookrunner provides $P_{mid1} < P_{mid}^{H}$, the other bookrunner can always be better off by providing $P_{mid2} = \frac{P_{mid}^{H} + P_{mid1}}{2}$ if there are a continuum of file price range midpoints. In equilibrium each bookrunner provides P_{mid}^{H} and receives an allocation of half of the shares. Essentially, this is the classic prisoner's dilemma problem in game theory.

The second stage is the competition on the effort level. The payoff matrix of each bookrunner under different choices of Effort is as follows:

Bookrunner 2's Effort Level

Bookrunner 1's Effort Level	a^H	a^L
a^H	$\left[E(U_{HH}^{H}), E(U_{HH}^{H})\right]$	$\left[E(U_{HL}^{H}), E(U_{HL}^{L})\right]$
a^L	$\left[E(U_{LH}^{L}), E(U_{LH}^{H})\right]$	$\left[E(U_{LL}^{L}), E(U_{LL}^{L})\right]$

If the issuer can distinguish the effort level of each bookrunner, i.e., there is no overlap between high effort and low effort ($a_L + b < a_H - b$), each bookrunner will provide high effort in multiple bookrunner IPOs. If the issuers cannot observe effort directly, the effort level of each bookrunner is reflected in the offer price that each bookrunner provides with a random error ε. We need $E(U_{LH}^{H}) > E(U_{LL}^{L})$ and $E(U_{HH}^{H}) > E(U_{HL}^{L})$ to make sure that no collusion exists and the high-high choice is the Nash equilibrium. Appendix B gives the proof. If the competing bookrunner gives low effort, the other bookrunner is always better off by exerting high effort, which satisfies $a_H \in \left(\frac{B_{SEO} \times a_L + A - 2bR}{B}, \frac{B_{SEO} \times a_L + A + 2bR}{B} \right)$, where A and B are defined in

Appendix B. If the competing bookrunner exerts high effort, the bookrunner that exerts low effort can always get higher expected revenue by exerting high effort, which satisfies $a_H > \frac{4b^2 N_{IPO}(0.07-\beta)+Ba_L}{B_{SEO}-8b^2}$. Thus, the high-high choice is the only equilibrium in this game.

* * *

Figure 2 shows the expected relationship between the prices and the number of bookrunners, with the first closing market price given exogenously. The midpoint of the file price range is higher when there are multiple bookrunners, due to the competition among bookrunners. The offer price will be adjusted according to the effort. If the effort is high, as is the case with multiple bookrunners, the price will adjust upward for a high percentage of the price difference between P_{mid} and Close. Consequently, less money is left on the table.

No banks would choose to jointly run a book with other banks if they have a choice of being the sole bookrunner. The expected profit of each multiple bookrunner is always lower than that of a single bookrunner, which is proved in Appendix C. In multiple bookrunner IPOs, banks have to share the revenues with competitors and they get lower profits all together, both because of duplicative effort costs and because of less money being left on the table.

(2) Required Proceeds to Attract Multiple Bookrunners

Although multiple bookrunners will agree to a higher offer price as a result of less bargaining power and more effort exerted by each of the bookrunners than by a single bookrunner, this does not mean that all companies can and will choose multiple bookrunners. Proposition 2 gives the size cutoff that determines whether an issuer can choose multiple bookrunners or not.

Proposition 2: *Two bookrunners will run the IPO book jointly only when the issue size is large enough to ensure that each of them will earn non-negative profits. In other words, the gross spread revenue and the soft dollar revenue should be large enough to cover the duplicative effort costs of two bookrunners. If all-star analyst coverage is present, the minimum size is even larger.*

Proof of Proposition 2:

Let us first consider the multiple bookrunners' case. To have $\text{Expected}(U_{\text{Bookrunner}}^{\text{Multiple}})>0$, N_{IPO}, the number of shares issued, must exceed:

$$N_{\text{IPO}} > \frac{\text{EffortCost}_{\text{H}} + \text{AnalystCost} - \frac{1}{2}B_{\text{SEO}}}{\frac{1}{2}\left[\left(\frac{7}{100} - \beta\right) \times \left(P_{\text{mid}}^{\text{H}} + a_{\text{H}}\right) + \beta \times \text{Close}\right]} \tag{17}$$

Since the AnalystCost for an all-star analyst is higher than for a non-all-star analyst, the investment banks will require a relatively large number of shares being issued when they promise all-star analyst coverage, given that other aspects of the issuing company are equal.

In the single bookrunner IPO, the sufficient condition for $\text{Expected}(U_{\text{Bookrunner}}^{\text{Single}}) > 0$ is the following:

$$N_{\text{IPO}} > \frac{\text{EffortCost}_{\text{L}} + \text{AnalystCost} - B_{\text{SEO}}}{\left(\frac{7}{100} - \beta\right) \times \left(P_{\text{mid}}^{\text{L}} + a_{\text{L}}\right) + \beta \times \text{Close}} \tag{18}$$

From (17) and (18) we find that multiple bookrunners will require a larger minimum number of IPO shares than the single bookrunner, because the gross spread revenue is shared between two bookrunners, and each bookrunner has to provide a high file price range and a high effort level, resulting in a higher offer price and thus less money left on the table, decreasing the soft dollar revenue.

According to (17) and (18), we get the minimum share requirements for different types of bookrunners as follows.

$$N_{\text{Non-all-star}}^{\text{Single}} < N_{\text{All-star}}^{\text{Single}},\ N_{\text{Non-all-star}}^{\text{Multiple}} < N_{\text{All-star}}^{\text{Multiple}},\ N_{\text{Non-all-star}}^{\text{Single}} < N_{\text{Non-all-star}}^{\text{Multiple}}$$

When the number of shares issued is less than $N_{\text{Non-all-star}}^{\text{Single}}$, no bookrunner will work for this issuer since the expected net revenue of the bookrunner will be negative. If the shares issued are greater than $N_{\text{Non-all-star}}^{\text{Single}}$ but smaller than $N_{\text{Non-all-star}}^{\text{Multiple}}$, the issuer can only have a single bookrunner, even though multiple bookrunners would provide a higher P_{mid} and OP accordingly, because there is not enough net revenue to support multiple bookrunners. When the issuing shares are larger than $N_{\text{All-star}}^{\text{Multiple}}$, the issuer will choose multiple bookrunners with all-star analyst coverage for sure. We provide a numerical example in Appendix D.

* * *

When the issuing shares are smaller than $N^{Multiple}_{All\text{-}star}$, but larger than both $N^{Multiple}_{Non\text{-}all\text{-}star}$ and $N^{Single}_{All\text{-}star}$, the choice of the issuing company may vary according to the relative importance of analyst coverage. The following proposition explains the issuer's choice.

(3) Analyst Coverage

Proposition 3: *The issuer may prefer a single bookrunner with all-star analyst coverage to multiple bookrunners without all-star analyst coverage when the relative benefit of all-star analyst coverage is large enough. If issuers with high risk gain more benefits from all-star coverage, they will be more likely to opt for a single bookrunner than multiple bookrunners.*

Proof of Proposition 3:

Proposition 2 provides the conditions under which the issuer can choose a multiple bookrunner IPO. However, it does not mean the issuer will always choose multiple bookrunners when it can. Here, we discuss when the issuer will find it optimal to choose a multiple bookrunner IPO. Suppose the issuing shares are larger than $N^{Single}_{All\text{-}star}$, but smaller than $N^{Multiple}_{Non\text{-}all\text{-}star}$. Let's compare the utility of the issuer under two choices, a single bookrunner with all-star analyst coverage or two bookrunners without all-star analyst coverage. In the single bookrunner IPO, if the bookrunner promises to provide all-star analyst coverage, the P_{mid} will be P^{L}_{mid}. AnalystCoverage will be AC_{high}. At the same time, the cost of analyst coverage, AnalystCost, will be $AnalystCost_{high}$. Substituting P^{L}_{mid} and AC_{high} into equation (14), the expected proceeds of the issuer are:

$$\text{Expected}(U_{issuer}) = N_{IPO}\left(P^{L}_{mid} + \left(\frac{1}{\text{Float}} - 1\right)\left(\text{Close} + \text{Risk} \times \left(AC_{high} - 1\right)\right) + a_{L}\right) \tag{19}$$

In the multiple bookrunner IPOs, if the analyst coverage will be non-all-star analyst coverage AC_{low}, the P_{mid} will be P^{H}_{mid}. The cost of analyst coverage to the bookrunner will be $AnalystCost_{low}$. Thus,

$$\text{Expected}(U_{issuer}) = N_{IPO}\left(P^{H}_{mid} + \left(\frac{1}{\text{Float}} - 1\right)\left(\text{Close} + \text{Risk} \times \left(AC_{low} - 1\right)\right) + a^{H}\right) \tag{20}$$

Let:

$$\Delta = U^{Single} - U^{Multiple}$$

If $\Delta = U^{Single} - U^{Multiple} > 0$, a single bookrunner is a better choice, meaning that all-star analyst coverage is more important than the high P_{mid} provided by multiple bookrunners for the issuer. Substituting (19) and (20) into the difference Δ, we get

$$\Delta = \left(P_{mid}^{H} - P_{mid}^{L} + \left(\frac{1}{Float} - 1 \right)(AC_{high} - AC_{low}) \times Risk + (Effort_{low} - Effort_{high}) \right) \times N_{IPO}$$

If $\Delta = U^{Single} - U^{Multiple} > 0$, then AC_{high}-AC_{low} satisfies the following condition:

$$AC_{high} - AC_{low} > \frac{P_{mid}^{H} - P_{mid}^{L} + (a_H - a_L)}{\left(\frac{1}{Float} - 1 \right) \times Risk} \quad (21)$$

If the issuer satisfies this condition, a single bookrunner with all-star analyst coverage will be chosen. The numerical example in Appendix E gives an example. Note that the higher is the issuer's risk, the more likely that the condition for a single bookrunner with all-star coverage will be satisfied.

* * *

If we allow AC_{high} and AC_{low} to change over time, condition (21) can be used to explain the changing number of multiple bookrunner IPOs over time. When all-star analyst coverage becomes relatively less important to issuing companies on the market, i.e. $AC_{high} - AC_{low}$ becomes small, the fraction of issuing companies that hire multiple bookrunners will increase.

During the bubble period, more than one company on average went public each business day. All-star analyst coverage was a very important concern, especially for growth stocks in the technology and internet sectors (which almost all observers would characterize as high risk). Some of these companies would prefer all-star analyst coverage rather than multiple bookrunners, although multiple bookrunners would give them a higher offer price. After 2000, the number of IPOs dropped dramatically and the proportion of young growth companies dropped dramatically. For the more mature firms going public, a high IPO offer price has become their big concern since, being low risk, the benefits of coverage from an all-star analyst are less in the issuer's objective function, equation (14). Thus, the decreased importance of analyst coverage results in a higher percentage of companies choosing multiple bookrunners.

To summarize, our model generates both cross-sectional and time series predictions. The model predicts that both the file price range and the offer price will be closer to the first-day closing market price for multiple bookrunner IPOs because of the competition among bookrunners. For issue size above a certain level, banks are more likely to accept being joint bookrunners than to choose multiple bookrunners. High-risk companies are more likely to use a single bookrunner with all-star analyst coverage. We now test these predictions of our model.

III. Data and Empirical Analysis

Our data source for IPOs from 1995-2005 is Thomson Financial's SDC new issue database, with corrections from Dealogic and other sources. In our analysis, we exclude best efforts offers, auction offers, ADRs (American Depository Receipts), closed-end funds, REITs (Real Estate Investment Trusts), banks and savings & loans, partnerships, unit offers, and IPOs with an offer price below $5.00 per share. We hand-collect the number of total syndicate members for IPOs from 1995-1998 from electronic prospectuses on EDGAR, or, for the pre-EDGAR period, from the GraemeHoward/Todd Huxster collection of prospectuses and from Dealogic. The number of syndicate members for 1999-2005 and the number of managing underwriters for each IPO are downloaded from SDC. Information on company founding dates is from Jay Ritter's website. Data on analyst coverage is from I/B/E/S, Investext, and other sources, and is cross-tabulated with *Institutional Investor* all-star analyst designations.

(Table I is about here)

III A. Empirical Patterns

Table I shows that the percentage of IPOs that use multiple bookrunners. In 1995 and 1996, all IPOs used a single bookrunner. In 1997, Only 4 IPOs used multiple bookrunners. By 2001, there was a sharp increase in the percentage of IPOs using multiple bookrunners. This proportion increased from 7.1% in 2000 to 19.2% in 2001, coincident with a sharp increase in the percentage of multiple lead underwriters, a sharp decrease in the number of IPOs, and an even sharper drop in the number of small IPOs. In 2005, over 50% of IPOs used multiple bookrunners.

Continuing the trend documented in Chen and Ritter (2000), Loughran and Ritter (2004) Corwin and Schultz (2005), and Ljungqvist, Marston, and Wilhelm (2006), Table I shows that over time issuers use more managing underwriters and fewer other syndicate members. The median number of managers in the syndicates increased from two for IPOs in 1995-1997 to four managers for IPOs in 2001-2005. The median syndicate size dropped from 18 syndicate members in 1995 to only 5 syndicate members in 2005. In the last decade, non-managing underwriters played little or no role in the underwriting syndicate, except for occasionally getting some shares for allocation to retail clients in cold IPOs (Chen and Ritter, 2000). About 66% of IPOs have no non-managing underwriters in 2005.[10]

(Table II is about here)

In 2001, the number of IPOs decreased dramatically from the level prevailing in 1995-2000. The number of IPOs in 2001 was less than one-fourth of the number of IPOs in 2000, as shown in Table I. The number of active bookrunners dropped from 60 to 30 at the same time, as shown in Table II. This means that each bank was facing half of the previous bookrunning opportunities. The capacity for each bookrunner remained high, because investment banks do not want to lay off all their excess employees at once, although the bonuses of the workers can be reduced. Because of the excess capacity, investment banks needed to win business but were leery of cutting their percentage fees (gross spreads). As a result, the issuers' bargaining power over non-fee dimensions increased significantly. Investment banks were left with no choice but to accept the joint bookrunning business. If they did not maintain activity in the underwriting business, they risked losing personnel whose expertise would be hard to replace when there is an upturn in underwriting activity.

From the boom times of 1991-2000 to the depressed activity levels of 2001-2005, the goal of bookrunners switched from earning a large amount of money by sole bookrunning and collecting soft dollars through high underpricing, to surviving in the IPO business until good times return. Prestigious banks began to accept running the book jointly, consistent with the dramatic increase in the percentage of joint bookrunners in 2001, as seen in Table I. Table II shows that the total gross spread revenue of the top 10 bookrunners had drop from $3.23 billion in 2000 to $1.33 billion in 2001. It was a difficult IPO underwriting business market.

At the same time, the mean and median issue sizes of IPOs increased dramatically. The mean proceeds for IPO issues increased from $171.2 million in 2000 to $439.2 million in 2001. The median increased from $78.8 million to $117.0 million, in spite of a lower level of stock

[10] A careful reader of Table I might note that in 2004 and 2005, the median number of managers is 4 and the median number of total syndicate members is 5, while at the same time, the majority of IPOs have no non-managing syndicate members. This is possible because the median of (A+B) may not equal the median of (A) plus the median of (B).

prices. Because of the larger issue sizes, a higher percentage of IPOs became profitable for joint-bookrunners.

(Figure 3 is about here)

According to our Proposition 2, the issue size is a critical factor in an IPO company's selection of bookrunners. If the issue size is very small, the multiple bookrunners cannot generate enough profits from the underwriting to meet their reservation utilities. Empirically, Figure 3 shows that the percentage of companies using multiple bookrunners increases as the issue size increases, consistent with the prediction of Proposition 2. For the smallest issue size deciles, with proceeds of less than $32 million, only 9% of the IPOs use multiple bookrunners. In contrast, 76% of IPOs in the largest issue size decile, with proceeds of more than $410 million, use multiple bookrunners.

III B. The Effect of Multiple bookrunners on underpricing

We assume that multiple bookrunners compete over the P_{mid} and offer price, instead of the gross spread. Proposition 1 predicts that issuers can make multiple bookrunners play against each other, which results in a high P_{mid} and a high offer price. Empirical evidence supports our assumptions and the predictions of Proposition 1. Figure 4 shows that the gross spreads for multiple bookrunner IPOs have no material difference from the gross spreads for single bookrunner IPOs in each expected proceeds category. The gross spread clustering at 7% for moderate-size deals is apparent.

(Figure 4 is about here)

The total return, defined as the (closing price-offer price)/offer price, and the first-day return, defined as the (offer price-P_{mid})/P_{mid}, are quite different for single and multiple bookrunner IPOs. From Table III, we observe that multiple bookrunner IPOs have lower first-day returns in 7 out of 10 size categories, and lower total returns in 8 out of 10 size categories. These patterns support the argument that issuers have more bargaining power in multiple bookrunner IPOs and bookrunners provide both a high P_{mid} and offer price.

(Table III is about here)

The issue size plays a very important role in determining the first-day return and the total return. In Table IV, we use OLS regression to estimate the effect of the number of bookrunners on the Initial Return and the total return after controlling for the issue size.

(Table IV is about here)

We estimate the effect of the number of bookrunners on the first-day return in the first row of Table IV. It shows that underpricing is reduced as the number of bookrunners increases, after controlling for the size and other characteristics of the issuing companies. The coefficient on the number of bookrunners implies that underpricing is reduced by 1.02% for each additional bookrunner, although this is not statistically significant.

The value-weighted market return in the 15 trading days before the offer date has a positive effect on the underpricing, which is consistent with the findings in Loughran and Ritter (2002), Lowry and Schwert (2002), and Ince (2007). This suggests that offer prices are not fully adjusted to reflect publicly available information.

Rows 2 and 3 of Table IV split the sample IPOs into those with a positive market return during the three weeks before issuing and those with a negative market return during these three weeks. When there is one bookrunner, the sum of the coefficients on Rm15 and the interaction of the # of bookrunners×Rm15 gives the estimated effect on underpricing for a 1% market return. For positive market returns, the sum of the row 2 coefficients is 1.25 (1.82 – 0.57). When there are two bookrunners, the effect is reduced to 0.68 (1.82 - 2×0.57). Thus, the more bookrunners there are, there is a smaller sensitivity of underpricing to lagged positive market returns. This is consistent with our model: when there are multiple bookrunners, the improved bargaining power of the issuing firm results in the offer price being revised upwards when there is strong demand by more than it would otherwise be, resulting in less underpricing. The analogous calculations in row 3 show that when there are negative market returns, the effect on underpricing of a 1% negative market return is 0.48% (1.27 – 0.79) less underpricing when there is one bookrunner, and -0.31% (1.27 - 2×0.79) less underpricing when there are two bookrunners.

Corwin and Schultz (2005) attribute the low underpricing of multiple bookrunner IPOs to the information generation of more managers. They assume that the difference between the closing market price and the midpoint of the file price represents the total asymmetric information. Multiple bookrunners will adjust a higher percentage of this asymmetric information than a single bookrunner because of the superior information generation. We argue that the difference between the file price and the closing price is partly attributable to the bookrunner's intentional underpricing to get soft dollar commission revenue. Issuers have greater bargaining power in multiple bookrunner IPOs, resulting in a higher file price that is closer to the closing market price. Several papers support our argument. Ince (2007) finds that agency conflicts play a central role in the partial adjustment of the offer price using 1985-2003 IPO data. Houston, James, and Karceski (2006) find that underwriters low-ball the file price range systematically, especially in the 1999-2000 bubble period.

Our regression in row 4 shows that the Total Return also decreases with the increasing number of bookrunners in each IPO. Since the midpoint is established at the beginning of the road show process, this price does not reflect information generation during the road show. Multiple bookrunners give a high file price midpoint, which cannot be explained by the information generation of the bookrunners during the roadshow, but can be explained by our bargaining model. The coefficients in row 4 imply that for a \$20 closing price and \$15 midpoint of a single bookrunner IPO, one more bookrunner results in approximately \$0.3 higher midpoint ($(20\text{-}15)/15\text{-}(20\text{-}P_{mid}^{Multiple})/P_{mid}^{Multiple}=2.83\%,\ P_{mid}^{Multiple}=15.3$).[11] For an offering selling shares with a market value of \$100 million, the -2.83% coefficient implies that using multiple bookrunners results in approximately \$3 million more in proceeds for the issuing firm, relative to if a sole bookrunner was employed. This is consistent with our bargaining model.

(Table V is about here)

Our Proposition 3 predicts that there is a tradeoff between the high offer price provided by multiple bookrunners and receiving all-star analyst coverage from a single bookrunner. Consistent with the prediction of our model, Table V shows that single bookrunner IPOs with all-star analyst coverage have a larger first-day return and total return than multiple bookrunner IPOs without all-star analyst coverage. The competition of multiple bookrunners results in a higher P_{mid} and offer price relative to the closing price. We also notice that issuers that hire a single bookrunner with all-star coverage have a larger issue size (Ln(Proceeds)) on average than the multiple bookrunner IPOs without star analyst coverage. This supports the Proposition 3 prediction that some issuers choose a single bookrunner with all-star coverage and leave more money on the table, even though their issue sizes are large enough for multiple bookrunners with a higher offer price.

III C. Buyout-backed IPOs

[11] The results are robust to using the closing market price in the denominator rather than the OP or midpoint.

Since not all issuing companies can or will choose to use multiple bookrunners in their IPOs, we want to know how the issuing companies and multiple bookrunners match with each other. We define a variable Distance to measure the goodness of matching.

$$\text{Distance}=\frac{\text{Reputation-}\overline{\text{Reputation}_t}}{\text{STD}_t^{\text{Rep}}}-\frac{\text{Size-}\overline{\text{Size}_t}}{\text{STD}_t^{\text{size}}}$$

Reputation of the bookrunner is either market share or CM rank, and $\overline{\text{Reputation}_t}$ is the mean reputation of all bookrunners of a particular year t. $\text{STD}_t^{\text{Rep}}$ is the standard deviation of the reputation of all bookrunners of year t. $\frac{\text{Reputation-}\overline{\text{Reputation}_t}}{\text{STD}_t^{\text{Rep}}}$ is used to measure the deviation of the bookrunner's reputation from the mean level. $\frac{\text{Size-}\overline{\text{Size}_t}}{\text{STD}_t^{\text{size}}}$ is used to measure the deviation of the issuing size from the mean level for year t. A large value of Distance means that the issue size is small relative to the bank's reputation value.

First, we consider the characteristics of the issuing companies that use multiple bookrunners. Table VI shows a rapid increase in the buyout-backed IPO market during our sample period. In 2001, the total proceeds from buyout-backed IPOs were about \$3 billion. In 2002, the proceeds increased to \$4.3 billion. In 2005, the total proceeds increased to \$15.2 billion. As can be seen, 2005 was a stellar year for buyout-backed IPOs. Not only do we observe growth in the proceeds of buyout-backed IPOs, we also notice that the number and percentage of buyout-backed IPOs in relation to all IPOs has increased significantly in recent years. Table VI shows that less than 8% of IPOs were buyout-backed IPOs in each year from 1995 to 2000. In 2005, 41% of the IPOs were buyout-backed IPOs. The proceeds from buyout-backed IPOs as a percentage of total IPOs increased from 7.3% in 2000 to 55% in 2005.

(Table VI is about here)

One reason for a higher propensity to have multiple bookrunners in buyout-backed IPOs is that private equity (PE) firms usually have relationship banks that help them in tender offers, trading securities, providing bank loans, and underwriting other securities. These relationships will help the PE firms to convince banks to do joint-bookrunning IPOs. Another reason is that PE firms want to reward relationship banks with IPO underwriting business for the buyout deals that banks helped to carry out previously, and to curry favor for future deals. Buyout-backed companies are usually backed by several private equity firms. Different private equity firms have different preferred banks. PE firms prefer to use their own preferred banks in the IPOs. Figure 5 shows that buyout-backed IPOs have a higher percentage of multiple bookrunners than non-buyout IPOs in eight out of 10 offer-size deciles. This shows that buyout-backed companies are more likely to use multiple bookrunners than non-buyout-backed companies, after controlling for proceeds. In the largest size category, in which IPOs have proceeds of more than $460 million, all 50 buyout-backed companies use multiple bookrunners.

Size and buyout-backed features are the two most important company characteristics in determining the propensity to use multiple bookrunners. The third company characteristic we discuss is the risk of the issuing company. Risk can reflect either technological or valuation uncertainty. We use a technology industry dummy (including internet companies) and the age of the company to measure the risk of the issuing company. If it is a technology company, it should have higher risk than a non-technology company. According to our model, this type of company should prefer all-star analyst coverage over multiple bookrunners. Young companies should also have the same preference.

Second, we consider the characteristics that affect whether a bank will be selected as a bookrunner. Table VII shows that issuers are more likely to include commercial banks (CB) as a bookrunner when they use multiple bookrunners. About 30% of the sole bookrunners are commercial banks. More than 50% of the multiple bookrunner IPOs have a commercial bank as one of the bookrunners. Although not shown in Table VII, we also find that among the companies that choose multiple bookrunners, the small companies tend to choose pure IB bookrunner. The probability of hybrid bookrunners increases with the issue size. In 2004 only 45 out of 305 *Institutional Investor* all-star analysts were affiliated with commercial banks. All of the other all-stars are affiliated with investment banks. This is consistent with the hypothesis that small companies choose IBs because they care about the analyst coverage provided by IBs, and large companies are more concerned about their future borrowing ability.

(Table VII is about here)

Third, we also consider the factors that affect the decision of the banks regarding their willingness to be multiple bookrunners. From the bookrunner’s perspective, we predict that banks are less likely to accept running the IPO book jointly when they have a large amount of IPO underwriting business that is close to their full working capacity. We use the number of

IPOs that the bank is currently working on as a bookrunner when the bank considers to run this particular book (the filing date), to the total number of IPO issues that the bank has been a bookrunner on in the previous three years. We call this ratio pipeline. When a bookrunner has far less business than its full working capacity, it will be more likely to accept joint bookrunning.

Finally, we use probit regressions to estimate the factors that affect the choice of single bookrunner vs. multiple bookrunners by both issuers and bookrunners in Table VIII. We have 528 IPOs from 2001 to 2005. If one IPO has more than one bookrunner, we treat each bookrunner as a separate observation, because bookrunners in one IPO may have different characteristics.

The two regressions use two variables separately to estimate the match of the issuer's reputations and issuing sizes. DistanceCM is $\frac{\text{CMRank-}\overline{\text{CMRank}_t}}{\text{STD}_t^{\text{CMR}}}-\frac{\text{Size-}\overline{\text{Size}_t}}{\text{STD}_t^{\text{size}}}$. DistanceMS is $\frac{\text{Mktshare-}\overline{\text{Mktshare}_t}}{\text{STD}_t^{\text{Mkt}}}-\frac{\text{Size-}\overline{\text{Size}_t}}{\text{STD}_t^{\text{size}}}$. When we calculate the MarketShare, we use the SDC code of the lead parent to calculate all the IPO issues that a particular bank works as a bookrunner. If two banks merged, the previous IPO issues that both banks worked as bookrunners are counted as the previous deals of the merged bank.

We also use four underwriter characteristics, i.e., Relative Pipeline, Allstar Dummy, and Allstar Total. Here, we use relative pipeline, which is defined as follows:

$$\text{RelativePipeline}=\frac{\text{Pipeline}}{\text{Market share}\times\text{Gross spread revenue of all IPOs}}$$

The relative pipeline measures how busy a bookrunner is given its reputation and market condition. We use the pipeline divided by the product of the market share of the bookrunner in the past calendar year and the gross spread revenue of all IPOs in the past twelve months. In the bookrunner characteristics, we also include Allstar Dummy in the regression, which indicates whether the bookrunner provides all-star analyst coverage for this IPO. Allstar total is the number of all-star analysts from all bookrunners covering the company. For an IPO with two bookrunners, Allstar total can take on the value of 0, 1, or 2.

(Table VIII is about here)

Consistent with our previous univariate analyses, the results from both methods show that the larger the distance is, the less likely the IPO is to have multiple bookrunners. It means that more reputable banks are less likely to be one of the multiple bookrunners given the issue size. The regressions also show that relative pipeline has a negative coefficient, which means that the banks would not want to be the joint bookrunners if they have relatively high amount of other IPO business to do. Multiple bookrunner IPOs are more likely to have more all-star analyst covering the IPOs, which is manifested by the positive coefficient on Allstar Total. This result is rather mechanical. Multiple bookrunner IPOs might mechanically have more analysts covering the issue, although each all-star is less likely to promise coverage due to the smaller benefit received by the bank. The negative coefficients on the Allstar dummy are consistent with this prediction. Commercial banks are more likely to be one of the multiple bookrunners, instead of running the book alone.

The regression in Table VIII estimates the effect of issuing company characteristics on the choice of single bookrunner vs. multiple bookrunners. Large issue-size company and buyout-backed companies are more likely to use multiple bookrunners, which is consistent with our univariate analyses. We also find a significantly negative coefficient on tech dummy as predicted due to the desire for all-star analyst coverage.

IV. Conclusion

We explain the use of multiple bookrunners in IPOs by using a bargaining model. Our model assumes that when there are multiple bookrunners, competition between the bookrunners reduces the tendency to "hold up" the issuing firm after winning the mandate. Specifically, in equilibrium, joint bookrunners will give a high midpoint of the file price range after they enter the IPO syndicate and will give a high effort level in the roadshow process because they are facing the threat of being kicked out of the syndicate or will receive a low allocation of shares to distribute to investors. Further, a low effort level jeopardizes being chosen to underwrite follow-on issues of the company.

Using a dataset of 532 U.S. IPOs from 2001-2005, our regression results show that each additional bookrunner is associated with a file price range midpoint that is 2.8% higher, and an offer price that is 1% higher. Although these are small effects, the average underpricing of IPOs during 2001-2005 was only 11.6%, much lower than during the previous decade. Our main explanation of the higher offer prices for multiple bookrunner IPOs is the low bargaining power of the bookrunners relative to the issuing company when they are facing the two threats. The low bargaining power is reflected in the high file price range at the beginning of the road show, which cannot be explained by information generation during the road show process, and the high offer price. Our empirical evidence is consistent with the predictions of this model, although the statistical significance is weak.

Not all companies that can use multiple bookrunners will use them because of the tradeoff between a higher offer price with multiple bookrunners and receiving all-star analyst coverage from a sole bookrunner. When the issuing companies are facing a choice between multiple bookrunners without all-star analysts and a single bookrunner with an all-star analyst, the issuer's choice also depends on the relative importance of the analyst coverage. High-risk companies are very likely to choose a single bookrunner with all-star analyst coverage.

If we allow the relative importance of analyst coverage to change over time, we can use it to explain the increasing fraction of IPOs that use multiple bookrunners in recent years. When there is a large fraction of high-risk companies going public, all-star analyst coverage is more important. When the fraction of high risk IPOs is small, the higher issuing price becomes the first order of concern for most issuers. This helps explain the increasing number of multiple bookrunners after 2001.

Our analytical model shows that the issue size must be large enough to include multiple bookrunners in the syndicate and to make each bookrunner profitable from the issuing business. Our data show that the issue sizes increased dramatically after 2001, permitting the rapidly increasing number of multiple bookrunners. The decreasing number of IPO companies in recent years may also have reduced the costs of the underwriters, which makes multiple bookrunner IPOs acceptable to the underwriters.

Lastly, we should note that our model is unable to explain why there were no multiple bookrunners at all before 1997. Undoubtedly there is some path dependency involved. If no deals had been done using multiple bookrunners, the first deal using multiple bookrunners faces the extra cost of educating issuers and investors about this permutation of the existing practice. This cost is imposed on the first user, and deters anyone from changing industry practice. Once a precedent is set, however, other deals using multiple bookrunners can be undertaken with lower costs. We do not formally model this path dependency.

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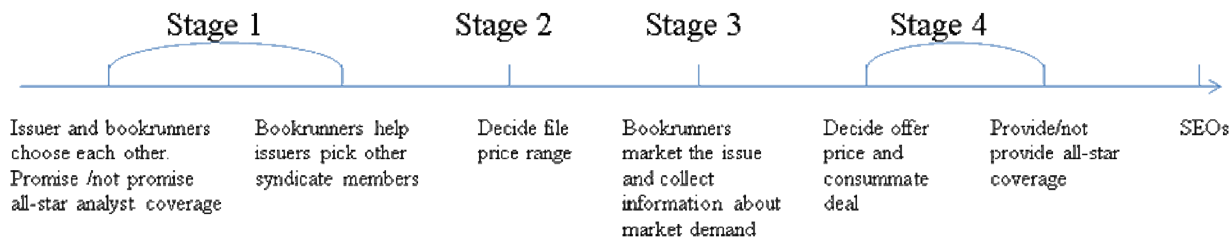

Figure 1

Figure 1 plots the IPO process from the formation of the underwriting syndicate to the aftermarket analyst coverage.

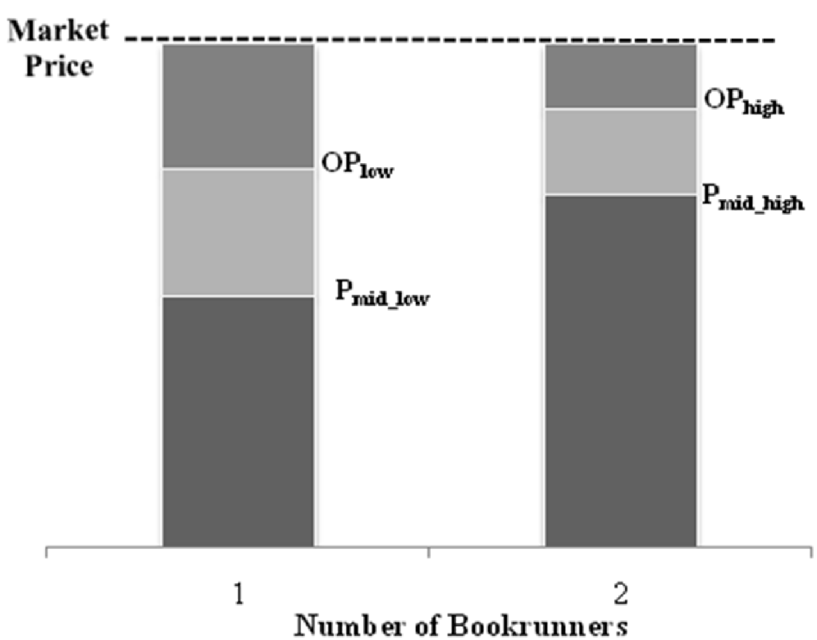

Figure 2

Figure 2 plots the relationship between the number of bookrunners and the IPO stock prices. P_{mid} is the midpoint of the file price range. OP is the offer price. Market price is the first closing market price, which is exogenous. With multiple bookrunners, both the equilibrium file price range midpoint and the offer price are higher than with a sole bookrunner.

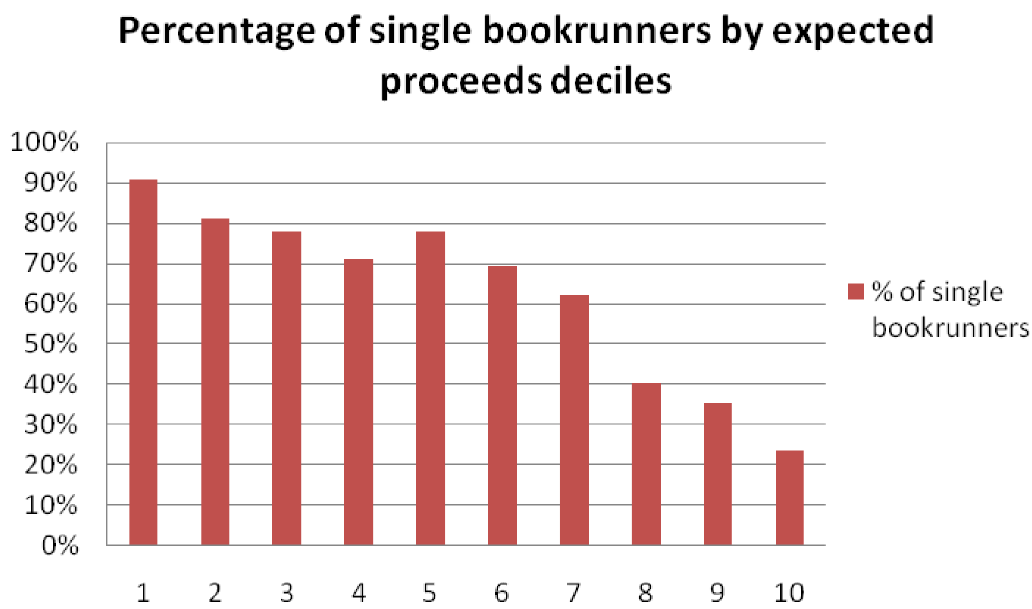

Figure 3

Figure 3 shows the percentage of single bookrunners by expected proceeds deciles for IPOs from 2001 to 2005. We put 532 IPO companies into 10 expected proceeds categories with 53 observations in each expected proceeds category except for the largest expected proceeds category, which has 51 observations. Category 1 IPOs have expected proceeds of $0 to 43.0 million, Category 2: $32.1 to 59.5, Category 3: $59.5 to 72.0, Category 4: $72.0 to 78.0, Category 5: $78.0 to 100.1, Category 6: $100.1 to 129.0, Category 7: $129.0 to 173.5, Category 8: $173.5 to 225.0, Category 9: $225.1 to 410.0, Category 10: $410.0 and higher. No inflation adjustments have been made, and expected proceeds are midpoint of file price range times the issuing shares.

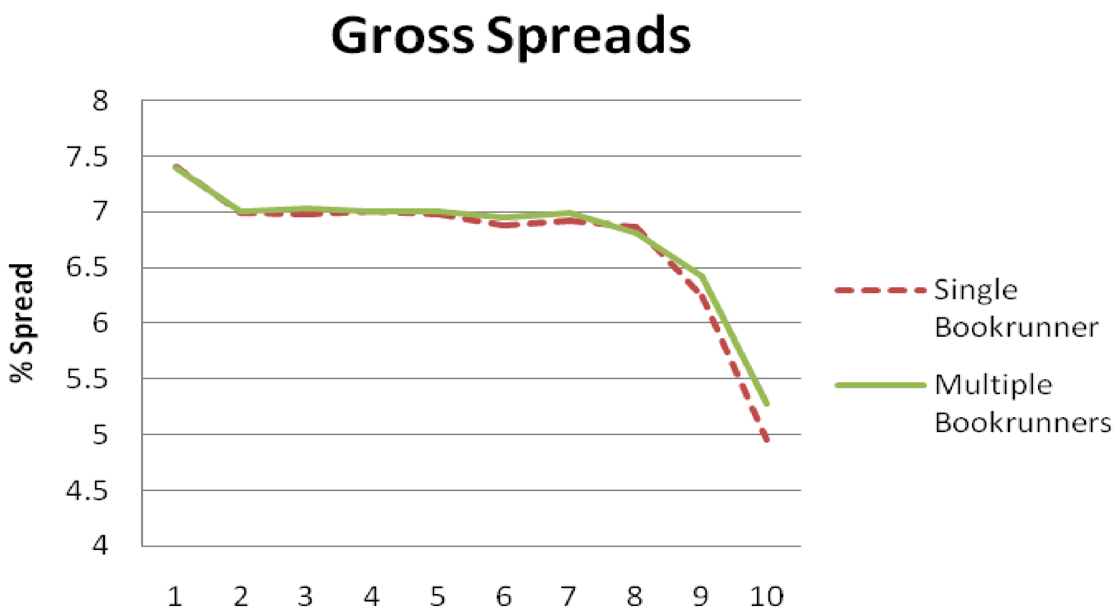

Figure 4

Figure 4 shows the mean percentage gross spreads by expected proceeds deciles for single bookrunner IPOs and multiple bookrunner IPOs from 2001 to 2005.

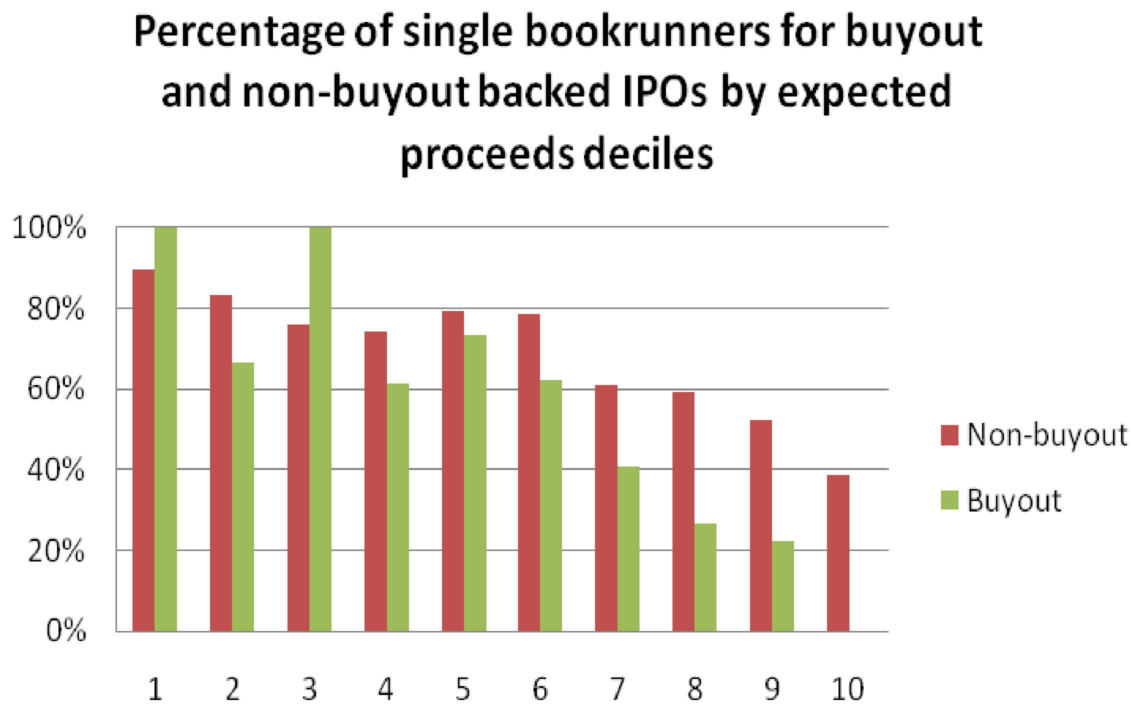

Figure 5

Figure 5 shows the percentage of single bookrunners for buyout- and non-buyout-backed IPOs by expected proceeds deciles (2001-2005).

Table I

Underwriting syndicate structures by years

This table shows the percentage of multiple bookrunner IPOs, the percentage of multiple lead underwriter IPOs, the average and median number of 1) bookrunners, 2) lead underwriters, 3) all managers, and 4) all syndicate members in underwriting syndicates, and the percentage of U.S. IPOs with zero non-managing underwriters from 1995-2005. We exclude best-efforts offers, auction offers, ADRs (American Depository Receipts), closed-end funds, REITs (Real Estate Investment Trusts), banks and savings & loans, partnerships, unit offers, and IPOs with an offer price below $5.00 per share. Data are from Thomson Financial, with corrections.

Year	# of IPOs	% with Multiple Book-runners	# of Bookrunners		% of Multiple Leads	# of Leads		# of Managers		# of Syndicate Members		% of IPOs with Zero Non-managing Underwriters
			Mean	Median		Mean	Median	Mean	Median	Mean	Median	
1995	457	0	1.00	1	0.9%	1.01	1	2.29	2	19.26	18	10.6%
1996	672	0	1.00	1	0.7%	1.01	1	2.41	2	19.89	19	5.4%
1997	471	0.8%	1.01	1	2.3%	1.02	1	2.51	2	18.51	18	7.6%
1998	283	1.8%	1.02	1	4.9%	1.05	1	2.89	3	16.45	17	8.8%
1999	473	4.7%	1.05	1	11.8%	1.12	1	3.43	3	16.41	15	5.5%
2000	380	7.1%	1.07	1	21.1%	1.23	1	3.71	3	15.41	14	5.8%
2001	78	19.2%	1.19	1	53.8%	1.54	2	4.44	4	16.01	15	3.8%
2002	65	29.2%	1.34	1	49.2%	1.54	1	4.75	4	14.91	12	4.6%
2003	61	32.8%	1.33	1	50.8%	1.56	2	4.05	4	8.43	8	24.6%
2004	172	37.2%	1.41	1	63.4%	1.72	2	4.48	4	6.65	5	51.2%
2005	156	51.3%	1.63	2	63.5%	1.79	2	4.76	4	6.28	5	65.4%

Table II

Summary statistics for bookrunners

The table lists the summary statistics for bookrunners by years: # of bookrunners is the total number of investment banks or commercial banks who act as bookrunner for at least one IPO in that particular year. Ratio of # of IPO to # of bookrunners is the total number of IPOs / the number of bookrunners. Total gross spreads of the top-10 bookrunners are measured in billion dollars. The market share of each bookrunner is the total gross spread revenue of that bookrunner from all IPOs divided by the total gross spread revenue from all bookrunners in that year. If two banks jointly run one book, each is attributed half of the credits. All of the gross spread revenue from a deal is attributed to the bookrunner(s). The total market share of gross spread revenue of the top-10 bookrunners is the sum of the market shares of the 10 bookrunners with the largest gross spread revenue. Proceeds are global proceeds, not including any overallotment shares that are exercised. Mean and Median of proceeds from each IPO are listed in the last two columns. No inflation adjustments are made.

Year	# of Bookrunners	Ratio of # of IPOs to # of Bookrunners	Average # of IPOs for Top 10 Bookrunners	Total Gross Spread Revenues of Top 10 Bookrunners	Total Market Share of Top 10 Bookrunners	Proceeds from Each IPO	
						Mean	Median
1995	105	4.4:1	23.7	$1.35b	75.6%	$62.7m	$32.5m
1996	127	5.3:1	31.2	$1.79b	67.8%	$62.8m	$33.7m
1997	127	3.7:1	18.3	$1.14b	57.1%	$67.0m	$33.6m
1998	88	3.2:1	15.7	$1.50b	81.1%	$119.3m	$42.9m
1999	68	7.0:1	35.1	$3.11b	85.3%	$136.5m	$61.6m
2000	50	7.6:1	31.4	$3.23b	88.2%	$171.2m	$78.8m
2001	24	3.3:1	7.0	$1.33b	85.3%	$439.2m	$117.0m
2002	24	2.7:1	7.1	$1.07b	94.6%	$338.3m	$120.0m
2003	24	2.5:1	6.3	$0.54b	85.4%	$156.1m	$119.0m
2004	39	4.4:1	17.5	$1.53b	87.1%	$173.4m	$84.8m
2005	43	3.6:1	18.8	$1.46b	86.0%	$179.8m	$115.6m

Table III

Comparison of the mean First-day and Total Returns for IPOs with single bookrunner and multiple bookrunners

This table compares the First-day Returns and the Total Returns for 532 IPOs from 2001-2005 with single bookrunner and multiple bookrunners, after classifying an IPO into a proceeds decile. Initial return is defined as the (closing price-offer price)/offer price. Total return is the (closing price-midpoint of file price range)/midpoint of file price range.

		# of IPOs		Mean First-day Return, %		Mean Total Return, %	
Size	Proceeds	Single Bookrunner	Multiple Bookrunners	Single Bookrunner	Multiple Bookrunners	Single Bookrunner	Multiple Bookrunners
1	<$43m	48	5	9.6	6.2	4.7	-10.2
2	$43.0- 59.5m	43	10	14.6	22.3	7.4	24.2
3	$59.5-72.0m	42	12	12.0	4.9	2.2	-7.5
4	$72.0-78.0m	37	15	9.1	12.9	0.3	11.6
5	$78.0-100.1m	42	12	12.3	15.0	14.2	14.8
6	$100.1-129.0m	36	16	18.1	24.5	20.6	35.9
7	$129.0-173.5m	33	20	9.8	13.9	6.3	14.1
8	$173.5-225.0m	21	33	13.2	8.3	13.2	1.7
9	$225.0-410.0m	19	33	12.6	6.4	18.6	3.0
10	>$410.0m	13	42	12.5	5.9	18.7	1.4
Total		334	198	12.4	12.0	10.6	8.9

Table IV

OLS regressions relating the number of bookrunners to first-day and total returns for 532 IPOs from 2001-2005

The table lists coefficient estimates from OLS regressions with the percentage first-day return and total return as the dependent variables. Total return is defined as the (closing price-midpoint of file price range)/midpoint of file price range. First-day return is the (closing price-offer price)/offer price. Ln(Expected proceeds) is the log of the product of midpoint of file price range and issuing shares. Rm15 is the CRSP value-weighted 15 trading day percentage return before the IPO. LBO dummy equals 1 if the IPO company is backed by buyout firms, and it equals 0 otherwise. VC dummy equals 1 if the IPO company is backed by venture-capital firms, and it equals 0 otherwise. Spinoff dummy equals 1 for spin-offs. OP is the offer price. P-values are in parentheses.

	Intercept	Ln(Expected Proceeds)	# of Bookrunners	Rm15	# of Bookrunners x Rm15	Buyout Dummy	VC Dummy	Spinoff Dummy	N	R^2
First-day Return	15.23	-0.45	-1.02	1.66	-0.53	-2.15	1.52	-0.79	532	5.5%
	(<0.0001)	(0.591)	(0.409)	(0.001)	(0.068)	(0.192)	(0.462)	(0.329)		
First-day Return	13.81	-0.06	-0.44	1.82	-0.57	-4.29	1.51	-3.91	317	5.3%
(Rm15>0)	(0.364)	(0.967)	(0.843)	(0.126)	(0.315)	(0.055)	(0.604)	(0.186)		
First-day Return	14.94	0.83	-2.52	1.27	-0.79	1.07	2.32	0.330	215	1.8%
(Rm15<0)	(0.062)	(0.387)	(0.387)	(0.148)	(0.155)	(0.662)	(0.416)	(0.659)		
Total Return	13.39	0.14	-2.83	3.97	-1.09	-3.82	-2.97	0.06	532	6.6%
	(0.041)	(0.930)	(0.289)	(<0.0001)	(0.087)	(0.237)	(0.454)	(0.972)		

Table V

Trade-off between all-star analyst coverage of single bookrunner and high offer price of multiple bookrunners

This table shows the average first-day and total return in each category for IPOs from 2001-2005. N is the number of IPOs in the category. No all-star means no bookrunners' *Institutional Investor* top 3 analyst and runner-ups covered the issue in the year after the IPO. One all-star means one bookrunner's all-star analyst covered the issue. Total return is defined as the (closing price-midpoint of file price range)/midpoint of file price range. First-day return is the (closing price-offer price)/offer price. Ln(proceeds) is the inflation-adjusted log of proceeds. Proceeds are global proceeds, not including any overallotment shares that are exercised. Ln(ExpectedProceeds) is the natural logarithm of expected proceeds. Expected proceeds is computed as the midpoint of file price ranges time the actual number of shares issued (not including overallotments). 26 IPOs with more than one all-star analyst covering the issue are not included in the table, because these are almost very large IPOs.

		No All-star	One All-star
Single Bookrunner	N	251	75
	Ln(Proceeds)	4.19	4.98
	Ln(ExpectedProceeds)	4.27	5.01
	First-day Return (%)	11.62	13.79
	Total Return (%)	6.63	15.64
Multiple Bookrunners	N	97	83
	Ln(Proceeds)	4.83	5.51
	Ln(ExpectedProceeds)	4.91	5.56
	First-day Return (%)	11.32	10.22
	Total Return (%)	7.62	7.90

Table VI

Buyout-backed IPOs by year

This table shows how many issues are buyout-backed IPOs each year and the percentage of these issues to the total number of IPOs. This table also gives the total global proceeds, excluding overallotment options, from buyout-backed IPOs and its percentage to the total proceeds from all IPOs.

Year	# of IPOs	# of Buyout-backed IPOs	% of Buyout-backed IPOs	Proceeds from Buyout-backed IPOs (in $ millions)	Proceeds from Buyout-backed IPOs as % of Total	% of Multiple Bookrunner IPOs for Buyout-backed IPOs	% of Multiple Bookrunner IPOs for Nonbuyout-backed IPOs
1995	457	29	6.4%	3,580	12.5%	0	0
1996	672	35	5.2%	4,254	10.1%	0	0
1997	471	32	6.8%	4,054	12.8%	0	0.9%
1998	283	32	11.3%	5,056	15.0%	6.3%	1.8%
1999	473	35	7.4%	7,587	11.7%	8.6%	4.7%
2000	380	31	8.2%	6,833	10.5%	19.4%	7.1%
2001	78	23	29.5%	3,913	11.4%	26.1%	19.2%
2002	65	27	41.5%	5,046	23.0%	33.3%	29.2%
2003	61	21	34.4%	4,782	50.2%	61.9%	32.8%
2004	172	44	25.6%	9,261	31.0%	54.6%	37.2%
2005	156	66	42.3%	16,247	57.9%	72.7%	51.3%

Table VII

Statistics of bank reputation, analyst coverage, and commercial bank status categorized by the number of bookrunners

The table presents statistics of bookrunners, which includes the market share, bookrunner's all-star analyst coverage, and commercial bank or investment bank for 532 IPOs from 2001-2005. Each bookrunner is taken as a separate observation, resulting in 757 observations. CM rank is the Carter-Manaster rank. Market share is the proceeds-weighted market share of IPOs of the bookrunners in the previous three years before the IPO. Analyst coverage dummy equals 1 if a bookrunner's all-star analyst covers the IPO in the aftermarket; it is 0 if it is non-all-star analyst coverage. If a bookrunner is a commercial bank, Commercial Bank=1, otherwise it equals 0. The mean and standard deviation (STD) of Market Share, Analyst Coverage, and Commercial Bank are reported conditional on the number of bookrunners. N is the number of observations.

	One Bookrunner		Each of Two Bookrunner		Each of Three Bookrunners	
	Mean	STD	Mean	STD	Mean	STD
CM Rank	7.694	1.753	8.370	1.112	8.714	0.593
Market Share	0.110	0.086	0.095	0.075	0.108	0.075
Analyst Coverage	0.198	0.399	0.256	0.437	0.381	0.489
Commercial Bank	0.255	0.437	0.412	0.493	0.393	0.491
Number of Observations	333		340		84	

Table VIII

Probit regressions for number of bookrunners

The table reports estimation results for two Probit regressions with the dependent variable being the bookrunner dummy, which equals 1 in multiple bookrunner IPOs (MBI) and 0 otherwise. Each bookrunner in MBIs is taken as a separate observation, resulting in 757 observations. DistanceCM is $\frac{\text{CMRank-}\overline{\text{CMRank}_t}}{\text{STD}_t^{\text{CMR}}} - \frac{\text{Size-}\overline{\text{Size}_t}}{\text{STD}_t^{\text{size}}}$. DistanceMS is $\frac{\text{Mktshare-}\overline{\text{Mktshare}_t}}{\text{STD}_t^{\text{Mkt}}} - \frac{\text{Size-}\overline{\text{Size}_t}}{\text{STD}_t^{\text{size}}}$. MarketShare is the proceeds-weighted market share of the bookrunner in the preceding three years. CM Rank is the Carter-Manaster (CM) rank on a 1 to 9 scale. Pipeline is the number of IPOs in process for which the bank is a bookrunner when the bank considers to run the book (the filing date) for a particular IPO, to the total number of IPO issues that the bank has worked as a bookrunner in the previous three years. Relative pipeline, $\frac{\text{Pipeline}}{\text{Market share} \times \text{Total proceeds of all IPOs in the year}}$, is an alternative measure of how busy a bookrunner is. Allstar Dummy equals 1 if the issuing company is covered by the all-star analyst of a bookrunner. Allstar total is the total number of bookrunners' all-star analysts covering the company. Expected Proceeds is the P_{mid} times the issuing shares, measured in millions. Buyout Dummy equals 1 if the IPO company is backed by a buyout firm. VC Dummy equals 1 if it is backed by a venture capital firm. Tech Dummy equals 1 if it is a tech company. Ln(1+age) is the log of 1 plus the number of years from a company's founding. P-values are in parentheses.

	(1)	(2)
Intercept	-2.790	-3.612
	(<0.001)	(<0.001)
Matching variables		
DistanceCM	-0.154	
	(0.151)	
DistanceMS		-0.142
		(0.015)
Bookrunner Char.		
Relative Pipeline	-0.040	-0.050
	(0.320)	(0.214)
Allstar Dummy	-0.570	-0.584
	(0.001)	(0.001)
Allstar Total	0.428	0.438
	(<0.001)	(<0.001)
CB Dummy	0.629	0.496
	(<0.001)	(<0.001)
Issuer Char.		
Ln (Expected Proceeds)	0.499	0.526
	(<0.001)	(<0.001)
LBO Dummy	0.684	0.666
	(<0.001)	(<0.001)
VC Dummy	0.427	0.391
	(0.006)	(0.010)
Tech Dummy	-0.175	-0.138
	(0.160)	(0.266)
Ln(1+age)	-0.045	-0.038
	(0.481)	(0.489)
N	757	757
Pseudo R^2	23.6%	23.6%

Appendix A.

Assume bookrunner 1 provides $P_{mid1} < P_{mid}^{H}$. If bookrunner 2 provides the same price it will allocate one-half of the shares. The following steps show how the bookrunner 2 can increase its net revenue by providing higher P_{mid1}. If bookrunner 2 chooses $P_{mid2} > P_{mid1}$, its net revenue is:

$$\text{Expected}(U_{\text{Bookrunner2}}^{\text{Multiple}})=\left[0.07\times P_{mid2}+(0.07-\beta)\times \text{Effort}+\beta\times(\text{Close}-P_{mid2})\right]\times N_{IPO}$$
$$-\text{EffortCost}-\text{AnalystCost}+E\left[B_{SEO}\right]$$

If bookrunner 2 choose P_{mid1}, its net revenue is:

$$\text{Expected}(U_{\text{Bookrunner21}}^{\text{Multiple}})=\left[0.07\times P_{mid1}+(0.07-\beta)\times \text{Effort}+\beta\times(\text{Close}-P_{mid1})\right]\times\frac{1}{2}\times N_{IPO}$$
$$-\text{EffortCost}-\text{AnalystCost}+E\left[B_{SEO}\right]$$

Each bookrunner's expected net revenue must be higher than its minimum acceptable net revenue of 0, i.e., $\text{Expected}(U_{\text{Bookrunner}}^{\text{Multiple}})>0$. From equation (15), we know that

$$\frac{7}{100}\times P_{mid}+(\frac{7}{100}-\beta)\times \text{Effort}+\beta\times(\text{Close}-P_{mid})>0$$

Suppose P_{mid}^{H} is the highest possible midpoint value. From the above formula, we have

$$P_{mid}^{H} < \frac{\beta\times \text{Close}}{(\beta-0.07)} - \text{Effort} \tag{22}$$

No matter what's the choice of bookrunner in the next round of competition, in order to have $\text{Expected}(U_{\text{Bookrunner2}}^{\text{Multiple}}) > \text{Expected}(U_{\text{Bookrunner21}}^{\text{Multiple}})$, we need to have

$$\text{Expected}(U_{\text{Bookrunner2}}^{\text{Multiple}})-\text{Expected}(U_{\text{Bookrunner21}}^{\text{Multiple}}) > 0$$

$$\left[(\frac{7}{100}\times P_{mid2}+(\frac{7}{100}-\beta)\times \text{Effort}+\beta\times(\text{Close}-P_{mid2}))\times \text{Size}\right]$$
$$-\left[(\frac{7}{100}\times P_{mid1}+(\frac{7}{100}-\beta)\times \text{Effort}+\beta\times(\text{Close}-P_{mid1}))\times\frac{1}{2}\text{Size}\right]>0$$

After simplification, we have

$$\frac{\beta\times \text{Close}}{(\beta-\frac{7}{100})}-\text{Effort}>2P_{mid2}-P_{mid1} \tag{23}$$

If one bookrunner gives P_{mid1}, the other bookrunner can always be better off by providing $P_{mid2}=\frac{P_{mid}^{H}+P_{mid1}}{2}$ ($P_{mid1} < P_{mid2} \le P_{mid}^{H}$). Because $2P_{mid2}\text{-}P_{mid1}=P_{mid}^{H}<\frac{\beta\times\text{Close}}{(\beta\text{-}\frac{7}{100})}\text{-Effort}$, condition in (23) is satisfied.

Appendix B.

The following two conditions need to be satisfied for the high-high effort to be the unique Nash equilibrium.

(1) $\text{Expected}(U_{\text{Bookrunner}}^{\text{Multiple}})_{LH}^{H}>\text{Expected}(U_{\text{Bookrunner}}^{\text{Multiple}})_{LL}^{L}$

(2) $\text{Expected}(U_{\text{Bookrunner}}^{\text{Multiple}})_{HH}^{H}>\text{Expected}(U_{\text{Bookrunner}}^{\text{Multiple}})_{HL}^{L}$

$$(1)\ \text{Expected}(U_{\text{Bookrunner}}^{\text{Multiple}})_{LH}^{H}>\text{Expected}(U_{\text{Bookrunner}}^{\text{Multiple}})_{LL}^{L}$$

$$=\frac{1}{2}\left[\left(\frac{7}{100}\text{-}\beta\right)\times\left(P_{mid}^{H}+a_H\right)+\beta\times\text{Close}\right]\times N_{IPO}+B_{SEO}\times\int_{a_L+b}^{a_H+b}f_H(\varepsilon_1)d\varepsilon_1+\text{Bseo}\times\int_{a_H\text{-}b}^{a_L+b}f_H(\varepsilon_1)\int_{a_L\text{-}b}^{\varepsilon_1}f_L(\varepsilon_2)d\varepsilon_2 d\varepsilon_1\text{-EffortCost}_H$$

$$>\frac{1}{2}\left[\left(\frac{7}{100}\text{-}\beta\right)\times\left(P_{mid}^{H}+a_L\right)+\beta\times\text{Close}\right]\times N_{IPO}+B_{SEO}\times\int_{a_L\text{-}b}^{a_L+b}f_L(\varepsilon_1)\int_{a_L\text{-}b}^{\varepsilon_1}f_L(\varepsilon_2)d\varepsilon_2 d\varepsilon_1\text{-EffortCost}_L$$

We assume that a bookrunner that provides a low offer price will lose the mandate for future SEO to the bookrunner that provides a higher offer price. High effort does not guarantee the future SEO business, but it gives the bookrunner more opportunity to win the business. If one bookrunner provides high effort and the offer price that it gives is higher than $P_{mid}^{H}+a_L+b$, it will kick out the bookrunner that provides low effort for sure and get all of the benefit of SEOs. If the offer price that one bookrunner provides is between $\delta_H\text{Close}+a_H-b$ and $\delta_L\text{Close}+a_L+b$, its benefits from future SEOs depends on the price its competing bookrunner provides. If its opponent provides a higher price, it loses all the future SEO benefits. f(ε) is the p.d.f. of ε. $f_L(\varepsilon)=f_H(\varepsilon)=\frac{1}{2b}$. Without loss of generality, we assume $\text{EffortCost}=(\text{Effort})^2$. After simplification and integration, we have

$$\frac{1}{2}\left(\frac{7}{100}-\beta\right)\times a_H\times N_{IPO}+\frac{B_{SEO}\left(a_H-a_L\right)}{2b}+\frac{B_{SEO}}{4b^2}\left[\left(a_H-a_L-b\right)\left(a_L+2b-a_H\right)+\frac{1}{2}\left(a_L+b-a_H\right)^2-\frac{1}{2}b^2\right]-a_H^2$$
$$>\frac{1}{2}\left(\frac{7}{100}-\beta\right)\times a_L\times N_{IPO}+\frac{1}{2}B_{SEO}-\frac{1}{2}a_L^2 \qquad (24)$$

In order to satisfy this condition, we need to have

$$a_H\in\left(\frac{B_{SEO}\times a_L+A-2bR}{B},\frac{B_{SEO}\times a_L+A+2bR}{B}\right)$$
$$R=\sqrt{Ca_L^2-Da_L+E},\ A=4bB_{SEO}+2N_{IPO}\left(\frac{7}{100}-\beta\right)b^2,\ B=8b^2+B_{SEO},\ C=8b^2-B_{SEO},\ D=16bB_{SEO}+8b^2N_{IPO}\left(\frac{7}{100}-\beta\right) \qquad (25)$$
$$E=b^2{N_{IPO}}^2\left(\frac{7}{100}-\beta\right)^2+2{B_{SEO}}^2+\left(4bN_{IPO}\left(\frac{7}{100}-\beta\right)-16b^2\right)B_{SEO}$$

If one bookrunner provides a_L, the other bookrunner can always provide $a_H\in\left(\frac{B_{SEO}\times a_L+A-2bR}{B},\frac{B_{SEO}\times a_L+A+2bR}{B}\right)$ and get better off.

(2) $\text{Expected}(U^{\text{Multiple}}_{\text{Bookrunner}})^H_{HH}>\text{Expected}(U^{\text{Multiple}}_{\text{Bookrunner}})^L_{HL}$

Similarly, we have

$$\frac{1}{2}\left(\frac{7}{100}-\beta\right)\times a_H\times N_{IPO}+B_{SEO}\times\int_{-b}^{+b}f_H(\varepsilon_1)\int_{-b}^{\varepsilon_1}f_H(\varepsilon_2)d\varepsilon_2 d\varepsilon_1-\text{EffortCost}_H$$
$$>\frac{1}{2}\left(\frac{7}{100}-\beta\right)\times a_L\times N_{IPO}+B_{SEO}\times\int_{a_H-b-a_L}^{+b}f_L(\varepsilon_1)\int_{-b}^{\varepsilon_1}f_H(\varepsilon_2)d\varepsilon_2 d\varepsilon_1-\text{EffortCost}_L \qquad (26)$$

In order to have $E(U_{HH}^H)>E(U_{HL}^L)$, we only need

$$a_H>\frac{4b^2N_{IPO}\left(0.07-\beta\right)+Ba_L}{B_{SEO}-8b^2} \qquad (27)$$

If the competing bookrunner exerts high effort, the bookrunner that exerts low effort, can always get higher expected net revenue by exerting high effort which satisfies condition (27), High-high choice is the only equilibrium in this game.

We notice if the benefit from follow-on issues is smaller than $8b^2$, the equilibrium does not exist. Under this condition, $\text{Expected}(U^{\text{Multiple}}_{\text{Bookrunner}})^H_{LH}>\text{Expected}(U^{\text{Multiple}}_{\text{Bookrunner}})^L_{LL}$, while $\text{Expected}(U^{\text{Multiple}}_{\text{Bookrunner}})^H_{HH}<\text{Expected}(U^{\text{Multiple}}_{\text{Bookrunner}})^L_{HL}$. Each bookrunner expects the other bookrunner takes mixed strategy. Each bookrunner is expected to exert effort $a=\frac{a_H+a_L}{2}$. They both give P^H_{mid} in the first step. Thus, the offer price is higher than the offer price of single bookrunner.

Appendix C.

The single bookrunner's expected net revenue is always higher than each joint bookrunner's net revenue, for a given quality of analyst coverage. In a multiple bookrunner IPO, each bookrunner provides P_{mid}^{H} and $Effort_{high}$. We have

$$\text{Expected}(U^{multiple}) = \frac{1}{2}\left((\frac{7}{100}\text{-}\beta)\times\left(P_{mid}^{H}+Effort_{high}\right)+\beta\times Close) \right)\times N_{IPO}$$

$$\text{-}EffortCost_{high}\text{-}AnalystCost+(\frac{7}{100}\text{-}\beta)\frac{N_{IPO}}{Close}\sigma^2$$

Since $(\frac{7}{100}\text{-}\beta)\frac{N_{IPO}}{Close}\sigma^2 < 0$, we have

$$\text{Expected}(U^{single})\text{-Expected}(U^{multiple})$$

$$>\left[\left((\frac{7}{100}\text{-}\beta)\times\left(P_{mid}^{L}+Effort_{low}\right)+\beta\times Close) \right)\times N_{IPO}\text{-}EffortCost_{low}\text{-}AnalystCost\right]$$

$$\text{-}\left[\frac{1}{2}\left((\frac{7}{100}\text{-}\beta)\times\left(P_{mid}^{H}+Effort_{high}\right)+\beta\times Close) \right)\times N_{IPO}\text{-}EffortCost_{high}\text{-}AnalystCost\right]$$

Since $\text{Expected}(U^{single})>0$, we have $(\frac{7}{100}\text{-}\beta)\times\left(P_{mid}^{L}+Effort_{low}\right)+\beta\times Close)>0$. Thus we have

$$\text{Expected}(U^{single})\text{-Expected}(U^{multiple})$$

$$>\left[\frac{1}{2}\left((\frac{7}{100}\text{-}\beta)\times\left(P_{mid}^{L}+Effort_{low}\right)+\beta\times Close) \right)\times N_{IPO}\text{-}EffortCost_{low}\right]$$

$$\text{-}\left[\frac{1}{2}\left((\frac{7}{100}\text{-}\beta)\times\left(P_{mid}^{H}+Effort_{high}\right)+\beta\times Close) \right)\times N_{IPO}\text{-}EffortCost_{high}\right]$$

$\left(P_{mid}^{L}+Effort_{low}\right)\text{-}\left(P_{mid}^{H}+Effort_{high}\right)<0$, $(\frac{7}{100}-\beta)<0$ and $EffortCost_{low}<EffortCost_{high}$, we have $\text{Expected}(U^{single})>\text{Expected}(U^{multiple})$.

Appendix D.

Numerical example for Proposition 2:

We assume the variables in our model have the following values:

Close = 20; P_{mid}^{H} = 17.2; P_{mid}^{L} = 16.2;

$AC_{high} = 4.80$; $AC_{low} = 1.60$; $AnalystCost_{high} = 1.44$; $AnalystCost_{low} = 0.48$;

$a_H = 1.2$; $a_L = 0.8$; $EffortCost_{high} = a_H^2$; $EffortCost_{low} = a_L^2$;

b = 3; Bseo = 4; Float = 0.30; $\beta = 0.3$;

$Risk_{high} = 2.4$; $Risk_{low} = 0.8$;

Issuing shares from 1.25 to 20.5 million

We have the following relationship between issue size and the net revenue of each bookrunner:

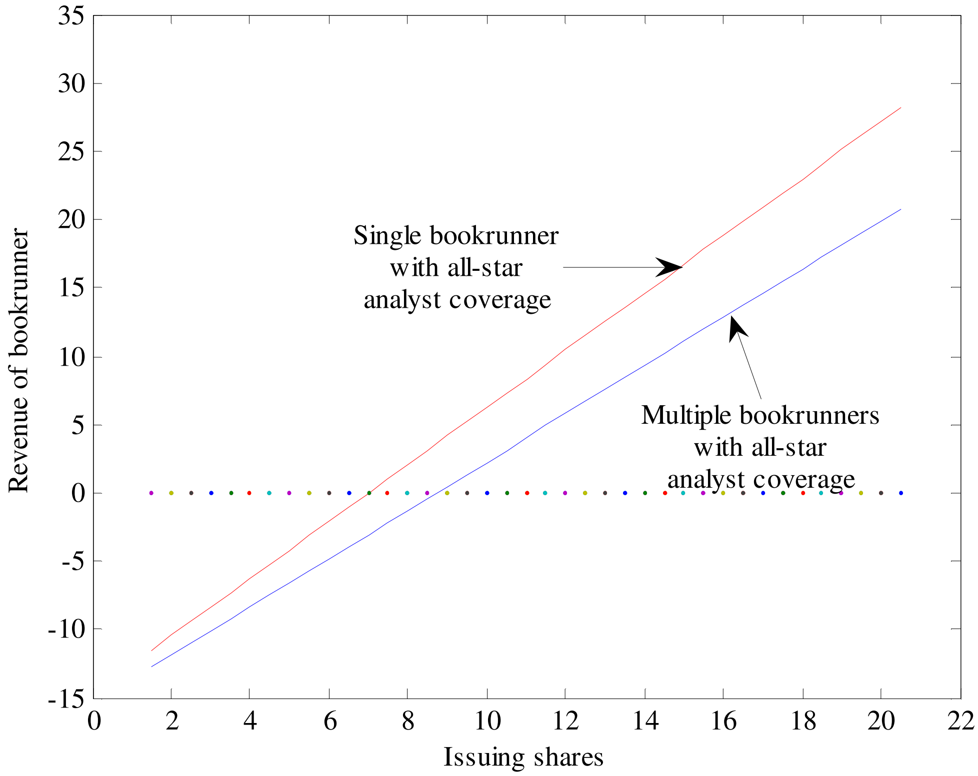

Figure 7

In this example, we assume that the multiple bookrunner issue and single bookrunner issue have the same type of analyst coverage. In other words, both have all-star analyst coverage, or both have non-all-star analyst coverage. We define the underpricing and Total Returns as follows:

$$Underpricing=(Close-OP)/OP$$

$$Totalreturn1=(Close-P_{mid})/P_{mid}$$

	Single Bookrunner	Multiple Bookrunners
Issuer's revenue	37.3124	38.7172
Underpricing	17.7 %	8.7%
Total Return	23.5%	16.3%

Figure 7 shows that the issuer always gets lower underpricing, a higher offer price, a higher P_{mid}, and higher proceeds from multiple bookrunners. Most importantly, only when the issuing shares are larger than 8.75 million is the expected net revenue of each multiple bookrunner larger than 0 from joint bookrunning. Bookrunners accept running the book jointly. When the issuing shares are between 7 million and 8.75 million, the net revenue of multiple bookrunners is less than 0. In this case, bookrunners will only accept sole bookrunning. When the issuing shares are smaller than 7 million, no bookrunner will work for this issuer.

Appendix E.

When AC_{high} minus AC_{low} is large, the issuer will prefer multiple bookrunners without an all-star analyst to a single bookrunner with an all-star analyst. We have the following example:

(1) ***Numerical Example1 for Proposition3:***

(2) Close = 20; $P^H_{mid} = 17.2$; $P^L_{mid} = 16.2$;

$AC_{high} = 4.8$; $AC_{low} = 1.6$; $AnalystCost_{high} = 16$; $AnalystCost_{low} = 14$;

$a_H = 1.2$; $a_L = 0.8$; $EffortCost_{high} = a_H^2$; $EffortCost_{low} = a_L^2$;

b = 3; Bseo = 4; Float = 0.30; $\beta = 0.3$;

$Risk_{high} = 2.4$; $Risk_{low} = 0.8$;

Given the numerical data above, the issuer's utilities under different choices are as follows:

Single Bookrunner without all-star	Single Bookrunner with all-star	Multi Bookrunner without all-star	Multi Bookrunner with all-star
35.0662	37.3124	36.4774	38.7172

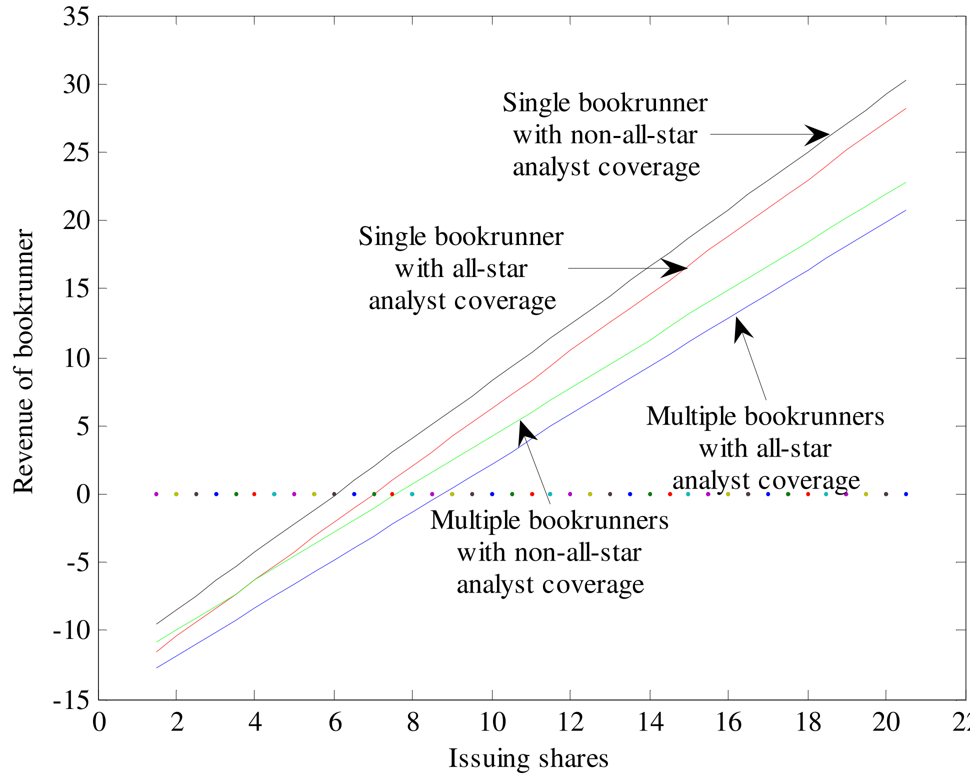

Figure 8

When the issuing shares are more than 8.75 million, the issuer will choose multiple bookrunners with all-star analyst coverage, giving the highest expected proceeds of 38.7172. When the issuing shares are less than 8.75 million, the issuer does not have enough gross spread revenue and underpricing to pay for the bookrunners with an all-star analyst. When the issuing shares are between 7.6 and 8.75 million, the issuer will have a choice between one bookrunner with all-star analyst coverage and two bookrunners without all-star analyst coverage. Under both choices of the issuer, bookrunners have positive net revenue.

The issuer's proceeds from multiple bookrunners without all-star analyst coverage is 36.4774, which is smaller than 37.3124, the proceeds from a sole bookrunning IPO with all-star analyst coverage. The issuer will choose a single bookrunner with all-star analyst coverage. When the issuing shares are between 7 and 7.6 million, the issuer can only use a single bookrunner, because the revenues of the multiple bookrunners are below 0. They will not accept running the book jointly. The issuer will use a single bookrunner with all-star analyst coverage. When the issuing shares are between 6 and 7 million, the issuer can only choose a single bookrunner without all-star analyst coverage. When the issuing shares are smaller than 6 million, no bookrunner will work for the issuer. In this example, $\Delta = 0.8350 > 0$.

When AC_{high} minus AC_{low} becomes smaller, the issuer will prefer multiple bookrunners without an all-star analyst to a single bookrunner with an all-star analyst coverage. We have the following example:

(3) Numerical example 2 for Proposition 3:

(4) Close = 20; $P^{H}_{mid} = 17.2$; $P^{L}_{mid} = 16.2$;

$AC_{high} = 3.2$; $AC_{low} = 1.6$; $AnalystCost_{high} = 16$; $AnalystCost_{low} = 14$;

$a_H = 1.2$; $a_L = 0.8$; $EffortCost_{high} = a_H^2$; $EffortCost_{low} = a_L^2$;

b = 3; Bseo = 4; Float = 0.30; Neg = -8; $\beta = 0.3$;

$Risk_{high} = 2.4$; $Risk_{low} = 0.8$;

The difference between numerical Example 1 and Example 2 is the AC_{high} is lower in Example 2.

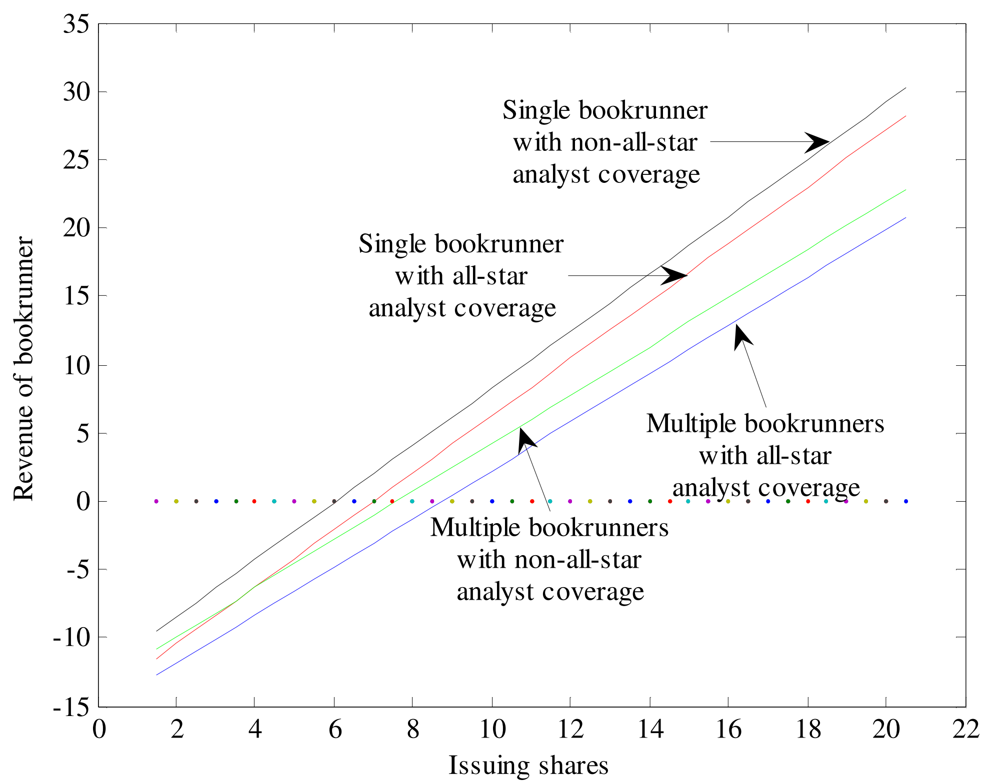

Figure 9

Given the numerical example above, the issuer's utilities under the four choices will be

Single Bookrunner without all-star	Single Bookrunner with all-star	Multi Bookrunner without all-star	Multi Bookrunner with all-star
35.0662	36.1944	36.4774	37.5856

When the issue size is in the range between 7.6 and 8.75 million, the issuer also has the choice of a single bookrunner with all-star analyst coverage and multiple bookrunners without all-star analyst coverage. The bookrunners' utilities are larger than zero under these two choices. However, the issuer will use multiple bookrunners without all-star analyst coverage in this example, since the proceeds of the issuer with multiple bookrunners is 36.4774, which is higher than 36.1944, the proceeds of the issuer with a single bookrunner. In this numerical example, $\Delta = -0.2830 < 0$.

The reason for the issuer to choose the multiple bookrunners in this case is that the relative importance of the all-star analyst coverage is decreased. In the previous example, AC_{high} -AC_{low} equals 3.2. In this example, AC_{high} -AC_{low} equals 1.6. The benefit high P_{mid} in multiple bookrunner IPOs exceeds the benefit of all-star analyst coverage in single bookrunner IPOs. In other words, the price factor P_{mid} dominates the all-analyst coverage factor, which makes $\Delta < 0$. Therefore, the issuer will choose multiple bookrunners without all-star analyst coverage.