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Does an initial public offering (IPO) issuer's Securities and Exchange Commission registration fee calculation method predict pricing revisions and IPO underpricing?

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Abstract

This paper proposes a new proxy for the ex ante expectations of issuers and their underwriters about the direction of pricing revisions during the roadshows of an initial public offering (IPO): the way issuers elect to calculate the registration fees owed to the Securities and Exchange Commission. Consistent with fee-minimizing decision-making, I find that the choice of fee calculation method is associated with pricing revisions and IPO underpricing. This relationship suggests that issuers or their advisors may not incorporate economically significant private valuation information into the initial pricing range estimate and initial public offering price. The results provide empirical support for theoretical models of partial adjustment and IPO underpricing driven by the preferences of underwriters or managers of issuers for underpriced IPOs.

KEYWORDS
bookbuilding, initial public offerings, IPO underpricing, underwriters

INTRODUCTION

Securities and Exchange Commission (SEC) rules require issuers in initial public offerings (IPOs) to include a "bona fide estimate of the range of the maximum offering price" (the Estimate of the Range of the Maximum Offering Price

[ERMOP] or initial pricing range estimate) in any preliminary prospectus circulated to investors.[1] This initial pricing range estimate serves as a reference point when the IPO underwriters solicit demand information from investors. In many IPOs, issuers revise the pricing range as the roadshows progress and may even price the IPO outside of the initial pricing range estimate entirely.

This paper studies the relationships between the way an IPO issuer calculates registration fees owed to the SEC and both pricing revisions and IPO underpricing in a sample of virtually all US commercial IPOs between 2010 and the first quarter of 2021. These relationships are not predicted by leading theories about IPOs and shed light on the IPO pricing process.

I propose that the method an issuer elects to calculate registration fees owed to the SEC—a decision made at the same time as the first pricing range estimate is filed—constitutes a proxy for the ex ante expectations of issuers or their underwriters about the direction of future pricing revisions. Issuers may choose to calculate the registration fees owed to the SEC under either Securities Act Rule 457(a) or Rule 457(o).[2] Issuers can minimize the registration fees they owe by matching their fee calculation method to expectations about future pricing revisions.[3] Assuming that issuers engage in fee-minimizing behavior, I interpret issuers that calculate fees under Securities Act Rule 457(a) as revealing expectations of positive pricing revisions, and issuers that calculate fees under Securities Act Rule 457(o) as revealing expectations of negative pricing revisions. Because the fee calculation decision is made by issuers and because it is made before underwriters even begin to solicit demand information from investors on the roadshows, variation in the choice of fee calculation method should be independent from private investor information. The potential fee-savings that drive the expected fee-minimizing decision are relatively small. In an IPO with average proceeds of about $252 million, registration fees are less than $24,000 under the current formula. The amount of fees that can be saved by making the "right" fee calculation choice under Rule 457 would typically only amount to a few thousand dollars.

[1]Regulation S-K Item 501 requires that any prospectus circulated by a company in a for-cash IPO must set forth on the front cover page of the prospectus an ERMOP. 17 C.F.R. § 229.512. In addition, Section 5(b)(1) of the Securities Act of 1933 provides that issuers can use a prospectus prior to effectiveness of the associated registration statement only if the prospectus meets the requirements of Section 10. 15 U.S.C. § 77e(b)(1). The combination of these provisions means that a Section 10 preliminary prospectus distributed to potential IPO investors before effectiveness must include the ERMOP or the prospectus would violate Section 5 of the Securities Act. The SEC staff has never publicly interpreted the term "maximum" for purposes of this regulation. The only requirement that the staff imposes is that the width of the ERMOP may not exceed $2 for maximum prices below $10 per share (e.g., $8–$10 per share), and 20% of the maximum price per share for prices per share above $10 per share (e.g., $20–$24 per share). Based on conversations with the SEC staff, the SEC staff does not appear to second guess ERMOP decisions by issuers as long as the initial pricing range estimate meets the guidelines on the size of the width.

[2]17 C.F.R. § 230.457.

[3]*See infra* Figure 3 and accompanying text for an analysis of the fee-minimizing fee calculation method given various expectations about future share and price revisions.

Various papers have studied the partial adjustment phenomenon in IPOs: the relationship between positive pricing revisions relative to the initial pricing range estimate and IPO underpricing (Hanley, 1993; Loughran & Ritter, 2002; Wang & Yung, 2011). Benveniste and Spindt (1989) and Sherman and Titman (2002) explain partial adjustment as the result of an efficient information gathering mechanism in which underwriters induce revelation of private valuation information from investors by credibly committing to underprice IPOs following positive pricing revisions. Loughran and Ritter (2002) instead provide a prospect theory explanation for partial adjustment in which underwriters exploit complacent managers by pricing IPOs with positive pricing revisions in a way that leaves money on the table. However, neither explanation for partial adjustment predicts that issuers and underwriters should leave out positive valuation information known to them in the initial pricing range estimate.

I find that the method that issuers use to calculate registration fees owed to the SEC robustly predicts various measures of returns from the initial pricing range estimate. Filing under Rule 457(a) is associated with four and a half percentage points greater pricing revisions—the percentage change from the initial pricing range estimate to the IPO offer price—and 11 percentage points greater returns from the midpoint of the initial pricing range estimate to the price of the issuer's stock at the end of the first day of trading on exchange. These estimates are based on multivariate regressions that control for year, industry, and underwriter fixed effects and other known determinants of IPO underpricing.

Much of the literature that studies how underwriters produce demand information from investors during the bookbuilding process interprets pricing revisions as a measure of learning by underwriters during the roadshows from the information production of investors (Ljungqvist & Wilhelm, 2003; Wang & Yung, 2011).[4] Because the fee calculation decision is made before demand solicitation from investors on the roadshows even begins, the relationship between the fee calculation method and pricing revisions makes this learning interpretation harder to sustain. If the information in the fee calculation decision was incorporated into the initial pricing range estimate, it should not have power to explain pricing revisions. The statistically significant relationship between the fee calculation decision and pricing revisions suggests that issuers or their underwriters may not incorporate all their private valuation information into the initial pricing range estimate.

The second set of empirical tests examine the relationship between the fee calculation method and IPO underpricing. I find that issuers that expect positive pricing revisions, as measured by the fee calculation proxy, are significantly associated with six percentage points greater first-day returns than issuers that

[4]A notable exception is Lowry and Schwert (2004) which found that market returns before the initial pricing range estimate are correlated with subsequent pricing revisions and suggested that underwriters may not incorporate all public information into the initial pricing range estimate.

expect negative pricing revisions. As a measure of money left on the table, the estimate suggests that issuers with expectations of positive pricing revisions are associated with $15 million of foregone IPO proceeds in an IPO with average proceeds compared to issuers with expectations of negative pricing revisions. The results show that an important component of IPO underpricing is predictable weeks before the IPO is priced. The significance of the relationship between the fee calculation method and IPO underpricing holds even after controlling for year, underwriter, and industry fixed effects; known determinants of IPO underpricing; and the part of the variation in pricing revisions during the bookbuilding period that is not predicted by the fee calculation method. The ability of the fee calculation method to predict IPO underpricing appears to show that some of the information revealed by the fee calculation method is not fully incorporated into IPO prices.

The empirical results provide indirect evidence on theories of IPO underpricing. Given that the fee calculation method is decided before solicitation from investors during the road shows even begins, the relationship between the fee calculation decision and IPO underpricing is hard to explain under bookbuilding models and other models of IPO underpricing premised on the idea that the private information of *investors* about the IPO issuer's valuation drives systematic IPO underpricing (Benveniste & Spindt, 1989; Rock, 1986; Sherman & Titman, 2002).

The analysis does not identify a causal mechanism for the identified relationships, but the results are best explained by theories of IPO underpricing driven by the preferences of either underwriters or managers of the issuer for underpriced IPOs. Managers may prefer IPO underpricing as a means to maximize stock prices at the end of a lock-up period (Aggarwal et al., 2002; Liu & Ritter, 2011); to encourage momentum trading among sentiment investors and thus to push the issuer's stock price above fundamentals, at least temporarily (Colaco et al., 2017; Ljungqvist et al., 2006); to compensate underwriters for soft services like underwriter-affiliated analyst coverage (Cliff & Denis, 2004); or to advertise the issuer's business (Chemmanur & Yan, 2009). Underwriters may prefer underpricing where it economizes on their effort costs as in Baron (1982) or where it enables them to receive a benefit in exchange for allocating underpriced stock to their institutional clients at the expense of issuers (Goldstein et al., 2011; Loughran & Ritter, 2004; Nimalendran et al., 2007; Reuter, 2006; Ritter & Zhang, 2007). Under this last interpretation, lowballing the initial pricing range estimate may be the first step in a process to impose IPO underpricing on issuers that would rather price at the market clearing price. To the extent that issuers with preferences to avoid IPO underpricing fail to anticipate such exploitation and bargain for contractual protections against predictable IPO underpricing, the results would be consistent with managers of issuers with behavioral characteristics (Corrigan, 2019; Loughran & Ritter, 2002).

Turning to an investigation of underwriters as a possible determinant of the fee calculation method, I find that underwriters with more IPO underwriting market share are associated with more frequent use of Rule 457(a)—the proxy for expectations of positive pricing revisions—to calculate registration fees. Moreover, returns from the initial pricing range estimate to the issuer's stock price at the end of the first day of exchange trading are positively associated with underwriter market share, suggesting that relatively higher market share underwriters are generally more conservative when submitting initial pricing range estimates.

Surprisingly few academic papers have studied whether issuers and underwriters incorporate all private information known to them into the initial pricing range estimate and into the IPO offer price. Most studies on the efficiency of the IPO pricing process study the extent to which *public* information is incorporated into these pricing decisions (Boulton et al., 2021; Bradley & Jordan, 2002; Ghosh et al., 2012; Loughran & Ritter, 2002; Lowry & Schwert, 2004; Thompson, 2010). Still another strand of this literature focuses on relationships between disclosures by the issuer and IPO underpricing (Hanley & Hoberg, 2010, 2012; Loughran & McDonald, 2013). My empirical results suggest that *private* information known to issuers or underwriters and signaled through the fee calculation decision is not fully incorporated into the initial pricing range estimate.

One paper with a similar analysis is Lowry and Schwert (2004). They find evidence that underwriters do not incorporate all public information into the initial offering price or the IPO offer price. However, they find that the economic significance of the unincorporated information is relatively small. A one standard deviation change in the source of the identified information that is apparently unincorporated—market returns leading up to pricing decisions—is associated with only a 0.08% standard deviation change in initial returns, or 1.6% greater IPO underpricing. However, the economic significance of the information that I identify as apparently unincorporated is substantially larger. Filing under Rule 457(a) is associated with 4.5 percentage points increased pricing revisions and 6 percentage points of increased IPO underpricing compared to issuers that file under Rule 457(o).

In addition, prior literature on the role of underwriters in the bookbuilding process studies the extent to which underwriters rely on information production of investors (Carter & Manaster, 1990; Cornelli & Goldreich, 2001; Cornelli & Goldreich, 2003; Habib & Ljungqvist, 2001; Jenkinson et al., 2006; Jenkinson et al., 2018; Jenkinson & Jones, 2004; Michaely & Shaw, 1994). I find that the fee calculation method predicts measures of information production during the roadshow. Expectations of positive pricing revisions through the fee calculation proxy are significantly associated with fewer roadshow days and fewer S-1 amendments. As above, the analysis does not speak to any causal mechanism, but the results are consistent with diminished effort by underwriters as in

Baron (1982) or diminished incentives from investors to reveal valuation information following an underestimated initial pricing range estimate as in Benveniste and Spindt (1989).

In summary, this paper argues that the method that issuers choose to calculate registration fees owed to the SEC reveals their expectations about the direction of pricing revisions during the roadshows. The empirical findings are consistent with this hypothesis. The empirical analysis finds that the fee calculation decision is related to pricing revisions and IPO underpricing.

DATA AND EMPIRICAL DESIGN

The sample of IPOs is collected from Thomson Reuters Securities Data Company Platinum Global New Issues Database (SDC Platinum). I collect data for all US commercial IPOs starting at the beginning of 2010 through the end of the first quarter of 2021. Consistent with prior studies in the literature on IPOs, I exclude offerings of penny stock issuers (deals with offer prices below $5 per share), closed-end-funds, real estate investment trusts, regulated banking entities, and offerings that are not common stock offerings, including American Depositary Receipt offerings, unit offerings, and limited partnership offerings. I also exclude issuers that had previously traded on a foreign exchange, bulletin board, or the pink sheets before their IPO.

I obtain issue-specific information from SDC Platinum including the offering price per share, the issuer's book assets during the last reporting period, and the issuer's revenue in the last financial year.

I obtain the price of the issuer's stock in the opening trade on exchange and at the close of the first day of trading from the Center for Research in Security Prices. The price of the issuer's stock 2 weeks after trading begins is taken from SDC Platinum. I obtain historical data about the CBOE Volatility Index (VIX) from the CBOE's website. After dropping observations with missing data, the final sample includes almost 1200 unique US commercial IPOs.

For each IPO, I identify the "initial pricing range prospectus": the first S-1 amendment that includes an ERMOP. I hand-collect the ERMOP and information about the issuer's calculation of registration fees owed to the SEC from this initial pricing range prospectus. I also collect the date of initial pricing range prospectus and the total number of S-1 amendments filed in connection with the IPO.

Table 1 reports descriptive statistics for the dataset. The means and other descriptive statistics for key variables are consistent with prior IPO studies. Definitions of variables and other key terms are in the Appendix.

The IPO pricing process is modeled as involving three stages, as illustrated in Figure 1.

TABLE 1 Descriptive statistics for full sample

Statistic	Mean	Median	Standard deviation
Offer price ($)	15.8	15.0	7.6
First-day closing price	19.7	16.8	12.9
Pricing revisions (%)	−2.5	0.0	20
ERMOP return (%)	21.0	6.9	53.8
457(a)	0.73	1.0	0.44
Assets ($mil)	1385	122	8423
Net income ($mil)	−4.3	−13.1	221
Nasdaq return (%)	0.71	1.1	2.8
VIX	17.4	15.8	6.0
Participation	0.11	0.0	0.25
Venture-backed	0.5	0.0	0.5

Note: This table presents descriptive statistics for the full sample.
Abbreviation: VIX, CBOE Volatility Index.

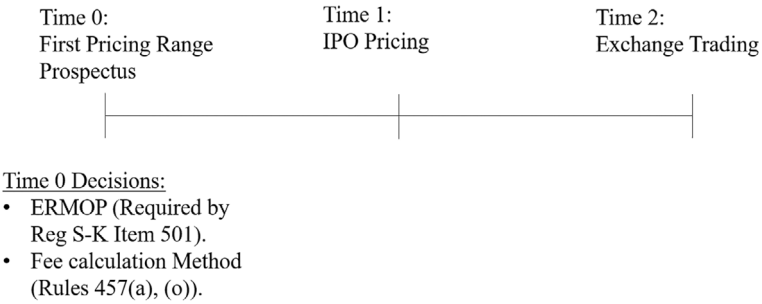

FIGURE 1 Provides a three-period model of the bookbuilding and initial public offering (IPO) pricing process.

At Time 0, the issuer files the initial pricing range prospectus, a pre-effective S-1 amendment that includes the first ERMOP as well as a calculation of the fees owed to the SEC. Because of SEC rules, the issuer cannot generally commence the roadshows—a blitz campaign of one-on-one meetings with large investors for the purpose of soliciting demand for the issuer's stock in the IPO—until the initial pricing range prospectus is filed with the SEC. In this period, the issuer and underwriter solicit demand information from investors. The issuer is permitted to amend the prospectus and the initial pricing range estimate until the registration statement is declared effective by the SEC.

At Time 1, the issuer and underwriter negotiate the initial offering price and execute the underwriting agreement.

At Time 2, trading begins on exchange and the full information equity value of the issuer's stock is revealed.

The main analysis studies the relations between the SEC fee calculation decision and three measures of financial returns.

Pricing Revisions is calculated as:

$$\frac{P_0 - P_E}{P_E},$$

where P_0 equals the IPO offer price and P_E equals the midpoint of the ERMOP (the high price plus the low price of the ERMOP all divided by two).[5]

First-Day Return is calculated as:

$$\frac{P_1 - P_0}{P_0},$$

where P_1 equals the price of the issuer's stock on exchange at the close of the first day of trading.

ERMOP Return is calculated as:

$$\frac{P_1 - P_E}{P_E}.$$

The main analyses below estimate ordinary least squares (OLS) regressions of the form:

$$Y_i = \beta_1 X_1 + yeardummies + industrydummies + underwriterdummies + \epsilon, \quad (1)$$

where Y_i, the dependent variable, is a measure of initial returns in connection with an IPO of firm *i*. The determinants of initial returns are assumed to be a vector of control variables associated with each firm, X_i; year dummies; industry dummies; managing underwriter dummies; and an error term. The industry dummies are based on primary North American Industry Classification codes for the IPO issuer. The underwriter dummies are based on the underwriter that is listed on the left side of the top row of the final prospectus associated with each IPO, with a residual category that aggregates non-bulge bracket underwriters that individually have less than 3% of underwriting market share in the

[5]Using the midpoint of the ERMOP is consistent with how pricing revisions are traditionally measured in the empirical finance literature. This convention is used, for example, by Hanley (1993) and Loughran and Ritter (2002). In certain calculations below, I use *ERMOP Return High*, which calculates the return from the *high* price of the ERMOP to the price of the issuer's stock at the close of the first day of trading.

sample. Consistent with the prior literature on IPO underpricing, the vector of control variables include log of book assets before the IPO; net income after tax for the prior 12 months before the IPO; the prior market return measured by the 2-week return of the Nasdaq; the value of the CBOE Volatility Index on the night before the IPO; whether the IPO has venture capital backing; and the ratio of secondary shares offered by insiders to the total number of shares offered in the IPO.

All reported standard errors for OLS regressions are robust.

THEORETICAL AND EMPIRICAL BACKGROUND

The partial adjustment observation and theory

Financial economists have long studied the IPO underpricing phenomenon. On average since 1980, US IPOs have experienced first-day returns of around 19%.[6]

A critical refinement of the mean IPO underpricing observation is that IPO underpricing is concentrated in IPOs with positive pricing revisions. The observation that underwriters do not appear to adjust IPO prices all the way up to trading prices on exchange following positive pricing revisions is called the "partial adjustment" phenomenon (see Hanley, 1993). However, underwriters appear to fully adjust the IPO offer price to the trading price following negative pricing revisions, as evidenced by the lack of a relationship between negative pricing revisions and IPO underpricing.

A key point of debate in the literature is whether the partial adjustment phenomenon reflects an efficient mechanism through which underwriters solicit information from investors or whether it constitutes part of a mechanism designed to produce IPO underpricing, such as where underwriters allocate valuable, underpriced shares to their institutional customers at the expense of issuers, consistent with principal-agent models of IPO underpricing.

In Benveniste and Spindt's (1989) seminal model of partial adjustment, issuers provide unbiased estimates of their equity value when submitting initial pricing range estimates. Investors, who have private valuation information about IPO companies, do not have incentives to reveal demand information to underwriters at prices in excess of the pricing range estimate because they would risk paying a higher price in the IPO by doing so. Benveniste and Spindt argue that, in a repeat game, the efficient outcome is for investors to reveal their truthful demand information while underwriters credibly commit to only partially adjust the price upwards, leaving some money on the table as compensation to investors who reveal unexpectedly positive information.

[6]Jay R. Ritter, Initial Public Offerings: Underpricing (May 27, 2022) available at https://site.warrington.ufl.edu/ritter/files/IPOs-Underpricing.pdf.

As applied to IPOs by Loughran and Ritter (2002), prospect theory suggests that managers bargain fiercely for a high IPO price in order to prevent downward changes to their wealth when initial pricing estimates are unexpectedly revised downwards. On the other hand, when prices are unexpectedly revised upwards, the issuer's managers are more likely to acquiesce in leaving money on the table in the IPO, content with their unexpectedly large payday.

Both of these theories assume that the initial pricing range estimate represents an unbiased estimate rather than a strategic decision.[7] A vast empirical literature related to IPO pricing also adopts this assumption and interprets pricing revisions as reflecting unexpected information production by investors during the roadshows (Hanley & Hoberg, 2012; Ljungqvist & Wilhelm, 2002, 2003; Wang & Yung, 2011).

Partial adjustment in two example IPOs

Consider the partial adjustment phenomenon as applied to the IPOs of two companies: Express, Inc. and Trulia Inc.

Express, a retail apparel company, completed its IPO on May 12, 2010. Bank of America Merrill Lynch served as the lead left underwriter. A week before pricing the IPO, Express filed a pre-effective amendment to its Form S-1 filing stating that "it is currently estimated that the initial public offering price per share will be between $18.00 and $20.00." In that same amendment, Express elected to calculate registration fees owed to the SEC using Rule 457(o). Express reported that it owed $24,955 in registration fees on a proposed maximum aggregate offering amount of $350 million. After soliciting investor demand during the roadshows, Express walked its pricing range estimate down and priced its IPO at $17 per share, a 12% decrease from the $19 midpoint of the original pricing range estimate. At the close of the first day of trading, Express's stock price had fallen modestly to $16.75 per share, providing IPO investors a first-day return of negative 1.5%. Express's first-day return following its IPO was in the ballpark of other issuers that priced their IPO below the low price of the pricing range, with mean first-day returns of 5% in this group.

Compare Express's IPO with Trulia Inc.'s IPO. Trulia completed its IPO on September 19, 2012. J. P. Morgan was the managing underwriter. Thirteen days before pricing its IPO, Trulia filed a pre-effective S-1 amendment containing a pricing range of $14–$16 per share. Trulia calculated its registration fees using Rule 457(a) and reported that it owed $12,652 in fees on a proposed maximum aggregate offering amount of $110 million. Trulia priced its IPO above the filing

[7]Biased initial pricing range estimates do not undermine the prospect theory explanation. Efforts by underwriters to encourage issuers to systematically underestimate initial pricing range estimates might serve as a step by underwriters in a process of exploiting managers with biases characterized by prospect theory.

range at $17 per share, a 13.3% increase over the $15 per share midpoint of the ERMOP. On the first day of trading, Trulia's stock price rocketed to $24 per share, a 41% increase over the IPO offer price. Trulia's first-day return was comparable to similarly situated IPO issuers, with mean first-day returns of 41% for issuers with positive pricing revisions, and 50% for issuers that priced above the high point of the pricing range entirely.

The systematic pricing range underestimation observation

This Section presents descriptive statistics showing that IPO issuers as a group systematically underestimate initial pricing range estimates in reference to the trading price that prevails on secondary exchanges at the close of the first day of trading.

The sample mean value of *ERMOP Return*—the return from the midpoint of the ERMOP to the issuer's stock price at the close of first day of trading—is 21%. A two-sided Welch t-test reveals that this mean is statistically significantly different than zero at the 1% level.

When returns to the first-day closing price are measured from the high price of the ERMOP (*ERMOP Return High*), instead of the midpoint, the mean *ERMOP Return High* value is 14% and also significantly different than zero below the 1% level.

To visualize the distribution of ERMOP returns and its bivariate relationship to first-day returns, Figure 2 displays a scatter plot of *First-Day Return* and *ERMOP Return*.

Systematic ERMOP underestimation is visible in the skewed rightward distribution of Figure 2. Moreover, the upward sloping locally weighted scatterplot smoothing line reveals an unconditional correlation with first-day returns. When ERMOPs are underestimated relative to the price revealed by the market when secondary trading begins, IPO underpricing tends to increase linearly. When ERMOPs are instead overestimated, IPO underpricing clusters around 0%.

Figure 2 contains a noticeable cluster of observations around a 45° line that runs through the point where the *X*-axis intersects with the *Y*-axis. This line includes observations where the IPO was priced at the midpoint of the initial pricing range estimate so that the IPO had no pricing revisions. This means, mechanically, that the *ERMOP Return* value associated with each of these IPOs is equivalent to the *First-Day Return* value. Observations above this 45° line represent IPOs with negative pricing revisions, while observations below the 45° line represent IPOs with positive pricing revisions.

Systematic underestimation of ERMOPs relative to the issuer's first-day trading value is surprising for three reasons. First, it conflicts with the assumption in the prior academic literature that ERMOPs constitute unbiased estimates by issuers. Even if there is uncertainty about the true valuation of an issuer, one

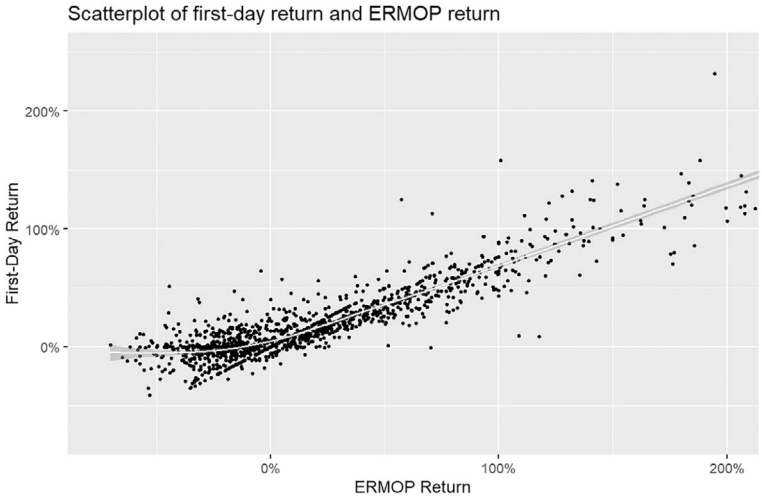

FIGURE 2 Scatterplot of first-day return and ERMOP return for all IPOs in the sample and a locally weighted smoothing line.

might nevertheless expect estimate errors to be distributed around the ultimate trading price on secondary exchanges shortly after trading begins. Second, systematic ERMOP underestimation is surprising if partial adjustment is persistent and foreseeable. Why do issuers systematically underestimate ERMOPs when underestimation is foreseeably associated with IPO underpricing? Finally, since SEC rules require issuers to submit a bona fide estimate of the range of the *maximum* IPO offer price, systematic underestimation of the ERMOP is also surprising if the term "maximum" is given its ordinary meaning.[8]

THE SEC FEE CALCULATION DECISION AS A PROXY FOR AN ISSUER'S EXPECTATIONS ABOUT PRICING REVISIONS

This section investigates whether initial pricing range estimates incorporate all valuation information known to issuers and underwriters. It asks the following question: at the time that issuers submit ERMOPs, before information production in the roadshows even begins, do issuers produce an observable prediction about the direction of future pricing revisions?

[8]As noted in footnote 1, however, the SEC staff only enforces limits on the width of the range and does not second guess the accuracy of the range.

Fee minimizing SEC fee calculation method for various price and share revision expectations

	Shares Up	Same Shares	Shares Down
Price Up	457(a)	457(a)	Deal size increase: 457(a) Deal size decrease: indifferent
Same Price	Indifferent	Indifferent	Indifferent
Price Down	457(o)	Indifferent	Indifferent

FIGURE 3 This figure provides the fee calculation election that would be expected to minimize registration fees owed to the SEC under specified expectations about future changes to the price of the shares offered and the number of shares offered.

Why the registration fee calculation decision is a bet on the direction of pricing revisions

I identify the Rule 457(a) fee calculation decision as a proxy for an issuer's ex ante expectations for pricing revisions during the IPO roadshows.

In the mean IPO with proceeds of $252 million, filing fees would generally equal $23,360 under the current formula.[9] The fees are high enough that it is worth minimizing them if it is possible and cost-effective to do so. But the fees are not high enough to drive an issuer's bargaining strategy in a major financial transaction. The total registration fees amount to about 0.01% of the entire amount of proceeds and 0.2% of the total amount of the typical underwriting fees.

Registration fees owed to the SEC are calculated and paid at the same time as the ERMOP is published in the first pricing range prospectus. To calculate the amount of fees owed to the SEC, an issuer has a choice of methods: Rule 457(a) or Rule 457(o). This choice of fee calculation method effectively invites issuers to make a bet about the likely direction of future pricing revisions. The payoff of getting the bet right is reduced registration fees.

Figure 3 describes the dominant fee calculation decision for issuers under various expectations about subsequent changes to price and share quantity given the fee calculation rules which are described in more detail below. Applying backwards induction to Figure 3 shows that a weakly dominant strategy turns solely on an

[9]At present, the registration fees owed to the SEC in an IPO are generally calculated by multiplying the aggregate offering amount by a constant, currently 0.0000927 ($92.70 per $1 million raised). See SEC, Filing Fee Rate, https://www.sec.gov/ofm/Article/feeamt.html

issuer's expectations about future pricing revisions. If the issuer expects *positive* pricing revisions—the boxes in the top row—it is weakly dominant to calculate registration fees under Rule 457(a). If a similarly situated issuer expects *negative* pricing revisions—the boxes in the bottom row—it is weakly dominant to file under Rule 457(o). Partners at a leading law firm in the IPO space, Latham & Watkins, summarize market practice and confirm that the optimal fee calculation decision turns on expectations about future pricing revisions: "[m]any deal teams elect to switch to Rule 457(a) at the time of printing the price range prospectus because increasing the price per share at pricing is a more likely outcome than increasing the number of shares and decreasing the price."[10]

To be more specific about how issuers should think about minimizing registration fees, an issuer effectively registers the number of securities offered when an issuer uses Rule 457(a) to calculate registration fees, not the aggregate dollar amount. The primary benefit of using Rule 457(a) is that an issuer pays no additional fees if the per share price *increases* in subsequent S-1 amendments—in other words, if there are *positive pricing revisions*.[11] Even if the new "aggregate offering amount"—the number of shares times the price per share—exceeds the original registration amount due to the price increases, no new fees are required. If the per share price falls or stays the same, however, the company cannot increase the number of shares it offers without registration of additional shares and payment of an additional registration fee.[12] In summary, calculating registration fees owed to the SEC under Rule 457(a) gives issuers option value to subsequently increase the proposed offering price without paying new fees (holding shares constant).

When issuers calculate registration fees under Rule 457(o), on the other hand, the issuer effectively registers the dollar amount of the offering—a composite of price and quantity of shares. Unlike when Rule 457(a) is used, new fees are not automatically required if the actual quantity of registered shares exceeds the estimated quantity of registered shares in the initial pricing range prospectus. If the per share price *decreases*—that is, if there are *negative pricing revisions*—the issuer can register additional shares without paying new fees so long as the new aggregate dollar amount of the offering does not exceed the maximum aggregate offering amount listed in the original fee table. New fees are only required if the maximum aggregate offering amount increases relative to the initial estimate of the maximum aggregate offering amount.[13] In summary, Rule

[10]See Latham & Watkins, Tips for Upsizing and Downsizing an IPO, Law 360 (August 8, 2016).

[11]"If a filing fee based on a bona fide estimate of the maximum offering price, computed in accordance with this rule where applicable, has been paid, no additional filing fee shall be required as a result of changes in the proposed offering price." 17 C.F.R. § 230.457(a).

[12]Once a filing is made, registration fees cannot be refunded, even if the price per share subsequently decreases. New fees for any newly registered shares are paid at the high price of the ERMOP at the time the S-1 amendment containing the new shares is filed.

[13]"If the maximum aggregate offering price increases prior to the effective date of the registration statement, a pre-effective amendment must be filed to increase the maximum dollar value being registered and the additional filing fee shall be paid." 17 C.F.R. § 230.457(o).

457(o) gives issuers option value to increase the number of shares offered without paying new fees following negative pricing revisions.

Given the foregoing, if some issuers act rationally to minimize expected registration fees, then the fee calculation decision should contain variation that is attributable to issuers' expectations about subsequent pricing revisions.

It is worth emphasizing the fact that the amount of fee savings is small compared to the deal size. To illustrate, consider the two example IPOs discussed above. Trulia submitted an initial pricing range estimate of $14–$16 per share and ended up pricing at $17 per share. Even though the aggregate offering amount increased by 6.25%, Trulia did not need to pay any new registration fees. By filing under Rule 457(a) instead of Rule 457(o), Trulia saved about $800.

Express submitted an initial pricing range estimate of $18–$20 per share that contemplated offering $350 million in Express stock. Express ultimately priced the IPO at $17 per share. By filing under Rule 457(o) instead of Rule 457(a), Express gave itself the option to increase the size of its offering by 15% without paying any new registration fees. If used in full, this option could have saved Express almost $6000 in registration fees relative to the fees that would have been owed by filing under Rule 457(a). While the fee calculation decision gave Express option value, Express did not actually decide to increase the number of shares it offered relative to the initial pricing range estimate, so Express did not actually realize any fee savings.

Validating the proxy: The fee calculation decision predicts pricing revisions and ERMOP returns

This section provides empirical evidence supporting the claim that some issuers select their fees consistent with the rational fee-minimizing strategies described in the last section and, thus, that the fee calculation method is a plausible proxy for the ex ante expectations of issuers about the direction of pricing revisions during the roadshows.

For each IPO, I code a dummy variable called *457(a)* as 1 if, at the same time it submitted its first ERMOP in the initial pricing range prospectus, the issuer calculated registration fees under Securities Act 457(a) and 0 if the issuer calculated fees under Securities Act Rule 457(o).[14] About 73% of issuers in my dataset calculated their fees under Rule 457(a).

Table 2 presents descriptive statistics when the sample is grouped according to whether the issuer filed under Rule 457(a) or Rule 457(o). Issuers that elect to file under Rule 457(a) are associated with relatively greater assets than issuers

[14]17 C.F.R. § 230.457. Issuers have the option of switching the methods under which they calculate registration fees in subsequent S-1 amendments if new shares are registered or the pricing range changes. To measure issuer expectations *before* the roadshows begin, the *457(a)* variable codes the issuer's election at the time the initial pricing range prospectus is printed.

TABLE 2 Group means sorted by fee calculation method

Statistic	Rule 457(a)	Rule 457(o)	*t*-Statistic
Offer price ($)	17.02	12.45	12.34
First-day closing price	21.6	14.2	12.32
Pricing revisions	0.03	−10.2	8.88
ERMOP return	0.27	0.03	8.49
Assets ($mil)	1604	781	2.08
Net income ($mil)	−1.1	−13.2	1.23
Nasdaq return (%)	0.63	0.95	−1.93
VIX	17.5	17.0	1.46
Venture-backed	0.51	0.48	0.79
Participation	0.12	0.09	2.30

Note: This table provides descriptive statistics when the sample is grouped according to whether the issuer elected to calculate registration fees owed to the SEC under Securities Act Rule 457(a) or Rule 457(o).
Abbreviation: VIX, CBOE Volatility Index.

Fee minimizing SEC fee calculation methods for various price and share revision expectations

	Shares Up	Same Shares	Shares Down
Price Up	457(a) 17% of total IPOs 86% elect 457(a)	457(a) 19% of total IPOs 78% elect 457(a)	Deal size increase: 457(a) 0.1% of total IPOs 0% elect 457(a) Deal size decrease: indifferent 0.8% of total IPOs 53% elect 457(a)
Same Price	Indifferent 4% of total IPOs 76% elect 457(a)	Indifferent 7% of total IPOs 81% elect 457(a)	Indifferent 0.4% of total IPOs 83% elect 457(a)
Price Down	457(o) 15% of total IPOs 53% elect 457(a)	Indifferent 26% of total IPOs 71% elect 457(a)	Indifferent 9% of total IPOs 61% elect 457(a)

FIGURE 4 Like Figure 3, this figure specifies the fee calculation election that would be expected to minimize registration fees owed to the SEC under specified expectations about future changes to the price of the shares offered and the number of shares offered. This figure also includes the percentage of IPOs in the sample that experienced the specified revisions to the IPO price and the number of shares offered as well as the percentage of issuers in each subgroup that elected to calculate their registration fees under Securities Act Rule 457(a).

that file under Rule 457(o). In addition, issuers that file under Rule 457(a) are associated with a slightly higher proportion of secondary shares offered to primary shares than issuers than file under Rule 457(o).

A bivariate analysis suggests that the fee calculation decision is unconditionally associated with pricing revisions. The mean (median) *Pricing Revisions* value is 0.3% (0.0%) when issuers file under Rule 457(a) and −10.2% (−6.9%) when issuers file under Rule 457(o). The Pearson correlation coefficient between *457(a)* and *Pricing Revisions* is 0.23.

Figure 4 provides one way to evaluate the frequency with which issuers made the "right" fee-minimizing decision based on ex post outcomes. Figure 4 layers descriptive statistics onto the decision framework set forth above in Figure 3. Each box in Figure 4 reports the total number of IPOs in the sample that actually experienced the specified combination of price and share revisions, as well as the percentage of issuers in each subgroup that calculated their fees under Rule 457(a). The descriptive statistics in Figure 4 come from a subsample of all 735 of the IPOs that occurred between 2010 and 2015 where data about revisions to the number of shares offered was hand-collected from SEC filings.

Because there are many scenarios in which issuers are indifferent between selecting between Rule 457(a) and Rule 457(o), it is impossible to precisely determine how many issuers made the "right" choice, even sorting on ex post outcomes. Consistent with fee-minimizing behavior in at least some IPOs, Figure 4 suggests that issuers made the "right" choice with relatively high frequencies in the only three boxes that describe scenarios where issuers are not indifferent between filing methods. In the top left box, where issuers upsized their deal by increasing both the price per share and the number of shares offered and where Rule 457(a) is the unambiguous fee-minimizing strategy, issuers selected Rule 457(a) 86% of the time, a higher proportion than in any of the other boxes in Figure 4. In the bottom left box, where issuers decreased the price per share but increased the number of shares offered, issuers made the "right" choice by electing to calculate their registration fees under Rule 457(o) 47% of the time, more frequently than in any of the other boxes in Figure 4.

The correlation between the fee calculation method and pricing revisions is driven in part both by issuers that file under Rule 457(a) and issuers that file under Rule 457(o). In IPOs with issuers that file under Rule 457(a) (1027 IPOs total), 49% of IPOs have positive pricing revisions, while 36% have negative pricing revisions (the remaining IPOs have a *Pricing Revisions* value of 0). Among IPOs with issuers that file under Rule 457(o) (371 IPOs in total), 58% have negative pricing revisions, while only 20% have positive pricing revisions.

Figure 4 also illustrates that the proxy is both noisy and subject to error. The proxy is noisy because a substantial number of IPOs exhibited share and price revision combinations where an issuer that had such ex ante expectations would have been indifferent between choosing Rule 457(a) or Rule 457(o) because the amount of expected new fees would have been equivalent under either method. Under these expectations, there is no "right" choice for an issuer to make. The proxy is subject to error because issuers do not always make the "right" choice, especially when negative pricing revisions actually occur.

TABLE 3 Predicting pricing revisions and ERMOP returns

	Dependent variable	
	Pricing Revisions **(1)**	***ERMOP Return*** **(2)**
457(a)	0.045***	0.111***
	(0.014)	(0.035)
Log assets	0.001	−0.014
	(0.004)	(0.010)
Net income	−0.0001***	−0.0001**
	(0.00002)	(0.0001)
Nasdaq return	0.002	0.008
	(0.002)	(0.005)
VIX	−0.002	−0.009**
	(0.001)	(0.004)
Venture-backed	0.035***	0.142***
	(0.013)	(0.038)
Participation	0.059***	0.074
	(0.023)	(0.055)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Underwriter FE	Yes	Yes
Observations	1209	1175
R^2	0.243	0.349
Adjusted R^2	0.209	0.319

Note: This table reports results from ordinary least squares estimation of Equation (1) with pricing revisions and ERMOP returns as dependent variables and the fee calculation method decision and other controls as independent variables. Standard errors are robust.
Abbreviation: VIX, CBOE Volatility Index.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

To further test the relationship between the fee calculation decision and pricing revisions, I estimate regressions of the form in equation (1) above. I use *Pricing Revisions* and *ERMOP Return* as the dependent variables and I use a dummy variable indicating the fee calculation method—the proxy for an issuer's expectations about the direction of pricing revisions—as the explanatory variable of interest.

The results, presented in Table 3, validate the fee calculation method dummy as a plausible proxy for an issuer's expectations for pricing revisions. Controlling for observable variables and year, industry, and managing underwriter fixed effects, using Rule 457(a) to calculate registration fees in the initial pricing range prospectus is associated with an additional 4.5 percentage points of

pricing revisions relative to filing under Rule 457(o). This association is statistically significant at the 1% level.[15] These results suggest that at least some issuers, or their advisors, have a good prediction about the direction of pricing revisions at the time the initial pricing range estimate is made, and this prediction is publicly signaled by the fee calculation method in the pricing range prospectus.

Moreover, Rule 457(a) IPOs are associated with more conservative initial pricing range estimates relative to the first-day trading price on exchange. Column 2 of Table 3 shows that issuers that file under Rule 457(a) are associated with 11 percentage points greater returns from the midpoint of the ERMOP to the full information trading value compared to issuers that file under Rule 457(o). This association is also significant at the 1% level.

Thus, the fee calculation decision—made weeks before the IPO is priced—robustly predicts both pricing revisions and returns from the initial pricing range estimate to the aftermarket trading price of the issuer's stock.

In another validation test, I investigate whether the fee calculation method predicts the likelihood that pricing revisions and initial returns will move in the predicted direction by regressing various dummy variables indicating the direction of returns from the initial pricing range estimate on the fee calculation method and controls. The dependent variables in Table 4 are dummy variables that are, respectively, equal to 1 if the IPO has positive pricing revisions and 0 otherwise; 1 if the IPO has a positive *ERMOP Return* value and 0 otherwise; and 1 if the IPO is priced above the ERMOP and 0 otherwise.

Table 4 presents the results. In each case, the dummy variable indicating a positive return is associated with the fee calculation method. Two of the coefficients are statistically significant at the 1% level, and the other coefficient is significant at the 5% level. These results, too, validate the proxy by showing that the fee calculation decision predicts the *likelihood* that an issuer will be associated with positive pricing revisions, positive ERMOP returns, and IPOs priced above the ERMOP.

The power of the fee calculation method to predict pricing revisions suggests that the fee calculation decision contains information that is not fully incorporated into initial pricing range estimates. This finding poses a challenge to leading explanations for partial adjustment which assume that issuers submit unbiased estimates when submitting initial pricing range estimates. The finding also calls into question a line of studies that interpret pricing revisions as a measure of learning during the roadshows. As just one example, Wang and Yung (2011) interpreted the observation that the highest ranked underwriters were associated with greater pricing revisions as evidence that the big three underwriters produce more information during the roadshow than lower-market share underwriters. However, this interpretation is difficult to support if pricing

[15]As a robustness check, I run in unreported regressions this same specification for two subgroups of IPOs: IPOs completed between 2010 and 2014 and IPOs completed between 2015 and 2019. In both cases, the coefficient on the *457(a)* variable is significant at the 5% level and similar in magnitude as the result for the full sample.

TABLE 4 Predicting the direction of pricing revisions and ERMOP returns

	Dependent variable		
	+ Revisions (1)	*+ ERMOP Return* (2)	*Underestimate Range* (3)
457(a)	0.160***	0.074**	0.119***
	(0.032)	(0.033)	(0.025)
Log assets	0.009	−0.0003	0.003
	(0.009)	(0.009)	(0.007)
Net income	−0.0001*	0.00002	−0.0002***
	(0.0001)	(0.00005)	(0.00004)
Nasdaq return	0.004	0.012***	0.007
	(0.005)	(0.005)	(0.004)
VIX	−0.004	−0.008**	−0.002
	(0.004)	(0.003)	(0.003)
Venture-backed	0.113***	0.084****	0.120***
	(0.031)	(0.030)	(0.028)
Participation	0.091	0.142***	0.039
	(0.060)	(0.051)	(0.052)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Underwriter FE	Yes	Yes	Yes
Observations	1209	1175	1209
R^2	0.553	0.649	0.434
Adjusted R^2	0.533	0.633	0.409

Note: This table reports results from ordinary least squares estimation of Equation (1) with various measures of the direction of returns from the midpoint of the initial pricing range estimate as dependent variables and the fee calculation method decision and other controls as independent variables. Standard errors are robust.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

revisions and ERMOP returns are predictable before information production during the roadshows even begins.

The fee calculation method predicts information production during the roadshows

This section investigates whether the fee calculation decision is associated with information production during the roadshows.

I use two measures for the amount of information produced during the IPO roadshows. The first measure is the number of pre-effective amendments filed by the issuer before the IPO. On average, issuers in the dataset file 3.4 pre-

TABLE 5 Predicting information production during the roadshows

	Dependent variable	
	Number of Amendments **(1)**	***Log Roadshow Days*** **(2)**
457(a)	−0.470***	−0.183***
	(0.168)	(0.053)
Log assets	0.110***	−0.076***
	(0.040)	(0.014)
Net income	−0.0001	0.0001*
	(0.0002)	(0.0001)
Nasdaq return	0.002	0.001
	(0.017)	(0.007)
VIX	−0.003	−0.012*
	(0.011)	(0.006)
Venture-backed	−0.508***	−0.205***
	(0.132)	(0.048)
Participation	−0.600**	−0.071
	(0.256)	(0.056)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Underwriter FE	Yes	Yes
Observations	1211	1163
R^2	0.817	0.953
Adjusted R^2	0.809	0.951

Note: This table reports results from ordinary least squares estimations of Equation (1) with measures of information production during the roadshows as dependent variables and the fee calculation method decision and other controls as independent variables. Standard errors are robust.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

effective amendments, and the median number of amendments in the dataset is 3.0. Since a pre-effective amendment updates the information available to investors in the preliminary prospectus, I assume that more pre-effective amendments correlate with more information production during the roadshows, other things equal. I use the number of S-1 amendments as the dependent variable in Column 1 of Table 5.

The second measure of information production is the length of the roadshows in days. The mean number of roadshow days in the dataset is 18.9 and the median is 10.0. This proxy for information production is premised on the assumption that the amount of information produced during a roadshow is correlated with the length of the roadshow. I calculate the length of the roadshow as the number of days between the filing of the first pricing range prospectus and the IPO date. I use the log of the number of roadshow days as the dependent variable in Column 2 of Table 5.

Table 5 shows results from OLS regressions in which the two measures of information production are used as dependent variables.[16] The table shows that the fee calculation decision is statistically related to both measures of information production. The coefficients on the Rule 457(a) indicator variables—the proxies for IPOs with underestimated ERMOPs—are negative and significant below the 1% level in both specifications. The point estimates suggest that expectations of positive pricing revisions are associated with almost 0.5 fewer pre-effective amendments and about a 20% decrease in the number of roadshow days.

The ability of the fee calculation method to predict measures of information production during the roadshow suggests the possibility that information production may vary based on features related to ex ante expectations about pricing revisions or something correlated with those expectations. The analysis does not identify a causal mechanism. However, the results are consistent with underwriters exerting less marketing effort when the IPO price is underestimated as in Baron (1982) or with investors having fewer incentives to divulge information when the initial pricing range estimate is underestimated as in Benveniste and Spindt (1989).

RELATIONSHIPS BETWEEN THE FEE CALCULATION DECISION AND IPO PRICING

This Section investigates whether issuers incorporate the information contained in the fee calculation decision into the ultimate IPO offer price. Continuing with a selection on observables methodology, this Section empirically analyzes conditional correlations between the fee calculation decision and IPO underpricing.

I run regressions of the form specified in equation (1) with three measures of initial returns, including *First-Day Return*, as dependent variables. The dummy variable indicating the issuer's fee calculation method—the proxy for an issuer's *expectations* about the direction of pricing revisions—is the variable of interest. Table 6 presents the results.

The coefficients for the fee calculation decision dummy variable are positive and significant at the 5% level in all specifications, and at the 1% level in the specification using the return from the IPO price to the opening trade on exchange as the dependent variable.[17] To the extent that first-day returns

[16]In unreported results, I run the same specifications using probit regression analysis and dropping the fixed effects. The statistical significance of the *457(a)* variable is similar in these regressions as in the reported table using OLS regressions.

[17]As a robustness check, I run in unreported regressions this same specification for two subgroups of IPOs: IPOs completed between 2010 and 2014 and IPOs completed between 2015 and 2019. The coefficient on the *457(a)* variable is significant at the 5% level when using year fixed effects and the vector of issuer-specific and market control variables. However, the coefficient is not statistically significant in either subgroup in the specifications using year, industry, and underwriter fixed effects. This is perhaps because of statistical power. The full set of fixed effects include around 37 intercepts across the three sets of fixed effects in addition to the control variables. Even the control for total assets of the issuer, which robustly predicts IPO underpricing in my main results and in almost all studies on IPO pricing, loses a statistically significant relationship with first-day returns in both of these subgroup analyses.

TABLE 6 Predicting initial returns

	Dependent variable		
	First-Day Return **(1)**	***Open Return*** **(2)**	***Two-Week Return*** **(3)**
457(a)	0.059**	0.059***	0.066**
	(0.025)	(0.019)	(0.031)
Log assets	−0.012*	−0.008	−0.011
	(0.007)	(0.005)	(0.011)
Net income	−0.00003	−0.0001*	−0.00001
	(0.00005)	(0.00003)	(0.0001)
Nasdaq return	0.004	0.004	0.003
	(0.004)	(0.003)	(0.004)
VIX	−0.007***	−0.006***	−0.005
	(0.003)	(0.002)	(0.004)
Venture-backed	0.084***	0.090***	0.100***
	(0.027)	(0.019)	(0.030)
Participation	−0.004	0.026	0.012
	(0.033)	(0.032)	(0.044)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Underwriter FE	Yes	Yes	Yes
Observations	1177	1137	1167
R^2	0.405	0.461	0.356
Adjusted R^2	0.378	0.435	0.326

Note: This table reports results from ordinary least squares estimations of Equation (1) with various measures of initial returns as dependent variables and the fee calculation method decision and other controls as independent variables. Standard errors are robust.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

represent foregone IPO proceeds, the point estimate suggests that issuers that calculate their fees under Rule 457(o) are associated with 5.9 percentage points greater IPO proceeds—more than $15 million in an IPO with average proceeds—than issuers that file under Rule 457(a).

The power of the fee calculation method to predict IPO underpricing raises the possibility that some information of economic significance that is known to the issuer or underwriter is not ultimately incorporated into the IPO offer price. However, one might conjecture that some or all of this information ultimately gets incorporated into the initial offering price through subsequent pricing revisions.

One way to test this is to add *Pricing Revisions* as a control to the regression analysis. Column 1 of Table 7 presents the results. Controlling for pricing

TABLE 7 Predicting first-day returns

	Dependent variable	
	First-Day Return	
	(1)	(2)
457(a)	0.032	0.103***
	(0.024)	(0.024)
Pricing revisions	0.673***	
	(0.059)	
PR residuals		0.673***
		(0.059)
Log assets	−0.013*	−0.013*
	(0.007)	(0.007)
Net income	0.00001	0.00001
	(0.00005)	(0.00005)
Nasdaq return	0.002	0.002
	(0.004)	(0.004)
VIX	−0.006**	−0.006**
	(0.002)	(0.002)
Venture-backed	0.064**	0.064**
	(0.025)	(0.025)
Participation	−0.044	−0.044
	(0.031)	(0.031)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Underwriter FE	Yes	Yes
Observations	1175	1175
R^2	0.490	0.490
Adjusted R^2	0.466	0.466

Note: This table reports results from ordinary least squares estimations of Equation (1) with first-day returns as the dependent variable and the fee calculation method decision and other controls as independent variables. Standard errors are robust.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

revisions, the coefficient on the Rule 457(a) variable is insignificant, suggesting that the information in the fee calculation decision is fully incorporated in the IPO price following information aggregation during the roadshows.

However, if the fee calculation method reflects ex ante expectations about future pricing revisions, and to the extent that pricing revisions actually do reflect information predicted by the fee calculation method as hypothesized, then including *Pricing Revisions* as a control variable would remove all of the meaningful variation in the fee calculation method from the *457(a)* coefficient.

A better test would be to control only for the portion of pricing revisions that are not predicted by the *Rule 457(a)* variable. To run this test, I orthogonalize *Pricing Revisions* against *457(a)*. This new variable, *PR Residuals*, isolates the information coming from investors during the roadshows or other new sources of information that is not otherwise predicted by the fee calculation decision. The *PR Residuals* variable constitutes the residual value for each observation after regressing *Pricing Revisions* on *457(a)*.

In the specification using *PR Residuals*, the Rule 457(a) variable is significant at the 1% level. The point estimate suggests that filing under Rule 457(a) is associated with 10.3% greater IPO underpricing than filing under Rule 457(o), other things equal—a substantially greater estimate than the 5.9% estimate in the primary specification in Table 6.

The relationship between the *457(a)* variable and IPO underpricing is not predicted by explanations of IPO underpricing in which investors have better information about the issuer's valuation than the issuer and its underwriters. I argue that these findings are better interpreted as evidence that at least some IPO underpricing results from strategic actions taken by a party with preferences for IPO underpricing. The results are thus consistent with a range of theories discussed in the introduction including theories explaining IPO underpricing as a mechanism to maximize stock prices at the end of a lock-up period; to encourage momentum trading among sentiment investors and thus to push the issuer's stock price above fundamentals, at least temporarily; to compensate underwriters for soft services like underwriter affiliated analyst coverage; to advertise the issuer's business; to economize on underwriter effort costs; or to allocate underpriced stock to institutional clients of underwriters at the expense of issuers.

ADVICE FROM UNDERWRITERS AS A POSSIBLE DETERMINANT OF THE FEE CALCULATION DECISION

Why might issuers have positive or negative pricing range expectations at the time they submit the initial pricing range estimate? This section tests the hypothesis that issuers' expectations about pricing revisions are related to the financial advice they receive from underwriters.

Underwriters may plausibly influence issuers' views about the initial pricing range estimate due to their advice about valuation or through the information they report to issuers during their due diligence and bookbuilding efforts. Indeed, anecdotal accounts suggest that underwriters merely dictate initial pricing range estimates to issuers in many cases.

I find that the probability that an issuer calculates its fees under Rule 457 (a) is associated with the issuer's choice of managing underwriter. Because the fee calculation decision is a proxy for an issuer's *expectations* about future

pricing revisions, this result is consistent with the hypothesis that underwriters influence the issuer's expectations of positive or negative pricing revisions through a financial advice channel.

I follow Megginson and Weiss (1991) in using IPO market share as a means of ranking underwriters. I create an ordinal rank of underwriters in which the underwriter with the highest market share is given the value of 1 and the underwriters with the lowest market share (12 unique investment banks that manage only a single IPO in the dataset) are given a value of 18. When different underwriters have equal market shares, they are given the same ordinal ranking.

Table 8 groups the sample by lead left underwriter and presents the market share of each underwriter group and the mean *457(a)* value associated with the IPOs managed by each underwriter.

The data in Table 8 appear to show that underwriter market share is unconditionally associated with issuers that elect to file under Rule 457(a). For example, the three investment banks that manage the most IPOs in the dataset are also associated with the greatest proportion of IPOs that calculate their fees under Rule 457(a), with *Rule 457(a)* values of 87.8%, 86.1%, and 86.6%, respectively. These underwriter-specific associations are consistent with the idea that underwriters provide issuers unique advice on the initial pricing range estimate.

To investigate whether higher market share underwriters are associated with a relatively higher likelihood of expectations of positive pricing revisions, I run OLS regressions that use the *457(a)* dummy variable as the dependent variable

TABLE 8 Underwriter market share and mean 457(a) values grouped by lead left underwriter

Lead left underwriter	Market share	Mean 457(a)
iBank A	16.9	87.8
iBank B	14.6	86.1
iBank C	14.4	86.6
iBank D	6.0	75.6
iBank E	5.9	74.7
iBank F	5.9	71.7
iBank G	5.5	66.7
iBank H	3.5	85.1
iBank I	1.6	73.9
iBank J	1.4	60.0
Residual	<1	49.0

Note: This table presents the underwriting market share for lead-left underwriters in the sample and the mean *457 (a)* value grouped by lead-left underwriter.

and that include most of the same control variables as specified in equation (1).[18] The specifications retain year and industry fixed effects, but replace underwriter fixed effects with *UW Rank* and *UW Market Share* as control variables, respectively.

The results are presented in Table 9. Column 1 presents results in which the ordinal *Underwriter Rank* variable is used as a control variable, in which the underwriters with the highest underwriting market share have the lowest ordinal ranking.

I also create a variable called *UW Market Share* which is a continuous variable representing the percentage of the total IPOs in the dataset each underwriter has managed. Underwriters with the highest market share have the highest market share values. This specification excludes underwriters that have less than 1% market share. Column 2 of Table 9 presents the results.

In both specifications, the variable measuring underwriter market share is statistically significant well below the 1% level. The sign on both coefficients suggest that the presence of a more prestigious underwriter managing an IPO is associated with an increased probability that the issuer will file under Rule 457 (a). More prestigious managing underwriters are, therefore, associated with expectations of positive pricing revisions through the fee calculation method proxy.

The other two explanatory variables with statistical significance are the log of the issuer's total assets and the dummy variable indicating whether the IPO is backed by a venture capital firm. The significance of the variable indicating that the IPO is backed by a venture capital firm is consistent with other empirical studies and with grandstanding theories in which venture capitalists take firms public early as a way to demonstrate to the market their ability to successfully exit an investment (Gompers, 1996; Krishnan et al., 2011; Nahata, 2008).

I also test whether certain underwriters are associated with systematically lower initial pricing range estimates relative to the issuer's stock price at the close of the first day of trading. Table 10 lists underwriters in order of market share with the highest market share underwriter at the top. The table reports mean values for *ERMOP Return* in all IPOs, in IPOs with issuers that elected to file under Rule 457(a), and with issuers that elected to file under Rule 457(o).

Table 10 provides support for two propositions. First, the systematic underestimation of ERMOPs described above is concentrated in the IPOs managed by one of five specific underwriters. For example, the groups of IPOs managed by the two underwriters with the greatest market share in the dataset each have mean *ERMOP Return* values of 39%, suggesting that these underwriters systematically underestimate initial pricing range estimates quite significantly relative

[18]In unreported results, I run the same specifications using probit regression analysis and dropping the fixed effects. The statistical significance of the *UW Rank* and *UW Market Share* variables are similar in these regressions as in the reported table using OLS regressions.

TABLE 9 Predicting the fee calculation method

	Dependent variable 457(a) Dummy (1)	(2)
UW rank	−0.032***	
	(0.005)	
UW market share		0.012***
		(0.002)
Log assets	0.050***	0.044***
	(0.008)	(0.009)
Net income	0.00001	0.00001
	(0.00004)	(0.00004)
Nasdaq return	−0.003	−0.003
	(0.004)	(0.005)
VIX	0.001	−0.001
	(0.003)	(0.004)
Venture-backed	0.088***	0.064**
	(0.029)	(0.032)
Participation	−0.009	0.010
	(0.049)	(0.049)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	1211	1048
R^2	0.795	0.824
Adjusted R^2	0.788	0.817

Note: This table reports results from ordinary least squares estimations of Equation (1) with the issuer's fee calculation method election as the dependent variable and measures of underwriter market share and other controls as independent variables. Standard errors are robust.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

to the issuer's initial trading price on exchange. Lower market share underwriters tend to manage IPOs that have negative or only slightly positive mean *ERMOP Return* values. These results suggest that some underwriters are systematically more conservative than others when advising on the initial pricing range estimate.

Table 10 also shows a bivariate relationship between the fee calculation method and *ERMOP Returns* even when IPOs are grouped by lead left underwriter. All but two underwriters have higher average *ERMOP Return* values in the IPOs they manage in which the issuer elects to calculate fees under Rule 457 (a) relative to IPOs where the issuer elects to calculate fees under Rule 457(o).

TABLE 10 Mean ERMOP returns (%) grouped by Lead left underwriter

Lead left underwriter	All IPOs	Rule 457(a)	Rule 457(o)	Difference	*t*-Statistic
iBank A	39	43	11	32	−4.16
iBank B	39	41	24	17	−1.57
iBank C	32	35	14	21	−1.84
iBank D	28	35	6	29	−2.46
iBank E	3	1	9	−8	0.75
iBank F	1	8	−17	25	−2.88
iBank G	23	26	16	10	−0.61
iBank H	4	7	−20	27	−2.10
iBank I	−4	2	−18	20	−1.51
iBank J	−7	−13	2	−15	1.41
Residual	5	12	−2	14	−2.70

Note: This table reports mean ERMOP returns grouped by lead-left underwriter for all IPOs; the IPOs in which an issuer elects to calculate registration fees owed to the SEC under Securities Act Rule 457(a); and the IPOs in which an issuer elects to calculate registration fees owed to the SEC under Securities Act Rule 457(o). The table also reports the difference in means for the Rule 457(a) and 457(o) columns and the corresponding t-statistic.

For three underwriters, the difference in group means across 457(a) and 457 (o) IPOs is statistically significant at the 5% level in a two-sided Welch t-test.

CONCLUSION

Do issuers and underwriters include all valuation information available to them in the initial pricing range estimate and the IPO offer price? This paper makes four important empirical contributions. First, it shows that, at the time they submit initial pricing range estimates, issuers systematically underestimate their equity value relative to the issuer's stock price at the close of the first day of trading on exchange, by around 21% over the last decade. Second, it shows that at least some issuers have a good prediction about the direction of pricing revisions at the time the initial pricing range estimate is submitted, suggesting that issuers or the underwriters that advise them may not incorporate all private valuation information into the initial pricing range estimate. Third, it shows that a significant component of first-day returns is predictable weeks before the actual IPO using information disclosed in SEC filings about how the issuer calculates registration fees owed to the SEC, suggesting that issuers or the underwriters that advise them may not incorporate all private valuation information into the IPO price. Fourth, it shows that choice of underwriter is associated with the fee calculation method.

The variation in fee calculation methods results from decisions made by issuers, advised by their underwriters, before solicitation of investor demand on the roadshows even begins. As such, this variation should be independent from the private information of investors. The power of the fee calculation method to predict pricing revisions and the IPO offer price suggests that information of economic significance known to issuers or underwriters is not incorporated into the initial pricing range estimate and the IPO offer price. These results present a challenge for explanations for IPO underpricing and partial adjustment that rely on private information of investors (Benveniste & Spindt, 1989; Rock, 1986) and instead appear to support models of IPO underpricing driven by the preferences of underwriters or insiders of the issuer to underprice IPOs.

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DATA AVAILABILITY STATEMENT

Data necessary to replicate the results of this article are available upon request from the author.

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APPENDIX: VARIABLE AND TERM DEFINITIONS

Variable/term	Definition
+ Revisions	A dummy variable equal to 1 if the IPO is associated with a positive percentage change from the midpoint of the initial pricing range estimate to the initial offering price in the IPO.
+ ERMOP Return	A dummy variable equal to 1 if the percentage change from the midpoint of the initial pricing range estimate to the issuer's stock price at the close of the first day of trading on exchange was greater than 0, and 0 otherwise.
Nasdaq Return	The 2-week return on the Nasdaq prior to the IPO.
ERMOP Return	A dummy variable equal to 1 if the IPO is associated with a positive percentage change from the midpoint of the initial pricing range estimate to the issuer's stock price at the close of the first day of trading.
457(a)	A dummy variable equal to 1 if the issuer calculated its fees under Rule 457 (a) in the first pricing range prospectus, and 0 if the issuer calculated fees under Rule 457(o) (hand collected).
Above Range	A dummy variable equal to 1 if the initial offering price of the IPO exceeded the high price of the ERMOP.
Below Range	A dummy variable equal to 1 if the low price of the ERMOP exceeded the initial offering price of the IPO.
First-Day Closing Price	The price of the issuer's stock at the close of the first day of exchange trading.
ERMOP	The "bona fide estimate of the range of the maximum offering price" filed pursuant to Regulation S-K in the issuer's first preliminary prospectus that contains such an estimate.
ERMOP Return	The percentage change from the midpoint of the ERMOP to the trading price of the issuer's stock at the close of the first day of trading.
ERMOP Return High	The percentage change from the high point of the ERMOP to the trading price of the issuer's stock at the close of the first day of trading.
First-Day Return	The percentage change from the initial offering price in the IPO to the trading price of the issuer's stock at the close of the first day of trading.
Log Assets	The log of the total balance sheet assets, including current assets, long-term investments and funds, net fixed assets, intangible assets and deferred charges, before the offering, in millions of dollars. This number equals total liabilities plus shareholders' equity plus minority interest.
Log Roadshow Days	The log of the number of calendar days between the date that the first pricing range prospectus is filed and the date the IPO is priced.
Nasdaq Return	The 2-week return on the Nasdaq prior to the IPO.
Net income	Net income after taxes for latest 12-month period, in millions of US dollars. Includes net income from continuing operations, after minority interest, before preferred dividends and before extraordinary items.

(Continues)

Variable/term	Definition
Number of Amendments	The number of pre-effective amendments to the issuer's Form S-1 filed with the Securities and Exchange Commission.
Offer Price	The price that the securities were offered to initial investors in the IPO.
Open Return	The percentage change from the IPO offer price to the price of the issuer's stock at the very first trade on exchange following the IPO.
Participation	The number of secondary shares offered divided by the total shares offered in the IPO.
PR Residuals	The residual value for each observation after regressing *Pricing Revisions* on *457(a)*.
Pricing Revisions	The percentage change from the midpoint of the ERMOP to the initial offering price of the IPO.
Underestimate Range	A dummy variable equal to 1 if the initial offering price is greater than the high end of the initial pricing range estimate and 0 otherwise.
UW Market Share	For each underwriter, the percentage of IPOs in the sample in which that underwriter served as lead left underwriter.
UW Rank	An ordinal rank in which the underwriters with the highest market share are given the value of 1 and the underwriters with the lowest market share are given a value of 18. When different underwriters have equal market shares, they are given the same ordinal ranking.
Venture-Backed	A dummy variable equal to 1 if SDC Platinum indicates that the issuer was venture-backed at the time of the initial public offering and 0 otherwise.
VIX	The value of the CBOE Volatility Index at the closing on the night before the IPO.