

IPOs versus Acquisitions and the IPO Valuation Premium Puzzle: An Empirical Analysis

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Abstract

Using a hand-collected data set of private firm acquisitions and IPOs, this paper presents an empirical analysis of a private firm's choice between IPOs and acquisitions, and develops the first empirical analysis in the literature of the "IPO valuation premium puzzle" (where many private firms seem to choose to be acquired rather than to go public at higher valuations). In the first part of the paper, I test several new hypotheses regarding a firm's choice between IPOs and acquisitions and develop several new empirical findings consistent with the theoretical predictions of Bayar and Chemmanur (2005). First, firms operating in less concentrated industries characterized by the absence of a dominant market player, (and therefore more viable against product market competition) are more likely to go public rather than be acquired. Second, firms facing a greater extent of information asymmetry in the equity market, more capital intensive firms, and those operating in industries characterized by greater private benefits of control, are more likely to go public rather than to be acquired. Third, the likelihood of an IPO over an acquisition is greater for venture backed firms and those characterized by higher pre-exit sales growth. Finally, I document that the passage of the Sarbanes-Oxley Act has motivated a larger proportion of firms to favor acquisitions over IPOs. My analysis of private firm valuations in IPOs and acquisitions in the second part of the paper indicates that IPO valuation premia disappear for larger firms after controlling for various factors affecting a firm's choice between IPOs and acquisitions. Further, after controlling for the long run component of the expected payoff to firm insiders from an IPO exit (as suggested by Bayar and Chemmanur (2005)), I find that the IPO valuation premium vanishes even for smaller venture backed firms and shrinks substantially for non-venture backed firms as well.

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1. Introduction

One of the most important events in the life of a private firm is the exit decision, where the original backers of the firm, namely, entrepreneurs and venture capitalists, liquidate (at least partially) some of their equity holdings in their private firm, while also raising external financing for new investment in the firm. “Going public” through an initial public offering (IPO) is an important and well-known exit mechanism that has been extensively studied in the literature both theoretically and empirically.¹ However, an equally important but less studied exit option for private firms is an acquisition by another (usually larger) firm. The ratio of acquisitions to IPOs among private firm exits has increased dramatically in recent years. Over the last decade, a private firm was much more likely to have been acquired than to go public. According to the National Venture Capital Association (NVCA), there were more exits by venture capital backed firms through acquisitions than by IPOs in each of the last five years. Moreover, acquisitions constituted 78% of the value of exits of venture backed firms in 2005.²

Surprisingly, however, the determinants of a firm’s choice between IPOs and acquisitions have been relatively unexplored in the literature. There are only two existing empirical studies on the choice of IPOs versus acquisitions so far: the first study is Brau, Francis, and Kohers (2003) who use industry-level data to document that current cost of debt, relative “hotness” of the IPO market, firm size, and insider ownership are positively related to the probability of an IPO whereas acquisitions are more likely in high market-to book and highly leveraged industries. The second study is Poulsen and Stegemoller (2005) who use firm-level data to document that firms with greater growth opportunities, more capital constraints and VC backing are more likely to go public rather than be acquired. Both studies report that IPO firms have

¹ See, e.g., Chemmanur and Fulghieri (1999), Maksimovic and Pichler (2001) or Pagano and Roell (1998)) and empirically (see, e.g., Pagano, Panetta, Zingales (1998), Helwege and Packer (2003), or Chemmanur, He and Nandy (2003)).

² In the first quarter of 2006, there were only 10 venture-backed IPOs raising a total of \$540.8 million according to the NVCA. On the other hand, the venture-backed M&A market continued to perform strongly in 2006 with 95 companies being acquired with a total value of \$4.8 billion, the highest total value in the last five years.

greater valuations and valuation multiples than acquired firms, suggesting that there exists a valuation premium for IPOs over acquisitions. However, existing empirical studies lack a theoretical foundation since there were no theoretical analyses in the literature of a firm's choice of an IPO versus an acquisition. However, in a recent paper, Bayar and Chemmanur (2005) develop a theoretical analysis of a firm's choice between IPOs and acquisitions, and develop several testable predictions regarding this choice. They also suggest that the IPO valuation premium documented in the empirical literature is puzzling, since, in the face of such a valuation premium, a rational entrepreneur would always choose an IPO over an acquisition (given that the latter exit mechanism would require them to accept a discount in valuation).

This paper has two objectives. The first objective is to explore a firm's choice between IPOs and acquisitions by testing several new hypotheses regarding this choice based on the implications of the Bayar and Chemmanur (2005) model. The second objective is to explain and empirically analyze the "IPO valuation premium puzzle". I use a hand-collected data set of private firm acquisitions by public companies from 1995 to 2004 and a data set of IPOs covering the same period. In the first part of the paper, I conduct univariate and multivariate tests (probit regressions) to empirically analyze a firm's choice between IPOs and acquisitions. In the second part of the paper, I study the IPO valuation premium puzzle by using a propensity score-based matching methodology to account for self-selection and compare the valuation of acquired firms to the estimated value they could have received in an IPO. I use theoretical insights from Bayar and Chemmanur (2005) to empirically distinguish between the short run and the long run payoffs to insiders of private firms in order to explain the IPO valuation premium puzzle.

In Bayar and Chemmanur (2005), insiders (entrepreneurs and VCs) of a private firm who are making an exit decision, have private information about the viability of their business model (and the firm itself) against future (post-exit) competition in the product market. In such a setting, the benefit of an acquisition over an IPO is that the acquiring firm can provide synergy to the private firm by increasing its probability of success in the product market. Clearly, this benefit is greater for private firms which are less viable against product market competition as stand-alone firms. The insiders trade off this benefit against three

major costs of an acquisition over an IPO. First, potential acquirers have industry expertise and can value the private firm much better than the investors in the IPO market. This means that depending on IPO market conditions, the valuations of many firms in an acquisition may be lower than their valuations in an IPO. Second, while the IPO market prices equity in firms going public competitively, acquirers may have considerable bargaining power, allowing them to extract some of the firm's value from firm insiders. Third, after their firm is acquired, the insiders of a private firm are likely to lose control of their firm. In contrast, after an IPO, insiders can continue to enjoy private benefits from being in control of their stand-alone firm. In addition, Bayar and Chemmanur (2005) point out that venture capitalists (VCs) may have shorter investment horizons and may need to exit their investments in a private firm earlier than entrepreneurs. If this is the case, private firms backed by VCs are more likely to choose an IPO over an acquisition.

The theory of Bayar and Chemmanur (2005) has several testable predictions. First, it predicts that more established firms with business models already viable against product market competition are more likely to go public through an IPO rather than be acquired. Second, the likelihood of IPOs relative to acquisitions will be smaller in more concentrated industries (where there is already a dominant firm) where the synergy arising from being acquired by a larger, established firm is greater. Third, firms operating in industries characterized by greater private benefits of control, firms facing a greater extent of information asymmetry, and relatively more capital intensive firms are more likely to choose an IPO over an acquisition. Finally, the above theory predicts that venture capital backed firms are more likely to choose an IPO over an acquisition relative to non-venture capital backed firms.

In the first part of the paper, I test the above predictions of Bayar and Chemmanur (2005). My main empirical findings are as follows. First, I find that firms with higher pre-exit sales growth and firms which are larger in size (and are more viable against product market competition as stand-alone firms), are more likely to choose an IPO over an acquisition. Second, firms operating in less concentrated industries and in those industries characterized by the absence of a dominant market player, are more likely to choose an IPO over an acquisition. Third, firms facing a greater extent of information asymmetry in the IPO market,

which are more capital intensive, and those operating in industries characterized by greater private benefits of control, are more likely to choose an IPO over an acquisition. Fourth, the likelihood of an IPO over an acquisition is greater for venture backed firms. These findings are strongly consistent with the implications of Bayar and Chemmanur (2005). Finally, I also document that the passage of the Sarbanes-Oxley Act has motivated a larger proportion of firms to favor acquisitions over IPOs.

As mentioned above, the second objective of this paper is to empirically analyze the “IPO valuation premium puzzle”. In a comparison of premiums earned by insiders of IPOs versus insiders of takeovers, Brau, Francis, and Kohers (2003) find that, on average, insiders of private firm targets receive a takeover payoff that equals only 78% of an IPO payoff.³ Similarly, Poulsen and Stegemoller (2005) report that the median market value to book value of assets ratio and the median market value to sales ratio are higher for IPOs compared to acquisitions.⁴ Bayar and Chemmanur (2005) suggest two potential explanations for the IPO valuation premium puzzle. First, they predict that the quality of firms going public and those being acquired will be different. Therefore, when comparing their valuations, acquired firms must be matched carefully with comparable IPO firms with a similar propensity to go public, controlling for all observable firm- and industry-specific factors which affect the choice of IPOs vs. acquisitions. Second, even when IPO valuations are higher, the long run expected payoff to entrepreneurs and venture capitalists may be higher in an acquisition. Bayar and Chemmanur (2005) point out that since firm insiders liquidate only a small fraction of equity in the IPO, and they have private information that the firm’s IPO valuations may not be sustainable in the long run, insiders will compare the acquisition value of their firm with the weighted average of its IPO value and its long run post-IPO market value (where

³ Similar in nature to these findings, Koeplin, Sarin, and Shapiro (2000) analyze a set of private firm acquisitions and public takeovers from 1984 to 1998. They find that private firm acquisitions are valued at a 20-30% discount to similar public takeover deals. Officer (2005) finds an average acquisition discount for stand-alone private targets of 15%-30% relative to similar public targets from 1979 to 2003. Lian and Wang (2006) document that withdrawn-IPO private targets sell at a 47 percent acquisition premium relative to comparable pure private targets that never file for IPO registration. They argue that “bidders are willing to value these “almost public” withdrawn-IPO targets as similar to public targets and to pay more for dual tracking private firms than for similar pure private targets.”

⁴ Poulsen and Stegemoller (2005) also consider whether the valuation multiples differ with VC backing. They find that firms that have VC backing have consistently higher valuation multiples than those firms that do not. However, they report that the statistically significant difference between IPO and acquisition valuation disappears in the subsets of non-VC backed firms and VC backed firms respectively.

long run value is weighted by the fraction of equity insiders retain after IPO). In the second part of this paper, I empirically analyze the IPO valuation premium puzzle based on the theoretical insights of Bayar and Chemmanur (2005).

My empirical findings regarding the IPO valuation premium puzzle are as follows. First, after controlling for various firm- and industry-specific factors affecting a firm's choice between IPOs and acquisitions and matching acquired firms with comparable IPO firms (using the propensity score methodology), the IPO valuation premium essentially disappears for larger private firms with a deal value above \$50 million (these are the firms that have a realistic chance to make a choice between an IPO and an acquisition, since smaller firms are unlikely to be able to go public). Second, for firms with a deal value below \$50 million, the IPO valuation premium continues to exist; however, for these firms, the median valuation premium for VC backed acquisitions is significantly smaller than the median valuation premium for non-VC backed firms. Third, consistent with the theoretical insights of Bayar and Chemmanur (2005), the IPO valuation premium vanishes for VC backed firms (regardless of whether their deal value is above or below \$50 million) after controlling for the long run component of the expected payoff to firm insiders from an IPO exit. Finally, I document that, overall, the long run IPO valuation premium (i.e., based on the weighted average of the IPO value and the long run post-IPO market value) is much smaller than the short run IPO valuation premium (i.e., based only on the IPO value) for the full sample of acquired firms.

The rest of the paper is organized as follows. Section 2 reviews the theory of the choice of IPOs versus acquisitions and develops hypotheses, both for my empirical analysis on the determinants of a firm's choice between IPOs and acquisitions (Section 2.1) and my empirical analysis of the "IPO valuation premium puzzle" (Section 2.2). Section 3 describes the data and the variables. Section 4 presents my empirical tests about a firm's choice between IPOs and acquisitions, and discusses results. Section 5 describes the empirical methodology used for firm valuation and propensity score matching used in my analysis of the IPO valuation premium puzzle and presents empirical tests and results. Section 6 concludes.

2. Theory and Hypotheses

In section 2.1, I will review the theoretical literature about the choice between IPOs and acquisitions and develop hypotheses for the empirical tests I present in section 4. Similarly, in section 2.2, I will review the implications of the theoretical analysis of Bayar and Chemmanur (2005) for the IPO valuation premium puzzle and develop hypotheses, which will serve as the basis for the empirical tests I present in section 5.

2.1 The Exit Choice between IPOs and Acquisitions

The first set of hypotheses studied in this paper concerns a private firm's exit choice between IPOs and acquisitions. In the setting of Bayar and Chemmanur (2005), insiders (entrepreneurs and VCs) of a private firm want to either sell some of their equity holdings in the firm or raise capital for a new project, or both. They can realize these objectives in one of two ways. First, they can take the firm public in an IPO, and thereby sell some of their equity holdings in the firm to satisfy their liquidity demands, and issue new public equity to raise the required funding for the new project, with the entrepreneur continuing to manage the firm after the IPO. Second, they can sell their private firm to an acquirer, in which case they will divest their entire equity holdings in the firm, with the entrepreneur giving up control of the firm to the acquirer. Firm insiders have private information about the viability of their business model (and the firm itself) against future (post-exit) competition in the product market. Firms with more viable business models and potentially dominant products (type H firms) have a better chance of success as stand-alone firms against established competitors in the product market than firms which are less viable and have products untested against product market competition (type L). The benefit of an acquisition over an IPO is that the acquiring firm can provide synergy to the acquired firm by increasing its probability of success in the product market while a stand-alone firm has to fend for itself after an IPO. This benefit will be clearly greater for type L firms.

Bayar and Chemmanur (2005) consider three major costs of an acquisition over an IPO. First, potential acquirers have industry and product expertise and can value the private firm better than IPO market investors. Thus, an acquisition is costly in the sense that private firm insiders have no information advantage against acquiring firms. Hence, type L firms will be correctly valued in an acquisition. In contrast, given that the IPO market investors have less information than firm insiders, type L firms can get potentially higher valuations in the IPO market by pooling with type H firms.⁵ Second, while the IPO market prices the firm's equity competitively (so that insiders can retain the entire net present value of their firm's project), acquirers will have considerable bargaining power, allowing them to extract some of the project's net present value from firm insiders. Third, after their firm is acquired, the insiders of a private firm will lose control of their firm. After an IPO, however, they can continue to enjoy private benefits from being in control of their stand-alone firm.

Given the above trade-offs, the equilibrium exit choices of private firms between IPOs and acquisitions are determined as follows in Bayar and Chemmanur (2005). For type H firms, with viable business models against competition, the "synergy" benefits of an acquisition will be negligible. Therefore, they will always prefer to remain stand-alone and choose an IPO over an acquisition. On the other hand, the insiders of type L firms will weigh the considerable synergy benefits of an acquisition in product market competition against the short run valuation benefits of the IPO market and the advantage of retaining private benefits of control. Therefore, in equilibrium, type L firms play a mixed strategy: they choose an IPO with a positive probability, but choose to be acquired with the complementary probability.

The above theory leads to the following testable predictions. First, more established firms with business models already viable against product market competition are more likely to go public through an IPO rather than be acquired (**H1**). Second, the likelihood of IPOs relative to acquisitions will be smaller in more concentrated industries where there is already a dominant firm so that the benefits of being acquired by a larger, established firm are greater (**H2**). Third, firms operating in industries

⁵ The size of the security benefits enjoyed by the insiders (entrepreneurs and VCs) of type L firms from these higher IPO market valuations would depend on the fraction of existing shares sold by insiders to satisfy their liquidity demands (secondary share offerings) and the fraction of new shares issued (primary share offerings) to raise financing for new investment projects.

characterized by greater private benefits of control are more likely to choose an IPO rather than be acquired (**H3**). Fourth, firms facing a greater extent of information asymmetry are more likely to choose an IPO over an acquisition (**H4**). Fifth, firms operating in more capital intensive industries are more likely to choose an IPO over an acquisition.⁶ (**H5**)

Bayar and Chemmanur (2005) also predict that venture backed firms are more likely to go public compared to non-venture backed firms (**H6**), provided that the venture capitalist divests a much larger fraction of equity in the IPO (or soon after) compared to entrepreneurs, which seems likely to be the case in practice. Venture capitalists typically have shorter investment horizons because they need to raise capital for other projects or they must return capital to their limited partners for liquidity or diversification reasons.

Finally, I also analyze (for the first time in the literature) whether the passage of the Sarbanes-Oxley Act has affected firms' choice between IPOs and acquisitions as often conjectured by practitioners in the financial press (**H7**).⁷

2.2 The IPO Valuation Premium Puzzle

The second set of hypotheses I test in this paper relates to the differences in valuations between the two exit choices. The theoretical model of Bayar and Chemmanur (2005) suggests two potential explanations for the IPO valuation premium puzzle. First, they predict that the quality of firms going public and firms being acquired will be different. Thus, there will be a self-selection among firms when

⁶ This is because, the more capital intensive the firm, the more funding it will need to finance its investment projects, so that the firm will benefit more from the short term valuation benefits of the IPO market over an acquisition.

⁷ See (*Wall Street Journal*, February 22, 2005, "IPO Outlook: More IPO Plans Turn Into Mergers --- Instead of Selling a Piece, Whole Firm Is Purchased; 'Dual Tracking' Is Popular"): "Now, with public-offering valuations a little closer to the ground, and many acquirers looking at a stockpile of ready cash or the ability to draw on low-interest debt, deals are getting snapped up in the middle of the pre-IPO road shows for investors, or before. In the case of many IPOs, the sponsors of the offering -- often private-equity firms that bought the companies in the past few years -- are only too happy to accept an acquisition over a public offering. "They are fundamentally in the business of making profitable investments, recouping capital and redeploying capital. There's no better way to do that than to sell an investment outright," says Doug Baird, co-head of US Equity Capital Markets for Deutsche Bank Securities. From the perspective of a small company readying itself to go public, getting acquired also avoids an after-market expense: The cost of complying with the Sarbanes-Oxley Act, which requires public companies to audit their internal controls. "There are some companies who don't want to go out and become Sarbanes-Oxley compliant due to the added time, expense and managerial implications," says Daniel P. Cummings, co-head of equity capital markets in the Americas for Merrill Lynch & Co."

they choose their optimal exit strategies and hence, it will not be the case that firms are simply randomly assigned to IPOs or acquisitions as their exit choices. Bayar and Chemmanur (2005) predict that the average valuation of firms going public will be greater than the average value of firms that are acquired. This is because in their setting firms choosing IPO, consist of a mix of higher and lower type firms, while only lower type firms are acquired. Hence, the intrinsic value of firms going public will be greater, and moreover, a larger proportion of firms choosing IPO do so during periods of higher IPO market valuations.

Therefore, testing for the existence of an IPO valuation premium requires controlling for various factors affecting a firm's choice between IPOs and acquisitions which I mentioned above in Section 2.1. I measure the propensity to go public for each firm in my sample using the factors discussed under hypotheses **H1** to **H7** above and then match each acquired firm with an IPO firm by the propensity to go public, industry, year, and VC backing in order to compare the valuations of IPOs and acquisitions and thus to test for the existence of an IPO valuation premium. The above arguments from Bayar and Chemmanur (2005) lead to the following hypothesis: Controlling for industry, time of transaction, and other characteristics affecting the choice of a firm between IPOs and acquisitions, there exists no IPO valuation premium, i.e., the valuation at which an acquired firm could have gone public is not higher than its acquisition value (**H8A**).

The valuation at which an acquired firm could have gone public in an IPO could be higher than its acquisition value even after controlling for its propensity to go public and matching it with a similar IPO firm. However, Bayar and Chemmanur (2005) point out that even when IPO valuations are higher, the long run expected payoff to entrepreneurs and venture capitalists may be higher in an acquisition. Insiders of less viable (type L) firms know that their current high IPO valuations (arising from pooling with type H firms) may not be sustained in the long run. Moreover, entrepreneurs and VCs are able to liquidate only a small fraction of their equity holdings in the IPO, whereas they are able to liquidate almost their entire

equity position in an acquisition.⁸ Therefore, insiders choosing between an IPO and an acquisition will actually compare the acquisition value of their firm not to its IPO valuation, but to the weighted average of the IPO value and its (potentially lower) long run stock market value where the weight on the IPO value is the fraction of equity insiders liquidate in the IPO. Thus, this second explanation of the IPO valuation premium puzzle has the following testable implication: Even if a firm's IPO valuation is truly higher, the acquisition value of a private firm will be higher than the weighted average of its current IPO value and long run (three years post-IPO) value, where the weight on the long run value is the fraction of equity retained by firm insiders subsequent to the IPO (**H8B**).⁹

3. Data and Variables

3.1 Data and Sample Selection

The data used in this study came from several databases. The list of IPO firms and acquired firms were collected from the Securities Data Company (SDC) databases on U.S. Global New Issues and U.S. Mergers & Acquisitions respectively. A large number of the private firms that are acquired do not have adequate financial data in the SDC database. Financial data on such private companies was hand-collected from SEC's EDGAR database and from the SEC filings in Thomson Research database. Since SEC EDGAR began keeping electronic filings for acquired companies in 1995, the issue dates for IPOs and the announcement dates for acquisitions were restricted to the period between 1995 and 2004.

In common with many other studies on IPOs, I eliminated financial institutions (SIC codes between 6000 and 6999) and regulated utility offerings, as well as very small issues with an offer price below \$5. In addition, the IPO should issue ordinary common shares and should not be a unit offering, closed-end fund, real estate investment trust (REIT), or a foreign issue. I also exclude spin-offs, limited partnerships and previous leveraged buyouts. Moreover, the IPO firms must be listed on the NYSE, AMEX, or

⁸ As shown Leland and Pyle (1977), if insiders sell a larger fraction of equity in their IPO relative to that required to satisfy their liquidity demands, IPO market investors will infer that the firm is of type L and value the firm accordingly.

⁹ The fraction of equity retained is assumed to be 1 minus the sum of the fraction of equity sold by insiders in the secondary offering (to satisfy their liquidity demands) and the fraction of equity issued to outsiders in order to raise external financing for the firm.

NASDAQ and the issuing firm must be present on the Compustat annual industrial database at least for the fiscal year prior to the offering, as well as on the University of Chicago Center for Research in Security Prices (CRSP) database within three months from the issue date.

There are 1980 IPOs from 1995 to 2004 which satisfy these criteria and form the basic sample of IPOs. Information on stock prices, returns, and number of outstanding shares necessary to analyze short run and long run firm valuation was obtained from CRSP, while the accounting information necessary to study firms' operating performance up to three years prior to the IPO, firm valuation at the time of the IPO, and to calculate various financial ratios was obtained from Compustat. I also used the SDC VentureXpert database in addition to the venture flag from the SDC database to distinguish between VC backed and non-VC backed IPOs. Out of the 1980 IPOs in my sample, there is financial data for 1038 IPOs with at least two fiscal years of financial data prior to the IPO for which I could compute pre-exit growth measures (e.g., sales growth, growth in capital expenditures, etc.) to be used in univariate and multivariate empirical analyses.

The sample of acquisitions is collected from SDC U.S. Mergers & Acquisitions database. I include 100% acquisitions of US private firms by US public firms between 1995 and 2004. The acquiring firms must be listed on the NYSE, AMEX, or NASDAQ. Since SDC does not have enough financial data for a large number of private firms that were acquired, I use the SEC's EDGAR database to hand-collect financial data about private target firms. Securities regulations (regulation S-X, Rule 1-02(w)) require that public acquirers disclose financial information of their private target firms in their SEC filings (S4, S3, 8K, Proxy, Prospectus) if the acquisition has a material impact to the acquiring public firm (for example, acquisitions with a deal value more than 10% to 20% of the acquirer's total assets would satisfy this materiality requirement). Further, according to Regulation S-X, Rule 3-05 acquirers must disclose financial information on private targets if "securities are being registered to be offered to the security holders of the business to be acquired". From all the private firm acquisitions reported by SDC for the period 1995-2004, 1706 acquisitions satisfy these data requirements and have at least one year of financial data. Out of these 1706 acquisitions, I can compute pre-exit growth measures for 1286 of them

because of data availability.

Panel A of Table 1 presents the number of deals and summary statistics about the valuation of deals for both the IPO and the acquisition sample for the entire period 1995-2004 and for each separate year in this period. The frequency distribution of the number of deals over the sample period follows a similar pattern for both the IPOs and the acquisitions, with a peak in 1999 (336 IPOs versus 290 acquisitions) and a decrease thereafter. The frequency of the deals seems to pick up again in 2004. The deal value for an IPO is defined as the offering price multiplied by the number of shares outstanding and the deal value for an acquisition is equal to the total value of consideration paid by the acquirer, excluding fees and expenses. The median deal value of IPOs in the full sample is \$183 million whereas the median deal value of acquisitions is \$36 million. Thus, a typical IPO is approximately as 5 times large as a typical acquisition in my sample. Panel B of Table 1 also shows an industry breakdown of IPOs and acquisitions in the sample. One can note that the rankings of the top 20 industries of IPOs and acquisitions respectively at the two-digit SIC level are not exactly the same.

Table 2 reports the summary statistics for all the firm- and industry-specific variables I constructed for the samples of IPOs and acquisitions respectively. The accounting values reported belong to the fiscal year prior to the exit transaction. Using the book value of total assets as a measure of size, the median IPO firm is as 2.5 times large as the median acquired firm (\$21.51 million vs. \$8.49 million). IPOs have also larger sales revenues than acquisitions (\$21.60 million vs. \$12.89 million). At first blush, one can also notice that the median growth in sales, capital expenditures, and R&D expenditures are larger for IPO firms than for acquired firms over the three years prior to the transaction. Another obvious difference between the IPOs and the acquisitions in my sample is the venture capital backing prior to the exit. The percentage of IPOs backed by venture capital is 55.8% whereas only 25.3% of acquired firms are backed by venture capital.¹⁰

¹⁰ In Poulsen and Stegemoller (2006), the percentage of VC backing is 55.5% for IPOs versus 41.4% of acquisitions. The apparent difference between my sample and their sample in terms of VC backing for acquisitions can be explained by the fact that Poulsen and Stegemoller exclude acquisitions with a deal value less than \$50 million from their sample. In my sample, for

3.2 Measures of Firm Specific and Industry Specific Test Variables and Control Variables

In this subsection I discuss the construction and measurement of the various firm specific and industry specific test variables and control variables used in the univariate and multivariate econometric analyses reported in the next section of this paper.

First, I define three proxies of firm viability: 1) firm size measured by the log of total assets in the fiscal year prior to the transaction, 2) sales growth up to three years prior to an IPO or an acquisition, and 3) return on assets (ROA) defined as the ratio of earnings before interest, tax, depreciation and amortization (EBITDA) over total assets as of the year prior to the transaction. Second, I construct three measures of industry specific competition measures. Similar to Pagano et al. (1998), Brau, Francis, and Kohers (2003), and Chemmanur, Nandy, and He (2005), I used the Herfindahl index in order to measure the concentration of the industry in which a private firm operates. The Herfindahl index is calculated by summing up the square of the market share (in sales) of all firms within a particular industry (at the two-digit SIC level) at the year of the exit transaction, using sales data obtained from Compustat. The higher the Herfindahl index, the higher the industry concentration. To determine if there is a dominant firm in a private firm's industry, I define a "Big Player" dummy variable which is equal to 1 if there is a public firm with a market share more than 30% at the time of IPO/Acquisition in the same industry (two-digit SIC) as the private firm and zero otherwise.¹¹ Finally, as a third measure of industry competition and barrier to entry, I define a continuous test variable denoted by "Leader Market Share" which is defined as the market share of the leading public firm in the same industry as the private firm (two-digit SIC level), with the largest market share at the time of an IPO/Acquisition.

In order to measure cross sectional variation in private benefits of control across different industries, I construct an industry-wide dummy variable inspired by Rajan and Wulf (2006) who study perk

deals worth more than \$50 million, the percentage of VC backed IPOs is 58.7% and the percentage of VC backed acquisitions is 38.3%.

¹¹ As a robustness check, I define the threshold market share to be a big player as 20%, 25%, 35%, and 40%. The results remain qualitatively similar.

consumption by firm executives (CEOs and divisional managers) of a large sample of public firms.¹² Rajan and Wulf rank CEO perk consumption and CEO-Divisional Manager perk consumption differentials across different industries in their sample at the two-digit SIC level. I define my “private benefits” dummy variable to be equal to 1 if a private firm’s industry is among the top 5 CEO perk consumption industries of Rajan and Wulf (2006) and the CEO-Divisional Manager differential in the Rajan-Wulf perk consumption score is greater than 1. The CEO-Divisional Manager differentials in the Rajan-Wulf perk consumption measure how much a CEO values his or her perks as a unique privilege. The higher the consumption and the privilege of perks in a particular industry, the more incentives would the entrepreneur of a private firm have to take his firm public via an IPO in which case he will be more likely to remain in control of his firm than after an acquisition.

I use several firm- and industry-specific asymmetric information proxies. First, I define the *tangibility of assets* of a private firm by the ratio of net property & equipment to the book value of total assets as of the fiscal year preceding the IPO/Acquisition. The higher the tangibility of assets, the less would be the information asymmetry facing the firm. Second, I define a *market to book* ratio which is equal to the market value of the deal over the book value of total assets. This proxy would be positively associated with the asymmetric information about the private firm. Third, I also construct an industry-wide measure of information asymmetry using analysts’ forecasts from I/B/E/S. Similar to Christie (1987), Krishnaswamy and Subramaniam (1999), and Chemmanur, He, and Nandy (2005) I use the average industry analysts’ forecast error (“*mean error*”) at the two-digit SIC level as a proxy of asymmetric information. The size of the average analysts’ forecast error in an industry is expected to be positively correlated with the degree of information asymmetry in that industry.

I define the capital expenditure ratio (*CAPEX/TA*) as the private firm’s capital expenditures over the book value of its assets. This measure captures the capital intensity of firms. The venture capital backing of a private firm is measured by a dummy variable which is equal to 1 if the firm is backed by venture

¹² The types of perquisite consumption enjoyed by high level executives and analyzed in Rajan and Wulf (2006) include the use of company plane, chauffer service, and country club membership.

capital. Finally, the last test variable is the *Sarbanes-Oxley* dummy which is equal to 1 if the transaction date was after July 30, 2002.

The control variables used in the multivariate probit regression analyses include the lagged six month return of the value weighted CRSP market index, leverage defined as the ratio of long-term debt over the book value of total assets, R&D ratio defined as the ratio of the research and development expenses over the book value of assets and the year dummies.¹³

4. Empirical Analysis of the Choice of IPOs versus Acquisitions

In this section, I will first present my results on the private firms' choice between IPOs and acquisitions. The results of univariate tests on my test variables (hypothesis H1 to H6) will be followed by the multivariate probit regression analysis of the choice of IPOs versus acquisitions.

4.1 Univariate Tests

Table 3 reports the means and medians of the key test variables tested. The table also provides the p-value of two sample t-test for the difference in means, and Wilcoxon-Mann-Whitney test for evaluating the significance of the median difference between the test variables of the two sub-samples of IPOs and acquisitions respectively.

Hypothesis **H1** predicts that more established firms with business models already viable against product market competition are more likely to go public through an IPO rather than be acquired. Consistent with **H1**, I find that IPO firms are larger than acquired firms in terms of size defined by the book value of assets. The median IPO firm has total assets of \$21.51 million versus the median acquired firm with total assets of \$8.49 million. Another measure of firm viability is the pre-exit sales growth rate of the private up to 3 years prior to the exit transaction. Table 3 also reports that IPO firms have greater sales growth rates compared to firms that are acquired. Since there are many private firms which have

¹³ Brau, Francis and Kohers (2003) report that IPOs are more likely in hotter markets and acquisitions are more likely in more leveraged industries.

zero sales initially, I define the sales growth of a particular private firm as the change in sales from year -3 to year -1 divided by the average size of total assets over that period. Consistent with **H1**, I find that the median sales growth rate for the IPO firms in my sample is 33.1% versus the median sales growth rate of 22.4% for an acquisition, and the difference in medians is statistically significant. The univariate results on the difference of profitability between IPOs and acquisitions are mixed. Even though the mean ROA for IPO firms is less negative than the mean ROA for acquired firms (-0.215 vs. -0.353), the median ROA for acquisitions is significantly higher than the median IPO profitability (0.057 vs. 0.104). Poulsen and Stegemoller (2006) also find in their univariate tests that their sample of acquired firms is more profitable than the sample of IPOs in years -2 and -1. Overall, the univariate test results support the predictions of hypothesis **H1**.

To examine the predictions of hypothesis **H2** which predicts that the likelihood of IPOs relative to acquisitions will be smaller in more concentrated industries where there is already a dominant firm so that the benefits of being acquired by a larger, established firm are greater, I look at the univariate difference tests for three measures. The Wilcoxon signed rank test statistics for differences in distribution show that acquired private firms are in more concentrated industries with a higher Herfindahl index and are more likely to be in industries (at the two-digit SIC level) dominated by a big player. Moreover, the market share of the biggest player in the same industry as the private firm is larger for acquired firms than for IPO firms. Consistent with hypothesis **H3**, Table 3 also reports that the fraction of firms going public rather than being acquired is greater in industries characterized by greater private benefits of control.

Hypothesis **H4** predicts that IPO firms face a greater extent of asymmetric information. Consistent with **H4**, Table 3 reports that IPO firms have higher market to book ratios, have less tangible assets as a fraction of total assets, and are in industries with higher mean analyst forecast error. Finally, the results of the univariate tests reported in Table 3 also show that fraction of VC backed firms going public rather than being acquired is significantly higher and the median ratio of capital expenditures to assets is significantly higher for firms going public via an IPO, supporting the implications of hypotheses **H5** and **H6** respectively. According to the results of univariate tests, I also find that the likelihood of an IPO

versus an acquisition is positively correlated with the lagged six month return of the CRSP value-weighted market index which confirms the earlier results of Brau, Francis, and Kohers (2003) and is consistent with the prediction of Bayar and Chemmanur (2005) that IPOs are more likely in better market conditions. The univariate tests for other control variables show that a larger fraction of acquisitions in my sample took place after the passage of the Sarbanes Oxley Act (**H7**) and the leverage ratios of acquired firms are significantly higher than those of IPO firms.

In summary, the results of the univariate tests show that the data strongly support the predictions of Bayar and Chemmanur (2005). In the next subsection, I examine whether these results hold in a multivariate framework as well.

4.2 Multivariate Tests: Maximum Likelihood Probit Regressions

In this subsection, I analyze the determinants of the choice between IPOs and acquisitions integrating all the test and control variables in a multivariate probit regression framework. On the basis of the hypotheses developed in Section 2.1, the likelihood of an IPO over an acquisition is estimated using the following probit regression on a pooled cross section data set covering both IPOs and acquisitions:

$$\begin{aligned}
 Pr(IPO_i = 1) = F & (\beta_1 SIZE_i + \beta_2 SALESNGTH_i + \beta_3 ROA_i \\
 & + \beta_4 HERFINDEX_i + \beta_5 PRIVBEN_i + \beta_6 MB_i + \beta_7 TANG_i \\
 & + \beta_8 FOREERR_i + \beta_9 VC_i + \beta_{10} CAPEXTA_i + \beta_{11} CRSP_i + \beta_{12} SOX_i \\
 & + \beta_{13} R\&D_i + \beta_{14} LEVERAGE_i + \varepsilon_{it})
 \end{aligned} \tag{1}$$

Individual firms are indexed by i , and t represents the year of the IPO or the acquisition. IPO_i is a dummy variable which is equal to 1 if the firm i goes public, or to 0 if the firm is acquired by a public company at time t . $F(\cdot)$ is the cumulative distribution function of a standard normal variable.

Table 4 reports the maximum likelihood estimates of the various specifications of the probit model in (2). From Regression 4 which includes all the test variables, we see that almost all of the test variables are significant and have signs consistent with the hypotheses described earlier. Regression 3 includes all

firms, but due to the data unavailability for some firms, the variable Sales Growth is excluded. Consistent with **H1**, Regression 4 in Table 4 reports that two proxies for firm viability, firm size and sales growth, are all positively associated with the probability of an IPO versus an acquisition. The coefficient on ROA (EBITDA/Total Assets) is insignificant in all specifications. Overall, these results indicate that larger firms and firms with higher pre-exit sales growth are more likely to choose an IPO over an acquisition and most likely these kinds of firms will be more viable against product market competition as stand-alone firms.

Consistent with **H2**, Table 4 also reports that firms in less concentrated industries which are not dominated by a “big player” are more likely to choose an IPO over an acquisition. In Regressions 3 and 4, we see that the Herfindahl index is significantly and negatively associated with the likelihood of an IPO versus an acquisition with a p-value less than 0.03. In Regressions 1 and 2, I omit the industry-based private benefits dummy variable due to its potential industry interaction with the Herfindahl index, but we see that the Herfindahl index, a measure of industry concentration, still remains statistically significant with a negative coefficient estimate in both specifications. As a robustness check, I replace the Herfindahl index variable with the “big player” dummy and the “leader market share” variable. We see in regressions 5, 6, and 9 that the big player dummy has a negative and significant coefficient. In unreported results, where we use other cut-off points for the definition of “big player”, the results do not change. In regressions 12-15 of Table 4, the continuous independent variable “Leader Market Share” has also always significant and negative coefficient estimates, strongly supporting the prediction that IPOs tend to be in less concentrated industries where product market competition is not dominated by “big player” public firms.

The coefficient of the “private benefits” dummy has a positive sign and is highly significant in almost all specifications. This supports the hypothesis **H3** predicting that firms in industries characterized by greater private benefits of control are more likely to choose an IPO over an acquisition.

The next group of independent variables relates to the hypothesis **H4** about asymmetric information. The coefficient on the ratio of tangible assets to total assets is negative and significant in all specifications

at the 1% level. Thus, there is a strong negative association between the tangibility of the assets of a private firm and its probability of going public. The market/book ratio has always a positive sign in Table 4 and it is highly significant at 1% level in all specifications in which the sales growth variable is excluded and the number of available observations is therefore larger. In other specifications where the sales growth variable is included, it has still a positive sign but the statistical significance is reduced to a level of 10%. This may be due to the fact that market to book ratio is a proxy for both asymmetric information about the firm as well as its growth opportunities as a viable firm. Similar to the market/book ratio, the coefficient on the average industry analysts' forecast error has a positive sign in all specifications and it is statistically significant in specifications where I include all observations of the sample. Overall, the results of the probit regressions are consistent with the prediction that firms facing greater information asymmetry: with less tangible assets as a fraction of total assets, in industries with higher average analyst forecast error, and with greater market/book ratios, are more likely choose an IPO over an acquisition.¹⁴

The positive and statistically significant coefficient on the venture capital backing in all specifications (at 1% level) gives further support to hypothesis **H6** which postulates that venture backed firms are more likely to choose an IPO over an acquisition compared to non-venture backed firms. Similarly, the results of the multivariate probit analysis also suggest that more capital-intensive firms are more likely to go public rather than be acquired (**H5**), since the coefficient on the capital expenditure ratio (*CAPEXTA*) is positive and significant in all specifications.

Finally, the results in Table 4 show that the likelihood of an IPO over an acquisition is positively associated with the lagged six month return of the value weighted CRSP market index at 1% level. This result is consistent with both the empirical evidence of Brau, Francis, and Kohers and the theoretical model of Bayar and Chemmanur (2005). The coefficient on the Sarbanes Oxley dummy is negative and

¹⁴ As a robustness check, I exclude the market to book ratio in regressions 10, 11, 14, and 15 to see whether the results on other coefficients of interest change or not. The reason for that is that the market to book ratio is a valuation ratio and therefore, it can be correlated with unobservable factors which might affect the choice between IPOs and acquisitions as well. One can see that excluding or including the market to book ratio doesn't affect the significance, sign or the magnitude of other coefficients.

significant at 1% level in all specifications which include all firms in my sample. In specifications 7, 8, and 9, I exclude the year dummies because they could interfere with the effect of the Sarbanes Oxley dummy which is itself an aggregated year dummy. In these regressions, we see that the Sarbanes Oxley dummy is negative and mostly statistically significant suggesting that the likelihood of an acquisition over an IPO has increased after the passage of Sarbanes-Oxley in July 30, 2002. The coefficient on the control variable leverage is negative but insignificant in most of the specifications. Furthermore, the R&D expenditures ratio is insignificant and the direction of its effect is not obvious.

In summary, the results of the multivariate probit analysis in Table 4 show that the empirical evidence on the choice of IPOs versus acquisitions is broadly consistent with the hypotheses in Section 2.1 following from the theory of Bayar and Chemmanur (2005). As I mentioned above, this is the first paper in the literature analyzing the new testable implications of the above theory on the choice of IPOs versus acquisitions. I find that the proxies for the viability of the firm against product market competition, measures of asymmetric information between firm insiders and investors, the extent of private benefits of control in the firm's industry, the capital intensity of the firm and venture capital backing have a very significant impact on the exit choice between IPOs and acquisitions.

One potential concern about the empirical analysis of the choice between IPOs and acquisitions is about the sample selection of acquired firms specifically. Ideally, one would like to include into the sample studied only those acquisitions in which the acquired private firm could realistically face a choice between going public through an IPO and getting acquired by another company. One can argue that the flotation costs of an IPO (fixed costs of an IPO such as road-shows, underwriting spread, other investment banking and auditing fees etc.) can be prohibitively expensive for many small firms and moreover, these firms cannot meet the listing requirements set by public stock exchanges and other requirements by SEC. If that is the case, for a significantly large number of acquired firms the only successful exit choice would be an acquisition by another company.

This concern is addressed in this paper in two ways. First, I obtain from the multivariate analysis above the predicted probability that a private firm chooses to go public rather than be acquired. We can

expect that for those firms for which an IPO is not a feasible exit choice, our model would predict that their probability of going public will be very low. Or in other words, the propensity to choose an IPO over an acquisition for these firms will be very low. Second, similar to Poulsen and Stegemoller (2006), I exclude from my sample acquisitions and IPOs with a deal value less than \$50 million and carry out the empirical analysis without these smaller deals as well. The rationale for this is that larger private firm acquisitions could be more comparable to IPOs (recall from Table 1 that the median deal value for an IPO is \$183 million versus the median deal value of \$36 million for an acquisition). Hence, we can expect that the target firms of these larger acquisition deals could indeed choose between an IPO and an acquisition.

Table 5 reports the results of the probit regressions where I include only deals worth more than \$50 million. Clearly, the signs and the statistical significances of the test variables of interest largely remain as predicted and the results continue to support the hypotheses developed above. There is still strong evidence that more viable firms (larger firms and firms which have higher pre-exit sales growth) are more likely to choose an IPO over an acquisition consistent with **H1** even if we exclude the smaller deals. Moreover, once again we find that firms in industries characterized by greater private benefits of control (**H3**), firms facing greater information asymmetry (**H4**) and firms backed by venture capital (**H6**) are more likely to choose an IPO over an acquisition. The coefficients of the test variables related to hypotheses **H2** and **H5** (Herfindahl index and CAPEX/TA) are still in the directions predicted; however, it seems that their statistical significance is reduced once we exclude the smaller deals. In the next section, I examine the IPO valuation premium puzzle with the full sample as well as with the sample of deals valued more than the \$50 million threshold.

5. Empirical Analysis of the IPO Valuation Premium Puzzle

In this section, I will first describe the propensity score matching methodology which will be used to compare the valuations of acquired firms and the valuations they could have obtained in an IPO. In the following section, I will present the results of the analysis of the IPO valuation premium puzzle.

5.1 Propensity Score Matching Methodology

In the empirical analysis of IPO valuation premium puzzle, the first step is to estimate for each acquired firm the IPO valuation at which it could have gone public. This is the case because when we compare the valuations of IPOs and acquisitions, we need to account for self-selection by private firms into their exit choices between the two alternatives. For this purpose, I use a propensity score based comparable firm approach where I value each acquired private firm using the price multiples of a similar private firm from the same industry which had an IPO at the same year the acquired firm was taken over and had the same VC backing status as the acquired firm. I find a similar IPO firm match for the acquired firm being valued along several dimensions which include all observable firm-specific, industry-specific and macroeconomic characteristics that are hypothesized above to determine the likelihood of an IPO versus an acquisition. These observable characteristics are motivated by the theory of Bayar and Chemmanur (2005) and they proxy for the viability of the firm in product market competition, the competitive environment of its industry, the asymmetric information facing the firm, the extent of private benefits of control in the firm's industry, the capital intensity of the firm, venture capital backing, and other control variables. Using these factors which are expected to determine a firm's choice between IPOs and acquisitions, it is possible to estimate for each private firm the propensity to go public through an IPO and match each acquired firm with an appropriate IPO firm with a similar propensity to go public from the same industry, same VC backing status and year of exit.

The propensity score matching approach has two major advantages over a simple matching method. First, it is possible to match an acquired firm with a similar IPO firm along as many dimensions as possible. The propensity score can aggregate and summarize the information from multiple matching characteristics which are hypothesized to affect the choice between IPOs and acquisitions. Thus, one can avoid the "curse of dimensionality" problem which plagues simple matching methods. Second, there is a growing theoretical and empirical literature in econometrics about the estimation of treatment effects in the presence of self-selection which proposes the application of the propensity score matching approach to take care of the self-selection problem in observational studies. I, therefore, make use of the propensity

score algorithm proposed by Dehejia and Wahba (1999, 2001) which is based on Rosenbaum and Rubin's (1983) propensity score theorem. This technique allows one to accommodate a large number of matching characteristics and has proven to be rather successful in producing accurate treatment effect estimates in a non-experimental setting where the event group (treatment group) significantly differs from the population of the potential matching subjects (control group). It also eliminates possible source of bias due to systematic differences between treatment and control subjects (in our setting, an IPO firm that we select as a "comparable firm" and an acquired private firm which we wish to value).^{15,16}

The propensity score approach allows me to correct for differences in sales growth and/or other operating performance and industry characteristics between an acquired firm being valued and a candidate matching IPO company in a multiple factor framework. The set of firm- and industry-specific factors used are log of total assets, sales growth, EBITDA/Total Assets, private benefits industry dummy, market to book ratio, tangibility of assets, average industry analysts' forecast error, CAPEX/Total Assets, VC backing dummy, Sarbanes Oxley dummy and the control variables described above.

I use the "nearest-match" version of the propensity score matching algorithm that works as follows. Let $X_{i,j}$ be a vector of independent characteristics observed for company i (acquired firms as well as IPO firms) in fiscal year j prior to the issue. Let $D_{i,j}$ be a dummy that is equal to 1 for an IPO firm and 0 for an acquired firm. I estimate the propensity score probit function as $P_{i,j} = P(D_{i,j} = 1 | X_{i,j})$, $i = 1, \dots, N_j$, for each fiscal year (j takes values from 1994 to 2003). With the estimated propensity score values $P_{i,j}$, I match each acquired firm to a single IPO company with the closest $P_{i,j}$ value, within the same industry and with the same VC backing status. I impose the industry restriction to avoid differences in operating risk characteristics between an IPO and its matching firm and thus obtain more economically meaningful

¹⁵ The propensity score method has already been used in the finance literature to pair-match companies based on a given set of characteristics. In particular, Villalonga (2002) use the propensity score method in her study of diversification discount to find the appropriate benchmark companies for diversifying firms. Hillion and Vermaelen (2001) apply propensity score matching in their study of the operating performance of companies issuing death spiral convertibles.

¹⁶ In my setting, the treatment group is the sample of IPO firms, and the control group is the sample of acquisitions. One can think of the treatment to a private firm as going public through an IPO. My objective is to estimate the average treatment effect on the untreated, or the control group of acquisitions. If the average treatment effect on the control group is positively significant, it would mean that there exists an IPO valuation premium.

matches. Similarly, I impose the absolute restriction that the matched firms have the same VC backing status.¹⁷ Once the matching IPO firm is obtained, I use the sales price multiples approach to estimate the IPO valuation for each acquired firm as follows:

$$\hat{V}_{ipo} = Sales_{acqui} \frac{V_{match}}{Sales_{match}}, \quad (2)$$

where \hat{V}_{ipo} is the estimated IPO value of the matched acquired company and V_{match} is the IPO valuation of the matching IPO firm defined as the IPO offer price multiplied by the number of shares outstanding. Thus, I multiply the sales of the acquiring firm $Sales_{acqui}$ as of the fiscal year prior to the acquisition by the *Deal Value/Sales* multiple of the matching IPO firm and the result yields the estimated IPO valuation of the acquired firm. In order to be able to employ the propensity score based comparable firm valuation approach, I include private firms with positive sales only. Moreover, I exclude those firms for which the sales growth measure is not available because sales growth is potentially a very significant factor affecting a private firm's exit choice. The IPO valuation of an acquired firm could also be estimated by using *Deal Value/EBITDA* and *Deal Value/Book Value of Equity* multiples. However, for many private firms the measures of EBITDA and the book value of equity are negative. Therefore, in order not to introduce estimation bias due to massive sample truncation, I report the valuation premium results only by using the price/sales multiple as the main valuation multiple.

5.2 Empirical Tests and Results of the IPO Valuation Premium Puzzle

In this section, I examine the IPO valuation premium puzzle using the propensity score based comparable firm method described above. The first hypothesis I test is **H8A**. Recall that this hypothesis postulates that controlling for industry, time of transaction, and other firm- and industry-specific characteristics affecting the choice between IPOs and acquisitions, there exists no IPO valuation premium, i.e., the valuation at which an acquired firm could have gone public is not higher than its

¹⁷ Thus the VC backing dummy serves both as a determinant of the IPO propensity score and as an absolute matching criterion.

acquisition value. In section 5.1, I showed which of those factors predicted by Bayar and Chemmanur (2005) have a significant impact on the choice of IPOs versus acquisitions. Therefore, I use the probit regression specification 4 from Table 4 to estimate for each firm the propensity to go public p . The propensity scores are obtained from the predicted probability of going public in regression 4. Since sales growth is an important matching dimension determining the choice between IPOs and acquisitions, I prefer to use regression specification 4 and therefore I eliminate those firms from the sample for which data about sales growth is not available (1038 IPOs and 1286 acquisitions remain in the sample). Furthermore, since I use the deal value/sales multiple to calculate the imputed IPO value of an acquired firm, 80 firms which have zero sales in the fiscal year prior to the IPO or the acquisition cannot be matched. The number of ultimately matched acquisition-IPO pairs is 951 since I require that an acquired firm is matched with an IPO from the same industry and year, and same VC backing status only.

Before applying the propensity score matching methodology to match acquisitions with similar IPOs and then compare their valuations, I first reestablish the empirical evidence that the population of IPOs on average have higher valuations than the population of acquired private firms. Table 6 reports the summary statistics for the valuations and valuation multiples of IPOs and acquisitions and the results of the difference tests. From Panel A, which reports the results for the entire sample of firms, we see that the mean and median valuations of IPOs are significantly higher than the valuations of acquisitions in the entire sample as well as in the sub-sample of VC backed firms and in the sub-sample of non-VC backed firms. In Panel B, I use only the sample of matched pairs of acquisitions and IPOs, but the difference tests are done as if the acquisitions and the IPOs were not matched, and as if they are coming from two independent samples in order to compare the two populations. The results of the two sample difference tests in Panel B of Table 6 also show that the valuations of IPOs are significantly higher than those of acquired firms in the matched sample of firms.

However, in order to test Hypothesis **H7A** which claims that there is no IPO valuation premium after controlling for various observable factors, one must compare acquired firms' valuations with the valuations of their paired IPO firms which are matched by the propensity score matching algorithm. Table

7 reports the comparison of the deal value/sales multiples of acquired firms and their matching IPOs. Panel A shows the results for the entire matched sample. Clearly, the median deal value/sales ratio of the matched IPOs is higher than the median ratio of the acquired firms (6.50 vs. 2.69). More interestingly, when we look at sub-samples of VC backed acquisitions and non-VC backed acquisitions we notice where the valuation premium is coming from. In Panel A, the p-value of the paired sample Wilcoxon signed rank test is 0.14 for VC backed acquisitions and their matched IPOs (13.62 for matched IPOs vs. 7.08 for acquired firms) whereas the p-value of the signed rank test for the non-VC backed acquisitions and their matched IPOs is 0.00 (3.84 for matched IPOs vs. 1.83 for acquired firms). This suggests that the IPO valuation premium is larger for non-VC backed private target firms. The reported results in Table 8 further confirm the results reported in Panel A of Table 7.

Table 8 presents the comparison of acquired firms' deal valuations and their imputed IPO valuations \hat{V}_{ipo} calculated from (1). For each acquired firm, its short run IPO valuation premium is defined as follows:

$$Premium = \log(\hat{V}_{ipo} / V_{acqui}), \quad (3)$$

where V_{acqui} is the deal value of the acquisition and \log is the natural logarithm function.¹⁸ This is called the “short run” premium because the implicit assumption is that the insiders of the firm can sell all of their stakes in an IPO firm for the offer price just at the time of the initial public offering. Table 8 reports that the median short run IPO valuation premium for all acquired firms is 62.78% and it is highly significant at the 1% level. Similarly, the median short run IPO valuation premium for all non-VC backed acquired firms is reported to be 73.82% and one can clearly reject the null hypothesis. However, for the VC backed acquired firms, the median premium is only 34.22%, but still significantly different from zero.

To further address the concern that the target firms of very small acquisitions could not have been eligible to go public at all in the first place, I also analyze the IPO valuation premia of acquisitions worth

¹⁸ To calculate the valuation premia I use the log returns in order to reduce the effects of outlying observations due to the positive skewness in firm valuations.

more than \$50 million exclusively. Panel B of Table 7 reports the deal value/sales multiples of acquisitions with a deal value more than \$50 million. Similarly, Panel B of Table 8 reports the comparison of acquired firms' deal valuations and their imputed IPO valuations where the acquired firms were purchased for more than \$50 million.

Panel B of Table 7 shows that the difference in distributions of the deal value/sales multiple is not statistically significant for all acquisitions worth more than \$50 million and their matched IPOs. Compared with the overall matched sample, the median valuation multiple of acquisitions increases from 2.69 to 4.96 whereas the median valuation multiple of the matched IPOs increases from 6.50 to only 6.99. Furthermore, the difference in valuation multiples is not statistically significant either for non-VC backed acquisitions (3.16 for acquisitions vs. 3.63 for their matched IPOs).

Another interesting observation about larger private firms is that the short run IPO valuation premia for these deals is much smaller than the ones reported for the entire matched sample. Panel B of Table 8 reports that the median short run IPO valuation premium for all acquired firms with a deal value greater than \$50 million is 14.00% (down from 62.78%) and it is not statistically significant from 0. The median premium for non-VC backed firms is 20.70% (down from 73.82%) and it is not significant either. The median valuation premium for VC backed acquisitions is -3.77% (down from 34.22%) which suggests that for larger VC backed acquisitions the IPO value that the insiders could have realized was actually lower than the value they got from the acquisition. However, this median IPO valuation "discount" is not statistically different from zero (p-value is 0.97).

In summary, the results of the empirical analysis of the IPO valuation premium in the short run suggest that after controlling for the determinants of the choice between IPOs and acquisitions and matching acquired firms with comparable IPO firms, the IPO valuation premium essentially vanishes for larger private firms with a deal value above \$50 million regardless of their VC backing. Moreover, for the overall sample, the magnitude of the short run premia is found to be much smaller for VC backed acquired firms.

In Section 2.2, I pointed out that even after controlling for factors that determine a private firm's choice between IPOs and acquisitions, one can reject the null hypothesis of **H7A** that there is no IPO valuation premium. Thus, the valuation at which an acquired firm could have gone public could be higher than its acquisition value even after controlling its propensity to go public and matching it with a similar IPO firm. Recall the second explanation of Bayar and Chemmanur (2005) for the IPO valuation premium puzzle. Their theoretical insight is that even if a firm's IPO valuation is truly higher, the acquisition value of a private firm is higher than the weighted average of its current IPO value and long run (three years post-IPO) value, where the weight on the IPO value is the fraction of equity liquidated by firm insiders (**H7B**). Since, entrepreneurs and VCs are able to liquidate only a small fraction of their equity holdings in the IPO, whereas they are able to liquidate almost their entire equity position in an acquisition; Bayar and Chemmanur (2005) argue that this is the correct comparison of expected payoffs. Moreover, the empirical evidence presented above rejects hypothesis H7A for the sample of small acquired firms. Therefore, in the remainder of this section, I present the results of testing hypothesis **H7B**.

Table 9 presents the comparison of acquired firms' deal valuations and their imputed *long run* IPO valuations \hat{V}_{ipo} calculated from (1). Now, in (1) V_{match} is calculated as follows:

$$V_{match} = \alpha V_{ipo,0} + (1 - \alpha) V_{ipo,3}, \quad (4)$$

where α is the fraction of shares sold in the IPO by firm insiders. $V_{ipo,0}$ denotes the IPO valuation of the matched firm and $V_{ipo,3}$ stands for the stock market valuation of the matched IPO firm three years after the IPO. Panel A of Table 9 reports that the median long run IPO valuation premium for all acquired firms is 53.93% (down from 62.78% in the short run). The median long run premium for non-VC backed acquired firms is 65.89% (down from 73.82% in the short run) and still significant at a level of 1%. Finally, the median log-run premium for VC backed acquisitions is -3.06% and not significantly different from zero (down from a significant 34.22% short run premium). Table 10 reports the test results of the difference between the short run premia and long run premia. The results reported in Panel A of Table 10 show that the long run IPO valuation premia are smaller than the short run PO valuation premia (about 8.9%) and

the differences are statistically significant. In particular, the difference in the median valuation premia is particularly large for VC backed acquisitions (37.27%).

The results presented in Panel B of Table 9 are strongly consistent with my earlier findings in Panel B of Table 8 and the second theoretical prediction of Bayar and Chemmanur with regard to the IPO valuation premium puzzle (**H7B**). Panel B of Table 9 reports the results of the analysis of long run IPO valuation premia for acquired firms with a deal value greater than \$50 million. We see that the median long run IPO premium for all large private firm targets is -10.17% (down from 14.00% in the short run) and it is statistically not different from zero. Similarly, the median long run IPO premium for non-VC backed large private firm targets is 6.17% (down from 20.70% in the short run) and it is not significantly different from zero as well. Last but not least, the median long run IPO premium for VC backed large private firm targets is -48.87% (down from -3.77% in the short run), but still not statistically different from zero. This suggests that the acquisition value of a large private firm backed by venture capitalists is much higher than the weighted average of its current imputed IPO value and long run (three years post-IPO) stock market value. The results in Panel B of Table 10 further confirm this suggestion by showing that the long-run premia for large acquisitions are significantly smaller than their short run premia both statistically and economically.

In summary, the empirical analysis of the IPO valuation premium puzzle shows that there exists no IPO premium for large acquisitions after controlling for various firm- and industry-specific factors affecting a firm's choice between IPOs and acquisitions consistent with hypothesis **H7A**. Moreover, consistent with hypothesis **H7B**, the IPO valuation premium vanishes for all VC backed firms after controlling for the long run component of the expected payoff to firm insiders from an IPO exit and long run premia are much smaller than short run premia.

6. Conclusion

Using a hand-collected data set of private firm acquisitions and IPOs, this paper presents an empirical analysis of a private firm's choice between IPOs and acquisitions, and develops the first empirical

analysis in the literature of the “IPO valuation premium puzzle” (where many private firms seem to choose to be acquired rather than to go public at higher valuations). In the first part of the paper, I test several new hypotheses regarding a firm's choice between IPOs and acquisitions and develop several new empirical findings consistent with the theoretical predictions of Bayar and Chemmanur (2005). First, firms operating in less concentrated industries characterized by the absence of a dominant market player, and therefore more viable against product market competition, are more likely to go public rather than be acquired. Second, firms facing a greater extent of information asymmetry in the equity market, which are more capital intensive, and those operating in industries characterized by greater private benefits of control, are more likely to go public rather than to be acquired. Third, the likelihood of an IPO over an acquisition is greater for venture backed firms and those characterized by higher pre-exit sales growth. Finally, I document that the passage of the Sarbanes-Oxley Act has motivated a larger proportion of firms to favor acquisitions over IPOs. In the second part of the paper, my preliminary analysis of private firm valuations in IPOs and acquisitions indicates that IPO valuation premia essentially disappear after controlling for various factors affecting a firm’s choice between IPOs and acquisitions, in particular, for larger acquired firms. Moreover, after controlling for the long run component of the expected payoff to firm insiders from an IPO exit (as suggested by Bayar and Chemmanur (2005)), I find that the IPO valuation premium vanishes for all VC backed firms and substantially shrinks for all acquired firms.

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Table 1: Deal Values of IPOs and Acquisitions from 1995 through 2004

The following table describes the size and number of deals in a given year. In Panel A, IPOs must be of US firms, must be listed on NYSE, AMEX or NASDAQ, must be an original IPO, must not be a spin-off and must be an offering of common stock. Acquisitions must have a disclosed dollar value, must be a private US firm, the acquirer must be traded on the NYSE, AMEX, or NASDAQ, and the acquirer must acquire 100% of the target. In addition, financial and utility firms are eliminated from both samples. The last row provides the relevant statistics for all acquisitions and IPOs over the sample period from 1995 to 2004. Deal value is defined as the total value of consideration paid by the acquirer, excluding fees and expenses. Deal value for an IPO is defined as the offering price multiplied by the number of shares outstanding. The average, median and total columns are reported in millions of dollars. Panel B reports the top 20 industries (two-digit SIC code level) for the samples of IPO and acquisition firms respectively.

Panel A: Summary Statistics of the Deal Values of IPOs and Acquisitions

Year	IPOs				Acquisitions			
	N	Mean	Median	Sum	N	Mean	Median	Sum
1995	251	\$185.941	\$106.579	\$46,671.291	93	\$69.588	\$38.800	\$6,471.686
1996	419	\$170.366	\$107.514	\$71,383.360	156	\$93.243	\$36.850	\$14,545.983
1997	280	\$244.602	\$109.508	\$68,488.467	254	\$90.360	\$22.000	\$22,951.458
1998	169	\$265.690	\$158.710	\$44,901.642	254	\$77.500	\$25.000	\$19,685.022
1999	336	\$705.947	\$294.306	\$237,198.330	290	\$150.019	\$40.084	\$43,505.600
2000	258	\$557.916	\$401.136	\$143,942.240	263	\$187.909	\$67.000	\$49,419.960
2001	49	\$481.868	\$342.160	\$23,611.514	96	\$95.542	\$36.987	\$9,172.002
2002	46	\$542.386	\$310.585	\$24,949.775	73	\$87.863	\$36.500	\$6,413.964
2003	46	\$463.081	\$310.660	\$21,301.742	90	\$99.842	\$51.268	\$8,985.792
2004	126	\$491.460	\$263.883	\$61,924.017	137	\$107.170	\$34.947	\$14,682.239
Total	1980	\$375.946	\$183.133	\$744,372.370	1706	\$114.791	\$36.027	\$195,833.710

Panel B: Industry Decomposition of IPOs and Acquisitions

IPOs			Acquisitions		
Industry	SIC Code	N	Industry	SIC Code	N
Business Services	73	697	Business Services	73	634
Electronic & other electric equipment	36	190	Electronic & other electric equipment	36	130
Chemicals and Allied Products	28	170	Engineering & Management Services	87	102
Instruments and Related Products	38	151	Instruments and Related Products	38	92
Communication	48	90	Communication	48	90
Industrial Machinery and Equipment	35	76	Chemicals and Allied Products	28	59
Engineering & Management Services	87	75	Wholesale Trade - Durable Goods	50	55
Health Services	80	59	Industrial Machinery and Equipment	35	54
Miscellaneous Retail	59	58	Health Services	80	53
Wholesale Trade - Durable Goods	50	38	Oil and Gas Extraction	13	36
Transportation Equipment	37	30	Miscellaneous Retail	59	30
Oil and Gas Extraction	13	29	Printing and Publishing	27	27
Eating and Drinking Places	58	26	Wholesale Trade - Nondurable Goods	51	25
Educational Services	82	19	Transportation Equipment	37	20
Food and Kindred Products	20	18	Fabricated Metal Products	34	19
Wholesale Trade - Nondurable Goods	51	15	Primary Metal Industries	33	18
Amusement & Recreation Services	79	15	Food and Kindred Products	20	18
Hotels and Other Lodging Places	70	14	Automotive Dealers & Service Stations	55	17
Printing and Publishing	27	13	Amusement & Recreation Services	79	16
Apparel and Other Textile Products	23	12	Misc. Manufacturing Industries	39	16

Table 2: Summary Statistics

This table reports the summary statistics for the sample s of IPOs and acquisitions from 1995 to 2004. All variables are measured as of the nearest fiscal year prior to the transaction except Sales Growth, Capex Growth, R&D Growth, which are measured from year -3 to -1. Total Assets is the book value of assets. For Market/Book the numerator is equal to the offer price multiplied by the number of shares outstanding for an IPO and is equal to the transaction value for an acquisition; the denominator is the book value of total assets. Sales Growth, Capex Growth, R&D Growth measure the firm's growth in sales revenues, capital expenditures, R&D expenditures over the previous three years respectively and they are available for only 2324 observations. Tangible Assets/TA is net property and equipment scaled by total assets. Capex/TA is capital expenditures scaled by total assets. Leverage is long-term debt plus short-term debt scaled by total assets. R&D/TA is R&D expenses scaled by total assets. ROA is EBITDA divided by total assets. VC backing is a dummy variable, which is equal to 1 if the firm was financed by venture capital. Private Benefits is a dummy variable that takes value 1 if the firm is in a high private value industry with a two-digit SIC code of 13, 28, 29, and 37. CRSP index return is the value weighted return of the CRSP market index in the 6 months prior to the transaction. Industry portfolio return is the return of an equally weighted portfolio of all public firms in the same two digit SIC industry as the firm. After Sarbanes Oxley is a dummy variable that is equal to 1 if the transaction took place after the enactment of the Sarbanes-Oxley Act on July 30, 2002. Herfindahl Index is equal to the value of the Herfindahl Index in the two-digit SIC industry level the firm belongs to at the time of the transaction. The higher the Herfindahl Index, the more concentrated the industry. Big Player is a dummy variable equal to 1 if there is another company in the firm's industry (two-digit SIC level) with a market share of more than 30 percent. Leader Market Share is the market share of the leading public firm in the same industry as the private firm (two-digit SIC level), with the largest market share at the time of an IPO/Acquisition. Mean Error is the two-digit SIC level mean of average analysts forecast errors across firms in the industry.

	IPOs				Acquisitions			
	N	Mean	Median	St. Dev	N	Mean	Median	St. Dev
Total Assets	1980	122.381	21.507	478.592	1706	41.968	8.489	170.057
Current Assets	1949	47.798	14.156	162.743	1706	549.461	5.331	22001.971
Cash	1980	13.200	3.702	44.407	1706	3.461	0.795	9.672
Tangible Assets	1980	37.803	2.856	179.481	1706	14.019	1.267	80.179
Current Liabilities	1950	33.498	7.786	136.383	1706	17.379	3.937	107.902
Short-term Debt	1980	7.776	0.788	63.075	1706	7.694	0.606	81.984
Long-term Debt	1980	51.250	1.290	246.341	1706	14.232	0.240	85.020
Total Liabilities	1978	97.782	11.856	417.509	1706	32.553	5.334	151.353
Preferred Stock	1980	20.616	4.326	44.172	1706	8.381	0.000	28.487
Sales	1980	138.927	21.596	662.284	1706	52.237	12.888	150.585
EBITDA	1980	10.995	1.007	62.727	1706	4.015	0.840	42.400
Operating Income	1980	4.641	0.216	40.674	1706	0.533	0.418	23.319
R&D	1980	4.754	1.207	20.304	1706	1.464	0.000	3.816
Capex	1980	10.330	1.317	80.192	1706	3.209	0.466	15.224
Sales Growth	1038	0.515	0.331	0.683	1286	0.437	0.224	1.012
ROA	1980	-0.215	0.057	0.819	1706	-0.353	0.104	3.008
Herfindahl Index	1980	0.057	0.044	0.054	1706	0.063	0.044	0.066
Big Player	1980	0.046	0	0.209	1706	0.072	0	0.259
Leader Market Share	1980	15.305	15.292	8.518	1706	16.475	15.642	9.520
Private Benefits	1980	0.116	0	0.320	1706	0.069	0	0.254
Market/Book	1980	22.164	6.651	108.247	1706	16.594	3.584	62.138
Tangible Assets/TA	1980	0.222	0.149	0.202	1706	0.248	0.170	0.257
Mean Error	1979	2.796	0.557	6.066	1704	1.922	0.507	5.018
Capex/TA	1980	0.096	0.062	0.109	1706	0.106	0.057	0.415
VC Backing	1980	0.558	1	0.497	1706	0.253	0	0.435
CRSP market return	1980	0.108	0.119	0.083	1706	0.086	0.106	0.104
Industry portfolio return	1980	0.150	0.138	0.168	1706	0.109	0.110	0.199
After Sarbanes Oxley	1980	0.091	0.000	0.288	1706	0.148	0.000	0.356
R&D/TA	1980	0.214	0.068	0.401	1706	0.297	0.000	0.833
Leverage	1980	0.354	0.218	0.611	1706	0.476	0.250	0.990
Preferred Stock/TA	1980	0.841	0.162	1.630	1706	0.907	0.000	2.500
Capex Growth	1038	0.040	0.020	0.130	1286	0.032	0.008	0.260
R&D Growth	1038	0.086	0.003	0.199	1286	0.109	0.000	0.523

Table 3: Univariate Tests

This table reports the results of the univariate tests on some of the test variables from the sample s of IPOs and acquisitions from 1995 to 2004. All variables are measured as of the nearest fiscal year prior to the transaction except Sales Growth, which is measured from year -3 to -1. Total Assets is the book value of assets. For Market/Book the numerator is the offer price multiplied by the number of shares outstanding for an IPO and is transaction value for an acquisition; the denominator is the value of assets from the balance sheet. Sales Growth measures the firm’s growth in sales revenues over the previous three years respectively and is available for only 2324 observations. Tangible Assets/TA is net property and equipment scaled by total assets. Capex/TA is capital expenditures scaled by total assets. Leverage is long-term debt plus short-term debt scaled by total assets. R&D/TA is R&D expenses scaled by total assets. ROA is EBITDA divided by total assets. VC backing is a dummy variable, which is equal to 1 if the firm was financed by venture capital. Private Benefits is a dummy variable that takes value 1 if the firm is in a high private value industry with a two-digit SIC code of 13, 28, 29, and 37. CRSP index return is the value weighted return of the CRSP market index in the 6 months prior to the transaction. Industry portfolio return is the return of an equally weighted portfolio of all public firms in the same two digit SIC industry as the firm. Herfindahl Index is equal to the value of the Herfindahl Index in the two-digit SIC industry level the firm belongs to at the time of the transaction. The higher the Herfindahl Index, the more concentrated the industry. Big Player is a dummy variable equal to 1 if there is another company in the firm’s industry (two-digit SIC level) with a market share of more than 30 percent. Leader Market Share is the market share of the leading public firm in the same industry as the private firm (two-digit SIC level), with the largest market share at the time of an IPO/Acquisition. Mean Error is the two-digit SIC level mean of average analysts forecast errors across firms in the industry. ***, **, * represent significance levels at the 1%, 5%, and 10% levels of the two sample t-tests for the difference in means and the Wilcoxon signed rank test for the difference in distributions for key test variables across the samples of IPOs and acquisitions, respectively.

	IPOs			Acquisitions			Difference in Means	Difference in Medians
	N	Mean	Median	N	Mean	Median		
Total Assets	1980	122.381	21.507	1706	41.968	8.489	80.414***	13.018***
Sales Growth	1038	0.515	0.331	1286	0.437	0.224	0.078*	0.107***
ROA	1980	-0.215	0.057	1706	-0.353	0.104	0.138*	-0.047***
Herfindahl Index	1980	0.057	0.044	1706	0.063	0.044	-0.005***	-0.000**
Big Player	1980	0.046	0	1706	0.072	0	-0.026***	-0***
Leader Market Share	1980	15.305	15.292	1706	16.475	15.642	-1.170***	-0.351***
Private Benefits	1980	0.116	0	1706	0.069	0	0.047***	+0***
Market/Book	1980	22.764	7.403	1706	16.594	3.584	6.170*	3.818***
Tangible Assets/TA	1980	0.222	0.149	1706	0.248	0.170	-0.026***	-0.022***
Mean Error	1979	2.796	0.557	1704	1.922	0.507	0.874***	0.051***
Capex/TA	1980	0.096	0.062	1706	0.106	0.057	-0.009	0.005***
VC Backing	1980	0.558	1	1706	0.253	0	0.305***	1.000***
CRSP market return	1980	0.108	0.119	1706	0.086	0.106	0.022***	0.014***
After Sarbanes Oxley	1980	0.091	0.000	1706	0.148	0.000	-0.057***	-0***
R&D/TA	1980	0.214	0.068	1706	0.297	0.000	-0.084***	0.068***
Leverage	1980	0.354	0.218	1706	0.476	0.250	-0.123***	-0.032**

Table 4: Probit Regressions on the choice of IPO vs. Acquisition

This table presents the effects of firm-specific, industry-specific and market-wide variables on a private firm's choice of exit mechanism. The dependent variable is equal to 0 if the observation is an acquisition and equal to 1 if it is an IPO. All of the independent variables are measured as of the nearest fiscal year prior to the transaction except Sales Growth, which is measured from year -3 to -1. Log (Assets) is log of the book value of assets. For Market/Book the numerator is the offer price multiplied by the number of shares outstanding for an IPO and is transaction value for an acquisition; the denominator is the value of assets from the balance sheet. Sales Growth measures the firm's growth in sales revenues over the previous three years and is available for only 2322 observations. Tangible Assets/TA is net property and equipment scaled by total assets. Capex/TA is capital expenditures scaled by total assets. Leverage is long-term debt plus short-term debt scaled by total assets. R&D/TA is R&D expenses scaled by total assets. ROA is EBITDA divided by total assets. VC backing is a dummy variable, which is equal to 1 if the firm was financed by venture capital. Private Benefits is a dummy variable that takes value 1 if the firm is in a high private value industry with a two-digit SIC code of 13, 28, 29, and 37. CRSP index return is the value weighted return of the CRSP market index in the 6 months prior to the transaction. After Sarbanes Oxley is a dummy variable that is equal to 1 if the transaction took place after the enactment of the Sarbanes-Oxley Act on July 30, 2002. Herfindahl Index is equal to the value of the Herfindahl Index in the two-digit SIC industry level the firm belongs to at the time of the transaction. The higher the Herfindahl Index, the more concentrated the industry. Big Player is a dummy variable equal to 1 if there is another company in the firm's industry (two-digit SIC level) with a market share of more than 30 percent. Leader Market Share is the market share of the leading public firm in the same industry as the private firm (two-digit SIC level), with the largest market share at the time of an IPO/Acquisition. Mean Error is the two-digit SIC level mean of average analysts forecast errors across firms in the industry. Independent variables are winsorized at the 1% and 99% levels. Year dummies are included in regressions (1) – (6) and (9) – (15). ***, **, * represent significance levels at the 1%, 5%, and 10% levels, respectively. Observations are clustered by year and industry. Robust p-values are reported in brackets.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Log (Assets)	0.346*** [0.000]	0.462*** [0.000]	0.342*** [0.000]	0.457*** [0.000]	0.343*** [0.000]	0.460*** [0.000]	0.330*** [0.000]	0.457*** [0.000]	0.332*** [0.000]	0.296*** [0.000]	0.452*** [0.000]	0.340*** [0.000]	0.456*** [0.000]	0.302*** [0.000]	0.450*** [0.000]
Sales Growth		0.364*** [0.000]		0.383*** [0.000]		0.389*** [0.000]		0.372*** [0.000]			0.391*** [0.000]		0.388*** [0.000]		0.396*** [0.000]
ROA	-0.021 [0.791]	-0.024 [0.717]	-0.024 [0.759]	-0.036 [0.559]	-0.024 [0.763]	-0.038 [0.541]	0.025 [0.766]	-0.045 [0.439]	0.025 [0.767]	-0.054 [0.180]	-0.062 [0.294]	-0.025 [0.747]	-0.039 [0.517]	-0.112* [0.064]	-0.066 [0.262]
Herfindahl Index	-1.388*** [0.008]	-1.848*** [0.010]	-1.194** [0.022]	-1.541** [0.027]				-0.734 [0.196]	-1.553** [0.028]		-1.133** [0.030]	-1.546** [0.027]			
Big Player					-0.293** [0.021]	-0.417** [0.011]			-0.261* [0.072]						
Leader Market Share												-0.008*** [0.009]	-0.013*** [0.002]	-0.008** [0.013]	-0.013*** [0.002]
Private Benefits			0.328** [0.038]	0.505** [0.012]	0.336** [0.036]	0.511** [0.012]	0.367** [0.014]	0.531** [0.018]	0.365** [0.015]	0.305** [0.048]	0.497** [0.013]	0.294* [0.063]	0.446** [0.026]	0.275* [0.081]	0.438** [0.029]
Market/Book	0.006*** [0.000]	0.003* [0.060]	0.006*** [0.000]	0.003* [0.052]	0.006*** [0.000]	0.003* [0.053]	0.005*** [0.000]	0.003* [0.064]	0.005*** [0.000]			0.006*** [0.000]	0.003* [0.051]		
Tangible Assets/TA	-0.876*** [0.000]	-0.698*** [0.000]	-0.938*** [0.000]	-0.833*** [0.000]	-0.962*** [0.000]	-0.884*** [0.000]	-0.784*** [0.000]	-0.869*** [0.000]	-0.796*** [0.000]	-0.963*** [0.000]	-0.863*** [0.000]	-0.951*** [0.000]	-0.847*** [0.000]	-0.989*** [0.000]	-0.877*** [0.000]
Mean Error	0.014*** [0.008]	0.007 [0.172]	0.013*** [0.006]	0.007 [0.256]	0.012** [0.013]	0.005 [0.397]	0.021* [0.059]	0.013*** [0.009]	0.020* [0.067]	0.012*** [0.009]	0.006 [0.274]	0.015*** [0.001]	0.009 [0.111]	0.014*** [0.002]	0.009 [0.121]
VC Backing	0.807*** [0.000]	0.854*** [0.000]	0.811*** [0.000]	0.861*** [0.000]	0.807*** [0.000]	0.855*** [0.000]	0.815*** [0.000]	0.838*** [0.000]	0.808*** [0.000]	0.825*** [0.000]	0.865*** [0.000]	0.812*** [0.000]	0.860*** [0.000]	0.813*** [0.000]	0.863*** [0.000]
Capex/TA	1.043*** [0.002]	0.863** [0.019]	1.085*** [0.002]	0.928** [0.011]	1.089*** [0.002]	0.928** [0.011]	0.894*** [0.005]	0.907** [0.013]	0.888*** [0.005]	1.356*** [0.000]	1.036*** [0.005]	1.097*** [0.001]	0.956*** [0.008]	1.303*** [0.000]	1.066*** [0.003]
CRSP index return	1.350*** [0.001]	2.706*** [0.000]	1.381*** [0.001]	2.768*** [0.000]	1.392*** [0.001]	2.780*** [0.000]	1.385*** [0.001]	2.586*** [0.000]	1.412*** [0.000]	1.309*** [0.003]	2.790*** [0.000]	1.391*** [0.001]	2.794*** [0.000]	1.330*** [0.002]	2.815*** [0.000]
After Sarbanes Oxley							-0.505***	-0.182	-0.514***						

							[0.000]	[0.153]	[0.000]						
RD / TA	-0.071	0.198	-0.104	0.132	-0.099	0.14	-0.065	0.134	-0.063	-0.051	0.16	-0.109	0.117	-0.124	0.145
	[0.695]	[0.187]	[0.547]	[0.304]	[0.567]	[0.278]	[0.711]	[0.272]	[0.718]	[0.744]	[0.195]	[0.526]	[0.353]	[0.454]	[0.232]
Leverage	-0.091	-0.167**	-0.083	-0.148*	-0.082	-0.145*	-0.041	-0.179**	-0.04	-0.078	-0.156**	-0.085	-0.146*	-0.110**	-0.154**
	[0.122]	[0.037]	[0.154]	[0.060]	[0.160]	[0.065]	[0.519]	[0.024]	[0.527]	[0.105]	[0.043]	[0.145]	[0.061]	[0.035]	[0.044]
Year Dummies	yes	yes	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	yes	yes
Observations	3683	2322	3683	2322	3683	2322	3683	2322	3683	3683	2322	3683	2322	3683	2322
Pseudo R-squared	0.219	0.268	0.222	0.275	0.222	0.276	0.192	0.259	0.193	0.204	0.272	0.222	0.276	0.206	0.274

Table 5: Probit Regressions on the choice of IPO vs. Acquisition (Deal Value greater than \$50 million)

This table presents the effects of firm-specific, industry-specific and market-wide variables on a private firm's choice of exit mechanism only for transactions valued more than \$50 million. The dependent variable is equal to 0 if the observation is an acquisition and equal to 1 if it is an IPO. All of the independent variables are measured as of the nearest fiscal year prior to the transaction except Sales Growth, which is measured from year -3 to -1. Log (Assets) is log of the book value of assets. For Market/Book the numerator is the offer price multiplied by the number of shares outstanding for an IPO and is transaction value for an acquisition; the denominator is the value of assets from the balance sheet. Sales Growth measures the firm's growth in sales revenues over the previous three years and is available for only 1517 observations. Tangible Assets/TA is net property and equipment scaled by total assets. Capex/TA is capital expenditures scaled by total assets. Leverage is long-term debt plus short-term debt scaled by total assets. R&D/TA is R&D expenses scaled by total assets. ROA is EBITDA divided by total assets. VC backing is a dummy variable, which is equal to 1 if the firm was financed by venture capital. Private Benefits is a dummy variable that takes value 1 if the firm is in a high private value industry with a two-digit SIC code of 13, 28, 29, and 37. CRSP index return is the value weighted return of the CRSP market index in the 6 months prior to the transaction. After Sarbanes Oxley is a dummy variable that is equal to 1 if the transaction took place after the enactment of the Sarbanes-Oxley Act on July 30, 2002. Herfindahl Index is equal to the value of the Herfindahl Index in the two-digit SIC industry level the firm belongs to at the time of the transaction. The higher the Herfindahl Index, the more concentrated the industry. Big Player is a dummy variable equal to 1 if there is another company in the firm's industry (two-digit SIC level) with a market share of more than 30 percent. Leader Market Share is the market share of the leading public firm in the same industry as the private firm (two-digit SIC level), with the largest market share at the time of an IPO/Acquisition. Mean Error is the two-digit SIC level mean of average analysts forecast errors across firms in the industry. Independent variables are winsorized at the 1% and 99% levels. Year dummies are included in regressions (1) – (6) and (9) – (15). ***, **, * represent significance levels at the 1%, 5%, and 10% levels, respectively. Observations are clustered by year and industry. Robust p-values are reported in brackets.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Log (Assets)	0.120*** [0.000]	0.243*** [0.000]	0.111*** [0.001]	0.233*** [0.000]	0.112*** [0.000]	0.236*** [0.000]	0.103*** [0.002]	0.238*** [0.000]	0.104*** [0.001]	0.095*** [0.001]	0.237*** [0.000]	0.110*** [0.001]	0.232*** [0.000]	0.098*** [0.001]	0.236*** [0.000]
Sales Growth		0.418*** [0.000]		0.446*** [0.000]		0.451*** [0.000]		0.444*** [0.000]			0.443*** [0.000]		0.449*** [0.000]		0.447*** [0.000]
ROA	-0.002 [0.973]	0.01 [0.906]	-0.006 [0.923]	-0.005 [0.943]	-0.006 [0.922]	-0.01 [0.903]	0.04 [0.610]	-0.009 [0.907]	0.039 [0.612]	0.013 [0.727]	0.005 [0.946]	-0.008 [0.906]	-0.013 [0.867]	-0.027 [0.637]	-0.002 [0.979]
Herfindahl Index	-0.823 [0.166]	-1.200* [0.091]	-0.592 [0.327]	-0.821 [0.230]			-0.11 [0.869]	-0.848 [0.219]		-0.565 [0.348]	-0.823 [0.230]				
Big Player					-0.166 [0.330]	-0.318 [0.137]			-0.101 [0.572]						
Leader Market Share												-0.005 [0.240]	-0.011** [0.033]	-0.005 [0.248]	-0.011** [0.033]
Private Benefits			0.451** [0.014]	0.654*** [0.004]	0.454** [0.014]	0.655*** [0.004]	0.471*** [0.001]	0.681*** [0.004]	0.467*** [0.002]	0.441** [0.014]	0.658*** [0.004]	0.432** [0.019]	0.603*** [0.008]	0.425** [0.020]	0.607*** [0.008]
Market/Book	0.001 [0.115]	-0.001 [0.204]	0.001* [0.095]	-0.001 [0.322]	0.001* [0.092]	-0.001 [0.318]	0.001* [0.075]	-0.001 [0.219]	0.001* [0.073]			0.001* [0.095]	-0.001 [0.326]		
Tangible Assets/TA	-0.777*** [0.000]	-0.511** [0.015]	-0.866*** [0.000]	-0.682*** [0.001]	-0.879*** [0.000]	-0.714*** [0.001]	-0.732*** [0.000]	-0.710*** [0.001]	-0.731*** [0.000]	-0.870*** [0.000]	-0.674*** [0.002]	-0.869*** [0.000]	-0.683*** [0.001]	-0.870*** [0.000]	-0.675*** [0.001]
Mean Error	0.017*** [0.000]	0.010* [0.053]	0.016*** [0.006]	0.008 [0.326]	0.015*** [0.008]	0.006 [0.421]	0.026*** [0.004]	0.013 [0.145]	0.026*** [0.004]	0.015*** [0.007]	0.008 [0.324]	0.017*** [0.004]	0.009 [0.252]	0.017*** [0.004]	0.009 [0.249]
VC Backing	0.561*** [0.000]	0.703*** [0.000]	0.565*** [0.000]	0.710*** [0.000]	0.562*** [0.000]	0.701*** [0.000]	0.567*** [0.000]	0.679*** [0.000]	0.562*** [0.000]	0.563*** [0.000]	0.711*** [0.000]	0.564*** [0.000]	0.701*** [0.000]	0.560*** [0.000]	0.703*** [0.000]
Capex/TA	0.713** [0.048]	0.269 [0.525]	0.732** [0.042]	0.322 [0.444]	0.734** [0.041]	0.327 [0.438]	0.609* [0.072]	0.34 [0.411]	0.603* [0.074]	0.827** [0.024]	0.278 [0.515]	0.735** [0.041]	0.334 [0.426]	0.786** [0.029]	0.289 [0.495]
CRSP index return	1.341*** [0.002]	2.937*** [0.000]	1.379*** [0.002]	3.003*** [0.000]	1.383*** [0.002]	2.998*** [0.000]	1.609*** [0.000]	2.693*** [0.000]	1.622*** [0.000]	1.366*** [0.002]	2.994*** [0.000]	1.388*** [0.001]	3.019*** [0.000]	1.383*** [0.001]	3.010*** [0.000]

After Sarbanes Oxley

							-0.326***	-0.094	-0.327***						
							[0.005]	[0.466]	[0.005]						
RD / TA	-0.063	0.201	-0.127	0.081	-0.125	0.08	-0.114	0.107	-0.114	-0.071	0.072	-0.132	0.055	-0.132	0.046
	[0.708]	[0.291]	[0.394]	[0.581]	[0.400]	[0.588]	[0.463]	[0.432]	[0.457]	[0.607]	[0.622]	[0.372]	[0.710]	[0.368]	[0.755]
Leverage	-0.121	-0.182*	-0.103	-0.149	-0.101	-0.146	-0.056	-0.179*	-0.056	-0.096	-0.144	-0.104	-0.15	-0.112	-0.145
	[0.100]	[0.060]	[0.163]	[0.119]	[0.167]	[0.125]	[0.481]	[0.062]	[0.484]	[0.142]	[0.142]	[0.156]	[0.114]	[0.117]	[0.137]
Year Dummies	yes	yes	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	yes	yes
Observations	2401	1517	2401	1517	2401	1517	2401	1517	2401	2401	1517	2401	1517	2401	1517
Pseudo R-squared	0.091	0.14	0.096	0.153	0.097	0.154	0.075	0.137	0.075	0.095	0.153	0.097	0.155	0.096	0.155

Table 6: Valuations of IPOs and Acquisitions in the Full Sample and the Matched Sample

This table presents the summary statistics (mean, median, and number of observations) for the valuations and deal -value/sales multiples of IPOs and acquisitions and reports the results of the tests for differences in mean and median valuations of IPOs and acquisitions. The value for an IPO is defined as the offering price multiplied by the number of shares outstanding and the value of an acquired firm is the deal value reported by SDC. Sales is equal to net revenues of a private firm as of nearest prior fiscal year. Panels A and C report the difference test results of valuations and deal-value/sales multiples of IPOs and acquisitions for the full sample respectively. Panels B and D report the difference tests results of valuations and deal-value/sales multiples of IPOs and acquisitions for the matched sample respectively. In each panel, firms are divided into sub-samples based on whether they were backed by venture capital or not. In Panels B and D, I report the valuation comparisons between IPOs and acquisitions for the matched sample without pairing the observations as if IPOs and acquisitions are obtained from independent samples. Asterisks ***, **, * represent significance levels of the t-tests for differences in sample means and the Wilcoxon rank-sum tests for differences in distributions between IPOs and acquisitions at the 1%, 5%, and 10% levels, respectively. The p-values are also reported to show the statistical significance of the tests.

Panel A: Full Sample (Deal Values)

All Firms				Non-VC Backed Firms				VC Backed Firms			
	Mean	Median	N		Mean	Median	N		Mean	Median	N
IPOs	375.946	183.133	1980	IPOs	435.807	150.200	876	IPOs	328.447	205.195	1104
Acquisitions	114.791	36.027	1706	Acquisitions	86.094	28.000	1275	Acquisitions	199.685	74.994	431
Difference	261.154	147.106		Difference	349.713	122.200		Difference	128.762	130.201	
P-Values	0.0000***	0.0000***		P-Values	0.0003***	0.0000***		P-Values	0.0000***	0.0000***	

Panel B: Matched Sample (Deal Values)

All Firms				Non-VC Backed Firms				VC Backed Firms			
	Mean	Median	N		Mean	Median	N		Mean	Median	N
IPOs	263.126	163.196	951	IPOs	263.126	163.196	658	IPOs	213.782	160.464	293
Acquisitions	124.675	39.800	951	Acquisitions	124.675	39.800	658	Acquisitions	198.799	68.513	293
Difference	138.452	123.396		Difference	138.452	123.396		Difference	14.983	91.951	
P-Values	0.0000***	0.0000***		P-Values	0.0000***	0.0000***		P-Values	0.6666	0.0000***	

Panel C: Full Sample (Deal Value/Sales)

All Firms				Non-VC Backed Firms				VC Backed Firms			
	Mean	Median	N		Mean	Median	N		Mean	Median	N
IPOs	207.09	6.10	1879	IPOs	96.40	2.64	842	IPOs	296.98	14.18	1037
Acquisitions	912.53	2.13	1633	Acquisitions	91.98	1.67	1237	Acquisitions	3475.71	6.17	396
P-Value		0.0000***		P-Value		0.0000***		P-Value		0.0000***	

Panel D: Matched Sample (Deal Value/Sales)

All Firms				Non-VC Backed Firms				VC Backed Firms			
	Mean	Median	N		Mean	Median	N		Mean	Median	N
IPOs	69.52	6.50	951	IPOs	35.51	3.84	658	IPOs	145.88	13.62	293
Acquisitions	1021.13	2.69	951	Acquisitions	72.88	1.83	658	Acquisitions	3150.65	7.08	293
P-Value		0.0000***		P-Value		0.0000***		P-Value		0.0011***	

Table 7: Valuation Multiples of Acquisitions and Matching IPOs

This table presents summary statistics of the valuation multiples of acquisitions and their matching IPOs and reports the results of the Wilcoxon signed rank tests for differences in the distribution of valuation multiples of acquisitions and their matching IPOs. The value for an IPO is defined as the offering price multiplied by the number of shares outstanding and the value of an acquired firm is the deal value reported by SDC. Sales is equal to net revenues of a private firm as of nearest prior fiscal year. Using the propensity score matching algorithm described in Section 4, acquired firms for which sales growth data is available are matched with comparable IPO firms with the nearest propensity score from the same industry and the same exit year as the acquired firm. The matched IPO firm has also the same VC backing status as the acquired firm being matched. The propensity scores are obtained from the estimation of the fourth probit specification of Table 4. Panel A reports the comparisons of deal value/sales ratios for the full sample of acquisitions and their matching IPOs. The acquired firms and their matching IPO firms in Panel A are also divided into sub-samples based on whether they were backed by venture capital or not, and the difference tests are performed for the sub-samples as well. Panel B reports the comparisons of deal value/sales ratios for the matched sample of acquisitions and their matching IPOs where the acquired firms are valued more than \$50 million. Panel B also decomposes the sample according the VC backing status of firms and reports the results of the difference tests for these sub-samples. Asterisks ***, **, * represent significance levels for the paired sample Wilcoxon signed rank tests for differences in distributions at the 1%, 5%, and 10% levels. The p-values are also reported to show the statistical significance of the tests.

Panel A: Deal Value / Sales, Full Matched Sample

All Acquisitions				Non-VC Backed Acquisitions			VC Backed Acquisitions				
	N	Mean	Median		N	Mean	Median		N	Mean	Median
Acquisitions	951	1021.13	2.69	Acquisitions	658	72.88	1.83	Acquisitions	293	3150.65	7.08
Matched IPOs	951	69.52	6.50	Matched IPOs	658	35.51	3.84	Matched IPOs	293	145.88	13.62
P-Value:			0.00***	P-Value:			0.00***	P-Value:			0.14

Panel B: Deal Value / Sales, Matched Sample with acquired firms valued more than \$50 million

All Acquisitions				Non-VC Backed Acquisitions			VC Backed Acquisitions				
	N	Mean	Median		N	Mean	Median		N	Mean	Median
Acquisitions	407	2313.85	4.96	Acquisitions	235	150.99	3.16	Acquisitions	172	190.50	13.95
Matched IPOs	407	99.84	6.99	Matched IPOs	235	33.48	3.63	Matched IPOs	172	5268.91	13.48
P-Value:			0.15	P-Value:			0.32	P-Value:			0.44

Table 8: Short Run Valuations (Propensity Score Matching)

This table reports the results of the empirical analysis testing for the significance of the short run valuation premium between IPOs and acquisitions. Depending on the availability of sales growth data, 951 acquisitions are matched with IPOs by year of transaction, two-digit SIC industry code, VC backing and the propensity score obtained from the fourth probit specification in Table 4. Panel A reports the mean and the median of the acquisition deal values reported by SDC and the mean and the median of the imputed short run IPO valuations of the acquired firms obtained from equation (1) for the sample of all acquisitions, the sample of non-VC backed acquisitions, and the sample of VC backed acquisitions. The short run value V_{match} of the matched IPO firm is defined as the offering price multiplied by the number of shares outstanding after the IPO. This value is then divided by the net sales revenue of the IPO firm of the fiscal year prior to the IPO and the resulting ratio is then multiplied by the net sales revenue of the acquired firm to estimate the short run IPO valuation of the acquired firm given in (1). Panel A then reports the summary statistics and the tests of the short run IPO valuation premia of acquisitions. The short run IPO valuation premium for each acquisition-matched IPO pair is calculated as the natural log of the ratio of the short run IPO valuation of the acquired firm to the deal value of the acquired firm. Panel B reports the summary statistics and the results of the difference tests for the sample of acquisitions valued more than \$50 million only. Asterisks ***, **, * represent significance levels for the Wilcoxon signed-rank test for the significance of the valuation premia at the 1%, 5%, and 10% levels respectively. The p-values of the tests are also reported to show the statistical significance.

Panel A: Short run valuation premia for all acquisitions

All Acquisitions				Non-VC Backed Acquisitions			VC Backed Acquisitions		
	Mean	Median	N	Mean	Median	N	Mean	Median	N
Acquisitions	124.675	39.800	951	91.668	31.000	658	198.799	68.513	293
Matched IPOs	1137.852	90.459	951	480.273	83.704	658	2614.601	105.140	293
Premium	60.09%	62.78%	951	70.17%	73.82%	658	37.45%	34.22%	293
P-value		0.00***			0.00***			0.01***	

Panel B: Short run valuation premia for acquisitions with a deal value more than \$50 million

All Acquisitions				Non-VC Backed Acquisitions			VC Backed Acquisitions		
	Mean	Median	N	Mean	Median	N	Mean	Median	N
Acquisitions	262.397	131.480	407	218.909	125.000	235	321.813	145.400	172
Matched IPOs	2273.241	148.676	407	875.141	144.016	235	4183.436	164.472	172
Premium	0.14%	14.00%	407	-0.42%	20.70%	235	0.91%	-3.77%	172
P-value		0.52			0.28			0.97	

Table 9: Long Run Valuations (Propensity Score Matching)

This table reports the results of the empirical analysis testing for the significance of the long run valuation premium between IPOs and acquisitions. Depending on the availability of sales growth data, 951 acquisitions are matched with IPOs by year of transaction, two-digit SIC industry code, VC backing and the propensity score obtained from the fourth probit specification in Table 4. Panel A reports the mean and the median of the acquisition deal values reported by SDC and the mean and the median of the imputed long run IPO valuations of the acquired firms obtained from equation (1) for the sample of all acquisitions, the sample of non-VC backed acquisitions, and the sample of VC backed acquisitions. The long run value V_{match} of the matched IPO firm is defined as the weighted average of its current IPO value and its long run (three years post-IPO) market value as defined in Equation (4). The current IPO value $V_{ipo,0}$ of the matched IPO firm is defined as the offering price multiplied by the number of shares outstanding after the IPO. The long run market value $V_{ipo,3}$ is defined as the closing price of the firm three years after the IPO multiplied by the number of shares outstanding at that point in time. If the firm was delisted within the three years after the IPO for any reason (e.g., a post-IPO acquisition), or there is still remaining time to completing a period of three years, I take the most recent available closing price of the IPO firm. The long run value V_{match} of the matched IPO firm is then divided by the net sales revenue of the IPO firm as of the fiscal year prior to the IPO and the resulting ratio is then multiplied by the net sales revenue of the acquired firm to estimate the IPO valuation of the acquired firm given in (1). Panel A then reports the summary statistics and the tests of the long run IPO valuation premia of acquisitions. The long run IPO valuation premium for each acquisition-matched IPO pair is calculated as the natural log of the ratio of the long run IPO valuation of the acquired firm to the deal value of the acquired firm. Panel B reports the summary statistics and the results of the difference tests for the sample of acquisitions valued more than \$50 million only. Asterisks ***, **, * represent significance levels for the Wilcoxon signed-rank test for the significance of the valuation premia at the 1%, 5%, and 10% levels respectively. The p-values of the tests are also reported to show the statistical significance.

Panel A: Long run valuation premia for all acquisitions

<u>All Acquisitions</u>				<u>Non-VC Backed Acquisitions</u>				<u>VC Backed Acquisitions</u>			
	<u>Mean</u>	<u>Median</u>	<u>N</u>		<u>Mean</u>	<u>Median</u>	<u>N</u>		<u>Mean</u>	<u>Median</u>	<u>N</u>
Acquisitions	124.675	39.800	951	Acquisitions	91.668	31.000	658	Acquisitions	198.799	68.513	293
Matched IPOs	1778.453	70.083	951	Matched IPOs	448.430	72.177	658	Matched IPOs	4765.330	61.548	293
Premium	42.80%	53.93%	951	Premium	60.61%	65.89%	658	Premium	2.81%	-3.06%	293
P-value		0.00***		P-value		0.00***		P-value		0.93	

Panel B: Long run valuation premia for acquisitions with a deal value more than \$50 million

<u>All Acquisitions</u>				<u>Non-VC Backed Acquisitions</u>				<u>VC Backed Acquisitions</u>			
	<u>Mean</u>	<u>Median</u>	<u>N</u>		<u>Mean</u>	<u>Median</u>	<u>N</u>		<u>Mean</u>	<u>Median</u>	<u>N</u>
Acquisitions	262.397	131.480	407	Acquisitions	218.909	125.000	235	Acquisitions	321.813	145.400	172
Matched IPOs	3715.577	139.025	407	Matched IPOs	850.694	148.101	235	Matched IPOs	7629.806	116.809	172
Premium	-24.63%	-10.17%	407	Premium	-17.88%	6.17%	235	Premium	-33.85%	-48.87%	172
P-value		0.14		P-value		0.76		P-value		0.12	

Table 10: Differences in Valuation Premia (Short Run vs. Long Run)

This table reports the summary statistics of the differences between the long run valuation premia reported in Table 9 and the short run valuation premia reported in Table 8 and the results of the empirical analysis testing the significance of the premium difference. The short run IPO valuation premium for each acquisition-matched IPO pair is calculated as the natural log of the ratio of the short run IPO valuation of the acquired firm to the deal value of the acquired firm. The long run IPO valuation premium for each acquisition-matched IPO pair is calculated as the natural log of the ratio of the long run IPO valuation of the acquired firm to the deal value of the acquired firm. Panel A reports the results for all acquisitions whereas Panel B reports the results for the sample of acquisitions with a deal value more than \$50 million. Each panel is divided into three categories where the test results and summary statistics are reported for all acquired firms, non-VC backed acquired firms, and VC-backed acquired firms. Asterisks ***, **, * represent significance levels for the Wilcoxon signed-rank test at the 1%, 5%, and 10% levels where the null hypothesis is that the difference between long run and short run valuation premia is from a distribution with a median value of zero. The p-values of the tests are also reported to show the statistical significance.

Panel A: Differences in Valuation Premia (Short Run vs. Long Run)

<u>All Acquisitions</u>				<u>Non-VC Backed Acquisitions</u>				<u>VC Backed Acquisitions</u>			
	<u>Mean</u>	<u>Median</u>	<u>N</u>		<u>Mean</u>	<u>Median</u>	<u>N</u>		<u>Mean</u>	<u>Median</u>	<u>N</u>
Short Run	60.09%	62.78%	951	Short Run	70.17%	73.82%	658	Short Run	37.45%	34.22%	293
Long Run	42.80%	53.93%	951	Long Run	60.61%	65.89%	658	Long Run	2.81%	-3.06%	293
Difference	17.29%	8.85%		Difference	9.56%	7.93%		Difference	34.64%	37.27%	
P-value	0.00***	0.00***		P-value	0.01***	0.01***		P-value	0.00***	0.00***	

Panel B: Differences in Valuation Premia (Short Run vs. Long Run) for acquisitions with a deal value more than \$50 million

<u>All Acquisitions</u>				<u>Non-VC Backed Acquisitions</u>				<u>VC Backed Acquisitions</u>			
	<u>Mean</u>	<u>Median</u>	<u>N</u>		<u>Mean</u>	<u>Median</u>	<u>N</u>		<u>Mean</u>	<u>Median</u>	<u>N</u>
Short Run	0.14%	14.00%	407	Short Run	-0.42%	20.70%	235	Short Run	0.91%	-3.77%	172
Long Run	-24.63%	-10.17%	407	Long Run	-17.88%	6.17%	235	Long- Run	-33.85%	-48.87%	172
Difference	24.77%	24.17%		Difference	17.46%	14.53%		Difference	34.76%	45.10%	
P-value	0.00***	0.00***		P-value	0.01***	0.01***		P-value	0.00***	0.00***	