THE IMPACT OF IPOs ON THE VALUES OF DIRECTLY COMPETING INCUMBENTS

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Abstract

Would an initial public offering (IPO) in a growing and uncertain industry have a positive or negative effect on directly competing incumbent firms in the industry? We assert that due to the risk and uncertainty inherent in a growing industry, a firm’s IPO may send a positive market signal of growing industry demand. An IPO can send a signal to the investors of directly competing incumbents that the market is promising and incumbent firms will enjoy a better future. If directly competing incumbent firms are capable of capturing these positive externalities, they will experience even greater positive results. In particular, an incumbent firm with a significant research and development investment may capture more of this increased demand in the industry. On the other hand, if a market segment is more concentrated it is more likely that directly competing incumbents will suffer when another firm announces an IPO. We find supporting results for the various arguments of our initial question examining the computer-related service industry. We also present discussion and implications for our results.

Keywords: initial public offering (IPO), uncertain industry, signaling.
INTRODUCTION

In order to reduce information asymmetry regarding the value of firms, markets typically rely on codified knowledge (Reilly and Brown, 1999; Sanders and Boivie, 2004). In an uncertain industry, however, markets lack codified knowledge (Stuart, Hoang, and Hybels, 1999). Determining the value of a firm in an uncertain industry is not an easy task because investors risk making an adverse selection, such as unintended investments in lemons (Akerlof, 1970; Sanders and Boivie, 2004; Certo, Daily, and Dalton, 2001). Kim and Ritter (1999) therefore suggested that when a firm decides to announce an initial public offering (IPO), financial information is not a good predictor for determining equity values in growing and uncertain industries.

Given the high uncertainty attached to firms in uncertain industries, it is natural that these shares are traded with a discount to a certain extent. Following this logic it is not difficult to understand that firms in uncertain industries tend to be undervalued (Reilly, 1989). Under a highly uncertain environment it is important to pay attention to signals from both outside and inside a firm, because outside information may provide better information regarding the firms’ value in growing and uncertain industries (Titman and Trueman, 1986). For example, in information-spillover models (e.g., Alti, 2005) certain informed investors’ behavior can send a signal toward uninformed investors that reduces their information
asymmetry and information spillover (e.g., hot and cold IPO markets created by investors’ herding behavior) can occur.

In this study we argue that in growing and uncertain industries a firm’s IPO sends a positive signal of future market growth to the investors of competing incumbent firms.\(^1\) We further argue that this positive signal is significant for directly competing incumbents, but less significant for indirectly competing ones. We view firms in an industry as belonging to two different groups: direct competitors and indirect competitors (Deephouse, 1999; Baum and Oliver, 1992; McGahan, 1999). Direct competitors are the firms that target similar market segments with equivalent products and services; indirect competitors are those firms that do not directly compete with equivalent products, but operate broadly within the same area of business. For example, if two companies make computers then both companies directly compete with each other. However, if one makes computers but the other makes printers, then they are now competing indirectly in the same area of business (making computer-related products) since the pricing decisions of computer and printer makers can be competitively interdependent.\(^2\) In addition, we also show the moderating effects of the

\(^1\) By incumbent firms we mean firms that have already gone public and whose shares are traded on the stock market. Incumbency in this paper is therefore related to listing on the stock market and not entry into the product and/or service markets.

\(^2\) Two producers of complementary products can be seen as indirectly competing. If one firm in the computer market decides to lower prices then another firm in the printer market can be forced to reduce its prices. Otherwise the printer maker can invite new entrants. For a more precise discussion in specific settings, see Cooper (1989).
directly competing incumbent firms’ R&D capabilities and market-segment concentrations on the relationship between an IPO and its impact on the valuation of incumbent competitors.

Due to the high uncertainty attached to similarly developing industries, IPOs in these industries tend to carry increased meaning (Cotei, Farhat, and Mukherjee, 2004). Given the comparatively uncertain future outlooks for firms in these industries, an IPO can provide a positive signal that the industry offers ample growth opportunities. The IPO of a competing firm can be regarded as resolving the uncertainty embedded in the value of the incumbent firms by reducing information asymmetry and revealing these firms’ real values to competitors (Spence, 1974). However, when an industry is already established there might be less room for new information to play a role. The signaling effect of an IPO on the prospects of the industry would therefore be stronger in relatively new and uncertain industries.

Spence (1974:1) defined signals as activities, “in a market which by design or accident, alter the beliefs of, or convey information to, other individuals in the market.” Signals are most effective when the substances are least observable (Milgrom and Roberts, 1986). In other words, the more uncertain the quality of a substance is, the higher the effectiveness of the signal. We argue that in an industry where future growth potential is unclear, a competing firm’s IPO will be a positive externality that provides information regarding future market growth opportunities to the investors of directly competing incumbent firms. We therefore presume that there are informational externality effects from a
competing firm’s IPO on incumbent firms. A competitor’s IPO reveals positive information on the growth potential of directly competing incumbent firms. While prior research treats signaling as a message driven by an intended action (Heil and Robertson, 1991), in this paper we examine the unintended signals of an IPO on competing firms.

We ask: Would a directly competing firm’s IPO have a positive influence on the market value of incumbent firms? If so, would this effect be stronger for directly competing or indirectly competing firms? We also ask if an IPO in a growing and uncertainty industry is a positive signal of the industry’s future potential, or does it signal a negative change such as fiercer competition for directly competing incumbents? Using the computer-related service industry as our sample, we examine how the IPOs of firms in a relatively dynamic and uncertain industry are reflected in the value of the incumbent firms. Prior research has used the same industry when examining issues of uncertainty (e.g. Lange, Boivie, and Henderson, 2009; Sanders and Boivie, 2004).

We assert that due to the risk and uncertainty inherent within the sample industry, a firm’s IPO may send a positive market signal such as growing demand in the industry. An IPO can signal that the market is growing and has a better future to the investors of competing incumbents (Benveniste, Busaba, and Wilhelm, 2002; Benveniste, Ljungqvist, Wilhelm, and Yu, 2003). The positive signal of growing market potential may be particularly strong for directly competing firms compared to indirectly competing firms.
Many would-be IPO firms drop out of the process when they foresee an unfavorable market response (Sine, Mitsuhashi, and Kirsch, 2002). It therefore makes sense that only those firms that foresee high potential go public (Stoughton, Wong, and Zechner, 2001). For this reason a firm’s IPO in an uncertain industry can strongly signal that existing incumbent firms with similar strategies and market orientations also have great potential for growth (Rao, 2004).

We can also see that if incumbent firms invest strongly in research and development (R&D) they stand to benefit even more from the market opportunities positively signaled by an IPO. Higher R&D spending by an incumbent firm may lead to even better prospects\(^3\); while an IPO may signal good things about the future potential of all directly competing incumbents, directly competing incumbent firms with high R&D investment have an even better chance to capture the increased market demand.

In addition, we argue that in a highly concentrated market segment, a directly competing firm’s IPO may disrupt the status quo of incumbent firms that are enjoying the current benefits. Given that incumbent firms in a concentrated market segment benefit from the current competitive structure, an IPO in that particular market segment signals that market

\(^3\) Reactions of rival firms were studied in the context of carve-outs, spin-offs, and sell-offs (Slovin, Sushka, and Ferraro, 1995), banking services (Benveniste et al., 2003), and the bankruptcy context (Lang and Stulz, 1992). Stoughton et al. (2001) studied the externality effects of IPOs, but focused on the spillover effect of previous IPOs on later IPOs.
share may be taken away from the incumbents causing more competition. This increase in competition might mean decreasing prices and the fall of incumbent firms’ profits if the incumbent firms directly compete with the IPO firms in the same market segments.

We next discuss our study’s theoretical background and develop our hypotheses, then describe the data and variables of our empirical analyses. In the fourth section we report the results. The final section concludes the study.

THEORETICAL BACKGROUND AND HYPOTHESES

IPO Signals in an Uncertain Industry

In an uncertain industry it is difficult to foresee which firms may prosper in the future. At this stage an IPO announcement by a directly competing firm within the same industry may signal to investors that the industry incumbents are promising firms with great market potential. This positive signal may be interpreted as growing market demand and decrease concerns regarding the existing directly competing incumbents’ future prospects (Mahajan, Sharma and Buzzell, 1993). A firm’s successful IPO provides positive externalities to directly competing incumbent firms in the industry by decreasing the level of uncertainty regarding the directly competing firms’ business potential, revealing that these incumbent firms are undervalued (Benveniste et al., 2002; Benveniste et al., 2003). Our research is therefore closely in line with a stream of research demonstrating that a firm’s strategic change has both
firm-specific implications and additional implications for other firms within the same industry (Akhigbe, Borde, and Whyte, 2003; Lang and Stulz, 1992; Zucker, 1988).

Prior research suggests that entry is easier than survival (Bhide, 2000; Geroski, 1995; Sarkar, Echambadi, Agarwal, and Sen, 2006). Bhide (2000) argued that the most significant risk for a new firm takes place not at the new entry stage, but at the point when a firm strives to grow. At this time of great risk firms could benefit from the positive signal sent by an IPO from a directly competing firm in the industry. For example, when Google announced an IPO the stock prices of its competitors went up as well. Google’s IPO signaled a better future for online search engines, and might have been interpreted as evidence of a larger market open to directly competing incumbent firms.

The Securities Exchange Commission (SEC) requires firms to make significant internal information available to the public at the time of an IPO announcement (Lowry and Shu, 2002). Potential investors can then easily compare the business of incumbent firms and the firm announcing an IPO in order to determine whether or not that firm is directly competing. In a growing and uncertain industry, potential investors may take an IPO announcement as a positive signal that directly competing incumbent firms targeting the same market will have a bright future. Investors may therefore reexamine and adjust their expectations regarding the value of directly competing incumbents in light of the positive signal sent by an IPO announcement (Cotei et al., 2004).
While an IPO creates various strategic benefits for a private firm (see Certo, Holcomb, and Holmes, 2009), these strategic benefits come at the cost of strict reporting requirements and regulations set for IPO firms by the SEC for the purpose of securing corporate transparency. This reporting requirement reveals information on the IPO firm. In addition, by going through the IPO process these firms reveal their value to the market. IPO firms typically follow the following steps when announcing an IPO: contracting with a lead underwriter, creating a syndicate, preparing a registration statement, undertaking road shows, working on a book-building process, and finally actually offering an IPO (Certo et. al., 2009).

Significant critical information including financial structures, profiles and demographics of executives, key technologies, and business risks, is disclosed to the market via this painstaking IPO process. A private firm without confidence in its visibility and marketability would not undertake this risk and would not be able to endure the costs of an IPO. It may be safe to assume that a successful IPO provides a proven market endorsement for the company, and it is likely that additional information on the IPO firm would eventually be revealed to the market.

The positive externality of IPOs may therefore lead to an increase in perceived value for incumbent firms. Subrahmanyam and Titman (1999: 1048) argued that, “[b]y going public, firms can generate positive externalities by increasing the size and information efficiency of the stock market.”
However, the same positive externality may not be as relevant for firms that are not directly competing with the IPO firm. IPOs cause investors to update a relevant market’s growth opportunities; this is a key aspect of an IPO’s information externality. If investors update the value of competing incumbents who have been previously underestimated due to uncertainty prior to IPOs, the effect of a positive signal will be limited to directly competing firms that are similar to the firm announcing an IPO (Heil and Robertson, 1991). Indirectly competing firms with less similarity may experience fewer positive results from an IPO than direct competitors.

Investors search for codified knowledge, and when codified knowledge is not available investors must resort to other information sources in order to estimate the correct value of the firms they have invested in (Sanders and Boivie, 2004). When investors of incumbent firms in growing and uncertain industries search for information that would reduce the uncertainty of future prospects, an IPO can be a good source of information and decrease the information asymmetry. At the same time, investors scrutinize the IPOs of other firms in the industry and examine their similarities. Therefore, we argue:

H1: The positive information externality impact of an IPO will be greater for directly competing incumbents than indirectly competing ones in an uncertain industry.

**IPO Signals and R&D Capabilities of Directly Competing Incumbents**

As stated in H1, we assert that a firm’s IPO in an uncertain industry sends a positive signal to the investors of directly competing firms. In this section we expand our previous
argument by contending that the same IPO may signal a stronger future potential and opportunity to the investors of directly competing incumbent firms that possess a high technological capability enabled by significant R&D investment. In an industry made attractive by an IPO, incumbent firms with high technological capability are more likely to capture future increased demands. Similarly, incumbent firms with significant R&D investments might appear more desirable when a future market size increase is signaled by an IPO.

R&D capability is generally shaped by R&D investment and is a fundamental source for a firm’s future success, particularly in a technology-oriented industry. Each firm controls its level of R&D investment based on incentives derived from the market (Soh, Mahmood, and Mitchell, 2004). Under the assumption of uncertainty (e.g. Lange et al., 2009; Sanders and Boivie, 2004) and information asymmetry (Spence, 1974), investors may regard an aggressive R&D investment made by an incumbent firm as a signal of increased capability in capturing demand in a stronger future market. Firms strongly invested in R&D would be more alert and able to sense rising opportunities (Kirzner, 1973); prior research therefore finds that firms with higher R&D capabilities are more likely to take advantage of these opportunities (Shane, 2000).

Prior research also finds that R&D investment is an excellent proxy for a firm’s intangible assets, as well as a reasonable predictor of a firm’s probability of successfully
competing in a high-tech industry (Deeds, DeCarolis, and Coombs, 1997). IPOs therefore more positively signal a potential future market demand increase for those incumbents with significant R&D investments. Furthermore, past research finds that out of the many indicators of technological capability, the degree of R&D investment can be a good proxy for a firm’s capability (Henderson and Cockburn, 1994; Dierickx and Cool, 1989) since investments in R&D provide firms with new product development opportunities (Sanchez, 1993).

Following these arguments, we easily understand why R&D investments have a positive association with a firm’s growth potential (Lee and Hwang, 2003), supporting our argument that IPOs send a more credible signal for the investors of directly competing firms with significant R&D investments. We argue that directly competing incumbent firms with high R&D investments are more likely to capture this opportunity because increased market demand would be extremely critical to these directly competing firms.

However, the same signal might not be as positive for indirectly competing firms because these firms might require different technology, and the potential R&D-related opportunities might not apply as strongly. The products and services provided by indirectly competing firms differ enough from those provided by the IPO’s firm that these differences might taint the signaling effect. The signal would therefore be stronger for directly competing incumbent firms with significant R&D investments. Thus, we hypothesize that:

H2: Moderating effect of IPO firms’ R&D intensity: the R&D intensity of the competing incumbents will positively moderate the relationship between directly competing incumbents and positive IPO externality in an uncertain industry.


**Market Segment Concentration**

Industry structure has also been of keen interest for entrepreneurship scholars (McDougall, Covin, Robinson, and Herron, 2006; Robinson, 1998). Within an industry, multiple market segments exist where firms directly compete with one another via more substitutable products and/or services (Porter, 1980). Scholars in industrial organization economics propose that concentrated industries tend to have large and relatively homogeneous firms. Incumbent firms also tend to raise high entry barriers for new firms and collude tacitly among themselves (Porter, 1980); they want to preserve the status quo provided by this high entry barrier. Any deviant behavior from a set pattern of collusion can be considered as a serious threat and easily escalate into fierce competition including price wars; this lowers profits for the incumbents (Bresnahan, 1987).

In a concentrated market segment with few large competitors, a direct competitor’s IPO can be considered a threatening event. It is risky for a firm to announce an IPO in a concentrated market segment with large and dominant competitors because the announcement is very likely to be met with hostile retaliation. More opportunities for expansion therefore occur in less concentrated market segments (Robinson, 1998).

Firms announcing an IPO in a concentrated market segment must therefore be more capable and better able to deal with incumbent firms that do not want to change the status quo. It is difficult to announce an IPO in a market segment with strong competitors due to the
potential threat of retaliation; however, if a firm announces its IPO in a highly concentrated market segment, it indicates that the IPO firm is capable of disrupting the status quo and potentially taking market share away from other directly competing incumbent firms. When a firm announces an IPO in a more concentrated market segment, the informational externality attached to the (strong and capable) IPO may therefore provide a negative signal for the future prospects of directly competing incumbent firms.

This means that while IPOs would send a positive signal to the investors of directly competing firms in a less concentrated market segment, the same IPOs would pose a threat to the directly competing firms in a highly concentrated market segment. While the IPOs send a positive signal of future potential and increasing market demand to both markets, the same IPOs also send a negative signal of more intense competition. While the positive signal of future market demand increase is dominant in a growing uncertain industry because the IPO resolves the uncertainty of future market conditions, the same IPO may send a stronger negative signal of competition when direct competitors are already enjoying large market shares.

For directly competing incumbents another visible player competing for the same market can be a significant threat. The IPO firm not only takes market share away from the incumbent firms, but also disrupts the status quo and stimulates more competition in a market
segment where stable and collusive market conditions have maintained a high market price.

Thus, we argue:

H3: (The moderating effect of market-segment concentration): the degree of market-segment concentration will negatively moderate the relationship between directly competing incumbents and positive IPO externality in an uncertain industry.

METHODS

Data

In testing the impact of a proposed IPO on directly competing incumbent firms, the challenge is in identifying highly uncertain industry conditions and measuring the benefits and costs of IPOs to competing incumbent firms separately. Given this difficulty it is very helpful to concentrate on a single industry under conditions of continued high uncertainty with intense competition. We hypothesized that the benefit of an IPO to incumbent competitors is providing a chance for investors to recognize unknown business opportunities. Since the positive externality of an IPO on directly competing incumbents is likely to vary with the internal and external conditions of incumbent firms, we also consider two critical moderating variables related to the internal and external conditions of incumbent firms in a highly competitive industry.

We choose the industry broadly defined as “computer-related services” as our sample. The context of IPOs in this technologically uncertain industry with intense competition provides an intriguing research opportunity for testing our hypotheses. For example, the
industry betas of computer software/services and computer peripherals in 2004 are approximately 1.90 and 2.06 respectively. This suggests that the industry risks are quite high due to technological uncertainty. In previous studies, internet-based firms (Sanders and Boivie, 2004), computer software firms (Audretsch, 2003), and other computer-related businesses (Abraham, 2005) are regarded as highly technologically uncertain (Stoughton et al., 2001). The level of uncertainty and intensity of competition are consistently high in these industries because of the ever-changing nature of the technological environment (Sanders and Boivie, 2004). By focusing on one industry we avoid the potentially confounding effects of different industries and maintain a homogenous test environment.

The sampling and data-gathering processes are as follow. First, the sample of incumbent firms (n = 29,930) was drawn from publicly traded companies in the computer-related service industry whose three-digit standard industry code (SIC) is 737. We used the three-digit SIC scheme for an industry, and the SEC uses an industry classification scheme that is very similar to the three-digit SIC codes (Mills and Schumann, 1985). Prior research (e.g., Balakrishnan and Koza, 1993) has also used the three-digit SIC as a proxy for operationalizing an industry. The COMPUSTAT database provided by Standard and Poor’s

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4 These market segments are highly ranked in terms of investment risks measured by total beta. The detailed data are drawn from the data sets provided by Professor Damodaran of the Stern School of Business at New York University; his homepage is at http://pages.stern.nyu.edu/~adamodar/New_Home_Page/data.html.

5 Our analysis (SIC 737) includes Computer Programming and Consulting Services (7370), Computer Programming Services (7371), Prepackaged Software (7372), Computer Integrated Systems Design (7373), and Computer Processing and Data Preparation and Processing Services (7374).
provides comprehensive information on publicly traded companies in the United States. Our study covers the years 2000 to 2004.

IPO cases for the study were gathered from two databases, Hoover’s and IPOdata.com. In order to test the IPO impact on the sample firms in this computer-related service industry, we initially identify a population of 100 IPO cases in the industry during the study period. We obtain specific information on these 100 IPO cases by searching both EDGAR at the SEC and Lexis/Nexis. After further investigating these IPO cases by referring to EDGAR at the SEC and Lexis/Nexis, we excluded 11 cases due to inconsistencies in filing and/or offering dates. We additionally dropped 36 IPO announcements made within a two-day period in order to avoid confounding effects from simultaneous IPO announcements. Information on the founding year and primary underwriters are not available for five other IPO cases, and we left these out of our study. Consequently, we concentrate on 48 IPO cases for our empirical analysis. Information on the dates of announcement, filing, and offering of the focal IPOs is then extracted from Lexis/Nexis, EDGAR, and Hoover’s by cross-checking all three sources.

Our empirical focus is on the stock market reaction of directly and indirectly competing incumbent firms to an IPO announcement in the computer-related services industry. In order to examine the stock price reactions of sample firms to IPO announcements, we use the stock price database of the Center for Research in Security Prices (CRSP).

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*Although IPO samples are from the period from 2000 to 2004, our data covers the period from 1997 to 2004 because we focus on IPO announcements; these can date back prior to the actual IPO dates.*
**Dependent Variable**

The dependent variable in this study is the cumulative abnormal returns (CAR) of directly and indirectly competing incumbent firms in response to the sample firms’ IPO announcements. This measure captures the competing firms’ updated stock market values at the time of the IPO announcements. If the IPO announcements are beneficial to incumbent rivals then the competing firms’ CAR will be positive.

Despite its limitations (primarily due to the short-term nature of CARs), we believe that CARs should be appropriate for evaluating the externality of information disclosure on IPOs for our study. Prior researchers (Porter, 1987; Ravenscraft and Scherer, 1987) suggested that many strategic decisions such as mergers and acquisitions and strategic alliances cannot be fully estimated using a short-term measurement of stock price reactions, since the success of these strategic decisions should include long-term strategic implementation efforts. Some management studies (e.g., Oler, Harrison, and Allen, 2008) also raised concerns regarding simple applications of CARs into management studies. The measure of CARs relies only on shareholders instead of other corporate stakeholders that management studies (e.g., litigations, human resource management, and responsible management) should consider. However, our study concentrates on assessing the externality of information disclosure in the capital markets when IPO announcements are made. Our dependent variable should capture the
short-term responses to IPO announcements that are primarily evaluated by investors, and the dependent variable of CARs is therefore suitable for testing our hypotheses.

Related to the assumption of stock-market efficiency in the information process, the dates of information disclosure are critical in deriving CARs (McWilliams and Siegel, 1997). Filing and/or offering dates may not truly represent the announcement dates of the companies’ strategic transition, since in many instances firms make the news of an upcoming IPO public in advance of the actual offer (e.g., Heil and Robertson, 1991). In order to identify meaningful IPO announcement dates we searched for news articles in Lexis/Nexis. In most cases companies released their IPO-related news via company announcements (e.g., press conferences), recruiting new top management team members, and/or board of directors’ decisions (e.g., the board meetings’ minutes). In order to better understand these announcements, we performed a content analysis using media articles. Two key words, firm name and IPO (or initial public offering), were used to collect all news regarding the IPO firms from the period of two years before their IPO filing dates until their IPO offering dates. We assumed the news release date as the IPO announcement date. If we found no relevant news article or announcement before the IPO offering’s filing date we then used the filing date as the announcement date.7

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7 By assuming that filing dates precede any other IPO information releases, if our content analysis finds no new results before filing dates then our test is rather conservative.
We measured the effect of these announcements on market values as the abnormal returns using conventional event study methodology (McWilliams and Siegel, 1997). We used an ordinary-least-square market model by implementing an equal weight CRSP index and estimate the wealth effect of IPO announcements for three different periods: from day -1 to day 0 [the day before announcement day and the day itself: CAR (-1,0)], from day 0 to day +1 [(the day itself and the day after announcement day: CAR (0, +1)], and from -1 to day +1 [three days including before and after the announcement day: CAR (-1,+1). The estimated period was from -255 to -46 days before the date of the announcement. The following equation represents the market model in use:

\[ R_t = \alpha + \beta R_{mt} + \epsilon_t \]  

(1)

where \( R_t \) is the firm's actual return and \( R_{mt} \) is the daily return on a stock market index \( m \) at time \( t \).

Another critical issue in the event study is the length of the event window (McWilliams and Siegel, 1997). As with the bankruptcy announcements and their contagious effect (Lang and Stulz, 1992), we consider that IPO announcements and their information externality on incumbent firms in the capital markets should occur within a very short period of time surrounding the date of information disclosure. By cumulating the differences between the actual and predicted returns from (1) for three time windows, we derive the dependent variables (the CARs). We use CAR (-1, +1) for reporting empirical results. The
results from using other types of CAR with different event windows (i.e., CAR (-1, 0) and CAR (0, +1)) are not qualitatively different. The detailed abnormal returns and their patterns over time are reported in the Appendix.

**Independent and Moderating Variables**

The primary independent variable for testing H1 (the positive IPO announcement impact on the value of directly versus indirectly competing incumbents) is the dummy variable of whether or not a sample competing firm is a direct rival of an IPO firm. Since the positive information externality of IPOs is signaling the unrecognized business opportunities of directly competing incumbent firms, we expect that the stock price reactions of direct competitors will be greater than those of indirect competitors (H1). In order to identify whether or not a sample incumbent competes directly with an IPO firm, we use four-digit SIC codes where firms are likely to compete with homogeneous products or services. For example, a prior study by McGahan (1999) used four-digit SIC codes as a meaningful unit for assessing the competitive advantages of a firm. In a study of firm diversification and comprised business segments, Silverman (1999) employed four-digit SIC codes as a measurement for business segments where similar firms competed with one another directly.

A study on IPOs by Chang (2004) also uses four-digit Venture Economics Industry Classification codes as a measure for similar direct rivalry. Since firms report their main business segment by SIC codes that SEC uses in managing various filings discretionarily, this
measurement has its own strength. If a competing incumbent was listed in the same four-digit SIC code (e.g., 737X) in COMPUSTAT as the corresponding IPO firm (e.g., 737X), we consider the incumbent firm to be a direct competitor. In the case that sample firms share only the first three-digits of their SIC codes (e.g., 737Y) with the corresponding IPO firms (e.g., 737X), then these firms are seen as indirectly competing firms. On the basis of this criterion, if a sample incumbent is a direct rival of the IPO firms we code it as one, and zero otherwise.

In order to test H2 and H3 (the varying impacts of IPO announcements on incumbent competitors due to internal and external conditions) we consider two moderating variables: R&D intensity, and the Herfindahl-Hirschman Index (HHI). Although IPOs can be beneficial to directly competing incumbent firms because IPOs provide more updated information on unrecognized growth opportunities (H1), the degree of the positive externality of IPOs may vary with the internal conditions of directly competing incumbent firms. H2 suggests that

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8 Although some sample incumbents engage in multiple business segments with multiple four-digit SIC codes, we focus on their primary business segments (i.e., the primary four-digit SIC codes reported to COMPUSTAT) for our analysis. This allows our analysis to be rather conservative. If an incumbent with multiple segments is grouped as a direct competitor (i.e., the match of its primary four-digit SIC code with that of IPO firms), its secondary segment that is not considered in the analysis should make the stock price reaction negative, and the estimate of direct rivalry should therefore be underestimated. If an incumbent with multiple segments is categorized as an indirect rival (i.e., the match of its secondary versus its primary four-digit code with that of IPO firms), then its secondary segment that is not considered in the analysis should increase the stock price reaction positively. The estimate of direct rivalry should therefore again be underestimated. In either of these two cases, any incumbents with multiple business segments should cause the estimation of direct rivalry to be conservative.
directly competing firms with high rather than low R&D capabilities should acquire greater positive externality benefits from IPOs.

In order to test H2 we use the R&D intensity as a moderating variable measured as R&D expenditure divided by sales. We first consider the interaction term between R&D intensity and direct competitor membership. Since the information on the R&D expenditures of one-third of the sample incumbents is unavailable, we construct the R&D expenditure variable in two ways - before and after inputting a very small number (0.0001) that fills in our missing R&D expenditure data since such firms that do not report R&D expenses can be assumed to have immaterial (or zero) spending in that area. For a robustness check we also consider comparing the coefficient estimates of direct rivalry across sub-sampled regressions.

We first analyze three sub-samples: high R&D-intensive incumbents, low R&D-intensive incumbents, and incumbents with no R&D. We then compare the coefficients of the independent variable (i.e., directly or indirectly competing incumbent) from the three different regressions (e.g., Guo, Lev, and Shi, 2006).

Another moderating effect we focus on is the structure of the direct rivalry between incumbents and IPO firms. As hypothesized in H3, the higher the concentration ratio in a market segment within an industry the more likely that an IPO will instigate heightened competition. The degree of concentration in a market segment can negatively moderate the impact of IPOs on competing incumbents. In order to measure this concentration of direct
rivalry we consider the Herfindahl-Hirschman Index (HHI), measured by the sum of squares of the market share of firms in the four-digit SIC as below:

\[ HHI = \sum_{i=1}^{n} S_i^2 \]  

(2)

\( S_i \) in Equation (2) is the market share of firm \( i \) in the market segment (i.e., the same four-digit SIC). The information on firm sales and four-digit SIC sales (the sum of sales of all firms in each 4-digit SIC) is available from the COMPUSTAT database.

**Control Variables**

There are three different groups of control variables regarding incumbent firms, IPOs, and environments. We first attempt to control how the size of directly and indirectly competing incumbents affects the variation in CAR. In response to IPO announcements in our sample industry the stock price reactions of large competing firms could be different from those of small firms. Taking this into account, we used the natural logarithm of the firms’ market value as our firm size measure since more visible firms may convey a stronger message to investors than less visible firms (e.g., Lang and Stulz, 1992). We derived the measurement of a firm’s market value from the number of outstanding shares multiplied by the stock price at year end. We obtain the data of the outstanding shares and year-end stock prices from COMPUSTAT.

We also control for the effect of firm performance to make sure we only measure the additional value change caused by the announcement of the IPO. High-performing firms may
gain greater benefits from the information externality signaled by IPOs than low-performing firms, since investors update the firm values of competitive incumbents more favorably than those of less competitive firms in response to IPO announcements. Firm performance is measured as the accounting performance measure of return on assets (ROA) (Lang and Stulz, 1994). We use accounting earnings (before interest and tax) divided by total assets. All necessary data for the two variables are gathered from COMPUSTAT.

Two additional firm-level control variables are financial leverage and R&D intensity. A firm’s existing capital structure is known as an important determinant for stock price reactions to equity issuance (Myers, 2001). If competing firms’ equity issuance implies the relative shortage of financial resources, then investors in high-levered firms that run higher default risks can respond negatively to competing firms’ IPO announcements. In order to control for the potential effect of firms’ financial leverage on their stock price reaction to IPOs, we added a leverage ratio measured by the end-of-year total liability divided by the book value of the end-of-year total equity (Lang and Stulz, 1992). Since our sample firms are all in a highly technological industry, their stock price reactions could be related to how much incumbent firms engage in R&D (Rajgopal, Venkatachalam, and Kotha, 2002). We also control for the effect of the incumbent firms’ R&D intensity (i.e., the R&D expenditure divided by sales) since this industry is driven by technological competition (e.g., Guo et al.,
Although R&D intensity is a moderating variable for testing H2, we consider this variable a control in testing our additional hypotheses.

At the IPO level we control for the effects of IPO magnitude, IPO firm age, and the leading underwriters. The effect of IPO magnitude measured by IPO total proceeds can affect the stock price reactions to competing firms’ IPO announcements. As Ritter and Welch (2002) noted, the IPO total proceeds can reflect the value estimates of the growth opportunity evaluated by large institutional investors. The more total proceeds the larger the growth opportunity, and therefore the more positive information the externality of IPOs will be. We take a natural logarithm of the IPO total proceeds.

A firm’s age at the time of an IPO announcement is considered a measure of maturity (e.g., Clark, 2002; Loughran and Ritter, 2004). As the pre-IPO period increases the IPO is more likely to become successful, resulting in higher stock performance. In this regard IPOs made by older firms are more likely to convey a positive signal of business opportunity to investors, and incumbent competitors are therefore more likely to benefit. We measured the age of IPO firms by using the difference between the year of incorporation and the year of IPO announcement (Clark, 2002).

---

9 Since there can be time lags between IPO announcements and IPO filings, we also attempt to control for any related effect from these time lags by including the difference in the dates between the IPO announcement and IPO filing in the regression models. The time-lag effect is found to be statistically insignificant, and rarely change the results from the models without the time-lag variable. The time-lag variable as a control is therefore excluded from the models.
We also control for the reputation effect of IPO underwriters. The positive impact of leading underwriters on IPO performance has been well-studied (e.g., Carter, Dark, and Singh, 1998; Loughran and Ritter, 2004). Leading underwriters’ reputations can have an endorsement effect that reduces concerns of information asymmetry. IPOs managed by prestigious underwriters provide a strong positive signal to the markets, and directly competing incumbents are therefore more likely to benefit. Loughran and Ritter (2004) recently reported that the prestige effects caused by IPO underwriters have reversed due to changes in the IPO market during the 1990s and the internet bubble period. Without specific expectations of the variable’s direction, we attempt to control for the prestige effect of IPO underwriters. Although there are many ways to measure the reputation of underwriters, we do so via the ranking scheme used by Loughran and Ritter (2004). We consider IPO underwriters the most prestigious if they are rated above nine in the ranking scheme based on Carter and Manaster’s study (1990). Based on the database used by Loughran and Ritter (2004), the five most prestigious IPO underwriters in the sample are: Goldman Sachs, Morgan Stanley, Credit Swiss First Boston, J.P. Morgan, and Salomon Smith Barney. If one of the top five underwriters managed an IPO we code it as one, and zero otherwise\(^\text{10}\).

Finally, our models consider environmental effects by incorporating IPO year dummies. During the study period the stock markets experienced both decline and growth.

\(^{10}\) We also tested other types of reputation variables based on the frequency of IPO underwriting that may reflect the industry expertise of underwriting institutions. The main results were qualitatively not different.
cycles. Environmental munificence is critical in considering the variations of stock reactions in this study. Benchmarking the year 2004 as zero, we include dummies for all other years from 1997 to 2003. For the cross-sectional analysis of CARs we employ the ordinary least square (OLS) estimation method. Furthermore, we rely on the most common estimation method of OLS (e.g., Lang and Stulz, 1992) because we cannot \textit{a priori} assume any specific distributions.\footnote{In order to consider the firm-specific effect from the repeated appearance of the same incumbents in response to new IPOs, we also run a fixed-effects regression model. The results remain robust.}

\textbf{RESULTS}

Table 1 reports the descriptive statistics of the variables. The sample incumbent firms appear to be relatively similar in terms of firm size since the standard deviation (i.e., 2.12) of the log (market value) is less than the average (i.e., 5.05). However, the sample incumbents’ accounting performances varied significantly across firms since the standard deviation of the ROA (i.e., 0.90) is far larger than the average of the ROA (i.e., -0.32). Controlling for firm performance therefore seems critical.\footnote{Univariate analyses are provided in the Appendix.} Another firm-level variable, leverage, shows a high standard deviation (23.2) compared to its average (1.12). Controlling for firm leverage therefore also appears necessary. The mean of the direct rivalry between incumbent and IPO
firms is 0.30; the chance of sample incumbent firms directly competing with IPO firms is approximately thirty percent.\textsuperscript{13}

\begin{table}[h]
\centering
\begin{tabular}{|c|c|}
\hline
\textbf{Table 1} & \\
\hline
\end{tabular}
\end{table}

Table 2 reports the results of testing the positive externality from IPOs toward directly competing incumbents relative to indirectly competing ones. We run a cross-sectional OLS regression analysis of the CARs for the three-day time window [i.e., CAR (-1, +1)]. The base model is provided in the first column. ROA and total proceeds are positively significant for the incumbent firms’ stock price reactions. One item of note is that the underwriter prestige variable is significantly negative, a similar result to that of Loughran and Ritter (2004). Their explanation was that the recent IPOs taken public by prestigious underwriters during the 1990s and the internet bubble period tended to increase information asymmetry (i.e., higher IPO under-pricing) more than previous years due to the issuers’ objective changes (e.g., preferring leading stock analysts [although harsh in pricing] at prestigious underwriting institutions for better management of the IPO process). Another interpretation can be that since IPO firms with prestigious underwriters are more likely to be competitive, IPOs with prestigious underwriters may provide a negative effect on the value of incumbent competing firms. The three-day CARs are then regressed on themselves as shown in Model 2. This

\textsuperscript{13} Although a significantly small portion in one category may reduce the power of testing our hypotheses since the sample size rather than distribution itself may influence the statistical significance (Pedhazur, 1997), approximately 30 percent of the directly competing incumbents out of total sample may not include these significantly small portions that might distort statistical testing.
demonstrates how the stock prices of all incumbents react to IPOs regardless of whether the incumbent firms are direct or indirect competitors. The constant in Model 2 is negatively significant at -0.486 percent. On average the stock price of incumbent firms responds negatively to IPO announcements by 0.486 percent. Model 3 tests H1 regarding the different stock price reactions to IPO announcements between directly and indirectly competing incumbent firms. The coefficient estimate of the direct rivalry variable is 0.487 in the regression with controls. The coefficient estimate of directly competing incumbents is statistically significant at p < 0.01. In terms of economic consequences, directly competing incumbents will benefit from IPO announcements by approximately 49 percent more than indirectly competing incumbents if other effects are controlled. This evidences that the stock prices of directly competing incumbent firms respond to the IPO announcement more positively than indirect competing incumbents, supporting H1.

The results of testing H2 are reported in Table 3. In order to test H2 we first considered the interaction term between incumbents’ direct rivalry with IPO firms and these incumbents’ R&D intensity. If we exclude the sample incumbents with no R&D activity, then the coefficient estimate of the interaction term of direct rivalry and R&D intensity is 0.733; this is marginally significant at p < 0.10. However, if we input a small number, 0.0001, into the missing R&D data then the coefficient estimate of the interaction term becomes 0.953;
this is statistically significant at $p < 0.05$.\textsuperscript{14} The data supports the positive moderating effect of R&D intensity.

As a robustness check we compare the regression results from our subsamples. Since approximately 30 percent of the sample incumbents exhibit no R&D intensity, we divide our sample into three sub-samples: high (above-median) R&D-intensive, low (below-median) R&D-intensive, and no-R&D incumbent firms (for example, see Guo et al., 2006). The results of the regressions for these three groups are shown in Models 3, 4, and 5 respectively. The coefficient estimates of the directly competing incumbents are 0.766, 0.381, and -0.235 respectively. The first coefficient from the high R&D-intensive group (0.766) is statistically significant at $p < 0.001$, while the second from the low R&D-intensive group (0.381) is marginally significant at $p < 0.10$. The final coefficient estimate from the no-R&D incumbents group (0.235) is statistically insignificant. Using Wald tests over the magnitudes of the three coefficient estimates, the first coefficient is the largest among three and the second is larger than the third. These test results are reported in the lower part of Table 3. Figure 1 also depicts the three different slopes varying with the level of R&D intensity, supporting the positive moderating effect of incumbents’ R&D intensity on the IPO’s relative impact on directly versus indirectly competing incumbent firms.

\textsuperscript{14} In this regression model we truncate and exclude the top one percent of R&D intensity due to a potential outlier concern; however, if we use the total sample the statistical significance of the coefficient estimate disappears, although the sign is positive as expected.
Table 4 reports the results of testing H3 regarding the negative moderating effect of the market-segment structure. We anticipate that a concentrated market-segment structure of incumbent firms instigates hostile retaliation toward the direct competitors’ new strategic initiatives. Given the potential retaliation, an IPO in the market segment indicates the confidence and competence of the IPO firm. Following this logic an IPO announcement in a highly concentrated market segment will increase the competition and negative impact of IPO announcements on directly competing incumbent firms. The coefficient estimate of the interaction term between direct rivalry and HHI of market segment is -0.066; this is statistically significant at p < 0.001 and supports H3.

In order to better understand the detailed moderating effect of concentration on our sample IPO firms’ markets, we divide the sample into high (above-median) and low (below-median) HHI groups. The coefficient estimates of the directly competing incumbents are -0.668 for high HHI cases and 1.171 for low HHI cases. The first coefficient estimate (-0.668) from high HHI cases is statistically significant at p < 0.01, while the second (1.171) from low HHI cases is statistically significant at p < 0.001. This suggests that while IPOs in a less concentrated (low HHI) market segment are relatively beneficial for directly competing incumbents, IPOs in a more concentrated (high HHI) market segment are relatively
disadvantageous for directly competing incumbent firms. This relationship is depicted in Figure 2 below. Overall, the data support all three of our hypotheses.\(^{15}\)

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Insert Table 4 and Figure 2 about here
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DISCUSSION AND CONCLUSIONS

Studying the antecedents of firm performance has been a major focus of management scholars (Rumelt, Schendel, and Teece, 1994; Short, Ketchen, Palmer, and Hult, 2007). However, there is relatively little research on the impact of other competing firms’ strategic decisions (e.g., IPOs) on firm values. This is particularly the case in the industry structure literature (Ketchen et al., 1997; Reger and Huff, 1993). While there are ample studies on the effects of IPOs on focal firms, studies on the impact of IPOs on other firms are limited. Our study contributes to this under-explored literature, finding that a firm’s IPO should also be viewed as an external event affecting the value of other incumbent firms within an industry.

From the signaling standpoint prior research has primarily focused on how an IPO event affected the value of the focal firm; however, our research goes beyond the effects of an IPO on the focal firm and examines and IPO’s effects as a signal for competitors (Benveniste et al., 2002). We also show that if an IPO acts as a signal to competing firms,

---

\(^{15}\) Since interaction terms are included in the models in Tables 2 and 3, multi-collinear problems are possible. We check the variance inflation factors (VIF) for all models, finding that these concerns are insignificant as neither the individual nor overall VIFs are larger than three. Even if we use mean-centering for both interaction terms (i.e., (direct competitors) x (R&D intensity) and (direct competitors) x (HHI)), the results remain robust. In addition, since the incumbent firms can appear repetitively in the sample we consider fixed-effects models in order to control for the potential bias from hidden firm-specific effects. The OLS results are still found to be robust even after considering fixed-effects models.
this signal would reveal more accurate information on the future opportunities of firms that are directly competing with the firm announcing IPO. This assertion is based on the primary thrust of signaling theory that unobservable but underlying attributes can be revealed via signaling (Spence, 1974). Those firms that share similar attributes by being in direct competition would therefore best enjoy the positive information asymmetry regarding future market potential compared to indirectly competing firms.

The data on IPOs in a technologically uncertain industry suggest that industry members’ IPO decisions can function as unintended signals of the future growth potential and market prospects of their direct rivals. However, when directly competing incumbent firms have a significant investment in R&D these firms would experience greater positive externalities, since the increase of future market demand would be most beneficial to directly competing incumbents that are fully ready to capitalize on opportunities. At the same time, we also find that this a positive externality bears competitive threats as well, particularly in more concentrated industries.

Our findings show that IPOs are not always equally beneficial to all firms within an industry. First, if the IPO is not announced by a directly competing firm then the impact on other firms is negligible. On the other hand, if the IPO is announced by a directly competing firm then the positive impact on other firms is high, but the impact is even higher on firms that are immediately prepared to take advantage of these future opportunities. In a high-tech
industry firms with significant R&D investments are better prepared to take advantage or opportunities and are therefore more likely to prosper.

However, when a firm announcing an IPO is in a highly concentrated industry then the IPO accompanies a negative effect for directly competing incumbents. IPOs in highly uncertain industries may appear to work together favorably in order to resolve the significant information asymmetry investors face on the stock market. At the same time an IPO announcement in a highly concentrated industry can break the status quo and negatively affect the perceived value of directly competing incumbents. The more directly competing incumbent firms are enjoying the status quo, the less likely another firm’s IPO would benefit them. Instead, an IPO would harm incumbent firms and pose a threat to their future success. When the incumbent firms’ present status provides greater benefits, the external signal of future growth in the market signal led by an IPO is not appreciated.

Our study is not without limitations. First, we limited our samples to one industry: computer-related services. This study therefore has somewhat limited generalizability. Future studies examining the same issue can examine broader industry samples and include events other than IPOs. Second, this study did not consider other strategic factors that may affect the degree of externalities (particularly from an IPO) within an industry including the location of a focal firm within a network, geographic location and the degree of firm concentration within that location (Deeds, DeCarolis, and Coombs, 2000), or the IPO firms’ geographic
proximity (Stuart and Sorenson, 2003). While these other strategic factors are not focal research interests in this study, we regard these factors as both directly and indirectly crucial in shaping the information asymmetry status quo and forming the externality processes from the firm to the industry level. We call for imminent future research with a more comprehensive research setting that addresses these strategic factors.

Third, this study presumed the similarity of the business natures of firms within the same four-digit SIC code. While this is a reasonable and convenient assumption for research purposes, this study did not directly measure the dimensions of firm-level strategies or any strategy per se in order to test strategic similarities among samples. We therefore call for extra caution in generalizing these findings. Finally, partially due to the first limitation mentioned above (a single industry sample), we did not directly measure the level of uncertainty in this study. We instead assumed theoretically that the sample industry bears a relatively high uncertainty. While the level of uncertainty itself is not a focal interest of this study, it complicates the interpretation of our findings to other industries with different levels of uncertainty and also limits the generalizability of these findings.

This study offers at least two theoretical contributions to the literature on entrepreneurship, particularly for the uncertainty-reducing process research stream at the industry level. First, this study reports on a multidimensional aspect of a competing firm’s IPO within an emerging and uncertain industry. Instead of monolithic and straightforward
associations between a competing firm’s strategic initiative (e.g., IPO) and incumbent firms’ market values within an industry, our study instead rather dynamic and multilateral processes emerging from the strategic initiative of a competing firm. These processes are positive spillover effects, reinforced moderating effects of the positive spillover effect contingent on the R&D capabilities of incumbents, and negative effects in the context of a highly concentrated industry. This study therefore contributes to better understanding of the dynamic and multilateral natures of a firm’s strategic initiatives within an industry.

Second, this study supplements and broadens the prior research, asserting that a firm’s strategic change has not only firm-specific implications, but also implications for other firms within the same industry (Akhigbe et al., 2003; Lang and Stulz, 1992; Zucker, 1988). In order to understand the complete picture of market and industry, the web of individual firms and their externalities should therefore be carefully investigated.

In addition to the above contributions to the literature, this study also provides practical implications for policy makers, business practitioners, and investor groups. First, evaluating the true value of a firm in an uncertain industry is a complex and difficult job for investors. Investors are therefore always under the risk of making an adverse selection. This fundamental and structural information asymmetry issue can be relieved by alerting investors to external signals (e.g., IPOs).
In addition, from the perspective of firm decision makers the scope of competition should be reconsidered because emerging competitors may have dual effects: a positive externality effect, and intensified competitive pressure. Decision makers for existing incumbents should fully appropriate these multiple aspects of an emerging competitor, particularly in an uncertain industry. We demonstrate in detail that in a relatively uncertain and emerging industry a competing firm’s IPO actually helps directly competing incumbents due to the positive externality embedded in the competing firm’s IPO.

Porter (1985) argues that there are both good and bad competitors. Good competitors are those who adopt different strategies so they will not directly compete with incumbents. On the other hand, bad competitors are firms that adopt the same or similar strategies as the incumbent firms. This weakens the industry structure and undermines differentiation. Our argument is quite the opposite.

Hanssens and Johansson (1991) found that Japanese auto makers were synergetic in generating profits when they entered the international arena together and sought the same market. Perhaps there are circumstances where the benefit of having rival firms prevails. It is possible that while the IPO announcements of rival firms can be beneficial in newly emerging and uncertain industries, the same contingencies can be beneficial when seeking opportunities abroad. In the future more varied contexts (e.g., global, intra-networks, and geographical
proximity contingencies) should therefore be explored with similar research questions study in order to develop a more generalizable theory.
References


Deephouse DL. 1999. To be different or to be the same? It’s a question (and theory) of strategic balance. *Strategic Management Journal* **20**: 147-166.


# APPENDIX

**Stock Price Reactions to IPO Announcements in the Computer-Related Services Industry (SIC 737)**

<table>
<thead>
<tr>
<th>Cumulative Abnormal Returns (CAR) Day</th>
<th>Overall Incumbents Mean AR (%) (t-statistic)</th>
<th>Directly Competing Incumbents Mean AR (%) (t-statistic)</th>
<th>Indirectly Competing Incumbents Mean AR (%) (t-statistic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-30, -2)</td>
<td>-1.28**</td>
<td>0.78 (0.52)</td>
<td>-2.16*** (-6.09)</td>
</tr>
<tr>
<td></td>
<td>(-2.62)</td>
<td>(N=28,929)</td>
<td>(N=20,995)</td>
</tr>
<tr>
<td>(-1,0)</td>
<td>-0.28***</td>
<td>-0.02 (-0.17)</td>
<td>-0.39*** (-6.20)</td>
</tr>
<tr>
<td></td>
<td>(-5.14)</td>
<td>(N=29,930)</td>
<td>(N=20,996)</td>
</tr>
<tr>
<td>-1</td>
<td>-0.13**</td>
<td>0.04 (0.47)</td>
<td>-0.20*** (-4.32)</td>
</tr>
<tr>
<td></td>
<td>(-3.13)</td>
<td>(N=28,930)</td>
<td>(N=20,996)</td>
</tr>
<tr>
<td>0</td>
<td>-0.15***</td>
<td>-0.06 (-0.69)</td>
<td>-0.19*** (-4.29)</td>
</tr>
<tr>
<td></td>
<td>(3.81)</td>
<td>(N=28,930)</td>
<td>(N=20,996)</td>
</tr>
<tr>
<td>+1</td>
<td>-0.21***</td>
<td>0.02 (0.26)</td>
<td>-0.31*** (-6.65)</td>
</tr>
<tr>
<td></td>
<td>(-5.39)</td>
<td>(N=28,930)</td>
<td>(N=20,996)</td>
</tr>
<tr>
<td>(0,+1)</td>
<td>-0.36***</td>
<td>-0.04 (-0.38)</td>
<td>-0.50*** (-7.86)</td>
</tr>
<tr>
<td></td>
<td>(-6.77)</td>
<td>(N=28,930)</td>
<td>(N=20,996)</td>
</tr>
<tr>
<td>(-1,+1)</td>
<td>-0.49***</td>
<td>0.00 (0.01)</td>
<td>-0.69*** (-9.13)</td>
</tr>
<tr>
<td></td>
<td>(-7.51)</td>
<td>(N=29,930)</td>
<td>(N=20,996)</td>
</tr>
<tr>
<td>(+1,30)</td>
<td>-1.05</td>
<td>3.42 (1.38)</td>
<td>-2.95*** (-10.25)</td>
</tr>
<tr>
<td></td>
<td>(-1.36)</td>
<td>(N=29,922)</td>
<td>(N=20,990)</td>
</tr>
</tbody>
</table>

*T-statistics are in parentheses. The statistics test the null hypothesis that mean AR is zero (i.e., insignificant abnormal returns to IPO announcements by competing firms) using the two-tailed test.*
Table 1
Descriptive Statistics of Variables for OLS Regression Analysis

<table>
<thead>
<tr>
<th>Sample Size (N): 29,930</th>
<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CAR (-1,+1) (%)</td>
<td>-0.49</td>
<td>11.2</td>
<td></td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Log (market value)</td>
<td>5.05</td>
<td>2.12</td>
<td>0.02**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Leverage</td>
<td>1.12</td>
<td>23.2</td>
<td>-0.01</td>
<td>-0.02**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Return on Assets</td>
<td>-0.32</td>
<td>0.90</td>
<td>0.03**</td>
<td>0.31**</td>
<td>-0.02**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. R&amp;D Expenditure/Sales</td>
<td>2.76</td>
<td>105.3</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.00</td>
<td>-0.01</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Log (total IPO proceeds) (LNTPRCD)</td>
<td>4.31</td>
<td>0.86</td>
<td>0.03**</td>
<td>0.03**</td>
<td>-0.00</td>
<td>0.00</td>
<td>-0.00</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Age of IPO Firm</td>
<td>8.29</td>
<td>9.74</td>
<td>0.01</td>
<td>-0.03**</td>
<td>-0.00</td>
<td>-0.03**</td>
<td>0.00</td>
<td>0.20**</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Underwriter Prestige Dummy (=1 if Carter/Manaster rate is the most prestigious)</td>
<td>0.53</td>
<td>0.50</td>
<td>-0.02**</td>
<td>0.01**</td>
<td>-0.00</td>
<td>-0.02**</td>
<td>0.00</td>
<td>0.31**</td>
<td>0.09**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9. Market-Segment Concentration (HHI) (%)</td>
<td>18.7</td>
<td>0.13</td>
<td>-0.02**</td>
<td>-0.07**</td>
<td>-0.01**</td>
<td>-0.06**</td>
<td>-0.02**</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>-</td>
</tr>
<tr>
<td>10. Direct Competitors (=1)</td>
<td>0.30</td>
<td>0.46</td>
<td>0.03**</td>
<td>0.04**</td>
<td>0.00</td>
<td>0.02**</td>
<td>0.00</td>
<td>0.03**</td>
<td>-0.09**</td>
<td>-0.06**</td>
<td>-0.31**</td>
</tr>
</tbody>
</table>

*a Significance level: * 5% or ** 1%.
Table 2
OLS Regressions of Stock Price Reactions of Computer-Related Service Firms (SIC 737) to IPO Announcements a:
The IPO Impact on Directly vs. Indirectly Competing Incumbents

<table>
<thead>
<tr>
<th>dependent variable: CAR (-1,+1) (%)</th>
<th>(1) Base</th>
<th>(2) All Incumbents</th>
<th>(3) Multiple</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control Variables of Incumbent Firms:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log (market value)</td>
<td>0.030</td>
<td>0.030</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td>(0.034)</td>
<td></td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.003</td>
<td>-0.003</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
<td></td>
</tr>
<tr>
<td>Return on Assets</td>
<td>0.293*</td>
<td>0.295*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.147)</td>
<td>(0.147)</td>
<td></td>
</tr>
<tr>
<td>R&amp;D Intensity (=R&amp;D expenditure/sales)b</td>
<td>-0.001</td>
<td>-0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td></td>
</tr>
<tr>
<td><strong>Control variables of IPOs:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log (total IPO proceeds) (LNTPRCD)c</td>
<td>0.306*</td>
<td>0.302**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.098)</td>
<td>(0.098)</td>
<td></td>
</tr>
<tr>
<td>Age of IPO firm</td>
<td>0.010</td>
<td>0.012†</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.007)</td>
<td></td>
</tr>
<tr>
<td>Underwriter Prestige Dummy (=1 if Carter/Manaster rate is the most prestigious)</td>
<td>-0.456**</td>
<td>-0.443**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.152)</td>
<td>(0.152)</td>
<td></td>
</tr>
<tr>
<td><strong>Control Variables of Environments:</strong></td>
<td>-0.011*</td>
<td>-0.001</td>
<td></td>
</tr>
<tr>
<td>Market-Segment Concentration (HHI)</td>
<td>(0.005)</td>
<td>(0.005)</td>
<td></td>
</tr>
<tr>
<td>IPO Year Dummies Included</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.060</td>
<td>-0.486***</td>
<td>-0.307</td>
</tr>
<tr>
<td></td>
<td>(0.282)</td>
<td>(0.065)</td>
<td>(0.291)</td>
</tr>
<tr>
<td><strong>Independent Variable:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directly Competing Incumbents (DRINCUM) (=1)</td>
<td>0.478***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>6.35***</td>
<td>6.31***</td>
<td></td>
</tr>
<tr>
<td>R-square (%) sample incumbent firms (N=29,930)</td>
<td>0.39</td>
<td></td>
<td>0.39</td>
</tr>
</tbody>
</table>

a Significance level: † 10%, * 5%, ** 1%, or *** 0.1%. The coefficient estimates of independent variables are standardized coefficients (or beta coefficients), and the robust standard error is provided in parentheses. As the variance inflation factors of all models are less than three, multi-collinear problems are limited. b No R&D expenditure cases are imputed as 0.0001. Data imputing rarely changes the results. c Total proceeds are in real 2004 USD adjusted using the CPI.
## Table 3

**OLS Regressions of Stock Price Reactions of Computer-Related Service Firms (SIC 737) to IPO Announcements**: The Moderating Effect of Incumbents’ R&D Intensity

<table>
<thead>
<tr>
<th>Dependent Variable: CAR (-1,+1) (%)</th>
<th>(1) Pooled (without inputting)</th>
<th>(2) Pooled (with inputting)</th>
<th>(3) Above-Median R&amp;D Intensity</th>
<th>(4) Below-Median R&amp;D Intensity</th>
<th>(5) No R&amp;D Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Variables of Incumbent Firms:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log (market value)</td>
<td>0.007 (0.038)</td>
<td>0.023 (0.034)</td>
<td>0.005 (0.063)</td>
<td>0.017 (0.049)</td>
<td>0.091 (0.071)</td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.003 (0.002)</td>
<td>-0.003 (0.002)</td>
<td>-0.004 (0.011)</td>
<td>-0.003 (0.002)</td>
<td>0.006 (0.028)</td>
</tr>
<tr>
<td>Return on Assets</td>
<td>0.338* (0.150)</td>
<td>0.325* (0.136)</td>
<td>0.275 (0.228)</td>
<td>0.168 (0.215)</td>
<td>0.250 (0.298)</td>
</tr>
<tr>
<td>R&amp;D Intensity (= R&amp;D expenditure/Sales)</td>
<td>-0.439† (0.235)</td>
<td>-0.552† (0.246)</td>
<td>-0.001 (0.001)</td>
<td>0.00 (1.867)</td>
<td></td>
</tr>
<tr>
<td>Control Variables of IPOs:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log (total IPO proceeds) (LNPRCD)</td>
<td>0.415*** (0.111)</td>
<td>0.308** (0.098)</td>
<td>0.275† (0.160)</td>
<td>0.528*** (0.152)</td>
<td>-0.080 (0.209)</td>
</tr>
<tr>
<td>Age of IPO Firm</td>
<td>0.014† (0.007)</td>
<td>0.013† (0.007)</td>
<td>0.012 (0.011)</td>
<td>0.016 (0.010)</td>
<td>0.006 (0.17)</td>
</tr>
<tr>
<td>Underwriter Prestige Dummy (=1 if Carter/Manaster rate is the most prestigious)</td>
<td>-0.681*** (0.171)</td>
<td>-0.443** (0.153)</td>
<td>-0.783*** (0.245)</td>
<td>-0.567* (0.237)</td>
<td>0.605† (0.332)</td>
</tr>
<tr>
<td>Market-Segment Concentration (HHI)</td>
<td>-0.010 (0.007)</td>
<td>-0.008 (0.005)</td>
<td>-0.012 (0.011)</td>
<td>-0.018* (0.009)</td>
<td>-0.001 (0.010)</td>
</tr>
<tr>
<td>IPO Year Dummies Included</td>
<td>0.112 (0.329)</td>
<td>-0.138 (0.293)</td>
<td>-0.023 (0.508)</td>
<td>0.044 (0.504)</td>
<td>-1.425* (0.628)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.112 (0.329)</td>
<td>-0.138 (0.293)</td>
<td>-0.023 (0.508)</td>
<td>0.044 (0.504)</td>
<td>-1.425* (0.628)</td>
</tr>
<tr>
<td>Independent/Moderating Variables:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directly Competing Incumbents (DRINCUM) (=1)</td>
<td>0.405* (0.188)</td>
<td>0.271† (0.178)</td>
<td>0.766*** (0.228)</td>
<td>0.381† (0.225)</td>
<td>-0.235 (0.467)</td>
</tr>
<tr>
<td>(DRINCUM)x(R&amp;D intensity)</td>
<td>0.733† (0.413)</td>
<td>0.953* (0.464)</td>
<td>0.345† (0.246)</td>
<td>0.616† (0.323)</td>
<td>1.901† (0.56)</td>
</tr>
<tr>
<td>Wald tests: b_i(DRINCUM)&gt;b_j(DRINCUM) (i, j=1,2,3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>6.13*** (6.63***</td>
<td>3.86*** (3.04***</td>
<td>3.64** (2.90***</td>
<td>2.90*** (5.78)</td>
<td></td>
</tr>
<tr>
<td>R-square (%)</td>
<td>0.53</td>
<td>0.46</td>
<td>0.52</td>
<td>0.50</td>
<td>0.68</td>
</tr>
<tr>
<td>Sample incumbent firms (N)</td>
<td>23,911</td>
<td>29,634</td>
<td>12,078</td>
<td>12,074</td>
<td>5,778</td>
</tr>
</tbody>
</table>

---

*Significance level: †10%, *5%, **1%, or ***0.1%. The coefficient estimates of the independent variables are standardized coefficients (or beta coefficients), and the robust standard error is provided in parentheses. As the variance inflation factors of all models are less than three, multi-collinear problems are limited. Total proceeds are in real 2004 USD adjusted using.
the CPI. For R&D intensity no R&D expenditure cases are excluded in Model 4, and are input as 0.0001 in Model 5. Data inputting rarely changes the results. In addition, we exclude one percent of the highest R&D intensity observations from analysis in order to avoid concerns regarding extreme outliers.
Table 4
OLS Regressions of Stock Price Reactions of Computer-Related Service Firms (SIC 737) to IPO Announcements a:
The Moderating Effect of Incumbents’ Competitive Environment

<table>
<thead>
<tr>
<th>Dependent variable: CAR (-1,+1) (%)</th>
<th>(1) Overall</th>
<th>(2) Above-median HHI</th>
<th>(3) Below-median HHI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control variables of incumbent firms:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log (market value)</td>
<td>0.032</td>
<td>0.047</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td>(0.046)</td>
<td>(0.049)</td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.003</td>
<td>-0.013***</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.005)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Return on Asset</td>
<td>0.297*</td>
<td>0.204</td>
<td>0.464**</td>
</tr>
<tr>
<td></td>
<td>(0.147)</td>
<td>(0.222)</td>
<td>(0.150)</td>
</tr>
<tr>
<td>R&amp;D intensity (= R&amp;D expenditure/Sales)</td>
<td>-0.001</td>
<td>0.008</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.063)</td>
<td>(0.001)</td>
</tr>
<tr>
<td><strong>Control variables of IPOs:</strong></td>
<td>0.341***</td>
<td>0.292*</td>
<td>0.393*</td>
</tr>
<tr>
<td>Log (total IPO proceeds) (LNTPRCD)b</td>
<td>(0.099)</td>
<td>(0.121)</td>
<td>(0.156)</td>
</tr>
<tr>
<td>Age of IPO firm</td>
<td>0.013†</td>
<td>-0.001</td>
<td>0.030**</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.009)</td>
<td>(0.010)</td>
</tr>
<tr>
<td>Underwriter prestige dummy (=1 if Carter/Manaster rate is the most prestigious)</td>
<td>-0.346*</td>
<td>0.088</td>
<td>-0.629**</td>
</tr>
<tr>
<td></td>
<td>(0.152)</td>
<td>(0.205)</td>
<td>(0.235)</td>
</tr>
<tr>
<td><strong>Control variables of environments:</strong></td>
<td>0.005</td>
<td>-0.018*</td>
<td>-0.122*</td>
</tr>
<tr>
<td>Market-segment concentration (HHI)</td>
<td>(0.005)</td>
<td>(0.009)</td>
<td>(0.062)</td>
</tr>
<tr>
<td>IPO year dummies included</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.664*</td>
<td>-0.054</td>
<td>0.764</td>
</tr>
<tr>
<td></td>
<td>(0.294)</td>
<td>(0.377)</td>
<td>(0.757)</td>
</tr>
<tr>
<td><strong>Independent/moderating variables:</strong></td>
<td>1.401***</td>
<td>-0.668**</td>
<td>1.171***</td>
</tr>
<tr>
<td>Directly competing incumbents (DRINCUM) (=1)</td>
<td>(0.002)</td>
<td>(0.247)</td>
<td>(0.209)</td>
</tr>
<tr>
<td>(DRINCUM)x(HHI)</td>
<td>-0.066***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>6.91***</td>
<td>3.36***</td>
<td>7.72***</td>
</tr>
<tr>
<td>R-square (%)</td>
<td>0.47</td>
<td>0.31</td>
<td>0.94</td>
</tr>
<tr>
<td>Sample firms (N): 23,380</td>
<td>29,930</td>
<td>15,042</td>
<td>14,888</td>
</tr>
</tbody>
</table>

---

a Significance level: † 10%, * 5%**, 1%**, or *** 0.1%**. The estimates of the independent variables are standardized coefficients (or beta coefficients), and the robust standard error is provided in parentheses. As the variance inflation factors of all models are less than three, multi-collinear problems are limited. b Total proceeds are in real 2004 USD adjusted using the CPI.
Figure 1
Stock Price Reactions to IPO Announcements: Directly vs. Indirectly Competing Incumbents with High (Above-Median), Low (Below-Median), and No R&D Intensity
Figure 2
Stock Price Reactions to IPO Announcements: Directly vs. Indirectly Competing Incumbents with High (Above-Median) and Low (Below-Median) Market-Segment Concentration (HHI)

CAR
[-1, +1]

Low HHI Market

High HHI Market Segments

Indirectly Competing Incumbents

Directly Competing Incumbents