

**INITIAL PUBLIC OFFERINGS AND PRE-IPO SHAREHOLDERS:  
ANGELS VERSUS VENTURE CAPITALISTS**

by

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## **INITIAL PUBLIC OFFERINGS AND PRE-IPO SHAREHOLDERS: ANGELS VERSUS VENTURE CAPITALISTS**

### **Abstract**

At the time of an initial public offering, shares in a firm are typically held by venture capitalists, insiders, corporate investors, and angel investors. We examine the role of angel investors in IPO firms and find that they provide equity capital in industries that venture capitalists choose not to serve. Like venture-backed IPOs, we find that angel-backed IPO firms are younger than non-backed IPO firms. Shareholders in angel-backed IPO firms are more likely to sell their shares at the time of the offering. Finally, where venture-backed IPO firms have higher underpricing, angel-backed IPO firms do not, implying that managers may prefer to obtain early stage financing from angel investors rather than other sources.

Before conducting an initial public offering, the equity of a firm is held by a combination of investors including venture capitalists, managers of the firm, and angel investors (private individual investors). The literature has examined the influence of venture capitalist stock holdings and management stock holdings on IPO firm valuation, underpricing, and long term performance and the role of these investors in the initial public offering.<sup>1</sup> Pre-IPO investors often have seats on the board of directors and should have considerable power in setting the offer price for the IPO firm (Lerner (1995)). As such, these investors will be able to make decisions that will ultimately influence the underpricing of the IPO firm, arguably the largest cost of the IPO to the firm going public. But there is one class of investor that has received almost no consideration in the empirical IPO literature, the individual angel investor. This omission is particularly surprising when Sahlman (1990) and Sohl (2003) estimate the aggregate volume of angel investments to be ten times the number of venture capital investments and the finance literature has generally recognized the deficiency of research in this area (Lerner (1998)).<sup>2</sup> The paper attempts to fill this void in the literature, examining the role of angel investors in the process of bringing firms into the public markets.

Angel investors are important for several reasons. First, they often make investments in start-up firms at dollar amounts far smaller than one would tend to find for venture investors (Sohl, 1999, 2007). Such early stage investments are likely to have a large influence not only on the success of the firm, but also on its management, governance, and operations. Second, angel investors do not have the agency problems inherent in venture capital investments. Angels invest their own money where venture capitalists are money managers and invest capital provided by their limited partners. This fundamentally changes the incentives of the venture capitalists. Pre-IPO investors are concerned about the liquidity provided to their investment by taking the firm public and the return on their investment.<sup>3</sup> Where angels are concerned most about the return of their

investment, venture capitalists must also consider the incentives to raise additional funds, take other portfolio firms public, and ultimately, to maximize the management fees they can obtain from running their venture fund. The literature has shown, for instance, that venture investors will actually sell the shares of IPO firms at lower prices to enhance their ability to raise future funds, so-called grand standing (Gompers (1996), Lee and Wahal (2004)). In contrast, angel incentives are more closely aligned with pre-IPO shareholders who wish to maximize the proceeds of the firm.

One of the main difficulties with comprehensive research involving angels is the lack of reliable data concerning angel investors. Much of the angel research has involved survey data (see, for instance, Freear, Sohl, and Wetzel (2002), and Wong (2002)) which is subject to data response bias. We utilize a unique method to gather our sample by focusing on the initial public offerings of private firms. At the time of an IPO, SEC regulation S-K item 403 requires a firm to disclose all principal and selling shareholders.<sup>4</sup> We utilize the data contained in the IPO firm's prospectus to classify shareholders in the IPO as being angel investors, venture capitalists, firm managers, or other investors. This allows us to avoid the problems inherent in survey based data. Also, our data allows us to focus on the firm rather than the angel investor, creating a dataset more amenable to studying corporate finance decisions.

Angel investors are individuals who invest a portion of their portfolio in privately held firms, typically at the seed and start-up stage (Harrison and Mason (2000), Sohl, Van Osnabrugge and Robinson (2000), Global Entrepreneurship Monitor 2000 Executive Report (2001) and Sohl (2003)). In the context of this research we define angels as any named investors in the IPO filing documents who are not categorized as managers or firm employees, venture capitalists, or friends and family of the managers. This definition is less stringent than Wong (2002), who requires that angels be accredited investors as classified by SEC regulation D rule 501. Investor accreditation is a self certification process and is not included in the IPO documentation. However, most angels are

likely to be accredited investors due to the size of the investments being made. In our methodology if an individual holds shares in an IPO firm and is unaffiliated with a venture capitalist, an insider, or a corporation, we consider them an angel investor.

Several papers have provided some information about the influence of angel investors on firms. For instance, Wong (2002) surveys a large number of firms to find the presence of angel investors. However, none of the firms in the sample go public, implying that these angel investments are either much smaller than the ones studied here, or less successful. Goldfarb, Hoberg, Kirsch, and Triantis (2007) use data on private equity financings from the defunct law firm, Brobeck, Phleger, and Harrison to study angel and venture capital financing. The paper provides some important advances in angel research in that it uses archival data to study a large number of financing rounds for early-stage firms. In addition, Goldfarb, Hoberg, Kirsch, and Triantis (2007) provide valuable insight into the advantages of angel investors over venture capital investors. However, their sample is very much focused on technology firms and has a geographical bias to states where Brobeck, Phleger, and Harrison had offices. Chahine, Filatotchev, and Wright (2007) study the effects of angel and venture investors on IPOs in the UK and French markets. However, the institutional differences between European markets and the US are likely to be large. Our paper is unique in that it focuses on the IPOs of firms in the US, the industry characteristics determining early stage investments and the influence of angels on the IPO.

This paper adds to the literature in several important ways. First, the paper examines the important role that angel investors play in providing much needed capital to small entrepreneurial firms before they go public. Second, this is the first paper to our knowledge studying angels to utilize data that is reported to the SEC, making the reliability of the data much higher than most previous work studying angel investors. Previous research on angels has almost exclusively relied on survey based methods. Third, this research examines the interaction between angel investors and

venture capitalists. As Gompers (1995) states, “Future work should examine appropriate sources of capital for new firms and how those sources change as the firm evolves.” It is clear that several types of investors are often involved in the financing of a firm, something that the literature has largely ignored to this point.<sup>5</sup> This paper shows that industry characteristics are important determinants of the source of financing for the IPO firm. It also presents new evidence on the costs associated with angel versus venture investments. Fourth, the paper adds to the literature by focusing on those angel-backed firms that exit through an IPO and compares these firm characteristics with venture-backed IPOs and non-angel and non-venture-backed IPOs. Finally, we utilize an econometrically robust technique to examine the relationship between the angel and venture investment decision and the underpricing of the IPO firm.

The paper is organized as follows. In section 1 we develop several empirical hypotheses with respect to various important characteristics of firms and their obtaining angel and/or venture financing. Section 2 presents the data and some summary statistics, and section 3 outlines our results. In section 4 we provide robustness checks on our results and we conclude in section 5.

## **1. Empirical Hypotheses**

In this section, we present hypotheses relating to the relationship between certain types of pre-IPO investors and IPO firm characteristics. Specifically, we consider the relationship between pre-IPO investors and firm location, the types of firms certain investor classes are likely to invest in, the size of investments by various types of investors, the impact of investor type on primary versus secondary share sales, and the impact of pre-IPO investors on IPO underpricing.

The finance literature has shown that the geographic concentration of banks (Petersen and Rajan (1995)) and venture capitalists (Lerner (1995), Lee and Wahal (2004)) has an impact on the

financing of firms. The geographic preference for financing firms in close proximity to the equity holder is the result of investors' desire to minimize monitoring and transactions costs (Lerner (1995), and Tian (2007)). As such, IPO firms with venture investors are disproportionately located in states with large concentrations of venture capitalists.

Like venture capitalists, angel investors have the same preference for investing in firms that are geographically proximate to reduce their monitoring costs. Since many angels are former entrepreneurs who have sold their firms, we may expect angel investors to be geographically concentrated in entrepreneurship centers, where the most sales of firms take place (Gittell and Sohl (2005)). This leads us to our first hypothesis:

H1: Angel investors disproportionately invest in firms located in states with a high concentration of venture capitalists.

Many private firms have difficulty in obtaining financing from traditional sources such as banks or public debt markets because either the firms are high risk or the firms have a considerable amount of information asymmetry. As such, these firms will turn to equity investors who can take controlling positions in the firm (Lerner (1995)). But these equity investors will also have preferences for certain types of investment opportunities. If the investors can hold a diversified portfolio of equity in private firms in the way that a venture capitalist can (Sahlman (1990)), then the risk tolerance of the investor for any one investment is likely to be higher than if the investor cannot diversify his portfolio. Unlike venture capitalists, angel investors tend to concentrate their investments in a smaller number of firms compared to venture capitalists (Van Osnabrugge (2000)). This increased diversification for venture investors along with the ability to raise capital from limited partners should make the optimal investment size for venture capital investors larger than

for angel investors. This difference in diversification between angel investors and venture capitalists leads us to propose the following:

H2: Venture investors will take larger positions in firms compared to the size of the position taken by angel investors.

This hypothesis is directly opposed to the assumption in Chemmanur and Chen (2006) that venture capitalists invest in less diversified portfolios than angel investors. However, the assumption of Chemmanur and Chen (2006) is predicated on the premise that venture capitalists add value to the relationship and angels only add capital. We propose that both angel and venture investors can add value to the relationship.

As pointed out by Bodnaruk, Kandel, Massa, and Simonov (2008) investors with a less diversified portfolio are more likely to liquidate at least part of their pre-IPO share holdings in the IPO. Since angel investors are less diversified than venture investors, we expect to see a substantially larger number of secondary share sales for firms backed by angel investors. Another reason to expect angels to sell more secondary shares than venture capitalists is that absent share sales, angels will have to hold the shares until the end of the lock-up. In contrast, the venture capitalist can gain diversification simply by distributing the shares to their limited partners (Gompers and Lerner (1998)). This additional option by venture capitalists further reduces their costs to hold the shares. Thus, we propose the following hypothesis:

H3: IPO firms backed by angel investors will be more likely to have mixed offerings (primary plus secondary shares). Also, the larger the share holdings by angels, the larger the number of shares sold by pre-IPO investors.

Venture capitalists and angels have skills in preparing IPO firms to go public, a skill that should make venture or angel-backed firms go public at a younger age, relative to unbacked firms. In addition, venture capitalists and angels will have the ability to screen through the private firms they wish to invest in. Since we can expect angels and venture capitalists to “cherry pick,” or invest in only the highest quality private firms, the firms venture capitalists and angels invest in should have a lower age at the time of their IPO, compared to unbacked firms.<sup>6</sup> This leads to a testable implication for IPO firm age at the time of the offering:

H4: IPO firms backed by angel investors and/or venture capitalists will be younger than IPO firms unbacked by outside investors.

As pointed out by Ljungqvist and Wilhelm (2003), the dilution caused by underpricing is much more damaging for investors selling their shares at the time of the IPO. This is because selling in the IPO causes investors to sell at the lower offering price rather than the higher closing price on the first day of trading. For investors who plan to sell their shares, they will bargain much harder concerning the offering price relative to shareholders who plan to hold their shares after the offering (or distribute shares to their limited partners). This result would imply that angel-backed IPO firms would have lower underpricing compared to venture-backed IPOs since angel investors are more likely to sell shares at the time of the IPO.

In addition, where angels are attempting to maximize the returns to their investments (conditional on taking the firm public), venture investors have incentives to take firms public earlier to gain a reputation for bringing firms to the IPO market (see Gompers (1996) and Lee and Wahal (2004)).<sup>7</sup> Taking the firm public in this manner may mean that the venture investor is forced to

underprice the firm more to alleviate information asymmetry. This leads to our fifth hypothesis:

H5: Firms backed by angel investors will on average have lower underpricing than firms backed by venture capitalists.

This result is particularly important in that it implies that it matters where entrepreneurs get their financing: from venture capitalists or from angels. Gompers (1996) states that older venture capitalists for whom reputation matters less than for younger venture capitalists would grandstand less. Thus an owner-manager looking for equity financing would be better off going to an older venture capitalist to obtain financing rather than a younger venture capitalist. If our conjecture is correct, then an entrepreneur may be better off avoiding a venture capitalist altogether and going to an angel to obtain their financing.

## **2. Data and Summary Statistics**

### *2.1 Sample and data collection*

The initial sample of IPOs is obtained from the Security Data Corporation (SDC) new issues database from 2001 to 2007. We begin our sample in 2001 for several reasons. Although electronic prospectus data for IPO firms is available from the Securities Exchange Commission in earlier years, we are concerned that the time period from 1999-2000 may not be representative of the overall market for IPOs (Ljungqvist and Wilhelm (2003)). We eliminate all unit offerings, closed-end funds, Real Estate Investment Trusts (REITs), American Depository Receipts (ADRs), demutualizations, IPO firms headquartered outside the U.S., and firms with an offer price below \$5 from the sample. These screens yield a total sample of 799 IPOs.

To gather the information related to manager, venture capital, and angel ownership, we

examine the prospectus of each firm. We therefore require firms to have an electronic prospectus filing with the Edgar database of the Securities Exchange Commission, further reducing our sample to 665 firms. We collect information in the offering prospectus about the stock ownership by managers, venture capitalists, and other investors from the “Management” and “Principal and Selling Shareholders” sections of the IPO prospectus. We categorize the identity of each investor owning greater than 2% of the shares of the IPO firm, gathering information from the prospectus to ascertain if the stock holder is a manager, a corporate entity, an employee, or a venture capitalist. As noted by Gompers and Lerner (2004), “In many cases individual investors (often called angels) will describe themselves as venture capitalists. Groups of individual investors often make their investments through partnerships that are given names not unlike those of venture capital organizations.” Because Gompers and Lerner (2004) are most concerned about correctly labeling venture capitalists, they only consider an investor to be a venture capitalist if the investor shows up in *Pratt’s Guide to Venture Capital Sources*. In contrast, we are most concerned with correctly labeling angel investors so we eliminate as angels any firms with names containing “venture”, “partners”, “limited partners”, “LP”, or “LLP”. We recognize that this process will eliminate some angel investors from our sample, but the benefit is that it will prevent us from incorrectly classifying venture capitalists as angel investors.

We then conduct some additional checks on the identity of our angel investors. First, we eliminate all investors with the same sir name as the CEO or founder of the firm. These investors likely fit into the category of friends and family of the entrepreneur and should not be considered in the same category as angel investors (Mason and Harrison (2000)). We then look up each possible angel investor in *Pratt’s Guide to Venture Capital Sources* to further re-classify our angel group as venture capitalists where appropriate. This process eliminates a total of 162 individuals as angels, reclassifying them as venture capitalists. Finally, we use Marquis’s *Who’s Who in Finance and*

*Business* to eliminate 17 additional venture capitalists from our sample. Individuals who get through these screens are classified as angel investors<sup>8</sup>. This results in a final dataset of 665 firms with a total of 523 angel investors.

## 2.2 *Summary statistics*

A frequency distribution for the IPO firms in our sample is reported in Table 1. We separate the firms in our sample into firms with no angel or venture investors, firms with only angel investors, firms with only venture investors, and firms with both angel and venture investors. As has been stated earlier, there are several main types of investors in pre-IPO firms: insiders, employees, friends and family, angels, and venture capitalists. Our classification is focused on only angels and venture capitalists. Our classification could be incorrect in that we are conservative in how we classify angel investors in particular. Therefore, the figures for the number of firms with angel investors are likely to be the minimum number of firms with angel investors. The table shows that of the 665 IPOs in our sample, 251 (37.7%) have no venture or angel investors, 89 (13.4%) have only angel investors, 218 (32.8%) of the IPO firms have only venture investors, and 107 (16.1%) of the firms have both angel and venture investors. Thus, 196 (29.5%) of the IPOs in our sample are backed by angels or by angels and venture capitals in combination. The finding that 29.5% of all IPO firms going public from 2001-2007 had angel investors in the firm indicates that angel investors provide vital capital not only to start-up firms, but to firms that eventually become large, mature firms going through the IPO process.

In Table 1 Panel B we examine the industries of the IPO firms in our sample. We find that, consistent with the prior literature (Loughran and Ritter (2004)), 156 (23.5%) of the sample of firms are in the technology industries. We also find a large percentage of firms in the healthcare field (22.4%), which includes biotechnology companies. It is interesting to note that the industry mix of

IPO firms is surprisingly different among firms backed by either angels or venture capital. For instance, where angel-backed IPO firms tend to be well represented in the wholesale and retail industries (12.4%) and manufacturing firms (10.1%), venture capitalists rarely invest in the wholesale and retail industries (4.1%) and manufacturing firms (5.0%). This result is likely due to the type of industries, industry structure, and firm characteristics that interest angel investors versus the venture capitalists. In contrast, angel investors are less likely to invest in technology IPO firms (22.5%) and healthcare firms (11.2%) compared to venture capitalists (29.8% and 41.3%, respectively).

We examine the firms and IPO offering characteristics in Table 2 Panel A. We find that the offering size for IPOs with venture backing (\$106 million) is similar to firms with only angel backing (\$156 million) and angel plus venture capital backed firms (\$138 million). But the proceeds of IPO firms without angel or venture backing are substantially larger, at \$269 million. We find that venture-backed firms have significantly higher ranked underwriters compared to the underwriter rankings of the other firm types. This result is consistent with the idea that venture capitalists are capable of attracting higher quality underwriters to the offering. While there appears to be no difference between the percent of firms not listed on major exchanges, the spread of the offering is different across firm types, but similar to that reported by Chen and Ritter (2000). The offer price revision for the firms tends to be negative in this time period. Our results show that venture-backed IPO firms have a significantly more negative offer price revision in this time period. We also find that the IPO underpricing for firms with venture capitalists is significantly higher than IPOs without venture capitalists, regardless of angel backing, consistent with Lee and Wahal (2004). The average underpricing, number of IPO offerings, and pre-IPO market price return are all similar to the historical pre-1999 average.

We also calculate the industry concentration and state concentration of IPO firms using a

Herfindahl index calculation for IPO firms without angel or venture capital backing, with angel backing, with venture backing, and with both angel and venture backing. To calculate this value, we use the percent of firms in each category (state or industry) going public in each state (Fama and French (1997)) industry,  $s_i$  to calculate:

$$(1) \quad \text{Herfindahl Index} = \frac{\sum_{i=1}^n s_i^2 - \frac{1}{N}}{1 - \frac{1}{N}}$$

We also find that IPO firms without angel or venture backing are quite geographically diverse with a Herfindahl value of 0.05. In contrast, IPOs with angel backing have a value of 0.09, IPOs with venture backing only have a value of 0.14, and IPOs with angel and venture backing have a value of 0.22.<sup>9</sup> These results are consistent with hypothesis H1, that IPO firms receiving angel backing are less geographically dispersed than IPO firms without angel backing. However, our results are consistent with angel-backed IPOs being more geographically diverse than venture-backed IPOs.

In addition to geographic concentration, we are also concerned with industry concentration. To this end, we utilize the Herfindahl index to measure industry concentration as well. We find that IPO firms with venture backing have a higher industry concentration whether the firms have angel backing (Herfindahl=0.10) or not (Herfindahl=0.12). In contrast, IPO firms without angel or venture backing and IPO firms with only venture backing have industry concentrations of 0.03 and 0.04, respectively.

In Table 2 Panel B we report the IPO firm characteristics across the four classes of IPO firms: IPO firms with no angel or venture backing, IPO firms with angel backing, IPO firms with venture backing, and IPO firms with angel and venture capital backing. We find that the market

capitalization of the IPO firms without angel or venture backing (\$833 million) and IPO firms with angel backing (\$775 million) tends to be substantially larger than IPO firms with venture backing (\$423 million) and angel plus venture backing (\$639 million). This result is likely to be due to the mix of firms that the venture capitalists versus angels are investing in.

We find that the percent of shares held by all the pre-IPO angels is 21.2% of the firm where the percent of shares held by venture capitalists is 34.7%. For IPO firms that are angel plus venture-backed, angels hold 14.6% of the shares and venture capitalists hold 36.4% of the shares. The difference between these two values is statistically significant indicating that the venture capitalists take larger positions in the firms than angels, consistent with our hypothesis H2.<sup>10</sup> In other words, for the 107 firms with both angel investors and venture investors, the venture investors have larger positions, on average (t-statistic=6.21). Also, for the universe of firms, the venture capital ownership of firms is substantially larger on average than the angel ownership (t-statistic=11.05).

When we consider the percent of shares sold in the offering by the angels versus the venture capitalists, we find that angels sell 4.2% of the shares outstanding, on average, where venture investors sell 3.8% of the shares outstanding. For firms backed by both angels and venture capitalists, the difference between the angel shares outstanding sold (2.3%) and the venture shares outstanding sold (5.3%) is significant (t-statistic =3.27). However, it is misleading to simply look at the percent of shares sold as a percent of the shares outstanding. This is because the initial position taken by the angels is less than half the position taken by the venture capitalists. Therefore, it is not surprising that they sell less, on average. These results support our hypothesis H3, that angel investors will sell more of their shareholdings in the offering compared to the venture investors.

On average, there are 3 angel investors in angel-backed firms and in angel plus venture-backed firms. There are 4 venture capital investors on average in venture-backed firms and 4

venture investors in venture plus angel-backed firms. On a per investor basis, each angel holds an average of 6.0% of the IPO firm and 5.6% of the IPO firm for IPO firms with angel backing and angel plus venture backing, respectively. Venture capitalists hold 13.9% of the shares individually for venture-backed firms and 11.4% of the shares for angel plus venture-backed firms.

We also examine the IPO industry characteristics in the year of the IPO firm founding. We find in general, that venture-backed firms are from industries with significantly higher growth rates as proxied for by Tobin's Q, significantly lower leverage, significantly higher intangible assets as proxied for by R&D/assets, and significantly lower tangible assets (property, plant, and equipment/assets). Angel-backed IPO firms have only slightly higher R&D/assets compared to non-backed IPO firms.

### **3. Results**

#### *3.1 Geography and pre-IPO investors*

Two firm characteristics have been found in the past literature to be highly correlated with whether or not a firm is backed by a venture capitalist: geography and firm age (Lerner (1995) and Gompers and Lerner (1998, 2000)). Lee and Wahal (2004) find that IPO firms in California, Massachusetts, and Texas account for 49.9% of all venture-backed IPO firms. We categorize firms by the location of their principal operations and find similar results as reported in Figure 1. For instance, we find that 27.1% of all IPOs from 2001-2007 are firms located in California, but 37.5% of all venture-backed IPOs are in California. We also find a high percentage of firms with angel investors in California, with 35.7% of all angel-backed firms going public in California. Likewise, Massachusetts only represents 7.2% of the overall sample, but represents 10.4% of the venture-backed firms and 10.2% of the angel-backed firms. These results imply that although angel-backed

firms may be slightly more geographically diversified compared to venture-backed firms (as shown by our Herfindahl classifications in Table 2), angel-backed firms are still disproportionately located in California and Massachusetts.

Table 3 Panel A shows that the four states with the largest number of IPO firms in our sample are California, Massachusetts, New York, and Texas. We find that these four states account for 56.5% of the venture capital backed firms but only 49.9% of all the firms in our total sample. In particular, 67.8% of the IPO firms in California, 70.8% of the IPO firms in Massachusetts, 64.0% of the IPO firms in New York, and 30.0% of the IPO firms in Texas have venture capital backing.

When we examine the firms going through IPOs in the states with the most angel-backed firms, we find similar results. The percent of firms with angel backing is 38.9% for IPO firms in California, 41.7% for IPO firms in Massachusetts, 24.0% for IPO firms in New York, and 20.0% for IPO firms in Texas. Thus, while angels may be slightly more geographically diverse than venture-backed firms, angels still own shares in a disproportionate number of firms that go public in California and Massachusetts.

Table 3 Panel B reports statistical tests of the percent of firms being angel and venture-backed conditional on being in or not being in a large VC state (either California or Massachusetts).<sup>11</sup> The table shows that 15.9% of all IPO firms without angel or VC backing are located in the big VC states whereas 45.0% of the IPO firms without angel backing but with venture backing are located in the big VC states. This difference is statistically significant at the 1% level. Likewise, IPO firms with angel backing but no venture backing are located in a big VC state 36.0% of the time but IPO firms with angel backing and VC backing are located in big VC states 54.2% of the time. This difference is significant at the 1% level. Differences in the percent of IPO firms in the big VC states with and without angel backing provide another interesting pattern. For firms that are not venture-backed, angel-backed IPOs are significantly more likely to be from big VC states,

significant at the 1% level. Finally, for firms that are venture-backed, angel backing provides a marginal increase to the probability of being in a big VC state. This difference is insignificant with a p-value of (0.11).

These results support hypotheses H1 that the angel market is concentrated in California and Massachusetts, however, angel-backed firms are slightly more diverse geographically than venture-backed firms.<sup>12</sup> These results lend support for the critical role of angel investors in the growth and development of entrepreneurial ventures.

### *3.2 Angel and venture backing and firm age*

We now examine the firm age and its relationship with backing by angel and venture investors. We report in Table 3 Panel C the relationships between backing and firm age at the time of the IPO. Lee and Wahal (2004) report that venture-backed IPOs have an average age of 7.0 years where non-VC backed IPOs have an age of 14.7 years. Table 3 Panel C shows that firm ages are very closely correlated with venture backing in that IPO firms without angel or venture backing are on average 27.5 years old, IPO firms with angel backing are 21.4 years old, IPO firms with VC backing are 14.4 years old, and IPO firms with angel plus venture backing are 10.9 years old.<sup>13</sup> We find that there is a statistically significant difference between IPO firm ages for firms backed versus not backed by venture capitalists. There is also a significant difference (at the 10% level) between the ages of firms that are angel-backed versus not angel-backed, whether the firms are venture-backed or not. The fact that firms are marginally younger when they are backed by angel investors is consistent with our hypothesis H4.

Our results suggest that IPO firms with venture backing are younger firms compared to non-venture-backed firms. Our results show that both, angel-backed and venture-backed IPO firms are taken public sooner after founding, compared to non-backed firms. This result could have three

explanations. First angels and venture capitalists may select firms with the highest quality management and the best business plans (the cherry picking hypothesis). Thus, firms may be able to go public sooner because the firms are of higher quality even before the angel or venture capitalist invests in the IPO. This result would imply that both venture investors and angel investors have some skill in picking good quality private firms to invest in.

Alternately, pre-IPO investors (angels and venture capitalists) may be better able to nurture firms and get them ready for an IPO sooner (the nurturing hypothesis). This hypothesis would imply that angel and venture investors are very valuable in the process of assisting a firm in the going-public process. They may provide many things that the pre-IPO firm requires including industry expertise, contacts with potential customers, and general business knowledge in addition to the capital needed by the firm.

Finally, angel and venture investors may simply pressure the firm to go public earlier and thus, provide liquidity to their portfolio (the liquidity hypothesis). This hypothesis would imply that there is some cost to having these early stage investors. The liquidity hypothesis would predict that pre-IPO investors will also cause the IPO to go public with higher underpricing, since these shareholders will not bargain for as high an offering price as would otherwise seem prudent since the main goal of these pre-IPO investors is to see some return on their initial investment.

### *3.3 Percent of primary versus secondary shares sold*

One important difference between angel investors and venture capitalists is that angel investors are much less well diversified compared to venture capitalists. As Sahlman (1990) points out, a typical large venture capital may invest in 12 firms per year. This suggests that the portfolio of investments for venture capitalists should be much more diversified compared to an angel investor, who has less capital to invest and makes fewer investments than their venture capital

counterparts. This difference in diversification makes it much more advantageous for the angel investor to sell shares as soon as possible, to diversify their overall portfolio. In contrast, even if the venture capitalist holds a concentrated position in the IPO, they can distribute their shares to the limited partners and thus, eliminate any idiosyncratic risk to the venture capitalist from share price declines (see Gompers and Lerner (1998)). If pre-IPO investors decide to hold rather than sell part of their holdings as secondary shares in the IPO, then the investors must hold the shares through the lock-up period, typically 6-12 months. The diversification benefit to angel investors means that they will typically wish to liquidate a much larger percentage of shares relative to venture capitalists (Bodnaruk, Kandel, Massa, and Simonov (2008)).

To this end, we examine the percent of pure primary offerings, IPO offerings where only newly created shares are sold in the IPO. In contrast, a mixed offering (primary offering plus secondary offering) occurs when some of the pre-IPO investors sell shares in the offering with the proceeds of these sales going to the investors, not the firm. We expect to see that angel-backed IPOs will sell a large percentage of their shares as secondary shares compared to venture investors, consistent with H3. We see in Table 4 Panel A that IPO firms without angel or venture backing are pure primary offerings 63.4% of the time where IPO firms with only angel backing are pure primary offerings only 47.2% of the time, a difference that is statistically significant at the 5% level. Likewise, the percentage of pure primary offerings for venture-backed IPOs is substantially lower if the firm is also angel-backed (47.7%) compared to non-angel-backed (72.9%). There is a statistically significant difference between venture-backed and non-venture-backed IPO firms if the firms are not angel-backed only. The correlation between a pure primary dummy variable and an angel backing dummy variable is a statistically significant -0.19. The correlation between a pure primary dummy variable and venture backing dummy variable is 0.05 and is statistically insignificant.

We also examine the average percent of primary shares sold as a function of angel and venture backing in Table 4 Panel B. Not surprisingly, the percent of primary shares offered tends to be lower for angel-backed IPOs and higher for venture-backed IPOs. These results are generally consistent with our conjecture that angel investors will typically sell some part of their pre-IPO shares if possible, to increase their portfolio diversification (H3).

Next we use multivariate regressions to determine the impact of angel and venture backing on the sale of primary and secondary shares in the IPO. We use a non-linear logit model to examine the relationship between a dummy variable for a pure primary offering and various control variables. The model we utilize is similar to Huyghebaert and Van Hulle (2006).

$$(2) \quad Pr(\text{pure primary}=1 | X = x) = \alpha + \delta_1 \text{Log}(1 + \text{age}) + \delta_2 \text{Log}(\text{proceeds}) + \delta_3 \text{IPO frequency} \\ + \delta_4 \text{Pre - IPO market return} + \delta_5 \text{ROA} + \delta_6 \text{Total assets} \\ + \delta_7 \text{Venture backing} + \delta_8 \text{Angel backing} + e$$

Note that for models 1-3 of Table 5 Panel A, we omit the accounting variables, ROA and Total assets as there are observations missing, reducing the overall sample size from N=665 to N=506. To support H3, the idea that less diversified angels are more likely to sell secondary shares in the offering, we would expect to see a negative and significant  $\delta_8$ .

Consistent with Huyghebaert and Van Hulle (2006), we find that age and log (proceeds) are negative and significantly related to a pure primary offering. In addition, we find that the coefficient on the angel dummy variable is negative and significant, supporting the idea that angel investors are much more likely to sell shares in the offering compared to venture investors. If instead of dummy variables for angel and venture backing, we use the number of angel and venture investors (model (2)) or the aggregate shares held by angel and venture investors (model (3)), we find similar results. When angels hold shares in the IPO, when there are more angels, or when

angels collectively hold more shares, there are more likely to be secondary shares sold in the offering. In models (4)-(6) we include the accounting variables ROA and Total assets and find that there are no appreciable changes to the models.

If we wish to explain the percent of primary shares sold in the offering rather than a dummy variable of whether or not the firm is a pure primary offering, we can use a similar technique. However, now there is data censoring at zero (you cannot sell less than 0% primary shares) so a Tobit model is necessary. In Table 5 Panel B we report qualitatively similar results using the percent of primary shares sold in the offering. Once again, when angels hold shares in the IPO, when there are more angels, or when angels collectively hold more shares, there is a lower percentage of primary shares in the offering.<sup>14</sup>

### *3.4 The underpricing of pure primary offerings*

We examine the relationship between pure primary/mixed offerings and IPO underpricing. Ljungqvist and Wilhelm (2003) find a strong relationship during the boom period (1999-2000) between IPO underpricing and pure primary offerings. They argue that selling shareholders are hurt more by underpricing, since they only get the offering price for the shares they sell. Shareholders who do not sell are hurt by underpricing as well, since the firm “leaves money on the table.” However, the shareholders who do not sell their shares are hurt less because they have the opportunity to sell shares at a stock price higher than the original offering price. Loughran and Ritter (2004) separate IPOs into pure primary versus mixed offerings and find similar results during the period from 1999-2000; pure primary offerings have substantially higher underpricing. However, they find a marginally lower level of underpricing for pure primary offerings from 1990-1998 (13.8% versus 16.1%) and virtually no differences between pure primary and mixed offerings from 1980-1989 and 2001-2003.

We first duplicate the results in Loughran and Ritter (2004) and report in Table 6 that the underpricing from 2001-2003 is virtually identical for pure primary offerings (12.7%) versus mixed offerings (12.9%). We then examine the balance of our sample period, from 2004-2007 and find that the results are somewhat different. For IPOs in this period, IPO firms with pure primary offerings have significantly lower underpricing (8.7%) compared to IPO firms with mixed offerings (16.9%). These results are much closer to the results from 1990-1998 reported by Loughran and Ritter (2004). Finally, we group all the IPO firms together (2001-2007) and find that the difference between IPO firms with pure primary offerings (9.7%) and IPO firms with mixed offerings (16.0%) is statistically significant at the 1% level. These results imply that the presence of a pure primary offering may be important in determining underpricing.<sup>15</sup>

### *3.5 Multivariate analysis of underpricing*

One of the largest costs faced by the firm in the going-public process is the implicit costs of underpricing. In the sample of IPOs from 2001-2007, underpricing averages 12.1% and the proceeds of the offerings average \$179.4 million. As such, the average firm leaves \$21.7 million “on the table,” or 12.1% of the offering proceeds. Since we are concerned with the influence of pre-IPO shareholders on the offering, we now examine underpricing in a regression format to determine if our univariate results showing venture-backed IPOs as having higher underpricing hold.

We use a multivariate regression format with control variables similar to Cliff and Denis (2004), Ljungqvist and Wilhelm (2003), and Loughran and Ritter (2004). Our regression model is as follows:<sup>16</sup>

$$\begin{aligned}
 (3) \quad \text{Underpricing} = & \alpha + \gamma_1 \text{revision} + \gamma_2 \log(\text{proceeds}) + \gamma_3 \text{spread} + \gamma_4 \text{high rank} \\
 & + \gamma_5 \text{non-exchangetraded} + \gamma_6 \text{averageunderpricing} + \gamma_7 \text{IPO frequency} + \gamma_8 \log(1 + \text{age}) \\
 & + \gamma_9 \text{pre-IPO market return} + \gamma_{10} \text{technology dummy} \\
 & + \gamma_{11} \text{angel backing dummy} + \gamma_{12} \text{venture backing dummy} + \varepsilon
 \end{aligned}$$

To test the hypothesis H5, we would expect to find  $\gamma_{12}$  to be positive and significant. On the other hand, since angel investors are selling more shares in the offering in the form of secondary sales, we expect angels to bargain harder over underpricing (Ljungqvist and Wilhelm (2003)). Therefore, we expect  $\gamma_{11}$  to be insignificant or possibly negative. In Table 7, we tabulate the results of our regressions. We find that underpricing is positively related to the offer price revision, the size of the offering, a dummy variable for a high underwriter rank, the average level of underpricing around the IPO, and a dummy variable for the firm being in the technology industry. These results are largely consistent with the previous literature.

In addition, we find that IPO firms with venture investors have higher underpricing, consistent with H5. This result, from model (1) indicates that underpricing is on average, 4.8% higher when the IPO firm has a venture investor before the IPO. In model (2) we find that IPO firms also have higher underpricing if the firm is angel-backed. The results in model (2) suggest that if a firm is backed by an angel, underpricing is higher by 3.3%. Finally, in model (3) we see that including both the dummy variable for angel backing and venture backing does not appreciably alter our results. These results are somewhat surprising with respect to angel backing since angel investors should bargain harder for lower underpricing since they anticipate to sell their shares in the offering.

We then repeat our tests including a dummy variable for pure primary offerings. Since there is a high correlation between the pure primary offering and angel backing, this control variable

is important in our regressions. We see in models (4)-(6) that the inclusion of the pure primary dummy, Fama and French (1997) industry dummies, or both has some impact on the significance of the angel backing dummy variable. However, we can see in all cases that the venture backing dummy is always significant, suggesting that venture-backed firms have consistently higher underpricing.

These results suggest that firms may have higher underpricing when the firm has angel backing, contradicting our hypothesis H5. However, as recognized by Megginson and Weiss (1991) and Lee and Wahal (2004), the investment decision by pre-IPO investors is endogenous to other firm characteristics.<sup>17</sup> As such, it is necessary to utilize an econometric technique with exogenous instruments to control for this endogeneity. Note that our model does not allow for sequencing of the investment decision, but rather is meant to predict, from the time of the IPO firm founding, the likelihood that the IPO firm will be either venture or angel-backed or backed by angel and venture investors.

Since we are interested in the determination of whether a firm is angel-backed, venture-backed, or both angel and venture-backed, we must use a system of non-linear equations in the first stage regression. The purpose of using a system of equations rather than independent probit models is that it allows us to control for the relationship between angel and venture financing. The model involves the following system of probit equations:

$$(4a) \quad \text{Pr}(\text{angel backed} = 1 \mid X = x, Z = z) = \alpha + \gamma x + \delta z + e$$

$$(4b) \quad \text{Pr}(\text{venture backed} = 1 \mid X = x, Z = z) = \alpha + \gamma x + \delta z + e$$

Where angel-backed and venture-backed are dummy variables taking a value of one if the IPO firm is angel or venture-backed, respectively,  $x$  is a matrix of control variables, and  $z$  is a matrix of

exogenous instruments. For our instruments to be valid, we make the assumption that  $E(z\varepsilon)=0$  where  $z$  is out matrix of instruments and  $\varepsilon$  is the residual from equation 3. Our instruments should be correlated to the IPO firm backing by angel or venture capital investors, but not correlated to the residual from the second stage underpricing regression.

The IPO literature has generated many important control variables (in matrix  $x$ ) in models to explain IPO underpricing (see for instance, Cliff and Denis (2004)). For our instruments, we are particularly interested in the IPO industry characteristics. However, if the angel or venture investors have some ability to time markets (as suggested by Lerner (1994)) then the industry characteristics at the time of the IPO may be endogenous. We therefore calculate the industry characteristics for the IPO firm in the founding year of the IPO firm.<sup>18</sup> At the time of the IPO, the average time the firm has been in existence is 19.7 years. As such, industry characteristics in the IPO founding year are unlikely to have an impact on the IPO underpricing. However, many investors in the firm will make decisions concerning purchasing equity positions within a few years of the IPO founding, implying that industry characteristics at the time of IPO founding should help to explain who invests in the firm. The industry characteristics we consider are IPO industry average Tobin's  $Q$ , leverage, R&D/assets, and Property, plant and equipment (PPE)/assets in the year that the IPO firm is founded. It should be noted that since the IPO firm is not publicly traded in the year it is founded, the IPO firm characteristics are not included in the mean industry characteristics in the year of IPO founding.

Our justification for these particular industry characteristics as instruments is as follows. Venture investors are more likely to value growth firms over value firms as well as firms investing in high levels of intangible assets (Zacharakis and Shepherd (2007)). Therefore, venture-backed firms should come from industries with high Tobin's  $Q$ , high R&D/assets, and low PPE/assets. In contrast, angel investors are likely to value investments in firms with the ability to raise financing

from non-equity sources. This results from the desire of angels to avoid future rounds of equity financing which would result in angel cram-down and general loss of control of the firm (Sohl (2006)).<sup>19</sup> Therefore, angel investors are likely to prefer investments in industries that can raise funding from banks, firms with high tangible asset values. Likewise, this preference for firms able to obtain loans will lead angels to invest in industries with higher leverage.

Finally, since Lerner (1998) and Lee and Wahal (2004) find that there is some geographical concentration of venture-backed firms in certain states. Specifically, firms from California, and Massachusetts are more likely to be venture-backed. Therefore, we use a dummy variable taking a value of one if the IPO firm is in these states and zero otherwise as an instrumental variable as well.

We estimate the system of equations 4a and 4b to determine the probability of any firm having angel or venture backing based on the control variables and instrumental variables discussed above. We find in Table 8 that controlling for characteristics that influence the IPO underpricing, the following instruments are significantly related to a firm being venture-backed: industry Tobin's Q in the IPO founding year, industry leverage in the year of the IPO founding, and industry R&D/assets in the IPO founding year. Being located in a state with a high concentration of venture capitalists is significantly related to having venture backing at the 10% level. We find in Table 8 that angel backing is only correlated with the leverage of the IPO industry in the year of the IPO firm founding and being located in California or Massachusetts.

In the second-stage regression, we utilized predicted values from the system of probit equations as instruments for the angel backing and venture backing dummy variables to examine underpricing. In Table 8 we find that, unlike the OLS regressions, an instrumental variables approach leads to higher underpricing for venture-backed IPOs only; angel-backed IPO firms do not have higher underpricing once we control for endogeneity. This result suggests that IPO firms with angel backing may have higher underpricing than IPO firms without angel backing (as suggested by

our OLS results), but angels are not causing this additional underpricing. Rather angel investors either select firms that have higher underpricing *ceteris paribus*, or another factor is correlated to both, angel backing and underpricing (such as pure primary offerings). However, in the case of venture backing, it is clear that IPO firms that are venture-backed have a higher degree of underpricing even once we control for endogeneity, consistent with Gompers (1996) and Lee and Wahal (2004). These results are novel in that they show angel investors as unique and distinct in their influence on IPO firm underpricing relative to venture investors. Where both angel investors and venture capitalists provide equity to the firm, angel investors have a lower incentive to underprice the offering resulting in a direct monetary gain to the firm.

As a robustness check, we also examine the system of equations governing angel backing, venture backing, and IPO firm underpricing using 3SLS. The main difference between our two step procedure outlined above and the 3SLS technique is that the 3SLS uses a linear probability model to calculate the probability of the IPO firms being angel or venture-backed. Otherwise, the systems of equations are largely similar. We find in Table 8 that our results are robust to using a 3SLS regression technique.

#### **4. Robustness Checks**

To insure that our results are robust, we duplicate our multivariate analysis using various alternative control variables. In our regressions we follow Loughran and Ritter (2004) in using a dummy variable for pure primary offering to describe the selling of shares by pre-IPO shareholders. However, Ljungqvist and Wilhelm (2003) utilize a measure called participation ratio which they calculate as the number of secondary shares sold divided by the number of pre-IPO shares outstanding. When we control for participation ratio as opposed to utilizing a pure primary dummy variable for the offering, we find that in Table 7 models (4) and (6) the dummy variable on angel

backing is now significant at the 5% level; our current results in models (4) and (6) show that the angel backing dummy is insignificant and significant at the 10% level, respectively. When we replace the pure primary backing dummy with participation ratio in the 2SLS and 3SLS models in Table 8, we find that the venture backing dummy is always significant at the 5% level and the angel backing dummy is always insignificant. Thus, we find that our results are not sensitive to our control for secondary share sales.

We also vary our definition of what it means for a state to be considered a “big venture backing” state. In our tabulated results, we use the definition as any firm located in California or Massachusetts. However, if we define a “big venture state” as any firm located in California alone, then our results in Table 8 for our first stage regression shows that the angel dummy is significantly related to this variable at the 10% level but the venture dummy is unrelated to this variable once we control for the other firm characteristics. Our second stage regression shows that underpricing is significantly (5% level) related to venture backing but unrelated to angel backing, once we control for endogeneity. If instead we define a “big venture state” as any firm located in California, Massachusetts, or New York, our first stage shows that venture backing is not related to geography and angel backing is significantly related to this dummy (10% level). This definition of a big venture-backed state results in a significant coefficient of the instrumented venture backing variable (5% significance) and an insignificant coefficient on the instrumented angel dummy variable.

In Table 5 we examine the relationship between pre-IPO ownership and whether or not the IPO firm is a pure primary offering (Panel A) and the percent of shares sold in the IPO that are primary shares (Panel B). We repeat our analyses of all models including Fama and French (1997) industry dummy variables. We find that the results are not appreciably changed. In all models where the variable related to angel backing is significant, it remains significant at least at the 10% level.

Our results in Table 7 examining the OLS relationship between angel backing and underpricing are somewhat sensitive to the inclusion of a pure primary offering dummy variable. This is due to the fact that a high percentage of angel-backed firms are not pure primary offerings. We duplicate our results in Table 8 omitting the pure primary dummy variable from the first and second stage regressions and find no significant alteration in the sign or significance of the key variables. Likewise, the 3SLS regression results are unchanged by the omission of the pure primary dummy variable. We also repeat our 2SLS results looking at the subsample of firms that are pure primary offerings (N=411) versus mixed offerings (N=254). We find that for pure primary offerings, the instrumented venture backing dummy is significant at the 5% level and the instrumented angel backing dummy is insignificant, consistent with our overall sample. We find that for mixed offerings, the instrumented venture backing dummy is insignificant with a p-value of 0.11. We attribute this lack of significance to the loss of power when the sample size drops from N=665 to N=254, as opposed to there being any substantial difference for pure primary versus mixed offerings.

We also examine the impact of omitting year dummy variables in our 2SLS and 3SLS regressions in Table 8. We find that our results are not significantly impacted by removing the year dummies either in the second stage regression alone, or in the first and second stage. Second stage regressions always have the instrumented venture capital dummy significant at the 10% level or better in all combinations, but the instrumented angel dummy variable is never significant.

The IPO underpricing literature has shown that a major determinant of underpricing is whether or not the IPO firm is in the technology industry (see Loughran and Ritter (2004) and Ljungqvist and Wilhelm (2003)). Our OLS regressions from Table 7 confirm this result. We also consider the possibility of including industry dummy variables in models that control for endogeneity in Table 8. However, our instrumental variables in the first stage are largely industry

specific meaning that adding industry dummies would eliminate the statistical significance of these instrumental variables in the first stage.<sup>20</sup> Cliff and Denis (2004) also point out the problems of multicollinearity when including large numbers of dummy variables in 2SLS systems. We find that the results are qualitatively similar when Fama and French (1997) industry dummy variables are included in Table 8 although the instrumented venture capital dummy variable is no longer significant at normal levels. We attribute this loss of significance to the loss of power for the instruments and the multicollinearity problem alluded to previously.

## **5. Conclusions**

We find that a substantial portion of IPO firms that go public are backed by angel investors. In fact, many IPO firms (13.4%) have angel investors as their only significant outside shareholders. We show that geography and industry characteristics, in particular, industry growth rates as proxied by Tobin's Q, firm R&D, and being located in California or Massachusetts are strong determinants of venture backing of IPO firms. In contrast, angel backing is most strongly related to being in California or Massachusetts and industry leverage.

We also show that while venture investors are prone to underprice IPO firms, reducing the proceeds from the offering, angel investors have incentives more aligned with non-venture capital pre-IPO shareholders. Our results suggest that prior to making a decision about obtaining angel versus venture financing, private firm management should also consider the consequences of such early investors on IPO firm proceeds raised in an eventual IPO.

Management in the process of looking for outside equity investors is faced with several decisions related to the source of capital. First, managers will be restricted by what kinds of firms angels and venture capitalists will invest in with respect to industry sector and other industry characteristics. Venture capitalists prefer industries with low debt, high R&D, and high growth

rates. In contrast, angel-backed firms are typically in industries able to take on higher levels of debt. Second, managers must consider the possibility of eventual exit to the IPO market. Angel and/or venture capital backed firms go public at a younger age than non-backed firms implying that these investors have unique skills that enable a firm to go public sooner. Finally, where both angel investors and venture capitalists provide equity to the firm, angel investors have a lower incentive to underprice the offering resulting in a direct monetary gain to the firm.

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**Appendix**  
**Construction of Variables**

Variable	Data Sources	Description
IPO proceeds	SDC	Offer proceeds.
High ranking underwriter (dummy)	Ritter	Dummy variable taking a value of one if the underwriter rank is 9 and zero otherwise. We thank Jay Ritter for providing this data on his web site at <a href="http://bear.cba.ufl.edu/ritter/ipodata.htm">http://bear.cba.ufl.edu/ritter/ipodata.htm</a>
Underwriter spread	SDC	Percent of the offering paid to the underwriter.
Offer price revision	SDC	Change from range midpoint to final offer price.
Underpricing	SDC, CRSP	The percent return from the offer price from SDC to the IPO day closing price (CRSP).
IPO frequency	SDC	Number of IPOs in month of issue and the previous month.
Average underpricing	SDC, CRSP	Average IPO underpricing for all IPOs in the month of issue and the previous month.
Pre-IPO market return	CRSP	Average market return on the CRSP value-weighted index from 3 weeks before the issuance to the issuance.
IPO market capitalization age	CRSP Ritter, Field	Shares outstanding times the closing price on the offer date. The difference between the IPO calendar year and the firm founding starting year. We thank Jay Ritter for providing this data on his web site at <a href="http://bear.cba.ufl.edu/ritter/ipodata.htm">http://bear.cba.ufl.edu/ritter/ipodata.htm</a>
Big VC state	COMPUSTAT	Dummy variable taking a value of one if the IPO firm is principally located in California or Massachusetts, and zero otherwise.
ROA or return on assets	COMPUSTAT	Calculated as COMPUSTAT data item 172/data item 6 in the fiscal year of the IPO.
Total assets	COMPUSTAT	COMPUSTAT data item 6 in the fiscal year of the IPO.
Percent of shares held by angels	Prospectus	Cumulative shares held by angels.
Percent of shares held by venture capitalists	Prospectus	Cumulative shares held by venture capitalists.
Number of angel backers	Prospectus	Count of angel investors owning shares in the firm.
Number of venture backers	Prospectus, SDC	Count of venture capitalists owning shares in the firm.
Non-exchange traded	SDC, COMPUSTAT	A dummy variable taking a value of one if the stock is not traded on the NASDAQ, MYSE, or AMEX and zero otherwise.
Shares per angel	Prospectus	The average percent of shares held by angel investors.
Shares per venture capitalist	Prospectus	The average percent of shares held by venture capitalists.
Technology industry (dummy)	COMPUSTAT, Loughran and Ritter (2004) Appendix D.	A dummy variable taking a value of one if the IPO firm SIC code is any one of the following codes: 3571, 3572, 3575, 3577, 3578, 3661, 3663, 3669, 3671, 3677, 3675, 3677, 3678, 3679, 3812, 3823, 3825, 3826, 3827, 3829, 3841, 3845, 4812, 4813, 4899, 7371-7375, 7378, 7379.
State concentration (Herfindahl Index)		Normalized Herfindahl-Hirschman index as defined by the sum of the squared market shares of all participants in the same industry as the IPO firm, normalized such that $H^* = (H - 1/N) / (1 - 1/N)$ .
Industry Tobin's Q	COMPUSTAT	The median Tobin's Q for the Fama and French (1997) 48 industry classification in the founding year of the IPO firm as defined by $(\text{data } 6 - \text{data } 60 + \text{data } 24 * \text{data } 25) / \text{data } 6$ .
Industry leverage	COMPUSTAT	The median leverage for the Fama and French (1997) 48 industry classification in the founding year of the IPO firm as defined by $(\text{data } 5 + \text{data } 9) / \text{data } 6$ .
Industry R&D/assets	COMPUSTAT	The median R&D/assets for the Fama and French (1997) 48 industry classification in the founding year of the IPO firm as defined by $(\text{data } 46) / \text{data } 6$ .
Industry PPE/assets	COMPUSTAT	The median PPE/assets for the Fama and French (1997) 48 industry classification in the founding year of the IPO firm as defined by $\text{data } 8 / \text{data } 6$ .
Industry assets	COMPUSTAT	The median assets for the Fama and French (1997) 48 industry classification in the founding year of the IPO firm as defined by $\text{data } 6$ .

**References**

- Brav, Alon and Paul Gompers, 1997, Myth or Reality? The Long-Run Performance of Initial Public Offerings: Evidence from Venture and non-Venture Capital-Backed Companies, *Journal of Finance* 52, 1791-1821.
- Bodnaruk, Andriy, Eugene Kandel, Massimo Massa, and Andrei Simonov, 2008, Shareholder Diversification and the Decision to Go Public, *The Review of Financial Studies* 21, 2779-2824.
- Booth, J. and L. Chua, 1996, Ownership Dispersion, Costly Information, and IPO Underpricing, *Journal of Financial Economics* 41, 291-310.
- Chahine, Salim, Igor Filatotchev, and Mike Wright, 2007, Venture capitalists, business angels, and performance of entrepreneurial IPOs in the UK and France, *Journal of Business Finance & Economics* 34, 505-528.
- Chemmanur, Thomas and Zhaohui Chen, 2006, Venture Capitalists versus Angels: The Dynamics of Private Firm Financing Contracts, AFA 2003 Washington, DC Meetings. Available at SSRN: <http://ssrn.com/abstract=342721>.
- Chemmanur, Thomas and Elena Loutskina, 2006, The Role of Venture Capital Backing in Initial Public Offerings: Certification, Screening, or Market Power?, EFA 2005 Moscow Meetings Paper. Available at SSRN: <http://ssrn.com/abstract=604882>.
- Chen, H. C., and Jay Ritter, 2000, The seven percent solution, *Journal of Finance* 55, 1105-1131.
- Cliff, Michael and David Denis, 2004, Do IPO Firms Purchase Analyst Coverage with Underpricing?, *Journal of Finance* 59, 2871-2902.
- Fama, E.F. and K.R. French, 1997, Industry costs of equity, *Journal of Financial Economics* 43, 153-193.
- Freear, John, Jeff Sohl, and William Wetzel, 2002, Angles on angels: Financing technology-based ventures – a historical perspective, *Venture Capital* 4, 275-287.
- Global Entrepreneurship Monitor 2000 Executive Report, 2001, P. Reynolds, M. Hay, W. Bygrave, S.M. Camp and E. Autio (Eds.). Kauffman Center for Entrepreneurial Leadership, London Business School and Babson College, Babson Park.
- Gittell, Ross and Jeffrey Sohl, 2005, Technology centres during the economic downturn: what have we learned?, *Entrepreneurship & Regional Development* 17, 293-312.
- Goldfarb, Brent, Gerard Hoberg, David Kirsch, and Alexander Triantis, 2007, Are angels preferred venture investors? University of Maryland working paper.
- Gompers, Paul, 1995, Optimal investment, monitoring, and the staging of venture capital, *Journal of Finance* 50, 1461-1490.

- Gompers, Paul, 1996, Grandstanding in the venture capital industry, *Journal of Financial Economics* 43, 133-156.
- Gompers, Paul and Josh Lerner, 1998, Venture capital distributions: Short-run and long-run reactions, *Journal of Finance* 53, 2161-2183.
- Gompers, Paul and Josh Lerner, 2000, Money chasing deals? The impact of fund inflows on the valuation of private equity investments, *Journal of Financial Economics* 55, 281-325.
- Gompers, Paul, and Josh Lerner, 2004, *The venture capital cycle*, MIT Press.
- Harrison, Richard and Colin Mason, 2000, Venture capital market complementarities: the links between business angels and venture capital funds in the UK, *Venture Capital: An International Journal of Entrepreneurial Finance* 2(3), 223-242.
- Huyghebaert, Nancy and Cynthia Van Hulle, 2006, Structuring the IPO: Empirical evidence on the portions of primary and secondary shares, *Journal of Corporate Finance* 12(2), 296-320.
- Lee, Peggy M, and Sunil Wahal, 2004, Grandstanding, certification, and the underpricing of venture capital backed IPOs, *Journal of Financial Economics* 73, 375-407.
- Lerner, Josh, 1994, Venture capitalists and the decision to go public, *Journal of Financial Economics* 35, 293-316.
- Lerner, Josh, 1995, Venture capitalists and the oversight of private firms, *Journal of Finance* 50, 301-318.
- Lerner, Josh, 1998, "Angel" financing and public policy: An overview, *Journal of Banking and Finance* 22, 773-783.
- Ljungqvist, Alexander and William Wilhelm, 2003, IPO pricing in the Dot-com Bubble, *Journal of Finance* 63, 723-752.
- Loughran, Tim and Jay Ritter, 2004, Why has underpricing changed over time?, *Financial Management* 33, 5-37.
- Mason, Colin and Richard Harrison, 2000, Informal venture capital and the financing of emergent growth businesses. In D.L. Sexton and H. Landström (Eds.), The Blackwell Handbook of Entrepreneurship, Oxford: Blackwell.
- Meggison, William, and Kathleen Weiss, 1991, Venture capitalist certification in initial public offerings, *Journal of Finance* 46, 879-903.
- Petersen, M.A. and R.G. Rajan, 1995, The effect of credit market competition on lending relationships, *Quarterly Journal of Economics* 110, 407-444.
- Sahlman, William, 1990, The structure and governance of venture-capital organizations, *Journal of Financial Economics* 27, 473-521.

- Sohl, Jeffrey, 1999, The Early Stage Equity Market in the United States, *Venture Capital: An International Journal of Entrepreneurial Finance* 1(2), 101-120.
- Sohl, Jeffrey, 2003, The private equity market in the USA: lessons from volatility, *Venture Capital: An International Journal of Entrepreneurial Finance* 5(1), 29-46.
- Sohl, Jeffrey, 2006, Angel investing: changing strategies during volatile times, *Journal of Entrepreneurial Finance and Business Ventures* 11(2), 27-47.
- Sohl, Jeffrey, 2007, The Angel Investor Market in 2007: Mixed signs of growth, Center for Venture Research Full Year 2007 Angel Market Analysis Report, <http://wsbe.unh.edu/analysis-reports-0>.
- Sohl, Jeffrey, Mark Van Osnabrugge and Robert Robinson, 2000, Models of angel investing: groups to the early stage market. In P.D. Reynolds, E. Autio, C.G. Brush, W.D. Bygrave, S. Manigart, H.J. Sapienza and K.G. Shaver (Eds.), Frontiers of Entrepreneurship Research, Babson Park: Babson College, 289.
- Tian, Xuan, 2007, Geography and the Structure of Venture Capital Financing, EFA 2007 Ljubljana Meeting Paper. Available at SSRN: <http://ssrn.com/abstract=965803>.
- Van Osnabrugge, Mark, 2000, A comparison of business angel and venture capitalist investment procedures: an agency theory-based analysis, *Venture Capital: An International Journal of Entrepreneurial Finance* 2(2), 91-109.
- Wong, Andrew Y., 2002, Angel finance: The other venture capital, University of Chicago working paper.
- Zacharakis, Andrew and Dean Shepherd, 2007, The pre-investment process: Venture capitalists' decision policies. In Hans Landström (Ed.), Handbook of Research on Venture Capital, UK: Edward Elgar Publishers, 177-192.

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**Footnotes**

<sup>1</sup> See, for example, Lerner (1995), Gompers (1996), Ljungqvist and Wilhelm (2003), Loughran and Ritter (2004), Chemmanur and Loutskina (2006), and Brav and Gompers (1997).

<sup>2</sup> In this paper, we utilize the term private investor, individual investor and angel investor interchangeably.

<sup>3</sup> Pre-IPO investors in general and managers in particular may also care about share ownership dispersion and control (Booth and Chua (1996)). As such, managers may have incentives to hold large blocks of shares to enhance their control of the firm.

<sup>4</sup> <http://www.sec.gov/divisions/corpfin/guidance/execcomp403interp.htm> describes the requirement to disclose stock ownership in the prospectus of the IPO firm.

<sup>5</sup> One notable exception is a theoretical paper by Chemmanur and Chen (2006) which proposes a model to explain whether entrepreneurs choose financing from angel investors or venture capitalists.

<sup>6</sup> In addition, for hypothesis H4, we could also add the argument that venture investors will take firms public earlier due to grandstanding (Gompers (1996)). We address this issue explicitly in hypothesis H5.

<sup>7</sup> Angel investors do still have the same incentives as venture capitalists to accept a lower than “fair market value” for their investment to enhance the liquidity of their position. But this incentive to accept a less than “fair market value” applies to all pre-IPO investors: venture capitalists, angels, and firm management.

<sup>8</sup> A venture capitalist which makes investments with their venture firms or as an individual angel will be classified for all investments as a venture capitalist. This is because the individual making the angel investment will show up as a venture capitalist in either *Pratt's* or *Who's Who*. Our classification is conservative in this sense because even angel investments by partners in a venture capital will be eliminated as potential angel investors.

<sup>9</sup> Note that because these Herfindahl measures use the entire sample to make the calculation we cannot do any statistical analysis on the differences between the groups. This is because we cannot get an individual firm measure of the geographic or industry diversification, only for the group as a whole.

<sup>10</sup> We recognize that in firms backed by angels plus venture capitalists, there are multiple rounds of financing which will result in the dilution of early investors in the firm, likely to be angels.

<sup>11</sup> We choose a large VC state as California or Massachusetts following Gompers and Lerner

(2000).

<sup>12</sup> This does not imply that the individual angel invests in firms farther away from their own geographic location. Rather the implication is that angel investors are less geographically concentrated than venture capitalists.

<sup>13</sup> The correlation between the venture backing dummy variable and firm age is -0.25, significant at the 1% level. The correlation between the angel backing dummy variable and firm age is -0.10, also significant at the 1% level.

<sup>14</sup> We choose not to present regressions using investors as the unit of observation. This is for two main reasons. First, we observe very little concerning each investor not allowing us to control for investor characteristics in the way that Bodnaruk, Kandel, Massa, and Simonov (2008) can. Second, the investor observations are clearly not independent, but are highly correlated within a firm. Thus, there are data problems and econometric problems with presenting a regression predicting individual shareholder sales based on if the individual is an angel or venture investor.

<sup>15</sup> In multivariate regressions, Loughran and Ritter (2004) find that a pure primary offering dummy variable is negative and significant for IPOs from 1990-1998, positive but insignificant for IPOs from 1999-2000, and negative but insignificant for IPOs from 2001-2003. These results are consistent with our relationship between underpricing and pure primary offerings from 2001-2003.

<sup>16</sup> Due to some inconsistency of the influence of a pure primary dummy variable on underpricing as documented by Loughran and Ritter (2004), we omit this variable from our initial regression model. Later regressions will include this variable to be sure our results are not appreciably influenced by its inclusion.

<sup>17</sup> Earlier research focuses on venture investments. We are obviously concerned with both angel and venture investments.

<sup>18</sup> 57 of our IPO firms out of 665 have a founding year prior to 1950. Rather than use the industry characteristics in the year of the IPO founding, for these firms, we use the IPO characteristics in 1950. Of these firms, the average age is 90.0 years but the time of the IPO after 1950 is 54.3 years. Our results are robust to the elimination of these 57 firms.

<sup>19</sup> Unlike venture firms, angel investors are not likely to be able to self-finance future rounds of equity in the firms they invest in. As such, any future investments of equity will likely be made by other investors who will take preferential positions in the firm and dilute the original angel investment substantially. Venture investors do not face these same constraints because they are able to raise more funding from their partners for future rounds of financing.

<sup>20</sup> Even a dummy variable for being in California or Massachusetts is somewhat industry specific

since there are excessive concentrations of certain industries in these two states.

**Table 1**  
**Frequency distribution of IPOs with private equity and venture capital investment backing, by year and industry**

The sample is comprised of 665 IPOs reported in the Securities Data Corporation (SDC) New Issues database between 2001 and 2007. All REITs, unit offerings, closed-end funds, ADRs, firms not covered by CRSP, banks, savings and loans, utilities, non-US based IPOs, and IPOs with an offer price below \$5 are removed from the sample. We use the SDC database and preliminary prospectus from the SEC's EDGAR web site to determine if the IPO is backed by a venture capitalist or a private investor. We define a private backed IPO as any firm with stock ownership at or above the 2% level by an individual, who is neither affiliated with the firm as an employee, is not related to the firm management, and who is not affiliated with a venture capitalist.

<i>Panel A: Total sample of IPOs with private equity and/or venture capital backing by year</i>					
Year	IPO firms without angel or venture backing (N=251)	IPO firms with angel backing (N=89)	IPO firms with venture backing (N=218)	IPO firms with angel and venture backing (N=107)	Total
2001	25	2	25	6	58
2002	24	7	18	4	53
2003	22	5	16	7	50
2004	50	10	60	23	143
2005	57	15	21	14	107
2006	40	22	48	14	124
2007	33	28	30	39	130
Total	251	89	218	107	665

<i>Panel B: Percent of sample with private equity and/or venture backing by industry</i>					
Industry	IPO firms without angel or venture backing (N=251)	IPO firms with angel backing (N=89)	IPO firms with venture backing (N=218)	IPO firms with angel and venture backing (N=107)	Total
Manufacturing	9.6%	10.1%	5.0%	1.9%	6.9%
Wholesale and Retail	10.8%	12.4%	4.1%	7.5%	8.3%
Healthcare	8.4%	11.2%	41.3%	26.2%	22.4%
Technology	13.9%	22.5%	29.8%	33.6%	23.5%
Other	57.4%	43.8%	19.7%	30.8%	39.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

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**Table 2**  
**Sample characteristics**

The sample is comprised of 665 IPOs reported in the Securities Data Corporation (SDC) New Issues database between 2001 and 2007. All REITs, unit offerings, closed-end funds, ADRs, firms not covered by CRSP, banks, savings and loans, utilities, non-US based IPOs, and IPOs with an offer price below \$5 are removed from the sample. We use the SDC database and preliminary prospectus from the SEC's EDGAR web site to determine if the IPO is backed by a venture capitalist or a private investor. We define a private backed IPO as any firm with stock ownership at or above the 2% level by an individual, who is neither affiliated with the firm as an employee, is not related to the firm management, and who is not affiliated with a venture capitalist. To determine the statistical significance of each variable across groups, we conduct the following multivariate regression:

$$\text{IPO firm characteristic} = \alpha + \beta_1 \text{ angel dummy} + \beta_2 \text{ vc dummy} + \beta_3 \text{ angel dummy} \times \text{vc dummy} + \varepsilon$$

We report the statistical significance for  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$  in the columns for IPO firms with angel backing, IPO firms with venture backing, and IPO firms with angel and venture backing, respectively. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level respectively.

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<b>Panel A: Average deal and time series characteristics</b>				
	IPO firms without angel or venture backing (N=251)	IPO firms with angel backing (N=89)	IPO firms with venture backing (N=218)	IPO firms with angel and venture backing (N=107)
IPO proceeds (\$ millions)	269.28	155.73**	105.74**	138.27**
Underwriter rank	7.88	7.84	8.27**	8.40
Non-exchange traded (dummy)	0.01	0.01	0.01	0.01
Spread	6.70%	6.87%*	6.90%**	6.88%
Offer price revision	-3.13%	-3.96%	-9.89***	-2.38%**
Underpricing	9.12%	11.36%	12.78%**	18.37%
Average underpricing	11.52%	12.37%	12.79%**	12.21%
IPO frequency	24.23	23.96*	22.56	24.76
Pre IPO market return	0.22%	0.52%	0.32%	0.31%
State concentration (Herfindahl index)	0.05	0.09	0.14	0.22
Fama and French (1997) 48 industry concentration (Herfindahl index)	0.03	0.04	0.12	0.10

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<b>Panel B: Average IPO firm characteristics</b>				
	IPO firms without angel or venture backing (N=251)	IPO firms with angel backing (N=89)	IPO firms with venture backing (N=218)	IPO firms with angel and venture backing (N=107)
IPO market capitalization (\$ millions)	833.82	775.62	422.69***	639.62
Percent of shares held by angels	0.00%	21.22%***	0.00%	14.59%
Percent of shares held by venture capitalists	0.00%	0.00%	34.70%***	36.35%
Percent of shares sold by angels in offering	0.00%	4.18%***	0.00%	2.30%**
Percent of shares sold by venture capitalists in offering	0.00%	0.00%	3.80%***	5.32%
Number of angel backers	0.00	2.84***	0.00	2.67
Number of venture backers	0.00	0.00	4.26***	4.21
Shares per angel	0.00	6.00%***	0.00	5.63%
Shares per venture capitalist	0.00	0.00	13.87%***	11.39%
<b>Panel C: Median IPO industry characteristics in IPO founding year</b>				
	IPO firms without angel or venture backing (N=251)	IPO firms with angel backing (N=89)	IPO firms with venture backing (N=218)	IPO firms with angel and venture backing (N=107)
Industry Tobin's Q	1.56	1.64	2.13***	1.96**
Industry leverage	0.43	0.43	0.37***	0.40**
Industry R&D/assets	0.03	0.05**	0.10***	0.09**
Industry PPE/assets	0.28	0.25	0.19***	0.18

**Table 3**  
**Geography and age of IPOs by angel and venture capital backing**

The sample is comprised of 665 IPOs reported in the Securities Data Corporation (SDC) New Issues database between 2001 and 2007. All REITs, unit offerings, closed-end funds, ADRs, firms not covered by CRSP, banks, savings and loans, utilities, non-US based IPOs, and IPOs with an offer price below \$5 are removed from the sample. We use the SDC database and preliminary prospectus from the SEC's EDGAR web site to determine if the IPO is backed by a venture capitalist or a private investor. We define a private backed IPO as any firm with stock ownership at or above the 2% level by an individual, who is neither affiliated with the firm as an employee, is not related to the firm management, and who is not affiliated with a venture capitalist. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level respectively.

<i>Panel A: Percent of IPO firms in California, Massachusetts, New York, and Texas backed by angels and venture capitalists</i>				
IPO firm principal location	IPO firms without angel or venture backing (N=251)	IPO firms with angel backing (N=89)	IPO firms with venture backing (N=218)	IPO firms with angel and venture backing (N=107)
California (N=183)	26	17	85	52
Massachusetts (N=48)	5	3	23	17
New York (N=54)	26	5	20	3
Texas (N=50)	27	0	12	11
Other states (N=333)	129	32	116	56
Total sample (N=665)	213	57	256	139

<i>Panel B: Percent of IPO firms in California or Massachusetts (Big VC state)</i>				
	IPOs without venture backing (N)	IPOs with venture backing (N)	Difference	t-statistic
IPOs without angel backing (N)	15.94% (N=251)	44.95% (N=218)	29.02%	7.24***
IPOs with angel backing (N)	35.96% (N=89)	54.21% (N=107)	18.25%	2.58**
Difference t-statistic	20.02% 4.06***	9.25% 1.57		

<i>Panel C: Age of IPO firms at the time of their IPO (years)</i>				
	IPOs without venture backing (N)	IPOs with venture backing (N)	Difference	t-statistic
IPOs without angel backing (N)	27.53 (N=251)	14.41 (N=218)	13.12	5.42***
IPOs with angel backing (N)	21.36 (N=89)	10.91 (N=107)	10.45	3.94***
Difference t-statistic	6.17 1.74*	3.50 1.64*		

**Table 4**  
**Percent of primary shares sold by angel and venture-backed IPO firms**

The sample is comprised of 665 IPOs reported in the Securities Data Corporation (SDC) New Issues database between 2001 and 2007. All REITs, unit offerings, closed-end funds, ADRs, firms not covered by CRSP, banks, savings and loans, utilities, non-US based IPOs, and IPOs with an offer price below \$5 are removed from the sample. We use the SDC database and preliminary prospectus from the SEC's EDGAR web site to determine if the IPO is backed by a venture capitalist or a private investor. We define a private backed IPO as any firm with stock ownership at or above the 2% level by an individual, who is neither affiliated with the firm as an employee, is not related to the firm management, and who is not affiliated with a venture capitalist. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level respectively.

<i>Panel A: Percent of pure primary IPO firms (IPO firms selling no secondary shares)</i>			
	IPOs without venture backing (N)	IPOs with venture backing (N)	Difference t-statistic
IPOs without angel backing (N)	63.35% (N=251)	72.94% (N=218)	-9.59% 2.22**
IPOs with angel backing (N)	47.19% (N=89)	47.66% (N=107)	-0.47% 0.07
Difference t-statistic	16.16% 2.68**	25.27% 4.61***	
<i>Panel B: Percent of primary shares sold / total shares sold in the offering</i>			
	IPOs without venture backing (N)	IPOs with venture backing (N)	Difference t-statistic
IPOs without angel backing (N)	82.16% (N=251)	92.11% (N=218)	-9.96% 4.17***
IPOs with angel backing (N)	80.28% (N=89)	83.99% (N=107)	-3.71% 1.17
Difference t-statistic	1.87% 0.52	8.12% 3.71***	

**Table 5**  
**Logit and Tobit models to examine the whether a firm is a pure primary offering and the percent of primary shares sold in the offering**

The sample is comprised of 665 IPOs reported in the Securities Data Corporation (SDC) New Issues database between 2001 and 2007. All REITs, unit offerings, closed-end funds, ADRs, firms not covered by CRSP, banks, savings and loans, utilities, non-US based IPOs, and IPOs with an offer price below \$5 are removed from the sample. We use the SDC database and preliminary prospectus from the SEC's EDGAR web site to determine if the IPO is backed by a venture capitalist or a private investor. We define a private backed IPO as any firm with stock ownership at or above the 2% level by an individual, who is neither affiliated with the firm as an employee, is not related to the firm management, and who is not affiliated with a venture capitalist. The dependent variable in Panel A is a dummy variable taking a value of 1 if the IPO is a pure primary offering and zero otherwise. The dependent variable in Panel B is the number of primary shares sold in the IPO divided by the total shares sold in the IPO. Standard errors robust to heteroskedasticity are reported below the coefficients. \*\*\*, \*\*, and \* indicates significance at the 1%, 5%, and 10% level, respectively.

<i>Panel A: Logit regression to determine if the IPO is a pure primary offering</i>						
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Offering and IPO characteristics</b>						
Log (1+age)	-0.232** (0.102)	-0.206** (0.098)	-0.199** (0.097)	-0.081 (0.117)	-0.047 (0.112)	-0.047 (0.111)
Log (proceeds)	-0.601*** (0.104)	-0.619*** (0.103)	-0.569*** (0.099)	-0.416*** (0.148)	-0.397*** (0.148)	-0.324** (0.141)
IPO frequency	-0.002 (0.012)	-0.004 (0.012)	-0.005 (0.012)	0.008 (0.015)	0.005 (0.015)	0.003 (0.015)
Pre-IPO market return	8.787 (6.156)	8.625 (5.912)	8.256 (5.673)	1.337 (12.674)	2.369 (11.632)	5.078 (11.453)
ROA				-5.374*** (1.254)	-5.406*** (1.229)	-5.526*** (1.218)
Total assets (\$ millions)				12.282 (18.524)	12.378 (18.039)	10.800 (17.268)
<b>Pre-IPO shareholder structure</b>						
Venture backing (dummy)	-0.056 (0.186)			-0.183 (0.234)		
Angel backing (dummy)	-1.004*** (0.191)			-1.407*** (0.249)		
Number of venture investors		0.000 (0.019)			-0.002 (0.023)	
Number of angel investors		-0.269*** (0.056)			-0.330*** (0.071)	
Percent of aggregate venture shares held			-0.001 (0.003)			-0.003 (0.004)
Percent of aggregate angel shares held			-0.018*** (0.006)			-0.022** (0.009)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	665	665	665	506	506	506
Pseudo R <sup>2</sup>	11.11	11.25	8.89	22.41	21.18	18.31

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Panel B: Tobit regression to determine the percent of primary shares sold in the offering

	(1)	(2)	(3)	(4)	(5)	(6)
<b>Offering and IPO characteristics</b>						
Log (1+age)	-0.022*	-0.024**	-0.024**	-0.004	-0.007	-0.007
	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)	(0.013)
Log (proceeds)	-0.079***	-0.082***	-0.081***	-0.066***	-0.068***	-0.066***
	(0.010)	(0.010)	(0.010)	(0.013)	(0.013)	(0.013)
IPO frequency	0.000	0.000	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Pre-IPO market return	0.880	0.847	0.833	0.105	0.157	0.323
	(0.621)	(0.622)	(0.626)	(1.268)	(1.275)	(1.288)
ROA				-0.179***	-0.194***	-0.204***
				(0.048)	(0.048)	(0.048)
Total assets (\$ millions)				-0.040	0.000	-0.118
				(1.833)	(1.844)	(1.855)
<b>Pre-IPO shareholder structure</b>						
Venture backing (dummy)	0.043**			0.040*		
	(0.020)			(0.024)		
Angel backing (dummy)	-0.064***			-0.084***		
	(0.021)			(0.026)		
Number of venture investors		0.004			0.003	
		(0.002)			(0.003)	
Number of angel investors		-0.015***			-0.015**	
		(0.005)			(0.006)	
Percent of aggregate venture shares held			0.000			0.000
			0.000			0.000
Percent of aggregate angel shares held			-0.001*			-0.001
			(0.001)			(0.001)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	665	665	665	506	506	506
Adjusted R <sup>2</sup>	64.20	62.72	58.41	56.55	53.79	50.68

**Table 6**  
**Relationship between pure primary offering and underpricing**

The sample is comprised of 665 IPOs reported in the Securities Data Corporation (SDC) New Issues database between 2001 and 2007. All REITs, unit offerings, closed-end funds, ADRs, firms not covered by CRSP, banks, savings and loans, utilities, non-US based IPOs, and IPOs with an offer price below \$5 are removed from the sample. We use the SDC database and preliminary prospectus from the SEC's EDGAR web site to determine if the IPO is backed by a venture capitalist or a private investor. We define a private backed IPO as any firm with stock ownership at or above the 2% level by an individual, who is neither affiliated with the firm as an employee, is not related to the firm management, and who is not affiliated with a venture capitalist. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level respectively.

<i>Underpricing of IPO firms arranged by pure primary offering over time</i>			
	2001-2003	2004-2007	2001-2007 Entire sample
Pure primary offering (N)	12.74% (N=105)	8.67% (N=306)	9.71% (N=411)
Shares sold by firm plus secondary shares (N)	12.85% (N=56)	16.88% (N=198)	15.99% (N=254)
Difference t-statistic	-0.11% 0.03	-8.21% 4.81***	-6.28% 4.29***

**Table 7**  
**OLS regression model to examine the determinants of IPO firm underpricing**

The sample is comprised of 665 IPOs reported in the Securities Data Corporation (SDC) New Issues database between 2001 and 2007. All REITs, unit offerings, closed-end funds, ADRs, firms not covered by CRSP, banks, savings and loans, utilities, non-US based IPOs, and IPOs with an offer price below \$5 are removed from the sample. We use the SDC database and preliminary prospectus from the SEC's EDGAR web site to determine if the IPO is backed by a venture capitalist or a private investor. We define a private backed IPO as any firm with stock ownership at or above the 2% level by an individual, who is neither affiliated with the firm as an employee, is not related to the firm management, and who is not affiliated with a venture capitalist. The dependent variable is the IPO closing price minus the offering price divided by the offering price. Standard errors robust to heteroskedasticity are reported below the coefficients. \*\*\*, \*\*, and \* indicates significance at the 1%, 5%, and 10% level, respectively.

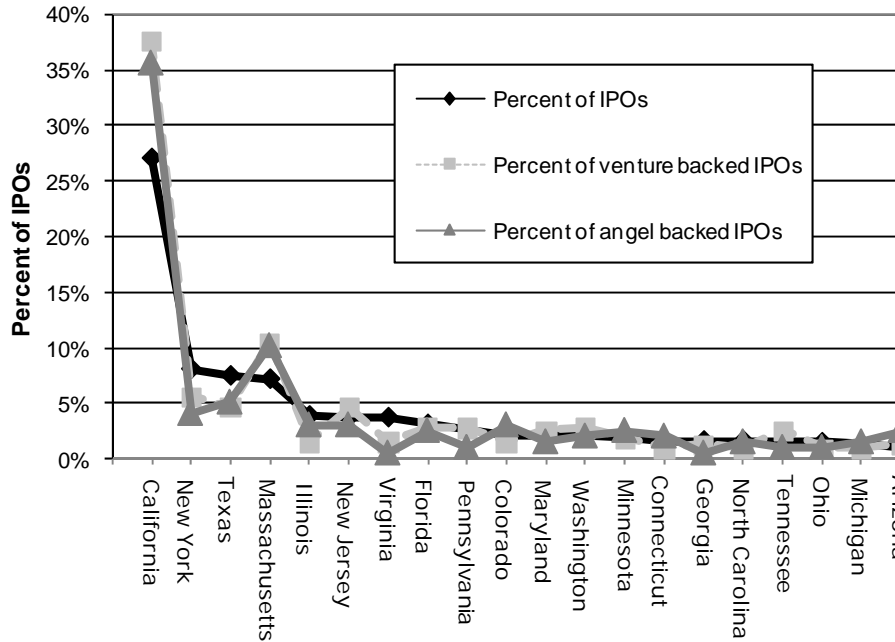
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Offering and IPO characteristics</b>						
Offer price revision	0.312*** (0.038)	0.301*** (0.039)	0.305*** (0.039)	0.299*** (0.038)	0.272*** (0.040)	0.272*** (0.041)
Log(proceeds)	0.024*** (0.009)	0.020** (0.008)	0.025*** (0.008)	0.020** (0.008)	0.029*** (0.009)	0.025*** (0.009)
Underwriter spread	0.031*** (0.010)	0.029*** (0.010)	0.031*** (0.010)	0.030*** (0.009)	0.025** (0.010)	0.024** (0.010)
High ranking underwriter (dummy)	0.025* (0.014)	0.032** (0.014)	0.024* (0.014)	0.028* (0.014)	0.030** (0.014)	0.032** (0.015)
Non-exchange traded (dummy)	0.064 (0.081)	0.059 (0.093)	0.069 (0.083)	0.075 (0.083)	0.050 (0.089)	0.056 (0.089)
Average underpricing	0.824*** (0.157)	0.874*** (0.162)	0.833*** (0.156)	0.835*** (0.152)	0.845*** (0.164)	0.846*** (0.161)
IPO frequency	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Log(1+age)	-0.002 (0.008)	-0.006 (0.008)	-0.001 (0.008)	-0.003 (0.008)	-0.007 (0.010)	-0.008 (0.009)
Pre-IPO market return	0.336 (0.481)	0.283 (0.492)	0.334 (0.484)	0.403 (0.482)	0.232 (0.505)	0.279 (0.506)
Technology firm (dummy)	0.041*** (0.016)	0.047*** (0.016)	0.039** (0.016)	0.037** (0.016)	0.009 (0.034)	0.009 (0.033)
<b>Pre-IPO shareholder structure</b>						
Venture backing (dummy)	0.048*** (0.013)		0.047*** (0.013)	0.046*** (0.013)	0.048*** (0.014)	0.046*** (0.014)
Angel backing (dummy)		0.033** (0.015)	0.030** (0.015)	0.023 (0.016)	0.034** (0.015)	0.029* (0.016)
Pure primary offering (dummy)				-0.037*** (0.014)		-0.027* (0.015)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No	Yes	Yes
N	665	665	665	665	665	665
Adjusted R <sup>2</sup>	29.15	28.32	29.66	30.44	35.90	36.28

**Table 8**  
**Regression models to examine the relationship between underpricing and angel and venture backing controlling for endogeneity**

The sample is comprised of 665 IPOs reported in the Securities Data Corporation (SDC) New Issues database between 2001 and 2007. All REITs, unit offerings, closed-end funds, ADRs, firms not covered by CRSP, banks, savings and loans, utilities, non-US based IPOs, and IPOs with an offer price below \$5 are removed from the sample. We use the SDC database and preliminary prospectus from the SEC's EDGAR web site to determine if the IPO is backed by a venture capitalist or a private investor. We define a private backed IPO as any firm with stock ownership at or above the 2% level by an individual, who is neither affiliated with the firm as an employee, is not related to the firm management, and who is not affiliated with a venture capitalist. The first stage regression is a bi-variate probit model used to predict private equity and venture backing. The second stage regression has IPO firm underpricing as the dependent variable. Standard errors robust to heteroskedasticity are reported below the coefficients. \*\*\*, \*\*, and \* indicates significance at the 1%, 5%, and 10% level, respectively.

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	2SLS Model		3SLS Model	
	First Stage Bivariate probit		Second Stage OLS	
	Venture-backed (dummy)	Angel-backed (dummy)	Underpricing	Underpricing
<b>Offering and IPO characteristics</b>				
Offer price revision	0.164 (0.208)	0.622*** (0.220)	0.289*** (0.046)	0.288*** (0.038)
Pure primary offering (dummy)	-0.194 (0.125)	-0.594*** (0.200)	-0.020 (0.025)	-0.020 (0.023)
Log(proceeds)	-0.200** (0.098)	-0.244* (0.135)	0.031*** (0.012)	0.032** (0.012)
Underwriter spread	-0.109* (0.058)	-0.056 (0.078)	0.033*** (0.010)	0.033*** (0.012)
High ranking underwriter (dummy)	0.430*** (0.120)	0.146 (0.147)	0.015 (0.016)	0.015 (0.016)
Non-exchange traded (dummy)	-0.411 (0.772)	-0.449 (0.472)	0.099 (0.083)	0.099 (0.069)
Average underpricing	2.290** (1.065)	-0.946 (0.848)	0.806*** (0.163)	0.807*** (0.132)
IPO frequency	-0.009* (0.005)	0.007 (0.005)	0.000 (0.001)	0.000 (0.001)
Log(1+age)	-0.184*** (0.057)	-0.078 (0.049)	0.005 (0.009)	0.005 (0.009)
Pre-IPO market return	-5.054*** (1.526)	1.247 (0.919)	0.431 (0.516)	0.430 (0.432)
Technology firm (dummy)	0.174** (0.087)	-0.007 (0.224)	0.025 (0.017)	0.025 (0.017)
<b>Instrumental variables</b>				
Industry Q	0.144* (0.077)	-0.035 (0.136)		
Industry leverage	-0.559* (0.306)	0.844** (0.433)		
Industry R&D/assets	4.033** (1.603)	-0.334 (0.408)		
Industry PPE/assets	-0.318 (0.335)	-0.163 (0.358)		
Big VC state (dummy)	0.330* (0.175)	0.447*** (0.142)		
<b>Pre-IPO shareholder structure</b>				
Instrumented venture-backed IPO (dummy)			0.102** (0.042)	0.101** (0.043)
Instrumented angel-backed IPO (dummy)			0.105 (0.116)	0.106 (0.099)
Year dummies		Yes	Yes	Yes
N		665	665	665
Log pseudolikelihood		-724.329		
R <sup>2</sup>			25.99	
χ <sup>2</sup>				637.62



**Figure 1. Percent of IPOs by state.** The sample is comprised of 665 IPOs reported in the Securities Data Corporation (SDC) New Issues database between 2001 and 2007. All REITs, unit offerings, closed-end funds, ADRs, firms not covered by CRSP, banks, savings and loans, utilities, non-US based IPOs, and IPOs with an offer price below \$5 are removed from the sample. We use the SDC database and preliminary prospectus from the SEC’s EDGAR web site to determine if the IPO is backed by a venture capitalist or a private investor. We define a private backed IPO as any firm with stock ownership at or above the 2% level by an individual, who is neither affiliated with the firm as an employee, is not related to the firm management, and who is not affiliated with a venture capitalist.