Staged Financing of Newly Public Firms Around the World*

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Abstract
We investigate the prevalence of capital staging (sequential infusion of capital) in the IPO markets in 47 countries between 1991 and 2019. Our evidence is consistent with the hypothesis that investors provide funds to IPOs in stages to mitigate costs associated with firm-specific uncertainty about future prospects and information asymmetry. Going public firms with more intangible assets and greater R&D intensity raise less money relative to financing needs at the time of the IPO and are more likely to return to capital markets for subsequent financing and do so more frequently. We also document that the evidence of staged financing is significantly stronger in countries that provide better legal protection to investors.

Keywords: Initial public offerings; Staging of capital; Uncertainty; Information Asymmetry; International investor protection

JEL classification*:* G24; G32; G34; G35; F30

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1. Introduction

A well-functioning Initial Public Offering ("IPO") market is important for innovation, growth, and the creation of firm value and jobs in the economy. For many entrepreneurial firms around the world, IPOs provide an immediate infusion of cash to finance current and future investment opportunities (Pagano et al.,1998; Doidge et al., 2017). Therefore, the benefits from raising an appropriate amount of capital in an IPO are potentially quite high. However, many going public firms are high-growth firms with short operating histories such that prospective public market investors face significant uncertainty about the viability of their investment opportunities as well as a higher degree of information asymmetry compared to more mature public companies. Such uncertainty and information challenges likely impede outside investors' willingness to invest in the IPO firms. Consequently, the ability of investors to manage their financial exposure and to avoid financing unviable projects of newly-public firms is critical for the efficient functioning of the IPO market.

Recent research suggests that one potential way for public market investors to manage the risks of investing in IPO firms is by staging the infusion of capital, i.e., disbursing capital to firms through a series of infusions that are conditional on performance. Staging of capital infusions is almost universally used by venture capitalists in financing entrepreneurs and start-up companies (Gompers 1995; Kaplan and Stromberg, 2003). Sahlman (1990) argues that staged financing is the most potent control tool that venture capitalists can employ to monitor their portfolio firms and to acquire information about the viability of firms' investment projects. Importantly, by monitoring and infusing capital in stages, investors can have better control over the potential moral hazard (agency cost) associated with an entrepreneur continuing to (over) invest in future investment opportunities that do not pan out. As Sahlman puts it (1990 p. 507),

"The right to abandon is essential because an entrepreneur will almost never stop investing in a failing project as long as others are providing capital."

Although widely-used by venture capitalists, to date there has been relatively little empirical research on whether staged financing is employed by public market investors in IPO markets. We know of only one related study: Hertzel, Huson, and Parrino (2012) finds evidence consistent with public market staging in a sample of U.S. IPOs between 1990 and 2007. We suggest that the relative dearth of empirical evidence is an important gap in the literature because of the economic importance of IPO markets, changes in IPO markets since the 2008 financial crisis (Doidge et al., 2013 and 2017), and increasing globalization of IPO markets. We endeavor to fill this gap by examining whether public market staging is evident in the time period following Hertzel et al., (2012) study, whether it extends to the global IPO market, and how country characteristics that may affect the ability to stage public investments affects outcomes.

We investigate staging in global IPO markets using a large sample of firms from 47 countries that went public from 1991 to 2019. We draw on analytical frameworks in Gompers (1995) and Hertzel et al., (2012) to develop our main *public market staging hypothesis*, which posits that the public market is more likely to stage the infusion of capital to going public firms whose projects are more difficult to evaluate due to higher uncertainty about possible outcomes and have greater levels of information asymmetry. Following a large literature in economics (e.g., Hall and Lerner, 2010), we measure information asymmetry and uncertainty at the time of the IPO with two variables: (i) intangible assets to total assets (*Intangible/assets*) and, (ii) research and development to sales (*R&D/sales*). Accordingly, our hypothesis implies that financing of going public firms with more intangible assets and a greater reliance on R&D are more likely to be staged by the market. The *public market staging hypothesis* predicts that an

IPO firm's R&D intensity and asset intangibility to be negatively related to the size of its IPO (relative to its financing needs), positively related to the likelihood of subsequent follow-on capital infusions, and positively related to the number of post-IPO financing rounds.

We begin our analysis by providing evidence on the relations between our firm-level measures of information asymmetry and uncertainty at the time of the IPO and (i) the amount of funds raised by the IPO relative to pre-IPO financing needs, (ii) whether a firm returns to the capital market in the two-year period following its IPO, and (iii) how often the firm return for funding. To this end, for each sample firm we identify its external equity and debt capital infusions in the two-year period following the IPO. Our tests provide strong support for the implications of the public market staging hypothesis: on average, firms with more intangible assets and firms that invest more heavily in R&D raise less money at their IPO relative to their financing needs, are more likely to return for follow-on financing, and do so more frequently in the two-year period subsequent to their IPO. These results hold for both the pre- and post-2008 financial crisis periods, are not driven by U.S. firms, and are significant for firms in economically advanced markets as well as for firms in economically emerging markets.

We next investigate how cross-country differences in legal institutions that are aimed at protecting public market investors affect the use of public market staging. This analysis draws on a large literature that establishes the importance of country-level institutions in (i) determining the extent of expected information and agency problems between insiders (controlling shareholders) and outside investors and (ii) explaining the availability to firms of external financing (La Porta et al. (1997, 1998, 2000, and 2002) and La Porta, Lopez-de-Silanes, and Shleifer (2006)).

We measure the strength of country-level institutions providing investor protection in IPO markets with two widely used proxies developed in La Porta et al., (2006). Specifically, we use (i) an index for the stringency of disclosure requirements in IPO prospectuses in each country's largest stock exchange and (ii) a composite investor protection index that captures both the strength of the legal rules protecting rights of investors in IPO firms and their enforcement in a given country.

Our evidence shows that the magnitude and statistical significance of the coefficient estimates on the intangible asset and R&D intensity ratios in all specifications are significantly larger for newly listed firms from strong protection countries than those from weak protection countries. These findings suggest that in strong investor protection countries, firms with greater uncertainty and information asymmetry receive less funding at their IPO and are more likely to return for funding within two years of their IPO and do so more frequently. To the extent that staged financing enhances capital formation by increasing the number and *types* of firms that can go public, this result potentially indicates that stronger legal institutions protecting interests of investors add to the vibrancy of the IPO market thereby promoting innovation and economic development.[1]

Overall, the findings in this paper contribute to our understanding of the staging of capital infusions that entrepreneurs and small business often experience, showing that staged financing of newly public firms is a global phenomenon and that it is influenced by country-level legal institutions aimed at protecting investors in the IPO market. Previous research on the financing

[1] It should be noted that the consistency of the findings across different specifications and proxies for investor protection notwithstanding, the results for the effects of investor protection only indicate associations and do not imply causality. This is a typical limitation in international legal institutions studies (e.g., La Porta et al. 2006).

mechanisms of newly listed firms, especially of those outside the U.S., is limited as most IPO studies focus on IPO firm stock performance (e.g., Loughran and Ritter 1995) or post-IPO survival (e.g., Carpentier and Suret 2011; Chou et al. 2013). Other studies that consider capital raising at or around IPOs include Iliev and Lowry (2020) that finds that about 15% of newly public firms in the U.S. continue receiving periodic capital infusions from their venture capitalists after the IPO; and Momtaz (2023) which examines the returns to newly public firms relative to private investors in PIPE (private investments in public firms) deals. We extend this literature by establishing the prevalence of staged financing in the IPO markets around the world and the effect of legal institutions on such financing strategy.

We also contribute to a broad literature in law and economics that considers the extent to which a country's institutions contribute to the development of capital markets and efficient allocation of capital to small and large enterprises (e.g., La Porta et al., 2006; McLean et al. 2012). A theoretical view underlying this line of inquiry is that legal institutions contribute to economic growth by facilitating the creation of well-functioning capital markets that allow firms access to external financing. We add to this evidence by examining the effect of legal institutions on capital raising at the time of their IPO, which is a crucial event in the life of a firm and one where outside investors have significant control over the amount of provided capital.

Our results also speak to the literature that studies corporate financing arrangements designed to mitigate information challenges (e.g., Kaplan and Stromberg 2003). We believe our findings on the prevalence of equity staging in stronger investor protection countries support the argument in Lerner and Schoar (2005) of a "contractual channel" through which stronger legal enforcement boosts economic development.

The remainder of the paper is organized as follows. Section 2 discusses related literature and discusses our hypotheses and analytical framework. Section 3 describes our sample. Section 4 presents our findings. Section 5 concludes.

2. Literature review, hypotheses, and analytical framework

2.1. Staging and the timing of capital infusions: The public market staging hypothesis

Staged financing is a hallmark of venture capital (VC) investing in entrepreneurial start-up firms which are typically characterized as having investment opportunities with uncertain prospects (Foss et al., 2007)[2] that have very high failure rates (Sahlman, 1990). Furthermore, VCs and entrepreneurs likely have different information, and even with the same information, are likely to disagree on a project's prospects and thus whether and when to discontinue or abandon the project (Sahlman, 1990). According to survey results in Sahlman (1990), one of top concerns for VCs is that entrepreneurs, in order to preserve their jobs, have strong incentives to continue investing in projects which otherwise should be abandoned. Providing funding in stages helps mitigate the costs associated with such overinvestment by limiting the amount of capital that start-up managers might be able to waste if anticipated valuable growth opportunities do not materialize.[3]

Gompers (1995) formally investigates how such uncertainty and information problems at the firm-level are related to round sizes and duration (time between rounds) of VC investments. The key firm characteristics that are widely associated with higher information asymmetry and

[2] Uncertainty here is broadly defined as Knightian uncertainty (Knight 1921), that is the probabilities of all possible future realization events are unknown or not unique.

[3] Staging can be viewed more broadly as capital "rationing" in the traditional framework of supply and demand for capital premised on the existence of uncertainty and information asymmetry between firms and providers of capital (e.g., Stiglitz and Weiss 1981). Rationing in the IPO market can occur because investors 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 those problems.

greater uncertainty are the degree of intangibility of firm assets and R&D intensity (see the survey paper by Hall and Lerner, 2010). Furthermore, assets of intangible- and R&D intensive firms tend to have low liquidation values thereby increasing losses from inefficient continuation of failing projects. Consistent with the predictions, Gompers (1995) finds that VC round sizes and duration both decline with increases in industry-level ratios of intangible to total assets and R&D to sales.

Hertzel et al., (2012) develop the hypothesis, and provide evidence using U.S. firms, that the practice of staging capital infusions, similar to that observed in VC markets, can explain both the size of IPOs and the timing and frequency of post-IPO financing activity.[4]. We follow Hertzel et al. 2012 and refer to the idea that there is staging in IPO markets as the *public market staging hypothesis* which predicts that the size of an IPO (relative to the firm's pre-IPO financing needs), the likelihood of the next public capital infusion, and the number of post-IPO financing rounds should be directly related to the firm's R&D intensity and asset intangibility at the time of the IPO.

There is also some extant evidence showing that more *mature* firms in the U.S. use financing arrangements that have characteristics similar to public market staging that also serve to control overinvestment. Mayers (1998) argues and provides evidence consistent with firms using convertible bonds to reduce the potential costs of overinvestment. The mechanism at play here is that stock prices will not be sufficiently high to trigger conversion if future projects turn out to be value-decreasing. Schultz (1993) shows that *unit IPOs*, where warrants are issued along

[4] As noted by Schultz (1993), managers of IPO firms' might have particularly strong incentives to keep investing in unprofitable investment projects simply to preserve their jobs. In this framework, suppliers of IPO funds recognize the potential and costs associated with these problems and are unwilling to advance additional funds to an entrepreneur with uncertain prospects even at higher required rates of return.

with shares, can similarly reduce overinvestment. In effect, unit IPOs pre-commit IPO firms to sell more equity in the future as long as the stock price exceeds the exercise price of the warrant. This feature restricts overinvestment, since stock prices will be less likely to exceed warrant exercise prices when expected valuable future projects fail to materialize. More recently, Denis and McKeon (2021) document the prevalence of publicly-traded firms with persistent negative cash flows that frequently raise external equity capital to cover their immediate funding needs. They interpret their findings as consistent with investors' staging equity capital infusions to reduce frictions associated with external equity financing.

2.2. Legal institutions and the practice of staged financing

To motivate our analysis of the effect of country-level legal institutions on public market staging, we draw on an influential strand of literature showing that when legal protection of investor rights in a country are strong, firm-level information asymmetry and agency problems are less severe, and firms have greater access to external financing (e.g., La Porta et al., 1997 and 2002; La Porta et al., 2006). However, the exact effect of legal protection on public market staging is ambiguous. To see this, consider the effect of investor protection on capital raising activity in the context of the tradeoff theory of cash holdings, which posits that firms trade off the costs and benefits of holding cash to arrive at optimal cash balances (see, for example, Opler et al.1999). This tradeoff can naturally be seen in the context of the role of internal cash (financial slack) in the pecking order theory of capital raising (Myers and Majluf, 1984). The benefit of holding cash (financial slack) is that it can protect against underinvestment that can arise due to asymmetric information limiting the ability to raise capital in the external market when firms have value-increasing projects. However, there is a dark side to having too much financial slack, as excess

cash can lead to managerial overinvestment in projects that do not meet investor standards and/or to perquisite consumption by managers.

When investor protection is weak, investor concerns about the cash holdings of newly-public firms are magnified if weak investor protection allows managers to more easily continue to overinvest IPO proceeds targeted at future investments. However, if it is harder for firms in weak protection countries to raise external capital, there are benefits to holding larger precautionary cash balances (issuing larger IPOs) since doing so would limit underinvestment in profitable investment opportunities that might arise if firms are less able to subsequently raise funds in the capital market. Thus, while increased investor concerns about potential overinvestment suggest a greater role for staging at the IPO in weak protection countries, the increased need for precautionary balances when access to capital markets is limited suggests a benefit to larger IPO sizes.

2.3. Alternative explanations for the timing of capital infusions

We recognize and consider alternative explanations for cross-sectional variation in post-IPO capital infusions motivated by signaling and market-discovery theories of equity issuance based on asymmetric information. Broadly speaking, these theories suggest that issuing firm managers, who have superior information about the true value of the firm, may choose to limit the size of an IPO and raise the rest, at a more attractive price, in a subsequent offering. For example, in Myers and Majluf (1984) managers optimally choose not to issue equity (or issue only part of the needed amount) when they believe their firm is undervalued by the market. In the IPO setting, Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989) propose that managers of high-quality firms intentionally underprice their shares to distinguish themselves from low-quality firms. In these models, high-quality firms make only a partial IPO.

Following the offering, a firm's true value is revealed to investors, and these firms subsequently return to the secondary market to issue more shares[5].

These theories suggest that the likelihood of post-IPO capital raising and the time to a firm's first post- IPO financing should be related to post-offering stock returns (a traditional measure of IPO undervaluation and changes in the cost of equity capital). Therefore, in our analysis we include the first-trading day return as a measure of IPO underpricing and post-IPO stock return over the longer 20-day window (as used in Jegadeesh et al., 1993) to control for the possibility that the issuers *themselves* stage their capital infusions when they believe their firms' shares are undervalued.

It is important to note that the above theories imply that the likelihood or the frequency of a firm's post-IPO capital infusions are not known at the time of the IPO as the true quality of the firm is revealed exogenously to investors after the offering. In contrast, the public market staging hypothesis implies that the firm's probability and timing of post-IPO capital infusions is related to key firm characteristics associated with uncertainty about a firm's prospects at the time of the IPO.

3. Sample, data, empirical design

3.1 Sample

Our analysis of public market staging and the size of IPOs focuses on IPOs in 47 countries that have data on investor protection as discussed below. Our initial sample comprises all firms in these countries that completed an IPO of common stock between January 1991 and December

[5] Such financing strategies can be viewed as *internal* or *firm staging* as opposed to staging imposed by outside investors which is the focus of our study.

2019 as reported in the Thomson/Refinitiv SDC Database. From the SDC database we collect data on the offer date, offer price, issue description, industry classification, total number of shares sold, the number of primary and secondary shares, amount of proceeds, marketplace of issue, offer price revision, underwriter name(s), whether the issue was backed by a venture capitalist, and information on pre-IPO total assets. We have tried to correct all data errors in the SDC database by cross verifying our sample with the IPO data from Bloomberg.

We exclude rights offerings, private placements, spinoffs, unit offers, reverse leveraged buyouts as well as offerings by utility firms (SIC codes 4900-4999), financial firms (SIC codes 6000-6999), limited partnerships, trusts, REITs, and governments or quasi-public firms. We drop offerings in which the issuer does not issue primary shares and thus does not receive cash. We consolidate concurrent issues in the domestic market and the foreign market as well as multiple issues within three calendar days into a single offering and aggregate the total proceeds. Finally, we require an offering to have either CUSIP or SEDOL identifiers to link to Compustat and Datastream databases.

Our analysis requires firm-level accounting and stock price data as well as country-level data on investor protection, and economic development. We obtain the firm-level accounting data from the Standard and Poor's Compustat Global and Compustat North America databases and Refinitiv. Stock return data come from Datastream and the Center for Research in Security Prices (CRSP). We drop firms that that do not have stock price data within 90 days of the issue date. Our sample includes 21,901 firms. However, not all firms have valid pre-IPO data on operating cash flows, investment outlays, intangibles, and especially R&D expenditures to construct our main test variables as described below. In each of our tests, we use as many valid observations as possible, so the sample is not necessarily the same across regressions. To reduce the effect of outliers, we

winsorize accounting variables at the 1% level.

Figure 1 plots the total number of IPOs and IPO proceeds by year. Global IPO activity both in terms of IPO counts and total proceeds exhibits significant time variation. For example, IPO counts reach their peaks in 2000, 2007, and 2010 and it collapses in 1999, 2001-2003 and 2008-2009. The time pattern of the IPO proceeds is similar to the counts.

3.2 Empirical framework and variables

We estimate the following general equation for the full sample and separately for the strong and weak investor protection subsamples:

$$\textit{Capital Staging}_{i,s} = \delta_{,i,s} + \beta_1 \textit{ Firm Information Environment}_{I,s\ t-1} +$$

$$\gamma \textit{ Country, Firm, and Deal Controls}_{i,s,t-1} + \textit{industry, country, year FE} + \varepsilon_{ist} \qquad (1)$$

where *i*, *s*, and *t* denote firm, country, and year, respectively.

We measure the extent of public market staging, *Capital Staging*, using three different dependent variables: *(i) the cash burn rate* (measured to capture the size of the IPO) *(ii) the likelihood* of the newly-listed firm returning to the capital market following the IPO, and *(iii) how often* the newly listed firm returns to the capital market. The *cash burn rate* is an inverse scaled measure of IPO size calculated as the difference between the funds used for investment by a firm and the funds it generates from operations in the year prior to the IPO, scaled by the total dollars raised in the IPO. Cash burn rates are positive when pre-IPO investment spending is more than operating cash flow, i.e., the firm has a financing deficit in the year prior to its IPO. We note that the cash burn rate is the inverse of the number of years of funding provided by the IPO assuming that the firm continues to burn capital at the same rate it did in the year before its IPO.[6]

[6] We do not divide the IPO proceeds by the difference between investment and funds from operations (i.e., compute the number of years of funding directly) to avoid the potential for division by zero or negative number.

For each of our IPO firms we identify all equity and public (bonds) and private (loans) debt capital infusions in the two-year period following the IPO from the Eikon Refinitiv Database. We refer to firms that raise new capital within two years of their IPOs, regardless of the type of capital, as *issuers* and refer to the time from the IPO to the first post-IPO capital infusion as the *spell length* or *duration*.

We measure our key test variables, the extent of information asymmetry and uncertainty at the going public firms, using the ratio of intangible assets to total assets (*Intangible/assets*) and the ratio of R&D expenditures to sales (*R&D/sales*), both estimated using data from the fiscal year just prior to the year of the IPO (also see relevant discussion in Peters and Taylor (2017)). The public market staging hypothesis implies that firms with uncertain future prospects should be "kept on a short leash", by providing less funding at the time of the IPO and thereby forcing a return to the capital market for follow-on financing *if* future growth prospects turn out to be profitable.. Therefore, the coefficient on the *Intangible/assets* and *R&D/sales* are expected to be positive in the regressions for the cash burn rate (which is the inverse of the IPO amount), the probability of returning to the capital market in the two-year period following the IPO, and the number of post-IPO financing rounds.

We measure the strength of country-level institutions protecting investor rights using two widely used proxies that are particularly relevant to the IPO setting. First, we measure investor protection with an index for disclosure requirements (*IPO Disclosure*) in the IPO prospectus developed by La Porta et al., (2006) and available for 40 countries in our sample. The index is based on a survey of securities law attorneys regarding IPO prospectus disclosure requirements in each country's largest stock exchange. The disclosure index is computed as the average of six

sub-indices measuring disclosure; a higher index value indicates more stringent IPO disclosure requirements and thus stronger investor protection.[7]

Our second measure is a composite investor protection index (*Investor Protection*), which also comes from La Porta et al., (2006). This index is the first principal component of three indexes: *Disclosure*, *Liability*, and *Anti-director Rights*. The *Liability* index is the average of three sub-indices that measure the judicial ease with which investors can pursue an IPO firm and its directors, the distributors, and the accountants in civil court if the investor suffers financial losses due to misleading statements in a prospectus. The *anti-director rights* index measures the different aspects of protection afforded to minority investors such as proportional board representation, pre-emptive rights, and judicial remedies. By construction, the *Investor Protection* index measures both the strength and enforcement of legal rules in a given country.

We also control for differences in economic and financial development across countries because firms in more economically and financially developed markets might have easier access to external funds. To control for the size of the economy and the level of economic development in the country, we use the natural log of Gross Domestic Product (*GDP*) and *GDP per capita* which we obtain from the World Bank's database. The development of financial markets is captured using the ratio of market capitalization of listed companies to GDP which comes from Čihák et al. (2013).

We control for firm and deal characteristics using the log of assets, total primary capital raised in the IPO, the cash burn rate, and capital expenditures.[8] We use the log of book assets as

[7] The six sub-indices reflect disclosure requirements related to: (1) prospectus delivery; (2) insider compensation; (3) ownership structure; (4) insider ownership; (5) irregular contracts; and (6) transactions with related parties such as the issuer, its directors and large shareholders.

[8] Although they may only add second order effects, we believe it would be interesting, although difficult, to study the effect of firm-level corporate governance measures in our setting. While there is a broad literature examining

a proxy for firm age, since we do not have firm age for most of our international sample. The cash burn rate, the dependent variable in the IPO size regressions, is included as a firm-specific control variable in our analysis of the probability and frequency of subsequent capital infusions since the public market staging hypothesis suggests that the amount of capital raised at the time of the IPO should be a good indicator of the likelihood a firm will need additional capital following the IPO. The ratio of capital expenditures to assets in the year prior to the IPO is included as an additional measure of a firm's pre-IPO capital outlays.

We also include the percentage of total IPO proceeds attributable to secondary sales (*percent secondary*) and whether the firm received venture backing (*venture-backed*) as additional control variables. We include *percent secondary* since the *public market staging hypothesis* is focused on the amount of (primary) capital provided to the firm at the time of its IPO. This variable also captures any effects associated with insider selling and/or ownership structure changes. We include *venture-backed* to control for certification provided by the venture capitalists thus suggesting less need for staging (e.g., Megginson and Weiss, 1991). Alternatively, to the extent that more mature firms do not use venture capitalists, venture backing could be associated with less mature firms and thereby a greater need for staging. Previous literature suggest that reputable IPO underwriters are associated with reduced information asymmetry and thus IPO undervaluation, for example, through a certification effect (e.g., Carter and Manaster 1990). Following the IPO literature (e.g., Duong et al. 2022), we create an

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firm level governance structures, how to identify a firm-level measure of governance given the multi-faceted nature of a firm's governance structure is challenging. This is especially the case when studying firms from different countries since country level institutions have been shown to affect firm's choice of governance structure. We note that Doidge et al. (2007), Claessens et al. (2000), and Faccio and Lang (2000) show that the overall legal environment of a country is relatively more important than any firm-level characteristics in determining the quality of corporate governance. Still, we believe this would be interesting to pursue and suggest it as a fruitful area for future research.

indicator binary variable for *top-tier underwriters* that takes a value of one if the underwriting investment bank is in the top quartile of the sample distribution based on combined IPO proceeds (as reported by the SDC), and zero otherwise.

We include the IPO first day return and post-IPO return over the first 20 days following the IPO as control for alternative explanations (e.g., market-feedback and discovery) for observed cross-sectional variation in the time between a firm's IPO and its next capital infusion. As noted above, these controls are motivated by theories of post-equity issuance based on asymmetric information and signaling and market-discovery (e.g., Allen and Faulhaber (1989), and Welch (1989)).

Finally, our **r**egressions include year fixed effects, industry effects (based on information from SDC) and, and later also include country effects. The year fixed effects account for changes in aggregate economic conditions and country fixed effects remove any persistent country-specific factors such as legal origin or culture that could be associated with going public firms' financing activities.

4. Results

4.1 Summary statistics and univariate comparisons

Table 1 describes IPO activity, frequency of firms that return to the market for post-IPO capital infusions, and the two investor protection indexes for each country in our sample. Similar to prior research (e.g., Doidge et al. 2013), the United States (5,645 offerings) is the most active market for IPOs, followed by China (3,574), and Japan (2,420). The percentage of firms that return to the market for follow-on capital raising within two years of their IPO varies significantly across countries. For example, 52% of the Australian firms raise capital within two years of going public while only 9% of firms in India do so. We also observe significant

variation across countries in our investor protection measures. In our sample, *Investor Protection* has a median value of 0.72 with a standard deviation of 0.25 and the *IPO Disclosure* has a median value of 0.83 with a standard deviation of 0.17. Notably, a number of highly industrialized countries such as Germany, Belgium, and Austria offer relatively weak protection to IPO shareholders with an *Investor Protection* level below 0.2. In contrast, IPO investors in Singapore, New Zealand, the United Kingdom, and the U.S. have the strongest protection with the index above 0.7. The *IPO Disclosure* index exhibits similar cross-country differences.

[Table 1 about here]

Table 2 provides univariate comparisons of firms that raised additional capital within two years of their IPO vs firms that did not. 6,268 firms or about 30% of the sample raised external capital within two years of their IPO. The sub-sample of firms that raised additional capital within two years of their IPO have an average (median) duration of 1.39 (1.058) years. The 14,906 firms that did not complete a post-IPO financing within two years of their IPO have a mean (median) duration of 5.9 (4.49) years.

[Table 2 about here]

Comparisons of our two key test variables provide evidence consistent with public market staging at the time of the IPO. Intangible assets comprise an average of 10.2 percent of total assets for firms that returned for financing within two years as compared to only 6.2 percent for firms that did not raise additional capital within two years. Similarly, the average ratio of R&D to sales is 3.62 for firms that raised additional financing within two years and 1.6 for firms that did not. Both differences are statistically significant at the 1% level.

A comparison of the cash burn rates across the two groups is also consistent with staging at the time of the IPO. The average cash burn rate for firms that return for financing is 0.168.

This indicates that these firms, on average, have an operating cash flow deficit equal to 16.8 percent of the IPO proceeds in the year prior to the IPO. Continued spending at this rate implies that the proceeds will last 5.9 years (=1/0.168). In contrast, firms that did not raise additional capital have a significantly lower mean cash burn rate of 3.8 percent. Thus, in principle, if such firms were able to continue funding investment in such a manner, they would need to return to the capital market in more than 20 years. The sample average cash burn rate is 0.078 (with a standard deviation of 0.52).

Table 2 also shows that the cumulative stock return over the twenty trading days immediately following the IPO (inclusive of the first day return) is not significantly different between the two groups. Underpricing (measured as the first day return) is also somewhat similar across subsamples. Our univariate evidence is therefore not supportive of market-feedback and market discovery explanations of post-IPO financing activity.

4.2 The prevalence of public market staging in global IPO markets

In this section we investigate the prevalence of public market staging in global IPO markets by examining the amount of capital raised in IPOs (subsection 4.2.1), the frequency and timing of post-IPO financing activity (subsection 4.2.2), and whether the global evidence is driven by U.S. firms (subsection 4.2.3). We turn to the effects of country-level investment protection measures in section 4.3.

4.2.1. Analysis of the amount of capital raised in the IPO

We start our analysis by estimating various specifications of the regression described by equation (1) that explain the amount of funding raised at the time of the IPO. The dependent variable in this analysis is the *cash burn rate* which, as described earlier, is equivalent to the

inverse of the length of time that the IPO proceeds will meet the firm's needs if the *cash burn rate* continued at the level observed in the year before the IPO. The public market staging hypothesis predicts that an IPO firm's intangible asset and R&D intensity will be positively related to its cash burn rate (and thus negatively related to the size of the IPO).

[Table **3** about here]

The results, reported in Panel A of Table 3, are generally consistent with this prediction. We find that, whether included separately in Models 1 and 2 or together in Model 3, the coefficient estimates for *Intangible/assets* and *R&D/sales* are both positive and statistically significant. These results indicate that firms with more intangible assets and firms with greater R&D intensity are associated with a higher cash burn rate, which implies that they receive less funding at their IPO relative to their pre-IPO dollar burn rate.

Note that Model 2 only includes observations with non-missing *R&D/sales* which reduces the sample to only 4,747 observations. Therefore, to preserve as many observations as possible, in subsequent specifications we follow a common approach in corporate finance research and set the missing R&D observations to zero and include a dummy variable for non-missing R&D observations. We note that our results are qualitatively the same using this specification.

To assess the economic magnitude of these results we calculate predicted changes in the *cash burn rate* that would result if the *Intangible/assets* increased by one standard deviation (16.5%) from its mean. The 0.119 coefficient estimate on *Intangible/assets* in Model 3 suggests that a one standard deviation increase in *Intangible/assets* is associated with a 1.96 percentage point increase in the *cash burn rate*. Given that the sample average *cash burn rate* is 7.4 percent, a 1.96 percentage point increase is clearly economically meaningful. A one standard deviation

increase in *R&D/sales* has an even greater impact as it is associated with close to a 5.0 percentage point increase in the *cash burn rate*.

Models (4) through (6) in Panel A assess whether our baseline results are robust to alternative sub-samples and additional fixed effects. To test for changes in IPO financing activity in the post-2008 period, which was noted by Doidge et al. (2013) and others, we split the sample into before and after the 2008 periods. The results in Models 4 and 5 show that the positive effects of intangible asset and R&D intensity on the cash burn rates are present and strong in both subperiods.

Model (6) includes country fixed effects (in addition to year and industry fixed effects) to control for any time-invariant country-level factors that could be correlated with the dependent variable (such as legal origin, culture etc.). We continue to observe positive and significant coefficients on *Intangible/assets* and *R&D/sales* indicating that unobserved persistent country-specific factors are unlikely to explain the results.

Turning to the control variables, we observe that the coefficient estimates for *percentage secondary* are negative and significant in all specifications indicating that firms with a larger proportion of secondary sales in their IPOs tend to receive more funding This is consistent with the idea that the proportion of secondary sales is negatively related to uncertainty about the firm's prospects. Coefficient estimates for the venture-backed dummy variables are positive and significant in all specifications suggesting that that venture-backed firms are more likely to be staged. This finding suggests that the effect of any certification provided by venture capitalists on the likelihood of staging is more than offset by the tendency for venture capitalists to back less mature firms. These findings are consistent with results for the U.S. firms in Iliev and Lowry (2020). In contrast, the coefficient estimates on the reputable underwriter dummy variables are

generally negative (but statistically insignificant in some specifications) suggesting that firms underwritten by more prestigious investment banks raise more funds relative to their financing needs on average. This result is consistent with the certification argument in Carter and Manaster (1990) that underwriter prestige is associated lower information asymmetry at (and lower risk of investing in) going public firms and thus possibly less need for staged financing.

4.2.2 Timing and frequency of post-IPO capital infusions

To the extent that firms receive lower funding due to staging motives, we should also observe these firms more likely and more frequently returning to the market to raise additional capital than firms with fewer intangible assets and lower R&D intensities. Panel B of Table 3 reports results on the likelihood of a firm returning for a subsequent equity capital infusion within two years of the IPO using a probit model of the marginal effects from various specifications described by equation (1). The specifications are similar to those in Panel A except that the dependent variable is a dummy (1/0) variable indicating whether the firm returns to public equity markets for a post-IPO capital infusion within two years of the IPO.

Notably, the two key variables of interest- *Intangible/assets* and *R&D/sales* – enter all specifications in Panel B with positive coefficients that are significant at the 1% level. The results are consistent with the implications of the public market staging hypotheses that firms with more intangible assets and higher levels of R&D expenditures are more likely to return to the capital market for additional equity or debt funding.[9]

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[9] In a previous version of this paper, we also estimated the hazard analysis of the time to first post-IPO capital infusion. The (untabulated) results show that firms with more intangible assets and higher levels of R&D expenditures not only are more likely to return but also return more quickly for post-IPO capital infusions.

The signs on the control variables are generally as expected, although many are not statistically significant at conventional levels. The cash burn rate and capital expenditures have consistently positive and significant coefficients, implying that firms that raise small amounts of capital relative to their pre-IPO financing needs and with greater investment outlays are more likely to return to the market for additional funding. As discussed earlier, the 20-day post-IPO return captures the effect of alternative theories related to firm and/or market decisions on post-IPO follow-on financing such as firm undervaluation as well as revelation of post-IPO information. We find that this variable is mostly positively related to the likelihood of return to the market suggesting that firms with favorable stock price performance over the 20-days following the IPO are more likely to be candidates for the follow-on financing. This evidence is consistent with a variety of alternative explanations of the timing of post-IPO capital infusions that rely on post-IPO (as opposed to pre-IPO) firm and market characteristics. Taken together, these findings highlight that the staging effects we document is separate from (and might be incremental) to the alternative explanations of post-IPO capital infusions.

In Panel C of Table 3, we examine the determinants of the *number* of capital infusions within two years following the IPO. We use the same regression specification as in the likelihood of post-IPO capital infusions analysis (Panel B) and employ a maximum likelihood Tobit model because the dependent variable is left censored at zero. We find that the coefficients on the two key ratios of interest- *Intangible/assets* and *R&D/sales* - are positive and significant at better than the 1% level in all specifications. These findings thus indicate that newly listed firms with more intangibles and R&D intensity (and thus greater information asymmetry and uncertainty) receive more financing rounds on average. Given that the same types of firms also receive smaller amounts of initial capital, these results are consistent with public market investors being aware and

concerned about the extent of information and uncertainty problems at the going public firms. Investors appear to mitigate these risks by infusing capital in stages as they likely obtain more information over time about the viability of firm investment opportunities.

4.2.3 Is the global evidence on public market staging driven by U.S. firms?

The results so far provide evidence consistent with public market staging in international IPO markets. Given that U.S. firms account for a sizable fraction of our sample, a natural question is whether our results are driven by public market staging by U.S. firms (which is already documented in Hertzel et al., (2012)) or whether the practice extends to non-U.S. firms. To examine this, we split our sample into three groups: U.S. firms, firms from non-U.S. economically developed countries, and firms from non-U.S. economically developing ("emerging") countries. We classify developed (emerging) countries as those with average GDP per capita above (below) the sample median (which is around $22,000). In Panel D of Table 3, we repeat the analysis of the amount of capital raised in the IPO (Columns 1-3) and the probability of returning for follow-on financing (Columns 4-6) for each subsample separately. (The results for the number of financing rounds are similar and not reported to conserve space.) The regressions using only U.S. firms do not include country fixed effects and cluster standard errors at the year level.

The coefficient estimates for *Intangible/assets* and *R&D/sales* are positive in each specification, although the estimates are only marginally significant for the probability of returning for follow-on financing regressions for the non-U.S. developed and emerging subsamples, respectively. These findings show that the core results are observed in different subsamples, suggesting that the practice of public market staging is relatively widespread.

4.3 The effect of country-level legal investor protection on public market staging

Having shown that staging is widespread in global IPO markets, we now consider whether its use varies with the widely used country-level measures of legal investor protection that previous literature has shown to be associated with firm-level information asymmetry and agency problems and the ability of firms to access capital markets (e.g., La Porta et al., 1997; La Porta et al., 2006; Mclean et al., 2012).

To investigate, we repeat earlier analyses separately for two subsamples of IPOs formed by whether the IPO firm is in a strong or weak investor protection country. The strong (weak) investor protection subsample includes IPO firms that are from countries where the *Investor Protection* index and the *IPO Disclosure* index are above (below) the median value for the countries in our sample. Running separate regressions allows key variables to vary across specifications and allows us to include important country fixed effects to control for any unobserved country-level effects that could be correlated with our key dependent and independent variables.

We start, in Table 4, with univariate comparisons for the two subsamples of firms on whether or not they return for financing within two years of their IPO. (We obtain very similar results using the *IPO Disclosure* index but do not tabulate the results to conserve space.) The results in Columns (1) and (2) suggest that IPO firms in weak protection countries appear less likely to be candidates for staging as they are less R&D intensive, have lower levels of intangible assets, have higher operating income, are burning through less cash, and are larger. One interpretation of this finding is that IPO markets in weak protection countries are less vibrant in that they are less able to accommodate (via staging) start-up firms with greater levels of

uncertainty. Consistent with the idea of less staging in these countries, we observe larger IPO sizes in weak protection countries; calculated using the inverse of the *cash burn rates* we see that IPO firms in weak protection countries raise 15.2 years of financing as compared to only 8.5 years of financing for IPO firms in strong protection countries. In addition, we also see that only 29 percent of weak protection country IPO firms (1,812 out of 6,203) return for the follow-on financing within two years of their IPO as compared to 40 percent of IPO firms from strong protection countries (2,385 out of 5,962).

[Table **4** about here]

Columns (3) through (6) of Table 4 provide comparisons of time to first post-IPO capital infusion, and firm, IPO, and market characteristics for subsamples of firms partitioned by whether they return for financing within two year. Focusing on our key test variables, the evidence for the strong investor protection country IPO firms is consistent with public market staging; firms that return for financing have significantly higher levels of intangible assets and are significantly more R&D intensive than firms that return for financing in weak protection countries.

Table 5 presents the regression results for the two subsamples partitioned using the *Investor Protection* index (Panel A) and the *IPO Disclosure* index (Panel B). The results in both panels paint the same picture: evidence supporting the public market staging hypothesis is significantly stronger for the subsample of IPO firms from countries offering greater investor legal protection. Specifically, for the subsample of IPOs from strong protection countries we see that the coefficients on *Intangible/assets* and *R&D/sales* are positive and significant at the 1% or 5% levels in all specifications. This stands in sharp contrast to our findings for the weak protection countries for which those same coefficients are positive but not statistically different

from zero at conventional levels in most specifications with the exception of the cash burn regressions (but even in those regressions the magnitude of the coefficients is significantly lower). Taken together, these findings suggest that in strong investor protection countries, firms with greater asset intangibility and higher R&D intensity receive less funding at their IPO and are more likely to return for an additional capital infusion within two years of their IPO and do so more frequently.

[Table **5** about here]

Evidence that firms in weak investor protection countries have larger IPO sizes and are less likely to return for post-IPO financing is consistent with theoretical arguments regarding the importance of maintaining higher precautionary cash balances and greater financial slack in countries where the ability to access capital markets for follow-on financing is more difficult. It is also case that, *ex ante*, staging is likely more difficult in these countries since the ability to provide follow-on financing for newly-public firms that actually *do* meet performance benchmarks is not assured. To the extent that staged financing enhances capital formation by increasing the number and *types* of firms that can go public, stronger investor protection contributes to the vibrancy of the IPO market thereby promoting innovation and economic development. Evidence noted above on the types of firms that go public in weak protection countries is consistent with this possibility: On average, IPO firms from weaker investor protection countries appear less likely to be *candidates* for staging at the time of their IPO: they are less R&D intensive, have lower levels of intangible assets, have higher operating income, and are burning through less cash.

Finally, we note an important caveat. Despite the consistency of the findings across different specifications and proxies for investor protection, the results for the effects of investor

protection only indicate associational relationships and do not necessarily imply causality. This is a typical limitation in international legal institutions studies (e.g., La Porta et al. 2006).

5. Conclusion

Evidence in this paper shows that the staging of capital infusions, which is pervasive in the venture capital market, is also evident in the markets for IPOs around the world. Our results suggest that factors that explain round sizes and the time between venture capital financing rounds also explain IPO sizes, the likelihood and frequency of a firm returning for follow-on capital infusions in international IPO markets. Specifically, we find that on average firms with higher ratios of intangible to total assets and firms with greater R&D intensity receive less funding relative to pre-IPO cash flow needs at the time of the IPO and are more likely to return for post-IPO capital infusions and do so more frequently. Also, consistent with staging at the time of the IPO, we find that firms that raise less money at their IPO are more likely to raise additional capital.

When we repeat our analyses separately for subsamples of our data based on country-level measures of investor protection, we find that results for countries offering stronger investor protection are more consistent with the public market staging hypothesis than those from weak investor protection countries. To the extent that the practice of equity staging enhances capital formation by increasing the number and types of firms that can go public, this evidence helps improve our understanding of the channel through which countries' legal environments affect their economic development. Nevertheless, as is typical in studies of international legal institutions, our results for the effects of investor protection only indicate associations and do not necessary imply causality. Finally, it should be noted that firm-level corporate governance characteristics can be important factors in financing decisions of firms around the world (see, for example, Araki and Martins, 2022). We believe this would be a fruitful area for future research.

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Appendix A: Variable Descriptions

Firm-level variables (source Compustat, Refinitiv SDC and Datastream):

Capital Staging	measured with three different variables: *(i) the cash burn rate ii) the likelihood* of the newly-listed firm returning to the capital market following the IPO, and *(iii) how often* the newly listed firm returns to the capital market.
Intangible asset ratio	intangible assets as a fraction of total assets at the time of IPO.
R&D/sales	Research and development expenditures as a fraction of sales.
Dollar burn rate	Funds used for investment - Cash flow from operations
Cash burn rate	Annual dollar burn rate / total capital raised in the IPO.
CapEx	Capital expenditures as a fraction of book assets.
IPO funds	Log of total proceeds raised in the IPO and the following thirty days.
1st-day return	the return on shares on the first trading day.
Post-IPO return	IPO underpricing measured as the return on shares over the first 20 days following the IPO including the first day return.
Country-level data	
Investor Protection:	we measure the strength of investor protection at a country-level with an index for disclosure requirements (*IPO Disclosure*) in the IPO prospectus and with a composite investor protection index (*Investor Protection*), both developed by La Porta et al., (2006)
Log GDP	the natural log of the real GDP in US dollars *(World Bank)*.
Log GDP per capita	the natural log of the real GDP per capita in US dollars *(World Bank)*.
Stock market development	The ratio of stock market capitalization to GDP (Čihák et al. (2013)

Figure 1 IPO Activity over the period 1991-2019

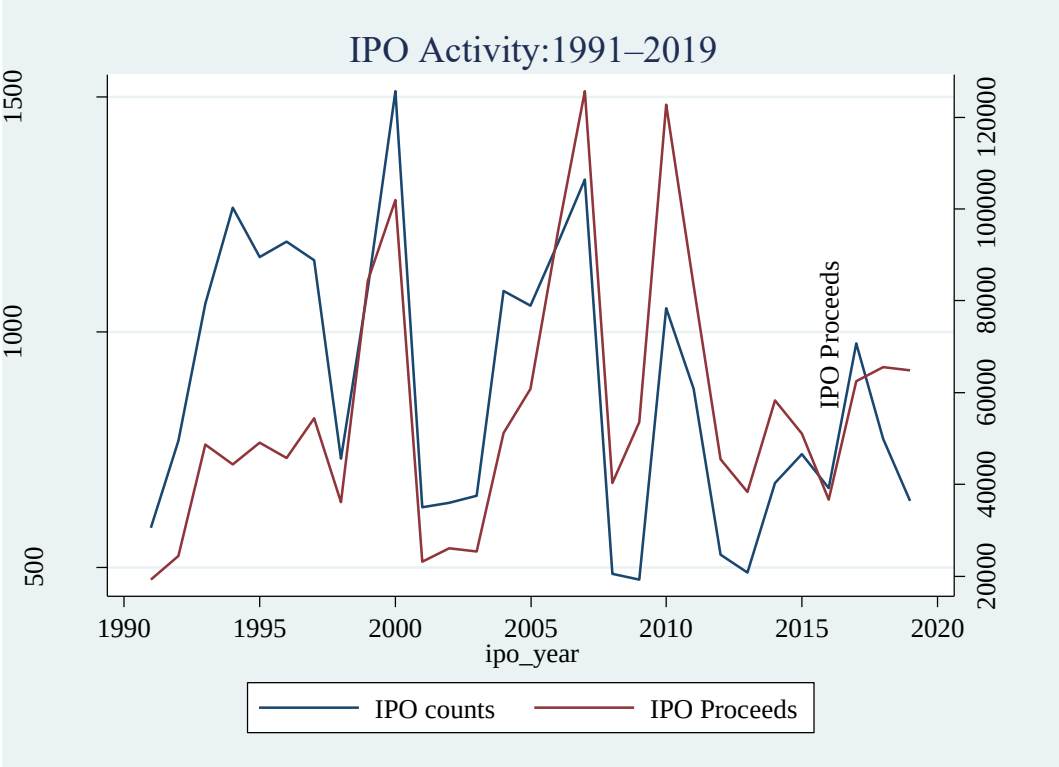

Table 1. Country-level summary statistics

This table reports country-level means on IPO and country characteristics by issuer country.

country	Obs	Proceeds in mil USD	cash burn rate	Fraction of IPOs that raise capital within 2 years	Investor Protection index	IPO Prospectus Disclosure index
Argentina	7	121.78	-0.11	0	0.45	0.50
Australia	1114	26.6	0.28	0.52	0.69	0.75
Austria	41	144.2	0.03	0.27	0.10	0.25
Belgium	70	100.55	0.16	0.3	0.05	0.42
Brazil	107	349.92	0.01	0.26	0.29	0.25
Bulgaria	8	18.12	-0.44	0.13	.	.
Canada	276	88.57	0.33	0.5	0.97	0.92
Chile	15	164.66	0.2	0.6	0.63	0.58
China	3574	125.08	-0.01	0.1	.	.
Denmark	92	71.26	0.19	0.33	0.44	0.58
Egypt	7	111.79	0	0.43	0.23	0.50
Finland	75	59.07	0.02	0.24	0.49	0.50
France	580	51.01	0.07	0.18	0.42	0.75
Germany	569	99.71	-0.07	0.18	0.01	0.42
Greece	59	45.92	-1.08	0.02	0.24	0.33
Hong Kong	626	50.6	-0.07	0.27	0.86	0.92
Hungary	3	90.48	-0.75	0	.	.
India	640	55.24	0.3	0.09	0.86	0.92
Indonesia	216	50.71	0.28	0.13	0.38	0.50
Ireland	46	116.49	0.07	0.39	0.62	0.67
Israel	67	39.67	0.08	0.12	0.55	0.67
Italy	222	89.49	-0.04	0.1	0.17	0.67
Japan	2420	37.97	-0.1	0.2	0.69	0.75
Korea Rep.	1212	46.43	0.11	0.14	0.46	0.75
Luxembourg	12	589.69	-0.03	0.58	.	.
Malaysia	429	36.62	0.2	0.15	0.74	0.92
Mexico	30	327.85	-0.11	0.17	0.10	0.58
Netherlands	79	223.61	0.17	0.24	0.49	0.50
New Zealand	67	45.17	0.06	0.33	0.58	0.67
Norway	127	85.26	0.59	0.35	0.55	0.58
Pakistan	11	17.77	2.18	0	0.67	0.58
Philippines	49	146.71	-0.08	0.14	0.72	0.83
Poland	175	21.65	-0.02	0.11	.	.
Portugal	6	197.09	-0.04	0.5	0.46	0.42
Romania	4	38.45	0.82	0	.	.

Russia	27	288.5	0.09	0.41	.	.
Singapore	420	22.1	-0.04	0.23	0.77	1.00
South Africa	31	138.38	0.16	0.13	0.83	0.83
Spain	46	157.59	0.05	0.17	0.60	0.50
Sri Lanka	10	19.96	0.1	0	0.50	0.75
Sweden	173	63.01	0.12	0.39	0.40	0.58
Switzerland	69	279	-0.02	0.26	0.36	0.67
Taiwan	925	14.38	0.43	0.19	0.57	0.75
Thailand	380	38.79	0.01	0.1	0.41	0.92
Turkey	101	27.88	0.3	0.06	0.23	0.50
United Kingdom	1018	87.31	0.17	0.38	0.83	0.83
United States	5645	115.66	0.16	0.33	1.00	1.00

Table 2. Characteristics of the initial public offerings

The sample is initial public offerings of common stock in the years 1991-2019. All accounting variables are measured at the end of the fiscal year preceding an IPO. See Section 3.2. and Appendix A for detailed variable definition. The mean and median values are reported for each characteristic within each subsample. [a, b,] and [c] indicate the mean for the 1st subsample (raised capital) is statistically different from the mean in the 2nd subsample (did not raise capital) at the 1%, 5%, and 10% level, respectively.

Characteristic		Raised capital within 2 years	Did not raise capital within 2 years
Observations		6268	14906
Time from IPO to next financing (Spell)	*mean*	1.39	5.939[a]
In years	*median*	1.058	4.495
Dollar burn rate	*mean*	10.644	1.657 [a]
	median	1.488	0.096
Cash burn rate	*mean*	0.168	0.038 [a]
	median	0.079	0.007
Intangibles/assets	*mean*	0.102	0.062 [b]
	median	0.005	0.006
R&D/sales (non-missing)	*mean*	3.621	1.609 [a]
	median	0.107	0.05
Book Assets ($U.S. millions)	*mean*	310.15	149.8 [a]
	median	40.948	33.9
Capital expenditures/assets	*mean*	0.127	0.09[c]
	median	0.05	0.02
Oper. Cash flow/assets	*mean*	0.09	0.259 [a]
	median	0.038	0.08
IPO proceeds ($U.S. millions)	*mean*	120.054	69.172 [a]
	median	36.176	23.887
IPO initial return	*mean*	0.27	0.387 [c]
	median	0.1	0.15
Post-IPO 20-day return	*mean*	0.413	0.51
	median	0.142	0.149

Table 3. Public market staging in global IPO markets

Coefficient estimates from ordinary least squares models predicting the cash burn rate for firms that completed an IPO between 1991 and 2019. The dependent variable, the *cash burn rate*, equals the ratio of the difference between funds used for investment and the funds from operations in the year prior to the IPO, divided by the total funds raised in the IPO. See Section 3.2. and Appendix A for detailed variable definition. We report robust standard errors clustered at the country level in brackets. ∗, ∗∗ and ∗∗∗ indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A. Predicting the amount of capital raised in the IPO

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES				pre-2008	post-2008	Country FE
Intangible/assets(t=-1)	0.131***		0.119**	0.141**	0.070**	0.152***
	[0.046]		[0.048]	[0.062]	[0.034]	[0.042]
R&D/Sales(t=-1)		0.009***	0.023***	0.024***	0.022***	0.021***
		[0.001]	[0.004]	[0.003]	[0.005]	[0.003]
Non missing R&D Dummy			0.024	0.050***	0.003	0.013
			[0.015]	[0.015]	[0.030]	[0.009]
Log of IPO Funds	-0.028	-0.035*	-0.031	-0.041*	-0.017	-0.044**
	[0.021]	[0.020]	[0.019]	[0.022]	[0.022]	[0.018]
Log of assets(t=-1)	0.013	0.016	0.015	0.017	0.009	0.026*
	[0.015]	[0.015]	[0.015]	[0.016]	[0.018]	[0.014]
Capex/assets(t=-1)	0.516***	0.524***	0.535***	0.379***	0.921***	0.513***
	[0.154]	[0.149]	[0.151]	[0.134]	[0.177]	[0.154]
Percent secondary	-0.298***	-0.287***	-0.277***	-0.259***	-0.299***	-0.213***
	[0.058]	[0.056]	[0.054]	[0.061]	[0.068]	[0.036]
Venture backed (1/0)	0.107***	0.104***	0.091***	0.088**	0.089***	0.094***
	[0.035]	[0.035]	[0.030]	[0.038]	[0.029]	[0.026]
Reputable Underwriter (1/0)	-0.035**	-0.019	-0.032**	-0.031**	-0.029	-0.000
	[0.015]	[0.014]	[0.015]	[0.014]	[0.025]	[0.010]
Initial return	-0.034***	-0.031***	-0.029**	-0.058***	-0.018	-0.017*
	[0.011]	[0.010]	[0.011]	[0.019]	[0.020]	[0.010]
Post-IPO 20-day return	-0.011	-0.010	-0.013*	0.019	-0.021	-0.001
	[0.007]	[0.006]	[0.007]	[0.014]	[0.013]	[0.005]
Log (GDP)	0.001	0.002	-0.001	0.004	-0.002	-0.161
	[0.016]	[0.015]	[0.015]	[0.012]	[0.022]	[0.402]
Log (GDP per capita)	0.027	0.020	0.021	0.001	0.045	0.076
	[0.023]	[0.022]	[0.023]	[0.017]	[0.037]	[0.379]
Stock Market/GDP	-0.000**	-0.000**	-0.000***	-0.000	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	No	No	Yes
Observations	13,496	4,747	13,496	7,302	6,194	13,496
Adjusted R-squared	0.113	0.118	0.120	0.110	0.126	0.146

Table 3. Panel B. Probit regressions on the likelihood of post-IPO capital infusion

Marginal effect estimates from probit models predicting whether a firm that completes an IPO subsequently completes another external capital infusion within two years of its IPO. The dependent variable equals one if the firm completes a subsequent financing and zero otherwise. We report robust standard errors clustered at the country level in brackets. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	1	2	3	Pre-2008	Post-2008	Country FE
Intangible/assets(t=-1)	0.093***		0.098***		0.106***	0.071**
	[0.029]		[0.028]		[0.035]	[0.035]
R&D/Sales(t=-1)		0.001***	0.007***	0.008**	0.005**	0.004**
		[0.000]	[0.002]	[0.003]	[0.002]	[0.001]
Non missing R&D dummy			-0.032*	-0.049**	-0.011	0.005
			[0.018]	[0.019]	[0.017]	[0.017]
Cash burn rate	0.035***	0.037***	0.034***	0.036***	0.025	0.023*
	[0.013]	[0.013]	[0.013]	[0.009]	[0.024]	[0.013]
Log of IPO Funds	-0.014	-0.013	-0.013	-0.011	-0.019	0.001
	[0.010]	[0.010]	[0.010]	[0.008]	[0.019]	[0.008]
Log of assets(t=-1)	0.098*	0.109**	0.103*	0.133***	0.072	0.099***
	[0.058]	[0.052]	[0.055]	[0.047]	[0.085]	[0.037]
Capex/assets(t=-1)	0.089***	0.086***	0.088***	0.083***	0.088***	0.070***
	[0.015]	[0.015]	[0.015]	[0.015]	[0.017]	[0.009]
Percent secondary	-0.041	-0.036	-0.038	-0.055	-0.014	-0.019
	[0.063]	[0.064]	[0.063]	[0.044]	[0.103]	[0.055]
Venture backed dummy	-0.026	-0.044***	-0.025	0.006	-0.044**	-0.000
	[0.018]	[0.016]	[0.018]	[0.024]	[0.017]	[0.019]
Reputable Underwriter (1/0)	-0.038	-0.025	-0.036	0.017	-0.104***	-0.007
	[0.034]	[0.036]	[0.034]	[0.033]	[0.018]	[0.032]
Initial return	-0.020*	-0.022**	-0.020*	-0.051***	-0.031***	-0.008
	[0.010]	[0.010]	[0.010]	[0.015]	[0.010]	[0.006]
Post-IPO 20-day return	0.022**	0.023**	0.022**	0.059***	0.013***	0.027***
	[0.010]	[0.010]	[0.010]	[0.019]	[0.005]	[0.011]
Log (GDP)	-0.005	-0.006	-0.005	-0.003	0.005	0.138
	[0.007]	[0.007]	[0.007]	[0.009]	[0.013]	[0.283]
Log (GDP per capita)	0.106***	0.110***	0.105***	0.087***	0.109***	-0.113
	[0.022]	[0.023]	[0.022]	[0.021]	[0.020]	[0.259]
Stock Market/GDP	0.000	-0.000	0.000	0.000	-0.000	-0.000**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	No	No	Yes
Observations	13,462	4,747	13,462	7,273	6,189	13,453

Table 3. Panel C. Predicting the number of post-IPO capital infusions

Coefficient estimates from Tobit regressions predicting the number of capital infusions within two years following the IPO. We report robust standard errors clustered at the country level in brackets. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES				pre-2008	post-2008	Country FE
Intangible/assets(t=-1)	0.619***		0.704***	0.370*	0.950***	0.578**
	[0.201]		[0.208]	[0.219]	[0.194]	[0.244]
R&D/Sales(t=-1)		0.012***	0.033***	0.030**	0.026***	0.030**
		[0.003]	[0.011]	[0.014]	[0.010]	[0.014]
Non missing R&D Dummy			-0.156*	-0.075	-0.118	-0.075
			[0.092]	[0.089]	[0.120]	[0.089]
Log of IPO Funds	0.175***	0.181***	0.170***	0.170***	0.148	0.145**
	[0.057]	[0.056]	[0.060]	[0.042]	[0.124]	[0.061]
Log of assets(t=-1)	0.100	0.107	0.108	0.123	0.043	0.186***
	[0.093]	[0.095]	[0.094]	[0.079]	[0.145]	[0.067]
Capex/assets(t=-1)	1.095***	1.125***	1.085***	0.968***	1.521***	0.750***
	[0.229]	[0.208]	[0.219]	[0.203]	[0.259]	[0.214]
Percent secondary	-0.470	-0.439	-0.457	-0.543*	-0.329	-0.382
	[0.385]	[0.391]	[0.402]	[0.297]	[0.623]	[0.300]
Venture backed (1/0)	-0.111	-0.205*	-0.095	0.030	-0.392***	-0.165**
	[0.136]	[0.109]	[0.134]	[0.134]	[0.130]	[0.081]
Reputable Underwriter (1/0)	-0.198	-0.191	-0.178	0.189	-0.663***	-0.020
	[0.217]	[0.179]	[0.219]	[0.154]	[0.153]	[0.224]
Initial return	-0.165**	0.057	-0.185***	-0.327***	-0.320***	-0.141***
	[0.073]	[0.081]	[0.070]	[0.112]	[0.060]	[0.042]
Post-IPO 20-day return	0.102*	-0.008	0.112*	0.312***	0.079**	0.149***
	[0.058]	[0.054]	[0.058]	[0.065]	[0.034]	[0.048]
Log (GDP)	-0.015	-0.019	-0.010	0.039	-0.003	0.213
	[0.054]	[0.055]	[0.053]	[0.057]	[0.079]	[1.432]
Log (GDP per capita)	0.766***	0.779***	0.766***	0.563***	0.888***	-0.091
	[0.173]	[0.172]	[0.174]	[0.153]	[0.157]	[1.317]
Stock Market/GDP	-0.000	-0.000	-0.000	0.000	-0.001*	-0.001**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.000]
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	No	No	Yes
Observations	13,496	4,747	13,496	7,302	6,194	13,496

Table 3. Panel D. U.S. vs non-U.S. subsamples

This table reports coefficients from the OLS regressions predicting the *cash burn rate* (amount of capital raised in the IPO) in Columns 1 through 3 and Probit regressions on the likelihood of post-IPO capital infusion in Columns 4 through 6 separately for three subsamples, U.S. firms, non-U.S. firms from economically advanced countries (those with GDP per capita above the sample median), and non-U.S. firms from emerging markets (those with GDP per capita below the sample median). ∗, ∗∗ and ∗∗∗ indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent variable:					
	cash burn rate			*probability of return*		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	U.S.	non-U.S. developed	non-U.S. emerging	U.S.	non-U.S. developed	non-U.S. emerging
Intangible/assets(t=-1)	0.099**	0.134***	0.285***	0.165***	0.061	0.131**
	[0.039]	[0.032]	[0.072]	[0.039]	[0.037]	[0.060]
R&D/Sales(t=-1)	0.015***	0.022***	0.045**	0.010***	0.009*	0.010
	[0.002]	[0.003]	[0.021]	[0.004]	[0.005]	[0.007]
R&D Dummy	0.016	0.042	-0.011	-0.095***	-0.016	0.028
	[0.017]	[0.026]	[0.033]	[0.020]	[0.018]	[0.023]
Cash burn rate				0.116***	0.079***	0.038***
				[0.029]	[0.016]	[0.008]
Log of IPO Funds	-0.066***	0.000	-0.095***	0.057**	0.031**	0.001
	[0.014]	[0.010]	[0.018]	[0.025]	[0.013]	[0.012]
Log of assets(t=-1)	0.019*	-0.008	0.086***	0.020	0.016**	0.048***
	[0.010]	[0.009]	[0.012]	[0.015]	[0.008]	[0.009]
Capex/assets(t=-1)	0.744***	1.437***	2.105***	0.407***	0.080	0.105**
	[0.110]	[0.166]	[0.160]	[0.133]	[0.082]	[0.054]
Percent secondary	-0.27***	-0.18***	-0.20***	-0.099	-0.121***	0.115***
	[0.030]	[0.028]	[0.054]	[0.071]	[0.043]	[0.042]
Venture backed dummy	0.152***	0.074***	0.055***	-0.015	-0.021	0.016
	[0.014]	[0.019]	[0.017]	[0.022]	[0.016]	[0.014]
Reputable Underwriter (1/0)	0.009	-0.004	0.038**	0.117***	-0.017	-0.043***
	[0.013]	[0.021]	[0.015]	[0.024]	[0.018]	[0.014]
Initial return	-0.063**	-0.018	-0.022	-0.130***	-0.037*	-0.020*
	[0.029]	[0.011]	[0.015]	[0.039]	[0.020]	[0.011]
Post-IPO 20-day return	0.008	0.004	0.003	0.169***	0.038***	0.014**
	[0.012]	[0.010]	[0.008]	[0.022]	[0.015]	[0.006]
Log (GDP)		-0.295	-0.208		-0.040	-0.277
		[0.201]	[0.384]		[0.210]	[0.214]
Log (GDP per capita)		0.330	0.059		0.187	0.345**
		[0.260]	[0.337]		[0.190]	[0.143]
Stock Market/GDP		-0.000	-0.001		-0.000	-0.001
		[0.000]	[0.001]		[0.000]	[0.001]
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	No	Yes	Yes	No	Yes	Yes
Observations	3,143	5,388	5,145	3,143	5,387	5,126
Adjusted R-squared	0.262	0.161	0.181			

Table 4. Characteristics of the initial public offerings: Strong vs weak investor protection

The sample is initial public offerings of common stock in the years 1990-2019. All accounting variables are measured at the end of the fiscal year preceding an IPO. The strong (weak) investor protection subsample includes IPO firms that are from countries where the *Investor Protection* index is above (below) the median value for our sample. See Section 3.2. for detailed variable definition. The mean (median) values are reported for each characteristic within each subsample. [a, b,] and [c] indicate the mean for the 1st subsample is statistically different from the mean in the 2nd subsample at the 1%, 5%, and 10% level, respectively.

				Investor Protection			
				Weak		Strong	
		Investor Protection		Raised capital		Raised capital	
		Weak	Strong	No	Yes	No	Yes
Observations		6203	5962	4391	1812	3577	2385
Spell in years	*mean*	3.848	2.883[a]	6.02	1.585[a]	5.655	1.252[a]
	median	2.395	1.638	4.507	1.142	4.153	0.978
Cash burn rate	*mean*	0.066	0.118[b]	0.017	0.182[a]	0.088	0.163[a]
	median	0.01	0.068	-0.014	0.088	0.057	0.088
Dollar burn rate	*mean*	1.318	10.162[a]	-0.303	5.248[a]	7.705	13.847[a]
	median	0.108	1.451	-0.212	0.771	0.924	2.936
Intangible/assets	*mean*	0.07	0.084	0.071	0.096[c]	0.07	0.107[c]
	median	0.006	0	0.006	0.006	0	0
R&D/sales	*mean*	1.891	3.147[a]	1.319	3.383[a]	2.47	4.028[b]
	median	0.038	0.141	0.037	0.044	0.131	0.154
Assets ($U.S. mil)	*mean*	151.3	211.0	96.40	284.46[c]	136.97	321.93[b]
	median	27.2	30.7	26.8	28.5	23.7	47.2
Capital exp./assets	*mean*	0.084	0.074	0.08	0.094	0.071	0.078
	median	0.04	0.041	0.039	0.044	0.041	0.042
Cash flow/assets	*mean*	0.437	-0.08[a]	0.446	0.416	-0.031	-0.152
	median	0.075	0.035	0.088	0.04	0.044	0.024
IPO proceeds ($U.S. mil)	*mean*	54.4	107.09[b]	42.08	84.28[b]	84.95	140.30[c]
	median	12.307	35.847	11.984	13.209	24.468	57.5
IPO initial return	*mean*	0.363	0.215[c]	0.376	0.331	0.222	0.204
	median	0.129	0.065	0.134	0.12	0.056	0.075
Post-IPO 20-day return	*mean*	0.395	0.273[c]	0.378	0.436	0.257	0.297
	median	0.111	0.114	0.101	0.131	0.094	0.143

Table 5. Strong vs weak investor protection countries: Multivariate analysis

Coefficient estimates from OLS, probit and Tobit models predicting the cash burn rate, probability of returning to capital markets, and the number of financing rounds within two years following the IPO for firms that completed an IPO between 1991 and 2019. The strong (weak) investor protection subsample includes IPO firms that are from countries where the investor protection index is above (below) the median value for the countries in our sample. We report robust standard errors clustered at the country level in brackets. ∗, ∗∗ and ∗∗∗ indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: Classifying countries using the *Investor Protection* index from La Porta et al. (2006)

			Dependent variable:			
	cash burn rate		*probability of return*		*number of financing*	
VARIABLES	weak	strong	weak	strong	weak	strong
Intangible/assets(t=-1)	0.060	0.225***	0.047	0.146***	0.156	0.606***
	[0.040]	[0.060]	[0.043]	[0.051]	[0.272]	[0.134]
R&D/Sales(t=-1)	0.015***	0.028***	0.001	0.005***	0.016	0.034***
	[0.002]	[0.007]	[0.004]	[0.001]	[0.024]	[0.007]
Nonmissing R&D Dummy	0.009	0.013	0.006	-0.03***	-0.002	-0.35***
	[0.006]	[0.023]	[0.018]	[0.008]	[0.076]	[0.021]
Cash burn rate			0.070***	0.074***	0.493***	0.275***
			[0.011]	[0.022]	[0.109]	[0.096]
Log of IPO Funds	-0.043*	-0.034	0.034***	0.034**	0.214***	0.208***
	[0.021]	[0.026]	[0.007]	[0.015]	[0.052]	[0.055]
Log of assets(t=-1)	0.014	0.022	-0.007	-0.012**	0.099	0.097***
	[0.014]	[0.022]	[0.007]	[0.005]	[0.102]	[0.021]
Capex/assets(t=-1)	1.261***	1.727***	0.049	0.190**	0.506	1.790***
	[0.303]	[0.436]	[0.050]	[0.074]	[0.321]	[0.447]
Percent secondary	-0.260**	-0.14***	-0.09***	-0.04***	-0.71***	-0.44***
	[0.043]	[0.039]	[0.028]	[0.018]	[0.195]	[0.159]
Venture backed dummy	0.150***	0.084***	-0.003	0.046*	0.019	-0.110
	[0.008]	[0.028]	[0.020]	[0.024]	[0.136]	[0.091]
Reputable Underwriter (1/0)	-0.001	0.000	0.004	0.080***	-0.020	0.448***
	[0.010]	[0.010]	[0.021]	[0.016]	[0.081]	[0.037]
Initial return	-0.036	-0.013	-0.007	-0.048**	-0.149*	-0.257*
	[0.024]	[0.018]	[0.013]	[0.021]	[0.081]	[0.133]
Post-IPO 20-day return	0.011	0.002	0.032***	0.069*	0.203***	0.269*
	[0.015]	[0.011]	[0.011]	[0.039]	[0.044]	[0.141]
Log (GDP)	-0.466	-0.034	-0.274**	0.590***	-0.721	1.213
	[0.372]	[0.198]	[0.133]	[0.179]	[0.839]	[1.119]
Log (GDP per capita)	0.167	0.108	0.437***	-0.96***	1.559	-2.680**
	[0.485]	[0.240]	[0.168]	[0.240]	[1.014]	[1.116]
Stock Market/GDP	-0.00***	0.001	-0.00***	0.001	-0.00***	0.002
	[0.000]	[0.001]	[0.000]	[0.001]	[0.000]	[0.001]
Year, Industry, and Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,521	5,600	5,583	5,521	5,600	5,521
Adjusted R-squared	0.182	0.134				

Panel B: Classifying countries using the *IPO Prospectus Disclosure* index from La Porta et al. (2006)

			Dependent variable:			
	cash burn rate		*probability of return*		*number of financing*	
VARIABLES	weak	strong	weak	strong	weak	strong
Intangible/assets(t=-1)	0.090**	0.175**	0.032	0.195***	0.107	0.756***
	[0.030]	[0.064]	[0.032]	[0.014]	[0.188]	[0.107]
R&D/Sales(t=-1)	0.013***	0.025***	0.001	0.006***	0.006	0.040***
	[0.002]	[0.005]	[0.003]	[0.001]	[0.019]	[0.003]
Nonmissing R&D Dummy	0.010	0.018	0.007	-0.032***	0.005	-0.382***
	[0.006]	[0.021]	[0.015]	[0.008]	[0.060]	[0.028]
Cash burn rate			0.074***	0.078***	0.491***	0.290**
			[0.011]	[0.024]	[0.098]	[0.114]
Log of IPO Funds	-0.054**	-0.030	0.032***	0.039***	0.199***	0.225***
	[0.021]	[0.023]	[0.009]	[0.011]	[0.044]	[0.055]
Log of assets(t=-1)	0.027*	0.013	-0.007	-0.012*	0.080	0.130***
	[0.013]	[0.020]	[0.006]	[0.006]	[0.079]	[0.026]
Capex/assets(t=-1)	1.293**	1.648***	0.045	0.191**	0.439	2.007***
	[0.376]	[0.388]	[0.045]	[0.088]	[0.291]	[0.448]
Percent secondary	-0.245***	-0.158***	-0.103***	-0.046*	-0.698***	-0.419**
	[0.056]	[0.034]	[0.025]	[0.025]	[0.168]	[0.200]
Venture backed dummy	0.151***	0.085***	0.001	0.051*	0.006	-0.068
	[0.008]	[0.028]	[0.020]	[0.029]	[0.113]	[0.114]
Reputable Underwriter (1/0)	-0.005	0.002	0.002	0.083***	-0.041	0.445***
	[0.010]	[0.009]	[0.021]	[0.015]	[0.060]	[0.036]
Initial return	-0.034	-0.016	-0.011	-0.038	-0.185***	-0.192
	[0.023]	[0.017]	[0.012]	[0.028]	[0.063]	[0.176]
Post-IPO 20-day return	0.001	0.008	0.033***	0.075*	0.194***	0.305**
	[0.015]	[0.012]	[0.012]	[0.040]	[0.045]	[0.140]
Log (GDP)	-0.817***	-0.062	-0.241*	0.419	-0.658	1.577
	[0.142]	[0.201]	[0.127]	[0.362]	[0.701]	[1.465]
Log (GDP per capita)	0.516*	0.157	0.374**	-0.633	1.216	-2.562
	[0.255]	[0.226]	[0.172]	[0.426]	[0.857]	[1.696]
Stock Market/GDP	-0.000***	0.001	-0.000***	-0.000***	-0.000***	0.002
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.001]
Year, Industry and Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,066	6,055	6,044	5,066	6,055	5,066
Adjusted R-squared	0.201	0.128				