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Underwriter deal pipeline and the pricing of IPOs☆

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ABSTRACT

This study examines how initial public offering (IPO) pricing is affected by the pipeline of deals in registration, measured at the underwriter level. Examining IPOs from 2002 to 2013, we find evidence that measures of the IPO bookrunner's pipeline significantly affect pricing decisions. The evidence is mostly consistent with market power and agency theories, which argue that underwriters use a young or growing pipeline to push for higher IPO first day returns.

1. Introduction

"If there's one thing we've all learned in the aftermath of the financial crisis, it's that stiffing your client is not a crime. Not if you're an investment bank." – Joe Nocera commenting on the first day return following LinkedIn's initial public offering (New York Times, 2011).

Research on initial public offerings (IPOs) has long recognized the significant impact that underwriters have on deal pricing. To measure this impact, early studies include measures of underwriter reputation such as Carter-Manaster ranking (Carter and Manaster, 1990) or underwriter market share (Megginson and Weiss, 1991) as independent variables in models of IPO first day returns. The initial evidence was consistent with theories, such as the Booth and Smith (1986) certification theory, arguing that underwriters play a positive role for issuers in reducing first day returns. In the late 1990s, findings about the relation between underwriter reputation measures and IPO first day returns became mixed, with several studies showing a positive effect (e.g., Beatty and Welch, 1996; Cooney, Singh, Carter, and Dark, 2001; Logue, Rogalski, Seward, and Foster-Johnson, 2002). These findings are more consistent with agency theories (e.g., Baron, 1982) arguing that underwriters play a negative role for issuers in pushing for higher first day returns.

Some researchers recognize that endogeneity makes interpretation of the evidence problematic. If common factors affect issuer choice of underwriter (or, alternatively, underwriter choice of issuer) and first day returns, then ordinary least squares first day return regressions including underwriter reputation measures, observable when an underwriter is selected, as independent variables could

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be biased. Some have responded by using econometric techniques that model endogeneity (e.g., Benveniste, Ljungqvist, Wilhelm, and Yu, 2003; Fernando, Gatchev, and Spindt, 2005). A challenge for this research is that inferences are based on joint hypotheses that certain relations hold between underwriter reputation and first day returns, and that the researcher has identified the correct structural econometric model.

We add to the literature by introducing several new measures to capture the role of underwriters in IPO pricing. These measures have two significant benefits. First, distinct predictions regarding the impact of our measures on pricing emerge from competing theories. Second, the new measures are constructed in such a way that endogeneity is not a significant issue. The primary measures focus on the pipeline of deals that have been initiated [i.e., registered with the Securities and Exchange Commission (SEC)] but are not completed or canceled that are led by each issuer's underwriter. For each IPO, we identify measures related to the change in total capital in the pipeline being managed by the issuer's bookrunner(s). Separate measures are constructed for intra-industry (same industry as the issuing firm) and extra-industry (all other industry) issues in the bookrunner's pipeline. We measure pipeline changes over two periods, one leading up to the first pricing date for the IPO but after its initial filing and one between the first pricing date and issuance.[1] We also introduce measures of the average calendar days in registration of a bookrunner's pipeline as of the first pricing date for the IPO (days between the filing date for each IPO in the pipeline and this IPO's first pricing date). Separate measures are constructed for intra-industry and extra-industry offerings in the bookrunner's pipeline. Our pipeline variables are noteworthy in that they are unobservable when an underwriter is selected and, thus, endogeneity should not be a concern.[2]

An examination of the impact of underwriter-level pipeline measures on IPO pricing can be motivated by several theories. Some theories posit a positive role for underwriters in facilitating lower first day returns for issuers. Benveniste, Busaba, and Wilhelm (2002) suggest that underwriters can reduce required first day returns by pooling offerings subject to a common valuation factor (frictions are reduced as information learned in one offering can be applied to others). Thus, changes to an underwriter's dollar pipeline (especially the pipeline of intra-industry deals) should be negatively related to IPO first day returns. Pipeline calendar days in registration should be positively related to first day returns, as an aging pipeline should make it more challenging to pool (information in stale offerings is less relevant).

Other theories posit a less positive role for underwriters in IPO pricing. In the Khanna, Noe, and Sonti (2008) model, when underwriters become overextended (because of a growing pipeline), their ability to effectively screen and market deteriorates and first day returns for IPOs managed by these underwriters increase. Other theories argue that underwriter market power relative to issuers is positively related to deal frequency (Liu and Ritter, 2011). Given agency conflicts arising from an underwriter's preference to reduce effort (Baron, 1982) or benefit from soft dollar commission revenue (e.g., Reuter, 2006; Nimalendran, Ritter, and Zhang, 2007; Goldstein, Irvine, and Puckett, 2011), underwriters with more market power should push for higher first day returns. Underwriter capacity, agency, and market power theories, therefore, predict that changes to an underwriter's pipeline should be positively related to IPO first day returns. Agency and market power theories predict a negative relation between pipeline calendar days in registration and first day returns, as market power arguably decreases with the calendar days in registration of an underwriter's pipeline. Underwriter capacity theory predicts a positive relation between pipeline calendar days in registration and first day returns, as an aging pipeline can be more challenging for an underwriter to market.

We examine the impact of an underwriter's pipeline on pricing for IPOs between 2002 and 2013. Measurement of the value of an underwriter's pipeline requires hand-collection of data from initial prospectuses from the SEC Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system database. We start our analysis in January 2002 to exclude the unusual dot-com bubble period (from January 1998 to June 2001) with its extreme issue characteristics (Ljungqvist and Wilhelm, 2003; Loughran and Ritter, 2004), dubious (and, in some cases illegal) practices (Hao, 2007; Liu and Ritter, 2010), and significant regulatory change [e.g., Regulation Fair Disclosure (Regulation FD) in 2000 and the Sarbanes-Oxley Act in 2002; see Gao, Ritter, and Zhu (2013)]. Our base analysis, therefore, focuses on the post-bubble period, which is likely to be more relevant to understanding the general (and current) role of underwriters in IPO pricing.

Underwriter-level pipeline measures significantly impact IPO pricing. The explanatory power of pricing models improves when pipeline variables are included. Our evidence is mostly consistent with agency and market power theories, which argue that underwriters play a negative role in pricing. Changes to a bookrunner's later filing period intra-industry pipeline significantly positively affect IPO first day returns, consistent with both underwriter capacity, agency, and market power theories. Bookrunner intra-industry pipeline calendar days in registration significantly negatively affects first day returns, which is consistent only with agency and market power theories, however. No significant evidence indicates that underwriters use a growing pipeline to push for lower IPO first day returns. The impacts of our new pipeline variables on first day returns are economically large. From 2002 to 2013, issuers in our sample raise approximately $204

[1] When an IPO is initially filed with the SEC, the issuer generally does not specify the number of shares expected to be sold or a bona fide range of prices. Instead, it simply indicates the maximum capital expected to be raised. Our pipeline size variables focus on the maximum proceeds in registration to ensure consistent measurement through the registration process. We are careful to distinguish between the filing date (the first date the IPO is registered with the SEC) and the first pricing date [the date on which the issuer first files an amendment to indicate valuation-relevant information, including the number of shares to be sold and a high and low initial (first) pricing range].

[2] When an underwriter's pipeline is unusually low or high at the filing date some change may be expected. We address this and other endogeneity concerns in Section 4.2.

billion in constant January 2010 dollars. A one standard deviation increase in the intra-industry bookrunner pipeline pre-issuance translates to approximately $2.61 billion additional dollars left on the table (10% of the total money left on the table for our sample). A one standard deviation increase in the intra-industry bookrunner pipeline calendar days in registration translates to approximately $3.26 billion additional dollars left on the table (13% of the total money left on the table).

While our primary analysis focuses on the post-dot-com bubble period, we also estimate pricing models during the bubble in an Online Appendix as a check on the validity of our pipeline measures. Given the extant evidence regarding excessive underpricing and dubious practices, our pipeline measures would be of questionable value if evidence during this period were not consistent with theories positing a negative role for underwriters. Consistent with expectations, virtually all pipeline measures have significantly positive effects on IPO first day returns during the dot-com bubble, and the economic significance of relations is even stronger. Finally, we complement the full sample analysis in our study with a case study of Morgan Stanley's technology IPO pricing in a second Online Appendix. Consistent with the full sample evidence, Morgan Stanley's technology IPOs have more positive first day returns in months following significant increases in their technology IPO pipeline.

The evidence in this paper complements existing research that attempts to determine the relative importance of agency and information theories in explaining IPO pricing. Like Ince (2014), we find limited support for information theories and more support for agency theories. Our study differs from some of the existing literature in that we focus on underwriter measures that do not require structural models to address endogeneity issues.

2. Data

We obtain data on all U.S. firm commitment IPOs using form S-1 (i.e., no foreign issuers or small businesses) from the Thomson Financial Securities Data (TFSD) New Issues database. While we focus on IPOs issued between 2002 and 2013, we initially obtain a sample of all IPOs between 2001 and June 2014. IPOs prior to 2002 are needed to obtain measures of past IPO activity. IPOs after 2013 are needed to ensure that we accurately measure the value of IPOs in registration at the end of the sample period. Consistent with many prior studies, we exclude issues by banks, unit offerings (combinations of equity and warrants) and other non-equity securities, real estate investment trusts (REITs), American depositary receipts, American depositary shares, global depositary receipts, or global depositary shares, mutual conversions, spinoffs, carve outs, and closed-end funds.[3]

The typical timeline for IPOs from initial filing through issuance is shown in Fig. 1. The TFSD New Issues database contains information on the expected size of an IPO at first pricing (expected number of shares to be offered and the minimum and maximum prices set on the first pricing date) and any changes to the filing size made in amendments between the first pricing and issuance. Filing data have numerous errors (incorrect amendment dates, missing price or share adjustments, etc.) requiring data checks on pricing terms and filing dates through manual searches of prospectuses on EDGAR. While most IPOs do not provide pricing data at the initial filing date, all observed filings indicate a proposed maximum filing size to compute registration fees payable. For each IPO we obtain and record this maximum filing size through manual prospectus searches. Overall, we have complete data on 1,058 IPOs issued between 2002 and 2013.[4]

While we focus on successful IPOs, pipeline measures must capture all offerings in the IPO pipeline including those that ultimately are withdrawn from registration (Dunbar and Foerster, 2008; Boeh and Dunbar, 2015). We obtain data from the TFSD Withdrawn Issues database on all IPOs in registration between January 1, 2002 and December 31, 2013 that are later withdrawn (using the same screening as for successful IPOs). The timeline for withdrawn IPOs is similar to that for successful IPOs shown in Fig. 1, with the issuance date replaced by a withdrawal date. Numerous IPOs are filed with the SEC but are neither successful nor formally withdrawn. These IPOs are first identified by searching the TFSD Filings in Registration database. Consistent with Rule 230.479 of the Exchange Act of 1933, we assume that an IPO is abandoned if nine months have passed from its last (amended) registration statement.[5] Filing data collection for withdrawn and abandoned IPOs is similar to that for completed IPOs. We identify 487 IPOs in registration between January 1, 2002 and December 31, 2013 that are later withdrawn or abandoned and 32 that remain in registration.

Filing data (e.g., timing, pricing, shares offered) for successful, withdrawn, and abandoned IPOs are obtained from TFSD and EDGAR. TFSD is used to obtain other issue-level data for successful IPOs. Data for some variables are obtained from the Center for Research in Security Prices (CRSP; e.g., shares outstanding and share prices after the IPO) and Compustat (e.g., pre-IPO revenue).

3. Empirical methods

We follow the approach introduced by Edelen and Kadlec (2005) to estimate a model explaining the price adjustment in each IPO, i (PA_i), defined as one hundred times the difference between the offer price and the

[3] To screen banks, we exclude issues from firms having Standard Industrial Classification (SIC) codes 6000, 6029, 6021, 6712, 6035, 6036, or 6022 (banks). Non-equity securities include beneficial interests, enhanced income securities, limited liability interests, and limited partner interests.

[4] Applying the screens to the TFSD New Issues database results in a sample of 1,108. An additional 50 IPOs are dropped as they do not meet (based on EDGAR searches) all screening criteria (e.g., NV5 Holdings IPO on March 27, 2013 clears the Thomson Financial Screens but is a unit IPO) or do not have pricing data available from the Center for Research in Security Prices (CRSP).

[5] According to Rule 230.479, when a registration statement has been on file with the SEC for a period of nine months and has not become effective the commission can determine that the registration has been abandoned. The nine-month period is computed from the date of the latest amendment.

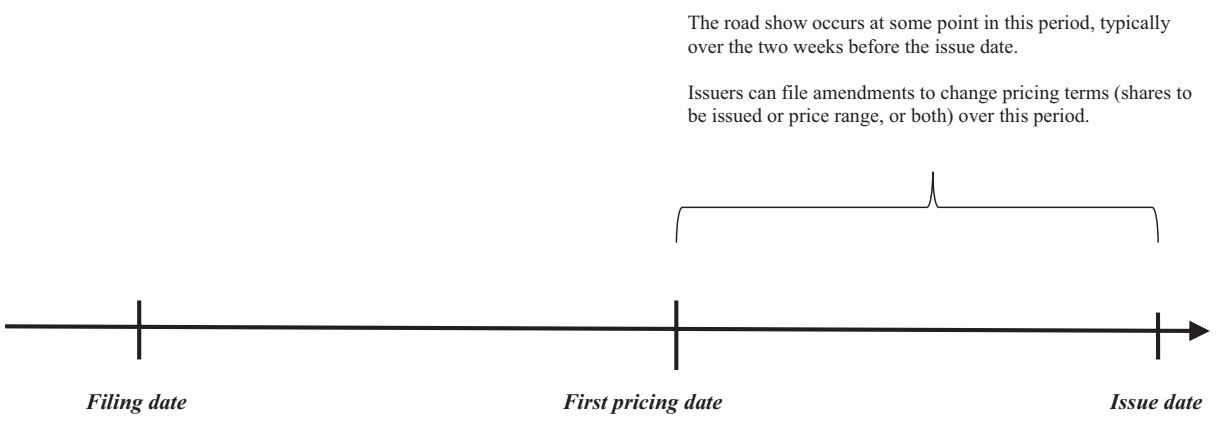

Fig. 1. Relevant dates in typical initial public offering timeline.

average of the high and low prices set on the first pricing date, divided by this average filing price.

$$PA_i = \alpha + \beta X_i + \delta BP_i + \varepsilon_i \ , \tag{1}$$

where X_i is a vector of controls, BP_i is a vector of bookrunner pipeline measures, and ε_i is the regression error. From this model we define two measures of abnormal price adjustment:

$$APA_i = PA_i - \hat{\alpha} - \hat{\beta} X_i - \hat{\delta} BP_i \tag{2}$$

and

$$PAPA_i = APA_i \quad if \quad APA_i > 0; \quad 0 \ otherwise, \tag{3}$$

where $\hat{\alpha}$, $\hat{\beta}$, and $\hat{\delta}$ are estimates from the price adjustment regression (1).

We include these abnormal price adjustment variables to explain the first day IPO return (UPR_i), defined as one hundred times the difference between the first trading day closing price for issuer i and the issue price, divided by the issue price.

$$UPR_i = \alpha + \varphi X_i + \gamma BP_i + \vartheta APA_i + \omega PAPA_i + \epsilon_i, \tag{4}$$

where ϵ_i is the regression error. This approach addresses endogeneity, as price adjustments are orthogonalized relative to independent variables X_i and BP_i. As Edelen and Kadlec point out, it also provides a useful economic interpretation, as unexplained, or residual, price adjustments arguably are driven by private, not public, information. We use both APA_i and $PAPA_i$ to capture the possibly nonlinear impact of price adjustments on first day returns.

The focus of our research is on the impact of underwriter-level pipeline measures (BPi) on pricing. We define these measures and identify predictions regarding their impact on pricing emerging from key theories. Appendix A provides an example using the IPO for FoxHollow Technologies to illustrate variable measurement. We also identify control variables used in our analyses (detailed definitions and sources of data) in Appendix B.

3.1. Bookrunner pipeline variables: definitions

We introduce four underwriter pipeline size measures for each IPO using the dollar value (the maximum file price multiplied by the number of shares to be offered) of all IPOs in the same industry (intra-industry) in registration (filed but not completed, withdrawn, or abandoned) managed by the issuer's bookrunners at four dates: 60 days prior to the first pricing date or the filing date, whichever is later; the first pricing date; 21 calendar days prior to the issuance date or the first pricing date, whichever is later; and the issuance date. IPOs are classified into five industry categories using TFSD Macro Industry Code (TF Macro Code): high-tech (HT), health (HEALTH), finance (FINANCE), energy (ENERGY), and other (all other codes).[6] When computing the dollar value in registration at each date, we include the current IPO to ensure changes are not driven by the IPO entering and then exiting the pipeline. If other deals in registration involve multiple bookrunners, each is given equal credit (e.g., if the value in registration for a given IPO is $100 million and there are two bookrunners, the resulting pipeline generated for each underwriter would be $50 million). If an underwriter merges or makes

[6] We consider other industry classification schemes and results are qualitatively unaffected. The TFSD scheme has the advantage that it is closely aligned with the industry corporate finance groups at many major underwriters that represent the majority of issuers over this period (from 2002 to 2013, there are 245 high-tech firms, 234 health firms, 102 finance firms, 106 energy firms, and 371 other firms in the sample).

an acquisition during the registration period for an IPO, its pipeline includes deals managed by all parties to the merger. After summing the value in registration at each date, we divide this by the number of bookrunners in the current IPO to get the average bookrunner pipeline.[7] The average dollar value underwriter pipeline at the four dates in billions of dollars is then multiplied by a consumer price index (CPI) adjustment factor for the month of the IPO so that pipeline measures are shown in billions of constant 2010 dollars.

With these industry pipeline measures we compute two independent variables. *Bookrunner intra-industry pipeline change pre-first filing* is the difference between the same-industry value in registration at the first pricing date and the earlier date (the filing date or 60 days prior to the first pricing date), and *Bookrunner intra-industry pipeline change pre-issue* is the difference between the same-industry value in registration at the issue date and the later of the first pricing date or 21 calendar days prior to issuance. We repeat this analysis but instead measure the value of the bookrunner pipeline of IPOs in all other industries (extra-industry) at the same four dates. With these other industry pipeline measures, we compute *Bookrunner extra-industry pipeline change pre-first pricing*, which is the difference between the other industry value in registration at the first pricing date and the earlier date (the filing date or 60 days prior to the first pricing date), and *Bookrunner extra-industry pipeline change pre-issue*, which is the difference between the other industry value in registration at the issue date and the later of the first pricing date and 21 calendar days prior to issuance.

In addition to these pipeline size measures, we introduce measures of the average calendar days in registration of a bookrunner's pipeline at the IPO's first pricing date. The calendar days in registration of each offering in the bookrunner's pipeline is the calendar days between its filing date and the first pricing date in this IPO. We weight the calendar days in registration of each offering in the pipeline by its value in registration as of the first pricing date (given N bookrunners, the value used in our weighting is $1/N$ times the total value in registration). *Bookrunner extra-industry calendar days in registration* is the weighted average days all other industry deals have been in registration as of the first pricing date. *Bookrunner intra-industry calendar days in registration* is the weighted average days all same-industry deals have been in registration as of the first pricing date.[8]

3.2. Bookrunner pipeline variables: theoretical predictions

Some theories posit a positive role for underwriters in facilitating lower first day returns for issuers. Benveniste and Spindt (1989) present a model in which issuers, through their underwriters, pre-commit to partially adjust prices if investors reveal positive private information regarding the value of the issuer. Benveniste, Busaba, and Wilhelm (2002) extend this theory by considering the role underwriters play in pooling IPOs. In their model, underwriters need not pre-commit to higher required returns in an IPO if they are taking public other firms subject to common valuation factors given that information learned in one IPO can be applied to others. This pooling theory, therefore, predicts that IPO first day returns should be negatively related to changes in an underwriter's intra-industry pipeline. While the theory focuses on the pool of IPOs brought forward by an underwriter that are subject to common valuation factors, underwriters could use a growing aggregate pipeline (including other industry IPOs) to push for lower first day returns as underwriters market IPOs across multiple industries to the same investors. In this case IPO first day returns would also be negatively related to changes in an underwriter's extra-industry pipeline.[9] The theory offers no reason to expect the timing of the changes to an underwriter's pipeline to affect the pricing equilibrium differently. Both early and late changes to an underwriter's pipeline should be negatively related to first day returns.

Other theories posit a less positive role for underwriters in IPO pricing. Khanna, Noe, and Sonti (2008) develop a model in which the supply of underwriting services is short-run inelastic. When underwriters overextend (resulting in an increasing pipeline) and screening declines, first day returns for IPOs managed by these underwriters should increase. Because the underwriter's most significant pricing activities happen later in the registration period (i.e., the roadshow), changes to an underwriter's pipeline that occur later in the registration should have a greater impact on its ability to screen and market. Underwriter

[7] We consider the average pipeline in multiple bookrunner offerings to ensure that capacity constraints can be compared across sole and co-managed deals. The secular increase in co-bookrunners over the sample period (see Corwin and Schultz, 2005; Huang and Zhang, 2011) presents significant measurement challenges. In the later part of our sample, several IPOs have six or more bookrunners (the maximum is 11 for Groupon in 2011). All bookrunners do not contribute equally in those situations, and some likely are included for symbolic reasons or simply to ensure that they provide analyst coverage. We, therefore, consider two other ways of measuring pipeline for IPOs with multiple bookrunners. First, we give each bookrunner equal credit on all deals but then consider only the bank with the maximum pipeline. Second, when an IPO has six or more bookrunners, the capital is allocated equally among the five banks having the highest market share of completed deals over the year preceding the filing date and then averaged across those banks. Results are qualitatively similar using these alternative measures.

[8] We consider several other ways to measure bookrunner pipeline calendar days in registration. Because variation in time exists in the normal calendar days in registration of IPOs in registration (see Boeh and Dunbar, 2014), we consider measures of the relative calendar days in registration for a bookrunner's pipeline (the bookrunner's average deal calendar days in registration divided by the average across all underwriters at the first pricing date). Our findings using such relative calendar days in registration variables are qualitatively similar. We also consider including pipeline calendar days in registration variables that are measured at different points in the registration process. Pipeline calendar days in registration at the filing date and issue date have no significant effect on price adjustments or first day returns when included with pipeline calendar days in registration when the first price range is established.

[9] The predicted effects of a bookrunner's intra- and extra-industry pipeline change variables and IPO pricing from all theories are likely to be most meaningful for IPOs in the high-tech, health, finance, and energy industries. IPOs from the other industries category contain a number of mostly unrelated companies. While the primary results shown include all IPOs, we replicate our analyses excluding the other industries firms. Our findings are qualitatively unaffected.

capability theory, therefore, predicts that the relation between underwriter pipeline changes pre-issue and IPO first day returns is more significant than the relation between pipeline changes pre-first pricing and first day returns.

Liu and Ritter (2011) present a model in which underwriters face agency conflicts and, therefore, prefer to price such that IPO first day returns are high. In addition to concerns for effort (Baron, 1982), underwriters have an incentive to underprice IPOs to attract soft dollar commission revenue. Several studies find a positive relation between underwriter commission revenues and IPO underpricing (e.g., Reuter, 2006; Nimalendran, Ritter, and Zhang, 2007; Goldstein, Irvine, and Puckett, 2011). When underwriters leave more issuer money on the table, investors direct more commissions to the underwriter. This quid pro quo arrangement allows underwriters to indirectly capture some of the value left on the table in IPOs.

While underwriters could prefer higher IPO first day returns, why issuers would accept this, given competition, is not obvious. Liu and Ritter note that underwriters provide multiple services to issuers in addition to pricing, including analyst coverage. Issuers would be willing to accept high first day returns if they place greater value on non-price services. In this setting, Liu and Ritter show that an underwriter's oligopolistic market power increases with deal frequency. Liu and Ritter's market power theory, therefore, predicts that first day returns are positively related to changes in an underwriter's intra- or extra-industry pipeline. The theory does not suggest any reason to distinguish between early and late changes to an underwriter's pipeline.[10]

The pooling, capacity, agency, and market power theories also can be used to make predictions regarding the impact of pipeline calendar days in registration variables on first day returns. An aging pipeline can make it more challenging to pool (information in stale offerings is less relevant). Pipeline calendar days in registration, therefore, would be positively related to first day returns. Because an aging pipeline can be more challenging for an underwriter to market, capacity arguments also suggest that pipeline calendar days in registration should be positively related to first day returns. Finally, underwriter market power arguably decreases with pipeline calendar days in registration. In this case, pipeline calendar days in registration would be negatively related to first day returns.

While our focus is on the effect of bookrunner pipeline measures on first day returns, the alternative theories also can be used to make predictions regarding the impact of our new measures on price adjustments. Pooling and capacity theories would not predict any relation between price adjustments and pipeline size change variables measured before first pricing and pipeline calendar days in registration variables measured at the first pricing date. Any information in those variables should be reflected in the initial price range. Some relation between price adjustment and these variables is possible under the market power theory, however. Prospect theory (Kahneman and Tversky, 1979) argues that underwriters with greater market power will push for lower initial prices on the first pricing date, allowing them room to move prices up, keeping issuers happy, while underpricing offerings. Bookrunner pipeline change pre-first filing variables would, therefore, be positively related to price adjustments and pipeline calendar days in registration at first pricing would be negatively related.

The predicted relation between price adjustments and pipeline size change variables measured after first pricing (pre-issue) depends on the extent to which those changes are anticipated by the bookrunners. If the changes are a surprise, then the predicted relation between pipeline changes and price adjustments should be, mechanically, the opposite of that predicted for first day returns by the various theories. To achieve lower (higher) first day returns in the pooling (underwriter capacity or market power) theory, price adjustments need to be more positive (negative). If the changes are anticipated, the pooling and capacity theories would predict no relation between post-first pricing pipeline change variables and price adjustment, as information in those variables should be reflected in the initial price range. Prospect theory would again indicate that underwriters anticipating increases to their market power would push for lower filing prices, resulting in positive price adjustments. Bookrunner pipeline change pre-issue (post-first pricing) variables would, therefore, be positively related to price adjustments.

3.3. Control variables

In this section we introduce control variables used in our pricing models and identify predictions regarding the impact of these measures on price adjustments and first day returns emerging from existing theories.[11]

3.3.1. Underwriter measures

While our focus is on new underwriter measures, we control for other established measures including *Carter-Manaster rank* (see Carter and Manaster, 1990; Loughran and Ritter, 2004) and *Bookrunner one-year market share* (Megginson and Weiss, 1991).[12] When there are multiple

[10] In defining pipeline size, we consider using both value and quantity measures as theory is silent regarding how an underwriter's pipeline (or deal volume in general) should be measured. In both the Liu and Ritter (2011) and the Benveniste, Busaba, and Wilhelm (2002) models, all offerings are equal in size, so quantity and value measures are equivalent. In practice, considerable variation exists in the size of offerings. Given high correlation between value and quantity measures, including both in the models is not possible. We ultimately settled on value-based measures, as their economic and statistical significance exceed those of quantity-based measures.

[11] We consider including change in pipeline size and pipeline calendar days in registration variables measured at the aggregate level (i.e., variables that capture the aggregate change in all intra- and extra-industry IPO value in registration and the aggregate average intra- and extra-industry IPO pipeline calendar days in registration). When included in pricing models, these variable estimates are statistically insignificant.

[12] Like *Bookrunner one-year market share*, many independent variables in this study are measured over arbitrarily defined periods. While no theory exists to guide such measurement choices, there are clear empirical trade-offs. In principle, more recent data should be more informative but shorter windows of measurement create noise and result in smaller sample sizes. Given the importance of many of these variables, we replicate our analyses using alternative windows. Overall, our results are robust to alternative definitions.

bookrunners, we use the highest Carter-Manaster rank and the average market share. Corwin and Schultz (2005) and Huang and Zhang (2011) examine syndicate structure in IPOs and find that the number of bookrunners impacts pricing, and so we include *Number of bookrunners*.

Hoberg (2007) introduces a measure of past underwriter-level first day returns and finds that past returns are positively related to future returns for underwriters. Following Hoberg, we include *Bookrunner average first day returns,* defined as the average first day returns for all deals managed by the issuer's bookrunner(s) over the 12 months prior to the first pricing date (averaging across bookrunners when an issuer uses multiple bookrunners).[13] For both market share and bookrunner average first day return measures, we include deals by all precedent underwriters in cases in which the bookrunner merges or acquires.

3.3.2. Other typical IPO pricing control variables

Most IPO theories predict that first day returns and price adjustments are positively related to issue and issuer riskiness (more precisely, ex ante valuation uncertainty). We use risk proxies in our models, including *Log of revenue, Log of first pricing size,* and share *Overhang* (Loughran and Ritter, 2004; Lowry, Officer, and Schwert, 2010; Benveniste, Ljungqvist, Wilhelm, and Yu, 2003; Lowry and Schwert, 2004; Hoberg, 2007; Liu and Ritter, 2011; Wang and Yung, 2011; Bradley and Jordan, 2002).[14] We also include a *Venture capital dummy* to capture the impact of past financing and certification on IPO pricing (Megginson and Weiss, 1991; Liu and Ritter, 2011).

Many studies beginning with Logue (1973) note that IPO pricing is affected by public market conditions (Benveniste, Ljungqvist, Wilhelm, and Yu, 2003; Lowry and Schwert, 2004; Hoberg, 2007). As such, we include the market return (the percentage return on NYSE-, Nasdaq-, and Amex-listed firms) from 21 calendar days pre-issue or the first pricing date, whichever is later, to the issue date. Recent studies find asymmetric effects of market returns on IPO pricing (Ince, 2014), with negative returns having more significant effects than positive returns. We, therefore, include two measures of market returns in our IPO pricing models: *Market return if negative* is the market return as defined above if negative, and zero otherwise; *Market return if positive* is the market return as defined above if positive, and zero otherwise.[15]

[13] We consider including average aggregate first day return measures in our models (the average return of intra- and extra-industry IPOs over the 12 months prior to first pricing) but these variable estimates were statistically insignificant.

[14] We use first pricing size instead of the ultimate IPO issue size so that all issue and issuer characteristics are observable at the time of the initial first pricing, consistent with the timing for our pipeline measures. *Log of revenue, Log of first pricing size,* and *Overhang* are adjusted for inflation.

[15] We consider including measures of the volume of past intra- and extra-industry IPOs in our models (e.g., Benveniste, Ljungqvist, Wilhelm, and Yu, 2003), but these variables are insignificant. We also consider including separate measures for early and late registration period market returns (using the same timing as for bookrunner pipeline measures). The statistical and economic significance of early and later period variables are virtually identical. We, therefore, present the more parsimonious model using the full filing period measures.

4. IPO price adjustments and first day returns

A total of 1,058 completed IPOs from 2002 to 2013 have necessary data for issue and issuer characteristics to be in our sample (and where first day return data are available). For some IPOs, some of the non-issue or issuer-specific variables introduced above are not measurable. In some cases, bookrunners do not manage sufficient numbers of prior deals to measure underwriter-level underpricing variables (119 cases).[16] We also exclude IPOs in which the bookrunners are not managing any other IPOs as of the first pricing date (62 cases). While we focus on bookrunner value in registration measures in our analyses, pooling arguments require at least one other contemporaneous deal. The resulting sample contains 934 IPOs, a reduction of approximately 12%. To address any concerns of sample bias or external validity, we compare statistics in the full and constrained samples. Table 1 presents means of relevant variables along with *t*-tests for differences between measures for full and constrained samples.

The evidence in Table 1 suggests that little significant difference exists between the constrained and full samples. The only variables with statistically significant means differences are *Log of first pricing size, Carter-Manaster rank,* and *Number of bookrunners*. Constrained sample IPOs are larger and backed by more reputable underwriters. This is not surprising given that we exclude issues by underwriters with limited (or no) current or past activity. To add further confidence that our primary results are not driven by sample selection biases, we replicate all analyses using the subset of variables measurable for all 1,058 offerings. The economic and statistical significance of those variables are similar to the results shown here. Overall, there is little evidence that the sample suffers from any selection bias.[17]

In Table 2, we present descriptive statistics for the bookrunner pipeline measures. Panel A presents means and standard deviations for pipeline change and calendar days in registration measures for the full sample of IPOs. The mean extra- and intra-industry pipeline ages at first pricing are 170 and 152 days, respectively, with both variables exhibiting significant variation. While mean pipeline size change variables are small, particularly for pre-issue changes, the standard deviations are large, ranging from $95 (for pre-issue intra-industry changes) to more than $280 million (for pre-first pricing extra-industry changes). In Panel B, we consider only those cases, for each pipeline change variable, in which changes are positive; in Panel C, only those cases, for each pipeline change variable, in which changes are negative. Conditional on having positive or negative pipeline changes, the means for each variable are large and highly variable. Overall, Table 2 indicates that our pipeline variables have sufficient variation

[16] We require at least two IPOs in the 12 months prior to first pricing. We consider other arbitrary cutoffs, and our results are qualitatively unaffected.

[17] While not explored in this paper, it is interesting to note that price adjustments and first day returns tend to be slightly more positive in the constrained sample. Average first day return when the bookrunner has no other deals in registration is 7.5%. It is puzzling that banks with limited experience price with such minimal first day returns, suggesting that these firms do not underprice deals to elicit information revelation.

Table 1
Sample selection, 2002–2013.

This table shows mean value for dependent and independent variables considered in later analyses. The sample includes all U.S. firm commitment IPOs using form S-1 issued between 2002 and 2013. We exclude we exclude issues by banks, unit offerings (combinations of equity and warrants) and other non-equity securities, real estate investment trusts (REITs), American depositary receipts, American depositary shares, global depositary receipts, or global depositary shares, mutual conversions, spinoffs, carve outs, and closed-end funds. Dependent variables are *Price adjustment* (one hundred times the difference between the offering price and the midpoint of initial filing range, divided by the midpoint of initial filing range) and *First day return* [the first day return for an initial public offering (IPO) defined as one hundred times the difference between the closing price on the first day of trading and the IPO price, divided by the IPO price]. Independent variables are defined in Appendix B. The full sample means are based on all IPOs, in which dependent variables, issue characteristics (*Log of revenue, Overhang, Log of first pricing size, and Venture capital dummy*), market conditions (*Market return if negative,* and *Market return if positive*), and underwriter identity (*Carter Manaster rank* and *Number of bookrunners*) are observable. The restricted sample contains two additional screens. (1) *Bookrunner average first day returns* must be observable (requiring at least two IPOs led by this IPO's bookrunners over the past 12 months). (2) The bookrunner(s) must have at least one other IPO in registration at the first pricing date for this IPO. The *t*-statistics are based on a test of equality of means for the full and restricted samples.

	Full sample	Restricted sample	*t*-Statistic
Price adjustment	−4.004	−3.692	−0.34
First day return	11.846	12.426	−0.66
Log of revenue (2010 millions of dollars)	4.388	4.506	−1.28
Overhang	3.234	3.297	−0.51
Log of first pricing size (2010 millions of dollars)	4.855	4.970	−3.16
Venture capital dummy	0.461	0.489	−1.25
Market return if negative	−0.781	−0.805	0.33
Market return if positive	1.375	1.335	0.55
Carter-Manaster rank	8.352	8.671	−6.54
Number of bookrunners	2.008	2.120	−2.02
Number of observations	1058	934	

to have meaningful effects on pricing. While some underwriters experience little variation in their pipeline over the registration period, a large number of IPOs see significant changes. Even for our least variable measure, pre-issue intra-industry pipeline changes, almost 70% of IPOs have a nonzero change.[18]

4.1. Price adjustments leading to pricing and IPO first day returns

Table 3 presents regression model estimates for the full sample of IPOs from 2002 to 2013 in which the dependent variables are price adjustments (Eq. (1)) and first day returns (Eq. (4)). In addition to the independent variables, all models include year and industry fixed effects. For each model, we show coefficient estimates, marginal effects, and *t*-statistics. We define marginal effect as the change in dependent variable given a one standard deviation increase in an independent variable (a unit increase for dummy variables) over the sample period. Marginal effects are included to provide insight into the economic significance of each variable.

Panel A of Table 3 shows output from pricing models without the pipeline measures. Price adjustments are significantly positively related to *Log of revenue, Overhang, Venture capital dummy, Market return if negative, Carter-Manaster rank, and Bookrunner one-year market share*. All of these variables (except *Bookrunner one-year market share*) also have significantly positive effects on first day returns, consistent with partial adjustment to the information in these measures. The finding of a significant relation between *Market return if negative* and first day returns is consistent with Ince (2014). The significantly positive effect of *Venture capital dummy* on first day returns is consistent with the Liu and Ritter (2011) analyst lust theory. Finally, *Log of first pricing size* has a significantly negative effect on IPO first day returns, and the abnormal price adjustment variables have significantly positive effects on first day returns, consistent with existing literature.

Panel B shows output from pricing models that include underwriter-level pipeline measures.[19] The inclusion of these measures significantly improves the explanatory power of the models. The R^2 in the price adjustment model increases approximately 11% from 0.217 to 0.240, and the R^2 in the first day return model increases approximately 4% from 0.422 to 0.440. The marginal effects for several of our new measures indicate that they are among the most economically significant variables in the models. The sign

[18] Forty percent of IPOs have pre-issue intra-industry pipeline changes for bookrunners in excess of $25 million, in absolute value.

[19] While not shown in the table, several industry and year fixed effects have significant coefficients. In the price adjustment model, the coefficients on the 2010 and 2012 dummies are both significantly negative (−12.9 and −4.7, respectively). The coefficient on the health industry dummy is also significantly negative (−13.8). In the first day return model, coefficients on the 2011 and 2013 dummies are significant (5.9 and 8.0, respectively). The coefficient on the health industry dummy is also significantly negative (−10.0).

Table 2
Bookrunner initial public offering (IPO) pipeline measure descriptive statistics, 2002–2013.

This table shows means and standard deviations for bookrunner pipeline change measures and pipeline calendar days in registration measures as defined in Appendix A. The sample includes all U.S. firm commitment IPOs using form S-1 issued between 2002 and 2013. We exclude we exclude issues by banks, unit offerings (combinations of equity and warrants) and other non-equity securities, real estate investment trusts (REITs), American depositary receipts, American depositary shares, global depositary receipts, or global depositary shares, mutual conversions, spinoffs, carve outs, and closed-end funds. For pipeline change measures the descriptive statistics are multiplied by one thousand for presentation purposes (because pipeline change variables are measured in billions of inflation-adjusted dollars, the numbers shown are in millions of inflation-adjusted dollars). Panel A shows statistics for all IPOs in the sample. Panel B shows pipeline change measure statistics for subsamples in which each bookrunner change variable is positive (each subsample is different by variable). Panel C shows pipeline change measure statistics for subsamples in which each bookrunner change variable is negative (again, each subsample is different by variable).

	Number	Mean	Standard deviation
Panel A: Overall sample			
Bookrunner intra-industry calendar days in registration	934	152.3	112.1
Bookrunner extra-industry calendar days in registration	934	170.4	113.4
Bookrunner intra-industry pipeline change pre-first pricing	934	28.5	173.7
Bookrunner intra-industry pipeline change pre-issue	934	0.8	95.3
Bookrunner extra-industry pipeline change pre-first pricing	934	42.8	280.6
Bookrunner extra-industry pipeline change pre-issue	934	3.3	155.5
Panel B: IPOs in which change variable is positive			
Bookrunner intra-industry pipeline change pre-first pricing	578	101.1	150.7
Bookrunner intra-industry pipeline change pre-issue	326	58.6	105.2
Bookrunner extra-industry pipeline change pre-first pricing	523	194.4	232.1
Bookrunner extra-industry pipeline change pre-issue	403	99.9	143.8
Panel C: IPOs in which change variable is negative			
Bookrunner intra-industry pipeline change pre-first pricing	355	−89.8	140.9
Bookrunner intra-industry pipeline change pre-issue	306	−59.9	93.3
Bookrunner extra-industry pipeline change pre-first pricing	387	−159.4	212.8
Bookrunner extra-industry pipeline change pre-issue	386	−96.2	131.7

and significance of significant variables from Panel A show little change when we include IPO pipeline measures.

Bookrunner intra-industry pipeline change pre-issue has a significantly positive effect on IPO price adjustments and first day returns. The positive relation between pipeline changes and first day returns is not consistent with pooling theory, which argues that underwriters use their growing intra-industry pipeline to push for lower first day returns. It is consistent with theories that argue for a less positive underwriter role in IPO pricing, however. The positive effect of pipeline changes on price adjustments is consistent with prospect theory (that is, underwriters push for lower first filing price, allowing positive price adjustments and more positive first day returns when market power is expected to increase).

Bookrunner intra-industry calendar days in registration has a significantly negative effect on both price adjustments and first day returns. These findings more strongly support agency and market power arguments. Because the calendar days in registration is known when the first filing price range is set, the negative relation between price adjustment and bookrunner intra-industry calendar days in registration is evidence that underwriters purposely set a low filing price when their market power is higher.

Overall, the evidence in Table 3 is mostly consistent with agency and market power theories. No significant evidence emerges that underwriters use a growing pipeline to push for lower first day returns. While the positive impact of pre-issue intra-industry pipeline changes on first day returns is consistent with capacity, agency, and market power theories, the evidence for the pipeline calendar days in registration variables is consistent only with agency and market power theories.

4.2. Endogeneity

We argue that our pipeline change variables are not affected by endogeneity because they cannot be observed when the underwriter is initially selected. However, some change could be expected, especially if the underwriter's pipeline at first filing is unusual. We attempt to address this concern in two ways. First, we include variables to capture the levels of an underwriter's intra- and extra-industry pipelines when an IPO is filed, but there is no significant effect on the pricing models. Second, we identify cases in which an underwriter's pipeline is unusually large or small and exclude these cases from the analyses. Using various exclusions, we find no significant change to

Table 3
Initial public offering (IPO) pricing, 2002–2013.

This table shows regressions in which the dependent variables are *Price adjustment* (one hundred times the difference between the offering price and the midpoint of initial filing range, divided by the midpoint of initial filing range) and *First day return* (the first day return for an IPO defined as one hundred times the difference between the closing price on the first day of trading and the IPO price, divided by the IPO price). The sample includes all U.S. firm commitment IPOs using form S-1 issued between 2002 and 2013. We exclude we exclude issues by banks, unit offerings (combinations of equity and warrants) and other non-equity securities, real estate investment trusts (REITs), American depositary receipts, American depositary shares, global depositary receipts, or global depositary shares, mutual conversions, spinoffs, carve outs, and closed-end funds. In Panel A, we show regression estimates including all control variables as defined in Appendix B. For the *First day return* regression we also include the following variables: *Abnormal price adjustment* (APA) is the residual from the price adjustment model, and *Positive abnormal price adjustment* (PAPA) takes the value of the *Abnormal price adjustment* variable if it is positive and zero otherwise. In Panel B, we include all control variables, and our new pipeline measures as defined in Appendix A (for the *First day return* regression, APA and PAPA are computed using the price adjustment model that includes bookrunner pipeline variables) are used also. Significant variables (at the 5% level or better) are in bold and italics. For each model we show each coefficient estimate, the marginal effect, and *t*-statistic. Marginal effect is defined as the impact of a one standard deviation change in the dependent variable on the independent variable (for dummy variables, economic significance is the change in the dependent variable due to a change from zero to one for the dummy variable). Models have 934 observations and include year and industry fixed effects.

	Price adjustment			*First day return*		
	Estimate	Marginal effect	*t*-Statistic	Estimate	Marginal effect	*t*-Statistic
Panel A: Model including only control variables						
Log of revenue	***1.46***	***3.01***	***3.18***	***0.96***	***1.99***	***2.60***
Overhang	***1.36***	***3.26***	***4.84***	***1.66***	***4.00***	***7.35***
Log of first pricing size	−1.56	−1.21	−1.25	***−2.25***	***−1.75***	***−2.25***
Venture capital dummy	***5.22***	***5.22***	***3.07***	***8.50***	***8.50***	***6.20***
Market return if negative	***1.55***	***2.59***	***3.68***	***1.36***	***2.27***	***4.00***
Market return if positive	−0.49	−0.79	−1.15	−0.12	−0.20	−0.35
Carter-Manaster rank	***2.13***	***1.64***	***2.21***	***1.76***	***1.35***	***2.26***
Number of bookrunners	0.01	0.02	0.02	−0.27	−0.34	−0.47
Bookrunner average first day returns	−0.16	−1.03	−1.41	0.02	0.12	0.21
Bookrunner one-year market share	***0.44***	***2.23***	***3.00***	0.10	0.53	0.88
Abnormal price adjustment				***0.19***	***3.45***	***3.64***
Positive abnormal price adjustment				***0.64***	***6.73***	***7.02***
R^2		0.217			0.422	
Panel B: Models including bookrunner pipeline variables						
Log of revenue	***1.48***	***3.06***	***3.24***	***1.01***	***2.09***	***2.70***
Overhang	***1.38***	***3.32***	***4.96***	***1.70***	***4.10***	***7.48***
Log of first pricing size	−1.66	−1.29	−1.33	***−2.36***	***−1.84***	***−2.33***
Venture capital dummy	***5.28***	***2.64***	***3.11***	***8.71***	***8.71***	***6.31***
Market return if negative	***1.44***	***2.41***	***3.41***	***1.22***	***2.04***	***3.53***
Market return if positive	−0.35	−0.57	−0.82	0.07	0.11	0.19
Carter-Manaster rank	***2.18***	***1.68***	***2.21***	***1.70***	***1.31***	***2.10***
Number of bookrunners	0.04	0.05	0.05	−0.26	−0.32	−0.44
Bookrunner average first day returns	−0.14	−0.96	−1.31	0.02	0.11	0.37
Bookrunner one-year market share	***0.42***	***2.12***	***2.84***	0.07	0.35	0.58
Bookrunner extra-industry calendar days in registration	0.00	0.02	0.03	−0.01	−0.73	−1.25
Bookrunner intra-industry calendar days in registration	***−0.01***	***−1.42***	***−2.04***	***−0.01***	***−1.60***	***−2.81***
Bookrunner extra-industry pipeline change pre-first pricing	1.47	0.41	0.64	0.60	0.17	0.32
Bookrunner extra-industry pipeline change pre-issue	−3.79	−0.59	−0.95	−5.49	−0.85	−1.88
Bookrunner intra-industry pipeline change pre-first pricing	0.01	0.00	0.00	1.82	0.32	0.61
Bookrunner intra-industry pipeline change pre-issue	***23.97***	***2.28***	***3.71***	***13.44***	***1.28***	***2.55***
Abnormal price adjustment (APA)				***0.21***	***3.83***	***3.96***
Abnormal price adjustment if positive (PAPA)				***0.59***	***6.14***	***6.30***
R^2		0.240			0.440	

the results, suggesting endogeneity is unlikely an issue for pipeline change measures.[20]

The bookrunner pipeline calendar days in registration variables are also constructed to minimize endogeneity as we measure the pipeline calendar days in registration after the underwriter has been retained. The pipeline calendar days in registration at first pricing could be predictable when the underwriter was selected, however. To check for this, we consider inclusion of pipeline calendar days in registration variables measured at the filing date. These variables are not significant in our pricing models, suggesting that endogeneity is also not an issue for the calendar days in registration variables.

Finally, our pipeline variables are not significantly correlated with "traditional" underwriter measures which do suffer from endogeneity concerns as they can be observed when the underwriter is selected. The impacts of all measures on IPO pricing that are observable when a bank is selected (issuer characteristics and bookrunner measures, such as *Carter-Manaster rank*) are qualitatively unaffected when adding our new pipeline measures.[21]

4.3. Alternative explanations for pipeline effects

While the predictions considered thus far focus on the incremental effects of underwriter pipeline measures on pricing arising from pooling, capacity, agency, and market power theories, our measures also could be capturing other effects. For example, underwriter pipeline measures can in part reflect changing information regarding the value of the issuer. It is well established (e.g., Bradley and Jordan, 2002; Edelen and Kadlec, 2005) that there is a partial adjustment to valuation-relevant information in the IPO market. One interpretation of our finding for *Bookrunner intra-industry pipeline change pre-issue*, for example, is that increases (decreases) to an underwriter's pre-issue intra-industry pipeline partly reflect good (bad) news regarding the valuation of the issuing firm. The industry pipeline is growing (shrinking) because prospects in the industry are believed to be increasing (decreasing). In this case, changes to the underwriter's pre-issue intra-industry pipeline would be both positively related to IPO price adjustments and first day returns. While this information story potentially explains the relation between pricing and pipeline pre-issue change variables, it does not explain the relation between pricing and pipeline change pre-first pricing or intra-industry calendar days in registration variables, as these variables are observable when the first price range is set.

To gain insight into the relative importance of the information story in explaining evidence in Section 4.1., we first extend our model in Panel B of Table 3 to allow asymmetric pipeline effects. Some recent research (Ince, 2014) finds information effects to be more pronounced on the downside. If pipeline changes reflect information, we would expect more pronounced effects as the pipeline declines. Pipeline effects arising from pooling, capacity, agency, and market power theories also could be asymmetric. For example, the impact of pooling on pricing could apply only when the pipeline is growing. An underwriter's capacity to screen is perhaps affected only if its pipeline grows. Similarly, growth in an underwriter's pipeline could have more significant effects on its market power than a decline in pipeline. Prospect theory arguments also most logically apply when market power is high or increasing.

Table 4 shows estimates from pricing models that allow for asymmetric effects in pipeline variables. To more parsimoniously present the evidence, we show estimates only for pre-issue pipeline change variables. Economic and statistical significance of control variables, pre-first pricing pipeline change variables, and calendar days in registration variables are generally very close to those shown in Panel B of Table 3 (we consider allowing asymmetric effects for pre-first pricing pipeline change variables, but all variables are insignificant).

Panel A shows output from a model that allows asymmetric effects for pre-issue period pipeline change variables. Marginal effects are based on a one standard deviation change in each variable conditional on each being nonzero. Bookrunner intra-industry late filing period pipeline change variables have significantly positive effects on first day returns regardless of whether the change is positive or negative. Asymmetrically defined intra-industry pipeline variables have very different effects on price adjustments, however. If the pipeline change is positive, it has a statistically insignificant positive effect on price adjustments. If the pipeline change is negative, it has a much more significant (statistically and economically) effect on price adjustments. While *Bookrunner extra-industry pipeline change pre-issue* does not significantly affect first day returns, we find that this variable has a significantly negative effect on first day returns if it is positive. This significant negative relation is consistent with pooling arguments. It also could be consistent with the information story if a growing extra-industry pipeline reflects bad news for the issuing firm. Growth in the extra-industry pipeline arises as prospects in other industries increase. Given competition for capital (Hsu, Reed, and Rocholl, 2010), increasing prospects in other industries should drive down the valuations possible in this industry. While not statistically significant, the *Bookrunner extra-industry pipeline change pre-issue, if negative* variable negatively affects price adjustments. In all cases, the signs on the relations between pipeline change variables and first day returns is the same as the signs on relations between pipeline

[20] We measure bank pipeline variables at the end of months t-12 through t-7 relative to the first filing date. In one analysis, we consider an underwriter's total (intra- plus extra-industry) pipeline to be unusually large at filing if it is 50% larger than the maximum observed in the earlier period. We also consider the pipeline to be unusually small if it is 50% smaller than the minimum observed in the earlier period. Excluding these "unusual" cases reduces the sample to 622 (194 are dropped because the pipeline at filing is too small and 118 are dropped because the pipeline is too large). We replicate models from Table 3 using this reduced sample and find no significant changes. Other arbitrary definitions of large and small are considered, and in no case are our findings materially affected.

[21] In unreported analyses, we estimate two-stage least squares models as in Benveniste, Ljungqvist, Wilhelm, and Yu (2003) in which *Carter-Manaster rank* is treated as an endogenous variable. The impact of our pipeline measures on price adjustments and first day returns are qualitatively unaffected relative to what is reported in Table 3.

Table 4
Initial public offering (IPO) pricing with asymmetric pipeline effects, 2002–2013.

This table shows regressions in which the dependent variables are *Price adjustment* (one hundred times the difference between the offering price and the midpoint of initial filing range, divided by the midpoint of initial filing range) and *First day return* (the first day return for an IPO defined as one hundred times the difference between the closing price on the first day of trading and the IPO price, divided by the IPO price). The sample includes all U.S. firm commitment IPOs using form S-1 issued between 2002 and 2013. We exclude we exclude issues by banks, unit offerings (combinations of equity and warrants) and other non-equity securities, real estate investment trusts (REITs), American depositary receipts, American depositary shares, global depositary receipts, or global depositary shares, mutual conversions, spinoffs, carve outs, and closed-end funds. All independent control variables from Table 3 (as defined in Appendix B) are included but we show only pre-issue underwriter-level IPO pipeline measures. In Panel A, we show estimates from *Price adjustment* and *First day return* regressions in which we allow for asymmetric effects of the pre-issue pipeline variables from Table 3. The "if negative" variables equal the pipeline change variable if it is negative and zero otherwise. The "if positive" variables equal the pipeline change variable if it is positive and zero otherwise. In Panel B, we show estimates from an extended model that includes all variables from the Panel A model but replaces *bookrunner intra-industry pipeline change pre-issue, if negative* with two variables. *Bookrunner intra-industry pipeline change pre-issue, if negative and aggregate intra-industry pipeline is shrinking* takes the value of *Bookrunner intra-industry pipeline change pre-issue, if negative* if the ratio of intra-industry to overall IPO pipeline (by value) is decreasing over the pre-issue period and zero otherwise. *Bookrunner intra-industry pipeline change pre-issue, if negative and aggregate intra-industry pipeline is growing* takes the value of *Bookrunner intra-industry pipeline change pre-issue, if negative* if the ratio of intra-industry to overall IPO pipeline (by value) is increasing over the pre-issue period and zero otherwise. In Panel C, we show estimates from an extended model that includes all variables from the Panel A model but replaces *Bookrunner intra-industry pipeline change pre-issue, if positive* with two variables. *Bookrunner intra-industry pipeline change pre-issue, if positive and aggregate intra-industry pipeline is growing* takes the value of *Bookrunner intra-industry pipeline change pre-issue, if positive* if the ratio of intra-industry to overall IPO pipeline (by value) is increasing over the pre-issue period and zero otherwise. *Bookrunner intra-industry pipeline change pre-issue, if positive and aggregate intra-industry pipeline is shrinking* takes the value of *Bookrunner intra-industry pipeline change pre-issue, if positive* if the ratio of intra-industry to overall IPO pipeline (by value) is decreasing over the pre-issue period and zero otherwise. In Panel D, we show estimates from an extended model that includes all variables from the Panel A model but replaces *Bookrunner extra-industry pipeline change pre-issue, if positive* with two variables. *Bookrunner extra-industry pipeline change pre-issue, if positive and extra-industry pipeline is growing* takes the value of *Bookrunner extra-industry pipeline change pre-issue, if positive* if the ratio of extra-industry to overall IPO pipeline (by value) is increasing over the pre-issue period and zero otherwise. *Bookrunner extra-industry pipeline change pre-issue, if positive and extra-industry pipeline is shrinking* takes the value of *Bookrunner extra-industry pipeline change pre-issue, if positive* if the ratio of extra-industry to overall IPO pipeline (by value) is decreasing over the pre-issue period and zero otherwise. Significant variables (at the 5% level or better) are in bold and italics. For each model, we show each coefficient estimate, the marginal effect, and *t*-statistic. Marginal effect is defined as the impact of a one standard deviation change (computed for nonzero values) in the dependent variable on the independent variable. Models have 934 observations and include year and industry fixed effects.

	Price adjustment			*First day return*		
	Estimate	Marginal effect	*t*-Statistic	Estimate	Marginal effect	*t*-Statistic
Panel A: Asymmetric bookrunner pipeline effects						
Bookrunner extra-industry pipeline change pre-issue, if negative	2.73	0.25	0.41	1.71	0.16	0.31
Bookrunner extra-industry pipeline change pre-issue, if positive	−9.67	−1.02	−1.60	***−10.51***	***−1.11***	***−2.13***
Bookrunner intra-industry pipeline change pre-issue, if negative	***42.70***	***5.62***	***4.07***	***14.63***	***1.93***	***2.15***
Bookrunner intra-industry pipeline change pre-issue, if positive	9.28	1.33	1.01	***10.47***	***1.50***	***2.09***
R^2		0.246			0.440	
Panel B: Bookrunner negative intra-industry pipeline changes related to aggregate pipeline changes						
Bookrunner intra-industry pipeline change pre-issue, if negative and aggregate intra-industry pipeline is shrinking	***44.51***	***4.70***	***4.15***	***15.24***	***2.53***	***4.15***
Bookrunner intra-industry pipeline change pre-issue, if negative and aggregate intra-industry pipeline is growing	11.11	0.46	0.28	−6.09	−0.47	0.28
R^2		0.246			0.440	
Panel C: Bookrunner positive intra-industry pipeline changes related to aggregate pipeline changes						
Bookrunner intra-industry pipeline change pre-issue, if positive and aggregate intra-industry pipeline is growing	8.15	1.02	0.88	***9.20***	***1.15***	***2.03***
Bookrunner intra-industry pipeline change pre-issue, if positive and aggregate intra-industry pipeline is shrinking	35.93	1.25	0.91	***33.12***	***1.16***	***1.97***
R^2		0.246			0.440	
Panel D: Bookrunner positive extra-industry pipeline changes related to aggregate pipeline changes						
Bookrunner extra-industry pipeline change pre-issue, if positive and aggregate extra-industry pipeline is growing	***−12.17***	***−2.02***	***−1.96***	***−10.82***	***−1.80***	***−2.13***
Bookrunner extra-industry pipeline change pre-issue, if positive and aggregate extra-industry pipeline is shrinking	17.73	1.36	1.04	−4.90	−0.38	−0.35
R^2		0.248			0.440	

change variables and price adjustments, consistent with the information story.

To highlight the relative importance of the information story, we split bookrunner pipeline change variables into two cases: one in which the bookrunner change is consistent with aggregate pipeline changes (e.g., intra-industry pipeline for this underwriter and all others are shrinking) and one in which the bookrunner pipeline change is not consistent with aggregate pipeline changes (e.g., the intra-industry pipeline for the underwriter is shrinking, but the aggregate intra-industry pipeline is growing). For the information story to hold, only the first variable should be significant. Other explanations (pooling, capacity constraint, agency, or market power) predict that both variables should have similar effects.

In Panel B of Table 4, we show evidence from a model splitting the *Bookrunner intra-industry pipeline change pre-issue, if negative* variable into two cases. In this specification, only when the bookrunner pipeline change is consistent with the aggregate pipeline change does a significantly positive relation exist, thus indicating that this variable is mostly capturing the negative effect of a declining intra-industry pipeline. In Panel C, we show evidence from a model splitting the *Bookrunner intra-industry pipeline change pre-issue, if positive* variable into two cases. Here the two variables have virtually identical effects on price adjustments and first day returns, suggesting that the pipeline change variable is capturing capacity, agency, or market power effects and is not simply reflecting positive information. Finally, in Panel D, we show evidence from a model splitting the *Bookrunner extra-industry pipeline change pre-issue, if positive* variable into two cases. In this specification, the pipeline variable significantly negatively affects price adjustments and first day returns only when the bookrunner pipeline change is consistent with the aggregate change. This indicates that this variable is primarily capturing information effects and not the positive effect (for issuers) of pooling on pricing.

Overall, the evidence in Table 4 supports the view that our pipeline change variables post-first pricing partly proxy for information effects. The significantly positive effect of the *Bookrunner intra-industry pipeline change pre-issue, if negative* variable on first day returns even when that change is not consistent with aggregate pipeline changes is strong evidence for capacity, agency, and market power theories, however.

6. Conclusion

This study adds to the understanding of the role of underwriters in the pricing of IPOs by introducing measures of the change over the issuance process to an underwriter's intra- and extra-industry pipeline of deals in registration. Our new measures are noteworthy in that distinct predictions regarding their impact on pricing emerge from theories positing either a positive or negative role for underwriters in IPO pricing. The variables are measured using information after an underwriter is selected, reducing concerns of endogeneity. Using IPOs from 2002 to 2013, the evidence is mostly consistent with agency and market power theories. We believe our new pipeline measures are noteworthy in that they add significant explanatory power to models of IPO price adjustments and first day returns and the economic impact of the variables on pricing is large. A one standard deviation increase in the late filing period intra-industry bookrunner pipeline translates to approximately $2.72 billion additional dollars left on the table, representing 10% of the total money left on the table for IPOs in our sample. A one standard deviation decrease in the intra-industry bookrunner pipeline calendar days in registration translates to approximately $3.26 billion additional dollars left on the table, representing 13% of the total money left on the table for IPOs in our sample. Stated differently, a $100 million increase in an underwriter's late filing period intra-industry pipeline translates to a 1.3% increase in per-deal first day returns. A 50-day decrease in its intra-industry pipeline calendar days in registration translates to a 0.7% increase in per-deal first day returns.

Another contribution lies in our use of an industry classification scheme that arguably better matches how investment banks (and the buy side) structure their equity activities. IPO pricing is mostly affected by measures of activity within the same industry grouping as the current IPO. This industry scheme could prove useful in other research.

We believe the evidence in this paper is relevant for issuers, underwriters, and policy makers. Issuers should be wary of underwriters that expand their intra-industry pipeline during the IPO process and could consider incorporating controls in their underwriting agreements. Underwriters seeking to build a reputation for pricing accuracy should be wary of spikes to pipeline and also attempt to manage pipeline calendar days in registration. Finally, given the importance of pipeline on pricing, regulators should consider regulatory impacts on the transparency of underwriter pipelines. The Jumpstart Our Business Startups ("JOBS") Act was signed into law in April 2012. While intended to rejuvenate the IPO market, it reduces transparency because emerging growth company (EGC) issuers are allowed to submit IPO registration statements to the SEC for confidential review.[22] Only if the issuer decides to move forward do these confidential filings become part of the public record. Such confidentiality reduces the ability of issuers and investors to track an underwriter's pipeline. We leave consideration of the impact of this change in transparency to future research.[23]

Appendix A. Underwriter-level IPO pipeline measure definitions

In this appendix, we use an example to show how underwriter-level IPO pipeline variables are measured. FoxHollow Technologies Inc. went public on October 27, 2004 with two bookrunners, J.P. Morgan and Piper Jaffray. The IPO was filed with the SEC on August 13, 2004,

[22] See Dambra, Field, and Gustafson (2014) and Chaplinksy, Hanley, and Moon (2014) for a detailed discussion of the JOBS Act and its impact on the IPO market.

[23] Because some of our sample period extends to after the JOBS Act became law, we replicate our analysis looking at subperiods before and after April 2012. While we find some preliminary evidence that the economic and statistical significance of our pipeline measures decline, the effects are not strong, however, due to small sample sizes.

Table A.1
Filing details for initial public offerings (IPOs) managed by J.P. Morgan and Piper Jaffray during the registration period for FoxHollow Technologies.

This table shows details on all IPOs managed at least in part by J.P. Morgan and Piper Jaffray that were in registration during the registration period for FoxHollow Technologies. Completed and withdrawn IPOs are considered. The industry classification for each IPO is based on Thomson Financial Securities Data Macro Industry Code. We include observations only if the code indicates the IPO is in the health industry or anything else (other). For each IPO in registration, the maximum value in registration on three dates correspond to the filing, first pricing, and issue date for FoxHollow Technologies. The value in registration is based on the most recent amendment for each IPO.

IPO	Number of bookrunners	Industry	Filing date	Issue date	Withdrawal date	Maximum value in registration per bookrunner (millions of dollars)			Calendar days in registration
						August 13, 2004	October 14, 2004	October 27, 2004	October 14, 2004
FoxHollow Technologies	2	Health	8/13/04	10/27/04		30.43	31.50	31.50	62
Bookrunner: J.P. Morgan									
Icagen Inc.	2	Health	8/08/04	2/3/04		37.50	37.50	37.50	189
American Reprographics	2	Other	10/15/04	2/4/04				100.00	
Beacon Roofing Supply	1	Other	5/28/04	9/22/04		189.00			
Brightmail Inc	1	Other	3/22/04		9/15/04	65.57			
Dreamworks Animation	2	Other	7/21/04	10/27/04			37.50	37.50	85
HouseValues Inc.	2	Other	9/1/04	12/10/04			37.50	37.50	43
InPhonic Inc.	2	Other	6/14/04	11/16/04		43.48	59.50	59.50	122
MarketAxess Holdings	2	Other	2/11/04	11/11/04		81.00	26.25	26.25	246
Nalco Holding Co.	4	Other	8/26/04	11/10/04			211.11	211.11	49
New York & Co.	2	Other	5/24/04	10/06/04		75.00			
Oasis Semiconductor	2	Other	3/19/04		12/17/04	30.00	30.00	30.00	209
SSA Global Technologies	2	Other	6/04/04	5/26/05		86.96	86.96	86.96	132
Worldspan Technologies	2	Other	3/30/04		3/23/05	290.25	290.25	290.25	198
Bookrunner: Piper Jaffray									
CoTherix	2	Health	3/11/04	10/15/04		35.00	25.00		217
VNUS Medical Technologies	2	Health	7/23/04	10/20/04		35.00	35.48		83
Dollar Financial	2	Other	3/12/04	1/31/05		63.75	63.75	63.75	216

and the first pricing amendment was filed on October 14, 2004. To compute the pipeline measures, we identify all IPOs (whether completed or withdrawn) for which these two underwriters are bookrunners in registration on three dates: the filing date, the first pricing date, and the issue date.[24] Details on each IPO are shown in Table A1. We separate IPOs into two groups: those in the same industry (intra-industry) as FoxHollow Technologies and all others. IPOs are classified into five industry categories using TFSD Macro Industry Code (TF Macro Code): high-tech (HT), health (HEALTH), finance (FINANCE), energy (ENERGY), and other (all other codes). FoxHollow Technologies' industry classification is health.

At FoxHollow Technologies' filing date, J.P. Morgan had two health IPOs in registration (including FoxHollow Technologies) and eight other industry IPOs in registration. Piper Jaffray had three health industry IPOs in registration (including FoxHollow Technologies) and one other industry IPO in registration. Including the maximum initial filing size for FoxHollow Technologies, the total value of health (intra-industry) IPOs in registration for these two underwriters is $168.36 million. We divide this by two thousand to measure the average value in registration per underwriter in billions of dollars. This value is then multiplied by 0.875, the CPI adjustment factor for October 2014 (the average adjustment factor for 2010 is 1.000; see http://research.stlouisfed.org/fred2/series/CPALTT01USM661S). Value in registration measures are scaled by the CPI adjustment factor in the month of issuance to ensure change measures are not driven by changes in the CPI. The resulting bookrunner value of intra-industry IPOs in registration at first pricing date is 0.0737 (corresponding to $73.7 million in constant dollars in registration per underwriter). The total value of extra-industry IPOs in registration for these two underwriters at FoxHollow Technologies filing date is $925.01 million. Dividing this by two thousand and multiplying by 0.875, the bookrunner value of extra-industry IPOs in registration at first pricing date measure is 0.4047.

At FoxHollow Technologies' first pricing date, J.P. Morgan still had two health IPOs in registration (including FoxHollow Technologies) and eight other industry IPOs in registration (although the identity of these firms had changed as two firms completed their IPO, one was withdrawn, and three new firms filed for IPOs). Piper Jaffray had three health industry IPOs in registration (including FoxHollow Technologies) and one other industry IPO in registration (the identities of the firms had not changed). Including FoxHollow Technologies, the total value of health (intra-industry) IPOs in registration for these two underwriters

[24] The first date we consider is the filing date because the IPO was filed less than 60 days prior to the first pricing date. If the filing date were more than 60 days prior to the first pricing date, we would use August 15, 2004 as the first date. Similarly, we do not require a fourth date because the first pricing date is less than 21 calendar days before the issue date. If the first pricing date were more than 21 calendar days prior to the IPO, we also would consider the value of IPOs in registration as of October 6, 2004.

is $160.98 million. Dividing this by two thousand and multiplying by 0.875, the bookrunner value of intra-industry IPOs in registration at first pricing date is 0.0704. The total value of extra-industry IPOs in registration for these two underwriters at FoxHollow Technologies filing date is $845.82 million. Dividing this by two thousand and multiplying by 0.875, the bookrunner value of extra-industry IPOs in registration at first pricing date measure is 0.3687.

At FoxHollow Technologies' issue date, J.P. Morgan still had two health IPOs in registration (including FoxHollow Technologies) and nine other industry IPOs in registration (American Reprographics was added to J.P. Morgan's pipeline). Piper Jaffray now had only one health industry IPO in registration (FoxHollow Technologies) and one other industry IPO in registration. Including FoxHollow Technologies, the total value of health (intra-industry) IPOs in registration for these two underwriters is $100.5 million. Dividing this by two thousand and multiplying by 0.875, the bookrunner value of intra-industry IPOs in registration at issue date is 0.0440. The total value of extra-industry IPOs in registration for these two underwriters at FoxHollow Technologies issue date is $942.82 million. Dividing this by two thousand and multiplying by 0.875, the bookrunner value of extra-industry IPOs in registration at issue date measure is 0.4125.

Using these values of IPOs in registration measures, the four underwriter-level IPO pipeline measures used as independent variables in the paper can be defined for FoxHollow Technologies. *Bookrunner extra-industry pipeline change pre-first pricing* is the difference between extra-industry value in registration measures at the filing date and first pricing, or −0.0360. *Bookrunner extra-industry pipeline change pre-issue* is the difference between extra-industry value in registration measures at issue and first pricing dates, or 0.0438. *Bookrunner intra-industry pipeline change pre-first pricing* is the difference between health industry value in registration measures at first pricing and filing dates, or −0.0032. Finally *Bookrunner intra-industry pipeline change pre-issue* is the difference between health industry value in registration measures at issue and first pricing dates, or −0.0265.

The FoxHollow Technologies example can be extended to almost all other offerings having anywhere from 1 to 11 bookrunners. The one situation not addressed by the FoxHollow Technologies example is when bookrunners merge or acquire at some point during the issuance process. In general, we include all precedent underwriter IPOs when computing bookrunner value in registration measures, if applicable. As an example, Credit Suisse First Boston acquired Donaldson Lufkin and Jenrette (DLJ) on November 4, 2000. One IPO managed by the combined underwriter, called Credit Suisse First Boston, was PDF Solutions. This IPO was initially filed with the SEC on August 7, 2000 and completed on July 26, 2001. The first pricing date for PDF Solutions was September 15, 2000. DLJ was still independently managing IPOs after the first pricing date for PDF Solutions. For example, DLJ was the sole bookrunner for W-H Energy Services. That IPO was initially filed with the SEC on December 30, 1997 and completed on October 11, 2000. When computing the value in registration for Credit Suisse First Boston on PDF Solutions first pricing date of September 15, 2000, we include the capital in registration for the W-H Energy Services IPO.

To compute the average calendar days in registration measures, we first determine how long each IPO has been in registration as of FoxHollow's first pricing date (October 14, 2004). To determine the *Bookrunner intra-industry calendar days in registration* variable, we first sum the product of the days in registration (final column of Table A1) and the maximum value in registration on the first pricing date for each IPO in the health industry. This sum is then divided by the total value of health industry IPOs in registration at the first pricing date, $160.98 million. The resulting value-weighted days in registration is 120.3. To determine the *bookrunner extra-industry calendar days in registration* variable, we first sum the product of the days in registration and the maximum value in registration on the first pricing date for each IPO in the other industry. This sum is then divided by the total value of other industry IPOs in registration at the first pricing date, $842.82 million. The resulting value-weighted days in registration is 127.6.

Appendix B. Independent control variable definitions

Log of revenue—Last 12 months' revenue in millions for each IPO issuer (prior to first filing date) multiplied by the US consumer price index as of the end of the month before the first pricing date (using the CPI series that is scaled to equal one in January 2010). To account for some issuers having zero sales, this variable is the natural logarithm of one plus CPI-adjusted revenue. Source: Compustat. When data are not available, sales are obtained from the initial IPO prospectus (EDGAR). Inflation (CPI) data are from the Federal Reserve Bank of St. Louis website (http://research.stlouisfed.org/fred2/series/CPALTT01USM661S).

Overhang—Ratio of shares retained to shares offered at the time of first pricing. Share retained equals shares pre-IPO (for issuers with multiple share classes, this is the sum of shares across all share classes) less secondary shares to be sold as noted in first pricing. Shares to be offered are the sum of primary and secondary shares. Source: Primary and secondary shares filed from IPO prospectus (EDGAR). Number of shares pre-IPO is the number of shares post-IPO less primary shares in the IPO from the final prospectus (EDGAR). Number of shares post-IPO is from CRSP with adjustments to account for multiple share classes, from Jay Ritter's website (see link to "A list of IPOs from 1980–April 2014 with multiple share classes outstanding" at http://bear.warrington.ufl.edu/ritter/ipodata.htm).

Log of first pricing size—First pricing size equals the number of shares to be sold (primary and secondary), excluding overallotments in millions multiplied by the average of the initial high and low filing price. This amount is then multiplied by the consumer price index as of the end of the month before the first pricing date (using the CPI series that is scaled to equal one in January 2010). This variable is the natural log of first pricing size. Source: Share and price information from IPO prospectus (EDGAR). Inflation (CPI) data are from

the Federal Reserve Bank of St. Louis website (http://research.stlouisfed.org/fred2/series/CPALTT01USM661S).

Venture capital dummy—Dummy variable that equals one if the IPO had prior venture capital backing and zero otherwise. Source: TFSD New Issues database is used to identify presence of venture capital backing.

Market return if positive—Cumulative return between the later of the IPO first pricing date and 21 calendar days before issuance and the issue date for the CRSP value-weighted index (including dividends) if positive and zero otherwise. Source: CRSP variable VWRETD.

Market return if negative—Cumulative return between the later of the IPO first pricing date and 21 calendar days before issuance and the issue date for the CRSP value-weighted index (including dividends) if negative and zero otherwise. Source: CRSP variable VWRETD.

Carter-Manaster rank—Ranking (from 0 to 9.001) is obtained from Carter and Manaster (1990) as updated by Loughran and Ritter (2004). For multiple bookrunners, the maximum underwriter ranking is used. Source: Jay Ritter's website for Carter-Manaster rankings [see link to "IPO underwriter reputation rankings (1980–2011)" at http://bear.warrington.ufl.edu/ritter/ipodata.htm]. TFSD New Issues database is used to identify bookrunners.

Number of bookrunners—Number of bookrunners for the IPO. Source: TFSD New Issues database is used to identify bookrunners.

Bookrunner average first day returns—Average of first day returns on all offerings over the 12 months prior to an IPO's first pricing date that are managed by one of the IPO's bookrunners (a bookrunner must have two prior IPOs for this variable to be measured). Equal credit is given to sole and jointly managed offerings. First day returns are defined as one hundred times the difference between the opening price on the first day of public trading and the IPO offer price, divided by the IPO offer price. In cases in which an underwriter merges, it is given credit for deals done by pre-merger underwriters. Source: IPO pricing data are from TFSD or IPO prospectuses (EDGAR). Bookrunners are identified using TFSD. TFSD's merger and acquisitions database is used to account for underwriter mergers. Opening first day prices are from CRSP.

Bookrunner one-year market share—Value of all IPOs over the 12 months prior to the first pricing date managed by the IPO's bookrunner (equal fractional credit given if more than one bookrunner) divided by the total dollars raised over that period. If an underwriter merged during this period, the value of IPOs managed by pre-merger underwriters is included in the numerator. This ratio is then divided by the number of bookrunners to get the average market share per bookrunner. The final measure is the natural logarithm of one plus this average market share measure. Source: IPO capital data are from IPO prospectuses (EDGAR). Bookrunners are identified using TFSD. TFSD's merger and acquisitions database is used to account for underwriter mergers.

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