Debt Financing, Venture Capital, and the Performance of Initial Public Offerings*

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Abstract

We compare the effects of debt and venture capital (VC) on initial public offerings (IPOs) using data on more than 5,000 IPOs during the period 1980-2002. Our paper finds that firms with high debt have lower levels of valuation uncertainty than those backed by VC, consistent with Ueda (2004). We find that the level of debt is negatively associated with initial returns (underpricing) of IPOs, consistent with the James and Wier (1990) theory. The effects of debt and VC differ over time, and firms with high levels of debt financing have much lower initial returns than low-debt firms during times of greater valuation uncertainty. We also examine effects on long-term performance of firms following their IPOs. Firms with higher levels of debt underperform low-debt firms even after accounting for a wide range of other factors.

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There are numerous studies of initial public offerings (IPOs), and many focus on the initial returns or long-run aftermarket performance of IPOs. While a number of such studies examine the effects of venture capital backing on the initial returns and long-run performance of IPOs, few empirically examine the role of debt financing on the process of going public, and none empirically examine the comparative roles and effects of debt financing versus venture capital (VC) on this process. We extend the literature by examining the contrast between the effects of VC and debt financing on the characteristics of the IPO firms, their initial returns (or underpricing), and their long-term performance following the IPO.

There is a large body of literature on the role of banks in certification and monitoring in general, but little evidence in the context of IPOs, which are characterized by an environment of large information asymmetry between the private firms and the investors. James and Wier (1990) develop a theory suggesting that debt-backed firms should have lower initial returns than firms without debt financing, and they find supporting evidence during 1980-1983. There is relatively scarce additional evidence on the effect of debt on IPOs: Gonzalez and James (2007) document lower underpricing for IPO firms with existing banking relationships during the Internet bubble, and Schenone (2004) documents lower underpricing for firms whose IPO underwriters were also their lenders, also during the bubble period.

There has been considerably more evidence on the effect of venture capitalists on IPO underpricing, and to some degree on the long-term performance of IPOs.[1] Only recently, however, Ueda (2004) examines theoretically the choice between VC and bank borrowing. Ueda hypothesizes that VC-backed firms should have comparatively low collateral, high risk, high growth prospects, higher expected returns, and larger size than firms backed by bank debt. Winton and Yerramilli (2008) also argue that VC backing is more suitable for risky firms. Brav and Gompers (1997) show that the negative long-term performance of IPOs, initially identified by Ritter (1991), is primarily associated with small firms that do not have venture capital backing. To our knowledge, there has been no empirical evidence on the contrast of performance for VC and debt financing on the IPOs' initial returns or long-term stock performance.

Using a sample of more than 5,000 IPOs during 1980-2002, we provide three major results that extend the literature. First, we find that debt backing is associated with lower underpricing, with the effect especially pronounced in periods of high uncertainty, providing direct support for James and Wier's (1990) theory. Furthermore, in contrast to James and Wier's evidence for the 1980-1983 period, we find that not just the existence of bank financing but the level of debt (as a percentage of total assets) is negatively associated with underpricing since the 1990s. For the full period of our sample, firms in the highest quartile of debt financing averaged 17.9% lower first day returns than firms in the lowest quartile of debt financing. During the bubble period of 1999-2000, the difference was 39.3%. Our results complement and extend the finding of Schenone

[1] For example, Barry, Muscarella, Peavy and Vetsuypens (1990) and Megginson and Weiss (1991) find lower underpricing for VC-backed firms in the 1980s; Loughran and Ritter (2004) and Lee and Wahal (2004) find higher underpricing for VC-backed firms during the during the Internet bubble of 1999-2000. Brav and Gompers (1997) find that IPOs with VC backing have higher long-term performance than those without VC.

(2004), who reports similar results on the effect of debt on underpricing for a narrowly focused subset of IPOs whose underwriters were also the firms' bankers during the 1998-2000 period (the peak of the "bubble"), and whose sample is limited to firms with DealScan-reported debt, which eliminates a large set of smaller firms. Our results continue to hold when we control for the endogeneity related to the selection of VC or debt financing.

Second, our paper shows that the characteristics of firms with high levels of debt financing are consistent with less uncertainty about firm value than those backed primarily by VC, and those characteristics generally support the theory of Ueda (2004) and Winton and Yerramilli (2008). Also in direct support of one of Ueda's hypotheses, we find that debt financing and VC backing are substitutes, and the firms that they back are very different. Gonzalez and James (2007) document positive associations between the existence of bank relationships and VC, but they do not use the actual levels of debt financing. We expand the examination by differentiating between high debt and low debt firms (relative to assets) and find that low debt firms are more similar to VC-financed firms than to high debt firms.

Our results on initial returns for high debt-backed firms contrast sharply with those of VC-backed IPO firms in our sample in recent periods. We find that firms that are heavily debt-financed generally have lower initial returns than VC-backed firms, especially during the bubble period of 1999-2000. While we find relatively low initial returns for VC-backed firms during the 1980s, consistent with Barry, Muscarella, Peavy and Vetsuypens (1990) and Megginson and Weiss (1991), for our overall sample VC-backed firms have relatively high initial returns. During the 1999-2000 period, firms with

VC and low debt financing averaged more than 62% higher initial returns than firms with high debt levels but without VC. The comparative characteristics of Ueda's theory also suggest that firms with high levels of debt financing should be easier to value than VC-backed firms. That is consistent with our findings of relatively low initial returns for IPO firms with high levels of debt financing as compared to, on average, relatively higher initial returns for VC-backed firms. The results are also consistent with the Winton and Yerramilli (2008) theory of higher risk for VC-backed firms.

Our third contribution is examining the comparative effects of debt financing and VC on the long-term performance of IPO firms. We find that firms with substantial debt financing tend to have especially low performance (relative to the market and risk factors), while VC-backed firms do not underperform on average. Furthermore, we show that the firms characterized by Brav and Gompers (1997) as small (in market capitalization) and without VC are frequently also firms with high percentages of debt financing. In particular, it is the high percentage debt financing that is especially related to their negative long-term performance relative to low-debt firms even after accounting for a wide variety of other factors.

Lenders tend to examine carefully the risk associated with firms to which they make substantial loans. Unlike venture capitalists, the lenders do not generally share in the upside in equity value from the companies they finance, and so their tendency is to provide backing to firms with characteristics that make the lending relatively safe as opposed to risky characteristics associated with potentially high equity returns. Accordingly, we would expect firms with high levels of debt financing to have relatively large quantities of assets suitable for use as collateral, to show less volatility, and to be

comparatively easier to value. These characteristics tend to be associated with less valuation uncertainty and, therefore, less underpricing at the IPO stage (see, for example, Rock (1986)). Those same characteristics may be associated with lower upside potential in equity value and hence lower long-term equity performance on average, in contrast with VC-backed IPO firms that tend not to have negative, long-run aftermarket performance on average. Our empirical results are consistent with both the initial offer performance and aftermarket performance associated with the characteristics of major borrowers.

The remainder of the paper proceeds as follows: Section I provides a discussion of the theories of debt financing and VC for firms that are going public and for their performance following their IPO. Section II describes the data examined in our study. Section III provides results on debt financing and the performance of debt-backed firms at the IPO stage. It also provides results for different periods. Section IV provides results on the long-term performance of debt-backed and VC-backed firms and examines the effects of including adjustments for market, size, and book-to-market effects. Section V provides a summary of the main results of the paper and the conclusions derived from those results.

I. Debt Financing and Venture Capital: Theory and Empirical Hypotheses

When companies issue common stock in their IPOs, there is uncertainty on the part of the market about the value of the company. There may also be substantial information asymmetry between the firm and the market because of the limited disclosures that private firms are subject to and because of their lack of an established

reputation in the public debt and equity markets. In obtaining debt financing before going public, such companies have to provide information about their assets and operations, and the lenders then are able to serve a role of "certifying" the nature of the company prior to its IPO. Moreover, lenders can take on a role of monitoring since they often have the ability to make choices about whether to renew maturing debt, and those choices may depend on the quality of the firm's investment decisions, operating performance, and financial results. In fact, the monitoring role of bank or private lending can serve further to certify the quality of the offering. On the other hand, venture capitalists tend to provide even more detailed monitoring activities than do lenders, and the venture capitalists may affect the choices and risk-taking activities of the firm as well (see, for example, Winton and Yerramilli (2008)).

Many prior studies have suggested that financial intermediaries help resolve problems of information asymmetry and moral hazard. Leland and Pyle (1977), Boyd and Prescott (1986), and Diamond (1984) emphasize the advantages that financial intermediaries have for monitoring costs relative to other market participants. James and Wier (1990) show that there is less uncertainty in their 1980-1983 sample for IPO firms with debt financing. Fama (1985) hypothesizes that private lenders are also better monitors because of their access to proprietary information. We hypothesize that, all else equal, the incentive to monitor should be an increasing function of the amount of lending.

Given the well-developed theory of banks' roles in resolving problems of information asymmetry through monitoring and certification, it is somewhat surprising that there have been few theoretical predictions on their role in the going public process. James and Wier (1990) extend the above theories to the IPO setting. They state that

"borrowing from intermediaries can reduce information costs for all of a firm's claimants by providing a credible signal about the firm's creditworthiness."[2] They develop a model of the IPO process that demonstrates that debt-financed firms can experience less underpricing (lower first-day returns) than firms without such financing. Beunza and Garud (2005) argue that creditors face very different exposure than stockholders in the companies in which they invest. They argue that creditors and debt analysts are more concerned about the potential downside risk than are shareholders and equity analysts.

The empirical evidence supports James and Wier's (1990) theory and the idea of bank certification in general, but it is fairly limited. James and Weir find lower initial returns for firms with existing banking relationships (but no relationship between underpricing and the level of borrowing) for a limited period during 1980-1983. There is additional supporting evidence that pertains specifically to the Internet bubble: Gonzalez and James (2007) document lower underpricing for IPO firms with existing banking relationships during the Internet bubble (1996-2000), and Schenone (2004) documents lower underpricing for firms whose IPO underwriters were also their lenders (1998-2000). Schenone concludes that the lending provided by the firms' IPO underwriters can reduce information asymmetries, and that such reduction is associated with lower initial returns following the IPO. Based on the James and Wier theory, and on the prior theory on the ability of banks to resolve problems of information asymmetry, we expect debt financing to be associated with lower underpricing. We also expect this effect to be especially pronounced in time periods when the asymmetry is greater.

A number of studies examine the role of VC in the process of going public. Barry, Muscarella, Peavy and Vetsuypens (1990) describe the monitoring role of venture

[2] James and Wier (1990), p. 150.

capitalists and explain the increased benefits to investors of the monitoring and certification roles of higher quality venture capitalists. They also show empirically for a sample during 1978-1987 that initial returns, or underpricing, for IPOs associated with higher quality venture capitalists tend to be lower than for IPOs with lower quality venture capitalist backing. Megginson and Weiss (1991) find that in general the presence of VC is associated with lower initial returns, further supporting the monitoring or certification roles of venture capitalists.

In contrast with these early results, Loughran and Ritter (2004) find average initial returns for VC-backed IPOs during the Internet bubble of 1999-2000 to be 82.2% as opposed to the 38.5% they find for firms without VC. Their VC dummy variable is insignificant during the 1980-1989 period, slightly negative during the 1990-1998 period (significant at the 10% level), and highly positive (21.48%) and significant during the bubble period.[3] Lee and Wahal (2004) also find larger differences in underpricing between IPOs with VC versus those without during the bubble (1999-2000), and they do so with a methodology that uses comparable firms in the comparison.

Ueda (2004) develops a theory of the comparative roles of banks versus venture capitalists in evaluating private companies. Her theory hypothesizes that venture capitalists are more adept at assessing the projects of entrepreneurs and therefore that there would exist greater information asymmetry between banks and borrowers as opposed to venture capitalists and the companies they back. This conclusion is consistent

[3] Since venture capitalists frequently backed Internet companies and since Internet stocks were especially prone to have high initial returns during the bubble period, it is not surprising that venture-backed IPOs would have higher initial returns during that period. However, Loughran and Ritter (2004) account for the Internet stock effect in their regressions (see Table V of their paper) and nevertheless find a large effect on initial returns associated with venture capital.

with Chan (1983), who argues that venture capitalists can screen projects and increase welfare in a world with high information asymmetry. It is also consistent with the monitoring and certification roles of venture capitalists described in Barry, Muscarella, Peavy and Vetsuypens (1990).

In the Ueda (2004) model, to overcome the effects of information asymmetry lenders would tend to back companies with higher levels of collateral, lower risk, lower prospective returns and lower growth rates. She also concludes that the VC-backed firms would have larger market capitalization when they go public. Thus, her model suggests that the characteristics of debt-backed companies, in contrast with VC-backed companies, would tend to result in lower uncertainty about the value of the firm. Myers (1977) hypothesizes that firms with high growth options will sometimes forego valuable investments if they are financed with debt. Thus, consistent with Ueda's hypothesis, firms with high growth potential may be more likely to avoid high levels of debt financing. Winton and Yerramilli (2008) suggest in their theory that VC is optimal only when firms are not so profitable *ex ante* and the firms have risky cash flow but "high returns if successful."[4]

Based on the contrasts drawn in Ueda's (2004) theory, we hypothesize that IPOs with significant debt financing will exhibit different characteristics than VC-backed IPOs in measures of valuation uncertainty and in terms of their growth options vs. assets in place. We also hypothesize that high debt financing and VC should be substitutes. Note that Gonzalez and James (2007) show positive correlation between the availability of bank relationships and VC capital for technology firms during the bubble.

[4] Winton and Yerramilli (2008), Abstract.

Another reason for the expected differences between the debt-backed firms and the VC-backed firms is due to the objective function of banks vs. venture capitalists. Venture capitalists share the upside potential of a rare but spectacular performance by the firm, while the banks do not. That is why venture capitalists can afford many of the firms that they back to fail; the banks cannot. Huntsman and Hoban (1980) demonstrate that VC-backed firms have a relatively high rate of failure but that they also include some firms with extreme upside potential. They examine a sample of 110 investments by three venture capital firms. They find an average rate of return for the VC funds of 18.9%, but when they remove just the top 10% of the sample investment firms, the average annual return falls to a negative value. Thus, they point out that VC depends on "outliers," or investments with prospects for extreme returns. Some in the industry describe this as depending on "home runs." Huntsman and Hoban show a failure rate of about one in six of the VC investments in their sample. On the other hand, banks would tend to rely on companies with stable operating performance and predictable cash flows, more similar to hitting "singles" and "doubles" than "home runs."

Overall, based on the theories of Ueda (2004), James and Wier (1990) and other arguments for the monitoring role of banks and venture capitalists, we hypothesize that firms with high capacities of debt financing will tend to be more easily valued and thus have lower initial returns immediately following their IPOs than will the firms that are largely VC-backed and/or have little or no debt. We also hypothesize that the VC-backed firms will tend to have higher levels of risk than do firms without VC and that high debt firms will have lower risk than firms with little or no levels of debt.

The literature on lending relationships and IPOs generally focuses on the initial returns, or underpricing, of the firms and not on their long-term performance in the aftermarket following the IPO. One exception is Eckbo and Norli (2005), who examine long-run performance in relation to both liquidity (measured as stock turnover) and leverage. They conclude that IPO firms with low, long-term performance are accounted for by their relatively low debt levels.

Ritter (1991) shows that IPO firms tend to have negative long-term aftermarket performance (relative to the equity market as a whole) over the three years following their IPOs. Loughran (1993) expands these results to six years for differences in security markets. Much work that follows Ritter continues to find negative aftermarket performance for IPO firms compared to market indices and to matched samples based on size, industry, and other characteristics of the IPO firms. However, Brav and Gompers (1997) investigate the aftermarket performance of IPO firms and conclude that VC-backed firms do not tend to have negative long-term aftermarket performance (on average) following their IPOs. They account for size and book-to-market effects, which explain some of the negative performance of IPOs previously observed in studies such as that of Ritter. Brav and Gompers, however, do find negative aftermarket performance for small firms that do not have VC. Given the Ueda (2004) hypothesis that venture capitalists tend to finance larger firms than those backed by debt financing, it is interesting to investigate further the relation among VC backing, debt financing, and the size of IPO firms and their long term performance.

Bradley, Jordan, Roten and Yi (2001) provide evidence that high technology stocks with VC backing are especially prone to negative long-run aftermarket

performance, in contrast to the results of Brav and Gompers (1997) regarding VC-backed IPOs. If the results of Bradley, Jordan, Roten and Yi are right, then IPO firms with high debt backing (which tend not to be high technology, VC-backed firms) might behave quite differently in the aftermarket. On the other hand, Brav and Gompers find that small firms (in terms of market capitalization of equity) without VC are the principal negative aftermarket performers. Accordingly, we hypothesize that, in light of the characteristics of heavily debt-financed firms that we observe, IPOs with high debt levels may also be associated with negative, long-run aftermarket performance relative to the market.

Some recent papers rely on the concept established by Miller (1977) suggesting that purchasers of common stock during and soon after an IPO may be the most optimistic investors and that the aggregate opinions of the full market are not reflected in prices.[5] If so, the large, first-day returns may reflect only the valuation opinions of optimists and lead to overpricing. If such overvaluations occur and are corrected over time, then buy-hold returns across time would be below market rates and below rates adjusted for the observable characteristics of the issued stock, including risk, size, market-to-book ratios and others. In such a setting, it may be difficult for arbitrageurs to step in and "correct" the overpricing because the lockup provisions on new issues make it relatively difficult to short the stock.[6]

[5] For example, Houge, Loughran, Suchanek, and Yan (2001) find evidence supporting the Miller concept of overpricing soon after the IPO, followed by poor returns in the aftermarket.

[6] Ofek and Richardson (2003) explain the collapse of the Internet bubble in the first quarter of 2000 by demonstrating that large numbers of Internet stocks had their lockup provisions expire in the February-March period. There are often observed price declines surrounding the end of the lockup period. Bradley, Jordan, Roten and Yi (2001) find that venture-backed, high technology firms have especially large losses around the expiration of the lockup period. Field and Hanka (2001) find negative returns around the lockup expiration, and they find especially large, negative returns when the IPO firms are VC-backed.

Brunnermeier and Nagel (2004) also argue that during the Internet bubble period, hedge funds that might have been expected to arbitrage away the effects of overpricing chose instead to "ride" the bubble and take advantage of continued overpricing, finally selling off their holdings of such stocks shortly before their declines. Since high-debt IPOs tend to have lower initial returns, if low aftermarket returns are driven by unduly optimistic market prices immediately after the IPO, then high-debt issues should not experience poor aftermarket performance. We hypothesize that the VC-backed IPOs will, on average, have higher quality long-run returns than will largely debt-backed IPOs (in both cases, relative to the market returns).

II. Data

We use IPO data generously provided by Jay Ritter and used in Loughran and Ritter (2004).[7] Our sample starts with a list of 8,097 IPOs of common stock in the US during the period 1980-2002. The list contains data on offer dates, firm identities, firm founding dates, Carter-Manaster underwriter ranks, an indicator of VC backing, and a variable indicating whether the firm was technology-related.[8] We match the IPOs with firm and deal characteristics from Thomson Financial's SDC New Issues database.

As in Loughran and Ritter (2004), we exclude American Depository Receipts (ADRs), closed-end funds, real estate investment trusts (REITs), financial institutions (those in SIC codes 6000-6999), unit offerings, and IPOs with an offer price below $5.00 per share. We also exclude IPOs for which the Center for Research in Securities Prices (CRSP) does not report stock prices within one calendar month of the offering. However,

[7] Some of the data were provided to Ritter by Laura Field and were used in Field and Karpoff (2002).
[8] Gonzalez and James (2007) specifically address the effects of technology versus non-technology firms over the 1996-2000 period.

we note that Loughran and Ritter do not exclude reverse leveraged buyout (LBO) IPOs from their sample. Reverse LBOs are firms with existing history and reputation since they were previously public firms before their LBO and before going public again, and so the level of valuation uncertainty can be lower. At the same time, these firms use a high level of debt, but their nature is such that they may be different than high-debt firms that have not been public before. Thus, the inclusion of these firms may influence the relation between the use of debt and underpricing for reasons unrelated to the issues that we raised in the previous section. Therefore, we exclude the reverse LBOs from the sample.[9]

The Securities Data Corporation (SDC) provides an indicator variable for the reverse LBOs until 1998. We hand-collect the data on reverse LBOs from the end of 1998 to the end of 2002 by searching Factiva and Lexis-Nexis for announcements of such offerings in newswires and articles. We exclude 269 LBOs that otherwise would have met our sample inclusion criteria. That reduces our sample to 5,840 IPOs.

We also add financial data from Compustat on the characteristics of the firms in the sample. We are able to obtain firm-level data from Compustat for 5,638 firms, including 5,203 observations for the fiscal year ending prior to the IPO (year -1). The number of observations for specific variables also varies due to data availability. The variables based on Compustat data are measured as of the end of the last fiscal year prior to the IPO. The one exception is the market-to-book ratio, which we measure (as do Brav and Gompers (1997)) using the market value of equity following the IPO (i.e., based on

[9] The results we report in the tables in the paper exclude reverse LBOs. We reran our tests including the reverse LBOs, and the results were qualitatively the same as they were without the reverse LBOs. Including the reverse LBOs, the annual sample sizes closely track those in Loughran and Ritter (2004).

the first trading day's closing price following the IPO) and book equity from the end of the fiscal year in which the IPO takes place.

An advantage of Compustat data on debt financing is that it allows us to use a large sample over our 23-year period (1980-2002), including periods of very different market conditions, such as the ultimate hot period of the Internet bubble and the cold period following the Internet bubble. It also includes details of both large and small firms that go public. A disadvantage is that we cannot separate bank debt from debt financing in general. We note, however, that James and Wier (1990) in their study of the period 1980-1983 could not reject the hypothesis that the effects of long-term debt in general and bank loans in particular on initial returns are the same. Thus, their evaluation does not provide evidence that bank loans play a unique role in reducing information costs for IPOs vis-à-vis other sources of debt financing.

Due to the presence of outliers, we Winsorize certain extreme observations for the empirical analyses. For total debt-to-total assets and long-term debt-to-total assets ratios, we set those ratios that are above the 99th percentile to be equal to the ratios of those at the 99th percentile (note that those below the 1st percentile have a value of zero, just as the 1st percentile does). For net profit margins, EBITDA/Total assets, EBITDA to sales, and operating cash flows to total assets, we set those ratios below the 1st percentile to be equal to those at the 1st percentile and those ratios above the 99th percentile to be equal to those at the 99th percentile.[10]

[10] We also perform analyses by eliminating those extreme observations (above the 99th percentile for debt-to-asset measures, and those below the 1st percentile and above the 99th percentile for the measures described above), and the results are very similar to those analyses in which we Winsorize.

Dollar levels throughout the paper are adjusted for inflation using the monthly consumer price index (CPI) obtained from the FRED database. They are presented in December 2002 constant dollars.

The attached Appendix provides a detailed description of the sample for each of the years (1980-2002) that we examine. We calculate the initial return as the rate of return from the IPO offer price (reported by SDC) to the closing price on the first day for which prices are reported in CRSP. The Appendix includes descriptions of annual IPO characteristics. The results are consistent with the unusually high initial returns that are described by us and by others in the 1999-2000 period of the Internet bubble.

In 2001, after the collapse of Internet stock prices, companies that went public were among the largest in history, measured by revenues, issue size, or total assets. However, the last year of the Internet bubble, 2000, has the largest average IPO market capitalization of any year we examine. Since our measure of market capitalization is based on the closing price for the first day of trades reported by CRSP, those figures include the high initial returns that were experienced on average that year.

We also observe a pattern of decreasing firm age for IPO firms across time from the start of our sample (1980) through the 1999-2000 period (not tabulated). Following the 1999-2000 bubble, the age of the average firm going public again rose compared to the average age during the bubble period.

In Figure I, we present the median total debt-to-total assets ratio, and the fraction of VC-backed IPOs. We calculate the ratio of total debt to total assets after excluding the amount of convertible debt that may be provided by equity investors since such investors may not provide the level of debt-related monitoring and certification roles about which

we hypothesized previously. VC is measured by a dummy variable, with the value "1" indicating the presence of VC and "0" indicating the lack of VC. During the 1999-2000 period, the median debt-to-assets ratio is by far the lowest of any year that we examine. The years 1999-2001 also have the three highest percentages of VC-backed IPOs during the entire period of our sample. The Figure shows a pattern of financing in which debt and venture capital appear to be negatively correlated, i.e., substitutes for each other. This result supports Ueda's (2004) theory. On the other hand, it is in contrast with Gonzalez and James (2007), who find that VC backing is positively correlated with the availability of bank debt. However, they only use the existence or lack of existence of bank debt and do not use the actual quantity of debt. Our results show that the level of debt makes a significant difference.

We calculate the relative frequency of high-debt and low-debt firms by industry affiliation based on two-digit SIC codes, and as we mention industries their two-digit SIC codes are attached. Certain industries account for a much larger percentage of IPO firms than others. For example, Business Services (two-digit SIC 73) accounts for 1,215 IPOs, or 22% of all of the IPOs in our sample, while many industries have IPOs in the single digits. Therefore, for each industry, we calculate the number of IPO firms (relative to the total number of IPOs in the sample) that are in the top half of the sample in terms of leverage, and in the bottom half, and take the difference (we find similar industry distributions if we use only the top and bottom quartiles instead of halves).

The top four industries with the largest relative number of firms in the high-debt quartile are Communications (SIC 48), Health Services (SIC 80), Eating and Drinking Places (SIC 58), and Wholesale Trade-durable Goods (SIC 50). For example, there are

233 IPO firms in Communications, 120 of these are in the top quartile of leverage, 39 are in the second quartile, 34 are in the third quartile, and 40 are in the bottom quartile. The four industries with firms in the highest relative number of low-debt firms are Business Services (SIC 73), Chemicals and Allied Products (SIC 28), Measuring, Analyzing, and Controlling Instruments (SIC 38), and Electronics and Other Electrical Equipment (SIC 36). For example, there are 1,146 firms with leverage data in Business Services, 424 are in the lowest leverage quartile, 344 are in the second lowest quartile, 186 are in the third quartile, and 192 are in the top quartile.

Similarly, we calculate the relative number of VC-backed firms for each industry. The industries with the highest relative number of VC-backed firms are Business Services (SIC 73), Chemicals and Allied Products (SIC 28), Measuring, Analyzing, and Controlling Instruments (SIC 38), and Electronics and Other Electrical Equipment (SIC 36). The industries with the lowest relative number of VC-backed IPOs are Oil and Gas Extraction (SIC 13), Wholesale Trade - Durable Goods (SIC 50), Eating and Drinking Places (SIC 58), and Transportation Equipment (SIC 37).

Once again, we notice a negative relation between leverage and VC-backing. Several of the top industries of high-debt firms are also among the industries with the lowest relative numbers of firms with VC backing. Conversely, the industries with the highest relative numbers of VC-backed firms are among the industries with the most low-debt firms.

As Section III demonstrates, the negative relation between debt financing and VC exhibited in Figure I and in the industry distribution reflects fundamental differences in firm characteristics, as we hypothesize and describe.

III. Debt Financing, Venture Capital, and Initial Returns for IPOs

Table I presents firm characteristics broken down by leverage quartiles and by the presence of VC backing, based on the entire sample period. The first quartile provides results for the firms with the lowest total debt-to-total assets (debt-to-assets) ratios, and the fourth quartile encompasses those with the highest ratios. The debt-to-assets ratios range from an average value of less than 2% for the first leverage quartile to about 84% for the fourth quartile. Thus, there are extreme differences in debt financing among the firms in the sample. For the entire sample (1980-2002), average and median initial returns are much lower for the firms with high debt levels than for those with low debt levels. We also observe that VC-backed firms have much higher average and median initial returns than those without VC in our overall sample period, on average. That result holds for the full sample period, but as we will show later it also varies across subperiods of the sample.

In contrast with the conclusions of Ueda (2004) regarding VC financing versus debt financing and firm size, firms in the high-debt quartiles (quartiles 3 and 4) of our sample period have much larger size on average (as measured by sales or assets) than the lower-debt firms. That is also true of firms without venture capital backing compared to those with VC backing. However, measuring size by market capitalization, the results are reversed and are then in agreement with Ueda's conclusions about size.

James and Wier (1990) argue that one reason for lower initial returns by debt-financed IPO firms compared to others is that debt-backed firms have lower levels of intangible assets. They argue that, "Perverse investment incentives are especially

troublesome for firms with mostly intangible assets,"[11] and they argue that the growth options associated with intangible assets are likely to be associated with greater uncertainty about firm value. One way to measure the relative level of tangible assets is to use the ratio of Property, Plant and Equipment (PPE) divided by Total Assets (TA). PPE indicates a level of investment in real, hard assets that are especially suitable for collateral. The results in Table I show that high-debt firms have much higher levels of the PPE/TA ratio than firms with low debt, which is consistent with the idea that high debt levels require greater levels of collateral.

Consistent with James and Wier's (1990) conjecture regarding uncertainty about firm value associated with high growth options, in Table I we show that Market-to-Book ratios are higher for firms with low debt levels than for firms with high levels of debt.[12] We also find a similar difference for VC-backed firms than for firms without VC, i.e., the firms with VC have higher Market-to-Book ratios on average. The results hold whether we examine the equity Market-to-Book ratios alone or the firm Market-to-Book ratios (the former is not included in the Table). To the extent to which the Market-to-Book ratio proxies for expected growth rates, our results support the idea (as shown, for example, in Ueda (2004)) that venture capitalists tend to back high growth firms that are likely to have greater levels of uncertainty about their values.

Lenders are normally expected to prefer lending to firms with relatively solid levels of earnings and cash flow. Using the results based on the ratio of EBITDA to Total Assets or the fractions of negative EBITDAs, we further observe in Table I that high-debt

[11] James and Wier (1990), p. 158.
[12] This result is also consistent with Myers' (1977) hypothesis that firms with high growth options will sometimes forego valuable investments if they are financed with debt, which suggests that high-growth firms may be more apt to avoid debt financing.

firms are on average more profitable (or, less unprofitable) than low-debt firms. VC-backed firms are also less profitable, on average, than those without VC. These figures reflect the performance of the firms in the fiscal year before their IPOs. Since the VC-backed and low debt firms have higher Market-to-Book ratios following their IPOs, then presumably the market has higher expectations of future growth and profitability for those firms than for those with high debt or without VC. These results are also consistent with higher risk levels for VC-backed IPO firms and, therefore, reflect greater valuation uncertainty.

As Table I further demonstrates, firms with high debt levels or without VC at the time of their IPO tend to be older firms. That is consistent with the generally accepted notion that venture capitalists are able to bring firms to the public market faster than are firms without VC.

We also examine the residual standard deviations and betas for the IPO firms. We note that in general firms with high levels of debt financing tend to have lower values for all of the risk measures, and firms with VC have higher values of the risk measures than do firms without VC. Again, these results are consistent with the hypotheses developed in Ueda (2004). Our results are confirmed if we use equally-weighted returns, or standard deviations instead of residuals (not tabulated).

Since equity betas are an increasing function of leverage ratios as applied to asset betas, all else equal the equity betas of high-debt firms should be higher than those of low-debt firms. Instead, we find the opposite, which further illustrates the point that "all else is not equal." High-debt firms tend to have characteristics associated with relatively low market-related asset risk.

Table I also illustrates the tendency for VC-backed IPOs to be underwritten by higher ranked underwriters than those firms without VC. That is illustrated by the proportion of firms with high-quality underwriters defined as those with a Carter and Manaster (1990) rank of 8 or above, for VC-backed and non-VC-backed IPOs shown in Table I. The Table also shows that the higher debt firms tend to be associated (on average) with lower quality underwriters than the lower debt firms, although the difference is smaller than is the case for VC versus non-VC.

In Table II, we further augment the analysis from Table I by reporting the joint effects of VC and debt on initial IPO returns and the associated firm characteristics. We only report the two biggest contrasts, firms with VC backing and low (or no) debt vs. firms without VC backing but with high debt, as the most illustrative aspects of this effect.[13]

The results near the top of the Table provide comparisons for sales levels and market capitalization (all measured in December 2002 dollars). As the results show, the VC-backed, low-debt IPO firms have much lower levels of pre-IPO sales than do the non-VC-backed, high-debt firms. The differences are strongly significant whether the tests are based on differences in means (using t-scores) or based on the Wilcoxon test of the full sample results. On the other hand, our other size measure, market capitalization, is much higher for the VC-backed, low-debt firms than for the non-VC-backed, high-debt firms. These results confirm the significance of the differences observed in Table I but contrast VC-backed firms with low debt against high debt firms without VC.

[13] The two groups that we do not report, i.e., the firms with VC backing and high debt use, and the firms without VC backing and with low debt use, generally fall between the groups for which we report results. Those two groups generally confirm the effects observed in the two extreme contrasts. For example, among the firms with VC, those with high debt have lower average initial returns than those with low debt.

Table II shows large differences in profitability, with high debt, non-VC firms showing much higher profitability levels or lower losses. The differences are highly significant. Table II also provides tests of the collateral and intangible levels for high debt firms without VC backing versus relatively low debt firms with VC. The PPE/TA ratio is about twice as high for the non-VC-backed, high-debt subset than for the VC-backed, low-debt subset, and the difference is highly significant. Thus, heavily debt-financed firms (without VC) have high levels of PPE assets that are useful for collateral.

Table II also shows that the Market-to-Book ratios are significantly higher for low-debt, VC-backed firms than for high-debt firms without VC. They are strongly supported by the comparisons in Table II which show that risk is much greater for low-debt firms with VC than for high-debt firms without VC. However, as Table II illustrates, when low-debt firms with VC are compared to high debt firms without VC, the differences in underwriter quality are highly significant whether measured by means or medians of the Carter-Manaster ranks.

Table II further demonstrates the differences in timing between firms with VC and low (or zero) percentage levels of debt as compared to firms without VC and with high percentage levels of debt. The IPO firms with VC and low levels of debt (or no debt) have less than half the average lives prior to their IPO as compared to those with high debt and without VC. Table II also shows that measures of risk, such as residual standard deviations and betas, are higher for VC-backed and low debt firms as compared to those with high debt and without VC.

Overall, observations in Tables I and II are largely consistent with a number of the arguments in James and Wier (1990) regarding debt financing and Ueda (2004)

regarding the effects of VC versus debt financing. Much more detailed analyses and results are developed in the remaining parts of this Section.

A. Regression Results: Characteristics that Affect Underpricing in Different Periods

Scholars examining the characteristics of IPO firms that are associated with levels of underpricing have previously included measures of firm size, whether the firm is technology-related, company age, the quality of the underwriter (usually measured by the Carter and Manaster (1990) ranks), proceeds of the offering and some other characteristics. Loughran and Ritter (2004) provide an example of such results and also provide references to earlier studies that examine such characteristics. Recent tests have tended to recognize that the Internet bubble period of 1999-2000 was quite different than other periods, and so some such studies incorporate "period" dummy variables. Some also incorporate dummy variables for VC backing (such as, for example, Brav and Gompers (1997)).

Table III provides regression results for initial returns, or underpricing, using a variety of variables that are commonly thought to be related to underpricing. The main point of Table III is to identify the effect of debt financing and VC on underpricing while controlling for other variables that influence underpricing as well. By design, our regression specification closely follows that of Loughran and Ritter (2004) except that we include the ratio total debt-to-total assets.

The first two columns of results are for the entire period of our sample, 1980-2002, but they also include dummy variables for subperiods including 1990-1998, 1999-2000, and 2001-2002. Our results across time include four subperiods (adding 1980-1989

to the list above). We break our sample period into these four subperiods for several reasons. First, these subperiods roughly correspond to different IPO cycles, as characterized by the initial returns or number of offerings per year. As Appendix Table AI indicates, the 1980s were characterized by relatively lower underpricing and fewer offerings than the 1990s. During the 1990s, the "bubble" period of 1999-2000 stands out with an especially high level of underpricing (or excess returns immediately after the IPO), while the period following the bubble (2001-2002) is characterized by comparatively low underpricing and few offerings.[14] Next, we use these subperiods for comparison with prior studies, e.g., Barry, Muscarella, Peavy and Vetsuypens (1990) and Loughran and Ritter (2004). Finally, James and Wier (1990) examine a period in the early 1980s, and we are interested in how the effect of debt financing may have changed over time.[15]

We observe in Table III that the level of debt (as measured by the ratio total debt-to-total assets) has a sizable, economically important, negative effect on initial returns for the full sample period. An increase of one standard deviation of leverage is associated with an almost 6% reduction in underpricing. However, examining the 1980-1989 results, we observe that the level of debt financing is not associated with the degree of underpricing, which is consistent with James and Wier's (1990) results covering their

[14] Although we do not report the results, the 2001-2002 period also had a higher fraction of IPOs that were reverse LBOs than did earlier periods.

[15] Since some authors have suggested that 1998 may be considered to be part of the bubble period, we reran our results including 1998 in the bubble period instead of the "nineties" period. We also ran a regression with year dummies, and another with year and industry dummies. Our results on the significance of debt financing are qualitatively the same under each of the alternative regressions. Overall, the results of these regressions demonstrate that our findings regarding debt levels and VC backing are not driven by industry effects.

sample period of 1980-1983.[16] VC is also not significant during that period. Subsequent periods, on the other hand, have much more sizable, negative effects of debt financing: increasing levels of debt financing are associated with lower levels of initial returns, or underpricing in each of the periods 1990-1998, 1999-2000, and 2001-2002. On the other hand, VC backing has statistically significant effects only during the 1999-2000 "bubble" period, and in that case it is significant at the 1% level. For the bubble period of 1999-2000, the coefficient on debt levels is especially large, reaching a negative 28.7% (which is to be multiplied by the percentage of total debt to total assets). In that same period, the VC variable shows a very sizable effect of a positive 23.5%, and others who have examined IPOs in that bubble period have generally found very high initial returns associated with VC.

To alleviate possible concerns that the observed effects of debt on underpricing in our samples may be simply capturing the effects of some other variables related to debt due to multicollinearity (e.g., firm age, size, or industry affiliation), in another unreported analysis we apply a two-stage regression in which we first regress the ratio total debt-to-total assets against ln(total assets), ln(firm age), ln(sales), and industry dummies, and obtain the residuals (i.e., the unexplained portion) for leverage (these tests are not presented in a table). Then, in the second stage we regress the initial returns against the variables used in Table III, except that we replace leverage with its residuals obtained in the first stage. Our results show that the effect of residual leverage on underpricing is still highly significant and economically meaningful and is not caused by multicollinearity between leverage and other firm characteristics. The differences

[16] For the same subperiod, 1980-1983, we find that the level of debt (relative to total assets) is only weakly and not significantly related to underpricing.

between effects of debt financing and VC backing also remain similar to their earlier comparisons.

Debt levels continue to have negative (-12%) and statistically significant effects on initial returns in the post-bubble period (2001-2002 in our sample), but VC has no significant effects on initial returns during that same period. Thus, VC is not significantly associated with underpricing in either of the pre-1999 periods or for the post-2000 period, but it is for the overall sample (1980-2002). That effect is driven by the high level of the VC effect observed for the 1999-2000 period. Under more typical circumstances, VC is not associated with higher levels of underpricing. On the other hand, contrary to results in Barry, Muscarella, Peavy and Vetsuypens (1990) and Megginson and Weiss (1991), the measured effect for the overall period is positive, i.e., VC is associated with greater underpricing for the overall period of our sample.

The fact that high levels of debt financing are associated with much less underpricing during the bubble period demonstrates the reduction of valuation uncertainty associated with the characteristics of firms that are able to rely on substantial amounts of debt financing. Their simpler valuation probably is a good news/bad news story for many investors: their values are relatively easier to measure, but their upside potential is probably much lower. Venture capitalists, in contrast, tend to invest in firms with high upside potential, consistent with the notion attempting to find some "home runs," as described by Huntsman and Hoban (1980).

B. Endogeneity of Borrowing, VC Backing, and IPO Underpricing

One potential concern about the results presented in Table III is the potential endogeneity between underpricing and debt use, or VC backing. For example, after Lee

and Wahal (2004) account for the endogeneity of VC, they conclude that the negative effect found by prior research disappears.

We provide two methods of correction. In the first method, we adjust for the endogenous selection of the level of debt financing using a two-stage instrumental variables approach. In the first stage, we regress the ratio of total debt to total assets against variables used in recent capital structure research, such as the natural logarithm of sales, the asset Market-to-Book ratio, the ratio of fixed assets to total assets, the ratio of EBITDA to total assets, the ratio of R&D expense to sales, a dummy variable equal to 1 if the firm had no R&D expenses reported, 0 otherwise, and the ratio of selling expenses to sales. These variables are recently used by Kayhan and Titman (2007) and similar variables are used by Flannery and Rangan (2006). We also include dummy variables for each industry (measured by two-digit SIC code) and each year.[17] In the second stage regression of IPO underpricing, we substitute the debt-to-assets ratio with its predicted value from the first stage. Those second stage results are shown in Table IV.

To account for the endogeneity of the VC choice, we use the Heckman (1979) and Maddala (1983) two-stage specifications to create two selection bias correction variables, γ_1 and γ_2, also used in the second stage. This model is also used by Schenone (2004) to account for the endogeneity of prior bank relationships, and, for example, by Bessembinder (2003), to account for endogeneity of trading venues. In the first stage, we run a probit model on the probability of having VC backing. We regress the binary choice of having VC backing against the natural logarithm of proceeds and sales, a dummy variable indicating whether the firm had negative EBITDA, firm age, Carter-

[17] In our sub-period analysis, only for the period 2001-2002, we use industry dummies based on one-digit SIC code industries, and we use only four state dummies (California, Massachusetts, New York, and Texas), as we have few degrees of freedom.

Manaster underwriter rank, equity market-to-book ratio, firm age, and dummies for industry, year, and location. These variables are used by Bradley and Jordan (2002). Lee and Wahal (2004) find that the VC choice is affected by similar variables.

We construct two new variables used to correct for selection biases, as suggested by Heckman (1979) and Maddala (1983), γ_1=f(Z)/F(Z), and γ_2=-f(Z)/(1-F(Z)), where Z is the fitted value from the probit model, f is the normal density function, and F is the normal distribution function. Further, γ_1 is a correction variable for the "selected" subsample, i.e., those firms with VC backing; thus, it is equal to 0 for the firms without backing. Conversely, γ_2 is the correction variable for the "non-selected" subsample, i.e., the firms without VC backing, and it is equal to 0 for the firms with VC backing.

Table IV presents the results. We find that over the full sample, the ratio of total debt to total assets remains significantly negatively related to underpricing. In subperiods, it is not significantly related to underpricing during the 1980-1989 period, similar to the results in Table III that does not include endogeneity. During the 1990-1998 period and the "bubble" period of 1999-2000, total debt-to-total asset ratios remain significant and negatively related to underpricing. The results are not significant in the post-bubble period, in contrast to the uncorrected model in Table III. Interestingly, the correction procedure for VC backing causes the coefficient for VC to switch from positive and significant to positive but highly insignificant over the entire period, in contrast to the uncorrected model (Table III) results that did not adjust for endogeneity.

Our second method of endogeneity adjustment is an extension of the first method. We correct for the endogeneity of VC choices in exactly the same way as in Table IV. However, for debt choices, we create a new indicator variable equal to 1 if the firm is a

high-debt firm, defined as having a debt-to-asset ratio above the sample median, or equal to 0 if it is a low-debt firm, defined as having a debt-to-asset ratio below the sample median. We note that this simple classification of firms as "high-debt" and "low-debt" firms produces very similar results in the regression of IPO underpricing if we replace the ratio of total debt to total assets with the new binary variable – the high-debt firms are associated with significantly lower underpricing, while the coefficients for the other variables are qualitatively the same as before.

We regress the binary debt choice variable against natural logarithm of sales, the asset market-to-book ratio, the ratio of fixed assets to total assets, the ratio of EBITDA to total assets, the ratio of R&D expense to sales, a dummy variable equal to 1 if the firm had no R&D expenses reported, 0 otherwise, and the ratio of selling expenses to sales, industry and year dummies. Then, we construct two new variables to correct for selection bias, γ_1=f(Z)/F(Z) for high-debt firms, 0 otherwise, and γ_2=-f(Z)/(1-F(Z)) for the low-debt firms, 0 otherwise, where Z is the fitted value from the probit model, f is the normal density function, and F is the normal distribution function.

Table V presents the results from the second stage of the second endogeneity analysis. Similarly to the first correction method, the high debt use variable is highly significant and negatively related to underpricing over the full sample period, as well as during the 1990-1998 period and the bubble period (1999-2000), but only weakly negatively related during the post-bubble period. Also, similar to the results in Table IV, the VC variable switches signs and significance over the whole period from positive and significant to negative and insignificant, and becomes negative and significant during the 1990-1998 period, in contrast with the uncorrected model in Table III.

Overall, we conclude that the negative relationship between debt use and IPO underpricing remains during the overall period whether or not endogeneity issues are incorporated. They are highly insignificant during the 1980-1989 period. In the prior analysis (shown in Table III), the debt levels were negative and significant during the 1980-1989 period.

C. Time Variation of Firm Characteristics and the Effects of Leverage on Underpricing

The regression results in the previous section show that the effects of leverage and venture capital on underpricing vary through time. Now we examine how the characteristics of the debt-backed and VC-backed issuers vary through time, and we relate them to the regression results. We specifically examine some of the firm characteristics that proxy for the potential magnitude of information asymmetry and uncertainty about firm value. The characteristics are shown on a period basis in Table VI which shows the results for the combinations of low debt and VC backing versus high debt without VC backing. The most dramatic difference that stands out is the comparison of low debt, VC-backed firms versus high debt, non-VC-backed firms in the 1999-2000 period: the difference in average initial returns for the two groups is 62.1%.

During each of the periods examined, IPO firms with VC and low debt are much smaller in sales, have a much lower proportion of fixed assets to total assets, are significantly younger, and exhibit higher measures of market betas and standard deviations than high debt firms without VC. After the collapse of the bubble, in 2001-2002 the IPO firms with high debt and no VC in our sample were by far the largest and oldest such firms.

For example, consider the average sales figures for the low-debt, VC-backed firms versus those of the high-debt, non-VC-backed firms in Table VI. For the 1980-1989 period, the average sales are $48 million versus $138 million for the two categories of firms, respectively. During the 1990-1998 period, the average sales values are $36 million and $241 million, respectively, and during the "bubble" the gap in sales widens as the average sales for the two classes of firms are $20 million and $308 million, respectively. For the same two categories of firms, the fractions of firms with negative EBITDA (not shown in the Table) are 26% and 13% during our first period, 47% and 18% during the second period, 89% and 41% during the bubble, and 69% and 16% during the post-bubble period, respectively. The average firm age for these two subsets is 7.9 years and 15.8 years, respectively, during the 1980s, 7.8 years and 16.4 years during 1990-1998, and 5.6 years and 16.1 years during the bubble. These differences are confirmed (and in some cases found to be stronger) if we examine the median values instead of the means.

Thus, when overall measures of uncertainty and information asymmetry are greater, there is a greater effect of debt monitoring and certification resulting in a larger reduction in underpricing, as is found in our period regressions. In other words, the value created by debt certification in terms of less "money left on the table" is especially large when the potential levels of uncertainty are greatest. These results contrast sharply with those for VC-backed IPOs.

We would expect lenders to seek to provide funds to firms with more predictable levels of profitability and other characteristics associated with firm value, i.e., characteristics that are less volatile over time. In an untabulated analysis, we examine the

variability of characteristics of debt-backed and VC-backed IPO firms across time. We measure the time-series standard deviations of firm characteristics across time using reported financial data for fiscal years –1, 0, +1 and +2 relative to the fiscal year of the IPO. We find low variability in earnings or cash flow measures (such as Net Income/Sales, and EBIT or EBITDA scaled by total assets, or operating cash flows scaled by total assets) for the highest debt firms; conversely, VC-backed firms and low-debt firms have high variabilities of earnings. This is consistent with the notion that heavily debt-backed firms tend to have relatively predictable levels of profit over time and are thus easier to value, resulting in lower initial returns (or, less underpricing) on average.

The higher standard deviations are also consistent with the idea that venture capitalists have to hit "home runs" in the sense of investing in a few firms that reach exceptionally high levels of profitability. When firms have little variation in profitability, the probability of extreme values on the upside tends to be lower. Venture capitalists generally prefer wider upper tails of the profit distribution, but achieving such tails also involves investing in firms with a significant risk of losing money or failing. That is consistent with our finding that venture-backed IPO firms tend to have greater volatility in profit measures.

IV. Debt Financing, Venture Capital, and the Aftermarket Performance of IPOs

As we described previously, Bradley, Jordan, Roten and Yi (2001) provide evidence that high technology stocks with VC backing are especially prone to negative aftermarket performance. Their results are in contrast to the results of Brav and Gompers (1997) regarding VC-backed IPOs in general. If the results of Bradley, Jordan, Roten and

Yi are right, then IPO firms with high debt backing (which tend not to be high technology, VC-backed firms) might behave quite differently in the aftermarket. However, Brav and Gompers find that small firms (in terms of market capitalization of equity) without VC backing are the principal negative aftermarket performers. In light of the characteristics of heavily debt-financed firms that we observe, that suggests that high debt levels may also be associated with negative aftermarket performance. That is what we find in our sample.

Our results below demonstrate worse aftermarket performance for high debt firms than for low debt firms, whether or not we adjust for market effects, systematic risk (beta), and the Fama and French (1993) factors. Thus, high-debt firms on average experience relatively low returns in the aftermarket despite their less uncertain valuations at the time of the IPO and their lower initial returns, or underpricing. Their compound returns in the aftermarket and their firm characteristics (including low market capitalization and the lack of VC) add additional information to the Brav and Gompers results regarding smaller and non-VC-backed firms.

A. Results for Raw Returns and Market-adjusted Returns

In Table VII, we report the buy-and-hold returns over the 60 months after the IPO for the subsamples based on high versus low debt financing and with and without VC backing. We also calculate the market-adjusted returns using the performance of the market as measured by the CRSP value-weighted index and the CRSP equal-weighted index (not reported in the table), and the CRSP size decile index (also not reported in the table).

For each security, buy-and-hold returns are calculated as $BHR_j = \prod_t (1 + r_{jt}) - 1$, where t is the month since the IPO (including returns for months 1 through 60), j is the security, and r_{jt} is the respective monthly return. Then we obtain the average and the median buy-and-hold return across firms for each subcategory. We also calculate the monthly market-adjusted returns. For firm j in month t the market-adjusted return is calculated as $ar_{jt}=(1+r_{jt})/(1+r_{benchmark,t})-1$. Then, for each firm we calculate the buy and hold period adjusted returns as $BHAR_j = \prod_t (1 + ar_{jt}) - 1$ over months 1 through 60. Finally, we obtain the average buy-and-hold adjusted return across the firms in each subcategory. Note that the average market-adjusted return is equivalent to the "wealth relative" measure suggested by Ritter (1991), minus 1.

The raw returns in Table VII show that the VC-backed firms have approximately twice the average returns of the non-VC-backed firms, and the difference is significant. When adjusted for the CRSP value-weighted and size decile indices, the VC-backed and non-VC-backed firms all show average returns that are negative with differences that are not significant at the 5% level. The medians for both groups are consistently, highly negative whether they are market-adjusted or not, and they do not differ meaningfully from each other. The medians indicate the high asymmetric risks that IPO investors face if they do not diversify their investments as broadly as possible.

Examining debt quartiles 1 and 2 (low debt) versus 3 and 4 (high debt), the low debt averages are higher than those for the high debt firms, whether they are market-adjusted or not, but the differences are not statistically significant. The medians are again consistently negative and do not differ meaningfully.

B. Effects of Debt and Venture Capital on Aftermarket Performance of IPO Firms

Next we examine the joint effect of VC backing and debt financing on the long-run performance of the IPO firms. Results are shown in Table VIII. We group our sample into subsamples of firms with VC and low debt use (those with ratios of total debt to total assets lower than the sample median, which means that they include debt quartiles 1 and 2), VC and high debt use (those with ratios of total debt to total assets higher than the median), no-VC and low debt use, and no-VC and high debt use. Table VIII presents the buy-and-hold and market-adjusted returns for the four groups of firms using calculations similar to those described above for Table VII.

The results for raw returns in Table VIII show maximum average returns for the VC-backed firms with high debt and the minimum average returns for the high debt firms that do not have VC backing. The t-scores shown for the raw returns demonstrate that the high debt, no-VC firms have significantly lower average returns than any of the other groups. None of the other paired comparisons have differences that are significant in part because of the very large range of five-year returns observed in the sample, with minimum and maximum values overall of -100% and +19,000%, respectively.

The market-adjusted returns adjusted for the CRSP value-weighted index again show the high debt, no-VC firms consistently underperforming all the other groups of firms, and no pair that excludes the high-debt, no-VC firms has significant differences. Interestingly, in the size-decile-adjusted returns, the only difference that is statistically significant at the 5% level is for the high-debt, no-VC firms versus the low-debt, no-VC firms, although the high-debt firms without VC differ from the low-debt, no-VC and

high-debt, VC firms at the 10% level of significance. No other pairs are meaningfully different.

The principal point of the results in Table VIII is that IPO firms with high debt and without VC backing tend to consistently underperform all the other groups of firms. This is consistent with the Brav and Gompers (1997) finding that VC-backed IPOs generally do not underperform, but we also highlight a characteristic of the non-VC-backed firms that stands out from the others, namely the use of high levels of leverage.

None of the results in tables VII and VIII for the VC comparisons or for the debt comparisons adjust for the risk levels, size or book-to-market effects. In the next subsection we examine the long-term performance after adjusting for these effects.

C. Results after Adjusting for Systematic Risk, Size, and Book-to-Market Ratios

Brav and Gompers (1997) find that much of the observed negative long-term performance of IPO firms disappears when the Fama-French factors are accounted for, especially for venture-backed IPO firms. We already have an indication that these additional factors matter from the market-adjusted returns – the underperformance is lowest, or for one of the subsamples, non-existent, when we adjust their returns for the CRSP size decile index. Now we examine the risk-adjusted long-term performance of debt-backed firms based on two methodological procedures. The first approach is to use the calendar-time-based Fama and French (1993) portfolio regressions. The model is based on the regression formula,

$$R_{pt} - R_{ft} = \alpha + \beta(R_{mt} - R_{ft}) + sSMB_t + hHML_t + e_{pt}, \quad (1)$$

where in each calendar month during the sample period we form portfolios based on the firms with IPO dates in that month. The dates for each firm start with the month after the IPO and continue for 60 months. R_{pt} is the monthly portfolio return in month t, R_{mt} is the contemporaneous return on the market index, SMB_t is the average return on small market cap portfolios minus the average return on large market cap portfolios, HML_t is the average return on the high book-to-market portfolios minus the low book-to-market portfolios, and R_{ft} is the return on the one-month T-bill for the month. The regression is estimated on portfolio returns, and the overall sample-wide measure of abnormal return is α. We estimate two versions of this approach, one with equal-weighted portfolios, and one with value-weighted portfolios where the value weights are based on equity market capitalizations. This approach is similar to the one used by Brav and Gompers (1997) in addition to their matched sample approach.[18]

The second approach combines Ibbotson's (1975) "Returns Across Time and Securities" (IRATS) with the Fama and French (1993) three-factor model. The regression formula is

$$R_{jt} - R_{ft} = \alpha_t + \beta_t(R_{mt} - R_{ft}) + s_t SMB_t + h_t HML_t + e_{jt,} \quad (2)$$

where R_{jt} is the monthly return on stock j in month t, R_{mt} is the contemporaneous return on the market index, SMB_t is the average return on small market cap portfolios minus the average return on large market cap portfolios, HML_t is the average return on the high book-to-market portfolios minus the low book-to-market portfolios, and R_{ft} is the return on the one-month T-bill for the month. In each calendar month during the sample period,

[18] The calendar-time approach eliminates problems associated with the pseudo-market timing identified in Schultz (2003). Gompers and Lerner (2003) use calendar-time portfolios in their examination of pre-Nasdaq IPOs and find that their performance is similar to that of the market when calendar time portfolios are applied. They also find that abnormal performance does not occur when they adjust for the Fama-French factors.

we estimate the regression across the stocks with IPO dates in that month. The dates for each firm start with the month after the IPO and continue for 60 months.[19] The regression is estimated using ordinary least squares (OLS) to test the null hypothesis that $\alpha_t = 0$. An α_t different from zero is an indication of significant abnormal returns. We then accumulate the α_t over the calendar months.

Both approaches take place in calendar time, and thus do not suffer from the pseudo-market timing problem identified by Schultz (2003). [20] On the other hand, as Brav and Gompers (1997) point out, a disadvantage of these approaches is that they give the same weight to a month in which few stocks went public as to a month with many listings. It is precisely that matter, however, that Schultz's (2003) pseudo-market timing identifies and that the calendar-time approach avoids.[21]

Table IX provides the results of these regressions. In Panel A, the intercept values shown are the monthly average alpha values. First, we consider the VC-backed and non-VC firms. Whether we examine equal-weighted portfolios or value-weighted portfolios, using Fama-French calendar-time portfolio regressions the VC-backed firms have no significant abnormal returns (intercepts). Although the non-VC firms have larger negative intercepts, they also do not have significant t-scores. We also show t-scores derived from the differences in alphas between the VC-backed and non-VC-backed firms. As the Table shows, neither the equal-weighted nor value-weighted portfolios result in

[19] Some firms go out of business or for other reasons are removed from the security markets and from the CRSP database. Thus, those have shorter-term sources of security returns.

[20] Schultz (2003) demonstrates that the empirical methods often applied in examining long-run performance can lead to "pseudo market timing" that can explain much of the negative aftermarket performance observed for IPOs.

[21] For robustness, we ran the Fama-French regressions using weighted least squares with the number of observations in each calendar month as weights. Our results are qualitatively unchanged.

significant differences in abnormal returns between venture-backed firms and those without venture capital backing.

Panel A of Table IX shows quite different results when we examine the level of debt financing. We show results for quartiles 1 (the lowest debt quartile) and 4 (the highest debt quartile). Examining high-debt firms, we consistently observe significantly negative abnormal returns[22] with intercepts of -.0055 and -.0074 for the equal-weighted and value-weighted portfolios, respectively, and they have t-scores of -2.32 and -2.70, respectively. These abnormal returns are equivalent to annualized abnormal returns of about -6.4% and -8.5%, respectively.

Moreover, the t-tests of differences in abnormal returns between the low-debt and high-debt firms show quite significant results in the case of the equal-weighted portfolios with a t-score of 3.30, significant at the 1% level. The difference in that case is 112 basis points, and that difference is based on monthly averages. In the case of value-weighted portfolios, the t-score is 2.75, which is also significant at the 1% level.

The results in Panel B show five-year cumulative abnormal returns using the Ibbotson RATS procedure. For those five-year cumulative returns, the highest abnormal performance is for low-debt firms, even in comparison to VC-backed firms. All four categories of firms have statistically significant abnormal returns, with VC and low debt (Quartile 1) firms have significantly positive long-term returns while those without VC as well as high debt (Quartile 4) firms each of significantly negative long-term returns.

Given the differences observed in the performance characteristics for VC-backed and non-VC-backed firms and for high-debt versus low-debt firms, we examine in Table X the performance characteristics of combined groups of firms as we did in our

[22] The negative abnormal returns are found whether we use OLS or heteroscedasticity-adjusted methods.

examinations of initial returns. As in some earlier tables, the groups consist of VC-backed firms with either low debt (debt in the two lowest quartiles) or high debt (debt in the two highest quartiles), and non-VC-backed firms with low debt or high debt. We again measure abnormal returns using equal-weighted and value-weighted IPO portfolios.

The one group of firms with consistently significant (and negative) abnormal returns is the group comprised of high-debt firms without VC backing. They show significantly negative monthly average abnormal returns (measured over a five-year period) in the Panel A results and significantly negative five-year returns in Panel B. The VC-backed firms with high debt levels are significantly negative at the 5% level in the case of value-weighted portfolios, but their negative average returns are not significant in the equal-weighted case. In contrast, in Panel B the VC-backed, low-debt firms show highly positive and significant five-year returns, in contrast to the non-VC-backed, high debt firms that have highly negative and significant five-year returns.

We also compare the monthly abnormal returns of the VC-backed, low-debt firms versus the high-debt firms without VC backing. In the case of the equal-weighted portfolios, the differences are 81 basis points and are significant at the 1% level. In the case of the value-weighted portfolios, the differences are 64 basis points and again are significant at the 1% level.

A related point from Panel A of Table X is that there are differences in size-related effects among the VC-backed firms with high levels of debt. VC-backed firms with high debt have negative abnormal returns that are significant at the 5% level when value-weighted, but not significant when equally weighted. Also, the difference in the measured abnormal returns is 42 basis points (-.0035 versus -.0077). That suggests that

the smaller firms within this group have less negative abnormal returns on average than the larger firms in the group.

We also examined the long-run performance of IPO firms using calendar-time-based Fama-French four-factor model portfolio regressions including a momentum factor (these results are not tabulated and are available from the authors). The model is based on the regression formula,

$$R_{pt} - R_{ft} = \alpha + \beta(R_{mt} - R_{ft}) + sSMB_t + hHML_t + uUMD_t + e_{pt}, \quad (3)$$

where in each calendar month during the sample period we form portfolios based on the firms with IPO dates in that month. The dates for each firm start with the month after the IPO and continue for 60 months. R_{pt} is the monthly portfolio return in month t, R_{mt} is the contemporaneous return on the market index, SMB_t is the average return on small market cap portfolios minus the average return on large market cap portfolios, HML_t is the average return on the high book-to-market portfolios minus the low book-to-market portfolios, UMD_t is the average return on high prior return portfolios minus the average return on low prior return portfolios, and R_{ft} is the return on the one-month T-bill for the month. The regression is estimated on portfolio returns, and the overall sample-wide measure of abnormal return is the intercept term, α. As in the three-factor model, we estimate two versions of this approach, one with equal-weighted portfolios, and one with value-weighted portfolios where the value weights are based on equity market capitalizations.

Once again, we document that firms in the lowest debt quartile outperform significantly the firms in the highest debt quartile, while the difference in performance between VC-backed and non-VC-backed firms is not significant. However, the

difference in performance between low debt and high debt firms in the four-factor model is due to a greater extent of the fact that low-debt firms exhibit positive and statistically significant abnormal performance (as measured by the intercept term), while high debt firms do not exhibit underperformance significant at conventional levels. For example, the intercept term for low-debt firms is 0.0101 with a t-value of 3.50 for the equal-weighted portfolios, and 0.0088 with a t-value of 2.97 for the value weighted portfolios. The high-debt firms have an intercept term of -0.0025 with a t-value of -0.97 for the equal-weighted portfolios, and -0.0034 with a t-value of -1.17 for the value-weighted portfolios.

We also find that firms with low debt (with or without VC-backing) significantly outperform high-debt firms, and especially so for those without VC-backing. Low-debt firms with VC backing have intercept terms of 0.0060 and a t-value of 2.47 for equal-weighted portfolios, and 0.0053 and a t-value of 1.53 for value-weighted portfolios. Low-debt firms without VC-backing have intercept terms of 0.0070 with a t-value of 2.23 for equal-weighted portfolios and 0.0063 with a t-value of 2.25 for value weighted-portfolios. High-debt firms with VC backing exhibit no abnormal performance. High-debt firms without VC backing have intercept terms of -0.0033 and a t-value of -1.52 for equally-weighted portfolios and -0.0037 with a t-value of -1.78 for value-weighted portfolios.

D. Long-run Aftermarket Performance with Debt Financing and Venture Capital

Overall, IPO firms with high levels of debt financing tend to underperform the market in the long run following their IPOs. Debt financing and/or the characteristics of firms that have access to substantial debt financing appear to have an appreciable effect

on the market performance of firms that go public. Our results are generally consistent with the Brav and Gompers (1997) results for the long-term performance of IPO firms except that our results suggest an added dimension in the nature of that performance. For example, we examine the firms characterized by Brav and Gompers as small (in market capitalization) and without VC, and we find that they tend to be firms with high ratios of debt financing relative to total assets. Thus, the characteristics of firms with extensive debt financing help to account for both the lower underpricing of such firms at the IPO stage and their negative, long-term performance following their IPO.[23]

Our results are also based on leverage measures calculated as total debt-to-total assets, i.e., they are based on book measures of leverage. Fama and French (1992) find that their book measures of leverage (based on total assets and the book value of equity) are associated with large, significant negative returns across time. Thus, our findings about leverage and the performance of IPO firms are consistent in broad terms with the findings of Fama and French.[24]

One reason for the poor performance of the high-debt firms is the possibility that they go bankrupt more frequently. We examine the CRSP database for delisting frequencies within 5 years of the IPOs. We observe greater delisting frequencies due to codes 400-490 (“liquidations") and 500-591 ("dropped"), 13.1% vs. 7.1%, or specifically item 574 ("bankruptcy"), 1.3% vs. 0.3%, for the high-debt firms without VC backing compared to the low-debt firms with VC backing. Similarly, firms in the highest debt quartile have greater delisting frequencies compared to the firms in the lowest debt

[23] Similarly, Billett, Flannery, and Garfinkel (2006) find negative abnormal performance for public firms (as opposed to recent IPO firms) in the three years after they announce that they have received additional debt financing.

[24] Fama and French (1992) interpret the coefficient on leverage as another manifestation of the book-to-market ratio. However, our results are obtained after controlling for book-to-market, beta, and size.

quartile. The CRSP delisting codes are admittedly a noisy measure of the default frequencies since bankruptcies may trigger delistings that are recorded in other ways, such as insufficient equity capital, price below exchange requirements, and others. Nevertheless, the overall results demonstrate that the IPO firms with high debt ratios are especially likely to be delisted.

V. Summary and Conclusions

In this paper, we examine the comparative roles of debt financing and venture capital (VC) in providing capital for different types of companies that go public, and the initial and long-term performance of companies that go public. We find that firms with high debt financing tend to be quite different than firms that are backed by VC, and the differences are consistent with the desire of lenders to protect the downside of their investments. We find that companies with substantial amounts of debt financing tend to have lower initial returns, or, less underpricing, than firms with lower levels of debt financing. These results hold for our overall sample (1980-2002), but are particularly pronounced during the period 1999-2000 when, arguably, the valuation uncertainty is greatest. We find very strong effects of both debt and VC on underpricing during the bubble period of 1999-2000, but the effects are in sharp contrast: while debt is associated with low underpricing, VC backing is associated with high underpricing. Our results confirm the predictions of James and Wier (1990) that debt financing would be associated with lower initial returns, and it expands their results to show that not just the existence of borrowing but the actual levels of borrowing are associated with levels of underpricing.

Our results are consistent with the notion that the characteristics of debt-financed firms facilitate valuation, so that uncertainty about the value of firms with significant debt financing tends to be lower than the uncertainty about the value of low-debt firms. Our results on lower underpricing for firms with high debt backing are logically consistent with those characteristics. Furthermore, we find that, consistent with the theory of Ueda (2004), firms that rely on bank debt have different characteristics than VC-backed firms, such as measures of size, risk, growth options and profitability. A central component of Ueda's theory is that VC and debt financing can be "substitutes." We find further in our empirical results that they tend to be used by different types of firms and at different times in the behavior of the market.

We also examine the aftermarket performance of firms backed by high levels of debt financing versus those with little debt financing, and we contrast those results versus results based on VC backing. We include a variety of other common factors that are usually included in tests of long-run performance. Overall, we find that high levels of debt financing are associated with negative aftermarket performance, in contrast with the comparatively positive performance of VC-backed firms.

High-debt firms have appreciably poorer long-term performance relative to low-debt firms after adjusting for a variety of factors such as market effects, risk, size, Book-to-Market, and momentum characteristics. While the abnormal performance demonstrates a statistically meaningful anomaly, on the other hand it may suggest that there may be additional considerations that need to be accounted for in performing tests of abnormal performance of IPO-based portfolios as well as for other types of portfolios. Since lenders can suffer from the downside risk of the firm but do not participate in the upside

potential of equity, it may be natural that the characteristics of their borrowers are not associated with higher long-term performance.

Appendix

This Appendix presents Table AI that provides a detailed description of the sample for each of the years (1980-2002) that we examine plus the average or total of each variable across the full set of years examined. It includes a variety of descriptions of annual IPO characteristics. Initial IPO returns are presented as the rate of return from the IPO offer price (reported by SDC) to the closing price on the first trading day for which prices are reported in CRSP. It provides information about the number of IPOs included in our samples each year, the IPO proceeds, average issue sizes, initial returns, total equity values, total assets, sales levels, the percentage with VC backing, debt-to-asset ratios, and long-term debt-to-total asset ratios, excluding convertible debt from all debt measures. The figures containing dollar values are all measured in December 2002 constant dollar values so that they are comparable.

Appendix Table AI: Sample Description

This table presents the means (with medians in parentheses) of selected characteristics for a sample of 5,840 initial public offerings (IPOs) in the US during 1980-2002. We exclude American Depository Receipts (ADRs), closed-end funds, real estate investment trusts (REITs), financial institutions (those in SIC codes 6000-6999), unit offerings, IPOs with an offer price below $5.00 per share, reverse LBOs, and those offerings that do not have CRSP data within one month of the offer date. All dollar values are converted into December 2002 constant dollars using the monthly Consumer Price Index (CPI). Market Capitalization of Equity is calculated as the number of shares reported by CRSP times the first day closing price. Total assets, sales, total debt, and long-term debt are as of the end of the fiscal year preceding the offer. The fraction that includes venture capital (VC) is also measured. Convertible debt is excluded from all debt figures.

Year	N	Total Proceeds ($ million)		Issue Size ($ million)		Initial Return		Market Capitalization of Equity ($ million)		Total Assets ($ million)		Sales ($ million)		Fraction with VC	Total Debt / Total Assets		Long-term Debt / Total Assets	
1980	65	1,791.7	27.6	(18.9)	0.18	(0.10)	179.6	(80.9)	64.3	(32.7)	98.7	(50.7)	0.34	0.31	(0.30)	0.23	(0.15)
1981	186	4,463.7	24.0	(16.5)	0.07	(0.02)	110.0	(66.2)	35.1	(16.8)	48.2	(27.9)	0.30	0.31	(0.26)	0.21	(0.15)
1982	74	1,834.1	24.8	(13.3)	0.13	(0.05)	129.0	(66.0)	38.8	(22.6)	55.5	(24.1)	0.28	0.24	(0.22)	0.14	(0.05)
1983	409	14,490.5	35.4	(21.0)	0.12	(0.04)	167.0	(83.6)	76.6	(21.4)	108.3	(28.3)	0.28	0.30	(0.29)	0.20	(0.12)
1984	162	3,322.2	20.5	(13.5)	0.05	(0.01)	89.1	(50.5)	68.8	(23.0)	88.5	(36.7)	0.28	0.35	(0.33)	0.21	(0.16)
1985	159	4,332.7	27.3	(17.0)	0.07	(0.03)	117.7	(59.7)	46.7	(24.1)	94.3	(35.8)	0.25	0.30	(0.27)	0.17	(0.13)
1986	322	13,820.3	42.9	(18.5)	0.08	(0.02)	156.6	(62.8)	75.9	(23.6)	110.4	(35.6)	0.25	0.36	(0.28)	0.23	(0.17)
1987	235	11,739.8	50.0	(20.4)	0.07	(0.02)	172.8	(69.6)	172.2	(27.1)	208.6	(38.7)	0.29	0.35	(0.31)	0.22	(0.12)
1988	96	4,964.8	51.7	(25.2)	0.05	(0.02)	288.6	(114.6)	259.4	(35.9)	223.6	(39.6)	0.34	0.32	(0.26)	0.20	(0.11)
1989	107	5,613.6	52.5	(24.5)	0.09	(0.05)	217.7	(95.0)	153.3	(33.1)	240.9	(48.1)	0.36	0.36	(0.23)	0.20	(0.10)
1990	92	3,969.1	43.1	(27.4)	0.11	(0.05)	186.8	(99.2)	100.2	(24.7)	115.4	(36.9)	0.45	0.33	(0.31)	0.21	(0.11)
1991	226	10,640.6	47.1	(35.4)	0.13	(0.08)	190.9	(119.0)	386.0	(27.1)	174.8	(41.0)	0.54	0.34	(0.28)	0.23	(0.13)
1992	301	14,324.2	47.6	(27.5)	0.11	(0.04)	172.9	(91.3)	97.7	(18.2)	121.3	(29.3)	0.48	0.36	(0.26)	0.22	(0.09)
1993	463	22,023.2	47.6	(29.4)	0.13	(0.06)	208.4	(99.5)	116.1	(26.2)	143.6	(40.5)	0.46	0.42	(0.35)	0.26	(0.13)
1994	392	16,201.4	41.3	(24.8)	0.09	(0.04)	165.4	(79.9)	156.1	(22.4)	184.9	(36.1)	0.36	0.40	(0.33)	0.24	(0.15)
1995	422	23,258.2	55.1	(35.5)	0.21	(0.13)	249.1	(124.9)	155.5	(19.2)	177.7	(28.4)	0.43	0.33	(0.24)	0.20	(0.08)
1996	639	37,649.3	58.9	(36.3)	0.17	(0.10)	264.3	(122.4)	135.5	(17.0)	180.0	(24.0)	0.41	0.40	(0.31)	0.24	(0.10)
1997	411	23,321.3	56.7	(34.0)	0.13	(0.08)	244.5	(113.7)	197.9	(20.4)	169.2	(28.3)	0.32	0.38	(0.28)	0.22	(0.09)
1998	243	26,858.2	110.5	(41.6)	0.23	(0.10)	378.2	(182.1)	316.0	(24.3)	276.1	(30.1)	0.32	0.34	(0.27)	0.19	(0.06)
1999	404	47,920.2	118.6	(59.3)	0.77	(0.44)	1,142.7	(457.4)	248.7	(17.7)	263.5	(11.0)	0.63	0.32	(0.13)	0.17	(0.04)
2000	334	48,085.4	144.0	(72.9)	0.57	(0.28)	1,441.3	(532.2)	284.1	(29.4)	120.8	(11.1)	0.64	0.24	(0.13)	0.15	(0.03)
2001	53	21,353.3	402.9	(74.1)	0.12	(0.09)	1,311.2	(424.4)	2,084.9	(60.6)	2,274.2	(67.4)	0.55	0.35	(0.19)	0.22	(0.11)
2002	45	7,829.2	174.0	(77.7)	0.07	(0.06)	631.3	(207.7)	378.0	(90.7)	420.4	(101.1)	0.34	0.33	(0.38)	0.25	(0.25)
1980-2000	5,840	369,806.7	63.3	(31.4)	0.20	(0.07)	353.8	(113.7)	186.9	(22.4)	187.9	(29.0)	0.40	0.35	(0.26)	0.21	(0.10)

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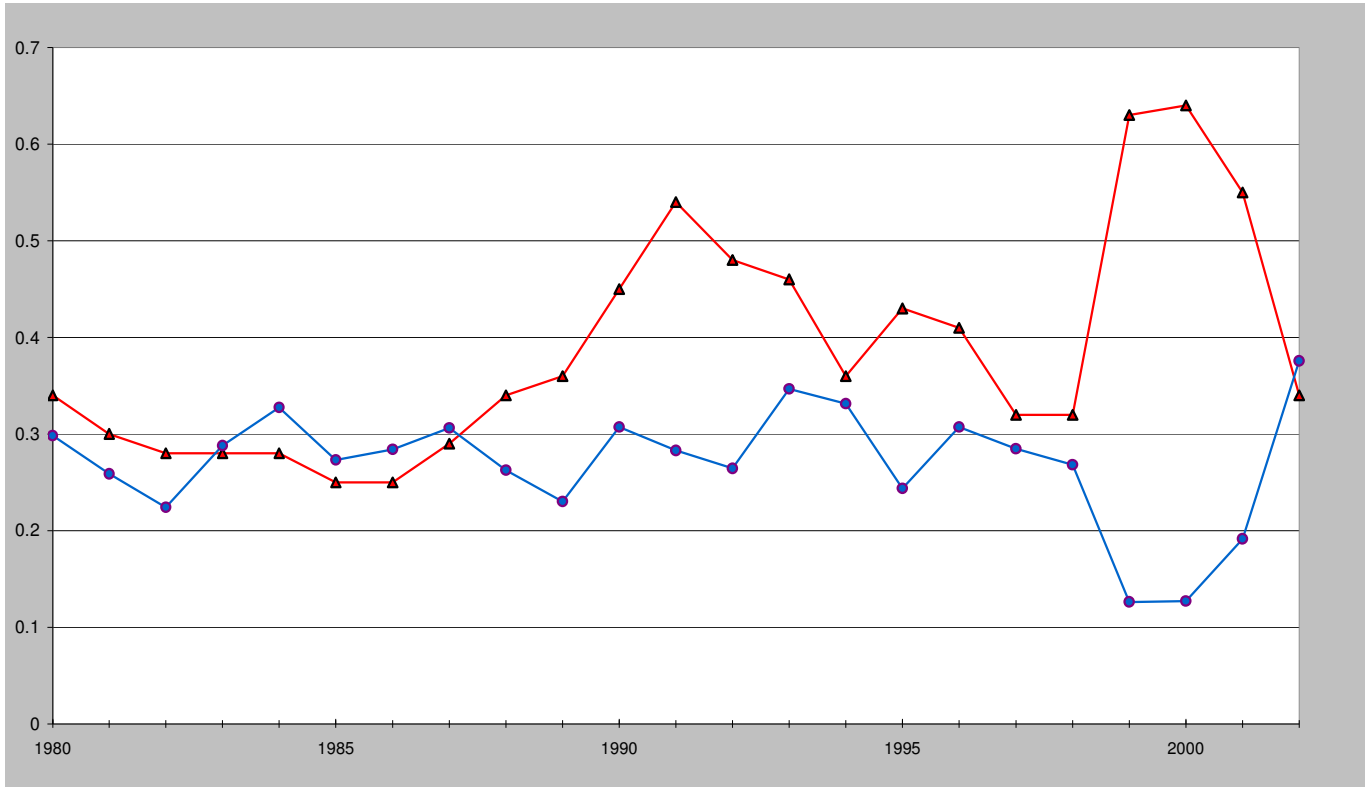
Figure I
Median Debt-to-Assets Ratios and Fraction of IPOs Backed by Venture Capital, 1980-2002



The figure presents the fraction of initial public offerings (IPOs) that had received venture capital (VC) prior to their IPOs, and the median ratio of total debt-to-total assets (TD/TA), for a sample of 5,840 IPOs in the US during 1980-2002. We exclude American Depository Receipts (ADRs), closed-end funds, real estate investment trusts (REITs), financial institutions (those in SIC codes 6000-6999), unit offerings, IPOs with an offer price below $5.00 per share, reverse LBOs, and those offerings that do not have CRSP data within one month of the offer date. All dollar values are converted into December 2002 constant dollars using the monthly Consumer Price Index (CPI). Total debt and total assets are measured as of the end of the fiscal year prior to the IPO date. Convertible debt is not included in the total debt figures. Data on VC backing was generously provided by Jay Ritter.

Table I
IPO and Firm Characteristics by Use of Debt and Venture Capital Backing

This table presents characteristics for a sample of 5,840 initial public offers (IPOs) in the US during 1980-2002 by leverage quartile and venture backing. Dollar values are in December 2002 constant dollars. Market Capitalization is the number of shares reported by CRSP times the first day's closing price. Total debt is equal to long-term debt plus debt in current liabilities minus convertible debt. Equity market-to-book is the market capitalization of equity divided by book value. Asset market-to-book is the sum of market capitalization of equity at the offering and total debt, divided by the sum of book equity and total debt. The first cash burn rate is calculated for the firms with negative operating cash flows as the inverse of the ratio of cash divided by the absolute value of operating cash flows. In the second cash burn rate, operating cash flows are reduced by the amount of investments. All accounting variables are from the fiscal year before the offering, except book value of equity, which is from the fiscal year of the offering. The return standard deviation, beta, and the standard deviation of the market model residuals are calculated over the 250 days following the IPO. "VW" and "EW" indicate "Value-Weighted" and "Equal-Weighted," respectively. "Top Tier Underwriters" have a Carter-Manaster rank of 8 or above.

	Leverage Quartile				VC Backing		Leverage Quartile				VC Backing	
	1	2	3	4	Yes	No	1	2	3	4	Yes	No
	Means						Medians					
Total Debt / Total Assets	0.018	0.161	0.382	0.844	0.285	0.401	0.006	0.155	0.378	0.698	0.160	0.335
Initial Returns	0.308	0.241	0.135	0.129	0.286	0.140	0.111	0.083	0.056	0.046	0.100	0.050
Sales	133.9	184.1	236.2	177.2	68.8	274.1	17.7	24.3	44.5	40.2	19.3	41.0
Market Capitalization	470.8	428.3	279.6	263.9	433.7	314.9	161.6	132.5	97.0	106.4	162.1	88.6
Offering Proceeds	64.7	71.5	66.0	60.0	51.9	73.4	37.3	32.7	29.6	34.7	38.1	25.9
Asset Market-to-Book	4.804	4.176	2.788	2.886	4.216	2.762	3.719	3.041	2.188	2.105	3.159	2.155
PPE / Total Assets	0.156	0.222	0.305	0.371	0.223	0.293	0.111	0.175	0.258	0.318	0.158	0.219
EBITDA / Total Assets	-0.119	-0.040	0.067	-0.163	-0.213	0.046	0.087	0.140	0.166	0.123	0.039	0.172
Fraction with Negative EBITDA	0.418	0.334	0.172	0.289	0.467	0.183	0.000	0.000	0.000	0.000	0.000	0.000
Years since Firm Founded	9.313	12.067	16.061	13.671	8.955	15.148	6.000	7.000	9.000	7.000	6.000	8.000
Residual Standard Deviation, VW	0.050	0.047	0.041	0.044	0.050	0.041	0.046	0.042	0.037	0.038	0.045	0.037
Beta, VW	1.168	1.082	0.825	0.775	1.209	0.770	1.032	0.959	0.741	0.701	1.146	0.699
Proportion with Top Tier Underwriters	0.655	0.603	0.517	0.521	0.712	0.453	1.000	1.000	1.000	1.000	1.000	0.000

Table II
Characteristics for Subsamples by Use of Debt and Venture Capital

The main sample consists of 5,840 initial public offers (IPOs) in the US during 1980-2002 by leverage and venture backing. Firms are grouped into four subsamples based on whether they are backed by venture capital and whether their ratio of total debt to total assets is higher or lower than the median for the sample. This table presents the subsamples with venture capital (VC) and below-median leverage and no VC with above-median leverage. Dollar values are in December 2002 constant dollars. Market Capitalization is the number of shares reported by CRSP times the first day closing price. Total debt is equal to long-term debt plus debt in current liabilities minus convertible debt. Equity market-to-book is the market capitalization of equity (based on the first day's closing price) divided by book value. Asset market-to-book is the sum of market capitalization of equity at the offering and total debt, divided by the sum of book equity and total debt. The first cash burn is calculated for the firms with negative operating cash flows as the inverse of the ratio of cash divided by the absolute value of operating cash flows. In the second cash burn rate, operating cash flows are reduced by the amount of investments. All accounting variables are from the fiscal year before the offering, except book value of equity, which is from the end of the fiscal year of the offering. The return standard deviation, beta, and the standard deviation of the market model residuals are calculated over the 250 days following the IPO. "VW" and "EW" indicate "Value-Weighted" and "Equal-Weighted," respectively. "Top Tier Underwriters" have a Carter-Manaster rank of 8 or above.

	VC, Low Debt		No VC, High Debt		t-values for Equality of Means	Wilcoxon p-values for Equality of Medians
	Mean	Median	Mean	Median		
Total Debt / Total Assets	0.084	(0.069)	0.612	(0.513)	-57.13***	0.000
Initial Return	0.361	(0.125)	0.112	(0.045)	13.35***	0.000
Sales	35.5	(15.1)	242.5	(48.5)	-8.30***	0.000
Equity Market Capitalization	523.9	(190.2)	252.5	(85.3)	6.38***	0.000
Proceeds	49.3	(38.5)	65.2	(26.9)	-2.94***	0.000
Asset Market-to-Book ratio	5.112	(3.739)	2.629	(2.051)	19.39***	0.000
PPE / Total Assets	0.170	(0.133)	0.350	(0.300)	-25.16***	0.000
EBITDA / Total Assets	-0.225	(-0.087)	0.020	(0.157)	-11.05***	0.000
Fraction with Negative EBITDA	0.539		0.178		21.92***	
Years Since Firm Founded	7.258	(5.000)	16.305	(9.000)	-16.60***	0.000
Residual Std. Dev., VW	0.054	(0.049)	0.041	(0.036)	16.88***	0.000
Beta, VW	1.364	(1.290)	0.716	(0.663)	24.97***	0.000
Proportion with Top Tier Underwriters	0.758		0.454		18.30***	

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table III
Initial Returns, Use of Debt, and Venture Capital

This table presents the results of regressions of initial IPO returns against a variety of explanatory variables. The dependent variable is the initial return for a sample of 5,840 initial public offers (IPOs) in the US during 1980-2002. The initial return is calculated as the percentage change from the IPO offer price to the CRSP closing price on the first day of reported prices. Dollar values are in December 2002 constant dollars. Total debt is equal to long-term debt plus debt in current liabilities (excluding convertible debt). Total debt, total assets, and sales are from the fiscal year before the offering. Venture capital (VC) is also included. The "Top Tier Underwriter" variable is a dummy variable with a value of 1 if the lead underwriter has a Carter-Manaster rank of 8 or above, and 0 otherwise.

	1980-2002		1980-1989		1990-1998		1999-2002		2002-2002	
Variable	Estimate	t-Value	Estimate	t-Value	Estimate	t-Value	Estimate	t-Value	Estimate	t-Value
Intercept	0.010	0.37	0.068	3.53***	0.078	3.44***	-0.519	-2.41***	0.115	1.08
Total Debt/Total Assets	-0.091	-5.96***	0.000	-0.02	-0.065	-5.41***	-0.287	-3.60***	-0.120	-2.01**
VC	0.032	2.61***	0.007	0.74	0.001	0.09	0.235	3.11***	0.036	0.80
Ln(Total Assets)	-0.053	-6.73***	-0.046	-6.20***	-0.050	-7.41***	-0.149	-3.97***	-0.009	-0.36
Ln(Age)	-0.011	-1.70*	-0.007	-1.40	-0.010	-1.91*	-0.028	-0.57	-0.030	-1.13
Ln(Proceeds)	0.080	8.33***	0.047	6.64***	0.057	6.94***	0.297	5.22***	0.010	0.31
Ln(Sales)	0.010	1.63	0.014	2.31**	0.014	2.70***	0.040	1.35	0.018	0.96
Top Tier Underwriter	0.015	1.05	-0.043	-4.48***	0.036	3.00***	0.175	1.86*	-0.013	-0.25
Technology Dummy	0.397	16.34***	0.049	0.33	0.335	11.85***	0.354	5.10***	0.059	0.86
1990-1998 Dummy	0.020	1.54								
1999-2000 Dummy	0.309	13.23***								
2001-2002 Dummy	-0.075	-1.75*								
N	4,939		1,320		2,829		701		89	
Adjusted R-squared	0.272		0.069		0.109		0.149		0.030	

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table IV
Regressions Corrected for Endogeneity of Debt and Venture Capital

This table presents the results from the second stage of a two-stage least squares instrumental variable estimation that corrects for the endogeneity of debt and venture capital (VC). Convertible debt is excluded from the debt figures. To correct for the endogeneity of debt choice, in the first stage we model the total debt-to-total assets ratio as a function of the natural logarithm of sales, the asset market-to-book ratio, the ratio of fixed assets to total assets, the ratio of EBITDA to total assets, the ratio of R&D expense to sales, a dummy variable equal to 1 if the firm had no R&D expenses reported, 0 otherwise, the ratio of selling expenses to sales, and industry and year dummies. In the second stage we use the fitted values from the first-stage in place of the observed debt-to-asset ratio.

To account for the endogeneity of the VC choice, we use the Heckman (1979) and Maddala (1983) two-stage specifications to create two selection bias correction variables, γ_1 and γ_2, also used in the second stage. First, we run a probit model on the probability of having VC backing against the natural logarithm of proceeds and sales, a dummy variable indicating whether the firm had negative EBITDA, firm age, Carter-Manaster underwriter rank, equity market-to-book ration, firm age, and dummies for industry, year, and location. Then, we construct two new variables used to correct for selection bias, $\gamma_1=f(Z)/F(Z)$ if the firm had VC backing, 0 otherwise, and $\gamma_2=-f(Z)/(1-F(Z))$ for the firms without VC backing, 0 otherwise, where Z is the fitted value from the probit model, f is the normal density function, and F is the normal distribution function.

The dependent variable is the initial return for a sample of 5,840 initial public offers (IPOs) in the US during 1980-2002. The initial return is calculated as the percentage change from the IPO offer price to the CRSP closing price on the first day of reported prices. Dollar values are in December 2002 constant dollars. Total debt is equal to long-term debt plus debt in current liabilities minus convertible debt. Total debt, total assets, and sales are from the fiscal year before the offering. The "Top Tier Underwriter" variable is a dummy variable with a value of 1 if the lead underwriter has a Carter-Manaster rank of 8 or above, and 0 otherwise.

	1980-2002		1980-1989		1990-1998		1999-2000		2001-2002	
	estimate	t-value	estimate	t-value	estimate	t-value	estimate	t-value	estimate	t-value
Intercept	0.162	4.48***	0.089	3.57***	0.195	6.22***	-0.603	-2.04**	0.062	0.40
Total Debt/Total Assets	-0.422	-10.01***	-0.013	-0.44	-0.269	-7.98***	-1.071	-5.42***	0.060	0.51
VC-backed	0.028	0.82	-0.011	-0.53	-0.030	-1.16	0.482	2.63***	-0.015	-0.16
Ln(Total Assets)	-0.040	-3.81***	-0.045	-4.83***	-0.030	-3.37***	-0.216	-4.51***	-0.050	-1.70*
Ln(Age)	-0.013	-1.80*	-0.010	-1.87*	-0.009	-1.54	-0.055	-0.94	-0.017	-0.54
Ln(Proceeds)	0.095	8.33***	0.056	6.80***	0.067	7.04***	0.405	5.74***	0.053	1.53
Ln(Sales)	-0.017	-1.87*	0.006	0.82	-0.018	-2.39**	0.083	1.89*	0.012	0.52
Top Tier Underwriter	0.020	1.14	-0.041	-3.82***	0.044	2.90***	0.144	1.18	0.035	0.58
Technology Dummy	0.363	12.71***	0.060	0.40	0.302	9.57***	0.236	2.66***	0.014	0.19
1990-1998 Dummy	0.042	2.72***								
1999-2000 Dummy	0.289	10.55***								
2001-2002 Dummy	-0.078	-1.58								
γ_1 VC	-0.057	-2.04**	0.003	0.18	-0.002	-0.09	-0.329	-1.91*	0.022	0.28
γ_2 VC	0.082	3.09***	0.033	1.84*	0.050	2.40**	-0.040	-0.27	0.085	1.05
N	4,194		1,156		2,384		578		76	
Adjusted R-squared	0.272		0.760		0.130		0.172		-0.035	

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table V
Regressions Corrected for Endogeneity of Debt and Venture Capital

This table presents the results of a Heckman (1979) and Maddala (1983) two-stage specifications to create selection bias correction variables for the choice of debt financing and venture capital (VC). Convertible debt is excluded. To account for the endogeneity of the debt choice, we create two selection bias correction variables, γ_1 and γ_2. In the first stage, we run a probit model for the probability of a firm being a high-debt firm, defined as having a debt-to-asset ratio above the median, or a low-debt firm, defined as having a debt-to-asset ratio below the median. We regress the binary debt choice variable against natural logarithm of sales, the asset market-to-book ratio, the ratio of fixed assets to total assets, the ratio of EBITDA to total assets, the ratio of R&D expense to sales, a dummy variable equal to 1 if the firm had no R&D expenses reported, 0 otherwise, and the ratio of selling expenses to sales, industry and year dummies. Then, we construct two new variables to correct for selection bias, γ_1=f(Z)/F(Z) for high-debt firms, 0 otherwise, and γ_2=-f(Z)/(1-F(Z)) for the low-debt firms, 0 otherwise, where Z is the fitted value from the probit model, f is the normal density function, and F is the normal distribution function. To account for the endogeneity of the VC choice, we run a probit model on the probability of having VC backing against the natural logarithm of proceeds and sales, a dummy variable indicating whether the firm had negative EBITDA, firm age, Carter-Manaster underwriter rank, equity market-to-book ration, firm age, and dummies for industry, year, and location. Then, we construct two new variables γ_1=f(Z)/F(Z) if the firm had VC backing, 0 otherwise, and γ_2=-f(Z)/(1-F(Z)) for the firms without VC backing, 0 otherwise, where Z is the fitted value from the probit model, f is the normal density function, and F is the normal distribution function. In the second stage, the dependent variable is the initial return for a sample of 5,840 initial public offers (IPOs) in the US during 1980-2002. The initial return is calculated as the percentage change from the IPO offer price to the CRSP closing price on the first day of reported prices. Dollar values are in December 2002 constant dollars. Total debt is equal to long-term debt plus debt in current liabilities minus convertible debt. Total debt, total assets, and sales are from the fiscal year before the offering. The "Top Tier Underwriter" variable is a dummy variable with a value of 1 if the lead underwriter has a Carter-Manaster rank of 8 or above, and 0 otherwise.

	1980-2002		1980-1989		1990-1998		1999-2000		2001-2002	
	estimate	t-value	estimate	t-value	estimate	t-value	estimate	t-value	estimate	t-value
Intercept	0.244	6.57***	0.084	3.38***	0.286	8.81***	-0.610	-2.23**	0.158	1.11
High Debt Use Dummy	-0.338	-11.02***	0.002	0.10	-0.250	-10.04***	-0.935	-5.44***	-0.065	-0.80
VC-backed	-0.016	-0.50	-0.007	-0.32	-0.074	-2.92***	0.433	2.53**	-0.033	-0.40
Ln(Total Assets)	-0.043	-4.28***	-0.048	-5.17***	-0.028	-3.30***	-0.194	-4.29***	-0.052	-1.88*
Ln(Age)	-0.013	-1.89*	-0.009	-1.82*	-0.009	-1.67*	-0.037	-0.68	-0.013	-0.48
Ln(Proceeds)	0.091	8.30***	0.057	6.85***	0.059	6.41***	0.383	5.87***	0.046	1.44
Ln(Sales)	-0.003	-0.34	0.009	1.21	-0.010	-1.43	0.097	2.34**	0.016	0.81
Top Tier Underwriter	0.025	1.46	-0.040	-3.73***	0.047	3.21***	0.165	1.46	0.042	0.77
Technology Dummy	0.341	12.62***	0.081	0.54	0.292	9.75***	0.217	2.63***	-0.020	-0.29
1990-1998 Dummy	0.040	2.73***								
1999-2000 Dummy	0.277	10.62***								
2001-2002 Dummy	-0.061	-1.29								
γ_1 Debt	0.128	4.95***	0.000	0.00	0.064	3.00***	0.549	3.69***	-0.116	-1.68*
γ_2 Debt	0.299	11.30***	0.015	0.83	0.203	9.64***	0.628	3.95***	0.024	0.31
γ_1 VC	-0.033	-1.24	0.000	0.00	0.028	1.28	-0.282	-1.76*	0.056	0.80
γ_2 VC	0.104	4.13***	0.033	1.84*	0.067	3.40***	-0.011	-0.08	0.054	0.74
N	4,194		1,156		2,384		578		76	
Adjusted R-squared	0.297		0.076		0.157		0.192		0.121	

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table VI
Firm Characteristics by Period, Including Effects of Venture Capital and Debt Measures

This table presents means of selected firm characteristics for the following periods: 1980-1989, 1990-1998, 1999-2000, 2001-2002. We present the subsamples with venture capital (VC) and below-median leverage and those with no VC and above-median leverage. Dollar values are in December 2002 constant dollars. Market Capitalization is the number of shares reported by CRSP times the first day closing price. Total debt is equal to long-term debt plus debt in current liabilities (with convertible debt excluded). Equity market-to-book is the market capitalization of equity divided by book value. Asset market-to-book is the sum of market capitalization of equity at the offering and total debt, divided by the sum of book equity and total debt. All accounting variables are from the fiscal year before the offering, except book value of equity, which is from the end of the fiscal year of the offering. The return standard deviation, beta, and the standard deviation of the market model residuals are calculated over the 250 days following the IPO. "VW" and "EW" indicate "Value-Weighted" and "Equal-Weighted," respectively.

	1980-1989		1990-1998		1999-2000		2001-2002	
Panel B	VC, Low Debt	Non-VC, High Debt	VC, Low Debt	Non-VC, High Debt	VC, Low Debt	Non-VC, High Debt	VC, Low Debt	Non-VC, High Debt
Initial Return	0.102	0.078	0.200	0.113	0.898	0.277	0.187	0.038
Sales	47.9	138.1	36.1	241.2	20.4	307.7	105.1	1,833.7
Market Capitalization	212.9	143.4	209.2	227.9	1,405.5	724.2	646.7	1,236.7
Asset Market-to-Book	3.698	2.513	4.156	2.573	8.226	3.734	3.990	2.476
PPE / Total Assets	0.192	0.379	0.177	0.344	0.139	0.281	0.155	0.326
EBITDA / Total Assets	0.115	0.126	-0.183	0.000	-0.549	-0.277	-0.328	-0.008
Firm Age	7.850	15.781	7.781	16.357	5.643	16.098	8.500	25.370
Residual St. Dev. VW	0.034	0.033	0.048	0.043	0.080	0.063	0.056	0.040
Beta, VW	1.064	0.681	1.338	0.705	1.654	1.051	1.055	0.464

Table VII
Long-term Performance

This table presents the average and median buy-and-hold raw and market-adjusted returns for subsamples of IPO firms with and without venture capital (VC) and those with low debt (first quartile) and high debt (fourth quartile). Convertible debt is excluded from the debt figures. For each security, buy-and-hold (BH) returns are calculated as $BHR_j = \prod_t (1 + r_{jt}) - 1$, where t is the month since the IPO (and the product is calculated over months 1 through 60), j is the security, and r is monthly return. Then we obtain the average buy-and-hold return across firms for each subcategory. The market monthly market-adjusted return for each firm j in month t is $ar_{jt}=(1+r_{jt})/(1+r_{benchmark,t})-1$. Then, for each firm we calculate the buy and hold period adjusted returns as $BHAR_j = \prod_t (1 + ar_{jt}) - 1$ over 60 months after the IPO. Finally, we obtain the average buy-and-hold adjusted return across the firms in each subcategory. The benchmark is the CRSP value-weighted (VW) index. The average market-adjusted return is equivalent to the "wealth relative" measure suggested by Ritter (1991), minus 1. In the "t-values" row we report the t-values for the test of equality of the 60-month means for VC-backed vs. non-VC-backed firms and low-debt vs. high-debt firms.

	VC=1		VC=0		Debt quarters 1 and 2		Debt quarters 3 and 4	
	Raw BH Returns	CRSP VW Index Adjusted Returns	Raw BH Returns	CRSP VW Index Adjusted Returns	Raw BH Returns	CRSP VW Index Adjusted Returns	Raw BH Returns	CRSP VW Index Adjusted Returns
Means	48.1%	-19.2%	22.86%	-29.4%	39.4%	-20.2%	32.9%	-26.4%
t-values	2.22**	2.06**			0.60	1.27		
Medians	-41.9%	-65.8%	-40.6%	-62.1%	-39.1%	-63.1%	-38.7%	-65.69%

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table VIII
Long-term Performance by Venture Capital and Debt Financing

This table presents the average buy-and-hold raw and market-adjusted returns for subsamples of IPO firms with and without venture capital (VC), with low debt (first and second quartiles) and high debt (third and fourth quartiles). Convertible debt is excluded. For each security, buy-and-hold (BH) returns are calculated as $BHR_j = \prod_t (1 + r_{jt}) - 1$, where t is the month since IPO (and the product is calculated over months 1 through 60), j is the security, and r is the monthly return. Then we obtain the average buy-and-hold return across firms for each subcategory. The monthly market-adjusted return for each firm j in month t is $ar_{jt}=(1+r_{jt})/(1+r_{benchmark\ t})-1$. Then, for each firm we calculate the buy and hold period adjusted returns as $BHAR_j = \prod_t (1 + ar_{jt}) - 1$ over 60 months. Finally, we obtain the average buy-and-hold adjusted return across the firms in each subcategory. The benchmark is the CRSP value-weighted (VW) index. The average market-adjusted return is equivalent to the "wealth relative" measure suggested by Ritter (1991), minus 1.

	Low Debt VC-backed	Low Debt Not-VC-backed	High Debt and VC-backed	High Debt, Not-VC-backed
		Raw Returns		
Means	37.0%	42.0%	69.7%	15.6%
Medians	-47.1%	-30.9%	-31.1%	-41.6%
N	1,358	1,212	821	1,749
Pair-wise t-values				
Low Debt, VC		-0.42	-1.16	2.36**
Low Debt, No VC			-0.98	2.72***
High Debt, VC				1.97**
		Market Adjusted Returns		
		Adjusted for CRSP VW Index		
Means	-22.9%	-17.1%	-11.8%	-33.3%
Medians	-67.1%	-58.5%	-60.6%	-67.5%
N	1,358	1,212	821	1,749
Pair-wise t-values				
Low Debt, VC		-0.93	-0.98	2.22**
Low Debt, No VC			-0.45	2.97***
High Debt, VC				1.98**

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table IX
Long-term Performance of IPOs by Venture Capital or Debt Financing

This table presents abnormal return estimates for IPO firms adjusted for Fama and French (1993) factors. The sample is split into subsamples of firms with venture capital (VC), without VC, and those in the first and fourth quartiles of total debt to total assets (excluding convertible debt). In Panel A, we estimate calendar-time Fama-French portfolio regressions of the form $R_{pt} - R_{ft} = \alpha + \beta(R_{mt} - R_{ft}) + sSMB_t + hHML_t + e_{pt}$, where on each calendar month during the sample period we form a portfolio from the returns of the IPO firms with an event date in that month. The dates for each firm start with the month after the IPO and continue for 60 months. R*pt* is the monthly portfolio return in month *t*, R_m is the contemporaneous return on the market index, SMB*t* is the average return on small market cap portfolios minus the average return on large market cap portfolios, HML_t is the average return on the high book-to-market portfolios minus the low book-to-market portfolios, and R_{ft} is the return on the one-month T-bill for the month. The regression is estimated on portfolio returns and the overall sample-wide measure of abnormal return is α. We estimate two versions of this approach, one with equal-weighted portfolios, and one with value (equity market capitalization) weighted portfolios. T-values are corrected for heteroscedasticity.

In panel B, we estimate Ibbotson (1975) "Returns Across Time and Securities" (IRATS) with Fama-French factors: $R_{jt} - R_{ft} = \alpha_t + \beta_t(R_{mt} - R_{ft}) + s_tSMB_t + h_tHML_t + e_{jt}$, where R_{jt} is the monthly return on stock *j* in month *t*, and the rest of the variables are as described above. In each calendar month during the sample period, we estimate the regression across the stocks with event date in that month. The dates for each firm start with the month after the IPO and continue for 60 months. The regressions are estimated using OLS to test the null hypothesis that $\alpha_t = 0$. We then cumulate the α_t over the calendar months.

	VC		No VC		Debt Quartile 1		Debt Quartile 4	
Panel A: Fama-French Calendar-Time Portfolio Regressions								
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Equal-weighted Portfolios								
Intercept (Abnormal Return)	-0.0002	-0.09	-0.0032	-1.62	0.0066	2.36**	-0.0055	-2.32**
b(p)	1.3058	16.51***	1.1482	21.02***	1.2578	16.37***	1.1963	20.39***
s(p)	1.2258	11.22***	1.0545	9.17***	1.0601	7.95***	1.1017	8.50***
h(p)	-0.6712	-6.53***	-0.0249	-0.27	-0.7838	-6.04***	0.0049	0.05
R-squared	0.8392		0.8036		0.7731		0.7480	
t-scores: Intercepts for VC versus No VC then Debt Q1 versus Debt Q4	1.01				3.30***			
Value-weighted portfolios								
Intercept (Abnormal Return)	-0.0034	-1.07	-0.0017	-0.90	0.0041	1.30	-0.0074	-2.70***
b(p)	1.5352	13.22***	1.2173	23.50***	1.3893	14.10***	1.3461	17.36***
s(p)	1.1245	7.08***	0.7267	8.50***	0.9081	6.28***	0.9513	8.44***
h(p)	-0.8879	-5.69***	-0.1884	-2.39**	-0.9687	-7.02***	-0.1764	-1.48
R-squared	0.7806		0.8087		0.7667		0.7037	
t-scores: Intercepts for VC versus No VC, then Debt Q1 versus Debt Q4	-0.46				2.75***			
Panel B: Ibbotson RATS with Fama-French Factors								
Cumulative Excess Return, Months 1-60	15.95%	3.66***	-27.52%	-8.36***	27.95%	4.734***	-31.27%	-5.184***

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table X
Long-term Performance of IPOs Identified with Venture Capital and/or Debt Financing

This table shows abnormal performance estimates for firms for which we show both debt and venture capital (VC) characteristics (excluding convertible debt). The sample is split into subsamples of firms with VC and low debt (those in the first two quartiles of leverage), without VC and with low debt, with VC and high debt (those in the top two quartiles of leverage), and those without VC backing and with high debt. In Panel A, we estimate calendar-time Fama-French (1993) portfolio regressions of the form $R_{pt} - R_{ft} = \alpha + \beta(R_{mt} - R_{ft}) + sSMB_t + hHML_t + e_{pt}$, where on each calendar month during the sample period we form a portfolio from the returns of the IPO firms with an event date in that month. The dates for each firm start with the month after the IPO and continue for 60 months. R_{pt} is the monthly portfolio return in month t, R_m is the contemporaneous return on the market index, SMB_t is the average return on small market cap portfolios minus the average return on large market cap portfolios, HML_t is the average return on the high book-to-market portfolios minus the low book-to-market portfolios, and R_{ft} is the return on the one-month T-bill for the month. The regression is estimated on portfolio returns and the overall sample-wide measure of abnormal return is α. We estimate two versions of this approach, one with equal-weighted portfolios, and one with value (equity market capitalization) weighted portfolios. T-values are corrected for heteroscedasticity.

In panel B, we estimate Ibbotson (1975) "Returns Across Time and Securities" (IRATS) with Fama-French factors: $R_{jt} - R_{ft} = \alpha_t + \beta_t(R_{mt} - R_{ft}) + s_tSMB_t + h_tHML_t + e_{jt}$, where R_{jt} is the monthly return on stock j in month t, and the rest of the variables are as described above. In each calendar month during the sample period, we estimate the regression across the stocks with event date in that month. The dates for each firm start with the month after the IPO and continue for 60 months. The regressions are estimated using OLS to test the null hypothesis that $\alpha_t = 0$. We then cumulate the α_t over the calendar months.

	VC w/ Low Debt		No VC w/ Low Debt		VC w/ High Debt		No VC w/ High Debt	
Panel A: Fama-French Calendar-Time Portfolio Regressions								
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Equal-weighted Portfolios								
Intercept (Abnormal Return)	0.0025	1.07	0.0036	1.35	-0.0035	-1.35	-0.0056	-3.00***
b(p)	1.3181	15.86***	1.1412	19.65***	1.2452	16.72***	1.1188	21.22***
s(p)	1.2418	11.61***	0.9612	7.80***	1.0847	8.65***	1.0195	8.87***
h(p)	-0.9165	-8.87***	-0.2886	-2.42**	-0.3920	-3.39***	0.0704	0.79
R-squared	0.8482		0.7145		0.7547		0.7981	
t-score: Intercepts for VC w/ Low Debt Versus Non-VC w/ High Debt	2.71***							
Value-weighted Portfolios								
Intercept (Abnormal Return)	0.0000	0.01	0.0028	1.05	-0.0077	-2.43**	-0.0064	-3.32***
b(p)	1.5621	12.35***	1.2058	20.31***	1.4448	14.28***	1.2096	21.50***
s(p)	1.1431	6.75***	0.6931	6.94***	0.9455	6.59***	0.6676	6.73***
h(p)	-1.1010	-6.83***	-0.3366	-3.22***	-0.6025	-4.03***	0.0219	0.26
R-squared	0.7723		0.7033		0.7182		0.7696	
t-score: Intercepts for VC w/ Low Debt versus Non-VC w/ High Debt	3.32***							
Panel B: Ibbotson RATS with Fama-French Factors								
Cumulative Excess Return, Months 1-60	33.00%	5.61***	-0.14%	-0.03	-5.28%	-0.74	-37.08%	-8.07***

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.