IPO Underpricing, Insider Selling and Subsequent Equity Offerings: Is Underpricing a Signal of Quality?

Jon A. Garfinkel

Jon A. Garfinkel is a Doctoral Candidate in Finance at the Graduate School of Business, University of Florida, Gainesville, Florida.

■ Recent papers (e.g., Allen and Faulhaber [1], Welch [31], and Grinblatt and Hwang [10]) model IPO underpricing as a mechanism for signalling firm quality. The basic idea behind these theories is that high quality firms are firms that have favorable private information about their future prospects that will be at least partially revealed at some future date. These papers argue that underpricing is a vehicle whereby firms with favorable private information can signal their quality and thereby increase the price received in subsequent securities offerings. In particular, firms with favorable private information underprice their initial offering, and because there is a positive probability that true firm quality will be exogenously revealed prior to a subsequent sale, it is costly for low quality firms to mimic them. Previous research has focused on the implication of these models that underpricing will be positively related to the probability of the firm selling additional equity before inside information at the time of the IPO is revealed to the market through other mechanisms (see Jegadeesh, Weinstein, and Welch [16] (JWW)).

An additional implication of these signalling models is that underpricing will be related to the probability that firm insiders will sell shares in the open market at some future date. Specifically, just as firms with favorable private information underprice to increase the proceeds from subsequent seasoned offerings, insiders may also recoup the costs of underpricing through subsequent open market sales of their shares at a more favorable price. Thus, these signalling theories imply a relation between underpricing and subsequent insider sales, and therefore provide an additional test of underpricing as a signal of quality.

A difficulty associated with testing for a relation between underpricing and the likelihood of seasoned offerings or open market insider sales is that underpricing may be correlated with other variables that impact the likelihood of subsequent equity sales. In particular, underpric-

ing may be affected by ex-ante uncertainty surrounding the issue (see, for example, Beatty and Ritter [6]). Moreover, proxies for ex-ante uncertainty, for example, the importance of growth options, may also be related to the likelihood of subsequent equity offers. To isolate the signalling content of underpricing, proxies for ex-ante uncertainty observable at the time of the IPO should be controlled for in explaining the likelihood of insider selling or firm equity issuance.

In addition, Hanley [11] shows that underpricing is related to the partial adjustment phenomenon. Briefly, the partial adjustment process, as modeled by Benveniste and Spindt [7], involves investment bankers partially adjusting the share price and number of shares issued in response to strong demand for an IPO during the pre-selling period. The IPO share price is not fully adjusted to reflect strong demand because complete adjustment would result in no compensation to informed investors for truthfully revealing their information about demand for the shares. In the model, favorable information is revealed through high demand for the issue, while bad information is revealed through low demand for the issue.

Since the IPO offer price (and number of shares offered) are only partially adjusted to reflect strong demand, the share price will rise in the secondary market once trading begins. This implies that underpricing will be directly related to partial adjustment in the IPO offer price and the number of shares issued. Moreover, upward adjustment in price and shares offered lead to greater proceeds at the IPO, perhaps mitigating the need to reissue or sell shares in the open market. As a result, this partial adjustment phenomenon must be controlled for when testing for a relation between underpricing and the likelihood of a seasoned offering or open market insider sale.

Finally, analysis of the partial adjustment phenomenon provides an additional test of the market feedback hypothesis as suggested by JWW [16]. In their test of the signalling by underpricing theories, JWW [16] suggest the "market feedback hypothesis" as an alternative (to the signalling) hypothesis that is consistent with the observed positive relation between underpricing and the likelihood of a seasoned offering. Specifically, JWW [16] argue that underpricing informs the original owners of the firm that the marginal returns to their projects have been underestimated by the firm. The market believes that the firm's projects are worth more than is indicated by the IPO price, and push up the share price (on the first trading day) in the market. JWW [16] argue that under the market feedback hypothesis, share price changes in the early post-IPO period will have equal or greater explanatory power for the

probability of reissue than underpricing.[1] Unfortunately, the analysis by JWW [16] does not control for the effect of the partial adjustment phenomenon on underpricing. Since partial adjustment can be construed as pre-IPO market feedback, JWW [16] may be misestimating the signalling importance of underpricing on the probability of reissue.

This paper examines the relation between underpricing and both subsequent equity issuance and open market insider sales. Although other papers have tested for a relationship between underpricing and seasoned equity issuance (see Welch [31], JWW [16], and Michaely and Shaw [23]), this is the first paper to examine the role of open market insider sales as a mechanism to recoup the losses associated with underpricing. It is also the first test of IPO underpricing as a signal that controls for partial adjustment as well as other factors affecting underpricing.

The preceding can be formalized in the following two hypotheses:

> (i) *Hypothesis 1: The Seasoned Offering Signalling Hypothesis.* The *likelihood* that a firm will issue seasoned equity is positively related to underpricing, after controlling for factors related to both underpricing and the probability of reissue.

> (ii) *Hypothesis 2: The Open Market Insider Sales Signalling Hypothesis.* Insiders of firms that experience greater IPO underpricing are more *likely* to sell shares in the open market, after controlling for factors related to both underpricing and the probability of an open market insider sale.

The rest of the paper is organized as follows. Section I contains a description of the data and some summary statistics. Section II describes the model and methodology and Section III provides results. Section IV concludes.

I. Data

The initial sample is Chris James' IPO dataset, comprised of all firms that made initial public equity offerings between January 1, 1980 and December 31, 1983 and were announced in the *Investment Dealer's Digest* as using firm commitment underwriting agreements. Further, none of these firms possessed outstanding publicly traded securities at the time of their IPO, nor did they include warrants as part of the offering. The sample consists of 549 firms, none of which are regulated. Initial returns on the IPO (my

---

[1]JWW [16] use the run-up in the firm's stock for the two 20-day periods following the IPO to proxy for the market feedback effect.

measure for underpricing) were obtained from Ritter's IPO database.[2]

Data on preliminary prospectus price ranges and shares offered come from *Going Public: The IPO Reporter* published by Howard & Co. I use both the preliminary price range and initial number of shares to be offered from the preliminary prospectus. I construct two variables to proxy for partial adjustment: (i) the difference between the final IPO price and the midpoint of the preliminary price range, and (ii) the difference between the final number of shares offered and the preliminary number of shares to be offered. The required data were only available from 1981 on, shrinking the sample to 494 firms. Aftermarket returns are from the CRSP daily NASDAQ and NYSE/AMEX tapes.

For the sample of IPOs, I also examine whether firms make a seasoned equity offer within a period of seven years following the IPO. Information on seasoned equity offers was obtained from the Moody's *Over The Counter* and *Industrial* 1991 Manuals. I follow each IPO forward seven years to determine whether they ever reissue equity. In other words, I determine whether 1980 IPO firms reissue by the end of 1987 and I follow 1983 IPO firms through 1990 to determine whether they issue seasoned equity. Of the 494 firms in my sample, 101 reissue equity within seven years of their IPO.

I also examine insider sales for the firms in my sample. An insider sale is defined as the open market sale of 10,000 or more shares by an owner or director within two years of the IPO.[3] My data on open market insider sales come from the Securities and Exchange Commission's Insider Trading Tape. I define insiders as owners and directors, since these individuals appear to be the most likely candidates for initial (pre-IPO) shareholders.[4] I choose a two-year interval since most of the reissuance activity by firms in the sample occurs within two years of the IPO.

Exhibit 1 provides summary statistics for the sample of IPOs studied. Average and median initial returns for the firms in the sample are 10.2% and 5.3%, respectively. JWW [16] document average underpricing of 9.78%. In my sample, 51.6% of the firms show positive underpricing.

Exhibit 2, Panel A contains descriptive statistics for firms classified by reissuance behavior. Note that only 20.5% of the firms reissue equity within seven years of the

Exhibit 1. Summary Statistics for the Sample of 494 IPOs Issued During the Period 1981-1983

	Mean	Median	Min	Max
Offer size (000s)	$15,116	$9,933	$1,400	$215,000
Assets (000s)	$20,116	$7,329	$52	$236,398
Sales (000s)	$33,102	$11,519	$0	$716,397
Age (in years)	8.94	5.2	0.08	80
Initial return	0.102	0.053	-0.9	4.0

IPO. Welch [31], in contrast, finds 28%. This difference may be attributable to the different sample period and the inclusion of IPOs with warrants in his sample. Given the frequency of reissue (28% in Welch's [31] sample), signalling to improve seasoned offering prices does not appear to be the sole motivation for underpricing, otherwise one would expect either a greater percentage of IPOs to reissue, or a smaller percentage of IPOs to be underpriced.

Average underpricing by firms in my sample that reissue is 10.71%, while firms that do not reissue experience average underpricing of 10.07%. This difference is not significant at conventional levels ($t < 0.5$). If firms with positive partial adjustment in price are discarded, average underpricing by reissuers is 8.28% versus 7.01% for non-reissuers. Although the difference in underpricing across groups widens, it is still not significant at conventional levels.

Exhibit 2, Panel B examines the characteristics of firms whose insiders sell shares in the open market with those whose insiders do not. Note that 15% of the firms in my sample have at least one large open market insider sale associated with them.[5] Average underpricing by firms with open market insider sales (12.2%) is not significantly different from underpricing by firms without open market insider sales (9.8%), with a t-statistic equal to 0.74. Finally, average underpricing by firms that either reissue or whose insiders sell shares (11.8%) is not significantly different from underpricing by firms that exhibit neither reissuance nor insider selling (9.5%) (t-statistic = 0.89).

[2]Percent underpricing is calculated as the closing bid price at the end of the first day of trading, less the offer price, all divided by the offer price.

[3]Since the sale of small share blocks is more likely to represent a liquidity trade, I do not include these in the analysis (see Seyhun [30]).

[4]The Insider Trading Tape does not provide information on whether the insider was an initial (pre-IPO) shareholder.

[5]Although many firms have multiple open market sales by insiders, I use the first of such sales to measure the average time to sale. I do this because it allows me to treat all firms with one or more insider sales the same. This alleviates the need for a complex weighting scheme to facilitate the analysis of underpricing's effect on the likelihood of open market insider sales.

Exhibit 2. Characteristics of Firms Broken Down by Reissuance and Insider Selling Activity

Panel A. Characteristics of Firms That Reissue Equity Versus Firms That Do Not Reissue Within Seven Years of IPO

	Reissuers	Nonreissuers
% of all IPOs	20.5%	79.5%
Average underpricing	10.71%	10.07%
Average amount of subsequent offer	22.5 million	N/A
Average relative size of IPO to SO	98%	N/A
Average number of months from IPO to subsequent offer	24	N/A

Panel B. Characteristics of Firms With Open Market Insider Sales During Two Years After the IPO, Versus Firms Without

	Firms With OMIS	Firms Without OMIS
% of all IPOs	15%	85%
Average underpricing	12.2%	9.8%
Average number of months to open market insider sale	15	N/A

Panel C. Characteristics of Firms With Both OMIS and Equity Reissuance Versus Firms With Neither

	Firms With Both	Firms With Neither
% of all IPOs	4.55%	68.6%
Average underpricing	8.59%	9.5%
Average number of months to first action	14	N/A

II. Tests of Underpricing as a Signal of Quality

A. Underpricing, Ex-Ante Uncertainty and Partial Adjustment

Taken together, the above results suggest that signalling is not a significant determinant of underpricing. The above analysis, however, does not control for other factors (such as partial adjustment and ex-ante uncertainty) that may affect underpricing. In this section, I examine the relation between underpricing, partial adjustment and proxies for ex-ante uncertainty. In the next section, I examine the relation between insider sales, seasoned equity offerings and underpricing while controlling for these factors.

Several proxies for ex-ante uncertainty have been suggested in the literature on IPO underpricing (see Beatty and Ritter [6], James and Weir [15], Barry, Muscarella, and Vetsuypens [4], Ritter [28], and others). James and Weir

[15] argue that ex-ante uncertainty is decreasing in the existence of debt in a firm's pre-IPO capital structure. Ritter [28] and Barry, Muscarella, and Vetsuypens [4] posit that the age of the firm (measured in years since the date of incorporation) is negatively related to ex-ante uncertainty. Carter and Manaster [8] assert that prestigious underwriters are associated with IPOs with low dispersion in firm value (less ex-ante uncertainty). Barry and Brown [3] suggest a positive relation between firm-specific information in the equity market and firm size. Larger IPOs should be associated with larger firms and thus, under Barry and Brown's hypothesis, less ex-ante uncertainty.

Finally, Marsh [21] argues that the ratio of plant and equipment to total assets (*Plant*) proxies for the ratio of tangible assets to total assets. Firms with more intangible assets (or growth options) are more difficult to value, i.e., there is greater ex-ante uncertainty regarding their true value. Therefore, underpricing should be increasing in the ratio of intangible to tangible assets or decreasing in the ratio *Plant*.

The above factors, identified in the IPO literature as affecting underpricing, may also be related to the probability of reissue. For example, Myers [25] shows that the existence of debt in a firm's capital structure induces an underinvestment problem. This implies a negative relationship between the endogenous existence of debt in a firm's capital structure pre-IPO and the probability of reissue. In addition, Myers [25] argues that growth-oriented firms are more likely to finance projects using equity as opposed to debt. Therefore, firms with more growth options should be more likely to issue seasoned equity, especially since they are more likely to receive profitable projects that must be financed with outside capital.

James [14] finds evidence that firms using prestigious underwriters reissue more often. These firms also experience less underpricing on average than firms using non-prestigious underwriters (see Carter and Manaster [8], although James and Weir [15] do not find supporting evidence). Older firms with longer operating histories are more likely to survive and issue securities in the future, implying a positive relation between firm age and the probability of reissue, although older firms may have less need for external equity capital. Finally, larger firms are more likely to survive and reissue, suggesting a positive relation between IPO size and the likelihood of a seasoned offer.

Exhibit 3 provides cross-correlations between underpricing, partial adjustment variables and proxies for ex-ante uncertainty. The correlation results indicate that underpricing is affected by both the partial adjustment

Exhibit 3. Cross-Correlations Between Underpricing, a Seasoned Offering Dummy, Two Partial Adjustment Variables and Various Proxies for Ex-Ante Uncertainty

	Reissue	Undpg	Pdiff	Shsadj	DebtD	RankD	LnSize	LnAge	Plant
Reissue	1	0.036	0.02	0.108	0.001	0.098	0.17	-0.03	-0.05
Undpg		1	0.24	0.148	-0.176	-0.069	-0.08	-0.17	-0.06
Pdiff			1	0.016	0.017	0.060	0.24	0.03	-0.01
Shsadj				1	0.035	-0.014	0.16	-0.08	0.03
DebtD					1	-0.038	0.17	0.20	0.01
RankD						1	0.44	0.04	0.05
LnSize							1	0.07	0.04
LnAge								1	0.07
Plant									1

Note: Variables are defined in the Appendix located at the end of this article.

phenomenon and proxies for ex-ante uncertainty. Underpricing is directly related to the percentage difference between the final IPO price and the average of the prices in the preliminary prospectus (*Pdiff*) as well as the percentage adjustment in shares offered from the preliminary to final prospectuses (*Shsadj*). In other words, upward partial adjustment in offer price and shares issued indicates strong demand, which is reflected in the initial return on the stock.

Underpricing is decreasing in the indicator for the existence of debt in a firm's pre-IPO capital structure. This is consistent with the joint hypothesis that greater ex-ante uncertainty leads to greater underpricing and the existence of debt in a firm's capital structure pre-IPO indicates lower ex-ante uncertainty (see James and Weir [15] for further discussion). Finally, underpricing is decreasing in the age of the firm (measured in years since the date of incorporation) at the time of the IPO. This is consistent with the findings by Ritter [28] and Barry, Muscarella, and Vetsuypens [4].

I examine the marginal effects of the above variables on underpricing via an ordinary least squares regression. The results are (*t*-statistics in parentheses):

$$Undpg = 0.446 + 0.316Pdiff + 0.038Shsadj - 0.090DebtD$$
$$\quad\quad (4.95) \quad\; (5.52) \quad\quad\; (3.27) \quad\quad\; (2.88)$$
$$\quad\quad + 0.011RankD - 0.025LnSize - 0.022LnAge$$
$$\quad\quad\; (0.53) \quad\quad\quad (2.12) \quad\quad\quad (2.44)$$
$$\quad\quad - 0.011Plant \quad\quad\quad\quad\quad\quad\quad\quad (1)$$
$$\quad\quad\; (0.97)$$

$N = 379$ (due to missing data); Adjusted $R^2 = 0.133$

where *Undpg* is the underpricing variable and the other variables are as defined in the Appendix.

The adjusted $R^2 = 13.3\%$ is comparable to those found in the literature on IPO underpricing. In particular, Hanley [11] reports an adjusted R^2 of 17.8%, while Beatty and

Ritter [6] explain seven percent of the variation in underpricing. James and Weir [15] report an adjusted R^2 of 11%.

The observed significant relations from the cross-sectional regression imply that any test for a relation between underpricing and insider selling or firm equity issuance should control for the above factors. Specifically, I use the unexplained underpricing or error from Model (1) as the underpricing variable in my test for a relation between underpricing and either reissue or open market insider sales.

B. Underpricing and the Probability of Reissue

I test for a relationship between underpricing and the probability of reissue using a logit model while controlling for the effects of ex-ante uncertainty and the partial adjustment phenomenon. Specifically, in testing the signalling hypotheses, I include proxies for ex-ante uncertainty and partial adjustment, in addition to the unexplained underpricing (or error) from Equation (1). Under the signalling by underpricing hypotheses, firms with greater underpricing are more likely to reissue equity than firms with less underpricing.

I also test for a relationship between underpricing and the likelihood of open market sales by insiders using a logit model that controls for the same potentially confounding variables. If initial (pre-IPO) shareholders (owners) underprice to signal their quality and thus obtain a more favorable price on subsequent sales of equity, they may also recoup their losses due to underpricing by selling their shares in the open market. Thus, the signalling theories imply a positive relation between underpricing and the likelihood of an open market insider sale.

Finally, I control for the stock price performance of the firm in the post-IPO period. Lucas and McDonald [19] argue that firms which experience a run-up in stock price are more likely to issue equity. Their intuition is as follows.

Suppose that investment project arrival is independent of a firm's price history. Overvalued firms which receive a project will have average to superior price performance prior to their reissuance. This is because they issue as soon as the project arrives, and the firm's stock price path is assumed to be normal. However, undervalued firms will wait to reissue (so long as the danger of losing the project by waiting is not too high), and will therefore experience a run-up prior to reissuance. Given that there exist undervalued firms in the market, the average stock price path prior to reissuance should be upward biased.

The reason undervalued firms wait to reissue stems from Myers and Majluf's [26] arguments. Managers act in old shareholders' interests and would therefore prefer not to issue equity to new holders at bargain prices. If a project arrives while the firm's stock is undervalued, the manager waits until the stock price rises to fair value before issuing equity. I expect a positive relation between the probability of reissue and the run-up in stock price immediately after the first day of trading of a firm's IPO. This expectation is also consistent with the notion that the market may know of a project's arrival (which the firm will wish to finance) and will push up the stock price.

Finally, Lin and Howe [18] find that insider sales are more likely following a run-up in the insider firm's stock price. I control for this in my insider selling logit model.

My logit model takes the following general form:

$$Reissue = f(Initial\ Res,\ Pdiff,\ Shsadj,\ Firm\ Ret,\ Mkt\ Ret,$$
$$DebtD,\ RankD,\ LnSize,\ LnAge,\ Plant). \qquad (2)$$

I test the open market insider sales signalling hypothesis using a logit model to relate the probability of an open market insider sale to underpricing, partial adjustment variables, proxies for ex-ante uncertainty and the firm's and market's stock price performance following the IPO. All cumulative returns are for 200 days following the IPO unless the open market insider sale occurs before the end of this period, in which case the cumulative returns are calculated until the day before the sale. Again, the use of these cumulative returns to explain the likelihood of an open market insider sale allows me to examine whether insiders are more likely to sell shares following a run-up in stock price (see Lin and Howe [18]).

Finally, I test for a relationship between three possible "y" outcomes and the explanatory variables from Equation (2). In particular, the three possible "y" outcomes are: (i) the firm reissues equity or (ii) exhibits an open market insider sale or (iii) both events occur; while the explanatory variables are underpricing, the firm's and market's price performance following the IPO, and proxies for ex-ante

uncertainty regarding firm value. The test utilizes a multinomial logit specification. This allows me to examine the effect of each explanatory variable on the likelihood of reissue separately from their effect on the probability of open market insider sales. If I were to treat reissuance and insider selling as equivalents (ones) in a standard logit, this would imply an identical impact of all explanatory variables on the likelihood of reissue as on insider selling.

III. Results on IPO Underpricing as a Signal of Quality

A. Seasoned Offerings, Insider Selling and Underpricing

The results from testing the seasoned offering signalling hypothesis are presented in Exhibit 4. *Initial Res* (my measure of unexplained underpricing) fails to significantly explain the likelihood of a seasoned offer ($t = 1.131$).[6] This is inconsistent with the signalling by underpricing theories. Under the null hypothesis of Welch's [31] signalling theory, firms that underprice more are more likely to reissue equity in the future. The data do not indicate such a relationship is reliably present.

The coefficient on the adjustment in shares offered (*Shsadj*) exhibits a sign consistent with the "pre-IPO" market feedback hypothesis, but it is not significant at conventional levels. Specifically, this hypothesis states that market feedback during the pre-selling period convinces owners to issue more shares in the IPO and increases the likelihood of a seasoned offer. The negative coefficient on the extent of price adjustment (*Pdiff*) is more puzzling. Perhaps the additional funds raised through the increased offer price mitigate the need to reissue equity later. (Recall that additional shares offered between the preliminary and final prospectuses, *Shsadj*, are often provided by existing shareholders, raising no additional funds for the firm.) Overall, the lack of significant coefficients on *Shsadj* and *Pdiff* is generally inconsistent with the pre-IPO market feedback hypothesis.

The significant positive ($t = 3.48$) relation between the probability of reissue and the firm's cumulative raw return

---

[6]Giliberto [9] shows that when residuals from an orthogonalization procedure are used to explain a dependent variable in a second pass regression, the coefficient on the residual is unbiased. However, if the independent variables used in the first pass (orthogonalization) regression are included as independent variables in the second pass regression (along with the residuals), the coefficients on these variables are biased. I therefore run my logit on raw underpricing and the proxies for ex-ante uncertainty and partial adjustment. The results using this second procedure are qualitatively similar to those reported in Exhibit 4.

Exhibit 4. Logistic Model Relating Probability of Reissue to Unexplained Underpricing, Partial Adjustment Variables, and Proxies for Ex-Ante Uncertainty

	Coefficient	Asymptotic t-Statistic
Constant	-5.964	-3.26**
Initial Res	0.939	1.13
Pdiff	-0.822	-0.87
Shsadj	0.628	1.18
Firm Ret	0.966	3.48**
Mkt Ret	-0.640	-0.77
DebtD	0.001	0.00
RankD	0.327	0.85
LnSize	0.488	2.34*
LnAge	0.013	0.10
Plant	-1.087	-1.28
Log-likelihood = -143.5; Pseudo - R^2 = 0.143†		

Notes:
*Significant at the 5% level.
**Significant at the 1% level.
†Pseudo - R^2 calculated as 1-[(-2/n)*log likelihood].
Variables are defined in the Appendix located at the end of this article.

Exhibit 5. Logistic Model Relating Probability of Open Market Insider Sale (OMIS) to Unexplained Underpricing, Partial Adjustment Variables, and Proxies for Ex-Ante Uncertainty

	Coefficient	Asymptotic t-Statistic
Constant	-1.537	-0.83
Initial Res	0.680	0.79
Pdiff	1.440	1.44
Shsadj	-0.170	-0.31
Firm Ret	0.930	3.26*
Mkt Ret	-1.049	-1.08
DebtD	0.523	0.86
RankD	-0.213	-0.57
LnSize	-0.057	-0.27
LnAge	0.050	0.32
Plant	-0.798	-0.95

Notes:
*Significant at the 1% level.
Variables are defined in the Appendix located at the end of this article.

following its IPO is consistent with Lucas and McDonald's [19] theory of the timing of stock issues. This evidence is consistent with the argument that managers of undervalued firms will wait to reissue until the stock price increases to reflect fair value; hence the observed run-up. The positive coefficient is also consistent with a story involving no asymmetric information.

The coefficient on *LnSize* is positive and significant (t = 2.34), indicating that larger firms (proxied for by larger IPO size) reissue more often than smaller firms. This is arguably due to the survivorship potential of larger firms; i.e., a larger firm is more likely to survive and reissue in the future.

The results from testing the open market insider sales signalling hypothesis are contained in Exhibit 5 and indicate that unexplained underpricing is not an important determinant of whether insiders sell shares in the open market within two years of the IPO. (Note that "lockup" periods prevent insider sales for some period of time after the IPO, although this is not expected to affect the results since the lockup period is generally much shorter than the two-year window that I examine for insider trading activity. "Lockup" periods are sometimes written into IPO contracts to ensure that pre-IPO shareholders do not trade in the open market directly after the IPO.) The coefficient on *Initial Res* (0.68) is insignificant at conventional levels

(t = 0.789). This finding is inconsistent with the notion that underpricing signals quality. If underpricing serves as a signal, then firms with greater underpricing should have insiders who sell shares more often than insiders of firms with less underpricing. This is because the signal should reveal to the market that the firm is of high quality, causing its share price to rise and the insiders to sell. The insider selling is the mechanism by which losses due to underpricing are recouped.

A large cumulative raw return (*Firm Ret*) following the IPO is likely to encourage insiders of such firms to sell shares in the open market. Consistent with this view, I find a positive and statistically significant relation between *Firm Ret* and the probability of an open market insider sale. (The t-statistic for the coefficient on *Firm Ret* is 3.26, which is significant at the one percent level).

Both the likelihood of a firm reissuing shares and of insiders selling shares in the open market are increasing in the cumulative returns to the firm's stock following the IPO. It might be argued that underpricing caused this run-up, lending credence to the idea of IPO underpricing as a signal of quality (i.e., firms with a large post-IPO run-up are also underpriced more). To examine this question, I regress the measures of *Firm Ret* (for seasoned offerings and insider sales, respectively, in two separate regressions) on underpricing and find that the relationship is insignificantly negative (t = -0.069 and t = -0.085, respectively).

Exhibit 6. Multinomial Logistic Model Relating Probability of Returning to the Market to Unexplained Underpricing, Partial Adjustment Variables and Proxies for Ex-Ante Uncertainty

	Reissue		OMIS		Both	
	Coefficient	Asymptotic t-Statistic	Coefficient	Asymptotic t-Statistic	Coefficient	Asymptotic t-Statistic
Constant	-4.859	-2.439*	0.444	0.213	-10.285	-2.560**
Initial Res	1.076	1.155	0.825	0.827	1.093	0.673
Pdiff	-0.579	-0.537	1.864	1.581	-0.063	-0.034
Shsadj	0.881	1.161	0.431	0.506	-0.437	-0.265
Firm Ret	1.261	3.790**	1.318	3.710**	1.645	3.240**
Mkt Ret	-0.691	-0.720	-1.119	-0.969	-1.192	-0.711
DebtD	-0.012	-0.022	0.561	0.804	0.614	0.530
RankD	0.639	1.460	0.057	0.135	-0.573	-0.770
LnSize	0.340	1.493	-0.309	-1.264	0.822	1.858
LnAge	-0.007	-0.046	0.054	0.295	0.018	0.065
Plant	-1.106	-1.189	-0.779	-0.872	-1.955	-1.090

Notes:
*Significant at the 5% level.
**Significant at the 1% level.
Variables are defined in the Appendix located at the end of this article.

I also test for a relationship between the firm's stock price performance prior to a seasoned offering and the partial adjustment variables since a significant relationship may indicate that market feedback drives the run-up. The coefficients on *Pdiff* and *Shsadj* in a least squares regression of *Firm Ret* are both insignificant, with t-statistics of -1.17 and 0.06, respectively.

The results from the multinomial logit are contained in Exhibit 6. (Results are reported first for equity reissuance, second for insider selling, and third for firms exhibiting both.) *Firm Ret* is significant ($t = 3.79$, $t = 3.71$, and $t = 3.24$) in determining the likelihood of reissue and insider selling, indicating that seasoned equity offers and open market insider sales are more likely to follow run-ups in the firm's stock price.

B. Share Price Reactions to the Announcement of Seasoned Offerings

Bayless and Chaplinsky [5] find that the announcement returns to securities issues depend on the market's expectations. When the expected type of security is offered, the announcement effect is less pronounced than when the unexpected type of security is offered. Given their results, one way to determine whether the estimated likelihood of reissue from my model is related to market expectations is to fit (using the parameter estimates from the logit) the estimated probability of reissue (*LReissue*) for each reissuing firm in the sample, and then see if this expectation is priced. Since the average stock price reaction to the

announcement of seasoned equity offers is negative, this reaction should be increasing (less negative) in the fitted probability of reissue.

The results of my weighted least squares regression are given in Exhibit 7, Panels A and B.[7] The evidence indicates that the abnormal announcement returns to the seasoned equity offerings in the sample are increasing in the fitted probability of reissue. The coefficient on *LReissue* is positive and significant ($t = 1.97$, Panel A). This is consistent with the model in Equation (2).

I also include underpricing as an explanatory variable in my regression as a check on my previous finding of insignificance. (In this regression, I use an *LReissue* that was estimated without underpricing as an explanatory variable so that *Initial Res* captures the full impact of underpricing on the stock price response to the announcement of a seasoned equity offer.) Underpricing continues to be unimportant ($t = 0.14$), i.e., it does not mitigate the abnormal return to the announcement of a seasoned equity offer after controlling for the fitted probability of reissue.

IV. Conclusion

Many papers have attempted to explain the phenomenon of IPO underpricing. Three recent papers, by Welch [31], Allen and Faulhaber [1], and Grinblatt and Hwang [10], suggest that IPO underpricing serves as a signal of

---

[7]My regressions are weighted by the standard deviations of each firm's pre-announcement abnormal returns.

Exhibit 7. Weighted Least Squares Regressions Relating the Two-Day Abnormal Return to the Announcement of a Seasoned Equity Offer, to the "Fitted" Probability of Reissue and Underpricing (Weight is the Standard Deviation of the Time Series of Prediction Errors Over the Window [-120,-41] Relative to the Seasoned Offer Announcement Date (Day 0))

Dependent Variable: *Pe2day* (Two-Day Prediction Error at Announcement of Seasoned Offer)

Panel A. Weighted Least Squares Regression Using "Fitted" Probability of Reissue

	Standard Error	Asymptotic *t*-Statistic	Two-Tailed *p*-Value
Constant	-0.041	0.008	-4.986**	0.000
LReissue	0.056	0.028	1.967*	0.053

Adjusted R^2 = 0.168; *F*-Statistic = 15.938**

Panel B. Weighted Least Squares Regression Using "Fitted" Probability of Reissue and Underpricing Residual

	Standard Error	Asymptotic *t*-Statistic	Two-Tailed *p*-Value
Constant	-0.042	0.009	-4.645**	0.000
LReissue	0.055	0.028	1.941*	0.056
Initial Res	0.003	0.025	0.139	0.890

Adjusted R^2 = 0.156; *F*-statistic = 7.833**

Notes:
*Significant at the 6% level.
**Significant at the 1% level.
Variables are defined in the Appendix located at the end of this article.

quality. Underpricing appears to have little incremental (signalling) effect on both the likelihood of reissue and the abnormal return to the announcement of a seasoned offering, after controlling for other variables that may affect both the probability of reissue and underpricing.

I also find that underpricing has no significant impact on the probability that insiders will sell shares in the open market, after controlling for ex-ante uncertainty, the firm's post-IPO stock price performance and the partial adjustment phenomenon. This finding is also inconsistent with the notion of underpricing as a signal of quality since under the signalling theories firms with greater underpricing should exhibit greater insider selling. This finding is not contaminated by the finding of a positive relationship between the firm's post-IPO run-up and the likelihood of insider selling. Underpricing is unrelated to the run-up. My

findings are generally inconsistent with implications of the signalling by underpricing theories.

References

1. F. Allen and G. Faulhaber, "Signalling by Underpricing in the IPO Market," *Journal of Financial Economics* (August 1989), pp. 303-323.

2. P. Asquith and D. Mullins, "Equity Issues and Offering Dilution," *Journal of Financial Economics* (January-February 1986), pp. 61-89.

3. C. Barry and S. Brown, "Differential Information and the Small Firm Effect," *Journal of Financial Economics* (June 1984), pp. 283-294.

4. C. Barry, C. Muscarella, and M. Vetsuypens, "Underwriter Warrants, Underwriter Compensation, and the Costs of Going Public," *Journal of Financial Economics* (March 1991), pp. 113-135.

5. M. Bayless and S. Chaplinsky, "Expectations of Security Type and the Information Content of Debt and Equity Offers," *Journal of Financial Intermediation* (June 1991), pp. 195-214.

6. R. Beatty and J. Ritter, "Investment Banking, Reputation, and the Underpricing of Initial Public Offerings," *Journal of Financial Economics* (January-February 1986), pp. 213-232.

7. L. Benveniste and P. Spindt, "How Investment Bankers Determine the Offer Price and Allocation of New Issues," *Journal of Financial Economics* (October 1989), pp. 343-362.

8. R. Carter and S. Manaster, "Initial Public Offerings and Underwriter Reputation," *Journal of Finance* (September 1990), pp. 1045-1067.

9. M. Giliberto, "Interest Rate Sensitivity in the Common Stocks of Financial Intermediaries: A Methodological Note," *Journal of Financial and Quantitative Analysis* (March 1985), pp. 123-126.

10. M. Grinblatt and C. Hwang, "Signalling and the Pricing of New Issues," *Journal of Finance* (June 1989), pp. 393-420.

11. K. Weiss-Hanley, "The Underpricing of Initial Public Offerings and the Partial Adjustment Phenomena," Working Paper, University of Michigan, 1992.

12. R. Ibbotson, "Price Performance of Common Stock New Issue," *Journal of Financial Economics* (September 1975), pp. 235-272.

13. R. Ibbotson and J. Jaffe, "Hot Issue Markets," *Journal of Finance* (September 1975), pp. 1027-1042.

14. C. James, "Relationship-Specific Assets and the Pricing of Underwriter Services," *Journal of Finance* (December 1992), pp. 1865-1885.

15. C. James and P. Weir, "Borrowing Relationships, Intermediation and the Cost of Issuing Public Securities," *Journal of Financial Economics* (November-December 1990), pp. 149-171.

16. N. Jegadeesh, I. Welch, and M. Weinstein, "An Empirical Examination of Seasoned Equity Offerings and IPO Underpricing," Working Paper, University of California at Los Angeles, 1991.

17. H. Leland and D. Pyle, "Informational Asymmetries, Financial Structure, and Financial Intermediation," *Journal of Finance* (May 1977), pp. 371-387.

18. J. Lin and J. Howe, "Insider Trading in the OTC Market," *Journal of Finance* (September 1990), pp. 1273-1284.

19. D. Lucas and R. McDonald, "Equity Issues and Stock Price Dynamics," *Journal of Finance* (September 1990), pp. 1019-1043.

20. G.S. Maddala, *Limited Dependant and Qualitative Variables in Econometrics*, Cambridge, Cambridge University Press, 1983.

21. P. Marsh, "The Choice Between Equity and Debt: An Empirical Study," *Journal of Finance* (March 1982), pp. 71-100.

22. R. Masulis and A. Korwar, "Seasoned Equity Offerings: An Empirical Investigation," *Journal of Financial Economics* (January-February 1986), pp. 91-118.

23. R. Michaely and W. Shaw, "The Pricing of Initial Public Offerings: A Test of Adverse Selection and Signalling Theories," Working Paper, Cornell University, 1992.

24. W. Mikkelson and M. Partch, "Valuation Effects of Security Offerings and the Issuance Process," *Journal of Financial Economics* (January-February 1986), pp. 31-60.

25. S. Myers, "Determinants of Corporate Borrowing," *Journal of Financial Economics* (November 1977), pp. 147-175.

26. S. Myers and N. Majluf, "Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have," *Journal of Financial Economics* (June 1984), pp. 187-221.

27. J. Ritter, "The 'Hot Issue' Market of 1980," *Journal of Business* (April 1984), pp. 215-240.

28. J. Ritter, "The Long Run Performance of Initial Public Offerings," *Journal of Finance* (March 1991), pp. 3-27.

29. H. Seyhun, "Information Asymmetry and Price Performance of IPOs," Working Paper, University of Michigan, Ann Arbor, 1991.

30. H. Seyhun, "The Effectiveness of the Insider-Trading Sanctions," *Journal of Law and Economics* (April 1992), pp. 149-181.

31. I. Welch, "Seasoned Offerings and the Pricing of New Issues," *Journal of Finance* (June 1989), pp. 421-450.

Appendix — Definitions of Variables

Undpg equals underpricing.

Pdiff equals the percentage difference between expected IPO price (average of range stated in preliminary prospectus) and final IPO price.

Shsadj equals the percentage difference between number of shares expected to be offered (stated in preliminary prospectus) and number of shares actually offered.

LnSize is the natural log of the inflation-adjusted dollar amount of equity offered in the IPO, exclusive of overallotment (number of shares times the price to the issuing firm per share).

LnAge is the natural log of the firm's age at the time of the IPO.

Plant is the ratio of plant and equipment to total assets at time of IPO.

Reissue takes on the value of 1 if the firm issues seasoned equity, 0 otherwise.

Initial Res is the underpricing residual from regression Equation (1), i.e., it is the underpricing not explained by proxies for ex-ante uncertainty and partial adjustment.

Firm Ret is the cumulative raw return to the stock for the 200 days following the end of the first day of trading on the exchange (except for firms who reissue or show an open market insider sale before 200 days have passed, and then the run-up is calculated until the day before the announcement of the seasoned offering or the day before the open market insider sale).

Mkt Ret is the cumulative market return (equal weighted) calculated over the same window as *Firm Ret*.

DebtD is a dummy variable that equals 1 if the firm had bank or public debt in its capital structure prior to the IPO, 0 otherwise.

RankD takes on a value of 1 if the underwriter of the firm's IPO was a national (Carter/Manaster [8] rank ≥ 6), 0 otherwise.

OMIS equals 1 if there is an insider transaction of 10,000 or more shares within two years of IPO, 0 otherwise.

LReissue is the "fitted" probability of reissue.