

Litigation Risk and IPO Underpricing

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Abstract

We examine the relation between litigation risk and IPO underpricing. To adjust for the endogeneity bias in previous studies, we use a simultaneous equation framework. Evidence suggests that firms employ underpricing as a form of insurance against future litigation costs. Specifically, firms with greater litigation risk underprice their IPOs by a greater amount. Further, consistent with underpricing representing a viable form of insurance, results indicate that higher underpricing significantly lowers litigation risk.

1. Introduction

Firms conducting Initial Public Offerings (IPOs) earn a return of approximately 15% on their first day of trading. While the magnitude of this initial return varies over time and as a function of firm characteristics, it shows no signs of dissipating. The persistent and systematic underpricing of IPO issues is puzzling, and this apparent violation of market efficiency has received considerable attention from researchers. There currently exist three main theories for these high initial returns: signaling, information asymmetry, and litigation risk. A substantial body of literature empirically tests the first two potential explanations, and evidence indicates that information asymmetry is an important determinant of IPO initial returns. However, much of the magnitude of and variation in initial returns remains unexplained. Interestingly, the third potential explanation for underpricing, litigation risk, has received relatively little attention in the empirical literature. The idea that IPO firms and underwriters intentionally underprice their shares to insure against future liability is intuitively appealing, yet the existing evidence on this is at best mixed and inconclusive.

Skeptics of the litigation-risk hypothesis (e.g., Alexander, 1993) often point to the high costs of underpricing relative to the average lawsuit settlement costs and the low historical lawsuit frequency (around 6% for our sample) as anecdotal evidence against this hypothesis. However, this 'back-of-the-envelope' reasoning ignores many important factors. First, it is possible that the lawsuit frequency and settlement payments are low precisely because most firms have used underpricing as a form of insurance. Further, as discussed in more detail below, this argument omits many of the costs associated with lawsuits.

For a firm planning to go public, the potential costs of litigation are substantial. One of the most highly publicized costs of litigation is the settlement payment, which averages \$7 million in our sample and represents 20% of the total proceeds raised. While this amount is non-

trivial, it is only a small portion of the total costs associated with a lawsuit. There are other, potentially more important, costs of litigation that are often overlooked because they are not directly observable. Examples of such costs include reputation costs to the firm and the individuals involved, legal fees, and opportunity cost of management time dedicated to the lawsuit.

The costs associated with reputation damage can be quite substantial both for the IPO firm as a whole and for the individual managers personally. First, a charge of misleading investors could damage a firm's credibility and lead to a higher cost of capital if they access the capital market in the future. Second, customers and other companies are less likely to conduct business with a firm in the midst of litigation due to the uncertainty over the firm's future. Moreover, managers in particular would be averse to litigation because accusations of securities fraud might dampen their future job prospects and/or compensation. In addition to reputation costs, a sued firm incurs considerable costs trying to retain a legal team. Finally, dealing with litigation makes significant demands on management time. The time and effort management allocates to litigation-related issues distract them from their core businesses, and thus represent an additional cost to the firm.

Because litigation is costly, managers have incentives to insure against such costs. One way to effectively insure against these costs is to lower the probability of being sued. For this reason, all firms and their underwriters conduct due diligence prior to the IPO, i.e., they investigate all aspects of the firm's business, finances, management, and projections and discuss their findings in the IPO prospectus. However, it is not feasible to foresee every possible future event, and there are obvious limits to what can be incorporated into a prospectus. A second way to lower the probability of being sued is to decrease the potential damages that plaintiffs can recover. Alexander (1993) emphasizes that the amount of the expected settlement reward is a

major determinant of the probability of being sued. For this reason, underpricing is a particularly attractive form of insurance. Unlike other forms of insurance that firms can purchase, underpricing lowers the potential damages that plaintiffs can recover, and thus reduces plaintiffs' incentives to bring a lawsuit against the firm.

To understand why underpricing potentially lowers the probability of being sued, we briefly discuss some specifics of the securities laws. The Securities Acts of 1933 and 1934 give investors the right to bring a lawsuit against an IPO firm for material untruths or omissions in the prospectus and provide guidelines for the calculation of associated damages. Most IPO-related lawsuits against the issuer are brought under Sections 11 and 12 of the Securities Act of 1933 and Section 10(b) of the Securities Act of 1934. Under Section 11, damages for direct purchasers in the IPO are based on the difference between the *offer price* and either the sale price or the security's price at the time of the lawsuit, depending on whether or not the share was sold. For persons who bought the stock in the aftermarket, damages are based on the lower of the *offer price* and the price at which the security was bought. Thus, for all suits brought under Section 11, damages are directly related to the offer price. A firm that underprices its IPO by a greater amount has a lower offer price, meaning that it has lower potential damages and a decreased probability of being sued.

Sections 12 and 10(b) similarly apply to both direct and aftermarket purchasers. However, damages under both these sections are based on the investor's purchase price. Section 12 has a narrower scope in that it only holds the seller liable. The courts have interpreted the seller as someone who solicits the investor, for example the broker-dealer who calls the investor, rather than the issuer. Section 10(b) places a heavier burden of proof on the plaintiff. However, from the plaintiff's point of view, it has the advantage of holding more parties liable.

Based on these institutional facts, Ibbotson (1975) and Tinic (1988) hypothesize that underpricing represents a form of insurance against future litigation. The issuer and the underwriter agree to set the offer price below the expected market value of the securities because this decreases the probability of future litigation as well as the costs of litigation in the event of a lawsuit. Consistent with this, Tinic (1988) finds that the initial returns of a sample of IPOs prior to the Securities Act of 1933 are significantly lower than those of a sample of firms that went public after this Act was implemented. Drake and Vetsuypens (1993) note that these results can be misleading because they do not control for the time variation in initial returns unrelated to litigation risk. Using a cross-sectional framework, they find that initial returns of firms that are ultimately sued are no different than those of firms that are not sued. Drake and Vetsuypens interpret these results as inconsistent with the litigation-risk hypothesis, since sued firms do not appear to be overpriced. However, as discussed in more detail in the subsequent section, this analysis suffers from an endogeneity problem, which makes results difficult to interpret.

The objective of this paper is to examine the relation between underpricing and litigation risk in more depth. Specifically, we want to address two distinct but related questions: (1) whether litigation risk affect IPO issuers' incentives to underprice their issues, and (2) whether underpricing lowers the expected litigation costs by reducing lawsuit probabilities.

This study contributes to the literature in several ways. First, we address the shortcomings of both these earlier studies by using a cross-sectional, simultaneous-equation approach. To do this, we collect actual lawsuit data for a sample of IPOs between 1988 and 1995. These data enable us to estimate the litigation risk for each firm and to examine the relation between litigation risk and initial returns. Second, our research design has the added benefit of being able to examine both dimensions of the litigation-risk hypothesis, i.e., the extent

to which issuers underprice their IPOs as a form of insurance against future litigation as well as the deterrence effect of underpricing in reducing expected litigation costs.

Results show that the relation between the probability of a lawsuit and initial returns lends support to both predictions of the litigation-risk hypothesis. First, firms with higher legal exposure tend to underprice their offerings by a significantly greater amount, suggesting that firms use underpricing as a form of insurance against future litigation. As discussed in more detail later, the OLS regression produces the opposite result, thus highlighting the importance of controlling for endogeneity in this context. Second, consistent with the effectiveness of underpricing as a form of insurance, we also find evidence that underpricing lowers the expected litigation costs by reducing lawsuit probability.

Section 2 discusses the related literature in more detail. Section 3 describes the data selection process and provides some descriptive statistics. Section 4 details the simultaneous-equation methodology used in this study. Section 5 presents empirical evidence on the relation between IPO underpricing and litigation risk. Conclusions are offered in Section 6.

2. Related literature

This paper contributes to both the considerable literature on the determinants of underpricing and to the growing evidence on the importance of litigation risk. We first broadly review the main evidence on underpricing, as this motivates many of our controls in the empirical analysis. We then go into more detail regarding the papers that have focussed on the relation between IPO initial returns and litigation risk.

The literature on IPO underpricing offers three main theories on the determinants of underpricing. First, Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989) posit that high quality firms underprice their issues to signal their quality to the market. Greater

underpricing enables them to raise more capital in the future at more favorable rates. Jegadeesh, Weinstein and Welch (1993), Garfinkel (1993), and Spiess and Pettway (1997), among others, find relatively little support for the signaling story.

Second, Beatty and Ritter (1986), Benveniste and Spindt (1989), Rock (1986), and Baron (1982) hypothesize that underpricing results from information asymmetry between the various parties involved in the IPO. Issues that are characterized by greater uncertainty are underpriced more to compensate for the higher costs of learning about these firms' true values. Many papers, including Beatty and Ritter (1986), Megginson and Weiss (1991), Koh and Walter (1989), and Hanley (1993), find empirical support for the importance of information asymmetry as a determinant of underpricing.

Third, Ibbotson (1975) and Tinic (1988) posit that firms intentionally underprice their shares as a form of insurance against future liability. Tinic models expected legal liabilities as:

$$E[L_t] = f(P_0/P_t) * g(P_0 - P_t), \quad (1)$$

where L_t equals the dollar cost of legal liabilities, P_0 is the offer price, and P_t is the post-offer price of the stock at $t=1,2,\dots,T$. The probability of being sued, f , is an increasing function of P_0/P_t . Damages, g , are an increasing function of the difference between P_0 and P_t . Hughes and Thakor (1992) extend Tinic's analysis in a game-theoretic setting and specify the conditions required for equilibrium underpricing. Hensler (1995) formalizes Tinic's model using a utility-maximization single-period model. Both models similarly predict a positive relation between litigation risk and underpricing.

Tinic (1988) tests the litigation-risk hypothesis by comparing the underpricing of IPOs prior to and subsequent to the 1933 Securities Act, which substantially increased the legal exposure of IPO issues. He compares initial returns in the 1923-1930 period to those in the 1966-1971 period. Average underpricing was significantly higher in the later period. He

concludes that the 1933 Securities Act increased expected litigation costs and therefore resulted in more underpricing.

However, Tinic's finding of higher initial returns in the 1966-71 period, compared to the 1921-30 period, may be driven by factors other than litigation risk. Ibbotson, Sindelar, and Ritter (1988) show that initial returns fluctuate substantially over time. Drake and Vetsuypens (1993) point out that average initial returns between 1972 and 1977 were actually lower than those in the 1921-1930 period.

Drake and Vetsuypens (1993) address some of these issues in a cross-sectional analysis. They compare 93 IPO firms that were sued with a sample of matched non-sued IPO firms, where firms are matched on year, underwriter rank, and offer size. They find that the average initial returns of the sued firms are greater than those of non-sued IPO firms. They also compare IPOs with positive initial returns to those with initial returns less than or equal to zero. They find that a greater portion of IPOs in the first category is sued. They conclude that sued firms are not overpriced and interpret the result as inconsistent with the litigation-risk hypothesis.

The Drake and Vetsuypens analysis suffers from the following endogeneity problem. Under the litigation-risk hypothesis, initial returns can be related to the probability of a lawsuit along two dimensions. First, firms with higher litigation risk should underprice their IPOs by a greater amount as insurance against litigation. This implies that initial returns are an increasing function of litigation risk. Second, firms that buy more insurance against litigation, i.e. underprice more, should be sued less often. This implies that litigation is a decreasing function of initial returns. Because the probability of being sued is itself an endogenous variable that could depend on underpricing, a comparison of initial returns across sued and non-sued firms is problematic.

Keloharju (1993) examines the underpricing of IPOs in Finland, where there is negligible litigation risk. He finds a mean initial return of 8.7%, despite essentially zero potential legal liabilities associated with the IPO. This suggests that expected litigation costs can not explain all of initial returns, but it provides little information on their relative importance in the U.S. As Keloharju notes, mean initial returns are significantly higher in the U.S., and it is possible that the difference reflects litigation risk.

3. Data

Data on IPOs between 1988 and 1995 are obtained from the Securities Data Company (SDC). Closed-end funds, REITs, financial firms, reverse LBOs, ADRs, and spinoffs are excluded. We also require firms to have initial return data and data on the expected offer price. Initial return is defined as the percentage difference between the offer price and the closing price after one month (21 trading days after the IPO). We use the closing price one month after the IPO instead of the first closing price to mitigate the effects of underwriter price support. Ruud (1993) shows that underwriter price support in the days following the IPO artificially inflates the aftermarket price of many issues that would otherwise trade below their offer price. However, as discussed later, the empirical results are insensitive to initial returns defined over various windows. Finally, the expected offer price equals the midpoint of the range of prices stated in the Red Herring prospectus. This variable is used to compute price update, which Hanley (1993) shows is an important determinant of underpricing. The price update for an issue equals the percentage difference between the expected offer price and the offer price. The final sample consists of 1841 IPOs.

We search the *Securities Class Action Alert* newsletters between 1990 and 1997 for all lawsuits filed against IPO firms under the Securities Acts of 1933 and 1934.¹ We further searched the *Securities Class Action Clearinghouse* website for cases that were filed after 1997. *Securities Class Action Alert* does not include lawsuits filed in state courts. Our lawsuit sample consists of all firms that had an IPO between 1988 and 1995, meet the above criteria (e.g., not ADRs, spinoffs, etc.), and were sued for violations relating to the IPO. We find that 106 (5.8%) of the 1841 IPOs were sued.

Table 1 shows the distribution of sued IPOs and non-sued IPOs across years and industries. IPO volume was highest in 1995 with 431 IPOs, and lowest in 1990 with 91 IPOs. Only 2% of the IPOs in 1988 were ultimately sued, versus over 7.5% of the 1992 IPOs. While both the total number of IPOs and the number of lawsuits against IPO firms vary over the sample period, there does not appear to be any systematic relation between the two. The most lawsuits, 47, were against firms in the communications, computers, and electronics industry. However, this industry also had the largest number of IPOs. On a percentage basis, almost 8% of IPO firms in this industry were ultimately sued. Similarly, between seven and ten percent of firms in the apparel industry, the recreation industry, and the utility industry were also sued.

Table 2 provides descriptive statistics on the sued and non-sued firms. There is no significant difference between the initial returns of sued and non-sued firms.² This is consistent with the findings of Drake and Vetsuypens. However, the endogeneity problem discussed earlier

¹Data availability constraints prevent us from collecting lawsuit information for 1988 and 1989. However, the majority of lawsuits are listed in *the Securities Class Action Alert* two or more years after the IPO. The possibility that some sued firms are classified as non-sued biases against finding our predicted results.

² As shown in Table 2, the initial return, when measured as the percentage difference between the closing price on the twenty-first day of trading and the offer price, equals 17.6% for sued firms and 17.9% for non-sued firms. In comparison, the initial return measured as the percentage difference between the first day closing price and the offer price, equals 15.6% for sued firms and 14.5% for non-sued firms. These numbers are similar to the 15.3% average returns obtained by Ibbotson, Sindelar, and Ritter (1994).

makes this comparison inappropriate. Regression results in Section 5 illustrate the importance of controlling for endogeneity.

Sued firms are significantly larger in terms of mean and median proceeds raised, mean and median market capitalization after the IPO, and median total assets after the IPO. Market capitalization is measured as the number of shares outstanding after the IPO times the market price one month after the IPO, and all size measures are expressed in real dollars. As discussed earlier, the price at the end of one month better reflects true firm value, unaffected by underwriter price support. The positive relation between a firm's size and its legal exposure has been well documented in the legal literature, and is referred to as the 'deep pocket' theory. Because of the fixed costs associated with filing a lawsuit, plaintiffs initiate a lawsuit only if they perceive the recoverable damages to be sufficiently large. Alexander (1991) finds that of the seventeen IPOs in the computer industry in 1983, the six largest offerings were all sued. In contrast, none of the companies with offerings of \$20 million or less were sued. While smaller firms probably are riskier, the benefits of suing larger firms are greater because of their 'deep pockets'. The benefits of suing a small firm may not justify the costs.

Sued firms have significantly higher ranked underwriters than non-sued firms. Underwriter rank is measured using the Carter, Dark, and Singh (1998) measures, with higher ranks representing higher quality. The significant difference in underwriter ranks also reflects the importance of 'deep pockets'. In particular, several and joint liabilities make all defendants of a lawsuit jointly responsible for the damage payments. In the case that the IPO firm does not have sufficient funds to meet all the damage payments, the plaintiffs can recover the rest from the other parties, including the underwriter. Consistent with Bohn and Choi (1996), we find the 'deep pocket' of an underwriter is likely to increase the probability of an IPO lawsuit.

The ‘deep pocket’ argument can also be extended to the venture capitalist backing an IPO. The potential recovery from a venture capitalist increases the perceived benefits from a lawsuit, hence increasing plaintiffs’ incentives to initiate a lawsuit. Consistent with this conjecture, almost 60% of sued firms were backed by a venture capitalist, compared to only 44% of non-sued firms.

Alexander (1991) reports that every firm in the computer industry that went public in 1983 and whose total value of the offering declined over \$20 million during the several years subsequent to the IPO was sued. Consistent with such prior evidence, we find that sued firms have significantly lower mean and median one-year stock returns (-30% and -44% respectively, compared to 16% and 2% for non-sued firms). One-year stock return is measured as the buy-and-hold percentage return, measured over one year beginning one month after the IPO.

A stylized fact is that a class-action lawsuit tends to be precipitated by a steep drop in stock price. There is a higher probability of a substantial stock price decrease (or increase) if stock volatility is higher. Thus, more volatile stocks are exposed to higher litigation risks. Volatility is measured as the standard deviation of daily returns in percentage terms, measured over a one-year period beginning one month after the IPO. Consistent with this conjecture, sued firms have significantly higher mean and median standard deviation of stock returns (5% for sued firms, compared to 4% for non-sued firms).

Stock turnover, measured as the proportion of shares traded at least once during a given period, is also related to plaintiffs’ incentives to initiate lawsuits. This is because shareholder damages are generally increasing in the number of shares traded at the allegedly misleading prices. Turnover is defined as $[1 - \prod_{t=22}^{387} (1 - \text{volume traded}_t / \text{total shares}_t)]$, computed for the one-

year period starting from one month after the IPO.³ Not surprisingly, sued firms have significantly higher mean and median turnover.

Firms in high-tech industries derive more of their values from growth options than from tangible assets. Growth options are harder to value and subject to more uncertainties. The Alexander (1991) study of IPOs in the computer industry is a good example of the litigation risks associated with high growth and high-risk industries. The SDC classification system is used to define firms as high-tech. Interestingly, the descriptive statistics reveal little difference across the two samples in terms of membership in high-tech industries. Fifty percent of sued firms are in the technology industry, compared to 49% of non-sued firms.

The signaling hypotheses of Leland and Pyle (1977) and Grinblatt and Hwang (1989) predict that insiders of high quality firms signal firm quality by retaining a greater portion of the firm, i.e. by selling fewer shares than insiders of low-quality firms. Consistent with this theory, insiders of firms that are ultimately sued sell significantly more shares in the IPO than insiders of non-sued firms. The mean (median) fraction of secondary shares (i.e. shares sold by insiders) over total shares equals 17% (9%) for sued firms compared to 11% (0%) for non-sued firms.

Table 3 shows a correlation matrix. The correlation between market capitalization and proceeds is high, 0.81. To mitigate multicollinearity we only use one variable, market capitalization, as a proxy for size in the regression analysis. The correlation between other variables is relatively low.

³The stock turnover measure is a direct input in estimating damaged shares under the proportional trading model, which has been accepted by the courts as the appropriate way to calculate damages in class action lawsuits. Consistent with prior literature, we adjusted for the Nasdaq volume definition by dividing Nasdaq trading volume by a factor of two.

4. Methodology

As argued earlier, a firm about to make an IPO faces a trade-off in its pricing decisions. A higher offer price (i.e., lower underpricing) increases proceeds from the IPO, but it also raises the expected litigation costs. Individual IPO firms select the amounts of underpricing to maximize their net benefits (proceeds minus expected litigation costs), and the resulting underpricing levels reflect this trade-off. Two predictions emerge concerning the cross-sectional relations between IPO underpricing and inherent litigation risks. First, firms with higher litigation risk purchase more ‘insurance’, i.e., they underprice their shares by a greater amount (the insurance effect). Second, firms who choose higher levels of insurance incur lower expected litigation costs in the form of reduced probabilities of lawsuits (the deterrence effect). This inter-relation between underpricing and litigation risk is captured by the following equations :

$$\text{Insurance Effect: } \text{Initial Return} = \mathbf{g}_1 \text{ Litigation Risk} + \mathbf{b}_1 X_1 + \varepsilon, \quad (2)$$

$$\text{Deterrence Effect: } \text{Litigation Risk} = \mathbf{g}_2 \text{ Initial Return} + \mathbf{b}_2 X_2 + v, \quad (3)$$

where Initial Return equals the amount of underpricing for firm i , Litigation Risk equals the probability of litigation for firm i , X_1 equals a vector of exogenous IPO characteristics related to the amount of underpricing, and X_2 equals a vector of exogenous variables related to the probability of an IPO lawsuit.⁴

Eq. (2) addresses whether and how potential litigation risk affects a firm’s underpricing. Note that, because of the potential interdependencies discussed earlier, it is not appropriate to substitute a dummy variable denoting *ex post* occurrence of litigation for litigation risk and estimate this equation with OLS. The occurrence of litigation is not exogenous. Rather, it

⁴ In order to estimate this system of equations, it is important that both Eqs. (2) and (3) are identified. Specifically, X_1 needs to contain a variable not in X_2 , and vice versa. To satisfy this condition, X_1 contains price update, a variable that conceptually explains initial return but not the occurrence of litigation. Also, X_2 contains stock turnover, a variable that captures the fraction of potentially damaged shares and is therefore conjectured to be related to litigation risk. Turnover *per se* is not expected to contribute to initial return.

depends in part on the amount of underpricing. For example, from Eq. (2), a firm that chooses to overprice its IPO will have an especially low error term, ε , and is also likely to have a high probability of being sued. Therefore, the error term and litigation risk are not independent. This violates a fundamental assumption of OLS and will yield inappropriate inferences.

Eq. (3) examines whether underpricing is effective in deterring litigation. For similar reasons, it is not appropriate to estimate this equation by a regular probit model. For example, firms faced with higher litigation risk might underprice their shares more at the time of IPO, leading to an endogeneity bias, as discussed above. To account for the interdependency between the amount of underpricing and the litigation risk, we estimate Eqs. (2) and (3) simultaneously.⁵

The estimation of the simultaneous equation system is slightly complicated by the fact that the dependent variable in the first equation, initial return, is continuous, while that in the second equation, litigation risk, is observed only as a dichotomous variable. In this case, we can not fully recover the parameters in Eqs. (2) and (3) (Maddala, 1983, p.244). The estimable structural equations are:

$$\text{Insurance Effect: } \text{Initial Return} = \mathbf{g}_1 \mathbf{s}_2 \text{ Litigation Risk}^{**} + \mathbf{b}_1 \mathbf{X}_1 + \varepsilon, \quad (4)$$

$$\text{Deterrence Effect: } \text{Litigation Risk}^{**} = \frac{\mathbf{g}_2}{\mathbf{s}_2} \text{Initial Return} + \frac{\mathbf{b}_2}{\mathbf{s}_2} \mathbf{X}_2 + \frac{\mathbf{n}}{\mathbf{s}_2} \quad (5)$$

where $\sigma_2^2 = \text{Var}(v)$. The estimation method consists of two stages. In the first stage, we regress initial return and litigation risk on all the exogenous variables in the system, using OLS and probit, respectively. In the second stage, we substitute the predicted values from the first-stage estimation as explanatory variables in Eqs. (4) and (5), and then estimate Eq. (4) by OLS and Eq.

⁵ Note that litigation risk is an ex ante concept. At the time of the IPO, each firm chooses an underpricing amount that affects the ex ante litigation risk. While realized litigation outcomes might depend on future events not in an IPO firm's information set at the time of an IPO (such as the realization of future cash flows), the ex ante expectation is an unbiased forecast of the ex post legal exposure as long as managers have rational expectations.

(5) by probit.⁶ While we are not able to separately estimate g_1 and g_2 , we can at least test whether the two coefficients are *statistically* different from zero, and thus shed light on the insurance and deterrence effects.

5. Underpricing and the probability of litigation

This section addresses the cross-sectional relation between underpricing and the probability of litigation related to the IPO. Section 5.1 discusses the insurance effect, i.e., the effect of litigation risk on IPO underpricing. Section 5.2 examines the deterrence effect, i.e., whether higher underpricing lowers expected litigation costs.

5.1. Does litigation risk affect underpricing?

To examine the effects of litigation risk on underpricing, we must control for other determinants of initial returns. The control variables should capture the effects of information asymmetry, signaling, and other factors that potentially affect initial returns.⁷

A variety of control variables are included to capture the effects of information asymmetry. Ritter (1984), Carter and Manaster (1990), and Michaely and Shaw (1994) note that there exists less uncertainty surrounding issues whose values are certified by higher quality players. Underwriters and venture capitalists are repeat players in the new issues market, and they have valuable reputations to protect. Therefore, underwriter rank and venture capitalist backing should proxy for information asymmetry. As mentioned in Section 3, firms in high-tech industries are subject to higher information asymmetry since they have more growth options and

⁶ The regression coefficients from the second-stage regression are consistent, but the standard errors are underestimated since the explanatory variables include two generated regressors. We adjust the standard errors using the methodology in Maddala (1983). Adjusted standard errors are reported in all of the tables.

⁷ Many of the variables were described earlier in the comparison of sued versus non-sued firms, and thus are not re-defined here.

thus are harder to value. In addition, we use return on assets (ROA) prior to the IPO to proxy for information asymmetry, since firms that experience stronger operating performance prior to the IPO are subject to less uncertainty. Carter and Manaster (1990) and Megginson and Weiss (1991) note that more information is readily available about older firms, and they find a negative relation between initial returns and age. Because we do not have data on age, we construct a dummy equal to one if the firm has five or more years of pre-IPO earnings data, and zero otherwise. Finally, firms with more volatile stock are characterized by higher information asymmetry, and therefore the standard deviation of post-IPO returns is included as a control variable.

To control for the effects of signaling, we add shares sold by insiders, as a fraction of total shares. Insiders of higher quality firms should sell fewer shares, and IPOs of these firms should be more underpriced.

Other variables can also affect IPO underpricing. For example, market capitalization after the IPO can be related to initial returns in several ways. First, information tends to be more readily available about larger firms. Thus, the information asymmetry hypothesis predicts a negative relation between firm size and initial returns. However, other things held constant, Michaely and Shaw (1994) point out that larger issues can be harder to sell, suggesting that an underwriter may underprice them by a larger amount.⁸

Benveniste and Spindt (1989) show that the difference between the expected offer price and the actual offer price will be related to underpricing. They model initial returns as consisting of some new information and some information known by underwriters prior to the offering. When a company files an IPO, it must file a prospectus containing the range of prices within which it expects the IPO offer price to be. During the registration period, the company and the

underwriter market the issue to institutional investors. They rely on these investors to reveal their true valuation of each IPO. Benveniste and Spindt conjecture that underwriters must give investors incentives to reveal their true value. Therefore, underwriters only partially update the final offer price, from the expected offer price (equal to the midpoint of the range of prices stated in the prospectus). Consistent with this theory, Hanley (1993) finds a strong positive relation between price update and initial returns.

All of the control variables are included in the regressions in Table 4. The first column shows an OLS regression of initial returns on a lawsuit dummy, equal to one if the firm was sued and zero otherwise, with control variables. This OLS regression is similar in spirit to the analysis of Drake and Vetsuypens and ignores the endogeneity of lawsuit probability. Columns two and three contain the first and second stage regressions in the simultaneous equation estimation, which does control for endogeneity.

Controlling for these other determinants of initial returns, the OLS regression in Column one suggests that firms that were sued had significantly lower initial returns. This implies that firms with higher litigation risk underprice their IPOs less, which contradicts the insurance effect. However, as discussed earlier, this coefficient estimate may be biased because litigation risk is an endogenous variable. The simultaneous equations shown in columns two and three highlight the importance of controlling for this endogeneity.

Column two shows the first-stage probit regression of ex post lawsuit on all of the exogenous variables in the system of Eqs. (2) and (3). The dependent variable equals one if an IPO firm was sued and zero otherwise. Column three shows the second stage regression of initial return on the control variables and the lawsuit instrument, equal to the fitted variable from the first-stage regression.

⁸ We use market capitalization after the IPO instead of proceeds raised because of the mechanical relation between

In striking contrast to the OLS result, the coefficient on the lawsuit instrument in column 3 is significantly positive, which supports the litigation-risk hypothesis. Firms subject to higher litigation risk underprice their IPOs by a greater amount. The coefficient is 54.705, with a standard error of 20.794, and significant at the 5% level using two-tailed tests. Endogeneity appears to drive the apparent negative relation between the probability of being sued and initial returns in Column one.⁹

Most of the inferences on the control variables are similar to the findings in prior literature. Consistent with the information asymmetry hypothesis, initial returns are significantly negatively related to underwriter rank and to venture capital backing. Further, coefficients on the age dummy and ROA are both negative, but neither is significant at conventional levels. Finally, the significantly positive coefficient on the technology dummy is also consistent with the importance of information asymmetry as a determinant of underpricing.

Surprisingly, the coefficient on standard deviation is negative and significant at the 5% level, in contrast to evidence in previous literature. It appears that after controlling for its effect through litigation risk, the incremental effect of standard deviation on initial return is negative. This suggests that the positive effect of stock volatility documented by previous literature may be due to a failure to control for litigation risk. Similarly puzzling is the significantly positive relation between initial returns and one-year-ahead stock returns. Alternative specifications produce similar results.

Consistent with the signaling hypothesis, the coefficient on shares sold by insiders is negative, but it is not significant. Signaling theory also predicts a positive relation between underpricing and the probability of a seasoned equity offering in the near future. While most

proceeds and initial returns.

tests find little support for this hypothesis, we rerun the regressions adding a dummy variable equal to one if the firm has a seasoned equity offering within three years of the IPO, zero otherwise. The coefficient is insignificant, and inferences on the other variables are unaffected.

Finally, consistent with the findings of Hanley (1993), we find that the price update is significantly positively related to initial return.

5.2. *Does underpricing deter litigation?*

This section examines the relation between the amount of IPO underpricing and the probability of a lawsuit. The objective is to shed light on the incremental effect of underpricing in reducing the probability of lawsuits. The estimation results are presented in Table 5 in a format similar to Table 4. The first column presents the results from a regular probit regression, with initial return as one of the explanatory variables. The second and third columns present results using the simultaneous-equation approach.

Looking at the second stage equation, most of the coefficient estimates on the control variables are consistent with the inferences in Table 2. The significantly positive coefficients on issuer market capitalization and the venture capital dummy support the importance of ‘deep pockets’. The significantly negative coefficient on one-year stock return and the significantly positive coefficients on standard deviation and turnover are consistent with the prior evidence on factors that lead to litigation. Notably, the coefficient on the technology dummy is significantly negative, suggesting that membership in a high-tech industry *lowers* the probability of experiencing a lawsuit. It is possible that high-tech firms are vulnerable to litigation because of

⁹ As can be seen in Eqs. (4) and (5), we can not recover the original parameters γ_1 and γ_2 . Consequently, even though we can *statistically* test whether the original parameters are zero, we cannot interpret the economic significance of the original equations since we only have estimates for $\gamma_1\sigma_2$ and γ_2/σ_2 .

high stock volatility and stock turnover. After controlling for these effects, membership in a high-tech firm does not incrementally increase a firm's legal exposure.

To test the deterrence effect, we focus on the initial return coefficient. In Column one, initial return is used as one of the explanatory variables, without adjusting for the potential endogeneity. The coefficient on initial return is negative and significant, suggesting that more underpricing reduces the probability of a lawsuit. This is consistent with the deterrence effect of underpricing, but must be interpreted with caution because initial return is endogenous.

In Column three, we estimate Eq. (5) after substituting an instrumental variable for initial return. The instrumental variable equals the fitted value from the first-stage regression. The initial return instrument is still negative, but the significance level is substantially attenuated compared to the simple probit regression. The coefficient is -0.012 , significant only at the 10% level using one-tailed tests.

So far we have provided strong support for the insurance effect, that firms with higher litigation risk underprice their IPOs by a greater amount. Yet we find relatively weak support for the deterrence effect, that greater underpricing lowers a firm's litigation risk. In an attempt to reconcile the two findings, we further investigate the deterrence effect of underpricing. We conjecture that the timing of the lawsuit might be important for detecting the impact of underpricing on litigation risk. Specifically, managers are likely to forecast lawsuits closer to an IPO with greater accuracy. In contrast, a lawsuit that occurs long after an IPO is more likely prompted by random stock price fluctuations not in the managers' information set at the time of IPO, and this greater noise might mask any deterrence effect. Thus, we can enhance the power of the deterrence test by focusing on litigation risk within a shorter horizon. In addition, we find that the median length of time between the IPO and the date on which the lawsuit is filed equals

198 days for lawsuits filed under Section 11, compared to 346 days for all other suits.¹⁰ As discussed earlier, Section 11 lawsuits are more directly related to IPO underpricing than Section 12 and Section 10(b) lawsuits, meaning that underpricing more effectively deters Section 11 lawsuits.

Based on the above analysis, we discard lawsuit observations that happen more than a year and a half after the IPO and re-estimate the simultaneous equations with a focus on the deterrence equation,

$$\text{Litigation risk}^{**} = \mathbf{g}_2^* \text{Initial Return} + \mathbf{b}_2^* \mathbf{X}_2 + \mathbf{v}^*,$$

As can be seen in Panel B, Row 2, the deterrence effect is now statistically significant. The coefficient on γ_2^* is negative, and highly significant (p value=0.02). This is in contrast to the full-sample results shown in Row 1 (copied from Panel A). Row 3 presents the results for the 2-year window. The coefficient is again negative and significant at the 5% level. This evidence indicates that underpricing has significant power to deter a lawsuit that occurs relatively close to the IPO date.

We also perform other sensitivity analyses to test the robustness of both the insurance effect and the deterrence effect. First, we define the initial return as the percentage change between the offer price and the closing prices on the first trading day and on the eleventh trading day (two weeks after an IPO). Second, we define stock related variables, such as return, volatility and turnover, over different intervals, starting from one day and two weeks after the IPO. Third, we recalculate both turnover and market capitalization excluding those shares that are subject to lock-up and therefore not part of the potential damaged class.¹¹ Finally, we rerun the deterrence regressions (shown in Table 5) excluding IPOs with offer prices less than \$5.

¹⁰ We could identify this information only for 45 firms. All suits that are brought under multiple sections are considered Section 11 suits as long as one of them is Section 11.

¹¹ Because we do not have lock-up data for all of the IPOs, this limits our sample.

Since tiny firms are generally not worth suing, their inclusion potentially introduces noise and thus decreases the power of our tests. Results are qualitatively similar across all of these specifications.

6. Conclusion

Potential litigation costs are quite significant for firms that have recently gone public. Attorney fees, the costs of management time allocated to the lawsuit, reputation costs, and settlement costs represent an enormous potential liability for a young firm. Unlike most forms of insurance, IPO underpricing is a viable form of insurance against all of these costs because it lowers plaintiffs' potential recoverable damages, and thus lowers the probability of being sued. This paper investigates the extent to which firms underprice their IPOs as a form of insurance and whether underpricing is effective in deterring litigation.

After controlling for the endogeneity of initial returns and lawsuit probability, the evidence lends support to the litigation risk hypothesis. First, we find that firms with higher litigation risk underprice their IPO by a significantly greater amount. Second, consistent with underpricing representing a viable form of insurance, firms that engage in more underpricing significantly lower their litigation risks, especially for lawsuits occurring closer to the IPO dates.

More generally, our findings emphasize the importance of controlling for endogeneity. For example, results from OLS regressions contradict the insurance effect component of the litigation risk hypothesis. However, this finding was overturned once we jointly modeled initial returns and litigation risk in a simultaneous equations system. Notably, many corporate finance events are similarly endogenous in nature, and researchers' ability to account for such endogeneity in future studies potentially affects the conclusions that are drawn.

This study also emphasizes the importance of considering the *total* costs of litigation, even though some costs are not measurable. Many people perhaps underestimate the importance of litigation, in light of the relatively small litigation settlement payments. However, as mentioned earlier, many of the costs of a lawsuit are indirect, e.g., reputation costs and the opportunity costs of management time dedicated to the lawsuit. The significance of such costs is analogous to the importance of similar indirect costs in bankruptcy proceedings. Warner (1977) finds that the direct costs of bankruptcy average less than 2% of firm value for a sample of railroad firms. When multiplied by the probability of going bankrupt, it is hard to imagine that such *direct* costs alone would substantially affect firm policy. Yet most people consider expected bankruptcy costs to be an important determinant of firm capital structure. In both litigation and bankruptcy, it is important to consider *indirect* costs that are not directly measurable but substantial enough to affect firm behavior.

In summary, our findings support both predictions of the litigation-risk hypothesis. In addition, they highlight the importance of controlling for endogeneity and of considering the total costs of a corporate event.

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Table 1: Data

The sample consists of IPOs between 1988 and 1995 that are in the Securities Data Company (SDC) database. Closed-end funds, REITs, financial firms, reverse LBOs, ADRs, and spinoffs are excluded. Firms must also have data on initial return and the expected offer price range as listed in the preliminary prospectus. The final sample consists of 1841 IPOs. Sued firms represent those IPOs that are listed in the Securities Class Action Alert newsletter or database as having been sued under the Securities Acts of 1933 or 1934. Panel A classifies the total number of IPOs and the number of IPOs that were sued by year. Panel B classifies the firms by industry, where industries are defined by SIC code. Industry classifications are available upon request.

Panel A: Distribution across years

Year	# IPOs	# IPOs that were sued	Percentage of IPOs each year that were sued
1988	102	2	1.96
1989	109	4	3.67
1990	91	6	6.59
1991	223	14	6.28
1992	273	21	7.69
1993	390	27	6.92
1994	222	11	4.95
1995	431	21	4.87
Total	1841	106	5.54

Panel B: Distribution across industries

Industry	# IPOs	# IPOs that were sued	% IPOs in each industry that were sued
Agriculture and Mining	11	0	0.00
Apparel	41	4	9.76
Communications, Computers, & Electronics	601	47	7.82
Construction	23	2	8.70
Finance	1	0	0.00
Food	28	1	3.57
Health	105	7	6.67
Manufacturing Materials	272	10	3.68
Oil & Gas	33	0	0.00
Printing & Publishing	19	0	0.00
Recreation	64	5	7.81
Science	190	9	4.74
Services	77	3	3.90
Trade	254	14	5.51
Transportation	86	2	2.33
Utilities	27	2	7.41
Other	9	0	0.00
Total	1841	106	5.76

Table 2: Descriptive Statistics

The sample consists of IPOs between 1988 and 1995, excluding closed-end funds, REITs, financial firms, reverse LBOs, ADRs, and spinoffs. Firms must also have data on initial return and the expected offer price range as listed in the preliminary prospectus. There are 102 sued IPO firms and 1739 non-sued IPO firms. Some of the variables are based on fewer observations because of missing data. Initial return is the percentage change between the offer price and the closing price on twenty-first day of trading. Market capitalization equals the price 21 trading days after the offer times the number of shares outstanding. Proceeds raised in the IPO (in the domestic market), market capitalization, and total assets after the IPO are in millions of 1983 dollars. Underwriter rank equals the Carter, Dark, and Singh (1998) ranks, with higher ranks representing higher quality underwriters. One-year stock return is the buy-and-hold percentage return during the first year after the IPO. Standard deviation equals the standard deviation of daily returns during the first year after the IPO in percentage terms. Turnover equals $[1 - \Pi_t (1 - \text{volume traded}_t / \text{total shares}_t)]$, computed for the year after the IPO. One-year stock return, standard deviation, and turnover are measured over one year starting at day 22. Firms are labeled as technology firms or venture capital backed IPOs according to the SDC classifications. Frac. secondary offering equals the number of shares sold by insiders in the IPO, divided by the total number of shares in the offering.

	<u>Sued IPO firms</u>		<u>Non-sued IPO firms</u>		<u>Tests</u>
	Mean [median]		Mean [median]		T-test
	(Std Err)		(Std Err)		[Wilcoxon test]
Initial Return	17.55 (3.71)	[9.38]	17.88 (0.82)	[11.35]	-0.09 [-0.77]
Proceeds Raised	27.38 (2.46)	[20.96]	20.84 (0.68)	[14.18]	2.57** [5.40]***
Market Cap after the IPO	133.61 (16.95)	[87.78]	96.22 (4.10)	[50.64]	2.14** [4.31]***
Total assets after IPO	55.55 (10.89)	[32.65]	66.99 (10.11)	[21.54]	-0.77 [4.04]***
Underwriter rank	6.67 (0.34)	[8.75]	5.23 (0.09)	[7.38]	4.10*** [3.32]***
% Firms Backed by Venture Capitalist	59.43%		43.61%		
1 Year Stock Return	-29.92 (6.25)	[-43.53]	16.12 (1.98)	[1.27]	-7.03*** [7.52]***
Standard Deviation	5.39 (0.18)	[5.01]	4.35 (0.04)	[4.10]	5.48*** [6.10]***
Turnover	0.76 (0.02)	[0.81]	0.68 (0.23)	[0.72]	3.93*** [2.98]***
% Technology Firms	50.00%		48.65%		
Frac. Secondary Offering	16.70%	[9.00%]	11.02%	[0.00%]	2.90*** [3.42]***

*Significant at 10% level, ** Significant at 5%, *** Significant at 1%, using two-tailed tests.

Table 3: Correlations

The sample consists of IPOs between 1988 and 1995, excluding closed-end funds, REITs, financial firms, reverse LBOs, ADRs, and spinoffs. Firms must also have data on initial return and the expected offer price range as listed in the preliminary prospectus. There are 102 sued IPO firms and 1739 non-sued IPO firms. Some of the correlations are based on fewer observations because of missing data. Proceeds equals proceeds raised in the IPO. Initial return is the percentage change between the offer price and the closing price on the twenty-first day of trading. Market capitalization equals the price 21 trading days after the offer times the number of shares outstanding. Price update is the percentage change between the midpoint of the file range and the offer price. Return on assets (ROA) equals earnings during the last audited year prior to the IPO over total assets prior to the IPO. Standard deviation equals the standard deviation of daily returns during the first year after the IPO. Turnover equals $[1 - \Pi_t (1 - \text{volume traded}_t / \text{total shares}_t)]$, computed for the year after the IPO. One-year stock return is the buy-and-hold return during the first year after the IPO. Standard deviation, turnover, and one-year stock return are measured over one year starting at day 22. Underwriter rank equals the Carter, Dark, and Singh (1998) ranks, with higher ranks representing higher quality underwriters. Settlement \$/proceeds equals the amount of the settlement, as reported in the SCA newsletter, divided by proceeds raised in the IPO.

	IR	Proceeds	Market capitalization	ROA	Standard Deviation	Turnover	1 Yr Stock Return	Underwriter rank	Price update
Proceeds	0.03								
Market capitalization	0.22 ^{***}	0.81 ^{***}							
ROA	0.05 [*]	0.02	0.09 ^{***}						
Standard Deviation	-0.02	-0.32 ^{***}	-0.27 ^{***}	-0.19					
Turnover	0.35 ^{***}	-0.06 ^{**}	-0.06 ^{**}	0.02	0.14 ^{***}				
1 Year Stock Return	-0.01	0.02	0.07 ^{***}	0.01	-0.33 ^{***}	0.18 ^{***}			
Underwriter rank	0.09 ^{***}	0.30 ^{***}	0.29 ^{***}	0.02	-0.23 ^{***}	0.08 ^{***}	0.06 ^{**}		
Price update	0.34 ^{***}	0.14 ^{***}	0.25 ^{***}	0.05 [*]	-0.06 ^{**}	0.20 ^{***}	-0.02	0.14 ^{***}	
Settlement \$ / proceeds	-0.04	-0.05	-0.04	-0.01	-0.05	-0.20	-0.02	-0.28 ^{**}	0.02

* Significant at 10% level, ** Significant at 5%, *** Significant at 1%, using two-tailed tests.

Table 4: Determinants of Underpricing

These regressions are based on 1423 IPOs between 1988 and 1995. Price update equals the percentage change between the midpoint of the file range and the offer price. The age dummy equals 1 if the firm reports 5 years of earnings in its prospectus, 0 otherwise. All other variables are defined in Table 2. Column 1 represents an OLS regression. Columns 2 and 3 are the first and second stage regressions, respectively, in the simultaneous equation system, where initial return (IR) and lawsuit probability are the endogenous variables. The first stage is a probit regression. The lawsuit instrument in column 3 equals the fitted value from the first stage regression. Standard errors in column 3 are adjusted to account for the fact that the lawsuit instrument is a generated regressor. Standard errors are shown in parentheses.

Variable	Parameter [Marginal effect] Standard Error		
	OLS	Simultaneous Equation	
	Dep.=IR	First-stage Dep.=Suit	Second-stage Dep.=IR
Intercept	20.437*** 5.392	-2.588*** 0.424	138.108*** 50.469
Lawsuit	-7.407** 3.275		
Lawsuit Instrument			54.705** 20.794
Market Cap.	10.193*** 0.930	0.291*** 0.075	-7.298 7.583
1 Year Return	0.001 0.011	-0.005*** 0.001	0.228** 0.104
Standard Dev.	1.790*** 0.544	0.170*** 0.040	-9.021** 4.526
Turnover		0.857*** 0.318	
ROA	1.107 1.068	0.077 0.104	-3.862 6.142
UW Rank	-0.834*** 0.246	0.027 0.020	-2.277* 1.230
Dummy: Age>5 yrs.	-4.432*** 1.711	-0.026 0.124	-1.900 7.051
Tech. Dummy	4.066** 1.686	-0.275*** 0.129	17.595** 8.573
Frac. Secondary Offering	-0.007 0.050	0.003 0.004	-0.231 0.209
Price Update	0.456*** 0.042	-0.004*** 0.003	0.586*** 0.186
Dummy: Venture Capital Backed	0.916 1.733	0.242* 0.133	-14.634** 9.297
(Pseudo) Adj-R ²	0.201	0.157	0.270

* Significant at 10% level, ** Significant at 5%, *** Significant at 1%, using two-tailed tests.

Table 5: Determinants of IPO lawsuits

Panel A: Full Sample Analysis

Panel A tests the deterrence effect using 1423 IPOs between 1988 and 1995. Please refer to Tables 2 and 4 for variable definitions. Column 1 represents an OLS regression. Columns 2 and 3 are the first and second stage regressions, respectively, in the simultaneous equation system. The first stage is an OLS, and the second stage is a probit regression. The IR instrument equals the fitted value from the first stage regression. Standard errors, shown in parentheses, are adjusted for generated regressors.

Variable	Parameter [Marginal Effect] Standard Error		
	Probit	Simultaneous Equation	
	Dep.=Suit	First-stage Dep.=IR	Second-stage Dep.=Suit
Intercept	-2.690*** 0.430	-3.456*** 5.523	-2.628*** 0.431
IR	-0.008*** 0.002		
IR Instrument			-0.012 0.009
Market Cap.	0.369*** 0.079	8.635*** 0.890	0.393*** 0.131
1 Year Return	-0.005*** 0.001	-0.029*** 0.010	-0.005*** 0.001
Standard Dev.	0.178*** 0.041	0.276 0.524	0.173*** 0.040
Turnover	1.298*** 0.345	46.903*** 3.941	1.409** 0.618
ROA	0.100 0.107	0.373 1.022	0.082 0.104
UW Rank	0.017 0.019	-0.874*** 0.235	0.017 0.021
Dummy: Age>5 yrs	-0.025 0.125	-3.346** 1.635	-0.066 0.131
Tech. Dummy	-0.257** 0.130	2.560 1.614	-0.245* 0.134
Frac. Secondary Offering	0.002 0.004	-0.090* 0.048	0.002 0.004
Price Update		0.357*** 0.041	
Dummy: Venture Capital backed	0.237* 0.133	-1.371 1.662	0.226* 0.135
(Pseudo) Adj-R ²	0.173	0.270	0.155

Panel B: Further Analysis of Deterrence Effect

Panel B performs a sensitivity analysis for the deterrence effect of initial returns. Specifically, we rerun the simultaneous equations with the focus on the deterrence equation, $Lawsuit\ Prob.^* = \beta^* IR + \beta_2^* X_2 + v^*$, limiting the time windows of the lawsuits. Row 1 replicates the results from Panel A, i.e. it is based on all lawsuits. In Row 2, a lawsuit observation is used only if the suit occurs within 2 years of the IPO. We report the estimated coefficients for γ_1 .

Sample	Coefficient on γ_1	Standard Error
<i>Full Sample: lawsuits within 3 years</i>	-0.012	0.009
<i>Sub-sample: lawsuits within 1.5 years</i>	-0.023**	0.011
<i>Sub-sample: lawsuits within 2 years</i>	-0.018**	0.011

* Significant at 10% level, ** Significant at 5%, *** Significant at 1%, using one-tailed tests.

