Signalling, Insider Trading, And Post-Offering Performance: The Case of Initial Public Offerings

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Abstract

Previous IPO studies have concluded that, on average, (1) the shares of firms going public are underpriced at the time of the offering, (2) prices adjust rapidly in the aftermarket, and (3) IPOs are generally poor performers over the longer-term. This study reevaluates the IPO pricing phenomenon utilizing more recent data and empirically tests the signalling models of Leland and Pyle (1977) and Gale and Stiglitz (1989), which imply that both first-day and aftermarket returns may be related to insiders' transactions. Our results suggest that initial returns are inversely related to the proportion of the offering representing insiders' shares and that corporate insiders are, on average, net sellers in the year subsequent to the initial public offering. We also find that the greatest volume of post-offering insider sales occurs in those firms in which insiders also sold shares at the offering.

Introduction

The pricing of unseasoned equity offerings has been researched extensively in the last two decades. Current literature suggests the following stylized facts on initial public offerings (IPOs): (1) IPOs are, on average, underpriced by underwriters at the time of issuance, and (2) market prices adjust rapidly in the aftermarket. (See, for example, Smith (1986), Miller and Reilly (1987), and Chalk and Peavy (1987).)

A closer look at the accumulated empirical evidence reveals some puzzling inconsistencies, however. With respect to the magnitude of initial returns, Ibbotson (1975) reports average underpricing which exceeds 11 percent. Klein et. al. (1990), however, report initial raw returns of just 4.69 percent, and several researchers have found that large proportions of their samples display negative initial returns. (Bear and Curley (1975), and Miller and Reilly (1987).)

Similarly, the evidence on post-offering performance is less than unanimous. Chalk and Peavy (1987), Reilly and Hatfield (1969), and Reilly (1973) find cumulative aftermarket returns ranging from 18 percent to nearly 44 percent. Block and Stanley (1980), on the other hand, calculate the market-adjusted returns on the unseasoned offerings of 102 firms over the 1974-78 period and find that the first-year returns are close to zero, while studies by McDonald and Fisher (1972), Bear and Curley (1975), and, more recently, Ritter (1991) indicate that the post-offering performance of IPOs is unfavorable.

The contradictory nature of the empirical evidence suggests that there may be one or more underlying factors which impact both the initial returns and the post-offering performance of the shares in IPOs. Recent theoretical and empirical developments suggest that transactions by corporate insiders may be an important explanatory variable. (1) The purpose of this paper is to examine the nature of insider transactions contemporaneous to unseasoned equity offerings.

Hypothesis Development

Wall Street lore has long held that corporate insiders possess and often act upon nonpublic information, which allows them to earn excess returns. Evidence consistent with this position is provided by, among others, Jaffe (1974), Finnerty (1976), and Seyhun (1986). In the context of IPOs, there exists a substantial amount of theoretical work which suggests that insiders' transactions may serve as "signals" which convey information to market participants about their firms' prospects. Leland and Pyle (1977), Grinblatt and Hwang (1989), Gale and Stiglitz (1989), and Welch (1989) all model IPO pricing

in terms of the signals conveyed by various issuer/issue characteristics.

The Leland and Pyle (LP) model suggests that new-issue discounts may be attributable to information asymmetries between issuers and investors. Building on the conceptual foundation of the Akerlof (1970) "lemons model", LP suggest that, having less information than the issuer, the average investor views equity sales by corporate insiders at the time of the offering as a signal of adverse information. In the LP model, a higher level of insider sales at the time of the offering signals a "low-quality" issue and should reduce the price investors are willing to pay, all else equal.(2)

The validity of the use of the level of initial sales by insiders as a signal in the LP sense is dependent upon the implicit assumption that insiders will sell their own shares only once (i.e., at the time of the offering), if at all. However, Gale and Stiglitz (1989) point out that if insiders are free to sell shares subsequent to the offering, low-quality issuers may initially retain shares in an attempt to mimic high-quality issuers. These shares could then be sold in smaller amounts subsequent to the offering, in order to reduce the impact of adverse information effects. In other words, rational insiders may recognize the depressing effect their actions could have on initial returns and attempt to mitigate that effect by "holding back" some portion of their shares at the time of the offering.

Insiders who possess adverse undisclosed information will not sell all of their shares as part of the initial offering because doing so would convey an unfavorable signal to investors and lower the proceeds of the offering. At the same time, these insiders would not retain all of their shares at the time of the offering. Doing so would expose them to the risk that their adverse information would be disclosed before they could complete their sales, a possibility that would be much more likely once the firm has gone public and is subject to the scrutiny of analysts, regulators, and the investing public.

Thus, we posit that insiders with adverse information will attempt to trade off the risk of lower initial prices against the risk of subsequent disclosure of unfavorable information by selling some of their shares at the time of the offering and parcelling the sales of the remainder out in subsequent periods. This line of reasoning suggests the following. First, to the extent that they trade at all in the period following an initial public offering, insiders will be net sellers. Second, to the extent that insiders sell a portion of their holdings at the time of the offering, they will also sell shares in the post-offering period. However, given that insiders sell shares for reasons other than undisclosed adverse information, we contend simply that the volume of post-offering share sales will be greater for those firms whose offerings included insiders' shares than for those that did not.

In summary, we test the following hypotheses:

H1: Initial returns on the shares of firms going public will be inversely related to the proportion of the offering which represents insiders' shares.

H2: Post-offering sales by insiders will be greater for firms for which insiders sell shares at the time of the offering than for those offerings which do not include insiders' shares.

Sample and Methodology

Sample Selection

In order to obtain a sample of unseasoned equity offerings, the Media General Price-Volume database was searched for firms which went public between January 1, 1982 and December 31, 1986. The details of each offering (including offering size, offer price, underwriter, and number of shares offered by insiders) were obtained from the Investment Dealers' Digest. Firm and offering characteristics were then cross-checked in Moody's Industrial Manual. After removing firms for which (1) complete offering information was unavailable, (2) offering dates and prices could not be verified, (3) a secondary offering of common shares was held in the 250-day period following the initial offering, and (4) complete daily prices for 250 days following the offering were unavailable, a final sample of 419 firms and offerings was obtained. (3) (The use of a one year post-offering period is consistent with previous research; see, for example, Reilly (1977) and Block and Stanley (1980).)

Information on post-offering share purchases and sales by corporate insiders in the sample firms was extracted from a machine-readable data set compiled by the Securities and Exchange Commission. This file contains information on approximately 1.5 million transactions reported under section 16 of the Securities Exchange Act of 1934 over the period 1975-87. Within this data set, corporate insiders are classified by their relationship to the firm, and transactions are categorized by type. By cross-referencing the firms in the initial offering file with those in the insider transactions database, a file containing all of the transactions by registered insiders in the sample firms was constructed.

Methodology

This study utilizes daily market-adjusted returns to measure initial and post-offering price performance. The abnormal return for stock j on day t, AR(j,t), is defined as

$$AR(j,t) = R(j,t) - R(m,t) \quad (1)$$

where R(j,t) and R(m,t) are the raw returns on the stock j and the market, respectively. For day 1, R(j,t) is defined as the closing price of the stock divided by the offer price, minus 1; the returns on subsequent days employ closing prices. Because our sample is heavily weighted toward over-the-counter firms, we employed the daily NASDAQ Composite index as a market proxy.(4) The portfolio average abnormal return on any day t is

$$\overline{AR}(t) = (1/N)\sum_{j=1}^{N} AR(j,t) \quad (2)$$

where there are N firms in the portfolio.

To test the null hypothesis that the portfolio average abnormal return on any day t is equal to zero, we employ the approach of Dennis and McConnell (1986). The test statistic is

$$t = \overline{AR}(t)/(s^2_t/N)^{.5} \quad (3)$$

where

$$s^2_t = \{1/N \left[\sum_{j=1}^{N} \overline{AR}(j,t) - 1/N \left(\sum_{j=1}^{N} \overline{AR}(j,t)\right)^2\right]\}. \quad (4)$$

Under the null hypothesis, the test statistic is distributed student t with N-1 degrees of freedom.

Aftermarket performance is measured by computing average cumulative abnormal returns (CARs) for five subperiods: (1) days 1 to 100, (2) days 101 to 200, (3) days 201 to 250, (4) days 1 to 250, and (5) days 2 to 250. Subperiod one captures the initial offering return and any initial aftermarket adjustments, while subperiods two and three measure aftermarket returns in consecutive post-offering periods. Subperiod four measures cumulative returns over the entire interval (including the first-day return). The last subperiod measures the same thing, net of the first-day return.

Given no abnormal performance, the expected value of the cumulative abnormal returns over the interval from day t to day T is zero; we compute the following test statistic.

$$t_T = CAR_T/(s_T * T^{.5}), \quad (5)$$

where

$$s_T = \left[\left(\sum_{\tau=t}^{T} (\overline{AR}_\tau - CAR_T/T)^2\right)/T\right]^{.5}. \quad (6)$$

Of course, the market-adjusted returns approach does not explicitly adjust for risk differentials across firms. As noted by Tinic (1988) and Ritter (1991), to the extent that our sample of firms is riskier than average and that the market risk premium is positive, reported returns overstate the true risk-adjusted returns. Nonetheless, we are reasonably comfortable in using market-adjusted returns because of (1) the favorable simulation evidence of Brown and Warner (1985), (2) the well-known difficulties in obtaining accurate beta estimates for firms going public, and (3) the use of similar return measures in the existing literature on IPO pricing. (See, for example, Tinic (1988), Ritter (1991), and Aggarwal and Rivoli (1990).)

In order to measure the level of post-offering transactions by corporate insiders, we employ a metric which accounts both for the nature of insiders' transactions (i.e., purchases or sales), and the volume of shares sold relative to the number of shares outstanding. The post-offering insider activity measure is computed as follows. First, we calculate the difference between the number of shares purchased and the number of shares sold by insiders for each firm, j, in the sample on each day t, of the 250-day post-offering period.(5) This value is divided by the total number of shares offered at the time of the IPO. This fraction measures net insider purchases as a percentage of outstanding shares, and is denoted NETPCT(j,t). The cumulative value of this measure from the offering day to day t is denoted CNETPCT(j,t). A large positive value for CNETPCT(-j,t) reflects substantial net insider purchases over the period, while a large negative value can be interpreted as evidence of a preponderance of insider sales.

Measured over the entire portfolio, the average cumulative net insider purchases as a percentage of the offering, ACNETPCT, measured from the initial offering date to day t following the offering is defined as

$$ACNETPCT(t) = 1/N \sum_{j=1}^{N} CNETPCT(j,t) \quad (7)$$

In the absence of information-based insider trading, one would expect insider purchases and insider sales to be approximately equal over any given period. That is, the expected value of NETPCT(j,t) is zero and, over time, the cumulative portfolio measure, ACNETPCT(t), would be expected to fluctuate randomly around zero.

Empirical Results

Sample Characteristics

Table 1 reports selected sample characteristics. For the 419 issues which qualified for inclusion in the final sample, the mean (median) offering size was 2.68 million (1.00 million) shares and the mean (median) offer price was $10.56 ($10.00) per share.

The mean (median) age of the firms in the sample was 8.9 (5.0) years at the time of the offering, which compares with the findings of Muscarella and Vetsuypens (1989), who report a mean age of 71 months in a similar sample. Insiders' shares as a proportion of the offering ranged from 0 to 100 percent, with an average value of 21.3 percent over the entire sample. As shown in panel B, the majority of the offerings occurred in 1983 and 1986.

Table 1

Characteristics of the Sample of Initial Public Offerings Used in This Study

A. Summary of Issue Characteristics

	Mean	Median	Standard Deviation
Number of Shares Offered	2,682,355	1,001,000	17,444,197
Offer Price ($)	10.56	10.00	6.57
Offer Value ($)	29,238,344	10,400,000	215,939,011
Firm Age (years)[a]	8.9	5.0	11.7
Proportion of Offering Representing Insiders' Shares (INPCT) (%)	21.3[b]	16.5	23.9

B. Chronological Composition of the Sample

Offering Year	Number of Firms
1982	17
1983	130
1984	65
1985	85
1986	122
Total	419

C. Sample Firms Categorized By Listing Status

Listing Status	N	Mean/Median Age (Years)	Mean/Median INPCT
NYSE/AMEX	31	7.42/5.01	24.83%/37.87%
OTC	388	9.07/5.11	21.03%/16.25%

[a] Age is defined as the length of time between incorporation and the initial public offering.

[b] INPCT equals 100 percent for four sample firms, all of which are members of the OTC subsample.

Panel C of Table 1 indicates that the majority (nearly 93%) of the sample firms were traded over-the-counter at the time of the offering. At the time of the initial public offering, the average age of the OTC firms was approximately 9.1 years, and 7.4 years for the 31 listed firms. The average proportions of the initial offering representing insiders' shares were 21.0 percent and 24.8 percent for the OTC and the listed firms, respectively. Across subsamples, neither the age difference nor the difference in insider proportions are statistically significant. (6)

First-Day Returns and Initial Insider Sales

As shown in Table 2, the aggregate average first-day return is -1.9 percent, which is not significantly different from zero (t = -.72). Subdividing the sample into those firms for which insiders' shares were sold in the offering and those without (hereafter referred to as the "positive initial insider sales" or "PIINS" and "no initial insider sales" or "NIINS" subsamples, respectively), we find that first-day market-adjusted returns are large and negative (-9.52 percent, t = -5.61) for the former and large and positive (10.28 percent, t = 1.68) for the latter. A two-sample t test indicates the difference between the two is statistically significant (t = 3.08).

One implication of hypothesized inverse relationship between first-day returns and initial insider sales is that the proportion of negative abnormal returns in the PIINS subsample will be greater than .50, while the analogous proportion for the NIINS subsample will not be different from .50. For the aggregate sample, just over half (54 percent) of the first-day returns are negative. (7) These proportions are .48 and .58 for the NIINS and PIINS subsamples, respectively.

The last row of Table 2 reports the results of one-sided binomial tests of the null hypothesis that the proportion of negative returns exceeds .50, against the null that the proportion is less than or equal to .50.(8) For the aggregate and the NIINS portfolios, the critical values of the test statistic are (193,226) and (70,91), respectively, at the 5 percent level of significance. Since the number of positive values for these two groups are 198 and 83, we are unable to reject the null hypothesis. However, the results suggest that the null hypothesis can be rejected for the PIINS subsample at the 5 percent level: the critical values are 116 and 142; the number of positive returns is 109.

In order to more closely examine the relationship between initial insider sales and first-day returns, the PIINS subsample was subdivided into quintiles based on the proportion of the initial offering which represented insiders' shares ("INPCT"). Panels A through C of Table 3 report first-day and cumulative market-adjusted returns for the aggregate sample, the PIINS subsample, and the NIINS subsample, respectively. Panel D provides similar statistics for quintiles of the PIINS subsample, based on the level of INPCT.

As shown in panel A, the aggregate sample's market-adjusted returns are negative in every interval, and statistically significant for all but the first. Comparison of panels B and C suggests that the negative abnormal returns reported for the aggregate sample are largely driven by the those firms with positive initial insider sales. Market-adjusted returns for the PIINS firms are negative and statistically significant in every interval, while only the first-day return is significantly different from zero for the firms in the NIINS subsample.

Further indication of a difference in aftermarket performance is indicated by the fact that, with the exception of the interval (201,250), a two-sample t test suggests that average cumulative abnormal returns are significantly lower for the firms in the PIINS subsample than those for the firms in the NIINS subsample at the 10 percent level or better.

The PIINS subsample is stratified by INPCT in panel D of Table 3. The average proportion of the initial offering consisting of insiders' shares ranges from 9.81 percent to 65.98 percent. The first-day return is .11 percent (t = .05) for the firms in the quintile with the lowest levels of initial insider sales and reaches -12.79 percent (t = -2.79) for those with the highest average initial insider sales levels. All but one of the initial returns are negative and significantly different from zero.

Examination of columns 1 and 3 of panel D also suggests an inverse relationship between the level of initial insider sales and initial returns. Across the stratified PIINS subsample, the correlation coefficient between initial insider sales and first-day market-adjusted returns is -.15 and is statistically significant at the .01 level. We also computed two nonparametric measures of association - Kendall's tau and Spearman's rank correlation coefficient, which are based on the ranks of the variables, rather than on the values of the variables themselves. The values of these measures are -.18 and -.12, respectively; both are significant at the .05 level.

Some additional evidence is provided by the ratio of positive to negative first-day returns for each quintile. In the portfolio of firms with the lowest level of initial insider sales, 29 of the first-day returns are positive while 21 are negative. In every other portfolio, the number of negative first-day returns exceeds the number that are positive. (These results are not strong, however; binomial tests of the proportions indicate that they exceed .50 at the 5 percent level only for the largest INPCT quintile.)

Table 2

Market-Adjusted Returns One Day Subsequent to the Offering Date

	Full Sample		No Initial Insider Sales (NIINS)		Positive Initial Insider Sales (PIINS)	
	N	$\overline{AR}_t$	N	$\overline{AR}_t$	N	$\overline{AR}_t$
Positive	198	22.0% (4.41)[a]	83	37.5%[b] (3.36)	109	10.2% (6.60)
Negative	227	-22.4% (-14.11)	78	-19.1% (-7.93)	149	-24.1% (-11.99)
Total	419	-1.9% (-.72)	161	10.3% (1.68)	258	-9.5% (-5.61)
Critical Values[c]	(193,226)		(70,91)		(116,142)	

[a] The values in parentheses are cross-sectional t-statistics. That is, for any portfolio k and day t, the test statistic equals AR_{kt}/SE_{kt}, where AR_{kt} is the mean abnormal return for the firms in the k^{th} portfolio on day t, and SE_{kt} represents the standard error of the abnormal returns for the securities in the k^{th} portfolio.

[b] The no-initial insider sales (NIINS) subsample means include two firms which realized market-adjusted returns of 793 percent and 460 percent, respectively. Eliminating those observations reduces the average positive return to 22.9 percent and to 2.4 percent for the overall mean return. Investigation of these values indicated that they are correct.

[c] Test of H_0: The proportion of positive market-adjusted returns is equal to the proportion of negative market-adjusted returns. Critical values are computed as follows.

$$s_1 = Np_o + z[(Np_o(1 - p_o))]^{.5}, \text{ and}$$
$$s_2 = Np_o - z[(Np_o(1 - p_o))]^{.5},$$

where: N = the number of observations,
p_o = the hypothesized proportion (.50), and
z = the standard normal variate corresponding to the level of significance chosen.

The null hypothesis is rejected if S (the number of negative abnormal returns), is outside of the interval (s_1, s_2).

Table 3

Selected Firm Characteristics - Categorized By Level of Initial Insider Sales (INPCT)

A. All Firms

(1) N	(2) Average INPCT	(3) Average Age (Years)	(4) $\overline{AR}(1)$	(5) $\overline{CAR}(1,100)$	(6) $\overline{CAR}(101,200)$	(7) $\overline{CAR}(201,250)$	(8) $\overline{CAR}(1,250)$	(9) $\overline{CAR}(2,250)$
419	21.31%	8.90	-1.92% (-.72)[a]	-5.81% (-1.96)	-6.03% (-3.69)	-5.16% (-4.12)	-17.00% (-4.49)	-15.08% (-5.40)

B. Firms With Positive Initial Insider Sales (PIINS)

(1) N	(2) Average INPCT	(3) Average Age (Years)	(4) $\overline{AR}(1)$	(5) $\overline{CAR}(1,100)$	(6) $\overline{CAR}(101,200)$	(7) $\overline{CAR}(201,250)$	(8) $\overline{CAR}(1,250)$	(9) $\overline{CAR}(2,250)$
258	34.61%	10.75	-9.52% (-5.61)	-13.48% (-6.30)	-10.08% (-5.44)	-6.46% (-5.13)	-30.02% (-10.23)	-20.50% (-6.67)

C. Firms With No Initial Insider Sales (NIINS)

(1) N	(2) Average INPCT	(3) Average Age (Years)	(4) $\overline{AR}(1)$	(5) $\overline{CAR}(1,100)$	(6) $\overline{CAR}(101,200)$	(7) $\overline{CAR}(201,250)$	(8) $\overline{CAR}(1,250)$	(9) $\overline{CAR}(2,250)$
161	N.A.	6.04	10.28% (1.68)	6.52% (.94)	.47% (.16)	-3.08% (-1.20)	3.91% (.46)	-6.37% (-1.20)

D. Firms With Positive Initial Insider Sales (PIINS) - By Quintile

(1) Initial Insider Sales Quintiles	N	(2) Average INPCT	(3) Average Age (Years)	(4) $\overline{AR}(1)$	(5) Pos:Neg	(6) $\overline{CAR}(1,100)$	(7) $\overline{CAR}(101,200)$	(8) $\overline{CAR}(201,250)$	(9) $\overline{CAR}(1,250)$	$\overline{CAR}(2,250$ ➤
Smallest	50	9.81%	6.82	.11% (.05)	29:21	-7.80% (-1.65)	-17.35% (-4.24)	-8.05% (-2.39)	-33.20% (-5.50)	-33.31% (-5.33)
2	57	21.73%	8.93	-8.94% (-3.71)	20:37	-7.96% (-1.88)	-6.76% (-1.67)	-2.55% (-.97)	-17.26% (-2.69)	-8.32% (1.17)
3	48	30.52%	12.15	-14.34% (-3.39)	19:29	-22.28% (-5.05)	-7.09% (-1.92)	-8.62% (-2.93)	-37.99% (-6.09)	-23.65% (-3.51)
4	44	41.87%	12.64	-11.65% (-2.57)	19:25	-10.62% (-2.36)	-6.78% (-1.56)	-9.69% (-3.64)	-27.08% (-4.01)	-15.43% (-2.28)
Largest	59	65.98%	13.34	-12.79% (-2.79)	22:37	-18.71% (-3.42)	-12.05% (-2.66)	-4.69% (-1.99)	-35.44% (-5.44)	-22.65% (-3.28)

[a] t-values are in parentheses.

Finally, we regressed first-day returns against variables measuring initial insider sales in order to assess the strength of the relationship between initial returns and the proportion of the offering representing initial insider sales. Panel A of Table 4 reports the results of three regressions: first-day abnormal returns against INPCT, using all of the sample firms; the same regression using only firms for which INPCT is not equal to zero; and

Table 4

Regressions of Portfolio Abnormal Returns Against Initial Insider Sales

A. First-Day Returns[a]

Model 1: $AR_{j1} = d_0 + d_1 INPCT_j + e_j$ (N = 419)

Model 2: $AR_{j1} = d_0 + d_1 INPCT_j + e_j$ (N = 258)

Model 3: $AR_j1 = d_0 + d_1 DUM1^a + d_2 DUM2 + d_3 DUM3 + d_4 DUM4 + e_j$ (N = 419)

Model	d_0	d_1	d_2	d_3	d_4	F-value	R^2
1	.0623	-.3854				11.82	.13
	(1.76)	(-3.44)					
2	-.0291	-.1923				5.85	.12
	(-.91)	(-2.42)					
3	.0086	-.1670	-.2220	-.1951	-.2065	3.55	.07
	(.11)	(-2.08)	(-2.57)	(-2.18)	(-2.58)		

B. Cumulative Aftermarket Returns[c]

Model 1: $CAR_{j1} = d_0 + d_1 INPCT_j + e_j$ (N = 419)

Model 2: $CAR_{j1} = d_0 + d_1 INPCT_j + e_j$ (N = 258)

Model 3: $CAR_j1 = d_0 + d_1 DUM1 + d_2 DUM2 + d_3 DUM3 + d_4 DUM4 + e_j$ (N = 419)

Model	d_0	d_1	d_2	d_3	d_4	F-value	R^2
1	-.1135	-.1762				2.22	.02
	(-3.03)	(-1.49)					
2	-.2261	.0615				.18	.00
	(-3.85)	(.42)					
3	-.1278	.0446	-.1087	-.0265	-.0987	.81	.01
	(-3.25)	(.52)	(-1.19)	(-.28)	(-1.17)		

Note: t-values are in parentheses.

[a] DUM1 through DUM4 are binary variables which take a value of 1 if the firm is in the (k + 1)th quintile, based on $INPCT_j$ values; and 0 otherwise. As such, the intercept measures the relationship between cumulative average returns and initial insider sales for firms in the first (i.e., smallest INPCT) quintile.

[b] "Aftermarket" refers to the interval (2,250) following the offering date.

first-day abnormal returns against dummy variables indicating quintile membership. The binary variables, DUM1 through DUM4 take on a value of 1 for firms in the (k + 1)th quintile, and 0 otherwise, so the relationship between initial returns and initial insider sales for firms in the first (i.e., smallest INPCT) quintile are captured by the intercept term. The hypothesized inverse relationship will be reflected in negative coefficients.

All of the regressions are statistically significant, as measured by their F-values. For models one and two, the coefficients on INPCT are of the expected sign and are statistically significant. Model 3 measures the relationship between first-day returns and initial insider sales by quintile grouping. All but one of the coefficients are negative and significant; the intercept value is positive, but is not statistically significant. Thus the regression results provide further evidence of an inverse relationship between initial insider sales and first-day returns for all firms but those with the lowest levels of initial insider sales. In sum, we reject the hypothesis of no relationship between initial insider sales and initial returns, in favor of the alternative hypothesis of an inverse relationship.

Aftermarket Performance and Insiders' Transactions

If IPO prices adjust rapidly in the aftermarket, abnormal post-offering returns should not differ significantly from zero. Ritter (1991), however, reports that his sample of IPOs generally underperformed a matched sample of non-IPO firms in the period following the offering. Similarly, our sample generally underperformed the market proxy. As shown in panel A of Table 3, the aggregate sample CAR reaches -17.0 percent by day 250 following the offering. When the first-day return is excluded, the CAR reaches -15.1 percent. For those firms with no initial insider sales, CAR(1,250) reaches 3.9 percent, while CAR(2,250) is -6.4 percent, neither of which is statistically significant.

Aftermarket performance is substantively less favorable for firms with positive initial insider sales, as shown in panel B of Table 3. Over the entire 250-day period, the CAR reaches -30 percent (t = -10.23); aftermarket returns are negative and statistically significant in every interval for the PIINS firms.

For the stratified PIINS subsample (panel D), CAR(-1,250) ranges from -17.3 percent to -37.8 percent, while CAR(2,250) ranges from -8.3 percent to -33.3 percent. In sum, the results suggest that aftermarket performance is generally least favorable for those firms with positive levels of initial insider sales.

The relationship between initial insider sales and aftermarket performance is somewhat weak, however. Aftermarket returns (CAR(2,250)) were regressed against variables measuring initial insider sales in a manner analogous to that described above for first-day returns. The regression results are reported in panel B of Table 4. While most of the regression coefficients are negative, few are statistically significant.

Further, it should be noted that, for firms with initial insider sales, poor post-offering performance does not appear to be confined to any particular subperiod following the offering. Aftermarket returns are uniformly negative, as shown in panel D of Table 3. All but four of the aftermarket returns are statistically significant.

Next, we consider the nature and the incidence of insider transactions in the post-offering period, and the relationship between post-offering performance and insider transactions.

Of 419 firms in the full sample, insiders in 98 firms (approximately 23 percent) reported a total of 408 purchases or sales of their own firms' shares in the 250 days following the offering. As shown in panel A of Table 5, approximately 64 percent (263/408) of these transactions were sales. Three-quarters (199/263) of the sales transactions occurred in the PIINS subsample.

On the other hand, on a per-firm basis, the transactions patterns are fairly similar across the subsamples. In both cases, the number of post-offering insider transactions average just under four; the highest number of transactions in any given firm are 23 and 29 for the NIINS and PIINS subsamples, respectively. In both cases, the smallest number of transactions in any of the firms in this group is one.

For the aggregate sample and the NIINS and PIINS subsamples we perform binomial tests of the null hypothesis of no difference in the number of purchases and the number of sales. In other words, we test the proposition that the proportion of sales transactions, p, is equal to .50. The alternative hypothesis is that the number of sales transactions exceeds the number of purchases transactions; i.e., p is greater than .50.(8)

For the aggregate sample, the critical values, s1 and s2, are 187 and 220, respectively, at the 5 percent significance level. Since the computed test statistic is 263, we reject the null hypothesis. Analogous critical values for the NIINS subsample are 50 and 67. As shown in panel A of Table 5, S equals 64, thus we cannot reject the null hypothesis of no difference in the nature of subsequent insider transactions for those firms for which there were no initial insider sales. On the other hand, the critical values, s1 and s2, are 131 and 159, respectively, for the positive initial insider sales subsample. Clearly, the null is rejected for this group. We

conclude that, (1) to the extent that insiders transacted in the post-offering period at all, they were net sellers, and (2) the preponderance of the the selling activity occurred in those firms in which insiders sold shares at the time of the offering. (9)

The fact that the insiders who transacted were generally net sellers in the post-offering period is consistent with our second hypothesis; however, the GS model implies a relationship between the volume of initial insider sales and post-offering insider sales. Thus, a

Table 5

Summary Statistics: Post-Offering Insider Transactions

A. Insider Transactions in the Post-Offering Period

	No Initial Insider Sales (NIINS)	Positive Initial Insider Sales (PIINS)	Totals
Number of Firms	30	68	98
Number of Transactions	118	290	408
No. Purchases/No. Sales	54/64	91/199	145/263
Mean (Median) No. of Transactions per Firm	3.9 (2.5)	3.9 (2.0)	N.A.
Maximum (Minimum) No. of Transactions per Firm	23 (1)	29 (1)	N.A.

B. Time-Series of Cumulative Net Insider Purchases as a Proportion of the Offering

	ACNETPCT[a]		
Day Subsequent to Offering	Full Sample	NIINS Subsample	PIINS Subsample
1	-0.0265	0.0007	-0.0365
20	-0.0835	-0.0788	-0.0697
40	-0.0786	-0.0809	-0.0688
60	-0.0767	-0.0803	-0.0674
80	-0.1294	-0.1303	-0.0702
100	-0.1913	-0.1323	-0.1307
120	-0.2436	-0.1343	-0.2464
140	-0.3641	-0.1768	-0.3385
160	-0.4254	-0.2507	-0.3526
180	-0.6681	-0.2512	-0.6011
200	-0.7172	-0.2320	-0.6578
220	-0.8330	-0.2129	-0.8017
240	-0.9429	-0.3109	-0.9420
250	-1.0888	-0.3002	-1.1493

[a] Cumulative values of NETPCT, daily portfolio average net insider purchases as a proportion of the offering.

stronger test of the signalling hypothesis requires a comparison of the time-series of insider transactions by the firms in the NIINS and the PIINS subsamples. Time-series values of the ACNETPCT variable for the subsamples appear in panel B of Table 5. The aggregate sample time-series is presented for comparison in the first column of panel B.

For the NIINS subsample, ACNETPCT reached approximately -.30 by the 250th day following the offering. The value of ACNETPCT for the PIINS subsample is -1.15. In other words, for those firms with no initial insider sales, insiders ultimately sold shares equal to approximately 30 percent of the initial offering (after netting out insider purchases). For those firms in which insiders did sell shares at the time of the offering, however, insiders sold 1.15 times as many of their own shares as were offered in the IPO.

In order to compare relative daily sales across the two subsamples, we utilized the Wilcoxon Rank-Sum test using the daily NETPCT values. (10) This procedure tests the null hypothesis that the medians of the two series are equal by ranking the observations in each series and comparing the differences. The resulting value of the test statistic is 4.06, which allows us to reject the null hypothesis of equality at the 1 percent level. We conclude that the volume of net insider sales in the post-offering period by firms in the PIINS subsample is significantly greater than that of the firms in the NIINS subsample, consistent with our second research hypothesis.

Conclusions

This study updates and extends previous research on the returns to IPOs by incorporating insider transactions volume into an examination of both initial and post-offering performance. We find that (1) initial insider sales are associated with lower initial returns; (2) insiders in general tend to be net sellers in the post-offering period; and (3) insiders in firms which displayed initial insider sales were also the heaviest (net) sellers in the post-offering period. In sum, our results are consistent with both the Leland-Pyle and Gale-Stiglitz theses, and indicate that the contradictory results of previous studies may be due in part to the omission of insider transactions as an explanatory variable.

Suggestions For Future Research

The IPO underpricing phenomenon continues to be widely reported in both the financial and the academic press. The results of this study suggest that sales by insiders provide a possible explanation; however, many other factors undoubtedly contribute to the phenomenon. Future researchers may find it useful to examine more closely such things as relationships between insiders' transactions and firm characteristics, the effects of changing capital market conditions and an evolving regulatory environment, and the relative importance of insiders' transactions and other factors as explanatory variables. ❧

Endnotes

1. See, for example, Karpoff and Lee (1991), who find that corporate insiders accelerate their sales prior to the issuance of seasoned equity.
2. Downes and Heinkel find a significant positive relationship between post offering firm value and insider equity retention and conclude that their findings constitute "strong support for the LP hypothesis" (1982, p. 9). It should be noted, however, that Ritter (1984) concludes that the relationship between insider equity retention and firm value may also be attributable instead to an "agency effect" arising as a result of the tendency for managers without significant ownership interests to engage in non-shareholder wealth-maximizing behavior.
3. We would like to thank an anonymous referee for alerting us to the possibility of subsequent offerings by the sample firms in the year following the IPO. Sixteen firms were eliminated due to the existence of additional equity offerings in the post-offering period.
4. Replication of the computations using the S&P 500 as the market proxy provided results which are qualitatively similar to those presented.
5. Days on which no insider transactions occur are excluded from the computation.
6. Tests of the differences in these two variables across subsamples employed a standard two-sample t-test. The test statistic for the difference in firm age is 1.19; the test statistic for the difference in initial insider sales is -.71.
7. This finding roughly parallels that of Reilly (1973) who reports 49 percent of the firms in his sample display zero or negative returns by the Friday immediately following the offering.
8. The critical values, s1, and s2, are computed as follows.

$$s_1 = Np_o + z[(Np_o(1 - p_o))]^{.5}, \text{ and}$$

$$s_2 = Np_o - z[(Np_o(1 - p_o))]^{.5},$$

where: N = the number of observations,
po = the hypothesized proportion (.50), and
z = the standard normal variate corresponding to the level of significance chosen.

The null hypothesis is rejected if S (the number of observations with the attribute being tested) is outside of the interval (s1,s2). See Daniel (1978).
9. In both subsamples, the majority of the transactions

occurred between day 90 and day 250. The virtual absence of insider transactions prior to day 90 may be the result of restrictions placed on the sale of shares by insiders by SEC Rule 144. With respect to this rule, Osborne (1982) indicates that, while insiders were not completely precluded from selling shares immediately following an offering, but that they were subject to limitations based on such things as number of shares outstanding and weekly trading volume. It is also interesting to note that our results roughly parallel those of Aggarwal and Rivoli who find that post-offering returns are positive through the 100th day following the offering, but "decline between 5 months and 1 year following the offering" (1990, p. 50).

10. Examination of the data suggests that it is not normally distributed; hence, parametric tests are inappropriate. In order to perform the test, the samples are combined and ranked from smallest to largest on the variable of interest, NETPCT. For samples greater than 20, the critical value of the test statistic, z, is equal to:

$$\frac{S - n_1(n_1 + 1)/2 - n_1(n_2)/2}{[n_1(n_2)(n_1 + n_2 + 1)/12]^{.5}}$$

where n1, n2 are the sizes of the respective samples and S is the sum of the ranks assigned to the observations from sample 1. Under H0 z is approximately normally distributed. (See Daniel (1978).)

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