Public Market Staging:
The Timing of Capital Infusions in Newly Public Firms[*]

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Abstract

This paper examines the financing activities of newly public firms for evidence on the staging of capital infusions. It considers an agency cost framework in which sequential financing increases issue costs, but controls the overinvestment problem that can arise when funds are provided prior to the maturity of an investment option. We find that the time from a firm's IPO to its first post-IPO capital infusion decreases with the ratio of intangible to total assets, R&D intensity, and with investment intensity, measured relative to the amount of capital raised in the IPO. This evidence is consistent with the agency cost framework and adds to our understanding of mechanisms used to control the overinvestment problem, the optimal level of cash holdings, and the timing of fund raising activities.

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I. Introduction

The extent to which managers of a firm should have access to cash beyond that needed to fund current operating and investment requirements is an important question in finance. A large empirical literature addresses this question by examining the cross-sectional determinants of the *levels* of firms' cash holdings. This literature is motivated by theoretical arguments suggesting that firms can benefit from holding "precautionary" cash balances to protect against underinvestment that can arise due to adverse cash flow shocks and/or capital market conditions that make it difficult to raise capital. In addition, there are agency theory arguments suggesting that "excess" cash balances can be associated with wasteful overinvestment that is detrimental to shareholders. Although not uniformly in agreement, evidence from empirical studies suggests that both forces can have an impact on the level of firms' cash holdings.

A related literature focuses on how firms *manage* their cash balances. One line of inquiry examines how dividend and capital structure policies can be used to limit the ability of managers to use excess cash in ways that destroy shareholder value (Easterbrook, 1984 and Jensen, 1986). In effect, these studies consider how firms can use disbursements to manage cash levels. Cash levels are also affected by capital infusions. There has been little research on how the trade-off between agency concerns and the need for precautionary balances affects capital raising activity of public firms. We investigate these issues in this paper.

Researchers have examined the use of "staging" by venture capitalists when funding young private firms which often have severe information asymmetry and/or uncertainty about their future investment prospects (Gompers, 1995). Since the potential for agency costs of overinvestment are high in such firms, providing funding in stages helps to control these costs by allowing the venture capitalist to abandon the firm when future prospects do not materialize.

Staging (or limiting the size of capital infusions) might be used in public markets to control agency costs in high growth public firms.[1] It might also be used to prevent managers of mature public firms from using fundraising activities to reduce the effectiveness of payout policies designed to control free cash flow problems and to force managers to submit to the discipline of the capital markets (Easterbrook, 1984; Jensen, 1986). That is, without effective staging in the public capital market, managers might be able to obtain sufficiently large capital infusions so as to render useless the control aspects of payout policies.[2]

We investigate staging in the public capital markets by examining the relations between firm attributes and the length of time between a firm's IPO and its first post-IPO financing. Shorter times between IPOs and subsequent financings suggest that investors

[1] Public equity market staging can be viewed more broadly as capital "rationing" in the traditional framework of supply and demand for capital. In principle, suppliers of IPO funds recognize the potential for agency problems and the costs associated with these problems are built into the supply curve of funds that a particular firm faces. Rationing occurs because suppliers put a ceiling on how much of this risk they are willing to accept and, more importantly, because the provision of funds endogenously raises the risk of this agency problem. Thus, for example, an entrepreneur with uncertain prospects who would be willing to pay more for funds for the option of continuing a failed mission in the future is effectively screened from this activity. See Stiglitz and Weiss (1981).

[2] In fact, recent evidence suggests that managers of public firms might be gaining access to excess cash through their financing activities. Kim and Weisbach (2008) show that, four years after an IPO (SEO), issuing firms still hold an average of 39 percent (32 percent) of the IPO (SEO) proceeds in cash. More recently, McLean (2009) finds that during the 1970s, 23 percent of the funds raised through equity issues ended up in cash. Over the last decade, the corresponding ratio was 60 percent. These studies suggest that capital structure and payout policies might not be sufficient to control managerial access to excess cash.

prefer to obtain additional information on firm prospects before providing additional capital. This effectively limits the cash available to managers.

We focus on newly public firms for several reasons. First, they are more likely to be candidates for staging than other public firms because there is less public information about them and there is greater uncertainty about their future investment prospects. Second, we consider newly public firms since this allows us to focus on the time between the first two rounds of financing as a public firm. Using later rounds of financing would result in a number of methodological challenges associated with not having a common frame of reference. Finally, other studies document considerable cross-sectional variation in the length of time before newly public firms obtain additional funding (see, for example, Helwege and Liang, 1996; and Jegadeesh, Weinstein, and Welch, 1993). For all of these reasons, our focus on newly public firms should facilitate informative tests.

Evidence from a sample of 4,054 firms that completed an IPO from 1990 through 2005 indicates that staging of capital, similar to that observed for venture capital financings, is present in the public equity market. Firms with more intangible assets prior to their IPO and firms with greater research and development (R&D) intensity raise additional capital sooner after their IPO. Firms that raise less money at their IPO, relative to their pre-IPO capital expenditures, also raise additional capital sooner. This evidence is consistent with the public equity market placing greater limits on the availability of capital to managers of firms that are more subject to agency problems associated with excess cash. We also find evidence suggesting that firms which delist within five years of their IPO are firms that were subject to staging, but that did not subsequently have sufficient prospects to merit a second round of public financing.

An examination of the discussion and analysis sections of IPO prospectuses for a subsample of our sample firms suggests that concerns about staging are central to decisions about funding at the time of the IPO. This examination reveals that the majority of firms acknowledge that the funds raised at the time of the IPO will be insufficient to fund their expected future investments and that a return to the capital market is anticipated. Of the firms acknowledging the need to return to the capital market, the median expected time before additional financing is needed is 12 months.

Overall, our study suggests that important determinants of the time to first post-IPO capital infusions are known at the time of the IPO. The public markets appear to use this information to price capital so as to limit managerial access to cash where agency problems with excess cash are likely to be most severe. These results have important implications for our understanding of the effectiveness of the various mechanisms for controlling these problems as well as providing insights for the broader literature on cash balances.

The remainder of the paper proceeds as follows. Section II discusses staging, the agency costs of cash, and the timing of capital infusions to firms. Section III describes our sample and Section IV the evidence. We conclude in section V.

II. Cash Holdings, Staging and the Timing of Capital Infusions

Firms can manage cash levels using capital structure and dividend policies that affect *cash disbursements* and through capital raising activities that result in *cash infusions*. This paper focuses on cash infusions by considering the extent to which the amount of external capital raised in an IPO should fund future operating and investment requirements of the firm. Our analysis builds upon two strands of literature. First, we add

to the literature on the staging of capital infusions by providing evidence on how concerns with managerial access to cash affect decisions about the size of capital infusions. Second, since firm characteristics that have been associated with greater precautionary balances are also positively related to the potential for agency problems, we add to the literature on the determinants of precautionary cash balances. In this section, we develop our analytical framework by discussing the relevant earlier work.

A. Cash Holdings

A broad literature examines the relation between excess cash and firm value. The causes of value destruction that have been associated with excess cash holdings are similar to those that staging can preempt. This relation between the literature on cash holdings and the staging of fundraising makes it important, in a study like this, to clearly identify the firm characteristics that determine optimal cash balances and to understand how these characteristics relate to those that predict staging.

There is considerable evidence that providing managers with access to excess cash can be detrimental for stockholders. For example, Faulkendar and Wang (2006) estimate that the unconditional marginal value of an extra dollar held as cash is about 94 cents and decreases as the cash balance increases. Dittmar and Mahrt-Smith (2007) estimate that a dollar held in cash is worth more than a dollar in a well governed firm, but is worth only between 42 and 88 cents in a poorly governed firm. They find that the low value of cash in poorly governed firms is associated with the rapid dissipation of cash reserves on projects that reduce future operating performance. Harford, Mansi, and Maxwell (2008) also show that managers of poorly governed firms tend to hold less cash, at least in part because they are quick to spend incoming cash on capital expenditures and

acquisitions. Finally, DeAngelo, DeAngelo, and Wruck (2002) present evidence that excess asset liquidity allows value destruction through the inefficient continuation of poorly performing operations.[3]

In contrast to the evidence that access to excess cash can lead to value destruction, there is evidence that large cash holdings can benefit stockholders. For example, cash balances vary with cash flow volatility, suggesting that these balances provide protection against adverse cash flow shocks. Large cash balances can enable firms to continue to fund profitable investment opportunities or to make required debt payments when operating cash flows are low (Opler, Pinkowitz, Stulz, and Williamson, 1999). Several recent studies have reported evidence consistent with this precautionary motive for holding cash. (See, for example, Han and Qiu, 2007; Haushalter, Klasa, and Maxwell, 2007; and Duchin, 2009). Cash balances might also vary with the relative productivity of capital; increasing when capital is less productive and declining when capital is more productive (Riddick and Whited, 2008).

The precautionary motive and the idea that cash balances vary with the relative productivity of capital suggest that cross-sectional variation in cash balances and changes in cash balances over time can reflect firm decisions that serve stockholder interests. It is worth noting that in the cash balance literature, evidence that firm risk and R&D spending are positively associated with cash holdings has been interpreted as consistent with the precautionary motive theory (Opler et al., 1999). However, in the venture capital literature, consistent with the rationale for staging, the evidence shows that firms with these attributes actually receive less funding. Our focus on IPO firms allows us to provide

[3] DeAngelo et al. consider all assets, including, for example, inventory, accounts receivable, and other components of working capital, which can easily be converted to cash.

some insight on these seemingly contradictory positions.

B. Staging and the Timing of Investments

B.1. Staging in Venture Capital Investing

The staging of capital infusions is ubiquitous in venture capital where start-up firms are typically characterized by severe information asymmetry and uncertainty. Providing funding in stages mitigates concerns with information asymmetry and uncertainty by allowing the venture capitalist to withhold funds and force liquidation when future investment prospects are dim. Staged financing also allows venture capitalists to allocate capital more efficiently between successful and unsuccessful ventures. Investing only a limited amount of capital and then waiting for confirming information before committing additional capital reduces the amount of capital that is invested in unsuccessful ventures.

The venture capital literature distinguishes between two types of venture capital staging. The first is ex ante (within round), or *milestone staging*, where a venture capitalist contractually commits to provide additional funds within a financing round only if a particular financial or non-financial milestone is met. Since the firm must achieve a pre-specified milestone before receiving additional funding, this type of staging allows the venture capitalist to force liquidation if performance is unsatisfactory.

The second type of staging is ex post (between round), or *round staging*, in which capital is staged through independent financing decisions (rounds). With *round staging*, each successive capital infusion is separately negotiated, often with different investors in later rounds. Round staging provides control benefits for investors because requiring managers to periodically raise additional capital increases the ability of investors to

monitor and to liquidate a firm if performance and/or investment prospects are unsatisfactory. Because the sequential financing we consider does not involve a pre-commitment by investors, we are focusing on *round staging* in this study.[4]

Gompers (1995) develops and tests predictions from agency theory that shed light on factors which affect the *round staging* of venture capital investments. He finds that financing duration (time between rounds) declines with (i) decreases in the industry ratio of tangible assets to total assets, (ii) increases in the industry market-to-book ratio and, (iii) greater industry R&D intensity.

We examine whether factors that explain the *round staging* of venture capital investments also explain the length of time between financing rounds for newly public firms. As in venture capital *round staging*, we expect the time between an IPO and a firm's next financing to decrease with R&D intensity, asset intangibility, and growth opportunities. We refer to the idea that there is *round staging* in the public equity market as the *staging hypothesis*.

B.2. Other Forms of Public Market Staging

The staging of capital infusions is not limited to the venture capital market. Researchers have noted that *public* firms enter into contractual financing arrangements that have characteristics of staging. Perhaps the simplest example involves a firm's debt maturity structure. Since managers must renegotiate with creditors in order to refund (roll over) maturing debt, shorter maturity loans increase the frequency with which lenders can review firm performance and adjust prices, or decide not to reinvest at all. This is a form of *round staging*. Consistent with this idea, Barclay and Smith (1995) show that firms

[4] It is worth noting that the model proposed by Easterbrook (1984) can be thought of as a means of forcing round staging upon managers.

which have more growth options tend to use more short-term debt.

Mayers (1998) demonstrates how convertible bonds, when compared to sequential financing with straight debt, can save on issue costs and still mitigate the overinvestment problem. He shows that when a firm's projects turn out to be valuable, conversion of the debt into stock leaves the funds that have been raised in the firm. Alternatively, when projects are not profitable, the debt is not converted and the funds that have been raised are returned to investors when the debt matures.

Schultz (1993) considers a similar mechanism in his study of unit IPOs. In a unit IPO, warrants are bundled with the common stock that is being sold. This bundling pre-commits the firm to sell more equity in the future at the strike price of the warrant. If future investment opportunities fail to materialize, the stock price will not increase enough to cause investors to exercise the warrants and the firm will not receive additional funds. Convertible debt and unit IPOs can be viewed as *milestone staging* where funds are provided when certain goals, as reflected in the stock price, are met.

Barclay and Smith (1995), Mayers (1998), and Schultz (1993) show that public markets rely on forms of both *round* and *milestone staging*. In addition to the *round staging* of debt, and the *milestone staging* associated with convertible debt and unit IPOs, we suggest that there might also be *round staging* of public equity investments. For example, and of particular relevance to our analysis, *round staging* of public equity investments might be preferable when the validity of market prices is suspect because managers can manipulate public signals or when managers are unable to effectively convey information about their firms to investors.[5]

[5] See Bienz and Hirsch (2005) for an analysis of the choice between *round* and *milestone staging*.

B.3. Other Explanations for the Timing of Capital Infusions

The idea that the capital provided to public firms might be staged also has implications for the timing of fundraising activities. A number of studies document considerable variation in the length of time before newly public firms return to the capital market for additional funding (see, for example, Helwege and Liang, 1996; and Jegadeesh, Weinstein, and Welch, 1993). Explanations for this variation include the *signaling hypothesis* in Allen and Faulhaber (1989), Chemmanur (1993), Grinblatt and Hwang (1989), and Welch (1989), the *market-discovery* pooling explanations in Allen and Faulhaber (1989) and Welch (1989), the *market-feedback* hypothesis in Jegadeesh, Weinstein, and Welch (1993) and, more broadly, *market-timing* explanations that are driven by post-IPO market conditions (sentiment, market liquidity, etc.) and/or aggregate levels of asymmetric information (e.g., the windows of opportunity hypothesis (Bayless and Chaplinsky, 1996)). All of these studies suggest that the time to first post-IPO financing is related to post-IPO stock returns. In contrast to these explanations, the *staging hypothesis* predicts that important determinants of the time to the first post-IPO financing are known *prior* to the time of the IPO.

III. Sample Selection and Data Description

We construct our sample by first identifying all firms in the SDC Platinum database that completed an IPO from 1990 through 2005 and for which the offer price exceeded $1.00 per share. We exclude utility firms (SIC codes 4900-4999), financial firms (SIC codes 6000-6999), ADRs, closed-end funds, and unit IPOs. This results in an initial sample of 4,330 firms. We drop 195 of these firms because there is insufficient

data on CRSP or COMPUSTAT and 81 firms whose IPO is actually a reverse LBO.[6]

For each of the remaining 4,054 firms, we identify all capital infusions in the five-year period following its IPO. Public equity and debt offering data are obtained from the SDC Platinum database. Private equity and debt offering data are obtained from Sagient Research and from the sample of private placements compiled by Hertzel, Lemmon, Linck, and Rees (2002). The debt offerings include both straight and convertible issues. Bank loan data are obtained from DealScan. We consider any financings that occur within 30 days of each other to be part of the same capital infusion.

Table 1 presents statistics that describe the post-IPO financing activities for the full sample and for industry subsamples. The statistics for the full sample are in the first row. While a majority of firms return to the capital market at least once during the five-year period following their IPO (2,515 firms, or 62 percent of the sample), 18 percent of the sample firms do not receive capital infusions during the five-year post-IPO period and yet are still trading. The remaining firms are either taken over (12 percent) or delist (8 percent). The last column in the table reports the average length of time between the IPO and a firm's next capital infusion for those firms that return for a capital infusion within five years of their IPO. Throughout the paper we refer to this time period as the spell length or duration. The average spell length for the entire sample is 1.42 years and approximately one half of the firms have durations of less than one year.

--Insert Table 1 here--

The industry breakdowns in Table 1 are based on the Fama/French 48 industry

[6] These are firms that have market prices for their equity in a period prior to the IPO date. We drop these firms because they are fundamentally different than firms which are going public for the first time.

classification. We report separate results for the 18 Fama/French industries that have at least 50 IPOs in the sample period. Several results are worth noting. First, the table shows that there is significant cross-industry variation in the percentage of firms that receive capital infusions in the five-year period following their IPO. Firms in the Pharmaceutical Products industry have the highest frequency of post-IPO financing activity (79.5 percent). Over 70 percent of the firms in the Petroleum and Natural Gas and Transportation industries also raise additional capital. The Business Services and Entertainment industries raise additional capital relatively infrequently (54.95 and 55.41 percent, respectively).

There is also variation in spell lengths across industries. On average, firms in the Healthcare industry that raise additional capital do so sooner than firms in other industries. The average spell length for Healthcare firms is 1.03 years and approximately one-half of the firms in this industry have spell lengths of less than 0.75 years. Firms in the Medical Equipment industry have the longest spell lengths in our sample. The average (median) spell length of IPO financing in this industry is 1.79 (1.58) years. The cross-industry variation in the spell length is statistically significant.

Finally, we note that there is very little correlation between the proportion of industry firms returning for funding and the average spell length. For example, like Pharmaceutical firms, Petroleum and Natural Gas firms return for additional financing relatively frequently (77.5 percent raise additional capital within five years). However, Pharmaceutical firms come back more slowly with an average (median) spell length of 1.51 (1.13) years as compared to 1.21 (0.92) years for Petroleum firms.

Two aspects of the industry comparisons are important for our analysis. First, the

cross-industry variation in the percentage of firms returning for funding and the variation in the time to the first post-IPO capital infusion provide preliminary evidence on the relative importance of the staging hypothesis. The alternative signaling, market-discovery, market-feedback, and market-timing explanations of post-IPO capital infusions do not predict cross-sectional industry variation in the likelihood or the timing of return trips to the capital market. In contrast, industry differences are important determinants of staging decisions at IPOs.

The industry comparisons also suggest that staging decisions can be usefully thought of as reflecting the outcomes from two processes. The first process determines whether or not a firm's financing should be staged. Conditional on the decision to stage financing, the second process determines the length of the stage. This latter process considers how long it will take to reduce uncertainty about the firm's prospects. To see the relevance of this for our analysis, consider a stylized example where a pharmaceutical firm and a petroleum firm are equally suitable candidates for staging. If it takes longer to determine the success or failure of drug trials than of oil exploration projects, spell lengths for pharmaceutical firms should be longer than for petroleum firms. This highlights why it is important to control for industry in our cross-sectional analysis.

We examine IPO prospectuses to obtain additional insights on differences in the characteristics of staging across industries. In particular, we examine two sections in the IPO prospectuses for evidence that firms acknowledge their need for post-IPO capital infusions. The first section outlines risk factors associated with the offering and the second section provides a description of the firm's liquidity and capital resources. In these two sections we find discussions concerning whether managers of issuing firms

anticipated returning to the capital markets and, if so, approximately how long they thought the IPO proceeds would last. For example, Millenium Pharmaceuticals' prospectus states:

> "*The Company believes that the net proceeds from this offering, existing cash and investment securities and anticipated cash flow from existing strategic alliances will be sufficient to support the Company's operations for at least the next 24 months*".

Another example comes from Brilliant Digital Entertainment Inc. whose prospectus states:

> *"The Company believes that the net proceeds from the Offering combined with the Company's current resources will be sufficient to enable the Company to meet its operating and capital needs as required by its present business plan for approximately 12 months."*

In a more systematic analysis, using the prospectus of each IPO firm in each of the Fama/French industries with at least 50 IPOs during the period 1994 through 2005 (we begin in 1994 because prospectuses are readily available on the Edgar database beginning in 1994) we tabulate the frequency with which firms indicate that they expect to return to the capital market and the expected timing of the return. There are ten industries with 50 or more IPOs in this shortened window.

The results from this investigation, which are presented in Table 2, show that the prospectuses for a majority of the firms in each industry acknowledge that the capital raised in their IPO is not expected to be sufficient to fund anticipated future investments. The fraction of prospectuses indicating that management anticipates returning to the capital markets ranges from 51 percent for firms in the Transportation industry to 88

percent for firms in the Pharmaceutical Products industry.[7]

--Insert Table 2 here--

We also tabulate the anticipated time to the next financing for the sample firms. The average anticipated spell length ranges from 13.16 months for firms in the Electronics industry to 21 months for firms in Pharmaceutical Products industry. The median expected spell is 12 months in eight of the ten industries. The median expected spell length for the Medical Equipment industry and for the Pharmaceutical Products industry are longer at 18 and 21 months, respectively. If uncertainty in the Medical Equipment and Pharmaceutical Products industry takes longer to resolve than in other industries, these cross-industry differences are consistent with staging decisions reflecting how long it with take for uncertainty to be resolved.

IV. Empirical Evidence on Staging in Public Markets

In this section we present evidence on the relations between firm characteristics at the time of the IPO and (i) whether a firm returns to the capital market and (ii) how quickly it returns. We begin by describing the test and control variables and then proceed with four stages of analysis. We first present univariate comparisons of firm, IPO deal, and post-IPO market characteristics across groups of firms, classified by whether they return for subsequent financing and, if they return, by how quickly they return for financing. Next we present a hazard analysis in which we model the time between the

[7] Firms that indicate in the IPO prospectus that they expect to raise additional capital are more likely to do so. Among the firms for which we have prospectuses, 47 percent of those that indicate they anticipate raising additional capital actually do so. In contrast, 38 percent of those that do not indicate they expect to raise additional capital do so. The difference in these return rates is significant with a p-value of 0.047. Among the firms that indicate they anticipate raising additional capital, 28 percent have not done so and are still trading five years after their IPO.

IPO and a subsequent capital infusion. We then report the results from a probit analysis which provides evidence on the relations between of pre-IPO firm characteristics and the likelihood of a subsequent financing. Finally, we describe the factors that affect whether a firm returns to the capital market, remains a listed firm without a subsequent financing, delists, or merges.

A. Test and Control Variables

A.1. Test Variables

As discussed earlier, Gompers (1995) reports evidence on venture capital staging from an examination of the relation between spell length (time between financing rounds) and industry measures of (i) the ratio of tangible to total assets, (ii) R&D intensity, and (iii) the market-to-book ratio. We take a similar approach, but use firm level versions of the first two measures from the end of the fiscal year immediately preceding the IPO. This pre-IPO information is obtained from each firm's first post-IPO 10-K filing. We measure R&D intensity using the ratio of R&D to either revenues or total assets. We are unable to construct a pre-IPO measure of the market-to-book ratio at the firm level and do not include one in our analysis. All of our results are robust to the inclusion of an industry-level market-to-book ratio.

We expect a larger ratio of tangible to total assets, which should be positively related to the liquidation value of the firm, to be associated with lower agency costs that might arise from inefficiently keeping a failing business operating. Information asymmetries should also be smaller at firms with more tangible assets. For both of these reasons, staging should be less important at firms with more tangible assets and the time

to the first post-IPO capital infusion (spell length) should be positively (negatively) related to the ratio of tangible (intangible) to total assets.

R&D intensive firms are more likely to have firm- and industry-specific assets that are worth less in the event of liquidation. Thus expected agency costs associated with overinvestment will tend to be larger at high R&D firms. In addition, there is likely to be greater uncertainty and information asymmetry associated with the returns to investment in R&D and the associated development of investment options than to other assets. Therefore, we expect to observe a negative relation between R&D intensity and spell length.

We also include the cash burn rate as a test variable. The cash burn rate is defined as the difference between a firm's funds used for investment and funds from operations in the year prior to the IPO, scaled by the dollars raised at the IPO. The cash burn rate is the inverse of the number of years of funding provided by the IPO.[8]

Under the null hypothesis of no staging, firms are provided with enough capital to meet their planned investments. In this situation, the amount of funding should not influence either the likelihood or timing of a post-IPO capital infusion. This is consistent with Hart's (1993) suggestion that in the absence of agency costs entrepreneurs would raise as much money as they wanted and deicide whether to continue their projects or return capital to investors. We also include the ratio of capital expenditures to assets, measured in the year prior to the IPO, as an alternative measure of the level of each firm's expenditures. As was the case with the cash burn rate, there should be no relation between spell length and capital expenditures under the null hypothesis of no staging.

[8] We do not divide the IPO proceeds by the difference between investment and funds from operations (in other words, compute the number of years of funding directly) to avoid the potential for division by zero.

A.2. Control Variables

As discussed earlier, other research documents extensive cross-sectional variation in the time between a firm's IPO and its next capital infusion. The explanations offered for this heterogeneity include the *signaling hypothesis*, the *market-feedback* hypothesis, *market-discovery* pooling explanations, and more broadly, *market-timing* explanations that are driven by post-IPO market conditions (sentiment, market liquidity, etc.) and/or aggregate levels of asymmetric information. We include both initial underpricing and immediate post-IPO returns to control for possible signaling or market- timing, feedback, or discovery effects. We measure IPO underpricing as the ratio of the closing price on the first day of trading to the offering price. Following Jegadeesh et al. (1993), we measure the post-IPO return over the first twenty trading days excluding underpricing. We note that in contrast to these explanations, the *staging hypothesis* that we investigate predicts that important determinants of the time to the first post-IPO financing are known *prior* to the time of the IPO.

We include total cash raised in the IPO and firm age as control variables. We also include share turnover, the ratio of total volume to shares outstanding, in the first twenty days of trading to measure investor interest in the issue. The final set of market condition controls we include are measures of the volume of aggregate IPO activity at the time of each IPO in our sample. For each IPO we count the total number of IPOs occurring in the window from 15 days before the IPO to 15 days after the IPO.[9] We then identify each of the IPOs in our sample as having occurred during periods of high, medium, or low IPO activity based on the surrounding aggregate IPO activity. High and low activity levels correspond to the first and third terciles of IPO activity. The average (median) number of

[9] We look ahead 15 days on the assumption that investors know the schedule of pending offers.

IPOs in the high, medium, and low activity periods are 61 (59), 38 (38), and 18 (18) respectively.

There are at least two channels through which aggregate IPO activity can affect staging. First, to the extent that human capital is limited, when facing large volumes of IPO activity, investors might not be able to engage in appropriate levels of due diligence. Staging theory suggests that in the absence of proper due diligence investors will provide less capital in order to get to take a second look at the firm in a later round. During periods of low IPO activity, investors would not need to substitute staging for due diligence. This argument would predict more staging or shorter spell lengths during periods of high IPO activity. The second possibility is that periods of high IPO activity coincide with periods where investors are "chasing deals" and providing firms with too much cash (Gompers and Lerner, 2000). Periods of low IPO activity would correspond to periods of low capital availability. At such times investors are more likely to conserve their cash. This would predict more staging during periods of low IPO activity.

We include Fama/French 12-industry industry dummy variables and year dummy variables in our specifications to control for other factors that could affect spell lengths. As suggested by Whited (2006), differences in competitiveness, the type of capital employed, and the level of technology can all affect investment decisions and, thereby, the time between financings. Including year dummy variables allows us to control for macro factors such as business and capital market cycles. For example, we would expect that in periods of tighter money, firms may be limited on funds they are able to raise thereby implying a shorter duration to the next financing.

B. Univariate Comparisons

Table 3 provides univariate comparisons of spell length, firm characteristics, and market characteristics for subsamples of firms partitioned by whether they return for financing in the five years following their IPO and how quickly they return. The first three columns report findings for short, medium and long-spell firms, respectively. These groups are terciles, classified by spell length, of the firms that raise capital within five years of their IPOs. The remaining three columns report results for firms that did not raise funds within five years of the IPO. Columns (4), (5), and (6) report results for firms that are still trading, firms that delisted, and firms that merged.

--Insert Table 3 here--

We begin by comparing firms that raise additional capital with firms that do not raise additional capital, but which are still trading after five years (columns (1) through (4)). As shown in Table 3, the sub-sample of 838 firms that come back the fastest have an average (median) spell length of 0.44 (0.46) years. Medium- and long-spell firms have average (median) spell lengths of 1.06 (1.04) and 2.73 (2.53) years, respectively. The 743 firms that do not complete a post-IPO financing and are still trading after five years have a mean (median) spell of 4.67 (5.00) years.[10] Our tests compare short-spell firms (column (1)) with long-spell firms and firms that are still trading (columns (3) and (4) respectively). Several results in Table 3 are of interest.

First, the evidence on intangible assets is consistent with public market staging. The ratio of intangible assets to total assets is decreasing across the four groups.

[10] The average is less than five years because 122 firms in this group did their IPOs after December 31, 2002 and their spell lengths are right censored.

Intangible assets comprise 9.3 percent of total assets at firms with short spell lengths, 8.3 percent at firms with medium spell lengths, and 6.3 percent at firms with long spell lengths. Intangible assets represent 5.9 percent of total assets at firms that do not raise additional capital within five years. The difference in intangibles between short-spell and long-spell firms is statistically significant as is the difference between short-spell firms and firms that have not returned for capital but that are still trading.

Comparing R&D intensity across the spell length groups yields mixed results. Consistent with the staging hypothesis, when we scale R&D by sales we find that the ratio of R&D to sales is largest in the short-spell sub-sample, but it is not significantly higher than the corresponding ratio in the long-spell sub-sample. In contrast, when we scale R&D by total assets, the ratio of R&D to assets is largest in the short-spell sub-sample. As discussed earlier, one possible explanation for these findings is that there may be cross-industry differences in the time that it takes to resolve key uncertainties about the future prospects of staged firms.

The pattern of cash burn rates across the groups is also consistent with the staging hypothesis. Short-spell firms have an average (median) cash burn rate of 0.17 (0.07). This indicates that these firms, on average, spent an amount equal to 17 percent of the IPO proceeds in the year prior to the IPO. Continued spending at this rate implies that the proceeds will last 5.95 years. Firms with the longest observed spell lengths spend, on average, an amount equal to 8.2 percent of the IPO proceeds in the year before the IPO. The median firm in this group spent 5.5 percent. These numbers suggest that the proceeds in this group will last on average 12 years and the median firm in this group has approximately 18 years of money. Firms that are still trading have an even lower cash

burn rate of 0.056 suggesting that on average these firms receive 18 years of funding at their current burn rates. The cash burn rates of the two slower returning groups are each significantly different from that of the fastest returning group. In the absence of agency costs, firms would obtain as much money as they needed at their IPO (Hart, 1993). In such a world we would not observe the negative relation between the cash burn rate and spell length. Consistent with the cash burn rate results, we also see significantly higher capital expenditures prior to the IPO for firms with that return quickly as compared to slow returners and still trading firms that do not return for funding within five years.

The last two columns in Table 3 describe firms that delisted or merged prior to obtaining a post-IPO capital infusion. We are particularly interested in the delisted firms and include the merged firms for completeness.[11] The staging hypothesis says that firms raise sufficient capital to see them through to a point where their performance can be re-evaluated for the purpose of deciding whether more capital should be committed. In this scenario some staged firms will not clear the hurdle and will fail. This suggests that both short-spell firms and delisted firms are likely to have been staged and therefore should have similar characteristics. Consistent with this conjecture we see that the cash burn rates and R&D intensities of short-spell firms and firms that delist are similar. Comparison of intangibles between the two groups does not support the conjecture as firms that delist have significantly fewer intangible assets than short-spell firms.

Turning to the market characteristics, we see that short-spell firms have significantly greater underpricing than long-spell firms and non-returning firms that are still trading. We also see that the returns over the first twenty trading days are higher for

[11] We do not provide indications of the significance of differences between merged firms and short-spell firms since there is no theoretical basis upon which to expect a difference.

short-spell firms, as is average share turnover. The negative relation between spell length and underpricing is consistent with the signaling hypothesis which predicts that firms under-price in anticipation of returning to capital markets. The negative relation between spell length and post-IPO returns is consistent with the *market-discovery*, *market-feedback,* and *market-timing* hypotheses as all three predict that higher post-IPO prices will lead a firm to raise additional funds.[12]

C. Hazard Analysis of Post-IPO Capital Infusions

The univariate analysis in the previous section provides evidence consistent with the staging hypothesis. We next perform a multivariate analysis of spell length using a semi-parametric hazard model of the form

$$h_i(t) = \left(h_0(t) \exp\left(x_i(t)' \beta \right) \right) \alpha_i \qquad (1)$$

where t is the length of the spell, $h_0(t)$ is the baseline hazard, $x_j(t)$ is a vector of covariates, and β is the corresponding unknown parameter vector. We model the effect of omitted covariates with the term α_i. In hazard analysis, the α_i term models frailty, or the tendency of observations to fail more or less often then predicted by the covariates.

We estimate the baseline hazard, $h_0(t)$, as a step function in time where the steps are at six-month intervals. For example, suppose a firm completes an IPO on February 1, 2001 and then raises additional capital on June 1, 2001. Its spell is five months and it is in a group of firms that have a similar baseline hazard (i.e., the baseline hazard associated with raising capital in the first six months following the IPO). Suppose there is a second

[12] We note that these hypotheses are typically used to explain the dynamics of raising equity. In particular, the market timing hypothesis would not predict issuing anything but equity. In both the pooling and the market feedback hypotheses, either the market or the firm learns that the projects are good and deserve more cash. It is not clear that equity is the appropriate form of funding.

firm that completes an IPO on February 1, 2001 and a subsequent fundraising on November 1, 2001. This firm's spell is nine months and it is in a group of firms with a similar baseline hazard (i.e., the baseline hazard for firms that raise capital in the second six-month period following the IPO) and this baseline hazard is not the same as the baseline hazard for firms that raise capital in the first six months.

As described earlier, we group all capital infusions that occur within 30 days of each other together and use the sum of the dollar values of all the infusions within 30 days as the size of the capital infusion. For purposes of timing, each capital infusion is deemed to have occurred at the time of the first infusion in each grouping. Thus, for example, if a firm has capital infusions 30 days apart in months 5, 6, and 7, our capital infusion variable is calculated as the sum of these three infusions and is treated as if it were a single capital infusion in month 5.

In interpreting our results, we note that the focus of our analysis is not on the shape of the hazard function per se, but on how our variables of interest (i.e. the firm-specific and market characteristics) affect the hazard rate (the likelihood of a capital infusion). Intuitively, the results can be interpreted in a fashion similar to a regression analysis: the baseline hazard is a measure of the hazard function when all covariates (regressors) are zero; variation in the covariates (both time-series and cross-sectional) results in shifts in the hazard rate, accelerating or decelerating the time to next financing depending on the sign of the estimated coefficient.

We estimate equation (1) assuming that the hazard rate follows an exponential distribution using an accelerated failure time form.[13] The results are presented in log expected time parameterization so that for a given covariate, the model gives the

[13] Estimation of a Cox proportional hazard model yields similar results.

logarithm of the expected time to the next capital infusion. Thus, negative coefficient estimates imply shorter durations (accelerated time to failure, or issue) positive coefficients imply longer durations (decelerated time to failure).[14] We analyze our test variables individually since the sample size falls considerably when we only include firms that have all data items available. We present the model using all variables for comparison. The coefficient estimates of the baseline hazard and of industry and year dummy variables are not tabulated.

--Insert Table 4 here--

Table 4 presents the results of the hazard analysis. When considered individually (columns (1) through (4)), the evidence for each of our test variables is consistent with the staging hypothesis. Firms with higher levels of pre-IPO intangibles return for post-IPO capital infusions more quickly (column (1)) and the estimated relation between R&D intensity and the time to the next capital infusion is negative and significant (column (2)). These results suggest that the costs associated with providing excess funds to firms with more uncertain investment opportunities outweigh the costs to these firms of having to return to the market for additional capital or of the possibility of having to forgo an investment opportunity. The theory of precautionary cash balances would predict that these attributes would lead to greater funding and therefore longer financing spell lengths.

In addition, the coefficient estimate on the cash burn rate is negative and significant (column (3)). This finding implies that firms that raise small amounts of

[14] An alternative approach is to present hazard ratios which compare hazards associated with the covariates to a baseline rate such that a hazard ratio greater than one implies a hazard rate greater than the baseline rate. With such an approach, a higher hazard rate implies a greater likelihood of a capital infusion and thus a *shorter* duration of financing inactivity.

capital relative to their pre-IPO spending come back more quickly for a post-IPO financing. Furthermore, like firms with high cash burn rates, firms with high levels of pre-IPO capital expenditures return faster (column (4)). If firms are not staged at the time of their IPO, but instead are provided all the capital they need to fund future investments, we would expect to see no relation between pre-IPO spending and the time to first post-IPO capital infusion.

Column (5) reports the results when we include all of the test variables except the ratio of R&D to sales. The coefficient estimate on intangibles has the sign suggested by the staging hypothesis, but is not significantly different from zero. Consistent with the staging hypothesis, we find that the cash burn rate and capital expenditures are significantly related to spell length. We note that the sample size drops significantly in this specification. Column (6) reports results where the omitted variable is capital expenditures. In this specification the coefficient estimates on, intangibles, R&D intensity, and the cash burn rate are all consistent with the staging hypothesis and statistically significant. In sum, the relations between ex-ante firm characteristics and spell length observed in Table 4 support the *staging hypothesis*.[15]

The models in Table 4 also include market characteristics. Including post-IPO stock returns is important because, as noted earlier, the decision to return for post-IPO financing can be affected by underpricing (*signaling* hypothesis) and post-IPO returns (*market-discovery, market-feedback, and market-timing* arguments). Since the variables we use to predict staging could simply be good predictors of post-IPO performance,

[15] In untabulated results we control for whether there was venture capital involvement in the firm before the IPO. In this analysis we include variables indicating whether the firm was venture capital-backed, the number of venture capital financing rounds, and the total venture capital investment prior to the IPO. None of these variables is significantly related to the spell length and their inclusion in the analysis does not change our results.

including post-IPO returns in our models reduces the likelihood that we are simply picking up such spurious relations.

IPO underpricing is negatively related to spell length as predicted by the signaling hypothesis but is only statistically significant in three of the seven specifications. The return measured over the 20-day window following the IPO is also negatively related to spell length. Similar to results reported by Jegadeesh et al. (1993) the negative relation between post-IPO returns and spell length is more consistently significant than that between underpricing and spell length. These results do not support the signaling hypothesis. They are consistent with the market discovery, feedback, and timing hypotheses.

Consistent with the idea that high IPO activity reflects investors chasing deals, we observe shorter spell lengths during periods of low IPO activity. The tabulated result shows that the spell lengths for firms conducting IPOs during periods of low IPO activity are shorter than the spell lengths for firms go public during medium levels of IPO activity. Untabulated univariate results show a greater and statistically significant difference between spell lengths for IPOs during high and low levels of IPO activity. This evidence suggests that staging occurs more often during periods of low IPO activity.

D. Probit Analysis of Post-IPO Capital Infusions

While short spell lengths are consistent with staging, we also expect to see cross sectional variation in spell length within the sample of staged firms. As discussed earlier, this is because spell length is determined in part by the amount of time it takes to resolve uncertainty about future firm prospects. A staged firm whose future success depends on a short-lived uncertainty is likely to come back more quickly than a staged firm with a

long-lived uncertainty; both firms anticipate returning for post-IPO financing but they expect to have different spell lengths.

Industry controls may not be sufficient to fully capture differences in spell length that are due to the time it takes for uncertainty to be resolved. For this reason, we provide results of a robustness test that focuses on the *likelihood* of a post-IPO capital infusion, instead of the *time* to first post-IPO capital infusion. We examine the determinants of the decision to obtain a post-IPO capital infusion using a probit model. In doing this we are classifying all firms that return for funding within five years as "staged firms" and examining the extent to which the results of the hazard analysis hold up under this assumption. In this analysis we drop firms that merged or delisted within five years of their IPO and compare firms that came back to the capital markets within five years of their IPO to firms that are still trading and did not obtain a post-IPO capital infusion. As in Table 4, we analyze our test variables individually since the sample size falls considerably when we only consider firms that have all data items available. We present the model using all variables for comparison. Table 5 presents the results of this analysis.

--Insert Table 5 here--

The results from the probit analysis are generally consistent with those from the hazard analysis. Firms with more intangible assets, higher levels of R&D expenditures, and with higher cash burn rates are more likely to return for post-IPO financing. The exception to the correspondence between the hazard and probit analyses is that there is no reliable relation between pre-IPO capital expenditures and the likelihood of obtaining a post-IPO capital infusion.

The evidence for the post-IPO market characteristics show that the returns in the first 20 days following the IPO have a positive and significant impact on the likelihood of raising money after the IPO. The level of initial underpricing does not significantly affect the likelihood of returning for more capital. These results are similar to those reported in Jegadeesh et al (1993) and are consistent with the *market-discovery*, *market-feedback*, and *market-timing* hypotheses. They are not consistent with *signaling*. Consistent with the results from the hazard analysis, firms that go public during periods of low IPO activity have a significantly greater likelihood of returning for post-IPO financing.

E. Other Post-IPO Outcomes

The analysis in table 5 compares firms that returned to the capital market to firms that did not return but were still trading, but does not include firms that merged or delisted prior to obtaining funds. While the staging hypothesis does not make clear predictions about firms that merge, firms that delist may be firms that were staged at the time of the IPO and did not have sufficient prospects post-IPO to obtain additional funding. To the extent that the firms that delist are firms that are staged at the time of the IPO but fail to raise subsequent capital, we expect that they will have characteristics at the time of the IPO that are similar to staged firms that return for capital. We present evidence on this in Table 6 from a multinomial logit analysis where the default outcome for the dependent variable is still trading without issuing. The other outcomes are (i) a post-IPO capital infusion, (ii) delisting and (iii) merging.

--Insert Table 6 here--

The results in Table 6 show that intangible assets are positively related to the

likelihood of *both* issuing after the IPO and delisting, with the former relation being statistically significant. We also observe that the relation between R&D intensity and the likelihood of *both* post-IPO financing and delisting is positive and significant. Finally firms with high cash burn rates are more likely to return for a post-IPO capital infusion *and* are more likely to delist. This finding implies that both raising more capital and delisting are more likely outcomes for firms with small IPO proceeds relative to their investment needs.

In an untabulated analysis we directly compare the relations between the intangible to total assets ratio, R&D intensity, and the cash burn rate and the likelihoods of (i) raising capital and (ii) delisting after the IPO. Neither the intangible asset ratio nor R&D intensity significantly explains the difference in the likelihoods of delisting versus issuing. Table 6 showed higher cash burn rates made both refinancing and delisting more likely than continuing without refinancing. The direct comparison of delisting versus refinancing shows that higher cash burn rates are associated with a greater likelihood of delisting. Overall the characteristics associated with a greater likelihood of post-IPO capital infusions are similar to those that predict post-IPO delisting. This is consistent with the staging hypothesis wherein the characteristics that lead to staging lead to either post-IPO capital infusions or delisting.[16]

The results in Table 6 show that market conditions do not only influence whether firms issue or remain trading but also affect the likelihood of delisting and merging. Again, we focus on delisting firms. Relative to issuing, the likelihood of delisting is

[16] The staging hypothesis is predicated on the idea that uncertainty about a firm's investment opportunities will affect the amount of money it raises in its IPO. To the extent that this uncertainty is unresolved at the time of the first post-IPO capital infusion it should also influence the firm's choice of financing. We are currently investigating factors that explain the *type* of post-IPO financing that returning firms obtain.

negatively and significantly related to underpricing. Untabulated results also show that high underpricing also makes delisting significantly less likely than issuing. If we think that high quality firms are less likely to delist, this lower incidence of delisting for firms with higher underpricing is consistent with the signaling models of Allen and Faulhaber (1989), Chemmanur (1993), Grinblatt and Hwang (1989), and Welch (1989) which posit that only high quality firms will have high underpricing [17] Post-IPO returns also significantly affect delisting outcomes. Firms with high post-IPO returns are significantly less likely to delist rather than to still be trading. In untabulated results we also observe that high post-IPO returns make delisting less likely than issuing. Finally we note that our measures of IPO activity do not significantly affect the likelihood of the various post-IPO outcomes in this model.

V. Summary and Conclusions

The staging of capital infusions is ubiquitous in the private equity market where venture capital investors provide funding to start up companies that are characterized as having severe information asymmetry problems. In this study, we investigate the extent to which staging carries over to the public equity market and can thereby explain the timing of capital infusions in newly public firms. We cast our analysis up in the context of the sequential financing problem which trades off transactions costs associated with funding in stages against agency costs associated with overinvestment.

We find that factors that explain the time between venture capital financing rounds also explain the time from a firm's IPO to its first post-IPO capital infusion. In

[17] In these models high quality firms recoup the cost of underpricing via higher proceeds at subsequent financings. If all high quality firms expect to return, we will see high underpricing by all high quality firms. Whether or a high quality firm actually returns is partially determined by its post-IPO cash needs and some of them may very well not return.

particular, we find that firms with higher levels of intangibles and with greater R&D intensity return more quickly for post-IPO capital infusions. Also, consistent with staging, we find that firms that raise less money at the IPO (relative to their pre-IPO capital expenditures) come back more quickly for subsequent financing. We also provide corroborating evidence from IPO prospectuses that many firms acknowledge that the funds raised at the time of the IPO will be insufficient to fund their expected future investments and that a return to the capital market is anticipated. The prospectus data indicate that concerns about staging are central to decisions about funding at the time of the IPO.

Overall, the results of our study suggest that important determinants of the time to first post-IPO capital infusions are known at the time of the IPO and that *round staging* exists in the public equity market as well as the private equity market. These results are interesting because the attributes that we find to be associated with staging are similar to those that predict holding precautionary cash balances. These results suggest that studies of cash holdings should consider the age of the firm or the stage of product development when assessing optimal cash holdings. Our analysis, which considers firm characteristics known at the time of the IPO, in addition to information revealed by the IPO and market conditions that develop following the IPO, also adds to the evidence on the timing of post-IPO capital infusions.

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Table 1: Post-IPO financing activity by industry

Post-IPO financing activity for 4,054 firms that completed an IPO between 1990 and 2005. Statistics are reported for the entire sample and for firms in the 19 (of 48) Fama-French industries with at least 50 IPOs over the 1990 to 2005 period. Reported statistics are for the number of firms and percentage of all firms in the industry that were still trading without having raised more capital, merged, delisted, or sold new securities five years after their IPO and the mean (median) number of years following the IPO that firms which returned to the market did so.

	Did Not Return to Market				Returned to Market	
	Still Trading	Merged	Delisted	Total	Total	Mean (Median) Years to Issue
All Firms	743 18.33%	490 12.09%	306 7.55%	1539 37.96%	2515 62.04%	1.42 (1.04)
Fama-French Industry						
6 Recreation	12 23.08%	5 9.62%	5 9.62%	22 42.31%	30 57.69%	1.18 (0.92)
7 Entertainment	17 22.97%	7 9.46%	9 12.16%	33 44.59%	41 55.41%	1.54 (0.95)
9 Consumer goods	11 22.00%	2 4.00%	6 12.00%	19 38.00%	31 62.00%	1.16 (0.84)
11 Healthcare	26 16.05%	16 9.88%	14 8.64%	56 34.57%	106 65.43%	1.03 (0.77)
12 Medical equipment	41 20.20%	35 17.24%	13 6.40%	89 43.84%	114 56.16%	1.79 (1.58)
13 Pharmaceutical products	29 10.82%	18 6.72%	8 2.99%	55 20.52%	213 79.48%	1.51 (1.13)
21 Machinery	14 16.67%	4 4.76%	9 10.71%	27 32.14%	57 67.86%	1.63 (1.25)
30 Petroleum and natural gas	9 11.25%	6 7.50%	3 3.75%	18 22.50%	62 77.50%	1.21 (0.92)
32 Communication	30 14.08%	26 12.21%	20 9.39%	76 35.68%	137 64.32%	1.12 (0.88)
33 Personal services	11 17.46%	3 4.76%	7 11.11%	21 33.33%	42 66.67%	1.29 (1.19)
34 Business services	208 19.05%	202 18.50%	82 7.51%	492 45.05%	600 54.95%	1.40 (0.95)
35 Computers	51 22.77%	23 10.27%	13 5.80%	87 38.84%	137 61.16%	1.58 (1.12)
36 Electronic equipment	80 27.03%	33 11.15%	6 2.03%	119 40.20%	177 59.80%	1.57 (1.11)
37 Measuring and control equipment	12 17.14%	11 15.71%	3 4.29%	26 37.14%	44 62.86%	1.65 (1.15)
40 Transportation	12 13.79%	5 5.75%	6 6.90%	23 26.44%	64 73.56%	1.52 (1.08)
41 Wholesale	21 13.46%	19 12.18%	19 12.18%	59 37.82%	97 62.18%	1.28 (0.98)
42 Retail	39 15.92%	22 8.98%	25 10.20%	86 35.10%	159 64.90%	1.25 (0.87)
43 Restaraunts, hotels, motels	19 16.10%	9 7.63%	9 7.63%	37 31.36%	81 68.64%	1.22 (0.84)
p-value from that test proportions are equal across industries					0.018	
p-value from test that mean distances are equal across industries						0.001
p-value from test that median distances are equal across industries						0.001

Table 2: Expectations concerning post-IPO financing activity at time of the IPO

This table presents summary statistics about the length of time that the issuing firm expects the IPO proceeds to last, when indicated in its IPO prospectus. Data are for a sample of 878 firms from 10 (of 48) Fama-French industries that completed an IPO between 1994 and 2005.

		Firms That Indicate In Their IPO Prospectus That They Are Likely to Require Additional Financing			
		Number	Percent of Sample Firms In the Industry for Which A Prospectus	Months IPO Funds are Expected to Fund Operations	
Fama-French Industry		of Firms	Can Be Found	Mean	Median
13	Pharmaceutical products	81	88.04%	21.53	21
12	Medical equipment	62	81.58%	17.60	18
40	Transportation	27	50.94%	16.48	12
41	Wholesale	37	69.81%	16.03	12
32	Communication	51	62.20%	15.47	12
42	Retail	77	83.70%	14.65	12
34	Business services	72	83.72%	13.49	12
43	Restaraunts, hotels, motels	23	60.53%	13.35	12
35	Computers	73	87.95%	13.23	12
36	Electronic equipment	73	87.95%	13.16	12

Table 3: Firm and market characteristics by post-IPO financing activity

Data are for a sample of 4,054 firms that completed an IPO between 1990 and 2005. The sample is partitioned based upon whether the firm completed a subsequent financing (returned to the market for debt or equity, whether public or private) within five years of the IPO. Those firms that did return to the market are further sorted into three equal subsamples, fast, medium, and slow, based upon how quickly they returned to the market. Firms that did not return to the market are partitioned based on whether they were still public (trading) five years after the IPO or whether they merged or delisted within five years. The mean (median) values and the number of observations (in {} brackets) are reported for each characteristic within each subsample. Superscripts a, b, & c indicate the the mean or median value is statitiscally different from the mean or median value in Column (1) at the 10%, 5%, and 1% level. respectively.

		Returned to Market Within Five Years (Spell Length)			Did Not Return to Market Within Five Years		
Characteristic	Description	Short (1)	Medium (2)	Long (3)	Still Trading (4)	Delisted (5)	Merged (6)
Spell	Time from IPO to next financing	0.440	1.064	2.743 [c]	4.668 [c]	2.573 [c]	2.365
		(0.459)	(1.040)	(2.529) [c]	(5.000) [c]	(2.396) [c]	(2.204)
		{838}	{838}	{839}	{743}	{306}	{490}
Firm characteristics:							
Intangible assets	Intangible assets as a fraction of total assets in year preceding IPO	0.092	0.083	0.063 [c]	0.059 [c]	0.063 [c]	0.073
		(0.000)	(0.000)	(0.000) [c]	(0.000) [c]	(0.000) [b]	(0.000)
		{707}	{700}	{708}	{647}	{253}	{428}
R&D/assets	Research and development expenditures as a fraction of total book assets in year preceding IPO	0.227	0.313	0.313 [c]	0.249	0.327 [b]	0.264
		(0.123)	(0.125)	(0.176) [c]	(0.158) [a]	(0.159)	(0.225)
		{470}	{504}	{554}	{476}	{160}	{330}
R&D/sales	Research and development expenditures as a fraction of sales in year preceding IPO	2.283	2.145	2.203	0.696 [c]	2.362	0.800
		(0.122)	(0.082)	(0.127)	(0.117)	(0.129)	(0.169)
		{449}	{466}	{517}	{459}	{144}	{317}
Cash burn rate	Annual cash burn rate as a fraction of total capital raised in IPO and following three months	0.166	0.199	0.082 [c]	0.056 [c]	0.193	0.110
		(0.068)	(0.101)	(0.055)	(0.007) [c]	(0.122) [c]	(0.062)
		{803}	{806}	{805}	{714}	{274}	{473}
CapEx	Capital expenditures as a fraction of boook assets in year preceding IPO	0.273	0.229	0.211 [a]	0.205 [a]	0.317	0.255
		(0.098)	(0.095)	(0.085)	(0.084)	(0.165) [c]	(0.098)
		{301}	{293}	{251}	{280}	{95}	{180}
IPO funds	Total capital raised in IPO and following three months	73.030	72.108	50.780 [c]	62.154 [b]	32.307 [c]	58.669
		(42.000)	(36.000)	(30.200) [c]	(33.100) [c]	(13.750) [c]	(42.000)
		{838}	{838}	{839}	{743}	{306}	{490}
Firm age at IPO	Years between Founding and IPO	13.582	14.641	13.309	15.653 [b]	7.754 [c]	11.842
		(7.000)	(7.000)	(7.000)	(9.000) [c]	(4.000) [c]	(7.000)
		{823}	{821}	{825}	{732}	{285}	{475}
Dollar burn rate	Difference between funds used for investments and funds from operations in the year prior to the IPO	10.435	13.769	2.010 [c]	5.500 [b]	11.172	7.573
		(2.467)	(3.126)	(1.241) [c]	(0.115) [c]	(1.679) [b]	(2.018)
		{803}	{806}	{805}	{714}	{274}	{473}
Market characteristics:							
Underpricing	IPO underpricing (first day return)	0.303	0.194	0.189 [c]	0.241 [c]	0.199 [c]	0.296
		(0.133)	(0.080)	(0.079) [c]	(0.109)	(0.080) [c]	(0.125)
		{838}	{838}	{839}	{743}	{306}	{490}
Post-IPO return	Return on shares over the first 20 days following the IPO, excluding the first day	0.115	0.035	0.027 [c]	0.033 [c]	-0.038 [c]	0.012
		(0.055)	(0.000)	(0.000) [c]	(0.000) [c]	-(0.042) [c]	-(0.017)
		{838}	{838}	{839}	{743}	{306}	{490}
Trading volume	Total trading volume over the first 20 days following the IPO as a fraction of total shares outstanding	1.321	1.061	1.063 [c]	1.101 [c]	1.229	1.382
		(0.881)	(0.791)	(0.863)	(0.835)	(0.901)	(1.007)
		{838}	{838}	{839}	{743}	{306}	{490}

Table 4: Predicting the time from IPO to first post-IPO financing

Coefficient estimates from a hazard model of the the time to the first post-IPO financing. The model is semi-parametric with a non-parametric baseline hazard and an exponential hazard distribution. The model is in accelerated failure time—a negative coefficient estimate indicates the event (first post-IPO financing) happens more quickly. The coefficient estimates of the baseline hazard, as well as those associated with industry and year dummy variables, are not tabulated. *Low IPO Activity* is an indicator variable that takes on a value of 1 if the IPO is completed during a period that is among the periods in the lowest quartile of IPO activity and zero otherwise. *High IPO Activity* equals 1 for IPOs completed during a period that is among the periods in the top quartile of IPO activity and zero otherwise. The level of IPO activity is measured over the period from day -15 to day +15 relative to the date of the sample firm's IPO. All other variables are defined in Table 3. Data are from a sample of 4,054 firms that completed an IPO between 1990 and 2005. p-values are reported in parentheses.

	Model						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	2.723	2.379	2.996	3.051	3.894	2.322	3.647
	(0.000)	(0.074)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)
Firm characteristics:							
Intangible assets	-0.744				-0.454	-0.759	-0.328
	(0.026)				(0.268)	(0.078)	(0.489)
R&D/sales		-0.014				-0.013	-0.016
		(0.000)				(0.006)	(0.001)
Cash burn rate			-0.495		-0.336	-0.639	-0.382
			(0.004)		(0.042)	(0.008)	(0.012)
CapEx				-0.124	-0.107		-0.109
				(0.006)	(0.047)		(0.095)
IPO funds	-0.002	-0.002	-0.002	-0.001	-0.001	-0.002	-0.001
	(0.000)	(0.154)	(0.000)	(0.000)	(0.000)	(0.050)	(0.133)
Firm age at IPO	0.002	-0.001	0.000	0.001	0.001	0.001	-0.003
	(0.269)	(0.566)	(0.797)	(0.821)	(0.584)	(0.664)	(0.383)
Market characteristics:							
Underpricing	-0.214	-0.176	-0.204	-0.135	-0.142	-0.264	-0.170
	(0.022)	(0.382)	(0.042)	(0.259)	(0.255)	(0.021)	(0.121)
Post-IPO return	-1.138	-0.813	-0.986	-0.876	-1.033	-1.127	-0.911
	(0.000)	(0.269)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)
Trading volume	0.016	-0.014	0.026	0.042	0.031	-0.022	0.005
	(0.762)	(0.822)	(0.544)	(0.526)	(0.669)	(0.708)	(0.939)
High IPO Actvity	0.022	-0.063	0.062	-0.122	-0.169	-0.104	-0.325
	(0.729)	(0.446)	(0.296)	(0.337)	(0.161)	(0.315)	(0.007)
Low IPO Activity	-0.137	-0.168	-0.134	-0.200	-0.189	-0.116	-0.269
	(0.040)	(0.047)	(0.055)	(0.067)	(0.075)	(0.289)	(0.031)
Number of subjects	3353	2306	3783	1384	1233	1997	782
Number of failures	2068	1410	2367	838	741	1205	469
Log likelihood	-4405.3	-3005.0	-5003.2	-1779.0	-1565.9	-2561.3	-970.6

Table 5: Predicting whether a firm obtains post-IPO financing

Coefficient estimates from Probit models predicting whether a firm that completes an IPO and survives for five years as a public company subsequently completes another financing within that period. The dependent variable equals 1 if the firm completes a subsequent financing and 0 otherwise. All variables are defined in earlier tables. Data are for the 3,258 firms, from a sample of 4,054 firms that completed an IPO between 1990 and 2005, that were still publiclty traded five years after their IPO. Firms that merge or delist within five years of their IPO are excluded. p-values are reported in parentheses. The coefficient estimates of industry and year dummy variables, which are also included in the models, are not tabulated.

	Model						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	-0.565	-0.460	-0.627	-0.612	-0.771	-0.483	-0.714
	(0.001)	(0.023)	(0.000)	(0.009)	(0.004)	(0.033)	(0.059)
Firm characteristics:							
Intangible assets	0.668				0.570	0.843	0.791
	(0.035)				(0.217)	(0.096)	(0.358)
R&D/sales		0.030				0.032	0.021
		(0.001)				(0.003)	(0.024)
Cash burn rate			0.453		0.548	0.482	0.499
			(0.002)		(0.003)	(0.014)	(0.041)
CapEx				0.029	0.022		0.000
				(0.559)	(0.785)		(0.997)
IPO funds	0.001	0.001	0.001	0.001	0.001	0.000	0.000
	(0.038)	(0.040)	(0.009)	(0.001)	(0.078)	(0.444)	(0.545)
Firm age at IPO	-0.004	-0.001	-0.002	-0.004	-0.005	-0.003	-0.002
	(0.002)	(0.305)	(0.029)	(0.144)	(0.079)	(0.085)	(0.677)
Market characteristics:							
Underpricing	-0.050	-0.057	-0.060	-0.073	-0.061	-0.024	-0.010
	(0.648)	(0.612)	(0.576)	(0.693)	(0.754)	(0.845)	(0.959)
Post-IPO return	0.436	0.284	0.357	0.478	0.524	0.371	0.565
	(0.016)	(0.025)	(0.007)	(0.053)	(0.060)	(0.029)	(0.072)
Trading volume	0.007	-0.007	-0.002	0.013	0.005	-0.003	0.003
	(0.901)	(0.894)	(0.972)	(0.900)	(0.963)	(0.959)	(0.979)
High IPO Actvity	0.056	0.146	-0.013	0.173	0.181	0.185	0.419
	(0.463)	(0.133)	(0.863)	(0.195)	(0.171)	(0.111)	(0.010)
Low IPO Activity	0.127	0.130	0.122	0.191	0.183	0.104	0.305
	(0.010)	(0.021)	(0.010)	(0.131)	(0.174)	(0.096)	(0.043)
N	2703	1862	3069	1113	985	1610	612
Log-likelihood	-1355.9	-948.4	-1515.5	-540.1	-477.1	-814.6	-293.7
Pseudo R^2	0.080	0.081	0.082	0.132	0.156	0.103	0.170

Table 6: Predicting whether a firm obtains post-IPO financing

Coefficient estimates from a multinomial logit model predicting whether a firm that completes an IPO subsequently completes another financing within five years. The default for the dependent variable is that the firm is still trading and has not issued at the end of five years. The other outcomes are that the firm has a post-IPO capital infusions, the firm delists before raising capital, or the firm merges with another firm before raising capital. All variables are defined in earlier tables. The coefficient estimates indicate how the independent variable affects the likelihood of being in the group. For example, *intangible assets* has an estimated coeffcient of 1.546 for the issued group. This indicates that a firm with more intangible assets is more likley to raise capital rather than to be still trading without having raised capital. Data are from a sample of 4,054 firms that completed an IPO between 1990 and 2005. p-values are reported in parentheses. The coefficient estimates of industry and year dummy variables, which are also included in the models, are not tabulated.

	Issued	Delisted	Merged
Constant	-0.754	-1.858	-2.280
	(0.057)	(0.001)	(0.000)
Firm charcateristics:			
Intangible assets	1.504	1.869	1.642
	(0.095)	(0.199)	(0.002)
R&D/sales	0.061	0.075	0.021
	(0.006)	(0.000)	(0.449)
Cash burn rate	0.907	1.567	0.375
	(0.024)	(0.000)	(0.330)
IPO funds	0.001	-0.031	-0.001
	(0.533)	(0.000)	(0.467)
Firm age at IPO	-0.006	-0.022	-0.008
	(0.058)	(0.108)	(0.155)
Market characteristics:			
Underpricing	-0.026	-1.037	-0.309
	(0.900)	(0.041)	(0.114)
Post-IPO return	0.648	-1.766	-0.582
	(0.015)	(0.000)	(0.006)
Trading volume	0.003	0.154	0.100
	(0.979)	(0.220)	(0.162)
High IPO Actvity	0.281	0.511	0.221
	(0.149)	(0.048)	(0.400)
Low IPO Activity	0.144	-0.126	0.000
	(0.185)	(0.604)	(0.999)
Number of observations		1997	
Log-likelihood		-1,895.0	
Pseudo R^2		0.109	