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Ownership structure and performance: Evidence from the public float in IPOs

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ABSTRACT

We investigate whether the post-IPO market performance of IPO stocks is related to the percentage of shares issued to the public, namely, the public float. We demonstrate that a non-linear relation exists between the public float and post-IPO returns. Specifically, as public float increases, long-run returns decrease for low levels of public float and increase for high levels of public float. This relation persists even after controlling for various firm characteristics. The best long-term performers are firms that sell either very little or sell most of their stock in the IPO. We suggest that the choice of public float level creates a trade-off between incentives to insiders and power granted to outsiders. This trade-off determines the non-linear relation found between the public float and long-run returns.

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1. Introduction

While IPOs have been one of the most studied topics in corporate finance, it is noteworthy that the percentage of post-IPO shares available in the public domain has received little attention in the literature. For each IPO, the firm must determine the percentage of shares that will constitute the public float. This float includes institutional ownership along with individual ownership. There are unanswered empirical and theoretical questions relating to the public float decision. Indeed, Ritter (2003) notes that "the academic literature is devoid of direct tests to see whether this is in fact a relevant valuation factor..." This is puzzling because the public float is one of the central decision variables under the control of management considering an IPO. Furthermore, in his seminal work, Zingales (1995) highlights the importance for the seller of balancing cash flow rights and control rights. The public float is naturally a central determinant of this balance. Because the public float is negatively related to the control the issuer retains, it directly affects the likelihood of subsequent takeovers, which is another important concern of IPO firm management (e.g. Hsieh et al., 2011). The public float also determines a parent firm's ability to re-acquire its subsidiary after issuing it to the public in an equity carve-out. This re-acquisition is an important factor in equity carve-outs as demonstrated in Desai et al. (2011).

In this study we examine the relation between public float and post-IPO long-run returns using a sample of 1801 IPOs that occurred between January 1996 and December 2006. In particular, we are interested in learning (i) what characterizes the distribution of the public float, (ii) whether the long-term performance of IPO stocks depends on the choice of the public float and (iii) whether the impact of the public float on long-run returns is related to pre-IPO firm characteristics. While earlier studies that investigate the public float focus on topics such as first day returns (e.g. Habib and Ljungqvist, 2001; Bradley and Jordan, 2002) and ownership of different outsider groups (e.g. Kaul et al., 2000), our study focuses on the relationship of the public float in IPOs and the associated long-run returns. We focus on insiders selling to outsiders and complement studies like Kaul et al. (2000) that consider differences within the outsider group (e.g. institutional investors vs. other outsiders). The IPO framework provides us with a natural laboratory to investigate the relation between insider ownership and long-term stock performance. This is because all firms have no public ownership before the IPO, but it is the choice of the public float that determines the level of public ownership following the IPO.

We define the public float as the fraction of post-IPO shares held by the public (both individuals and institutions) and investigate the post-IPO stock performance for various horizons. We first sort

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the sample into five public float size ranges: 0–20%, 20–40%, 40–60%, 60–80%, and 80–100%. We then calculate the average 4-factor adjusted abnormal return (alpha) using the three Fama–French (1993) factors and the Carhart (1997) momentum factor in each size group, for different time horizons ranging between 6 months and 36 months. Our findings here are novel. We find clear evidence that the relationship between the public float and the long-run return is not monotonic. Namely, at very low levels of public float the long-run returns decrease as the public float percentage increases. However, at higher levels of public float, the situation is reversed, and long-run returns increase as the public float percentage continues to increase. Consider for example our findings for the average 36-month 4-factor adjusted abnormal return (alpha). In the 0–20% public float range it is 20.90%. It decreases to −4.89% for the 20–40% public float range, and further decreases to a minimum of −11.29% in the 40–60% range, then increases to 11.23% for the 60–80% range, and reaches 12.23% in the 80–100% range. This U-shaped relation between the public float and long-run returns also holds for all the other horizons considered (6, 12, and 24 months after the IPO). Considering the number of IPOs in each public float range, we find that firms tend to choose a public float level for which long-run abnormal returns (alpha) tend to be low. In particular, 59% of the IPOs in our sample (1061 IPOs) are concentrated in the range 20–40%. In other words, firms generally issue a fraction of their shares that results in low (negative) abnormal returns.

Regression results indicate that the relation between long-run returns and the public float is indeed non-linear. When we try to fit a linear regression between alpha and the public float, the coefficient of the public float level in the regression is never significant. However, once we fit a quadratic regression, the coefficients of both the public float and square of the public float are significant at the 1% level. For example, in the regression using the 36-month alpha, the coefficient of the public float variable *PF* is −4.143 and the coefficient of $(PF)^2$ is 4.0202. This is consistent with the relation being decreasing for low levels of public float and increasing for high levels of public float.[1] The regression results suggest that the minimum alpha is attained at a public float level of 51.5%. The significance of the quadratic relation between long-run returns and the public float also holds in multivariate regressions where we control for various pre-IPO firm characteristics, including sales, operating profit, net income, property, plant and equipment (PPE), and leverage. Interestingly, when these firm characteristics are included in the regressions with the public float, only pre-IPO property, plant and equipment is significant in explaining the long-run abnormal returns.

What is it that drives the U-shaped relationship between long-run returns and public float? We suggest that two forces shape this relationship: incentives and monitoring. Before the IPO, the public owns no shares. Selling shares to the public introduces an agency problem because it reduces the incentives of insiders. The higher the public float, the less the incentive there is for insiders to exert themselves because they get to keep less of the fruits of their labor. Moreover, the higher the public float, the stronger the incentives for insiders to engage in empire building and other wasteful actions that result in the benefits going to insiders while the costs are shared by outside shareholders. On the other hand, the greater the public float, the less costly it is for outside shareholders to monitor decision makers. Furthermore, this results in outside shareholders having more power over insiders to enforce policies that prevent waste. At low levels of public float, increasing the float reduces incentives for insiders more than it increases monitoring power for outsiders. There is then some threshold level at which the situation is reversed and increasing the public float makes outside shareholder monitoring cost efficient. It enables them to dictate policies and prevent wasteful actions that only benefit insiders but not the firm as a whole or outside investors.

There are several additional scenarios that are consistent with the non-linear U-shaped relation we find between the public float and long-run returns. Consider first the association of low public float with high long-run returns. For example, market participants may obtain privately held information about the future prospects of an IPO by observing the level of public float. If the main reason for launching the IPO is to prepare the firm for future acquisition at a higher premium, then we may observe a lower level of public float at the IPO stage. By retaining a higher level of ownership, the managers possess the real option to sell the remaining ownership at a premium. Therefore, this category of IPOs would tend to have better long-run performance and lower time-to-acquisition. Next, consider the association of high public float with high long-run returns. A high-float IPO may occur, for example, in situations where a firm needs significant cash in order to take advantage of good investment opportunities that they cannot convey in a credible manner. To raise significant funds, management may tend to use a high-float IPO to realize a major equity infusion. Participants in the IPO will earn a premium only in the long run as the investment opportunities are revealed.

More generally, Jensen and Meckling (1976) raise the agency problem associated with the separation between ownership and control. Insiders have more of an incentive to benefit at the expense of the public shareholders, the larger the public ownership. On the other hand, the larger the public ownership, the more power the public has over management, and hence the higher the firm value and return to investors. These governance arguments are raised for example, by La Porta et al. (2000) and Hart (1995). The IPO framework provides a venue to investigate the incentive factor and the monitoring factor that is raised in the above governance literature. Our findings of a non-linear relation between the public float and long-run performance may indicate that the insiders' incentives are the dominating factor at very low levels of public float, while outsiders' monitoring power dominates at higher levels of public float. The agency framework clearly predicts a non-linear relationship between the public float and long-run performance. Therefore, the effect of the public float on long-run performance is an empirical issue and is the contribution of the paper.

The remainder of this paper is organized as follows. Section 2 reviews related literature and Section 3 describes our data and methodology. Section 4 reports the relation between the public float and long-run returns and considers the implications of these findings. Section 5 concludes.

2. Related literature

IPOs are perhaps the most studied topic in corporate finance. A substantial body of literature focusing on IPOs has been developed identifying three empirical themes: (1) short-run underpricing, (2) cycles in both the number of IPOs and first-day abnormal returns, and (3) poor long-run performance (see, for example Ritter, 1984; Ibbotson and Ritter, 1995; Ritter and Welch, 2002). However, to our knowledge, only the relation between the first theme (short-run underpricing) and the public float has been considered. In particular, Habib and Ljungqvist (2001) and Bradley and Jordan (2002) find that underpricing is negatively related to the public float, suggesting informational effects. Namely, the higher the public float, the lower the first day return.

[1] We are grateful to the reviewer for suggesting that we test for a quadratic relation.

In general, the literature documents negative abnormal long-run returns in the post-IPO period (Ritter, 1991; Ritter and Welch, 2002). However, a number of authors suggest that these negative returns are the result of measurement errors (e.g. Brav, 2000) and sample period selection (e.g. Ritter and Welch, 2002). In addition, once firm size and growth benchmarks are accounted for, there is only little evidence of under-performance (see Brav and Gompers, 1997; Gompers and Lerner, 2003). While this literature criticizes the manner in which long-run returns are measured, our focus is on the manner in which public float affects returns, rather than on measuring returns, per se. As discussed earlier, our findings suggest that the relationship between long-run returns and public float is U-shaped. We measure this relation against different benchmarks and different horizons and find that it persists.

There is also a considerable theoretical literature exploring the relation between ownership structure and corporate valuation (e.g. Shliefer and Vishny, 1986; Kahn and Winton, 1998; Noe, 2002, and more recently, Oded and Wang, 2010). Focusing on IPOs, Stoughton and Zechner (1998) show that ownership structure impacts returns through incentive and control considerations. However, they only consider first-day IPO returns and not the impact on long-run returns. Empirically, Lowry (2003) finds that long-run returns are negatively correlated with the size of the IPO. Decomposing the public float to primary shares (new shares sold by firm) and secondary shares (existing shares sold by pre-IPO owners), Ljungqvist and Wilhelm (2003) find that underpricing is negatively related to the fraction of secondary shares sold. They suggest that this results because the fewer shares insiders sell, the less they care about underpricing. However, Brau et al. (2007) find that neither underpricing nor long-run returns are affected by issuance of secondary shares in the IPO. Wang (2005) investigates changes in operating performance following Chinese IPOs. Interestingly, he finds that firms with low and high levels of non-state ownership exhibit a positive relation between non-state ownership and performance changes, whereas firms with intermediate levels of non-state ownership experience a negative relation between non-state ownership and performance changes. In a sample that does not focus on IPO firms, Morck et al. (1988) document a non-monotonic relation between management ownership and market valuation of the firm as measured by Tobin's *Q*. Morck et al. (1990) find that long-run returns are strongly related to sales, consistent with our findings for IPO firms. Focusing on pre-issue ownership structure, Alavi et al. (2008) show that public float is inversely related to management ownership and suggest that this results from control retention considerations.

3. Data and methodology

The IPO sample was obtained from the SDC database for the period January 1, 1996 through December 31, 2006. From an initial sample of 1979 IPOs obtained from the SDC after excluding IPOs of financial and utility firms (see, for example, Fama and French, 2001; Field and Karpoff, 2002), we eliminated 74 ADR firms. We also eliminated 52 firms because of missing CRSP data and 39 firms because of missing Compustat data. An additional 13 firms were eliminated because of erroneous SDC data. The final sample includes 1801 IPOs.

Stock return data for our sample of IPO firms is obtained from the CRSP monthly stock database for a 36-month period following the IPO. Information about the explanatory variables for the analysis was obtained from the Quarterly Compustat database from four quarters prior to the IPO until 12 quarters (three years) after the IPO. The variables we consider include revenues, EBITDA, net income, property, plant and equipment (PPE), total assets, total liabilities, leverage, and ratios and margins calculated based on these variables.

Table 1 presents summary statistics of our sample. Panel 1A reports the mean, median, and standard deviation of the percentage of shares offered (henceforth "public float" or "*PF*"), firm size, and the accounting variables used in the analysis. Due to missing data, the sample size for the accounting data variables ranges from 1316 to 1801. Consequently, the sample size in the operating performance analysis varies depending on the variables used. We report yearly data based on the last four quarters prior to the IPO (Year_{-1}) for income statement based variables (revenue, EBITDA, and net income) and values based on the last quarter figures prior to the IPO for balance sheet variables (PPE, assets, and leverage).[2] In Table 1 and throughout the analysis we winsorize variables at both the upper and lower 1% of the sample in order to mitigate the influence of extreme observations and data coding errors. Winsorizing has no qualitative effect on any of our results. Truncating instead of winsorizing observations also produces similar qualitative findings.

The post-IPO percentage offered to the public averaged 29.4%, with a median of 26.7% and a standard deviation of 13.9%. The mean size, reflecting the mean equity value of the firm just after the IPO (i.e. the number of shares outstanding immediately following the IPO multiplied by the offer price) is $516 million, while the median size is $233 million and the standard deviation is $796 million.

The mean sales (annual revenue), mean EBITDA, and mean net income in the year prior to the IPO are $219 million, $24.42 million, and $−1.81 million, respectively. The mean values for PPE and total assets in the last quarter prior to the IPO are $60.15 million, and $212 million, respectively. As the table shows, the medians of the size and accounting variables (with the exception of net income) are significantly lower than the means, reflecting the fact that the data is highly positively skewed. The standard deviations are also high because of several dramatic outliers. The mean leverage (the ratio of long-term debt-to-total assets) is 0.73 while the median is 0.67 and the standard deviation is 0.50.

Panel 1B reports the distribution of the sample by public float ranges (rows) and by year (columns). We sort the sample of IPOs into five groups by public float percentage in 20% ranges. Each row in the panel represents a different range of public float in ascending order. The first eleven columns report the number of IPOs in each of the years 1996–2006, respectively. The last column reports the public float range total over all years. The bottom row reports the yearly totals over all public float ranges. As the panel shows, the distribution is uneven. The number of IPOs peaks at the range 20–40% and then decreases. This pattern holds not only for the complete sample but also for each year. About 59% of the IPOs in the sample have a public float in the 20–40% range. As Panel 1B shows, the number of IPOs in each of the years 2001–2003 is about one third of the number of IPOs in each of the years 2004–2006 while in the years 1996–2000 there are even more IPOs. Judging by the number of IPOs, the years 2001–2003 are considered relatively cold IPO market years, and the rest of the years are hot IPO market years.

[2] This information is taken from the Compustat Fundamentals Quarterly database. Compustat information is sometimes missing. In such cases, we completed the information using the prospectus on the SEC website (http://www.sec.gov). If data was missing for multiple quarters, we omitted the observation, unless the missing data was for quarters prior to the IPO and there was no discontinuity in the reporting, in which case we assumed a value of zero. For example, if in the year before the IPO, net income was reported only in the last two quarters before the IPO we assumed that the net income in the other quarters of that year was zero. But, if net income was reported in three out of four quarters prior to the IPO and the missing quarter was the last before the IPO, we omitted the observation.

Table 1
Descriptive sample statistics.

Panel 1A: General sample characteristics

Item	(1) Mean	(2) Median	(3) Std.	(4) *N*
PF (Public Float)	29.40%	26.69%	13.93%	1801
Size ($ millions)	516.17	233.15	796.15	1746
$Sales_{-1}$ ($ millions)	218.61	36.22	654.09	1709
$EBITDA_{-1}$ ($ millions)	24.42	2.88	81.91	1316
$Net\ Income_{-1}$ ($ millions)	−1.81	−0.63	27.86	1709
PPE_{-1}	60.15	4.36	209.68	1751
$Assets_{-1}$	211.54	32.54	643.39	1753
$Leverage_{-1}$	0.73	0.67	0.50	1751

Panel 1B: number of IPOs by public float and by year

Public float range (%)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Range total
0–20	70	50	26	120	85	14	9	7	28	15	15	439
20–40	271	187	70	134	87	17	34	30	84	69	78	1061
40–60	64	53	20	16	9	5	6	5	16	24	17	235
60–80	13	6	2	5	1	3	0	0	4	5	2	41
80–100	3	1	1	3	1	1	1	6	2	3	3	25
Yearly total	421	297	119	278	183	40	50	48	134	116	115	1801

This table reports sample statistics. The sample consists of 1801 IPOs between January 1996 and December 2006. Panel 1A reports general sample characteristics. The mean, median, and standard deviation are reported in columns (1) through (3) for all IPOs for which information was available, and column (4) indicates the sample size (column (4) of Panel 1A reports the number of IPOs used in the analysis. Due to missing data and data constraints, the sample size ranges from 1316 IPOs for analyses on EBITDA to 1801 for the analyses involving *PF* only). *PF* is the public float, that is, the percentage of the company's shares owned by the public immediately following the completion of the IPO. *Size* represents the equity value of the post-IPO firm and is calculated as the number of shares outstanding as of the first closing quarter after the IPO multiplied by the closing price using Compustat data. $Sales_{-1}$ are sales in the year just prior to the IPO from Compustat quarterly data files aggregated over the last four quarters prior to the IPO (using Compustat data item REVTQ). $EBITDA_{-1}$ and $Net\ Income_{-1}$ are, respectively, EBITDA and net income in the year prior to the IPO and are calculated similar to $Sales_{-1}$ (using Compustat data items OIBDPQ and NIQ, respectively). PPE_{-1} is plant, property, and equipment in the last quarter prior to the IPO date (Compustat data item PPENTQ). $Assets_{-1}$ are total assets in the last quarter prior to the IPO (Compustat data items ATQ). $Leverage_{-1}$ is financial leverage, calculated as the ratio of long-term debt-to-total assets in the last quarter prior to the IPO using Compustat quarterly data files (data items DLTTQ and ATQ, respectively). To control for outliers, variables are winsorized at 1%. Panel 1B reports the distribution of the sample by year and by public float ranges.

4. Long-run returns

Next we investigate the post-IPO performance for different long-run horizons. We first consider long-run returns without controlling for public float. Table 2 presents our findings about the long-run returns for the complete sample of 1801 IPOs measured over 6, 12, 24, and 36 months following the IPO date. We measure long-run returns using CRSP monthly returns from the first month after the IPO (e.g. Barber and Lyon, 1997). In Panel 2A we report the buy-and-hold long-run returns, calculated over the four aforementioned time intervals.[3] Column (1) reports the mean 6, 12, 24, and 36 month 4-factor adjusted returns and column (2) reports the associated *t*-statistics. The results suggest that the abnormal returns are positive and significant at the 1% level. The mean abnormal returns are 3.35%, 1.79%, 2.02%, and 1.17% after 6, 12, 24, and 36 months, respectively. Thus, while the abnormal returns are positive and significant, they are generally decreasing over time. For completeness we also report average naïve returns and their *t*-stats in columns (3) and (4), respectively.

Buy-and-hold returns have been criticized for not providing robust results (e.g. Fama, 1998; Brav, 2000). Consequently, calendar-time returns have become more popular in long-run return studies (e.g. Fama, 1998; Mitchell and Stafford, 2000). We construct calendar time portfolios following Fama (1998) using monthly returns. Panel 2B reports calendar-time portfolio regression results for 6, 12, 24, and 36 months. Calendar time portfolio returns are insignificant as is evident from the low intercept. These findings are consistent with earlier literature suggesting that after controlling for factors such as size and market-to-book (e.g. Brav and Gompers, 1997), the post-IPO long-run returns are insignificant. As we will show, however, the public float does affect the post-IPO long-run returns and the impact on these returns is statistically significant even after controlling for various firm characteristics.

Next we move to investigating the relation between long-run returns and the public float. In Table 3 we report long-run returns as a function of the percentage of the public float for different horizons. The table reports the 4-factor adjusted buy-and-hold abnormal returns for these time periods for each of the public float ranges. In addition, we report the mean and the *t*-statistic for each horizon and public float range. The general picture that evolves for the average return, for all horizons and for both panels, is that the return drops when going from the 0–20% range to the 20–40% range, and then drops again when moving from 20–40% to 40–60%. Then, when moving from 40–60% to 60–80% the return is increasing. For the longer term horizons, namely 24 and 36 months, returns in the 80–100% range remain high, and even continue to increase in the 36 month horizon. Consider, for example, the mean 36-month horizon (column (7)). The mean return is 20.90% for the smallest interval of the public float, 0–20%. It decreases to −4.89% in the range 20–40%, further decreases to −11.29% in the range 40–60%, dramatically increases to 11.23% in the range 60–80%, and then slightly increases to 12.23% in the range 80–100%. All abnormal returns are significantly different from zero at the 1% level. It is particularly interesting to observe that about 59% of the IPO sample concentrates in the range 20–40%, and that these IPOs earn relatively low returns (the second to lowest range), A similar pattern is evident in each of the other horizons (6, 12, and 24 months).

Earlier literature has reported that dual-class IPOs tend to have less underpricing and better operating and stock performance than single-class IPOs (see Smart and Zutter, 2003; Boehmer et al., 1996). We therefore compared the average public float for dual-class shares with the public float associated with single-class

[3] Results using cumulative abnormal returns are qualitatively similar. Barber and Lyon (1997) argue that BHAR (buy and hold abnormal returns) are more appropriate than CARs (cumulative abnormal returns) for analyzing long-run returns, while Brav et al. (2000) conclude that results using CARs are more robust.

Table 2
Long-run returns of IPO stock.

Panel 2A: Buy-and-hold long-run returns

Holding period	4 Factor adjusted buy-and-hold abnormal returns		Naive buy-and-hold returns	
	(1) Mean (%)	(2) *t*-Stat	(3) Mean (%)	(4) *t*-Stat
6 Months	3.35	17.37	2.29	11.85
12 Months	1.79	6.55	0.09	0.32
24 Months	2.02	5.24	0.81	2.09
36 Months	1.17	2.47	3.22	6.81

Panel 2B: Long-run returns – calendar-time regression results

	(1) 6 Months	(2) 12 Months	(3) 24 Months	(4) 36 Months
Intercept	−0.0057	−0.0051	−0.0046	−0.0006
	(−1.0805)	(−1.3570)	(−1.6151)	(−0.1885)
Mkt − Rf	1.2420***	1.1190***	1.1119***	0.9654***
	(8.8297)	(11.0984)	(16.2481)	(13.6223)
SMB	0.8139***	0.8673***	0.9337***	0.7435***
	(5.7595)	(8.5117)	(11.9865)	(8.7785)
HML	−0.4718***	−0.5382***	−0.4396***	−0.5302***
	(−2.6117)	(−4.1894)	(−4.7062)	(−5.7413)
Mom	0.1136	−0.0876	−0.2489***	−0.2121***
	(1.1663)	(−1.2360)	(−4.6094)	(−3.9294)
Adj R^2	0.6695	0.7823	0.8560	0.7849

This table reports long-run returns of IPO stock. Panel 2A reports the average buy-and-hold returns to IPO investors for different holding periods for the entire sample of 1801 IPOs. The holding periods reported in the table are: 6 months, 12 months, 24 months, and 36 months, starting from the first month after the IPO. They are calculated using monthly returns from CRSP (see, for example, Barber and Lyon, 1997). Columns (1) and (2) report, respectively, the mean and *t*-statistic of the buy-and-hold abnormal return (alpha) calculated using a model that is based on the three Fama–French factors and the Carhart (1997) momentum factor. Columns (3) and (4) report the cumulative naive buy-and-hold return. Panel 2B reports calendar-time regression results for the different long-run horizons considered in Panel 2A. In column (1) of Panel 2B, we report the results of a regression where the dependent variable is the monthly return of a portfolio that includes all firms that had an IPO over the last six months and the independent variables are the monthly returns on the four factors. Columns (2) to (4) of Panel 2B report the calendar-time regression results for the other long-run horizons (which are constructed in a similar manner). *t*-statistics are reported in parentheses. To control for outliers, returns are winsorized at 1% (both panels).
* Significance level of 10%.
** Significance level of 5%.
*** Significance level of 1%.

Table 3
Four factor adjusted long-run returns of IPO stock sorted by public float.

Public float range (%)	*N*	6 Months		12 Months		24 Months		36 Months	
		(1) Mean (%)	(2) *t* Stat	(3) Mean (%)	(4) *t* Stat	(5) Mean (%)	(6) *t* Stat	(7) Mean (%)	(8) *t* Stat
0–20	439	10.31	22.41	2.22	3.41	7.49	8.15	20.90	18.56
20–40	1061	1.43	5.85	1.32	3.83	0.27	0.55	−4.89	−8.19
40–60	235	−2.52	−5.72	−4.17	−6.70	−5.45	−6.20	−11.29	−10.48
60–80	41	11.05	11.10	33.37	23.70	20.73	10.41	11.23	4.60
80–100	25	5.69	4.57	18.27	10.36	20.07	8.05	12.23	4.00

This table reports the average buy-and-hold long-run return in the different public float ranges for various holding periods. Returns are calculated from the first month after the IPO using monthly returns from CRSP (see, for example, Barber and Lyon, 1997) and a model that is based on the three Fama–French factors and the Carhart (1997) momentum factor. The complete sample consists of 1801 IPOs. Columns (1) through (8) report the 4-factor adjusted buy-and-hold abnormal returns. We first sort the IPO sample into five public float ranges: 0–20%, 20–40%, 40–60%, 60–80%, and 80–100% for each range. We then measure the return for 6, 12, 24, and 36 months. For each horizon, we report the mean return and the *t*-statistic of the mean return. To control for outliers, returns are winsorized at 1%.

shares in our sample and found the difference to be insignificant. There was also no significant difference in the average long-run return and no tendency for IPOs with dual-class shares to concentrate in any of the public float ranges. We therefore do not expect excluding dual-class shares to impact the robustness of the findings.

We next investigate the relation between long-run returns and public float using regression analysis. Given the evidence of a U-shaped relation in Table 3, we fit a quadratic regression.[4] Table 4 presents the results of five regressions relating long-run abnormal returns (alpha) to the public float percentage (*PF*), and $(PF)^2$, controlling for various pre-IPO firm characteristics. We present results only for the 36-month returns. The results for the other horizons (6, 12, and 24 months) are qualitatively similar. In all regressions, the dependent variable is the 4-factor adjusted buy-and-hold abnormal return. We consider five control variables. One control is the natural log of sales in the year prior to the IPO ($Log(Sales_{-1})$). We control for two measures of ROA (return on assets). These are EBITDA as a fraction of total assets ($EBITDA/Assets_{-1}$) and net income as a fraction of total assets ($NI/Assets_{-1}$).[5] We also control for property, plant and equipment as a fraction of total assets ($PPE/Assets_{-1}$) and leverage in the year prior to the IPO, measured as a ratio of total long-term debt to total assets in the year prior to the IPO ($Leverage_{-1}$). Because the data suggests that EBITDA and net income are highly correlated, we did not include these variables in the same regression in order to avoid problems of multicolinearity.

[4] We also verified that a linear relation does not exist, i.e. when we used only *PF* without $(PF)^2$, *PF* was not significant.

[5] We also performed the analysis using operating income after depreciation instead of EBITDA. The results obtained are qualitatively the same.

Table 4
Long-run abnormal returns – regression results.

	(1)	(2)	(3)	(4)	(5)
Intercept	1.0580***	0.8385***	0.6324***	0.5750**	0.7584***
	(5.2956)	(3.8218)	(2.5229)	(2.2728)	(3.2140)
PF	−4.1429***	−3.5804***	−2.3600**	−2.6089***	−3.7159***
	(−4.3213)	(−3.6654)	(−2.2335)	(−2.4399)	(−3.7092)
$(PF)^2$	4.0202***	3.3621***	2.0825*	2.2867*	3.5130***
	(3.6024)	(2.9565)	(1.7315)	(1.8910)	(3.0340)
$Log(Sales_{-1})$		0.0332	0.0229	0.0228	0.0384
		(1.4927)	(0.7819)	(0.7627)	(1.3839)
$EBITDA/Assets_{-1}$			0.0807	0.0742	
			(0.7328)	(0.6712)	
$NI/Assets_{-1}$					−0.0340
					(−0.3626)
$PPE/Assets_{-1}$				0.5176***	0.5411***
				(2.3810)	(2.5513)
$Leverage_{-1}$				−0.0968	−0.1629
				(−0.6724)	(−1.1828)
Adj R^2	0.0394	0.0411	0.0343	0.0371	0.0442
N	1801	1646	1249	1241	1611

This table describes regression analysis results on the relation between the buy-and-hold long-run abnormal return and the public float, controlling for various performance variables and firm characteristics. The dependent variable is the 36-month abnormal return, measured using a model that is based on the three Fama–French factors and the Carhart (1997) momentum factor (4-factor alpha). The explanatory variables in the different regressions reported are various combinations of the following variables. *PF* is the public float, that is, the percentage of the company's shares owned by the public immediately following the completion of the IPO, and $(PF)^2$ is the square of the public float. $Log(Sales_{-1})$ is the natural log of the sales in the year immediately preceding the IPO, where yearly sales are calculated by aggregating quarterly sales over the last four quarters prior to the IPO (using Compustat quarterly data item *REVTQ*). $EBITDA/Assets_{-1}$ and $NI/Assets_{-1}$ are respectively, EBITDA and net income in the year prior to the IPO and are calculated similar to $Sales_{-1}$ (using Compustat data items *OIBDPQ* and *NIQ*, respectively) normalized by total assets in the last quarter prior to the IPO (Compustat data item *ATQ*). $PPE/Assets_{-1}$ is plant, property, and equipment in the last quarter prior to the IPO date, normalized by total assets in the last quarter prior to the IPO (Compustat data items *PPENTQ* and *ATQ*, respectively). $Leverage_{-1}$ is financial leverage, calculated as the ratio of long-term debt-to-total assets in the last quarter prior to the IPO using Compustat quarterly data items *DLTTQ* and *ATQ*, respectively. The *t*-statistics are reported in parentheses below the coefficient. Adjusted R^2 and the sample size for each regression are reported in the last rows of the table. To control for outliers, returns are winsorized at 1%.
*** Significance level of 1%.
** Significance levels of 5% level.
* Significance levels of 10% level.

The five regressions that we ran are as follows. In regression (1) the only independent variables are *PF* (public float) and $(PF)^2$. As the table shows, the coefficient of *PF* is negative while the coefficient of $(PF)^2$ is positive, and both are significant at the 1% level. These findings suggest that the relation between the long-run returns and *PF* is indeed U-shaped. Considering the parabola $alpha36 = a(PF)^2 + bPF + c$, where *alpha36* is the 36-month abnormal return, regression (1) suggests that $a = 4.0202$, $b = -4.1429$ and $c = 1.058$. Thus, according to regression (1) results, the minimum *alpha36* is attained at $PF = -b/2a = 4.1429/(2 * 4.0202) = 51.5\%$. This is consistent with the findings in Table 3 for the 36-month return, where the minimum *alpha* attained is in the 40–60% range.

In regressions (2) through (5) of Table 4 we consider *PF* and $(PF)^2$ with other control variables. *PF* and $(PF)^2$ stay significant in all regressions. In regression (2) we add $Log(Sales_{-1})$ and in regression (3) we add $EBITDA/Assets_{-1}$. In regression (4) we add $PPE/Assets_{-1}$ and $Leverage_{-1}$, and in regression (5) we substitute $NI/Assets_{-1}$ for $EBITDA/Assets_{-1}$. As the results show, of the control variables added, only $PPE/Assets_{-1}$ is significant in explaining the abnormal return. Specifically $PPE/Assets_{-1}$ is positive and significant in both regressions (4) and (5), suggesting the higher the PPE at the time of the IPO relative to assets, the higher the abnormal long-run return. To summarize, Table 4 confirms that the relation between the abnormal return and *PF* is indeed quadratic and this quadratic relation is robust even after controlling for various firm characteristics.[6]

We also ran regressions (1) through (5) of Table 4 with a single dummy variable indicating whether the IPO was in 2001–2003 or the rest of the years (1996–2000, 2004–2006), in order to test whether our results are robust to the hot and cold market phenomena.[7] We ran these regressions for the 6, 12, 24, and 36 month horizons. The coefficient of this dummy variable was insignificant, suggesting that the time period has no impact on the long-run returns. There was also no impact on the coefficient of the public float variable, implying that the effect of the public float on returns does not depend on whether the market is hot or cold (we acknowledge that we only have one hot–cold–hot cycle in the sample, which weakens the robustness of this inference).

In unreported analyses we investigated whether post-IPO operating performance depends on the public float. We find that, like long-run returns, revenue growth is generally quadratic with the public float. However, we do not find any relation between the public float and other performance variables. It is possible that the market valuation of IPO firms is primarily driven by revenue and less by other operating performance measures. At the same time, we find that the quadratic relation between the public float and long-run returns persists even after controlling for the post-IPO change in operating performance. We also investigated whether the public float is determined by pre-IPO firm characteristics. Our findings here suggest that the public float is positively related to fixed assets (PPE) and leverage. This may be because greater fixed assets are associated with higher funding needs, while higher leverage may motivate the firm to reduce leverage through a larger equity issue. The public float is also positively related to profitability, perhaps because profitability provides

[6] In unreported analyses we also verified that the quadratic relation between long-run returns and the public float persists also after controlling for seasoned equity offers (SEOs) following the IPO.

[7] Judging by the number of IPOs in our sample, the years 2001–2003 were cold issue market years, whereas the rest of the years in our sample (1996–2000 and 2004–2006) were hot issue market years. Indeed, the numbers of IPOs in the years 2001–2003 were respectively, 40, 50, 48, whereas in the rest of the years they vary between 115 in 2006 and 421 in 1996.

credibility that enables the firm to sell a larger fraction of the firm.[8]

In the next paragraphs we offer a possible explanation for our findings. We suggest the relation between the public float and the post-IPO long-run returns can be explained by the post-IPO ownership structure and the tension between ownership and control that this structure engenders. While ownership is linear in the public float, control is not. At very low values of public float, with few shares in public hands, insiders gain significant pecuniary benefits from enhancing the value of the enterprise and their incentives are therefore aligned with maximizing shareholders' value. However, at these low levels, as public float increases, ownership rights of the insiders are reduced linearly in the public float, but their control is hardly reduced because they still own most of the shares. As a result, at low levels of public float, as the public float increases, the misalignment between ownership and control also increases. This reduces the insider-managers' incentive to perform. Increasing the public float reduces the insiders' share in the firm's profits, but their control over the firm is maintained. While the public ownership is increased, the public hardly increases its power to discipline insiders, nor does it have enough ownership to justify the costs of monitoring the insiders. Thus, at low levels of public float, the aggregate impact of increasing the public float is a decrease in the insiders' incentive to perform. Moreover, there is no comparable increase in outside shareholder monitoring and management discipline. Increasing the public float results in decreasing firm performance, which is reflected in lower returns. However, as the public float continues to grow, while insiders' pecuniary benefits continue to decrease, outside shareholders now gain increasing control over management. At the same time their potential benefits from monitoring and management discipline outweigh the costs. Consequently, at higher levels of public float increasing the public float improves firm performance, and as a result, long-run returns now increase with the public float.

Put differently, we suggest that at low levels of public float the incentive effects of significant insider ownership drive the returns. As public float increases, the proportion of insiders' shares decreases, and the outsiders' control and monitoring power prevail, now driving the returns. This tension between ownership and control determines the non-linear U-shaped relation found in the long-run analysis. At low public float levels, the impact of the decrease in incentive dominates. Hence, the higher the public float, the lower the returns. At high public float levels, the value enhancing impact of outsiders dominates, and hence higher public float levels are associated with higher long-run returns.

Lastly, it is somewhat surprising that the number of IPOs is largest in the range with relatively low (on average negative) returns, 20–40% (see Table 3). This may indicate that firms tend to issue shares where the agency problem is high; insiders do not have enough incentive to maximize firm value, while outside shareholders do not have enough power to monitor and discipline management.

5. Conclusions

In this study we investigate the relation between the public float and post-IPO returns using a sample of 1801 IPOs that occurred between 1996 and 2006. We provide novel findings about the relation. We show that a quadratic relation (U-shaped) exists relating long-run abnormal returns and public float. This quadratic relation persists even after controlling for pre-IPO firm characteristics. These findings differ from those of earlier literature about short-run returns (e.g. in Bradley and Jordan, 2002; Habib and Ljungqvist, 2001), where the higher the public float, the lower the first day return. Interestingly, we find that firms tend to choose a public float level for which long-run abnormal returns (alpha) tend to be low. In particular, the number of IPOs is largest in the range with relatively low (on average negative) returns, namely, public float in the range of 20–40%.

Our interpretation is that the tension between incentives and control determines the relation between the public float and returns in the long-run analysis. Specifically, in the long run, incentives for insiders (original owners) to deliver performance are lower, the higher the public float. This is because their post-IPO ownership is smaller, implying that a higher public float will result in lower post-IPO returns. At the same time, the ability of outsiders (new public investors) to govern and monitor increases with the public float, implying that higher public float will result in higher post-IPO returns. Our findings of a U-shaped relationship between long-run abnormal returns and the public float are consistent with the above argument. An important implication here is that for good long-term performance, the transition from a private to a public firm is accompanied by either keeping a high degree of ownership and control in the hands of insiders, or transferring most of the ownership and control to the public.

We suggest investigating the relation between long-run returns and governance aspects such as board composition, minority shareholders' wealth expropriation, as promising directions for further research. Given the documented variation in financing policies across countries (see, for example, Cohen and Yagil, 2010), another area for additional research is the examination of the cross country variation in the public float decision and whether its relation to long-run returns is consistent with our findings in this paper.

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[8] The results are available upon request.

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