THE JOURNAL OF FINANCE • VOL. LII, NO. 5 • DECEMBER 1997

Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies

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ABSTRACT

We investigate the long-run underperformance of recent initial public offering (IPO) firms in a sample of 934 venture-backed IPOs from 1972–1992 and 3,407 nonventure-backed IPOs from 1975–1992. We find that venture-backed IPOs outperform nonventure-backed IPOs using equal weighted returns. Value weighting significantly reduces performance differences and substantially reduces underperformance for nonventure-backed IPOs. In tests using several comparable benchmarks and the Fama-French (1993) three factor asset pricing model, venture-backed companies do not significantly underperform, while the smallest nonventure-backed firms do. Underperformance, however, is not an IPO effect. Similar size and book-to-market firms that have not issued equity perform as poorly as IPOs.

RITTER (1991) AND LOUGHRAN and Ritter (1995) document severe underperformance of initial public offerings (IPOs) during the past twenty years suggesting that investors may systematically be too optimistic about the prospects of firms that are issuing equity for the first time. Recent work has shown that underperformance extends to other countries as well as to seasoned equity offerings. We address three primary issues related to the underperformance of new issues. First, we examine whether venture capitalists, who specialize in financing promising startup companies and bringing them public, affect the long-run performance of newly public firms. We find that venture-backed firms do indeed outperform nonventure-backed IPOs over a five-year period, but only when returns are weighted equally.

The second set of tests examines the effects of using different benchmarks and different methods of measuring performance to gauge the robustness of IPO underperformance. We find that underperformance in the nonventure-

* Duke University and Harvard University and NBER. Jay Ritter and Charles Lee provided access to data. Victor Hollender and Laura Miller provided research assistance. We thank Chris Géczy, J.B. Heaton, Steve Kaplan, Shmuel Kandel, Marc Lipson, Andrew Metrick, Mark Mitchell, Steve Orpurt, Jay Ritter, Raghu Rajan, Stephen Schurman, Andrei Shleifer, René Stulz, Richard Thaler, Rob Vishny, Luigi Zingales, an anonymous referee, and seminar participants at Boston University, Tel Aviv University, the University of Chicago, the University of Georgia, the University of Rochester, Virginia Tech, the NBER Corporate Finance Summer Institute, and the Financial Decision and Control Workshop at Harvard Business School for helpful comments and suggestions. Financial support was provided by the Center for Research in Security Prices, University of Chicago. Any errors or omissions are our own.

backed sample is driven primarily by small issuers, i.e., those with market capitalizations less than $50 million. Value weighting returns significantly reduces underperformance relative to the benchmarks we examine. In Fama-French (1993) three factor time series regressions, portfolios of venture-backed IPOs do not underperform. Partitioning the nonventure-backed sample on the basis of size demonstrates that underperformance primarily resides in small nonventure-backed issuers. Fama-French's three factor model cannot explain the underperformance of these small, nonventure-backed firms.

Finally, this article provides initial evidence on the sources of underperformance. We find that returns of IPO firms are highly correlated in calendar time even if the firms go public in different years. Because small nonventure-backed IPOs are more likely to be held by individuals, bouts of investor sentiment are a possible explanation for their severe underperformance. Individuals are arguably more likely to be influenced by fads or lack complete information. We also provide initial evidence that the returns of small, nonventure-backed companies covary with the change in the discount on closed-end funds. Lee, Shleifer, and Thaler (1991) argue that this discount is a useful benchmark for investor sentiment. Alternatively, unexpected real shocks may have affected small growth firms during this time period. We find, however, that underperformance is not exclusively an IPO effect. When issuing firms are matched to size and book-to-market portfolios that exclude all recent firms that have issued equity, IPOs do not underperform. Underperformance is a characteristic of small, low book-to-market firms regardless of whether they are IPO firms or not.

The rest of the article is organized as follows: Section I presents relevant aspects of the venture capital market that are important in public firm formation. A discussion of behavioral finance and rational asset pricing explanations for long-run pricing anomalies is presented in Section II. The data are presented in Section III. Underperformance is examined in Section IV. Section V concludes the article and discusses some possible explanations for the underperformance of small, nonventure-backed IPOs.

I. Venture Capitalists and the Creation of Public Firms

Gompers (1995) shows that venture capital firms specialize in collecting and evaluating information on startup and growth companies. These types of companies are the most prone to asymmetric information and potential capital constraints discussed in Fazzari, Hubbard, and Petersen (1988) and Hoshi, Kashyap, and Scharfstein (1991). Because venture capitalists provide access to top-tier national investment and commercial bankers and may partly overcome informational asymmetries that are associated with startup companies, we expect that the investment behavior of venture-backed firms would be less dependent upon internally generated cash flows. Venture capitalists stay on the board of directors long after the IPO and may continue to provide access to capital that nonventure-backed firms lack. Additionally, the venture capitalist

may put management structures in place that help the firm perform better in the long run.

If venture-backed companies are better on average than nonventure-backed companies, the market should incorporate these expectations into the price of the offering and long-run stock price performance should be similar for the two groups. Barry, Muscarella, Peavy, and Vetsuypens (1990) and Megginson and Weiss (1991) find evidence that markets react favorably to the presence of venture capital financing at the time of an IPO.

If the market underestimates the importance of a venture capitalist in the pricing of new issues, long-run stock price performance may differ. (Conversely, the market may not discount the shares of nonventure-backed companies enough.) Such underestimation may result because individuals (who are potentially more susceptible to fads and sentiment) hold a larger fraction of shares after the IPO for nonventure-backed firms (Megginson and Weiss (1991)).

Venture capitalists may affect who holds the firm's shares after an IPO. Venture capitalists have contacts with top-tier, national investment banks and may be able to entice more and higher quality analysts to follow their firms, thus lowering potential asymmetric information between the firm and investors. Similarly, because institutional investors are the primary source of capital for venture funds, institutions may be more willing to hold equity in firms that have been taken public by venture capitalists with whom they have invested. The greater availability of information and the higher institutional shareholding may make venture-backed companies' prices less susceptible to investor sentiment.

Another possible explanation for better long-run performance by venture-backed IPOs is venture capitalists' reputational concerns. Gompers (1996) demonstrates that reputational concerns affect the decisions venture capitalists make when they take firms public. Because venture capitalists repeatedly bring firms public, if they become associated with failures in the public market, they may tarnish their reputation and ability to bring firms public in the future. Venture capitalists may consequently be less willing to hype a stock or overprice it.

II. Initial Public Offerings and Underperformance

A. Behavioral Finance

Behavioral economics demonstrates that individuals often violate Bayes' Rule and rational choice theories when making decisions under uncertainty in experimental settings (Kahneman and Tversky (1982)). Financial economists have also discovered long-run pricing anomalies that have been attributed to investor sentiment. Behavioral theories posit that investors weight recent results too heavily or extrapolate recent trends too much. Eventually, overly optimistic investors are disappointed and subsequent returns decline.

DeBondt and Thaler (1985, 1987) demonstrate that buying past losers and selling past winners is a profitable trading strategy. Risk, as measured by beta

or the standard deviation of stock returns, does not seem to explain the results. Lakonishok, Shleifer, and Vishny (LSV) (1994) show that many "value" strategies also seem to exhibit abnormally high returns. LSV form portfolios based on earnings-to-price ratios, sales growth, earnings growth, or cash flow-to-price and find that "value" stocks outperform "glamour" stocks without appreciably affecting risk. In addition, La Porta (1996) shows that selling stocks with high forecasted earnings growth and buying low projected earnings growth stocks produces excess returns. These articles imply that investors are too optimistic about stocks that have had good performance in the recent past and too pessimistic about stocks that have performed poorly.

In addition to accounting or stock market-based trading strategies, researchers have examined financing events as sources of potential trading strategies. Ross (1977) and Myers and Majluf (1984) show that the choice of financing strategy can send a signal to the market about firm valuation. Event studies around equity or debt issues (e.g., Mikkelson and Partch (1986), Asquith and Mullins (1986)) assume that all information implied by the financing choice is fully and immediately incorporated into the company's stock price. The literature on long-run abnormal performance assumes that managers have superior information about future returns and use that information to benefit current shareholders, and the market underreacts to the informational content of the financing event.

Ritter (1991) and Loughran and Ritter (1995) show that nominal five-year buy-and-hold returns are 50 percent lower for recent IPOs (which earned 16 percent) than they are for comparable size-matched firms (which earned 66 percent). Teoh, Welch, and Wong (1997) show that IPO underperformance is positively related to the size of discretionary accruals in the fiscal year of the IPO. Larger accruals in the IPO year are associated with more negative performance. Teoh *et al.* believe that the level of discretionary accruals is a proxy for earnings management and that investors are systematically fooled by the boosted earnings.

If investor sentiment is an important factor in the underperformance of IPOs, small IPOs may be more affected. Individuals are more likely to hold the shares of small IPO firms. Many institutions like pension funds and insurance companies refrain from holding shares of very small companies. Taking a meaningful position in a small firm may make an institution a large blockholder in the company. Because the Securities and Exchange Commission (SEC) restricts trading by 5 percent shareholders, institutions may want to avoid this level of ownership. Individual investors may also be more subject to fads (Lee, Shleifer, and Thaler (1991)) or may be more likely to suffer from asymmetric information. Lee, Shleifer, and Thaler use the discount on closed-end funds as a measure of investor sentiment. If investor sentiment affects returns and if closed-end fund discounts measure investor sentiment, then the returns on small IPOs would be correlated with the change in the average closed-end fund discount. Decreases in the average discount imply that investors are more optimistic and should be correlated with higher returns for small issuers.

B. Rational Asset Pricing Explanations

Recent work claims that multifactor asset pricing models can potentially explain many pricing anomalies in the financial economics literature. In particular, Fama and French (1996) argue that the "value" strategies in Lakonishok, Shleifer, and Vishny (1994) and the buying losers-selling winners strategy of DeBondt and Thaler (1985, 1987) are consistent with their three-factor asset pricing model.

Fama (1994) and Fama and French (1996) argue that their three factor pricing model is consistent with Merton's (1973) I-CAPM. While the choice of factor mimicking portfolios is not unique, sensitivities to Fama and French's three factors (related to the market return, size, and book-to-market ratio) have economic interpretations. Fama and French claim that anomalous performance is explained by not completely controlling for risk factors.

Tests of underperformance, however, suffer from the joint hypothesis problem discussed by Fama (1976). The assumption of a particular asset pricing model means that tests of performance are conditional on that model's correctly predicting stock price behavior. If we reject the null hypothesis, then either the pricing model is incorrect or investors may be irrational. Similarly, if factors like book-to-market explain underperformance, it does not necessarily verify the model. The results may just reflect that investor sentiment is correlated with measures like book-to-market. We do not wish to argue whether factors like book-to-market reflect rational market risk measures or investor sentiment. The tests we perform are consistent with either interpretation. Another problem with long-run performance tests, however, is the nonstandard distribution of long-run returns. Both Barber and Lyon (1996) and Kothari and Warner (1996) show that typical tests performed in the literature suffer from potential biases. While Barber and Lyon show that size and book-to-market adjusted returns give unbiased test estimates of underperformance for random portfolios (which we report in Figs. 5 and 6), neither article addresses the cross-sectional or time series correlation in returns when tests are predicated on an event.

III. Data

Our sample of initial public offerings is collected from various sources. The venture-backed companies are taken from three primary sources. First, firms are identified as venture-backed IPOs in the *Venture Capital Journal* for issues from 1972 through 1992. Second, firms that are in the sample of distributions in Gompers and Lerner (1996b) but are not listed in the *Venture Capital Journal* are added to the venture-backed sample. Finally, if offering memoranda for venture capital limited partnerships used in Gompers and Lerner (1996a, 1996c) list a company as being venture financed but it is not listed in either of the previous two sources, it is added to the venture-backed sample. Jay Ritter provides data on initial public offerings for the period 1975–1984. IPOs are identified in various issues of the *Investment Dealers'*

Digest of Corporate Financing for the period 1975–1992. Any firm not listed in the sample of venture-backed IPOs is classified as nonventure-backed. The data include name of the offering company, date of the offering, size of the issue, issue price, number of secondary shares, and the underwriter.

Our sample differs from that of Loughran and Ritter in two respects. First, our sample period is not completely overlapping. Loughran and Ritter look at IPOs from 1970 to 1990 and measure performance using stock returns through December 31, 1992. We look at IPOs conducted over the period 1975 to 1992 using stock returns through December 31, 1994. The different sample period does not change the qualitative results because we replicate Loughran and Ritter's underperformance in our sample period as well. Second, we eliminate all unit offerings from our sample. Unit offerings, which contain a share of equity and a warrant, tend to be made by very small, risky companies. Calculating the return to an investor in the IPO is difficult because only the share trades publicly. Value weighted results would change very little because unit offering companies are usually small.

For inclusion in our sample, a firm performing an initial public offering must be followed by the Center for Research in Security Prices (CRSP) at some point after the offering date. Our final sample includes 934 venture-backed IPOs and 3,407 nonventure-backed IPOs; 81.3 percent of the venture-backed sample are still CRSP-listed five years after their IPO. A slightly smaller fraction of nonventure-backed IPOs, 76.7 percent, are CRSP-listed after five years. The frequency of mergers appears low. Only 11.2 percent of the venture-backed IPOs and 9.7 percent of the nonventure sample merge within the first five years. The number of liquidations, bankruptcies, and other delisting events is small for both groups as well. Only 7.5 percent of the venture-backed IPOs are delisted for these reasons in the first five years while 13.3 percent of nonventure IPOs are.

We also examine the size and book-to-market characteristics of our sample. Each quarter we divide all NYSE stocks into ten size groups. An equal number of NYSE firms is allocated to each of the ten groups and quarterly size breakpoints are recorded. Similarly, we divide all NYSE stocks into five book-to-market groups each quarter with an equal number of NYSE firms in each group. The intersection of the ten size and five book-to-market groups leads to 50 possible quarterly classifications for an IPO firm. We calculate the market value of equity at the first CRSP-listed closing price. For book value of equity, we use COMPUSTAT and record the first book value after the IPO as long as it is within one year of the offering date.[1] The bias in book value should not be too great because the increment in book value due to retained earnings in the first year is likely to be very small. Our sample of venture-backed IPOs is heavily weighted in the smallest and lowest book-to-market firms: 38.5

[1] When we match firms on the basis of book-to-market values, we lose 778 firms because they lack COMPUSTAT data within one year of the offering. For most results, this is unimportant because tests do not rely on book values. Where book-to-market ratios are used either to sort firms or match firms, the 778 firms are excluded.

percent are in the lowest size decile with another 27.2 percent in the second decile, while 84.0 percent of the venture-backed IPOs are in the lowest book-to-market quintile. Most venture-backed firms are young, growth companies. These firms may have many good investment opportunities for which they need to raise cash. On the other hand, their low book-to-market ratios may just be indicators of relative overpricing. Loughran and Ritter (1995) and Lerner (1994) claim that issuers time the market for new shares when their firms are relatively overvalued.

Most nonventure-backed firms are also small and low book-to-market, but a substantial number of firms fall in larger size deciles or higher book-to-market quintiles: 58.6 percent of firms are in the lowest size decile, 20 percent more than are in the lowest decile for the venture-backed sample, and 73.2 percent of the nonventure-backed firms fall in the lowest book-to-market quintile. However, 7.3 percent are in the two highest book-to-market quintiles. The differences between venture and nonventure-backed IPOs may result from greater heterogeneity in nonventure-backed IPOs.

IV. Underperformance of Initial Public Offerings

A. Full Sample Results

Ritter (1991) and Loughran and Ritter (1995) document underperformance of IPO firms using several benchmarks. Our approach is an attempt to replicate their work and extend it along several dimensions. Several benchmarks are utilized throughout this article. First, as in Loughran and Ritter, the performance of IPO firms is matched to four broad market indexes: the S&P 500, Nasdaq value weighted composite index, NYSE/AMEX value weighted index, and NYSE/AMEX equal weighted index (all of which include dividends). Performance of IPOs is also compared to Fama-French (1994) industry portfolios and size and book-to-market matched portfolios that have been purged of recent IPO and seasoned equity offering (SEO) firms.[2]

Matching firms to industry portfolios avoids the noise of selecting individual firms and can control for unexpected events that affect the returns of entire industries. We use the 49 industry portfolios created in Fama and French (1994). While the Standard Industrial Classification (SIC) codes may be nonadjacent, industry groupings sort firms into the similar lines of business.

Comparing performance to size and book-to-market portfolios seems reasonable given the effects documented by Fama and French (1992, 1993) showing that size and book-to-market are important determinants of the cross section of stock returns. We form 25 (5×5) value-weighted portfolios of all NYSE/AMEX and Nasdaq stocks on the basis of size and the ratio of book equity to market equity. We match each IPO on those two dimensions to the corresponding portfolio for comparison.

[2] We purge SEO firms from our benchmark portfolios as well, since it has been argued (Loughran and Ritter (1995)) that these firms underperform after they make a seasoned offering.

We form the size and book-to-market portfolios as described in Brav, Géczy, and Gompers (1995). Starting in January 1964, we use all NYSE stocks to create size quintile breakpoints with an equal number of NYSE firms in each size quintile.[3] Size is measured as the number of shares outstanding times the stock price at the end of the preceding month. We obtain our accounting measures from the COMPUSTAT quarterly and annual files and define book value as book common equity plus balance sheet deferred taxes and investment tax credits for the fiscal quarter ending two quarters before the sorting date. This is the same definition as in Fama and French (1992). If the book value is missing from the quarterly statements, we search for it in the annual files.[4] Within each size quintile we form five book-to-market portfolios with an equal number of NYSE firms in each book-to-market quintile to form 25 (5×5) size and book-to-market portfolios.[5] Value weighted returns are calculated for each portfolio for the next three months. We repeat the above procedure for April, July, and October of each year. In order to avoid comparing IPO firms to themselves, we eliminate IPO and SEO firms from the various portfolios for five years after their equity issue. Each issue is matched to its corresponding benchmark portfolio. Each quarter the matching is repeated, creating a separate benchmark for each issue. We then proceed to equal (value) weight IPO firm returns and the individual benchmark returns resulting in equal (value) weighted portfolios adjusted for book-to-market and size. We thus allow for time-varying firm risk characteristics of each IPO and each matching firm portfolio.

We do not, however, replicate Loughran and Ritter's size-matched firm adjustment for several reasons. Matching on the basis of size alone ignores evidence that book-to-market is related to returns. Book-to-market seems particularly important for small firms (Fama and French (1992)). Matching to small nonissuers makes it likely that firms in the matching sample are disproportionately long-term losers, i.e., high book-to-market firms. IPO firms tend to be small and low book-to-market. The delisting frequency is low for the IPO sample and their risk of financial distress in the first five years may be small. A similar sized small firm that has not issued equity in the previous five years is probably a poorly performing firm with few growth prospects and is probably not an appropriate risk match for the IPO firm if book-to-market is important. These firms may have higher returns because their risk of financial distress is higher. They are likely to be the DeBondt and Thaler (1985) underperformers that we know have high returns. This bias is especially strong prior to 1978 because Nasdaq returns only start in December 1972. Therefore, all size-matched firms would come from the NYSE and AMEX, potentially biasing the matched firms even more towards long-term losers, i.e., very high book-to-market firms.

[3] Fama and French (1992) use only NYSE stocks in order to ensure dispersion of the number of firms across portfolios.

[4] For firms that are missing altogether from the quarterly files, we use the annual files.

[5] We do not include stocks with negative book values.

Table I

Five-Year Post-Initial Public Offering (IPO) Returns and Wealth Relatives Versus Various Benchmarks

The sample is all venture-backed IPOs from 1972 through 1992 and all nonventure-backed IPOs from 1975 through 1992. Five-year equal weighted returns on IPOs are compared with alternative benchmarks. For each IPO, the returns are calculated by compounding daily returns up to the end of the month of the IPO and from then on compounding monthly returns for 59 months. If the IPO is delisted before the 59th month we compound the return until the delisting date. Wealth relatives are calculated as $\Sigma(1 + R_{i,T})/\Sigma(1 + R_{\text{bench},T})$, where $R_{i,T}$ is the buy and hold return on IPO i for period T and $R_{\text{bench},T}$ is the buy and hold return on the benchmark portfolio over the same period. Size and book-to-market benchmark portfolios are formed by intersecting five size quintiles and five book-to-market quintiles (5×5) and removing all firms which have issued equity in the previous five years in either an IPO or a seasoned equity offering. All IPO and benchmark returns are taken from the Center for Research in Security Prices files.

	Venture-Backed IPOs			Nonventure-Backed IPOs		
Benchmarks	IPO Return	Benchmark Return	Wealth Relative	IPO Return	Benchmark Return	Wealth Relative
Panel A: Five Year Equal Weighted Buy-and-Hold Returns						
S&P 500 index	44.6	65.3	0.88	22.5	71.8	0.71
Nasdaq composite	44.6	53.7	0.94	22.5	52.4	0.80
NYSE/AMEX value-weighted	44.6	61.4	0.90	22.5	66.4	0.75
NYSE/AMEX equal-weighted	44.6	60.8	0.90	22.5	55.7	0.79
Size and book-to-market (5×5)	46.4	29.9	1.13	21.7	20.8	1.01
Fama-French industry portfolio	46.8	51.2	0.97	26.2	60.0	0.79
Panel B: Five Year Value Weighted Buy-and-Hold Returns						
S&P 500 index	43.4	64.5	0.87	39.3	62.4	0.86
Nasdaq Composite	43.4	50.4	0.95	39.3	51.1	0.92
NYSE/AMEX value-weighted	43.4	60.0	0.90	39.3	57.6	0.88
NYSE/AMEX equal-weighted	43.4	56.4	0.92	39.3	47.7	0.94
Size and book-to-market (5×5)	41.9	37.6	1.03	33.0	38.7	0.96
Fama-French industry portfolio	46.0	45.0	1.01	45.2	53.2	0.95

Tests in this article calculate returns two ways, although we only report buy-and-hold results. First, as in Ritter (1991) and Loughran and Ritter (1995), we calculate buy-and-hold returns. No portfolio rebalancing is assumed in these calculations. We also calculate full five-year returns assuming monthly portfolio rebalancing. While the absolute level of returns changes, qualitative results are unchanged if returns are calculated using monthly rebalancing.

Table I presents the long-run buy-and-hold performance for our sample. We follow each offering event using both the CRSP daily and monthly tapes. Compound daily returns are calculated from the offering date until the end of the offering month. We then compound their returns using the monthly tapes for the earlier of 59 months or the delisting date. Firms that drop out will have IPO returns and benchmark returns that are calculated over a shorter time period. Where available, we include the firm's delisting return. Our interval is

set to match Loughran and Ritter's results (1995). In Panel A we weight equally the returns for each IPO and their benchmark. As in Loughran and Ritter (1995), we calculate wealth relatives for the five-year period after IPO by taking the ratio of one plus the IPO portfolio return over one plus the return on the chosen benchmark. Wealth relatives less than one mean that the IPO portfolio has underperformed relative to its benchmark.

The results weighting returns equally show that venture-backed IPOs outperform nonventure-backed IPOs by a wide margin. Over five years, venture-backed IPOs earn 44.6 percent on average, while nonventure-backed IPOs earn 22.5 percent.[6] The five year equally weighted wealth relatives show large differences in performance as well. Wealth relatives for the venture capital sample are all close to 0.9. Wealth relatives for the nonventure capital sample are substantially lower and range as low as 0.71 against the S&P 500 index.

Controlling for industry returns leaves performance differences as well. Using Fama-French (1994) industry portfolios, the venture capital sample shows little underperformance. The five-year wealth relative is 0.97. Nonventure-backed IPOs show substantial underperformance relative to their industry benchmarks, 0.79 for the five year wealth relative.

Two interpretations of the industry results are possible. First, the benchmark industry returns for the venture-backed sample are lower than the industry returns for the nonventure-backed sample. Thus, venture-backed IPOs may be concentrated in industries that have lower risk and therefore expected returns should be lower. Second, the relatively lower industry returns may reflect the venture capitalist's ability to time industry overpricing.

Wealth relatives versus size and book-to-market portfolios demonstrate that underperformance is not an IPO effect. When IPOs and SEOs are excluded from size and book-to-market portfolios, we find that venture-backed IPOs significantly outperform their relative portfolio returns (average wealth relative of 1.13) while nonventure-backed IPOs perform as well as the benchmark portfolios. The poor performance documented by Loughran and Ritter (1995) is not due to sample firms being initial public offering firms, but rather results from the types of firms they are, i.e., primarily small and low book-to-market firms.

Although the time frame of our sample is slightly different from Loughran and Ritter, our wealth relatives for NYSE/AMEX value and equal weighted indexes, the Nasdaq value weighted composite, and the S&P 500 are virtually identical to theirs. For example, five-year performance versus the NYSE/AMEX equally weighted and S&P 500 indexes produces wealth relatives of 0.78 and 0.84 in Loughran and Ritter's sample while (in unreported results), our entire sample (venture and nonventure-backed IPOs) produces wealth

[6] The five-year buy-and-hold returns are not true five-year returns because the average holding period is less than 60 months. Firms may take several months to be listed on the CRSP data tapes and so the first several return observations may be missing. Similarly, firms are delisted and so are only traded for some shorter period of time than the sample period. Finally, IPOs in the last two years have truncated returns because observations on returns only run through December 1994. The average holding period is approximately 47 months.

relatives of 0.78 and 0.82. Nonventure-backed IPOs perform worse than Loughran and Ritter's results.

Panel B of Table I presents results in which returns of IPOs and their reference benchmarks are weighted by the issuing firm's first available market value. If we are concerned about how important IPO underperformance affects investors' wealth, then value weighted results may be more meaningful. Five-year value weighted nominal returns on nonventure-backed IPOs are higher than when returns are weighted equally. Value weighted returns on the benchmark portfolios are similar to the equally weighted benchmark returns. This increases wealth relatives at five years for the nonventure capital sample and leaves venture capital wealth relatives relatively unchanged. Value weighted performance looks similar for the two groups with little overall underperformance. Five-year wealth relatives are closer to one. Large nonventure-backed IPOs perform substantially better than smaller nonventure-backed firms.

B. Yearly Cohort Results

Ritter (1991) and Loughran and Ritter (1995) document clear patterns in the underperformance of IPOs. In particular, years of greatest IPO activity are associated with the most severe underperformance. Results in Panel A of Table II present equal weighted, buy-and-hold cohort results versus the NYSE/AMEX equal weighted index.[7] Nominal returns and wealth relatives are high in the late 1970s but fall sharply in the early and middle 1980s. While five-year returns increase in the late 1980s and early 1990s, they increase more in the venture-backed sample. Our five-year return patterns closely follow Loughran and Ritter's results. For the venture-backed IPOs, underperformance is concentrated in the 1979 to 1985 cohorts while for the nonventure-backed sample, five-year underperformance is prevalent from 1978 forward. These results are largely consistent with the results of Ritter (1991) and Loughran and Ritter (1995), who find similar time series patterns of underperformance.

We also investigate how value weighting affects yearly cohort buy-and-hold patterns in Panel B. Each IPO is given a weight proportional to its market value of equity using the first available CRSP-listed closing price. Value weighting has different effects on the venture capital and nonventure capital samples. Value weighting the venture capital IPOs has little impact on the pattern of performance. Value weighting returns of the nonventure capital sample improves their nominal performance and wealth relatives in most cohorts. There is still some evidence of underperformance in the early 1980s, but it is much smaller. Most five-year nonventure capital wealth relatives are closer to one.

[7] We use the NYSE/AMEX equal weighted index because it produces wealth relatives that are somewhere in the middle of all benchmarks utilized. Replacing the NYSE/AMEX equal weighted index with the S&P 500, Nasdaq composite index, or industry portfolios does not affect the time series pattern of underperformance in any significant manner. Similarly, monthly portfolio rebalancing yields qualitatively similar results.

Table II

Long-Run Performance of Initial Public Offerings (IPOs) by Cohort Year Versus NYSE/AMEX Equal-Weighted Index

The sample is all venture-backed IPOs and all nonventure-backed IPOs from 1976 through 1992. For each IPO, the returns are calculated by compounding daily returns up to the end of the month of the IPO and from then on compounding monthly returns for 59 months. If the IPO is delisted before the 59th month, we compound the return until the delisting date. Wealth relatives are calculated as $\Sigma(1 + R_{i,T})/\Sigma(1 + R_{\text{bench},T})$, where $R_{i,T}$ is the buy and hold return on the IPO i for period T and $R_{\text{bench},T}$ is the buy and hold return on the benchmark portfolio over the same period. All IPO and benchmark returns are taken from the Center for Research in Security Prices files.

	Venture-backed IPOs				Nonventure-backed IPOs			
Year	Number	IPO Return	NYSE/AMEX	Wealth Relative	Number	IPO Return	NYSE/AMEX	Wealth Relative
				Panel A: Equal Weighted Five-Year Buy-and-Hold Returns				
1976	16	310.2	193.2	1.40	14	192.8	189.8	1.01
1977	13	253.1	128.9	1.54	9	103.0	119.0	0.93
1978	8	525.0	226.9	1.91	24	99.6	160.8	0.77
1979	8	71.1	164.4	0.65	44	51.0	141.8	0.62
1980	27	48.8	115.1	0.69	107	−23.4	107.0	0.37
1981	63	24.4	121.0	0.56	241	5.9	114.0	0.49
1982	25	32.8	142.8	0.55	75	110.8	128.9	0.92
1983	117	−14.7	51.1	0.56	507	3.6	50.7	0.69
1984	52	2.1	71.0	0.60	258	46.7	66.1	0.88
1985	46	12.6	40.4	0.80	253	5.3	41.5	0.74
1986	94	79.0	30.1	1.38	505	4.0	30.3	0.80
1987	78	25.3	27.1	0.99	379	12.3	26.0	0.89
1988	35	120.6	59.4	1.38	183	95.4	63.3	1.20
1989	33	141.1	58.3	1.52	129	48.9	58.2	0.94
1990	40	−14.3	67.8	0.51	116	30.7	66.5	0.79
1991	111	38.2	49.3	0.93	208	26.3	49.6	0.84
1992	147	17.7	28.3	0.92	343	15.0	27.7	0.90
				Panel B: Value Weighted Five Year Buy-and-Hold Returns				
1976	16	166.8	208.0	0.87	14	228.7	183.0	1.16
1977	13	438.1	152.1	2.14	9	200.4	118.6	1.37
1978	8	529.4	218.1	1.98	24	141.8	181.7	0.86
1979	8	7.1	156.7	0.42	44	87.9	150.7	0.75
1980	27	1.3	115.6	0.47	107	−32.4	108.6	0.32
1981	63	37.6	127.1	0.61	241	22.6	122.6	0.55
1982	25	−25.7	125.3	0.33	75	81.1	108.2	0.87
1983	117	−26.0	53.3	0.48	507	21.8	54.7	0.79
1984	52	0.0	75.2	0.57	258	67.6	71.4	0.98
1985	46	26.5	43.3	0.88	253	13.9	39.4	0.82
1986	94	201.6	32.5	2.28	505	25.3	32.0	0.95
1987	77	20.1	29.8	0.93	379	39.2	25.4	1.11
1988	35	120.5	58.9	1.39	183	72.0	68.5	1.03
1989	33	130.6	59.0	1.45	129	65.4	61.5	1.02
1990	40	7.9	66.1	0.65	116	45.8	65.9	0.88
1991	111	46.9	48.3	0.99	208	49.8	50.7	0.99
1992	145	25.4	28.2	0.98	343	29.2	27.5	1.01

The yearly cohort results suggest several patterns that we examine more deeply. The level and pattern of underperformance previously documented seem to be sensitive to the method of calculating returns. When returns are value weighted, underperformance of nonventure-backed IPOs is reduced in most years.

C. Calendar Time Results

Event time results that are presented above may be misleading about the pervasiveness of underperformance. Cohort returns in Table II may overstate the actual number of years in which IPOs underperform because the returns of recent IPO firms may be correlated. If firms that have recently gone public are similar in terms of size, industry, or other characteristics, then their returns will be highly correlated in calendar time. For example, if a shock to the economy in 1983 substantially decreased the value of firms that issued equity, then it makes the cohort years from 1979 through 1983 underperform, even though all the underperformance is concentrated in one year. Similarly, as discussed in De Long, Shleifer, Summers, and Waldmann (1990), investor sentiment is likely to be market-wide rather than specific to a particular firm and may cause returns to be correlated in calendar time.

To address this correlation we calculate the annual return on a strategy that invests in recent IPO firms. In Panel A of Table III we calculate the monthly return on portfolios that buy equal amounts of all IPO firms that went public within the previous five years. We calculate the annual return by compounding monthly returns on the IPO portfolios starting in January and ending in December of each year. These calendar time returns are presented and compared to calendar time returns on the NYSE/AMEX equal weighted index and the Nasdaq composite index. The wealth relatives on the venture capital IPO portfolio are above one in nine of nineteen years and are higher than the nonventure capital portfolio wealth relative in eleven of nineteen years. Underperformance for the venture capital sample is primarily concentrated from 1983 through 1986 and is concentrated from 1981 through 1987 for the nonventure capital portfolio.

In Panel B, the calendar time portfolio is formed by investing an amount that is proportional to the market value of the IPO firm's equity in a given month. Value weighting the calendar time portfolio does not have a major impact on the pattern of underperformance for venture-backed IPOs, but reduces underperformance in the nonventure-backed sample.

The cross-sectional correlation between cohort years can be seen graphically in Figures 1 and 2. The cumulative wealth relative is calculated for each IPO cohort year from 1979 through 1982 by taking the ratio of one plus the compound return on the portfolio that invests in each IPO that went public in a given year divided by the compound return on the Nasdaq composite index. Figure 1 plots the cumulative wealth relative for venture-backed IPOs and Figure 2 plots the cumulative wealth relative for nonventure-backed IPOs. All

Table III

Calendar Time Initial Public Offering (IPO) Performance

Annual performance of initial public offerings from 1976 through 1992 relative to the New York Stock Exchange/American Stock Exchange (NYSE/AMEX) value weighted index and the Nasdaq value weighted composite index. The sample is all venture capital (VC) IPOs from 1972 through 1992 and all nonventure-backed (nonVC) IPOs from 1975 through 1992. Each month, the return on all IPOs that went public within the past five years is calculated. The annual return in each year is the compound return from January through December of these average monthly returns. The annual benchmark returns are the compounded monthly returns on either the NYSE/AMEX value weighted or Nasdaq composite index. IPO and benchmark returns are taken from the Center for Research in Security Prices files.

Year	VC-IPOs	nonVC-IPOs	NYSE/AMEX	VC Wealth Relative	nonVC Wealth Relative	Nasdaq	VC Wealth Relative	nonVC Wealth Relative
				Panel A: Equal Weighted IPO Calendar-time Portfolio Returns				
1976	48.9	14.6	26.5	1.18	0.91	29.3	1.15	0.89
1977	32.3	22.2	−4.2	1.38	1.28	10.5	1.20	1.11
1978	44.7	10.5	7.8	1.34	1.03	16.1	1.25	0.95
1979	43.8	53.9	23.6	1.16	1.25	32.3	1.09	1.16
1980	78.0	89.7	32.7	1.34	1.43	37.7	1.29	1.38
1981	−7.1	−20.9	−4.3	0.97	0.83	−0.7	0.94	0.80
1982	34.6	5.8	20.2	1.12	0.88	22.4	1.10	0.87
1983	10.5	28.5	23.1	0.90	1.04	21.3	0.91	1.06
1984	−34.4	−21.1	5.1	0.62	0.75	−9.1	0.72	0.87
1985	30.1	23.5	31.2	0.99	0.94	33.8	0.97	0.92
1986	−8.9	3.4	16.9	0.78	0.88	8.0	0.84	0.96
1987	−11.4	−19.9	2.8	0.86	0.78	−4.6	0.93	0.84
1988	23.9	20.1	17.5	1.05	1.02	18.4	1.05	1.01
1989	7.9	11.4	29.4	0.83	0.86	21.1	0.89	0.92
1990	−15.0	−27.3	−4.8	0.89	0.76	−15.3	1.00	0.86
1991	97.4	50.5	30.6	1.51	1.15	60.0	1.23	0.94
1992	8.1	19.1	8.0	1.00	1.10	16.3	0.93	1.02
1993[1]	5.3	16.1	11.0	0.95	1.05	14.5	0.92	1.01
1994[1]	−3.1	−10.5	−0.3	0.97	0.90	−2.3	0.99	0.92
				Panel B: Value Weighted IPO Calendar-time Portfolio Returns				
1976	1.1	2.7	26.5	0.80	0.81	29.3	0.78	0.79
1977	13.3	−5.9	−4.2	1.18	0.98	10.5	1.03	0.85
1978	44.9	12.7	7.8	1.34	1.05	16.1	1.25	0.97
1979	27.8	49.6	23.6	1.03	1.21	32.3	0.97	1.13
1980	67.3	99.3	32.7	1.26	1.50	37.7	1.22	1.45
1981	−7.6	−21.7	−4.3	0.97	0.82	−0.7	0.93	0.79
1982	29.6	14.6	20.2	1.08	0.95	22.4	1.06	0.94
1983	2.2	16.9	23.1	0.83	0.95	21.3	0.84	0.96
1984	−30.2	−19.4	5.1	0.66	0.77	−9.1	0.77	0.89
1985	21.4	30.5	31.2	0.93	0.99	33.8	0.91	0.97
1986	−7.0	8.9	16.9	0.80	0.93	8.0	0.86	1.01
1987	5.5	−11.3	2.8	1.03	0.86	−4.6	1.11	0.93
1988	14.0	15.4	17.5	0.97	0.98	18.4	0.96	0.97
1989	32.4	20.8	29.4	1.02	0.93	21.1	1.10	1.00
1990	0.1	−12.6	−4.8	1.05	0.92	−15.3	1.18	1.03
1991	78.6	38.3	30.6	1.37	1.06	60.0	1.12	0.86
1992	7.5	10.9	8.0	1.00	1.03	16.3	0.92	0.95
1993[1]	10.48	38.3	11.0	1.00	1.25	14.5	0.97	1.21
1994[1]	−4.7	10.9	−0.3	0.96	1.11	−2.3	0.98	1.14

[1] Returns for 1993 and 1994 only include IPOs that went public prior to December 31, 1992.

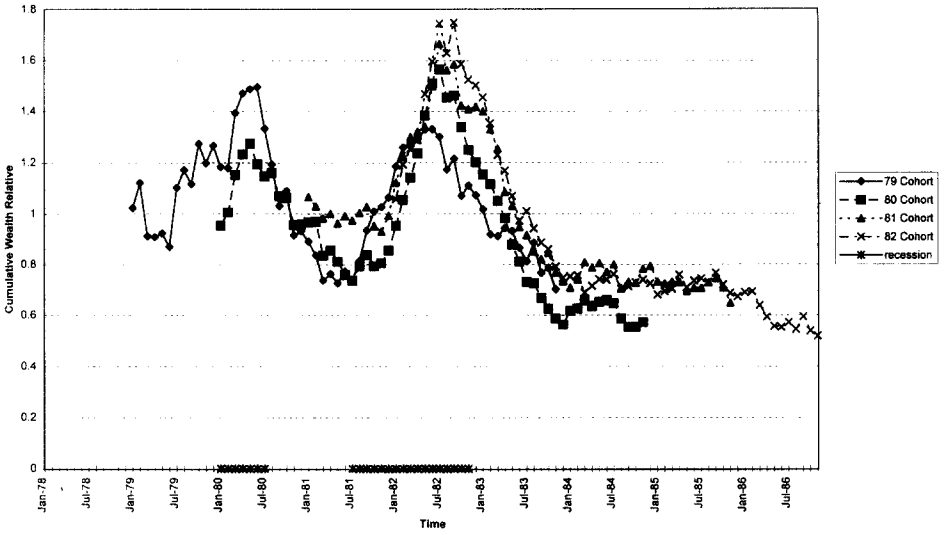

Figure 1. Time series of wealth relatives for selected venture-backed initial public offering (IPO) yearly cohorts. The sample is all venture-backed IPOs from 1979 through 1982. Performance of the portfolio of IPO firms is compared to the Nasdaq composite benchmark. The cumulative wealth relative from issue date through the calendar month is plotted by taking the ratio of one plus the equal weighted buy-and-hold return for the portfolio of issuing firms in a cohort year starting from the beginning of the cohort year up to the given month divided by one plus the compounded Nasdaq return over the same time period.

cohort years move in almost identical time series patterns. Relative returns decline sharply for all cohorts in mid-1980, rise in parallel from January 1982 through the end of 1982 and then decline in 1983. The time series correlation of the yearly cohorts illustrates the need to be concerned about interpretation of test statistics. Viewing each IPO as an independent event probably overstates the significance of estimated underperformance. Knowing that underperformance is concentrated in time may also help determine its causes.

D. Pricing the IPOs

If IPOs underperform on a risk-adjusted basis, portfolios of IPOs should consistently underperform relative to an explicit asset pricing model. Recent work by Fama and French (1993) indicates that a three factor model may explain the cross section of stock returns. Their three factors are: RMRF, which is the excess return on the value weighted market portfolio; SMB, the return on a zero investment portfolio formed by subtracting the return on a large firm portfolio from the return on a small firm portfolio;[8] and HML, the return on a zero investment portfolio calculated as the return on a portfolio of

[8] The breakpoints for small and large firms are determined by NYSE firms alone, but the portfolios contain all firms traded on NYSE, AMEX, and Nasdaq exchanges.

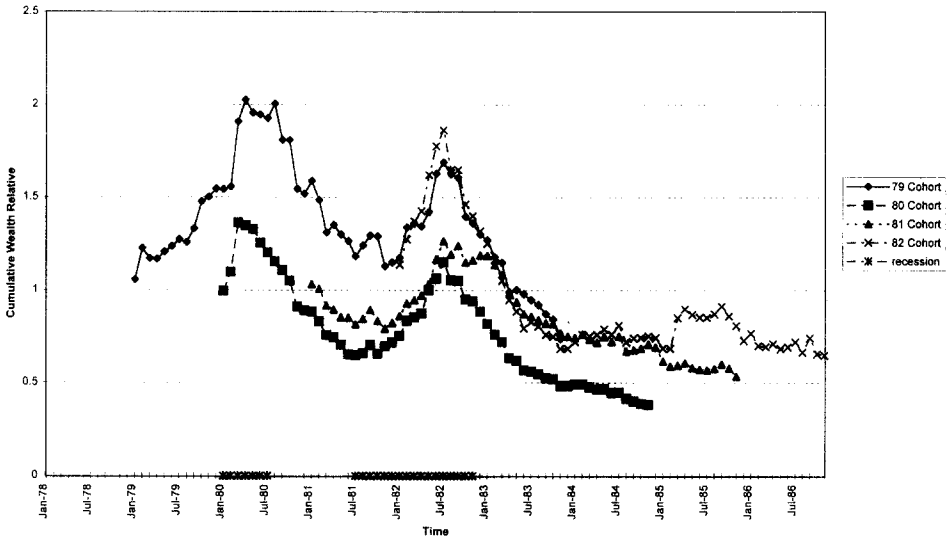

Figure 2. Time series of wealth relatives for selected nonventure-backed initial public offering (IPO) yearly cohorts. The sample is all nonventure-backed IPOs from 1979 through 1982. Performance of the portfolio of IPO firms is compared to the Nasdaq composite benchmark. The cumulative wealth relative from issue date through the calendar month is plotted by taking the ratio of one plus the equal weighted buy-and-hold return for the portfolio of issuing firms in a cohort year starting from the beginning of the cohort year up to the given month divided by one plus the compounded Nasdaq return over the same time period.

high book-to-market stocks minus the return on a portfolio of low book-to-market stocks.[9] We use the intercept from time series regressions as an indicator of risk-adjusted performance to determine whether the results documented by Ritter (1991) and Loughran and Ritter (1995) are consistent with the Fama-French model. The intercepts in these regressions have an interpretation analogous to Jensen's alpha in the Capital Asset Pricing Model (CAPM) framework. This approach has the added benefit that we can make statistical inferences given the assumption of multivariate normality of the residuals. This was not possible in our previous analysis due to the right skewness of long horizon returns. The disadvantage of this approach is that it weights each month equally in minimizing the sum of squares. This point can be appreciated by noting that a monthly observation in mid-1976 (the average of a few IPOs) gets the same weight as a monthly observation in mid-1986 (the average of a large number of IPOs). If underperformance is correlated with the number of IPOs in our portfolios, the Fama-French results will reduce the measured underperformance.

[9] The high book-to-market portfolio represents the top 30 percent of all firms on COMPUSTAT while the low book-to-market portfolio contains firms in the lowest 30 percent of the COMPUSTAT universe of firms.

Table IV

Fama-French (1993) Three Factor Regression on Initial Public Offering (IPO) Portfolios for the Whole Sample and Sorted on the Basis of Size

The sample is all venture capital IPOs from 1972 through 1992 and all nonventure-backed IPOs from 1975 through 1992. Portfolios of IPOs are formed by including all issues that were done within the previous five years. RMRF is the value weighted market return on all NYSE/AMEX/Nasdaq firms (RM) minus the risk free rate (RF) which is the one-month Treasury bill rate. SMB (small minus big) is the difference each month between the return on small firms and big firms. HML (high minus low) is the difference each month between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks. The first two columns present results for the entire sample. The next three columns show portfolios sorted by size. Every six months an equal number of stocks are allocated to one of three size portfolios. Size breakpoints are the same for both the venture and nonventure-backed samples. Portfolio returns are the equal weighted returns for IPOs within that tercile. IPOs are allowed to switch allocation every six months. All regressions are for January 1977 through December 1994 for a total of 216 observations (t-statistics are in parentheses).

	Full Sample Equal Weighted	Full Sample Value Weighted	Equal Weighted Size Terciles		
			Small	2	Large
Panel A: Venture Capital IPOs					
Intercepts	0.0007	0.0015	0.0001	−0.0004	0.0023
	(0.35)	(0.55)	(0.02)	(−0.20)	(0.93)
RMRF	1.0978	1.2127	0.9481	1.1096	1.2333
	(22.97)	(17.64)	(11.28)	(19.41)	(19.46)
SMB	1.2745	1.1131	1.6841	1.3237	1.1373
	(18.57)	(10.37)	(12.91)	(14.83)	(11.49)
HML	−0.6807	−1.0659	−0.2765	−0.6734	−1.1373
	(−8.24)	(−8.96)	(−1.90)	(−6.81)	(−9.95)
Adjusted R^2	0.889	0.821	0.687	0.846	0.849
Panel B: Nonventure Capital IPOs					
Intercepts	−0.0052	−0.0029	−0.0056	−0.0056	−0.0004
	(−2.80)	(−1.84)	(−1.63)	(−2.72)	(−0.27)
RMRF	0.9422	1.0486	0.8073	0.9900	1.0312
	(19.94)	(26.12)	(9.24)	(18.74)	(26.40)
SMB	1.1450	0.6612	1.3870	1.2245	0.8322
	(15.52)	(10.55)	(10.17)	(14.85)	(13.65)
HML	−0.1069	−0.3405	0.1909	−0.1906	−0.3229
	(−1.31)	(−4.90)	(1.26)	(−2.08)	(−4.77)
Adjusted R^2	0.825	0.868	0.544	0.813	0.879

Table IV presents the three-factor time series regression results. IPO portfolio returns are regressed on RMRF, SMB, and HML. For the equal and value weighted venture-backed IPO portfolios presented in Panel A, results cannot reject the three-factor model. The intercepts are 0.0007 and 0.0015. Panel B presents results for nonventure-backed IPOs. When the nonventure-backed returns are weighted equally, the intercept is −0.0052 (52 basis points per month) with a t-statistic of −2.80 indicating severe underperformance. Value

weighting nonventure capital returns produces a smaller intercept, −0.0029 with a *t*-statistic of −1.84.[10]

The coefficients on HML for venture-backed IPOs (−0.6807 and −1.0659) indicate that their returns covary with low book-to-market (growth) firms. When returns are value weighted, loadings on SMB decline but the loadings on HML become more negative for both IPO groups. The returns on larger IPO firms (in market value) tend to covary more with the returns of growth companies.

Every six months we divide the sample into three size portfolios based on the previous month's IPO size distribution using all IPOs to determine the breakpoints. The portfolios are rebalanced monthly and IPOs are allowed to switch portfolios every half year. We estimate equal weighted regressions within each size group. The venture capital terciles never underperform. No intercept is below −0.0004 and none is significant. The pattern for nonventure-backed IPOs verifies our earlier results. Underperformance is concentrated in the two smallest terciles. Intercepts for the smallest two size terciles in the nonventure-backed sample are large, −0.0056, with *t*-statistics of −1.63 and −2.72. Coefficients on SMB decline monotonically from the portfolio of smallest issuers to largest issuers. Returns of the smallest IPOs covary more with returns on small stocks.

Coefficients on HML show two interesting patterns. Coefficients for venture-backed IPO portfolios decline monotonically. The larger the firm, the more it covaries with low book-to-market firms. Venture-backed firms are similar in age and amount of capital invested (book value of assets). Venture-backed firms become large by having high market values. Large firms (in market value) will have low book-to-market ratios and hence covary with growth companies.

This pattern is not as clear in the nonventure-backed sample. First, the smallest tercile has a positive coefficient on HML and the largest two portfolios have negative coefficients. Similarly, venture-backed IPOs load more negatively on HML than nonventure-backed firms, indicating that venture-backed returns covary more with the returns of growth companies.

The results indicate that IPO underperformance is driven by nonventure-backed IPOs in the smallest decile of firms based on NYSE breakpoints. Over 50 percent of nonventure-backed firms are in the smallest size decile when breakpoints are determined by NYSE-listed firms. Therefore, all firms in the nonventure capital smallest portfolio of Table IV are from the smallest size decile.

[10] Loughran and Ritter (1995) also run Fama-French three-factor regressions and find negative intercepts for all issuer portfolios. Loughran and Ritter's regressions, however, combine IPO and SEO firms. Their regressions are therefore not directly comparable to our results. Loughran and Ritter also sort issuing firms into large and small issuers, but use the median firm on NYSE/AMEX to determine the size breakpoint. This cutoff would leave very few IPO firms in the large issuing firm portfolio.

Table V presents the results sorting firms on the basis of book-to-market ratios.[11] Panel A shows that for the equal weighted venture-backed IPO portfolio, no book-to-market portfolio underperforms. Nonventure-backed firms, however, show substantial underperformance in all terciles. Underperformance ranges from −0.0042 to −0.0055.

Panels C and D show that value weighting again reduces the influence of small firm underperformance. The lowest book-to-market portfolio for the venture-backed IPOs now has a positive intercept of 0.0036 (36 basis points per month). No other venture or nonventure-backed IPO tercile has significant underperformance relative to the Fama-French three-factor model. The Fama-French results provide evidence that underperformance remains even after controlling for size and book-to-market in time series regressions. Venture-backed IPOs do not underperform whether the results are run on the entire sample or sortings based on size or book-to-market. Nonventure-backed IPOs exhibit severe underperformance (primarily concentrated in the smaller issuers) even relative to the Fama-French model.

In order to address the source of the underperformance, we rerun the Fama-French three factor regressions including an index that measures the change in the average discount on closed-end funds. We construct the index as in Lee, Shleifer, and Thaler (1991). The discount on a closed-end fund is the difference between the fund's net asset value and its price divided by the net asset value. We value weight the discount across funds in a particular month and then calculate the change in the level of the index from the previous month. Lee, Shleifer, and Thaler argue that the average discount reflects the relative level of investor sentiment. If this is the case, we expect the change in the discount to be related to returns of firms that underperform relative to the Fama-French three-factor model. When the change in discount is positive, i.e., the average discount increases, individual investors may be more pessimistic and returns on firms affected by investor sentiment should fall. Conversely, when the change in average discount is negative, individual investors are becoming more optimistic and returns should rise.

Table VI confirms our predictions. The change in discount is negatively related to returns of the smallest group of firms, the smallest venture-backed companies and the smallest two terciles of nonventure-backed firms. These firms are potentially most affected by investor sentiment. The negative relation between changes in the closed-end fund discount and returns of small IPO firms indicates that investor sentiment might be an important source of underperformance. Sophisticated investors may not enter this market because the cost of gathering information about these firms may outweigh the potential returns from correcting the mispricing. Informed investors may also not want to bet against noise traders if prices can move further out of line in the

[11] Results for the whole sample are not the same as in Table IV because sorting by book-to-market is predicated on having book equity data from COMPUSTAT. Some firms are on CRSP but not on COMPUSTAT, so the number of firms in Table IV is larger than the number of firms in Table V by 778 observations.

Table V

Fama-French (1993) Three Factor Regression on Initial Public Offering (IPO) Portfolios for the Whole Sample and Sorted on the Basis of Book-to-Market Ratio

The sample is all venture capital IPOs from 1972 through 1992 and all nonventure-backed IPOs from 1975 through 1992. Portfolios of IPOs are formed by including all issues that were done within the previous five years. RMRF is the value weighted market return on all NYSE/AMEX/Nasdaq firms (RM) minus the risk free rate (RF) which is the one-month Treasury bill rate. SMB (small minus big) is the difference each month between the return on small firms and big firms. HML (high minus low) is the difference each month between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks. The first column presents results for the entire sample. The next three columns show portfolios sorted by book-to-market ratio. Every six months an equal number of stocks are allocated to one of the three book-to-market portfolios. Book-to-market breakpoints are the same for venture and nonventure-backed samples. Portfolio returns are either equal weighted or value weighted returns for IPOs within that tercile. IPOs are allowed to switch allocation every six months. All regressions are for January 1977 through December 1994 for a total of 216 observations (t-statistics are in parentheses).

		Book-to-Market Terciles		
	Full Sample	Low	2	High
Panel A: Venture Capital IPOs–Equal Weighted Portfolios				
Intercepts	0.0029	−0.0009	0.0026	−0.0007
	(0.15)	(−0.36)	(0.89)	(−0.23)
RMRF	1.0893	1.1128	1.1154	1.0400
	(20.94)	(16.51)	(14.75)	(13.70)
SMB	1.3416	1.2160	1.2801	1.5242
	(16.52)	(11.56)	(10.83)	(12.86)
HML	−0.6864	−0.9806	−0.8044	−0.2760
	(−7.63)	(−8.41)	(−6.15)	(−2.10)
Adjusted R^2	0.868	0.812	0.766	0.730
Panel B: Nonventure Capital IPOs–Equal Weighted Portfolios				
Intercepts	−0.0051	−0.0042	−0.0055	−0.0054
	(−2.90)	(−1.61)	(−2.60)	(−2.33)
RMRF	0.9762	1.0394	0.9881	0.9017
	(21.71)	(15.47)	(18.16)	(15.08)
SMB	1.1946	1.2839	1.1803	1.1264
	(17.02)	(12.24)	(13.90)	(12.07)
HML	−0.1667	−0.4977	−0.2641	0.2575
	(−2.14)	(−4.28)	(−2.81)	(2.49)
Adjusted R^2	0.852	0.770	0.805	0.703
Panel C: Venture Capital IPOs–Value Weighted Portfolios				
Intercepts	0.0012	0.0036	0.0029	−0.0030
	(0.42)	(1.09)	(0.86)	(−1.01)
RMRF	1.1991	1.1814	1.1772	1.1664
	(16.89)	(13.82)	(13.58)	(15.38)
SMB	1.0283	0.9384	1.2043	1.3184
	(9.28)	(7.03)	(8.90)	(11.13)
HML	−1.0470	−1.2152	−0.9706	−0.5252
	(−8.52)	(−8.22)	(−6.47)	(−4.00)
Adjusted R^2	0.804	0.744	0.734	0.756

Table V.—*Continued*

	Full Sample	Book-to-Market Terciles		
		Low	2	High
	Panel D: Nonventure Capital IPOs–Value Weighted Portfolios			
Intercepts	−0.0012	0.0021	−0.0015	−0.0039
	(−0.59)	(0.66)	(−0.71)	(−1.81)
RMRF	1.0438	1.0771	1.0631	1.0269
	(20.59)	(13.55)	(20.03)	(18.86)
SMB	0.6870	0.8899	0.7483	0.5189
	(8.68)	(7.17)	(9.03)	(6.10)
HML	−0.4282	−0.7053	−0.3632	−0.0090
	(−4.88)	(−5.12)	(−3.96)	(−0.10)
Adjusted R^2	0.813	0.698	0.802	0.732

short-run. Finally, short selling may be constrained because shares cannot be borrowed.

E. Cross-Sectional Results

Given the results from the Fama-French (1993) three factor regressions, we explore how raw returns and wealth relatives vary with size and book-to-market. In Table VII we present summary statistics for size and book-to-market quintiles of the full sample and the subsets of venture-backed and nonventure-backed IPOs. In Panel A, we sort the entire sample of IPOs by their real (constant 1992 dollars) market value at the first available CRSP listed closing price. Equal numbers of IPOs are allocated to each size quintile. We impose the same cutoffs for venture-backed and nonventure-backed IPOs. Size increases from an average of $11.5 million in the first quintile to $445.2 million in the biggest. Comparing average book-to-market ratios for the two subgroups demonstrates that venture-backed IPOs have substantially lower average book-to-market ratios within any given size quintile. The smallest two size quintiles have disproportionately more nonventure-backed IPOs. This reflects the larger average size of venture-backed IPO firms.[12] Differences in book-to-market ratios might reflect different industry compositions between the two groups. Venture capitalists back more firms in high growth, low book-to-market industries.

In Panel B IPOs are sorted into book-to-market quintiles. Average book-to-market ratios increase from 0.053 in the lowest quintile to 3.142 in the highest. Once again, significant differences are apparent across the two samples. Average size of the venture-backed IPOs is higher in the first through third

[12] No time series bias is imparted by sorting the entire sample by the total sample breakpoints. No trend or pattern in real size (in 1992 dollars) or book-to-market ratios is evident that would lead to dramatic differences in the yearly representation in size or book-to-market quintiles.

Table VI

Fama-French (1993) Three Factor Regression on Initial Public Offering (IPO) Portfolios Including the Change in the Average Closed-End Fund Discount

The sample is all venture capital IPOs from 1972 through 1992 and all nonventure-backed IPOs from 1975 through 1992. Portfolios of IPOs are formed by including all issues that were done within the previous five years. RMRF is the value weighted market return on all NYSE/AMEX/Nasdaq firms (RM) minus the risk free rate (RF) which is the one-month Treasury bill rate. SMB (small minus big) is the difference each month between the return on small firms and big firms. HML (high minus low) is the difference each month between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks. ΔDiscount represents the change in the average discount on closed end-funds from the end of last month to the end of this month. The first two columns present results for the entire sample. The next three columns show portfolios sorted by size. Every six months an equal number of stocks are allocated to one of the three size portfolios. Size breakpoints are the same for both venture and nonventure-backed samples. Portfolio returns are the equal weighted returns for IPOs within that tercile. IPOs are allowed to switch allocation every six months. All regressions are for January 1977 through May 1992 for a total of 185 observations (t-statistics are in parentheses).

	Full Sample Equal Weighted	Full Sample Value Weighted	Equal Weighted Size Terciles		
			Small	2	Large
Panel A: Venture-backed IPOs					
Intercepts	0.0009	0.0018	0.0011	−0.0008	0.0024
	(0.44)	(0.59)	(0.31)	(−0.34)	(0.89)
RMRF	1.0934	1.2043	0.9145	1.1258	1.2377
	(21.10)	(15.85)	(10.08)	(18.34)	(18.06)
SMB	1.3855	1.1071	1.7154	1.2986	1.1406
	(17.28)	(9.41)	(12.22)	(13.67)	(10.75)
HML	−0.7104	−1.0881	−0.4078	−0.6400	−1.0818
	(−7.51)	(−7.85)	(−2.47)	(−5.71)	(−8.65)
ΔDiscount	−0.0002	0.0018	−0.0038	0.0001	0.0031
	(−0.22)	(1.24)	(−2.18)	(0.06)	(2.34)
Adjusted R^2	0.891	0.819	0.701	0.850	0.853
Panel B: Nonventure Capital IPOs					
Intercepts	−0.0049	−0.0032	−0.0050	−0.0053	−0.0004
	(−2.38)	(−1.80)	(−1.28)	(−2.32)	(−0.52)
RMRF	0.9121	1.0271	0.7801	0.9480	1.0096
	(17.61)	(23.28)	(8.03)	(16.66)	(23.50)
SMB	1.1650	0.6853	1.3910	1.2554	0.8581
	(14.53)	(10.04)	(9.25)	(14.26)	(12.91)
HML	−0.2155	−0.4172	0.0862	−0.3313	−0.4045
	(−2.28)	(−5.18)	(0.48)	(−3.19)	(−5.16)
ΔDiscount	−0.0022	−0.0000	−0.0030	−0.0031	−0.0005
	(−2.23)	(−0.06)	(−2.62)	(−2.87)	(−0.64)
Adjusted R^2	0.829	0.871	0.543	0.824	0.882

Table VII

Summary Statistics for Size and Book-to-Market Quintiles

The sample is all venture capital initial public offerings (IPOs) from 1972 through 1992 and all nonventure-backed IPOs from 1975 through 1992. IPOs are divided into quintiles based on size (market value of equity at the first Center for Research in Security Prices (CRSP) listed closing price in constant 1992 dollars) or book-to-market at the time of IPO. The first book value of equity after the IPO is taken from COMPUSTAT as long as it is within one year of the offering date. An equal number of IPOs from the entire sample are allocated to each quintile. Breakpoints are the same for venture and nonventure-backed samples. Size is in millions of 1992 dollars. (Medians are in parentheses.)

Panel A: Summary Data for Size Quintiles

		Venture-backed IPOs		Nonventure-backed IPOs	
Size Quintile	Average Size	Average Book-to-Market	Number of Firms	Average Book-to-Market	Number of Firms
Small	\$ 11.5	0.465 (0.323)	58	1.901 (0.295)	806
2	\$ 26.1	0.360 (0.326)	132	0.531 (0.286)	732
3	\$ 52.3	0.326 (0.286)	220	0.892 (0.305)	648
4	\$101.3	0.248 (0.097)	285	0.907 (0.310)	579
Large	\$445.2	0.187 (0.235)	237	0.709 (0.280)	622

Panel B: Summary Data for Book-to-Market Quintiles

		Venture-backed IPOs		Nonventure-backed IPOs	
Book-to-Market Quintile	Average Book-to-Market	Average Size	Number of Firms	Average Size	Number of Firms
Low	0.053	\$201.4 (\$125.8)	198	\$115.6 (\$43.8)	404
2	0.167	\$147.1 (\$103.8)	182	\$149.8 (\$51.8)	420
3	0.277	\$117.2 (\$81.1)	181	\$101.9 (\$45.7)	422
4	0.400	\$ 90.2 (\$68.6)	157	\$103.4 (\$39.2)	447
High	3.142	\$ 72.4 (\$48.8)	92	\$200.5 (\$57.8)	510

quintiles, but lower in the fourth and fifth quintiles. Venture-backed growth (low book-to-market) firms tend to be larger and venture capital value (high book-to-market) firms tend to be smaller than comparable nonventure-backed IPOs. Except for the highest book-to-market quintile, the quintiles have roughly constant proportions of venture and nonventure-backed IPOs. The highest book-to-market quintile has substantially more nonventure-backed IPOs than venture-backed IPOs. This may indicate that venture capitalists avoid investment in industries that have high book-to-market ratios (value industries) or that the nonventure-backed firms simply have lower growth expectations.

Figure 3 plots the average equal weighted nominal five year buy-and-hold return for each size quintile classifying IPOs as venture or nonventure-backed. Venture-backed IPOs show no size effect. Performance of the smallest quintile of venture-backed IPOs looks very similar to performance of the largest. A

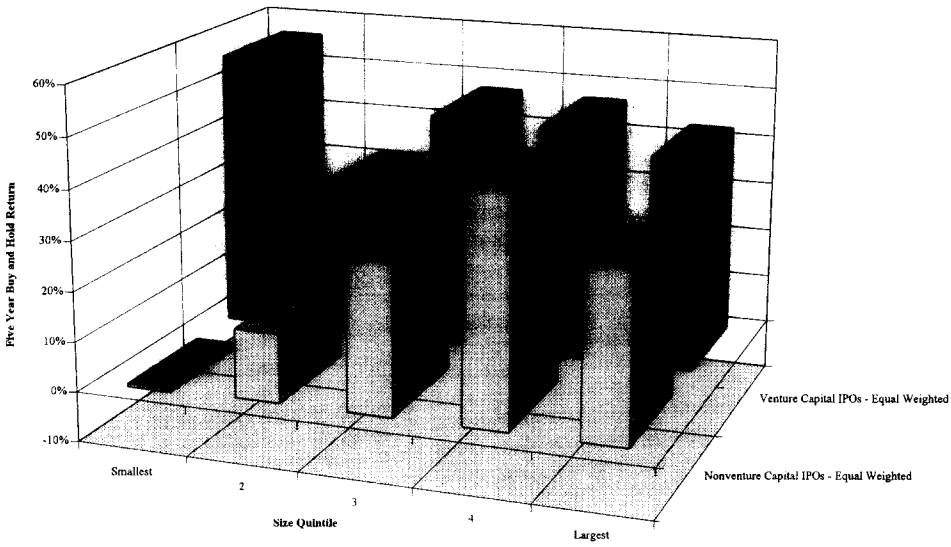

Figure 3. Five year equal weighted buy-and-hold returns for venture and nonventure-backed initial public offerings (IPOs) by size quintile. The sample is 3,407 nonventure-backed IPOs from 1975 through 1992 and 934 venture-backed IPOs from 1972 through 1992. Each sample of IPOs is sorted into size quintiles based on the real (1992 dollars) size at the first closing price listed by the Center for Research in Security Prices. Size breakpoints are the same for the venture and nonventure-backed samples. Quintile returns are the average buy-and-hold return for IPOs in that quintile.

pronounced size effect is apparent in the nonventure-backed firms, however. Average nominal returns on nonventure-backed IPOs in size quintile 1 are *negative*.

Equal weighted nominal five-year buy-and-hold returns for book-to-market quintiles are shown in Figure 4. Returns show an increase from lowest to highest quintile. The increase across book-to-market quintiles is substantially larger for nonventure-backed firms. On an equal weighted basis, all nonventure-backed book-to-market quintiles underperform the venture-backed quintiles.

Figures 5 and 6 show that underperformance of small, low book-to-market IPO firms is not due to their status as equity issuers. We sort the IPO firms into their appropriate 25 (5×5) size and book-to-market portfolio based on the NYSE breakpoints that are discussed above. The five year buy-and-hold return on the IPO firms is compared to the five year buy-and-hold return on the size and book-to-market portfolio that excludes IPO and SEO firms for five years after issue. Figure 5 plots the average excess returns of the venture capital-backed IPO sample by portfolio. Adjusting for size and book-to-market returns, no strong pattern of performance is seen. Small, low book-to-market venture-backed IPOs (380 of 934 firms) outperform the small, low book-to-market benchmark by 42 percent.

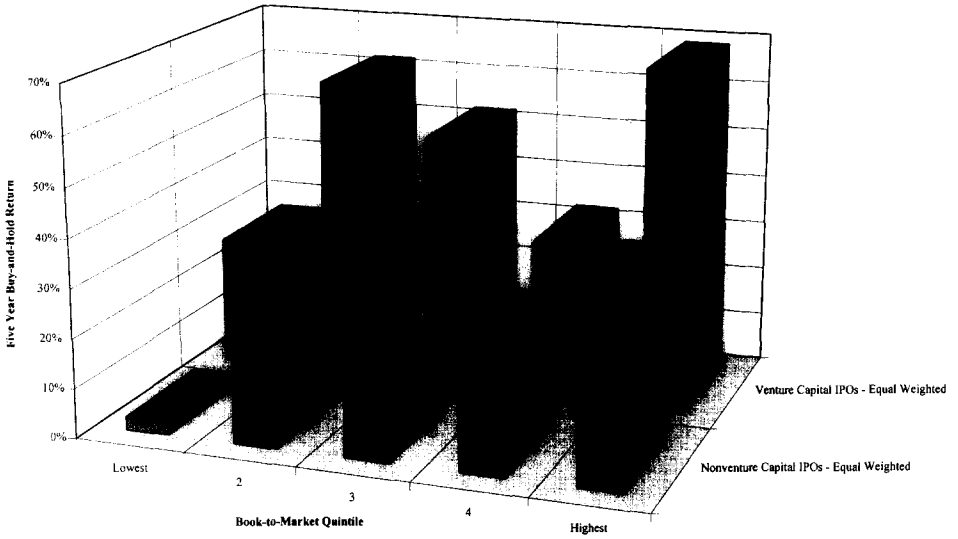

Figure 4. Five year equal weighted buy-and-hold returns for venture and nonventure-backed initial public offerings (IPOs) by book-to-market quintile. The sample is 3,407 nonventure-backed IPOs from 1975 through 1992 and 934 venture-backed IPOs from 1972 through 1992. Each sample of IPOs is sorted into book-to-market quintiles based on the real (1992 dollars) market value at the first closing price listed by the Center for Research in Security Prices and first available book value of equity. Book-to-market breakpoints are the same for both samples. Quintile returns are the average buy-and-hold return for IPOs in that quintile.

Figure 6 plots size and book-to-market excess returns for nonventure capital-backed IPO firms. The small, low book-to-market nonventure-backed IPO firms (which make up 1,465 of the 3,407 firms) outperform similar nonissuing firms by 12 percent. This positive relative performance is not the result of large returns by the IPO firms; they only earn an average of 5 percent over five years. Small, low book-to-market nonissuing firms, however, earn an average of -7 percent over the same time period. Portfolios further from the small, low book-to-market portfolio have far fewer issuing firms. Standard errors for the estimates of mean excess returns would be much larger and hence little emphasis should be placed on their significance. For the majority of the sample, i.e., the corner of the figure near the small, low book-to-market portfolio, relative performance is close to 0.

These results indicate that IPO underperformance is not an issuing firm effect. It is a small, low book-to-market effect. Similar size and book-to-market nonissuing firms perform just as poorly as IPO firms do. This does not imply that returns are normal on a risk-adjusted basis. In fact, small, low book-to-market firms appear to earn almost zero nominal returns over a five-year period that starts with IPO issuance. It may be difficult to explain this low return with a risk-based model.

In Table VIII we present cross-sectional estimates of the determinants of five year buy-and-hold wealth relatives using the Nasdaq composite index as

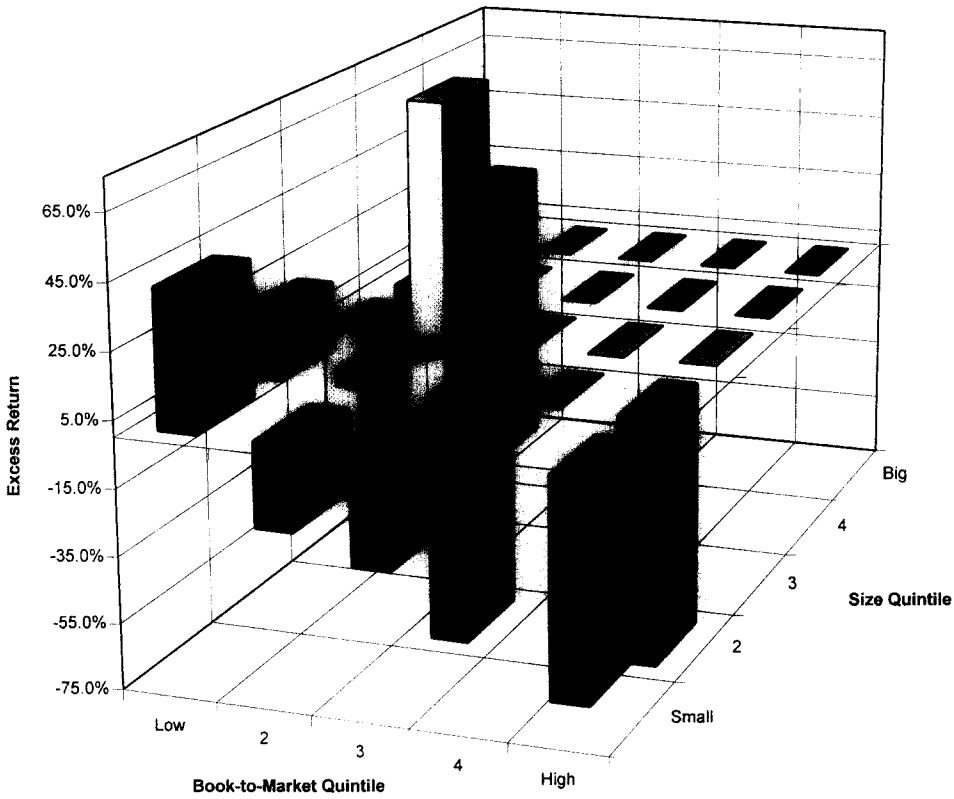

Figure 5. Five year excess returns for venture capital-backed initial public offerings (IPOs) by size and book to market portfolio. The sample is 934 venture-backed IPOs from 1972–1992. Twenty-five (5 × 5) size and book-to-market portfolios are formed based on the New York Stock Exchange (NYSE) breakpoints. IPO firms are assigned to their appropriate size and book-to-market portfolio at issue. The five-year excess return is calculated by subtracting the five-year buy-and-hold return on the size and book-to-market portfolio that excludes all IPO and SEO firms for five years after issue from the five-year buy-and-hold return on the IPO firm. The average excess return is plotted for each size and book-to-market portfolio.

the benchmark.[13] The dependent variable is the logarithm of the five-year wealth relative. The independent variables are the natural logarithm of the firm's market value of equity (in 1992 dollars) at the first available CRSP listed closing price, a dummy variable indicating if the firm was venture-backed, the natural logarithm of the firm's book value of equity to market value, and the lagged dividend price ratio for the entire market. We include the dividend price ratio to determine whether overall market pricing affects long-run returns.

The results demonstrate that size is an important determinant of relative returns. Across all specifications, the coefficient on logarithm of IPO firm size is positive and highly significant. This result captures the essence of value

[13] Because of the large cross-section that we employ, the standard 5 percent significance level should be reduced.

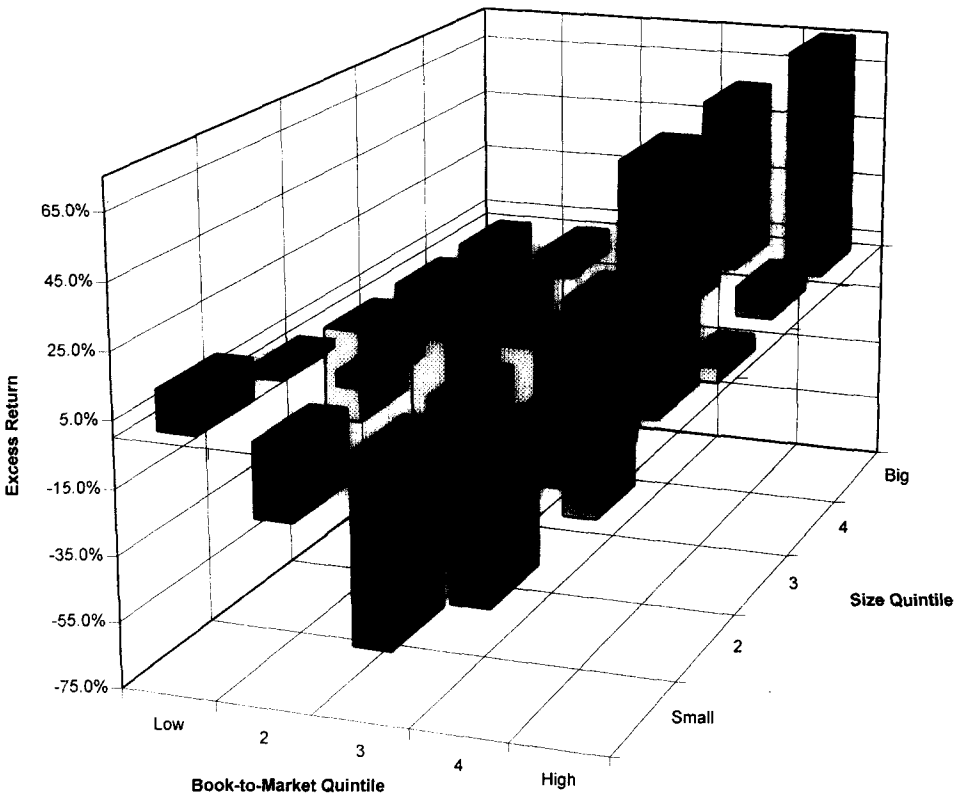

Figure 6. Five year excess returns for nonventure capital-backed initial public offerings (IPOs) by size and book to market portfolio. The sample is 3,407 venture-backed IPOs from 1975–1992. Twenty-five (5 × 5) size and book-to-market portfolios are formed based on the New York Stock Exchange (NYSE) breakpoints. IPO firms are assigned to their appropriate size and book-to-market portfolio at issue. The five-year excess return is calculated by subtracting the five-year buy-and-hold return on the size and book-to-market portfolio that excludes all IPO and SEO firms for five years after issue from the five-year buy-and-hold return on the IPO firm. The average excess return is plotted for each size and book-to-market portfolio.

weighting returns. The presence of a venture capitalist is positively related to a firm's wealth relative, although the coefficient is only marginally significant.[14] The coefficients on lagged dividend price ratio are negative and significant. If the dividend price ratio captures the general level of market prices, IPOs that go public during periods of higher market valuation perform worse over the subsequent five years relative to the market as a whole. Finally, book-to-market has an important impact on returns at five-year horizons. The coefficient on the book-to-market ratio is positive and highly significant. The positive relationship between book-to-market ratio and relative performance is

[14] If the regressions are run on firms below the median size, the coefficient on the venture capital dummy variable is positive and significant indicating that returns are significantly different for small venture and nonventure-backed companies.

Table VIII

Cross-Sectional Regressions on Buy-and-Hold Returns and Wealth Relatives

The sample of initial public offerings (IPOs) is all venture-backed IPOs that went public between 1972 and 1992 and all nonventure-capital-backed IPOs that went public between 1975 and 1992. The dependent variable is the logarithm of the five year wealth relatives using the Nasdaq composite index as the benchmark. The independent variables are the natural logarithm of the market value of the firm's equity in billions of 1992 dollars valued at the closing price on the first day for which a price from the Center for Research in Security Prices database is available, a dummy variable that equals one if the firm was venture-backed, the natural logarithm of the book-to-market ratio when the firm goes public, and the lagged dividend price ratio for the market. (t-statistics are in parentheses.)

Independent Variables	Dependent Variable: Logarithm of Five-Year Wealth Relative				
Logarithm of firm size	0.2063				0.1944
	(12.68)				(10.44)
Venture-backed dummy variable		0.0953			0.0992
		(1.94)			(1.93)
Logarithm of book-to-market ratio			0.1414		0.1321
			(7.44)		(7.03)
Lagged dividend price ratio				−0.2445	−0.1386
				(−9.81)	(−5.03)
Constant	−1.6919	−0.8923	−0.7190	0.0768	−0.9904
	(−25.01)	(−39.11)	(−20.54)	(0.77)	(−6.91)
Adjusted-R^2	0.035	0.001	0.015	0.021	0.062
Number	4332	4341	3563	4341	3563

consistent with both Fama-French's interpretation of book-to-market as a priced risk factor and Loughran and Ritter's belief that it proxies for relative overpricing.

V. Conclusions

The underperformance documented in Ritter (1991) and Loughran and Ritter (1995) comes primarily from small, nonventure-backed IPOs. We replicate Loughran and Ritter's results and show that returns on nonventure-backed IPOs are significantly below those of venture-backed IPOs and below relevant benchmarks when returns are weighted equally. We test performance against several broad market indexes, Fama-French (1994) industry portfolios, and matched size and book-to-market portfolios to test the robustness of our results. Differences in performance between the groups and the level of underperformance are reduced once returns are value weighted.

We also show that underperformance documented by Loughran and Ritter is not unique to firms issuing equity. Eliminating IPOs and SEOs from size and book-to-market portfolios demonstrates that IPOs perform no worse than similar nonissuing firms. This argues that we should look more broadly at types of firms that underperform and not treat IPO firms as a different group.

While small, low book-to-market IPOs perform no differently from similar small, low book-to-market nonissuing firms, the pattern of relative perfor-

mance in other portfolios needs to be examined in greater detail. Some of the IPO size and book-to-market portfolios appear to exhibit either under or overperformance. Examination of the time series and cross sectional properties of these patterns may be important in determining the source of performance anomalies.

The underperformance of small, low book-to-market firms may have various explanations. First, unexpected shocks may have hit small growth companies in the early and middle 1980s. The correlation of returns in calendar time may argue in favor of this explanation. Fama and French (1995) show that the earnings of small firms declined in the early 1980s but did not recover when those of large firms did. This experience was different from previous recessions. It is possible that small growth firms were constrained either in the capital or product markets after the recession. These constraints may have been unanticipated. This explanation argues that we should not view each IPO (or firm) as an event, i.e., they are not all independent observations. Correcting for the cross-sectional correlation is critical.

A second explanation for the underperformance of small, low book-to-market firms is investor sentiment. The evidence from Fama-French three factor regressions with and without the change in closed-end fund discount supports this alternative. If the IPO is small, "you can fool some of the people all of the time." If any type of firm is likely to be subject to fads and investor sentiment, it is these firms. Their equity is held primarily by individuals. Megginson and Weiss (1991) show that institutional holdings of equity after an IPO are substantially higher for venture-backed IPOs than they are for nonventure-backed IPOs. The relatively higher institutional holdings may occur because institutions have greater information on small, venture-backed firms through their investment in venture capital funds. Furthermore, because institutions invest such large amounts of money, holding an investment in a small firm may mean that the institutional investor becomes a 5 percent shareholder, something that many institutions want to avoid for regulatory reasons. The ability to short sell small firms is extremely limited because it may be difficult to borrow their stock certificates. Fields (1996) has shown that long-run IPO performance is positively related to institutional holdings. Fields' effects may similarly extend to nonissuing small growth companies.

Asymmetric information is also likely to be more prevalent for small firms because individuals spend considerably less time tracking returns than institutional investors do. Small nonventure-backed firms go public with lower tier underwriters than similar venture-backed firms (Barry, Muscarella, Peavy, and Vetsuypens (1990)) and may have fewer and lower quality analysts following the company after the offering.[15] Carter, Dark, and Singh (1998) and Nanda, Yi, and Yun (1995) have shown that the quality of the underwriter is related to long-run performance of IPOs, consistent with greater asymmetric information being associated with lower returns. It might not pay for a sophis-

[15] Michaely and Shaw (1991) provide evidence that underwriter reputation is positively related to the long-run performance of IPOs.

ticated investor to research a small firm because they cannot recoup costs of information gathering and trading. The absolute return that an investor can make is small because the dollar size of the stake they can take is limited by firm size.

Finally, individuals might derive utility from buying the shares of small, low book-to-market firms because they value them like a lottery ticket. Black (1986) argues that many finance anomalies may only be explained by this type of utility-based theory. Returns on small nonventure-backed IPOs are more highly skewed than returns on either large IPO firms or similar sized venture-backed IPO firms.

Ritter (1991) and Loughran and Ritter (1995) have discovered an area that may allow us to test the foundations of investor sentiment and rational pricing. Future tests that identify elements of investor sentiment may show that individual investors are less than perfectly rational. Alternatively, real factors may be responsible for the measured underperformance.

What are the implications of our results? First, most institutional investors will not be significantly hurt by investing in IPOs. They usually do not buy the small issues that perform the worst. Underperformance of small growth companies may be important for capital allocation, however. If the cost of capital for small growth companies is periodically distorted, their investment behavior may be adversely affected. If any of these small firms are future industry leaders, then we should be concerned about this mispricing. Further research is clearly warranted.

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