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An empirical investigation of IPO returns and subsequent equity offerings*

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Several recent papers present signaling models in which firms underprice their initial public offerings of equity (IPOs) so that they can subsequently issue seasoned equity at more favorable prices. We test the implications of these models. We find a positive relation between IPO underpricing and the probability and size of subsequent seasoned offerings. Although these results are consistent with the implications of the signaling hypotheses, the economic significance appears weak. We conduct additional tests to evaluate other explanations for these findings and find the alternatives more compelling.

Key words: IPO underpricing; Market-feedback hypothesis; Seasoned equity offering; Signaling hypothesis

1. Introduction

A number of theoretical models have been proposed to explain why initial public offerings of equity (IPOs) are on average underpriced [see Ibbotson (1975) and Ritter (1987)]. Recently, Allen and Faulhaber (1989), Chemmanur (1993), Grinblatt and Hwang (1989), and Welch (1989) presented signaling models of IPOs that differ from earlier models[1] in two important respects. First,

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[1]Examples of other models of IPO underpricing are Baron (1982), Rock (1982, 1986), Beatty and Ritter (1986), Benveniste and Spindt (1989), and Welch (1992).

these models endow the issuer, not outside investors or underwriters, with superior information. Second, the issuers explicitly consider the possibility of future equity issues in deciding on IPO prices. Typically, in these models, the firm raises capital through IPOs and expects to raise additional funds in the future through seasoned equity offerings (SEOs). 'High-quality' firms underprice their IPOs to credibly separate themselves from 'low-quality' firms, and thereby raise additional capital under more favorable terms in the future. The price at which a high-quality firm expects to issue seasoned equity is higher than what it could expect if it did not signal its quality through its IPO pricing decision, and the expected benefit at the time of the SEO offsets the signaling costs. In these models, a firm's 'true' quality may be exogenously revealed to the market with a certain probability between the IPO and the seasoned equity offering. As a consequence, low-quality firms are deterred from mimicking the high-quality firms because they are less likely to reap the benefits of IPO underpricing by selling their seasoned issues at higher prices.

We examine the relation between returns around the initial public offerings of firms and their subsequent decisions to raise additional capital through SEOs. Under the signaling models we expect that firms with greater IPO underpricing are: (a) more likely to subsequently issue seasoned equity; (b) likely to issue larger amounts of equity in their seasoned offerings; (c) likely to issue seasoned equity more quickly after the IPO; and (d) likely to experience a smaller price drop when the SEO is announced.

Consistent with these predictions, we find that firms that underprice their IPOs relatively more are more likely to issue seasoned equity, and on average to have larger seasoned offerings; in addition, these firms experience smaller price drops on the SEO announcement dates. These relations, however, are rather weak from an economic perspective. For example, 15.6% of the firms in the lowest IPO underpricing quintile (average underpricing of -6.4%) issue seasoned equity, whereas 23.9% of the firms in the largest underpricing quintile (average underpricing of 42.9%) reissue equity. The lack of a strong association between IPO underpricing and subsequent seasoned equity offerings calls into question the explanatory power of the signaling hypothesis. Moreover, there are other explanations for these empirical regularities. In fact, the results of additional tests favor these alternatives. One alternative explanation we consider is what we call the market-feedback hypothesis. This hypothesis posits that the market is better informed than the issuer and hence a high return on the IPO date implies that the issuer has underestimated the marginal return to the project. The issuer uses this information and increases the scale of the project by raising additional capital through seasoned offerings. Alternatively, in the spirit of the pooling equilibrium in Allen and Faulhaber (1989) and Welch (1989), it is possible that all issuer types pool (or set the same IPO price) and the high-quality firms issue seasoned equity if and when the market discovers their true quality.

To explore whether the observed relations between IPO returns and SEO activity can be explained by the market-feedback and/or pooling hypotheses, we examine whether the returns in two 20-trading-day periods immediately after the IPOs are related to subsequent equity offerings. Under these two alternative hypotheses, we expect the abnormal share price changes during the immediate post-issue period to have the same effect on future equity issues as similar price changes on the issue date. Under the signaling hypothesis, in contrast, the return on the IPO date plays a unique role: the issuer signals its quality only through IPO underpricing. Therefore, under the signaling hypothesis we expect IPO underpricing to affect subsequent equity offers differently from the returns in the period immediately following the IPO date.

We find that firms with higher post-IPO abnormal returns are more likely to return to the seasoned equity market and to return with larger offerings. In fact, the point estimates indicate a *stronger relation* between the aftermarket return in either of the 20-day periods and the likelihood of future seasoned offerings than between IPO returns and the likelihood of future seasoned offerings. Further, firms that experience higher returns in the aftermarket issue seasoned equity sooner. These results support the market-feedback and pooling hypotheses, and suggest that the association between IPO underpricing and subsequent seasoned offerings is also related to these hypotheses.

The rest of this paper is organized as follows. Section 2 presents the hypotheses that we test. Section 3 discusses our data, and section 4 contains the results of our empirical tests. Section 5 presents our conclusions

2. The hypotheses

This section describes the testable hypotheses of the signaling models. The central result of the theoretical models of Allen and Faulhaber (1989), Chemmanur (1993), Grinblatt and Hwang (1989), and Welch (1989) is that high-quality firms underprice their IPOs so they can subsequently issue seasoned equity at a favourable price. In reality, not all firms that underprice their IPOs issue seasoned equity. Some of the firms that underprice their IPOs with the intention of issuing seasoned equity may fail to do so because of unexpected economic shocks. Such shocks are less likely, however, to deter firms of very high quality (i.e., firms that substantially underpriced their IPOs) than those of marginally high quality (i.e., firms that underpriced their IPOs relatively less). Thus, the signaling hypothesis predicts:

H.1. Firms with higher IPO returns are more likely to issue seasoned equity than firms with lower IPO returns.[2]

[2]See Allen and Faulhaber (1989) for further discussion of this hypothesis.

Under the signaling hypothesis the costs of raising funds at the IPOs are higher for firms that underprice more, so these firms are more likely to raise a larger proportion of their capital requirements through seasoned offerings. Therefore, the signaling hypothesis implies:

H.2. Firms with higher IPO returns are likely to issue larger amounts of seasoned equity than firms with lower IPO returns.

Further, we expect firms with large IPO returns to return to the equity markets faster. The intuition behind this proposition is that it is more costly for the high-quality firms to defer their investments in new projects than for firms of relatively low quality. Therefore, under the signaling hypothesis we predict:

H.3. Firms with higher IPO returns are more likely to issue seasoned equity more quickly after the initial offerings than firms with lower IPO returns.

Since firms with higher IPO returns are more likely to return with seasoned equity issues, the market should be less surprised by seasoned equity issue announcements by these firms. Therefore, under the signaling hypothesis we expect:

H.4. The market will react less unfavourably to the announcements of seasoned equity issues by firms with higher IPO returns than by firms with lower IPO underpricing.[3]

These four hypotheses are also consistent with the market-feedback and pooling hypotheses. As discussed earlier, the market-feedback hypothesis posits that any relation between IPO underpricing and SEOs is due to the market information revealed to the issuer. Under the pooling hypothesis, the IPO price *per se* is not informative, but the IPO-date return provides a measure of the extent to which the market is able to discriminate high-quality firms from low-quality firms and thereby affects the likelihood of future SEOs. Unlike the signaling hypothesis, however, these hypotheses do not accord a unique role to the return on the IPO date. We test the following hypotheses to examine whether the market-feedback or the pooling hypothesis can potentially explain any relation we find between IPO returns and seasoned equity offerings:

H.1a. IPO-date returns are better predictors than returns in the period immediately after the IPO (henceforth 'aftermarket returns') of firms that subsequently issue seasoned equity.

[3]It has been well documented that the stock market reacts unfavorably to announcements of seasoned equity issues [see Smith (1986) for a summary of the evidence in the literature].

H.2a. IPO returns are better predictors than aftermarket returns of the size of the seasoned equity issues.

H.3a. IPO returns are better predictors than aftermarket returns of the time between the IPO and the first seasoned equity issue.

H.4a. IPO returns are better preditors than aftermarket returns of the stock-price reaction at the announcement of the first seasoned equity issue.

3. Data and methodology

Our sample consists of all firm-commitment initial public offerings from 1980 through 1986, as provided by Securities Data Corporation and published in Zehring & Co.'s *Corporate Finance Sourcebook*. We exclude best-efforts offerings because they are fundamentally different from firm-commitment offerings and because serious doubts have been expressed about whether investors in these firms can realize the returns on the dates of the IPOs.[4] We exclude IPOs issued after 1986 because we require data on seasoned equity issues for a three-year period after the IPO and our seasoned-issue data end in December 1989. We also require that the closing price be available in the Center for Research in Security Prices (CRSP) database for at least one day in the 30-day period after the IPO date.[5] There are 1,985 IPOs that meet our selection criteria. We then identify from the *Corporate Finance Sourcebook* the firms that filed with the SEC to issue seasoned equity within three years of the IPO.[6] We also obtain a complete list of SEC filing dates from this source, which we use as seasoned equity offering announcement dates.[7] Finally, we obtain the returns on the seasoned equity offering announcement dates from the CRSP NASDAQ and New York Stock Exchange/American Stock Exchange (NYSE/Amex) database.

The main explanatory variable we use to test the signaling hypothesis is the stock return on the IPO date (we define this variable, *UNDP*, as the difference between the first aftermarket price and the IPO issue price divided by the issue price). There is evidence that IPO underpricing is related to a variety of other

[4]For instance, see 'The Penny Stock Scam', Business Week, January 23, 1989, pp. 74–82.

[5]If the first date on which aftermarket price is available is more than 30 days after the IPO date we exclude the firm from our sample. For most of the sample firms the first aftermarket price is available within two days of the IPO.

[6]Some firms in our sample issue seasoned equity more than once in the three years after the IPO. We consider only the first offering in our analysis.

[7]We repeated our tests with announcement dates obtained from the Wall Street Journal Index and the Dow Jones News Service. These announcement dates were available for only about half the firms in our sample. The results reported here hold when we use these announcement dates instead of the SEC filing dates.

variables. To check whether our results on the explanatory power of IPO underpricing are driven by the correlation of seasoned issues with other well-known (or plausible) determinants of IPO underpricing, we extract a measure of 'unexplained' IPO underpricing. We regress *UNDP* against the following variables: (a) aftermarket standard deviation of returns[8] (*STDDEV*), (b) the Carter and Manaster (1990) rank of the lead underwriter (*IIBRANK*), (c) the reciprocal of the nominal offering price (1/*OP*), (d) the proportion of primary shares in the offering (*PRIMARY*), (e) the log of the last reported annual sales before the IPO (*LSALES*), (f) the log of the age of the firm before the IPO (*LAGE*), (g) a dummy for whether the offering is a unit offering (*ISUNIT*), and (h) the log of the amount of capital raised in the IPO (*LIPOSIZE*). In addition, we include a set of IPO year and industry dummies in the regression.[9] This regression is estimated with a sample of 1,391 firms with complete data, which is about 70% of our original sample. The resulting estimates are (t-statistics in parentheses):

$$\begin{aligned} UNDP = {} & \underset{(4.64)}{2.104}\,STDDEV - \underset{(-3.99)}{0.011}\,IIBRANK + \underset{(0.41)}{0.009}\,(1/OP) \\ & + \underset{(0.16)}{0.004}\,PRIMARY - \underset{(-3.11)}{0.014}\,LSALES - \underset{(-0.12)}{0.001}\,LAGE \\ & - \underset{(-5.76)}{0.140}\,ISUNIT + \underset{(3.89)}{0.030}\,LIPOSIZE \\ & + \text{year and SIC dummies.} \end{aligned} \tag{1}$$

The residual from the regression is the unexplained underpricing (*UUNDP*). We conduct our tests in the next section using raw underpricing as one explanatory variable and, in addition, replicate these tests using *UUNDP* in place of raw underpricing for the subsample of firms for which we have the data to estimate the residuals.

The other variables in our analysis are defined as follows:

REISSUE = dummy variable that assumes a value of one if the firm issues seasoned equity within three years of its IPO and zero otherwise.[10]

[8]The standard deviation of returns is estimated over days 1 to 100 after the IPO.

[9]Data for all of the variables used in this regression are taken from Securities Data Corporation except for (a) *AGE*, obtained from *Standard and Poor's Corporate Records* or *Moody's Manuals*, (b) *IIBRANK*, obtained from Carter and Manaster (1990), and (c) *STDDEV*, computed from CRSP return data as described in the previous footnote.

[10]Our results are not sensitive to the length of time after the IPO we use to classify whether or not a firm issues seasoned equity. We found results similar to those reported here when we used a five-year period instead of a three-year period.

AFTRET1 = abnormal return over the period from trading day 1 to trading day 20 after the IPO date. The abnormal return is estimated as the raw return minus beta times the market return. The CRSP value-weighted NASDAQ index is used as the market proxy and beta is estimated from a market-model regression fitted over days 41 to 140 following the IPO date.

AFTRET2 = same as *AFTRET1*, except that it covers the period from trading day 21 to trading day 40 after IPO.

We choose a 40-day post-IPO window to measure the aftermarket returns used in the tests for two reasons. First, we want the calendar time between the post-IPO window and the SEO to be comparable to that between the IPO and SEO. Second, the cross-sectional standard deviation of the aftermarket returns in the 40-day window is about the same as the cross-sectional standard deviation of the IPO date returns, which suggests that the same amount of information is revealed to the market during these two periods.

The following variables are defined only for firms that issue seasoned equity within three years of their IPOs:

SEOSIZE = size of the first seasoned equity offering within three years of the IPO, expressed in millions of dollars. If a firm does not issue seasoned equity within this period, *SEOSIZE* is set to zero. *LSEOSIZE* is the natural logarithm of *SEOSIZE* if this variable is greater than zero.

SEO/MKT = *SEOSIZE* as a fraction of the market value of equity at the time of the SEO announcement.

SEO/IPO = *SEOSIZE* as a fraction of the capital raised in the IPO.

SIBRANK = Carter and Manaster rank for the lead investment banker for the SEO.

ΔT = number of calendar days between the IPO and filing date for the first SEO.

ANNREACT = abnormal return around the date when the firm files with the SEC for the issue of seasoned equity.[11] The abnormal return is estimated in the same manner as the aftermarket returns,

[11] We repeated our tests with different definitions of announcement dates and our results were similar to those reported here. The other announcement dates we considered are the announcement dates in the WSJ or on the Dow Jones ticker tape and also the earliest of these dates and the SEC filing date.

over the event days -1, 0 and $+1$, where day 0 is the filing date.

SIC = set of 14 industry dummy variables based on the SIC codes of the firms in the sample. Our classification scheme is largely based on that of Ritter (1991).

IPOYR = set of six dummy variables that are set equal to one for the year of issue and zero otherwise. For example, the first *IPOYR* dummy variable is set equal to one if the IPO year is 1980 and zero otherwise; the second *IPOYR* dummy variable is set equal to one if the IPO year is 1981 and zero otherwise; and so on.

SEOYR = set of eight dummy variables that are set equal to one for the year of the seasoned equity issue and zero otherwise. These variables are defined like those for *IPOYR*.

All dollar-denominated variables are adjusted for inflation using the consumer price index and are expressed in 1980 dollars. Table 1 presents the distribution of new and seasoned equity offerings through time. Most IPOs and SEOs occur during the mid-1980s. Issues from 1983 to 1986 account for about 80% of the IPOs and 40% of the SEOs in our sample.

Table 1

Distribution of 1,985 firm-commitment initial public offerings (IPOs) and 411 first seasoned equity offerings (SEOs) by offering year, 1980–1989.

Initial public offerings by sample firms are shown in columns 2 and 3, seasoned equity offerings by these firms are shown in columns 4 and 5. For example, in 1981, we found 12 SEOs issued by some of the 72 + 199 IPO firms in 1980 and 1981. The IPOs are firm-commitment offerings in the 1980–1986 period. The SEO sample consists of the first seasoned equity offering within three years of the IPO.

	Initial public offerings		Seasoned offerings	
Year	Number	Percentage	Number	Percentage
1980	72	3.63%		
1981	199	10.03%	12	2.92%
1982	82	4.13%	35	8.52%
1983	548	27.61%	81	19.71%
1984	226	11.39%	27	5.57%
1985	262	13.20%	71	17.27%
1986	596	30.03%	97	23.60%
1987			65	15.82%
1988			16	3.89%
1989			7	1.70%
Total	1,985	100.00%	411	100.00%

Table 2

Descriptive statistics on 1,985 firm-commitment IPOs in the 1980–1986 period and 411 first seasoned equity offerings[a] (SEOs) in the 1980–1989 period.

Variable	Description	N	Mean	Std. dev.	Min.	Med.	Max.
UNDP	IPO underpricing	1,985	0.0978	0.2428	– 0.3990	0.0250	3.6875
UUNDP	Residual IPO underpricing[b]	1,391	0.0000	0.1599	– 0.3543	– 0.0319	1.7315
AFTRET1	First 20-day abnormal aftermarket return[c]	1,985	0.0044	0.1753	– 0.5562	– 0.0116	2.7632
AFTRET2	Second 20-day abnormal aftermarket return[c]	1,985	0.0134	0.1512	– 0.5038	– 0.0005	1.3115
IPOSIZE	IPO size (in 1980-million dollars)	1,985	17.3468	43.9570	0.7096	7.50623	910.1089
REISSUES	Dummy for SEO issue	1,985	0.2076	0.4057	0	0	1
	Variables to construct residual underpricing UUNDP						
LSALES	Log[d] of pre-IPO sales (in 1980-million dollars)	1,391	2.9212	1.4128	0.0953	2.9124	9.1417
LAGE	Log[d] years since incorporation	1,391	2.3919	1.3510	0	2.3026	5.1059
IIBRANK	Rank of IPO lead investment banker[e]	1,391	6.2038	2.2894	0	7	9
1/OP	Reciprocal of nominal offer price	1,391	0.1723	0.2418	0.0247	0.1278	6.5789
PRIMARY	Prop. of primary shares	1,391	0.8363	0.2136	0.0325	1	1
ISUNIT	Unit offering	1,391	0.0446	0.2064	0	0	1
	411 first seasoned equity offerings						
UNDP	IPO underpricing	411	0.1132	0.2695	– 0.3875	0.0357	3.6875
UUNDP	Residual IPO underpricing[b]	326	0.0093	0.1664	– 0.3460	– 0.0236	1.5038
AFTRET1	First 20-day aftermarket abnormal return	411	0.0332	0.1665	– 0.3991	0.0134	1.0324
AFTRET2	Second 20-day aftermarket abnormal return	411	0.0359	0.1367	– 0.3916	0.0097	0.6283
IPOSIZE	IPO size (in 1980-million dollars)	411	16.5167	21.1119	1.0419	10.4448	179.1877
SEOSIZE	SEO size (in 1980-million dollars)	411	16.9747	16.3283	0.7123	12.3399	107.0495
SEO/MKT	SEO size/Outstanding equity	410	0.2557	0.2092	0.0293	0.2067	2.3084
SEO/IPO	SEO size/IPO size	411	1.4268	1.0030	0.0903	1.2153	9.1470
SIBRANK	Rank of SEO lead investment banker[e]	313	6.9361	1.8847	0	7.5	9
ΔT	Time between IPO and SEO (in days)	411	523.0414	263.0431	100	470	1095
ANNREACT	SEO announcement abnormal return[c,f]	411	– 0.0116	0.0640	– 0.2578	– 0.0122	0.3156

[a]To be included in the sample, an SEO had to occur within three years of the IPO and be the first SEO of this firm.
[b]For further details on *UUNDP*, refer to eq. (1).
[c]Beta-adjusted aftermarket returns.
[d]The natural logarithm of one plus the variable.
[e]The underwriter rank is defined as in Carter and Manaster (1991).
[f]The event window is (– 1, 0, + 1), where 0 is the announcement day.

Table 2 presents the descriptive statistics on all variables used in the paper. The average IPO underpricing in our sample is 9.78%.[12] The average IPO underpricing for the SEO sample is 11.29%, which indicates that the underpricing is on average only slightly higher for the firms that reissue equity than for those that do not reissue. This evidence suggests that any relation between IPO underpricing and SEOs is likely to be weak.

The average aftermarket returns are also higher for the SEO subsample than for the entire sample. For example, the average abnormal return during the first 20 days after issue (*AFTRET1*) for the entire sample is 0.44%, whereas for the sample that subsequently returns to the market it is 3.26%. The average time between the IPO and the first seasoned equity issue is about two years. The average security-price reaction to the SEO announcement is about −1%. Finally, the firms that issue seasoned equity on average raise 1.4 times as much capital through seasoned issues as they raise in their IPOs (both adjusted to 1980 dollars).

4. Empirical results

4.1. Probability of seasoned equity issue

We test the hypothesis that the probability of a firm's issuing seasoned equity is related to IPO underpricing and to aftermarket returns by estimating the following logit model:

$$P_i = e^{\alpha + x_i'\beta + u_i}/(1 + e^{\alpha + x_i'\beta + u_i}) , \tag{2}$$

where P_i is the probability that the ith firm issues seasoned equity and x_i is the column vector of independent variables. The three independent variables of primary interest are the IPO underpricing (*UNDP*) and the unexpected aftermarket returns in the two 20-day periods after the IPO (*AFTRET1* and *AFTRET2*). Since firms that raise relatively small amounts of capital at the IPO may be more likely to return with a seasoned equity offering, we include the natural logarithm of IPO size as an additional explanatory variable. Finally, we allow for potential differences in SEO activity across years and across industry groups by including industry and year dummy variables (*SIC* and *IPOYR*) as independent variables in the logit regression.

Table 3 presents the logit regression estimates.[13] The slope coefficient (t-statistic) on the variable *UNDP* is 0.4442 (1.93).[14] The slope coefficients

[12] This is less than the 16.3% underpricing reported by Ibbotson, Sindelar, and Ritter (1988). The difference is probably due to our exclusion of best-efforts offerings, which are on average more underpriced than firm-commitment offerings.

[13] For the sake of brevity, we do not report the estimates of the slope coefficients on the year and SIC dummy variables.

[14] The t-statistics reported here are based on the estimates of asymptotic standard errors. We also computed the t-statistics by estimating bootstrapped standard errors. In the bootstrap experiment we omitted IPOs from one calendar year at a time. Our inferences do not change with the estimation method used.

Table 3

Logit regression estimates of the relation between stock returns at the time of the IPO and the probability of a subsequent seasoned equity offering[a] (SEO) for 1,985 firm-commitment IPOs in the 1980–1986 period.

The dependent variable is a dummy that is assigned a value of one if a firm issues seasoned equity within three years of its IPO and zero otherwise. The independent variables are IPO underpricing (*UNDP* and *UUNDP*), the abnormal aftermarket returns in the two 20-day periods after the IPO (*AFTRET1* and *AFTRET2*), the logarithm of IPO size (*LIPOSIZE*), and dummy variables for industry groups and the year of the IPO. For more detailed variable definitions, refer to table 2. The subsample consists of firms (about 70% of the full sample) for which data are available to allow us to extract a measure of unexplained IPO underpricing, *UUNDP* [for further detail, refer to eq. (1)]. The t-statistics are reported in parentheses below the corresponding estimates.

	Full sample	Subsample	
UNDP	0.4442 (1.93)	–	0.3333 (0.83)
UUNDP	–	0.3523 (0.85)	–
AFTRET1	0.9261 (2.84)	1.1455 (2.60)	1.1401 (2.58)
AFTRET2	1.4375 (3.79)	2.2556 (4.57)	2.2537 (4.57)
LIPOSIZE	0.4267 (6.70)	0.4024 (5.02)	0.4054 (5.07)
Industry and year dummies	Estimates are not reported		
Cragg–Uhler R^2	13.46%	14.27%	14.28%
N	1,985	1,391	1,391

[a]To be included in the sample, an SEO had to occur within three years of the IPO and be the first SEO of this firm.

(t-statistics) on the aftermarket return variables *AFTRET1* and *AFTRET2* are 0.9261 (2.84) and 1.4375 (3.79).[15] These point estimates suggest a stronger relation between the aftermarket price appreciation in each of the 20-day windows and the likelihood of SEOs than between *UNDP* and the latter.

Table 3 also reports the logit estimates with unexplained IPO underpricing (*UUNDP*) as an independent variable in place of raw IPO underpricing. The sample for estimating this regression is smaller, since the data required to estimate the unexplained IPO underpricing are not available for all the firms in our sample. The slope coefficient estimate (t-statistic) on unexplained IPO underpricing is 0.3523 (0.85), which is not reliably different from zero. To examine whether the difference in this estimate is due to differences in the sample characteristics or to the change in the definition of the underpricing variable, we fit the logit model with *UNDP* as the independent variable for this subsample of

[15]We obtained similar results when we used raw aftermarket returns in place of *AFTRET1* and *AFTRET2*.

IPOs. The estimate of the slope coefficient on *UNDP* is 0.3334, which is close to the estimate for unexplained IPO underpricing. Therefore, the difference between the underpricing coefficients for the subsample and the full sample does not seem to be related to how underpricing is defined, but rather to the exclusion of a significant part of the sample. The point estimates of the slope coefficients on the aftermarket return variables, however, remain significantly positive in the subsample.

The estimates here are obtained under the assumption that the probability of a firm's issuing seasoned equity is characterized by the logistic distribution. We explore the relation between SEOs and IPO underpricing and aftermarket returns further by examining the fraction of firms within subsamples partitioned on the basis of these variables.[16] The results of these tests also allow us to assess the economic significance of the predictability of future seasoned issues based on returns around the IPOs.

We consider the relation between IPO underpricing and the probability of seasoned offerings first. The firms are ranked in ascending order of IPO underpricing and grouped into IPO underpricing quintiles. Table 4 reports the fraction of firms that issue seasoned equity within the three years of the IPO for each quintile. Only 15.62% of the firms in the lowest IPO underpricing quintile issue seasoned equity, compared with 23.93% of the firms in the largest underpricing quintile. About 21% of the firms in the other three quintiles issue seasoned equity and there is virtually no difference across these quintiles. These results indicate that the differences in the predictability of future seasoned offerings are important mostly for extreme IPO underpricing.

Table 4 also reports the fraction of firms that issue seasoned equity within quintiles based on aftermarket returns. The differences between these fractions are particularly large across the extreme quintiles in this grouping as well. For instance, 15.11% of the firms in the lowest *AFRET2* quintile issue seasoned equity, whereas the corresponding percentage in the other extreme quintile is nearly twice that, at 29.98%

When quintiles are based on 40-day aftermarket returns (*AFTRET1* and *AFTRET2*), there is clear monotonic relation between the quintile rank and the likelihood of issuing seasoned equity, even for the intermediate quintiles. These results suggest that the aftermarket returns are more useful than IPO underpricing for predicting which firms will issue seasoned equity, which is contrary to Hypothesis H.1a.

4.2. The size of seasoned equity offerings

We use a tobit model to test the hypothesis that the size of a firm's seasoned equity issue is related to returns around its IPO. The tobit regression specifies

[16] Warner, Watts, and Wruck (1988) use a similar procedure to assess the goodness-of-fit of the logit regression.

Table 4

Actual and predicted incidence of seasonal equity offerings[a] (SEOs) by quintiles of IPO and abnormal aftermarket returns for 1,985 firm-commitment IPOs in the 1980–1986 period.

UNDP is the IPO underpricing, *AFTRET1* and *AFTRET2* are abnormal aftermarket returns in the two 20-day periods after the IPO. For more detailed variable definitions, refer to table 2. Quintiles are formed based on the variable listed in the first column of each block. 'Actual' refers to the percentage of firms that issued seasoned equity within three years of the IPO. 'Predicted' refers to the mean fitted values from the logit model from the full sample regression in table 3.

		% of firms reissuing			% of firms reissuing			% of firms reissuing			% of firms reissuing	
Quintile	*UNDP*	Actual	Predicted	*AFTRET1*	Actual	Predicted	*AFTRET2*	Actual	Predicted	*AFTRET1* + *AFTRET2*	Actual	Predicted
1	− 6.40%	15.62%	17.11%	− 19.05%	17.63%	17.99%	− 16.03%	15.11%	17.26%	− 26.30%	15.11%	16.28%
2	0.32%	21.16%	21.36%	− 7.33%	17.13%	18.73%	− 5.53%	20.40%	19.30%	− 9.64%	16.62%	18.55%
3	2.62%	21.41%	20.12%	− 1.14%	17.63%	19.71%	− 0.22%	18.89%	19.58%	− 0.48%	17.88%	19.69%
4	9.44%	21.66%	22.62%	5.46%	24.43%	22.07%	5.78%	19.40%	21.38%	9.40%	24.69%	21.92%
5	42.92%	23.93%	22.57%	24.24%	26.95%	25.27%	22.68%	29.97%	26.25%	35.89%	29.47%	27.34%

[a]To be included in the sample, an SEO had to occur within three years of the IPO and be the first SEO of this firm.

Table 5

Tobit regression estimates of the relation between stock returns at the time of the initial public offering and the size of subsequent seasoned equity offerings[a] (SEOs) for 1,985 firm-commitment IPOs in the 1980–1986 period.

The dependent variable is the size of the seasoned equity offering, measured as a fraction of the IPO size (*SEOSIZE/IPOSIZE*). *SEOSIZE* is zero if a firm does not issue seasoned equity within three years of the IPO. For more detailed variable definitions, refer to table 2. The independent variables are IPO underpricing (*UNDP* and *UUNDP*), the abnormal aftermarket returns in the two 20-day periods after the IPO (*AFTRET1* and *AFTRET2*), the logarithm of IPO size (*LIPOSIZE*), and dummy variables for industry groups and the year of the IPO. The subsample consists of firms (about 70% of the full sample) for which data are available to allow us to extract a measure of unexplained IPO underpricing, *UUNDP* [for further detail, refer to eq. (1)]. The t-statistics are reported in parentheses below the corresponding estimates.

	Full sample	Subsample	
UNDP	0.2596 (2.07)	–	0.1551 (0.71)
UUNDP	–	0.1384 (0.62)	–
AFTRET1	0.6543 (3.87)	0.7158 (3.00)	0.7100 (2.97)
AFTRET2	0.7518 (3.60)	1.1701 (4.40)	1.1710 (4.41)
LIPOSIZE	0.1804 (5.13)	0.1537 (3.48)	0.1551 (3.52)
Industry and year dummies	Estimates are not reported		
Squared corr.	6.45%	9.40%	9.42%
N	1,983	1,391	1,391

[a]To be included in the sample, an SEO had to occur within three years of the IPO and be the first SEO of this firm.

the relation between the size of seasoned offerings and the explanatory variables as follows:

$$(SEO/IPO)_i = \begin{cases} \alpha + x_i'\beta + u_i & \text{if} \quad \text{RHS} > 0\,, \\ 0 & \text{otherwise}\,, \end{cases} \tag{3}$$

where SEO/IPO_i is the real value of capital raised by the ith firm in the seasoned offering as a fraction of the real value of capital raised in the IPO. The vector of independent variables x_i is the same as that used for the logit analysis in the last subsection. This specification accounts for the fact that the recorded sizes of the seasoned offerings are bounded below by zero. For instance, some of our sample firms may have reduced the scale of the operations for which they raised capital at the time of their IPOs, for reasons such as unanticipated declines in project value, but these actions are not publicly observed, so the capital raised by these firms is recorded as zero. The tobit specification explicitly accounts for the fact that the data are left-censored.

Table 5 reports the tobit regression estimates. The estimate (t-statistic) of the slope coefficient on the variable *UNDP* is 0.2596 (2.07), which indicates that firms that are more underpriced at their IPOs tend to raise more capital through subsequent seasoned equity issues. The slope coefficients on the aftermarket return variables *AFTRET1* and *AFTRET2* are 0.6543 and 0.7518, and both these estimates are reliably different from zero. These results indicate that firms that experience larger price appreciation after their IPOs are likely to raise larger amounts of capital through seasoned equity issues. Although we do see evidence that IPO underpricing is related to the size of subsequent SEOs, we do not see evidence of unique importance of IPO-date returns.

Table 5 also reports the tobit estimates for the subsample of stocks for which the data to estimate unexpected underpricing are available. As with the logit regression, the slope coefficients of underpricing, both raw and residual, are not significant in the subsample, whereas those of the aftermarket returns are significant.

We examine mean predicted and observed relative SEO size by quintiles of the relevant IPO variables to judge the goodness-of-fit of the tobit model. Table 6 reports the results of the analysis. The differences in mean relative SEO sizes are particularly large across the extreme quintiles. For example, the mean size of SEOs for the lowest and largest IPO underpricing quintiles are 0.1755 and 0.3181. The mean relative SEO sizes are virtually the same, however, across the three intermediate *UNDP* quintiles. In contrast, when quintile ranks are based on 40-day aftermarket returns, there is a clear monotonic relation between the ranks and the mean relative SEO size. In addition, the differences between the average relative SEO sizes for the extreme quintiles are larger when firms are sorted on aftermarket returns rather than on IPO underpricing.

4.3. Time between the IPO and the first SEO

We now examine the relation between returns around the time of the IPO and the time before a firm returns to the market with a seasoned equity offering. For the firms that have an SEO within three years of their IPO, we regress the log of time between the SEO and the IPO on underpricing and aftermarket returns and the control variables used in the logit and tobit regressions. Table 7 presents the regression estimates.

For the full sample, the slope coefficient estimate on *UNDP* is negative, as expected, but only marginally significant (t-statistic of -1.77). The estimates of the slope coefficients on the aftermarket return variables *AFTRET1* and *AFTRET2*, however, are more negative and reliably different from zero at the 5% level. Table 7 also reports the regression estimates for the subsample of 328 IPOs with subsequent SEOs for which we have enough information to estimate the unexplained component of IPO underpricing. The results are similar to those reported for the entire sample of SEO firms. As before, our findings are not

Table 6

Actual and predicted relative size of seasoned equity offerings[a] (SEOs) by quintiles of IPO and abnormal aftermarket returns for 1,985 firm-commitment IPOs in the 1980–1986 period.

UNDP is the IPO underpricing, *AFTRET1* and *AFTRET2* are abnormal aftermarket returns in the two 20-day periods after the IPO. For more detailed variable definitions, refer to table 2. Quintiles are formed based on the variable listed in the first column of each block. 'Actual' refers to the average observed relative SEO size (*SEOSIZE/IPOSIZE*). 'Predicted' refers to the fitted values for this relative size from the full sample regression in table 5.

		Relative SEO size			Relative SEO size			Relative SEO size		*AFTRET1* +	Relative SEO size	
Quintile	*UNDP*	Actual	Predicted	*AFTRET1*	Actual	Predicted	*AFTRET2*	Actual	Predicted	*AFTRET2*	Actual	Predicted
1	− 6.40%	17.55%	19.08%	− 19.05%	18.73%	19.57%	− 16.03%	16.00%	19.93%	− 26.30%	15.92%	17.43%
2	0.32%	25.24%	23.88%	− 7.33%	20.39%	20.77%	− 5.53%	27.43%	22.02%	− 9.64%	17.91%	20.43%
3	2.62%	26.26%	23.40%	− 1.14%	19.75%	22.16%	− 0.22%	22.65%	22.22%	− 0.48%	22.23%	22.20%
4	9.44%	26.04%	27.54%	5.46%	28.22%	25.82%	5.78%	22.89%	24.92%	9.40%	29.93%	25.73%
5	42.92%	31.81%	27.77%	24.24%	39.82%	33.36%	22.68%	37.94%	32.59%	35.89%	40.92%	35.88%

[a]To be included in the sample, an SEO had to occur within three years of the IPO and be the first SEO of this firm.

Table 7

OLS regression estimates of the relation between stock returns at the time of the IPO and the log time between the IPO and the seasoned equity offering (SEO) for 411 SEOs[a] in the 1980–1989 period.

The dependent variable is the log of the time between the IPO and the SEO (*LAT*). The independent variables are IPO underpricing (*UNDP* and *UUNDP*), the abnormal aftermarket returns in the two 20-day periods after the IPO (*AFTRET1* and *AFTRET2*), the logarithm of the IPO size (*LIPOSIZE*), and dummy variables for industry and the year of the IPO. For more detailed variable definitions, refer to table 2. The subsample consists of firms (about 65% of the full sample) for which data are available to allow us to extract a measure of unexplained IPO underpricing, *UUNDP* [for further detail, refer to eq. (1)]. The *t*-statistics are reported in parentheses below the corresponding estimates.

	Full sample	Subsample	
UNDP	− 0.160	−	− 0.198
	(− 1.76)		(− 1.31)
UUNDP	−	− 0.285	−
		(− 1.83)	
AFTRET1	− 0.652	− 0.696	− 0.709
	(− 4.69)	(− 4.11)	(− 4.17)
AFTRET2	− 0.815	− 0.868	− 0.863
	(− 4.77)	(− 4.46)	(− 4.41)
LIPOSIZE	− 0.111	− 0.071	− 0.071
	(− 3.89)	(− 2.13)	(− 2.15)
Industry and year dummies	Estimates are not reported		
R^2	37.18%	40.94%	40.62%
$\bar{R}^2$	33.27%	36.23%	35.89%
N	411	326	326

[a]To be included in the sample, an SEO had to occur within three years of the IPO and be the first SEO of this firm. The IPO sample consisted of 1,985 firm-commitment offerings in the 1980–1986 period.

sensitive to whether total underpricing or unexplained underpricing is used as an independent variable. This result indicates that, among the firms that issue seasoned equity, those that experience larger stock-price appreciation after the IPO tend to return to the market earlier than the others.

Table 8 presents quintile analysis similar to that conducted for the logit and tobit models; the results confirm our regression findings. There is virtually no relation between quintile mean underpricing and average time between IPO and SEO for that quintile. For the aftermarket return variables, however, we see a monotonic relation between aftermarket return in either period and the average time between IPO and subsequent SEO.

4.4. Market anticipation

Finally, we examine the relation between the stock-price response to the announcement of seasoned equity offerings and underpricing and aftermarket

Table 8

Actual and predicted log time between the IPO and the seasoned equity offering (SEO) by quintiles of IPO and abnormal aftermarket returns for 411 SEOs[a] in the 1980–1989 period.

UNDP is the IPO underpricing, *AFTRET1* and *AFTRET2* are abnormal aftermarket returns in the two 20-day periods after the IPO. ΔT is the number of trading days between the IPO and the first seasoned equity offering, provided it occurs within three years of the IPO. For more detailed variable definitions, refer to table 2. IPOs without a seasoned offering are omitted. Quintiles in each block are formed based on the variable listed in the first column of each block. 'Predicted' refers to the exponentials of the fitted values for the log time between the IPO and the SEO from the full sample regression in table 7.

		ΔT			ΔT			ΔT		*AFTRET1* +	ΔT	
Quintile	*UNDP*	Actual	Predicted	*AFTRET1*	Actual	Predicted	*AFTRET2*	Actual	Predicted	*AFTRET2*	Actual	Predicted
1	− 5.39%	530	490	− 15.78%	639	591	− 12.94%	619	559	− 21.03%	627	595
2	0.79%	544	505	− 5.23%	578	521	− 4.13%	555	490	− 5.22%	576	527
3	3.56%	527	496	1.54%	474	434	− 1.57%	487	482	4.75%	551	465
4	11.42%	501	439	8.45%	492	450	9.73%	522	478	16.39%	455	444
5	45.60%	509	472	27.68%	430	404	23.76%	429	392	39.77%	402	370

[a]To be included in the sample, an SEO had to occur within three years of the IPO and be the first SEO of this firm. The IPO sample consisted of 1,985 firm-commitment offerings in the 1980–1986 period.

Table 9

OLS regression estimates of the relation between stock returns at the time of the IPO and the seasoned equity offering (SEO) announcement-period abnormal return for 410 SEOs[a] in the 1980–1989 period.

The dependent variable is the abnormal SEO three-day announcement price reaction (*ANNREACT*). The independent variables are IPO underpricing (*UNDP*), the rank of the lead underwriter in charge of the SEO (*SIBRANK*), the abnormal aftermarket returns in the two 20-day periods after the IPO (*AFTRET1* and *AFTRET2*), the log of the time between IPO and SEO (*LΔT*), the logs of the IPO offering (*LIPOSIZE*) and SEO offering size (*LSEOSIZE*), the size of the SEO as a fraction of the IPO size (*SEO/IPO*) and as a fraction of the value of the firm at the time of the SEO (*SEO/MKT*), and a complete set of SEO year, IPO year, and industry dummies. For more detailed variable definitions, refer to table 2. The sample consists of all IPOs from the 1980–1986 period that were followed by an issue of seasonal equity within three years. The subsample consists of firms (about 65% of the full sample) for which data are available to allow us to extract a measure of unexplained IPO underpricing, *UUNDP* [for further detail, refer to eq. (1)]. The *t*-statistics are reported in parentheses below the corresponding estimates.

	Full sample	Subsample	
UNDP/100	2.642	-	2.800
	(2.06)		(1.12)
UUNDP/100	-	3.3163	-
		(1.30)	
AFTRET1/100	0.538	4.241	4.163
	(0.26)	(1.62)	(1.59)
AFTRET2/100	− 0.60	1.404	1.374
	(− 0.24)	(0.49)	(0.48)
LIPOSIZE/1,000	7.504	5.006	4.496
	(0.69)	(0.32)	(0.29)
LΔT/1,000	− 7.954	− 2.380	− 2.565
	(− 0.82)	(− 0.22)	(− 0.24)
LSEOSIZE/1,000	− 5.879	1.655	2.020
	(− 0.54)	(0.11)	(0.13)
(*SEO/IPO*)/1,000	7.602	− 2.356	− 2.617
	(1.18)	(− 0.23)	(− 0.26)
(*SEO/MKT*)/1,000	0.035	0.048	0.048
	(1.97)	(2.18)	(2.18)
SIBRANK/1,000	-	− 6.052	− 5.860
	-	(− 2.19)	(− 2.11)
Industry and year dummies	Estimates are not reported		
R^2	13.37%	19.62%	19.47%
$\bar{R}^2$	5.01%	6.52%	6.35%
N	410	265	265

[a]To be included in the sample, an SEO had to occur within three years of the IPO and be the first SEO of this firm. The IPO sample consisted of 1,985 firm-commitment offerings in the 1980–1986 period.

Table 10

Actual and predicted seasoned equity offering (SEO) abnormal announcement price reactions by quintiles of IPO and abnormal aftermarket returns for 410 SEOs[a] in the 1980–1989 period.

UNDP is the IPO underpricing, *AFTRET1* and *AFTRET2* are abnormal aftermarket returns in the two 20-day periods after the IPO. For more detailed variable definitions, refer to table 2. Quintiles in each block are formed based on the variable listed in the first column of each block. 'Predicted' refers to the fitted values for the abnormal SEO announcement returns from the full-sample regression in table 9. The sample consists of all IPOs from the 1980–1986 period that were followed by an issue of seasoned equity within three days.

		ANNREACT			*ANNREACT*			*ANNREACT*		*AFTRET +*	*ANNREACT*	
Quintile	*UNDP*	Actual	Predicted	*AFTRET1*	Actual	Predicted	*AFTRET2*	Actual	Predicted	*AFTRET2*	Actual	Predicted
1	− 5.39%	− 2.65%	− 1.97%	− 15.78%	− 0.99%	− 1.07%	− 12.94%	− 0.97%	− 0.45%	− 21.03%	− 1.11%	− 0.78%
2	0.79%	− 2.04%	− 1.17%	− 5.23%	− 2.27%	− 1.00%	− 4.13%	− 0.97%	− 1.21%	− 5.22%	− 1.57%	− 1.33%
3	3.56%	− 2.19%	− 1.39%	1.54%	− 2.31%	− 1.66%	1.57%	− 1.05%	− 1.09%	4.75%	− 1.64%	− 0.97%
4	11.42%	− 0.23%	− 1.14%	8.45%	− 0.63%	− 1.28%	9.73%	− 2.17%	− 1.45%	16.39%	− 1.24%	− 1.49%
5	45.60%	0.17%	− 0.02%	27.68%	− 0.64%	− 0.81%	23.76%	− 1.67%	− 1.61%	39.77%	− 1.27%	− 1.24%

[a]To be included in the sample, an SEO had to occur within three years of the IPO and be the first SEO of this firm. The IPO sample consisted of 1,985 firm-commitment offerings in the 1980–1986 period.

returns. We expect the market to be less surprised by SEO announcements by firms that experience relatively larger price appreciation at the time of their IPOs, so we expect the price decline normally associated with SEO announcements to be less severe for these firms. We test this hypothesis by regressing the announcement-date stock return (*ANNREACT*) against the independent variables used in the previous regressions and the following additional variables: the natural logarithm of the number of calendar days between the IPO and the SEO announcement date (*LΔT*), the log of the size of the SEO (*LSEOSIZE*), the size of the SEO in relation to the size of the IPO (*SEO/IPO*), the size of the SEO in relation to the market value of equity at the time of the SEO announcement (*SEO/MKT*), and the Carter and Manaster rank for the lead underwriter for the SEO (*SIBRANK*).[17] These variables are included to control for possible differences in the extent to which the market is surprised by the SEO announcements that are unrelated to the stock returns around the time of their IPOs.

Table 9 presents the ordinary least squares estimates of this regression model.[18] The estimate of the slope coefficient on the variable *UNPD* is reliably positive. This indicates that the stock market reacts less unfavourably to SEO announcements by firms with high IPO returns, which in turn implies that the market attaches a higher probability to such announcements by these firms. In contrast, the estimates of the slope coefficients on the variables *AFTRET1* and *AFTRET2* are not significantly different from zero. Table 10 presents the results within quintiles based on IPO returns and aftermarket returns. The stocks in the lowest IPO underpricing quintile experience a −2.65% announcement-date return on average, whereas the stocks in the largest underpricing quintile on average experience a 0.17% return on this date. There does not seem to be any relation, however, between the announcement-date return and aftermarket return quintiles.

These results are somewhat surprising, given our earlier findings. One possible interpretation of the insignificant relation between aftermarket returns and the returns on the seasoned equity offering announcement dates is that the market expectations do not reflect the statistical relation between aftermarket returns and seasoned equity offerings that we document. It is also possible that this test is weaker than the logit regression. The logit regression uses the information in the subset of firms that issue seasoned equity and in the subset of firms that do not, whereas regression (3) is fitted with only the former subset.

[17]The lead underwriters for the SEOs are different from the lead underwriters for the IPOs for some firms. See James (1992) for an analysis of the determinants of underwriter switches.

[18]As mentioned earlier, our results are similar when the announcement date is the first mentioned date in the Wall Street Journal or on the Dow Jones ticker tape. We obtained similar results using market-adjusted SEO announcement date returns as the dependent variable.

5. Conclusion

Recent papers by Allen and Faulhaber (1989), Chemmanur (1993), Grinblatt and Hwang (1989), and Welch (1989) propose signaling models in which issuers convey their private information about the value of their projects by underpricing their IPOs. These models imply that firms with large IPO underpricing are (a) more likely to issue seasoned equity subsequently; (b) more likely to issue larger amounts of equity in their seasoned offerings; (c) likely to issue seasoned equity more quickly after their initial public offerings; and (d) likely to experience a smaller price drop on the date of the SEO announcement than firms with low IPO underpricing. Similar predictions, however, also arise from the market-feedback and pooling hypotheses we consider. Under these hypotheses, the issuer's IPO pricing decision does not convey any information to the market about the firm's quality. These hypotheses therefore do not accord a unique role to the IPO-date returns, but predict that the relation between returns in the immediate post-IPO period and seasoned equity offering decisions will be similar to that between the latter and IPO underpricing.

We find that firms that experience relatively larger IPO-date returns are more likely to issue seasoned equity within three years of their IPOs and that their seasoned equity offerings tend to be larger. We also find that the market returns in the two 20-day periods immediately following the IPOs are significantly positively related to the probabilities of subsequent seasoned equity offerings and the sizes of these offerings. Moreover, firms that experience relatively high returns in these periods return to the market with a seasoned equity issue more quickly than firms with low aftermarket returns. These results indicate that the return on the date of the IPO does not play a unique role in predicting future seasoned equity offerings. This evidence suggests that, contrary to the basic implication of the signaling hypothesis, issuers do not have to rely on the costly underpricing mechanism to signal to the market information relevant for future equity issues. Therefore, although we do find evidence consistent with the signaling hypothesis, when the evidence documented here is viewed in its entirety, the support for the signaling hypothesis as a major determinant of IPO underpricing is weak.

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