The Exit Rates of
Liquidated Venture Capital Funds

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Abstract

Exit rates provide a simple yet practical measure for evaluating and benchmarking the performance of venture capital funds. We create a sample of 138 liquidated U.S. venture capital funds and investigate the outcomes of their 4,549 portfolio companies. We study exit rates, proportions of different exit routes, and their determinants. The median fund in our sample exited 19% of portfolio companies through an IPO, 7% through a sale of listed equity, and 23% through mergers or acquisitions. There exist, however, interesting differences between fund types: In particular, large funds and fund management firms have significantly higher exit rates.

Introduction

What are the cross-sectional determinants of venture capitalist success? Institutional investors participating in venture capital funds have a significant interest in the answer, as it may help them decide which fund to choose. Research into cross-sectional differences and determinants of success is, however, made difficult by the scarcity of publicly available data on fund-specific returns. Consequently, new approaches are of interest in examining the comparative capabilities of venture capitalists.

Prior research on venture capital performance concentrates on the risk and return profiles of venture capital investments over time, and on comparisons with other asset classes such as stocks and bonds.[1] There is evidence that venture capital investments have, on average, yielded higher returns than investments in the public equity markets (see e.g. Cochrane, 2004), but significant differences exist within the asset class. Other studies, such as Martin and Petty (1983), Ibbotson and Brinson (1987), and Kleiman and Schulman (1992) look at the stock prices of publicly traded venture capital firms. Finally, on the practitioner side, the National Venture Capital Association (NVCA) reports average rates of return on a regular basis. Performance by industry, region, across time, and other classifications is reported annually in the publications of NVCA.

The existing literature reveals three areas in which information is scarce. First, there exists limited research on the determinants of venture capital success. Second, the exit rates of venture capital investments have been relatively little studied: Schwienbacher (2002) shows results from a survey, while Cumming (2002) studies a sample of 17 European funds. Measures of exit rates are interesting not only as a proxy of investment success; they also have value to practitioners as

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[1] Such studies include Huntsman and Hoban (1980), Bygrave et al. (1989), Chiampou and Kallett (1989), Schilit (1993), Gompers and Lerner (1997), and Wright and Robbie (1998).

they evaluate whether their investment memoranda are realistic. Is it, for example, reasonable for a venture capitalist to expect in its internal documentation that 50% of its investments will exit successfully, even if the median for similar funds is only 30%? Third, there appears to be a need for further research into liquidated funds, where future uncertainty no longer clouds the results. This has only become feasible in recent years.

This study looks at 138 U.S. based venture capital funds liquidated between 1990 and 2000 and investigates the ultimate disposition of each of their approximately 4,500 portfolio companies. Using this new dataset, we examine the proportion of successful exits to portfolio companies for each fund and investigate variables affecting this measure. We also study the proportion of different exit modes and show data on four different types of exits: 1. initial public offering only, 2. sale of listed equity (i.e. initial public offering followed by a merger or acquisition), 3. merger or acquisition only, and 4. M&A transaction followed by a stock market listing. Breakdowns and analyses of these measures allow practitioners to evaluate the realism of their currently planned exit strategy.

We examine several testable hypotheses regarding exit rates and the characteristics of venture capital funds. The exit rate may be affected by such factors as the size and portfolio composition of the fund, including industry preferences or a focus on early or late stage investments. Independent, banking, or corporate venture capital funds[2] may have different exit behavior based on differing incentive structures. We also study the evidence on learning effects among sequel funds: We define a sequel fund to be any fund that is not the first raised by a given fund management company. Finally, timing may be a significant factor: luck and market movements could be as relevant as managerial success or organization design.

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[2] We define a banking venture capital fund as an affiliate of a financial services firm; a corporate venture capital fund as an affiliate of the an industrial firm; other funds are classified as independent.

Using the proportion of successful exits as dependent variable, we find that large funds have significantly higher exit rates. This holds for measures of both fund size and firm capital under management. The larger fund management companies are presumably also the more established and reputable ones, and may capitalize on their reputation through certification as described in Megginson and Weiss (1991) for the IPO market. We investigate separately the possibility that the results are driven IPO market timing ability through a two-stage analysis controlling for the effects on all variables of a measure of IPO market timing: this does not change our results significantly.

The rest of this paper is organized as follows. Section I discusses the importance and profitability of various exit types to venture capitalists. Section II develops hypotheses as to variables likely to affect the exit rates and routes of a particular fund. Section III discusses the data used and the measurement of variables, while section IV describes the results obtained. Section V concludes.

I. The choice of exit mode

The investment performance of venture capital funds is driven by successful exits. There are several potential acquirers for the equity of a portfolio company. These include, most importantly, the investing public via the stock market, companies in the same or related industries as the portfolio company, other institutional investors, and, finally, the company or entrepreneur itself.

The public stock markets are often, though not always, the first choice. Black and Gilson (1999) state that U.S. venture capital funds earn an average 60% annual return on investment in IPO exits, compared to 15% in acquisition exits. Sahlman (1990) documents that almost all of the returns to investors in venture capital are earned by companies that eventually go public, while Barry (1994) concludes that IPOs appear to be the most profitable way of exit.

However, alternatives to IPOs are certainly not trivial in frequency or importance (see Black and Gilson, 1998). Robb (2002) points out that an IPO is a feasible alternative for only few small businesses. Schwienbacher (2002) reports the following exit frequencies from a survey of 67 U.S. funds: IPO (+ sale of quoted equity) 29.9%, trade sale / acquisition 30.3%, management buyout 2.0%, secondary sale / refinancing 5.0%, and finally liquidation (write-off), 32.8%.

Venture capitalists may rely on the IPO markets to a widely different extent depending on their strategy. Advantages of a non-IPO exit could be related to greater privacy or lesser external pressure on operating performance. Another disadvantage of an IPO exit may be that they often provide less immediate liquidity than most trade sales: a trade sale of a 100% stake liberates capital immediately, while only a part of the company is sold in an IPO[3].

The second common alternative is an acquisition of the portfolio company by a firm in the same or a related industry, i.e. a trade sale. This alternative provides a great deal of different options as to the amount of stake sold, the consideration received (cash or stock), and the formulation of the sales and purchase agreement. Earn-out conditions (i.e. tying the transaction value to future financial performance) or strict formulations of the representations and warranties clauses may, in effect, make the payment received by the fund contingent on a number of future events.

An alternative type of buyer consists of financial investors such as other venture capitalist firms. Finding a second venture capitalist willing to buy the portfolio company at a reasonable price is not always obvious. Why should they see potential in a company their competitor is already trying to exit, unless their views are widely divergent?

The company, entrepreneur, or management group of the company is the final typical buyer. Such a transaction may happen in the context of a management buy-out from the venture capitalist. Alternatively, the transaction can be embedded in the original investment contract in

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[3] Dubil (2002) models the optimal liquidation behavior of venture capitalists faced with a sale of concentrated

the form of put or call options.

Can we then use exit rates as a proxy for investment success? Exits will differ widely in their terms and the price obtained. We should certainly be careful in making inferences based on, say, the IPO exit rate only. Although IPOs have often been a high profit exit method, there may be characteristics of the portfolio companies or market situations in which a particular fund would find other exit methods more optimal.

The total rate of successful exits, however, while not a perfect proxy for performance, presents fewer problems. We can in most cases safely assume that a venture capitalist will prefer almost any kind of exit to liquidation. The exit rate can mostly be more clearly observed from the outside than the actual cash flows of the fund. In contrast, the calculation of performance through internal rates of return (IRR) is tricky in terms of both data availability and measurement problems. As an example of the latter, in IPO exits, venture capitalists typically keep a large stake for a certain period after the IPO and exit piece by piece (see Cumming and Macintosh, 2003, for partial exits). The difficult part for an outside observer would be to track all the actual cash flows the venture capitalist receives from selling portions of its ownership after the IPO.

II. Determinants of the exit rate

This section discusses a number of possible determinants of exit rates. The determinants are divided into five categories: Compensation and incentives, learning and experience, portfolio size, portfolio composition, and timing.

Compensation and incentives

Like rates of return, compensation schemes in individual venture capital funds are not public

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security holdings.

information. However, prior research discusses a number of issues relating to the compensation and incentives of different kinds of venture organizations.

Gompers and Lerner (1999b) study the agreements of 419 U.S. independent venture capital partnerships. They note that the agreements typically designate a percentage of the fund's capital or assets as an annual management fee and a percent of profits (i.e. carried interest) to be paid out as investment returns are realized. Management fees typically vary between 1.5% and 3%. In 81% of the funds, the carried interest is found to be between 20% and 21%, and in over 300 funds exactly 20%.

As to captive venture capital funds, the compensation of managers appears not as performance based as in independent funds. Gompers and Lerner (1998) note that corporations have frequently been reluctant to compensate their venture managers though profit-sharing (i.e. carried interest) provisions, fearing that they might need to make overly large payments if their investments were successful. Typically, successful risk-taking may have been inadequately rewarded and failure excessively punished.

There exist also some differences relating to the fees charged by funds from portfolio companies. According to the classification provided by VentureXpert, a minority of funds note that their business model relies only partially on investment success and is completed by charging direct fees such as closing fees, service fees, etc from the portfolio companies.

Based on this discussion, we suggest two testable hypotheses. First, referring to Gompers and Lerner (1998) the compensation structures of captive funds run by corporations or banks are expected to create weaker incentives on average than the carried interest systems of independent venture capital funds. We expect to find that captive funds have lower exit rates than independent funds. Second, we expect funds that charge fees from their portfolio companies to have lower rates of successful exits. This is because their financial incentives are less reliant on

exits.

Learning and experience

If fund managers learn from their experience and improve over time, we would expect follow-on funds to perform better than their predecessors. We classify sole funds separately, because their performance may be affected by reverse survivorship bias: managers of badly performing funds never get an opportunity to raise another fund. Sole funds, as well as the first fund in a series, may therefore perform less well and have lower exit rates. Less experienced funds may face particular hurdles on the IPO market, where they have not yet built a certification reputation as in Megginson and Weiss (1991)

Proximity to information on innovative firms and capital markets may have an impact on learning and performance. Smith and Smith (2000) report that a majority of venture capital investments were made in Silicon Valley and New England. We expect to find that funds operating close to their target companies or in major financial centers should perform better on average and have a higher proportion of successful exits.

Portfolio size

We examine the capital under management of the fund management company as well as the size of an individual fund. These two appear related, but their correlation coefficient is only 0.27. We relate management company size primarily to reputation and experience, whereas fund size has a link to the universe of investment opportunities available.

According to Gompers and Lerner (1999a), the age of the venture capital firm is likely to be positively related to its performance through experience and reputation. Unfortunately, we have no reliable data on the age or reputation of management firms. We test for these effects indirectly. Venture capital firms with a good track record are likely to attract more investors and

better quality entrepreneurs than newcomers. As a result, a venture capital firm's capital under management is a reasonable proxy for reputation. We therefore expect funds managed by larger firms to have longer experience and better reputations. They should have a higher proportion of successful exits and are more likely to have developed a certification reputation on the IPO market.

Sahlman (1990) documents that venture capitalists' returns are directly related to the size of the fund's investment portfolio. A possible mechanism explaining this is that larger funds are able to make larger individual investments while maintaining sufficient diversification. Accordingly, certain large investment opportunities are available only to large funds and not to small ones. With a larger universe of investments to choose from, we expect the larger funds to find more attractive opportunities resulting in higher rates of successful exits. As our variable we choose fund size rather than the number of portfolio companies, as the latter is already used in our dependent variable [Successful exits / Portfolio companies]. The correlation between ln(fund size) and the number of portfolio companies is still 0.55, making it necessary to omit the variable altogether in some specifications of the model as a robustness check.

Portfolio composition

The venture capital fund's portfolio composition is likely to affect its exit rate and the proportions of different exit routes. Variables to be considered include the fund's investment stage focus and industry focus.

Other things equal, a given start-up company is less likely to succeed and provide exit opportunities than a comparable mature company: there are simply more things that can still go wrong. In other words, the likelihood of failure decreases with time as the company becomes more mature. As a consequence, we expect to find that the later the stage at which the fund typically invests in portfolio companies, the greater the chance of a successful exit.

Funds also have differing industry focuses. We divide the sample into funds focusing on information technology, medical (including biotechnology), or traditional industries. The past decade was a time of high technology: Telecommunications and other IT companies attracted much of the investors' interest, particularly in the IPO markets of the latter part of the 1990s. We expect funds concentrating on IT companies to have higher exit rates than other industries overall.

Timing

A critical issue for the success of a venture capitalist fund is timing. Success can be a matter not only of managerial skill and organizational ability, but also of plain luck. The exit markets are heavily cyclical, and the IPO market extremely so. A fund maturing in a good IPO year will find its exit plans much simpler to implement. We expect that funds which have exited during years of high IPO activity have had the highest exit rates, and use measures of market activity as control variables. Additionally, we perform a two-stage analysis in which the effects of an IPO timing factor are first taken out.

We also study the effects of fund lifetime. The expected effect is that funds with a longer lifetime have more exits, as they have self-selected to wait longer for a favorable IPO market. This is not necessarily optimal, however, as a longer investment period puts pressure on IRR.

III. Data and variables

The data used in the study are collected from SDC VentureXpert, New Issues and M&A databases. VentureXpert (provided by Venture Economics) provides data on venture capital and private equity worldwide from 1970 to present. So far, numerous venture capital related studies have used data from VentureXpert/Venture Economics (see. e.g. Bygrave et al., 1989; Brav and Gompers, 1997; Gompers and Lerner, 1998, 1999b). New Issues includes information on all

types of equity and debt issues worldwide from 1962 to date, while the M&A database goes back to 1979 for U.S. transactions.

The funds studied are identified from the VentureXpert database using the following criteria:

a. fund investment type is venture capital (i.e. no buyout or mezzanine funds);

b. fund nationality is U.S. We only examine U.S. funds because of their better coverage in the VentureXpert data;

c. the fund is reported as liquidated between 1990 and 2000;

d. the fund has not made investments or IPOs after its reported liquidation;

e. necessary descriptive data for the fund is available;

f. the fund has had at least ten portfolio companies

This leaves a total of 138 U.S.-based venture capital funds. Point f. is necessary to ensure smoother distributions of our exit rate variables, since funds with only very few portfolio companies will have extreme variation in exit rates. As shown in Figure 1, the distribution of exit rates peaks at the 45-50% and 50-55% categories, which have an equal number of observations. Only four funds have exit rates below 25% and another four rates above 75%. No funds have exit rates below 10% or above 90%. In addition, we perform robustness checks where the eight outliers above are excluded and find that they do not drive our results.

We identify all the portfolio companies of these 138 funds through VentureXpert. After eliminating a few instances of double-counted companies, we have a total of 4,549 portfolio companies whose ultimate disposition we seek to identify. We look at the IPO and M&A information separately and finally combine the two.

First, we use the SDC New Issues database to reveal the IPO exits for the sample funds. We cross-check that the fund and portfolio company information match in both New Issues and VentureXpert and eliminate doubtful cases. We find 1,384 IPO matches (30% of sample companies).

The M&A information is more difficult to match. We first define an M&A exit as a transaction reported as "completed" and where control of the company is transferred. In other words, in the case of staged exits we only count the one transaction where the venture capitalist became a minority shareholder. To avoid including false exits, we also eliminate cases where the percentage of shares sold is not listed and the transaction is described as a "stake purchase", or where the transaction is listed as taking place after fund liquidation. We start by using the "venture backed" flag of the M&A database, check that the fund name and portfolio company names match those on our list, and get 815 matches. The problem with the "venture backed" flag, however, is that it does not appear very reliable for older transactions: there are only 121 flagged transactions prior to 1989. For this reason, we extend our search to the whole M&A database and match portfolio companies by Committee on Uniform Securities Identification Procedures (CUSIP) numbers. More information on CUSIP codes is available at www.cusip.com. This provides 947 further matches. Finally, we look up companies from the M&A database by name and home state, and match 105 companies more. This brings our total of matched M&A transactions to 1,867 (41% of sample companies).

However, some of the matches show up on both the IPO and M&A side. The most common case is an IPO followed by a takeover, i.e. a sale of listed equity. There are 591 such cases in the data (13% of sample companies). In addition, in 7 cases an M&A transaction has been followed by a stock market listing in which the venture capitalist sold stock. This leaves us with 786 IPO only exits (17% of sample companies), 1,269 M&A only exits (28%), and 1,896 (45%) cases in which the portfolio company was liquidated or the outcome is otherwise unknown to us.

The *Exit rate* of a fund, which will be used as dependent variable in some of the analyses, is calculated as:

$$Exit\ rate = \frac{Number\ of\ successful\ exits}{Number\ of\ portfolio\ companies} \qquad (1)$$

where successful exits are understood as IPOs, M&A transactions, or combinations thereof.

The first group of independent variables is related to compensation and incentives. We divide the funds into three types: *independent*, *banking*, and *corporate* (*CVC*). VentureXpert divides banking funds into smaller groups such as investment bank affiliates and financial corporations, but because of their small number in the sample, we group all banking funds under the same category.

The fee structure of the fund in relation to portfolio companies is divided into two categories based on the classification in VentureXpert. This provides two categories, which are *return on investment most important, but charges closing fees, service fees, etc.,* and *return on investment is of primary concern, does not charge fees*.

The second group of independent variables relates to learning and experience. The funds are divided into three *fund sequence types*: sole, new, and follow-on funds. A fund can only be classified as sole or new, not both. *Fund sequence number* is the chronological number of the fund within a venture capital firm, e.g. two for the firm's second fund. The classification of fund regions includes thirteen geographical areas in the U.S. Of greatest interest are regions locating close to finance and technology centers, defined here as greater Greater New York, New England, and Northern California. These three regions provide a dummy for *favorable location*.

A third group of variables includes measures of portfolio size. *Firm capital under management* describes the size of a fund's management firm. It is the total amount of capital managed by all

of the firm's funds. *Fund size* is the amount of capital committed to the fund. *Average investment* is fund size divided by the number of portfolio companies. We use logarithmic transformations for all three size variables and use them in turns to avoid multicollinearity problems.

A group of variables relating to portfolio composition functions serves to control for stage and industry effects. *Fund stage focus* shows the fund's investment strategy according to the stage of portfolio companies. The fund stages are divided into five categories:

Seed stage: Mainly portfolio companies that have not yet fully established commercial operations, and may also involve continued research and product development.

Early stage: Mainly companies engaged in product development, initial marketing, manufacturing, and sales activities.

Expansion stage: Mainly companies in the process of initial expansion (e.g. further plant expansion, marketing, working capital, or development of an improved product).

Later stage: Mainly companies needing financing for growth such as producing, shipping and increasing sales volume.

Balanced: Investment strategy that includes investment in portfolio companies at a variety of stages of development (seed, early, expansion, and later stage).

For the *industry focus* of the fund's portfolio companies, we use a classification into three: information technology (IT), traditional industry, and medical (including biotechnology) focused funds, according to the mode type of portfolio company.

A final group of independent variables is related to fund timing. As an exogenous timing variable, relatively difficult for any fund manager to forecast with accuracy, we use the *number of IPOs* in the U.S. 5 to 10 years after the founding year of the fund. Additionally, we define an

IPO timing ratio (*TR*) which measures the fund's success in timing its exits with the IPO market peak. It is a weighted average that indicates how large a portion of the fund's IPO exits have occurred during hot IPO years. This is defined as:

$$\text{IPO timing ratio} = \frac{\sum_{t=1970}^{2000} \left[IPOs(f)_t \times IPOs(m)_t \right]}{\sum_{t=1970}^{2000} IPOs(f)_t} \qquad (2)$$

where *IPOs(f)$_t$* is the number of IPO exits of the fund in year t and *IPOs(m)$_t$* is the total number of IPOs in the U.S. in year t. As an example consider fund A which has made 6 exits in 1986 and 1 exit in 1990. Fund B has made 5 exits in both years. The total number of IPOs in the U.S. is 726 in 1986 and 214 in 1990. Consequently, the IPO timing ratio is (6x726+1x214)/(6+1)=653 for fund A, and (5x726+5*214)/(5+5)=470 for fund B, as A's exits were more concentrated on active IPO years. The *IPOs(m)$_t$* are obtained from the SDC New Issues database.

There are two econometric problems with the *IPO timing ratio* variable that may bias results. First, the variable is recursive with respect to our dependent variables. If a fund has good IPO timing, it is likely to have higher exit rates by definition, and vice versa. Second, IPO timing may have correlations with other explanatory variables, e.g. managers in funds with good track records may have better timing ability.

For these two reasons, we use the *number of IPOs 5-10 years after fund founding* variable in most specifications. We use the *IPO timing ratio* in a separate two-stage model that first removes its effect on other variables. In the first-stage regression, we create a set of instrumental variables for each of our model variables *y*, dependent or independent. These instrumental variables arise as residuals from a first-stage regression against an IPO timing ratio (*TR*) for each fund *i*:

$$y_i = \beta \ (TR_i) + \varepsilon_i \tag{3}$$

Fund liquidation year is the year in which the fund has distributed all its cash and possible remaining investments back to the limited partners. *Fund founding year* is the year of the first capital takedown. *Fund lifetime* is the difference of liquidation and vintage year, expressed in years.

IV. Empirical results

The following section presents descriptive statistics for fund types, exit types, and exit rates, and proceeds with an analysis of the determinants of the exit rate.

A. Descriptive statistics

Table I shows the distribution of sample funds into various types and categories. Independent venture capitalists form the majority among fund types. There are only few corporate venture capitalists, which restricts our examination of the compensation – performance relation. When sorted by investment stage, more than half of the sample are balanced funds. Funds focusing on IT companies dominate the sample, which is to be expected given the fast growth of high technology in the past decades.

[INSERT TABLE I ABOUT HERE]

Table II presents further descriptive statistics on the sample funds. The average number of portfolio companies is found to be 33. Fund size and especially firm capital under management show considerable variation. The smallest firm only manages $5 million while the biggest has a respectful $10.9 billion under management.

[INSERT TABLE II ABOUT HERE]

Table III shows descriptive statistics of exit rates by fund type. On average, the funds studied

manage to take public 29% of their portfolio companies. The median is slightly lower at 28% as the distribution is skewed to the right. This figure includes 7% of companies that are sold in takeovers following the listing. The average fund sells 23% of its portfolio companies through M&A transactions.

[INSERT TABLE III ABOUT HERE]

These results are relatively well in line with Schwienbacher's (2002) survey. IPOs and sales of listed equity total 29% in our study versus 30% for Schwienbacher; M&A exits are 23% and 30% respectively. The proportion of write-offs or other unknown outcomes is higher in our study (49% vs. 33%). This is not surprising given that our long term, large sample methodology is bound to miss some exits due to limitations on data availability. Our exit figures should therefore be interpreted as conservative, especially for trade sale exits. We are, however, also well in line with Lerner's (1994) figures that over the last two decades, 30 percent of the firms backed by venture capitalists have gone public. Over half of our funds have an IPO exit rate between 20% and 40%, while almost 90% of our funds fall between 10% and 50%.

Table IV shows the rates of the five possible outcomes against various fund types and shows univariate *t*-tests for differences. Each exit rate group average (e.g. IPO only for independent funds) is tested against the average of that exit type for all other funds in the sample. At conventional levels of significance, we notice that follow-on funds have higher than average IPO exit rates while new and particularly sole funds are below average in this respect. We also notice that IT focused funds have higher than average IPO exit rates while funds with a traditional industry focus place lower than average. For some groups of funds, such as expansion stage funds and medical focus funds, differences in exit rates seem marked, but statistical significance is low due to the small number of observations in those groups. Table V reports cross-correlations for variables used in this study.

[INSERT TABLE IV ABOUT HERE]

[INSERT TABLE V ABOUT HERE]

B. Determinants of the exit rate

The determinants of the exit rate are examined in a regression framework using three different OLS specifications and a two-stage analysis based on the IPO timing ratio. Table VI shows these results. Specification 1 focuses on fund background variables and specification 2 on investment style. Specification 3 includes all variables and specification 4 is the second stage of a two stage analysis as described in section III. There is no need for a Tobit regression in this case, since there are no observations at or near the truncation points of 0 and 100%. Due to lack of full data for 5 funds, there are a total of 133 observations. The OLS *t*-values reported are heteroskedasticity consistent as in White (1980).

[INSERT TABLE VI ABOUT HERE]

As robustness checks, we analyze subsamples excluding outliers. Outliers are defined as funds with an exit rate below 25% or over 75%. There are eight such cases. Excluding these outliers does not change our results.

<u>*Compensation and incentives*</u>

The *banking dummy* has a negative and the *corporate VC dummy* a positive impact on IPO exit rate. Independent funds act as benchmark and have no dummy. The results, however, are not significant at conventional levels and the number of these observations is quite low.

Barry (1994) states that bank-affiliated venture capitalists are often more conservative in their strategy than independent VCs which should affect risk and return. In fact, the data show that five of 22 banking funds (23%) have a traditional industry focus, against only 14% for

independent and 0% for corporate venture capitalists.

The *dummy for funds charging fixed fees* from portfolio companies has, as expected, a negative and significant coefficient. If the participation percentage under these schemes is, in fact, lower for funds charging fees (but we have no data on this), the result supports the idea that funds which only rely on investment performance have a stronger exit orientation.

Learning and experience

Fund sequence number has the expected positive coefficient, but is not consistently significant across specifications. Against a benchmark of follow-on funds, dummies for *new fund* and *sole fund* obtain coefficients of the expected negative sign. The sole fund dummy is in fact a highly significant negative determinant of the exit rate. For sole funds, there may be a process of natural selection going on. New funds that perform poorly make it harder for their managers to raise follow-on funds.

Another learning-related hypothesis investigated is that it may be easier to achieve successful exits in locations geographically close to a population of innovative firms and/or major financial centers. The *favorable location dummy* used gets a value of 1 for funds located in Northern California, New England and Greater New York and 0 otherwise. We find the expected positive sign but the significance of the result depends on the specification.

As an unreported robustness check related to learning, we perform an analysis of performance persistence within our sample. We take all funds which have follow-up funds, divide both the prior fund and the follow-up fund into three performance classes, and perform chi-squared tests to measure persistence. We only have 34 usable fund pairs and do not find results significant at conventional levels. There is, however, modest evidence of persistence among the funds with lower exit rates, possibly due to a similar investment strategy that is being followed.

We also examine whether there is performance persistence in a sequence of funds. Whether winners stay winners and losers stay losers has been studied especially in the mutual fund literature (see e.g. Carhart, 1997).

Portfolio size

The fund management firm's *log capital under management* has, as expected, a positive effect on the exit rate. The result is statistically significant at a 1% level when all variables are included. The finding provides support for the hypothesis that more reputable, and thus larger management firms benefit from their track record and influence in terms of exit success.

For *log fund size* we find the expected positive coefficients significant at the 5% level when all variables are included. This provides some support for Sahlman's (1990) idea that larger funds should perform better as they are able to invest in a wider universe of potential portfolio companies.

Portfolio composition

Dummies for *seed stage*, *early-stage*, *expansion*, and *later stage* funds act as control variables. Balanced funds are the benchmark for the regression. The hypothesis is that funds investing in later stage firms should have a higher success rate than early stage investors, as more is known about the company. While the *seed stage* dummy is negative as expected, and all later stages positive, the expansion stage fund dummy is the only one that comes out significant at conventional levels.

The dummies for *traditional industry focus* and *medical focus* have negative coefficients. As opposed to the univariate tests, the significance of the finding is low also for *traditional industry focus* and depends on the specification.

<u>Timing</u>

The variable *IPOs 5-10 years from fund start* is positive, as expected, and *fund lifetime* negative, but neither is significant at conventional levels. As described in section III, we use a specific *IPO timing ratio* in a two-stage analysis. The first stage computed new instrumental variables, obtained as residuals from a regression of each variable against the *IPO timing ratio*. Second-stage results are reported in specification 4 of Table VI. The results are very much in line with the other specifications. This supports the idea that our results are robust to endogeneity caused by IPO timing ability.

V. Conclusion

This study investigates venture capital exit rates (a proxy of fund performance), the proportions of different exit routes, as well as fund level variables that affect exit success. We create a new sample of 138 U.S. venture capital funds, all liquidated between 1990 and 2000 and all with 10 portfolio companies or more. These funds had 4,549 portfolio companies. The median fund in our sample exited 19% of its portfolio companies through an IPO, 7% through a sale of listed equity, and 23% through an M&A transaction, but there is significant variation across funds.

An empirical examination of the determinants of exit rates reveals the following facts. Large fund management firms have significantly higher rates of exit success, perhaps due to a better reputation as quality certifiers. So do larger funds, which may have a larger investment universe than smaller firms as described in Sahlman (1990).

Sole funds, i.e. funds that receive no follow-up have significantly lower exit rates. This is probably due to reverse survivorship bias: fund managers who perform badly never get another chance. The minority of funds which report not depending fully on investment performance and charging fees from portfolio companies have significantly lower exit rates. Finally, the stage and

industry focus of the fund seem to matter less than thought, although expansion stage funds had

larger exit rates in this sample.

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Table I

Categories of sample funds

The sample includes 138 liquidated U.S. venture capital funds that have 10 portfolio companies or more. Table I shows the distribution of these funds in various types. For the fund size variable, size classes include lower bounds but not upper bounds.

	N	%
Fund type		
Independent	111	*80 %*
Banking	22	*16 %*
Corporate VC	3	*2 %*
NA	2	*1 %*
Fund sequence type		
New	50	*36 %*
Sole	3	*2 %*
Follow-on	84	*61 %*
NA	1	*1 %*
Investment stage focus		
Seed stage	9	*7 %*
Early stage	27	*20 %*
Expansion	4	*3 %*
Later stage	13	*9 %*
Balanced	83	*60 %*
NA	2	*1 %*
Fund industry focus		
IT	104	*75 %*
Medical	10	*7 %*
Traditional industries	20	*14 %*
NA	4	*3 %*
Fund size ($m)		
0 – 10	26	*19 %*
10 – 20	26	*19 %*
20 – 50	53	*38 %*
50 – 100	24	*17 %*
100 –	9	*7 %*
NA	0	*0 %*
Number of portfolio companies		
10 – 19	35	*25 %*
20 – 29	34	*25 %*
30 – 39	34	*25 %*
40 –	35	*25 %*
NA	0	*0 %*

Table II

Descriptive statistics on sample funds

Table II reports the mean, median, standard deviation, minimum, and maximum for several descriptive variables for 138 liquidated U.S. venture capital funds with 10 portfolio companies or more. Firm capital under management includes all funds managed by the same venture capital firm. Fund sequence number is the chronological number of the fund within a venture capital firm, e.g. two for the firm's second fund.

	Mean	Median	St. dev.	Min	Max
Number of portfolio companies	33	30	20	10	157
Firm capital under management ($m)	1,065	373	2,076	5	10,857
Fund size ($m)	36.3	25.7	38.4	1.0	284.3
Fund sequence number	2.7	2.0	2.6	1	16
Fund lifetime (years)	15.4	15.0	4.3	8.0	37

Table III

Exit rates

Table III shows descriptive statistics for fund exit rates (defined as [Exits in category] / [Number of portfolio companies]). The sample of funds includes 138 liquidated U.S. funds with 10 portfolio companies or more. There are five possible outcomes for each portfolio company: 1. IPO only; 2. Sale of listed equity (IPO followed by M&A transaction); 3. M&A transaction only; 4. M&A transaction followed by listing; 5. Write-off or other unknown outcome. Successful exits include outcomes 1 to 4. IPO exits refers to outcomes 1 and 2 whereas M&A exits refers to outcomes 3 and 4.

Category	Mean	Median	St. dev.	Min	Max
1. IPO only	21 %	19 %	9 %	4 %	48 %
2. Sale of listed equity (IPO then M&A)	8 %	7 %	7 %	0 %	30 %
IPOs Total	*29 %*	*28 %*	*13 %*	*5 %*	*78 %*
3. M&A only	22 %	22 %	9 %	0 %	47 %
4. M&A then listing	1 %	0 %	2 %	0 %	11 %
M&A Total	*23 %*	*23 %*	*9 %*	*0 %*	*47 %*
5. Write-off or other unknown outcome	49 %	48 %	14 %	13 %	88 %
Successful exits / Portfolio companies	51 %	52 %	14 %	13 %	87 %
IPO exits (1. and 2.) / Successful exits	55 %	54 %	16 %	14 %	100 %
M&A exits (3. and 4.) / Successful exits	45 %	46 %	16 %	0 %	86 %

Table IV

Exit rates by fund type

Table IV examines fund type and the proportion of five different exit outcomes for a sample of 138 liquidated U.S. funds with 10 portfolio companies or more. The variable shown is the mean of [Exits / Portfolio Companies]. Each exit rate group average (e.g. IPO only for independent funds) is tested against the average of that exit type for all other funds in the sample using a two-tailed t-test. * and ** indicate significance at the 5% and 1% levels, respectively.

	Mean of [Exits / Portfolio Companies] (%)				
	1. IPO only	2. Sale of listed equity (IPO then M&A)	3. M&A only	4. M&A then listing	5. Write-off or other unknown outcome
All Funds	20,7	8,0	21,8	0,7	48,8
Fund type					
Independent	21,1	8,3	21,7	0,8	48,1
Banking	18,3	6,9	22,4	0,2	52,1
Corporate VC	22,6	9,6	20,6	0,0**	47,2
Fund sequence type					
New	18,6*	8,0	21,2	0,5	51,6
Sole	12,6**	5,9	16,4	0,0**	65,1
Follow-on	22,3**	8,1	22,3	0,8	46,4*
Fund stage focus					
Seed stage	19,7	4,7	24,4	1,3	49,8
Early stage	21,7	8,0	21,9	0,6	47,8
Expansion	28,1	18,8	19,2	0,5	33,3
Later stage	23,1	5,2*	21,9	0,0**	49,8
Balanced	19,8	8,4	21,6	0,7	49,5
Fund industry focus					
IT	21,6*	8,7*	22,2	0,7	46,9*
Medical	23,8	7,4	18,1	0,4	50,3
Traditional industries	15,4**	5,6	21	1,3	56,8*

Table V

Cross-correlations

Table V shows Pearson correlation coefficients between some of the key variables used. IPO exits include outcomes 1 and 2 and M&A exits outcomes 3 and 4 from Table III. Variables are defined similarly as in Table V. Statistical significance at the 5% and 1% levels is indicated by * and ** respectively. Significance tests are two-sided.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Sucessful exits / Portfolio cos	1.00**								
(2) IPO exits / Successful exits	0.24**	1.00**							
(3) M&A exits / Successful exits	-0.24**	-1.00**	1.00**						
(4) Fund sequence number	0.25**	0.10	- 0.10	1.00**					
(5) Ln(Cap. under management)	0.29**	0.20*	-0.20*	0.21*	1.00**				
(6) Ln(Fund size)	0.21*	0.04	- 0.04	- 0.10	0.27**	1.00**			
(7) Ln(Average investment)	0.20*	- 0.01	0.01	- 0.14	0.16	0.84**	1.00**		
(8) IPOs 5-10 years from founding	0.10	-0.06	0.06	0.09	- 0.14	0.07	0.19*	1.00**	
(9) Fund lifetime	- 0.10	0.11	-0.11	-0.19*	0.16	- 0.06	-0.24**	-0.57**	1.00**

Table VI

Determinants of [Successful exits / Portfolio companies]

Table VI shows regression results investigating the determinants of a fund's ratio of successful exits i.e. [Number of successful exits / Number of portfolio companies]. A successful exit is defined as outcomes 1 to 4 in Table III. The sample for this analysis includes 133 liquidated U.S. venture capital funds with 10 or more portfolio companies. Five firms are eliminated from the original sample due to missing fund-specific data. Specifications 1 through 3 show OLS results with different sets of explanatory variables. Specification 1 focuses on background factors, specification 2 on investment policy variables. Specification 4 shows the results of the second stage of a two-stage analysis. In this second stage each variable y, dependent or independent, has been replaced by an instrumental variable. These instrumental variables arise as residuals from a first-stage regression against an IPO timing ratio (TR) for each fund i:

$$y_i = \beta(TR_i) + \varepsilon_i$$

$$TR_i = \frac{\sum_{t=1970}^{2000}\left[IPOs(f)_t \times IPOs(m)_t\right]}{\sum_{t=1970}^{2000} IPOs(f)_t}$$

The IPO timing ratio is a measure indicating the level of IPO activity at the time of the fund's exits, where $IPOs(f)_t$ is the number of IPO exits of the fund in year t and $IPOs(m)_t$ is the total number of IPOs in the U.S. in year t. The favorable location dummy includes funds based in Northern California, New England and Greater New York. IPO activity is a measure of the number of IPOs brought to market within 5 to 10 years inclusive of the fund's founding year. Fund lifetime is the difference in years between the fund's liquidation and founding years. OLS results are corrected for heteroskedasticity as in White (1980). Statistical significance at the 5% and 1% levels is indicated by * and ** respectively. Significance tests are two-sided.

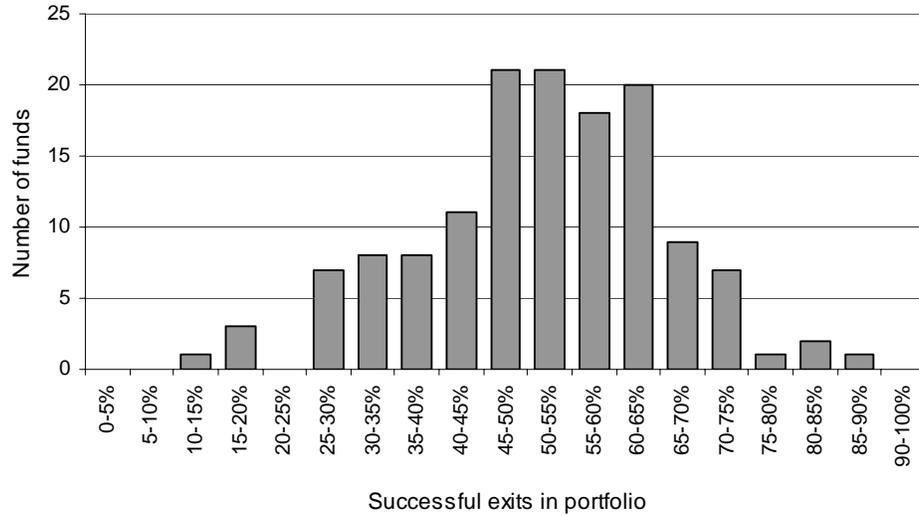| Dependent variable: Successful Exits / Portfolio Comps.	Predicted sign	(1) OLS: Background variables Coefficient	t-statistic	(2) OLS: Investment style Coefficient	t-statistic	(3) OLS: All variables Coefficient	t-statistic	(4) Second-stage OLS on residuals after elimination of timing ratio effect Coefficient	t-statistic
Constant		32.84**	5.11	28.31*	2.52	21.10	1.68	0.03	0.03
Compensation and incentives									
Banking fund dummy	–	-4.36	-1.48			-1.61	-0.46	-2.79	-0.81
Corporate VC fund dummy	–	4.85	0.71			9.29	1.16	8.37	1.23
Fund charges fixed fees dummy	–			-7.94**	-3.26	-8.83**	-3.28	-8.98**	-3.31
Learning and experience									
Fund sequence number	+	0.74*	1.98			0.69	1.58	0.73	1.77
New fund dummy	–	-1.84	-0.67			-0.70	-0.25	-2.54	-0.93
Sole fund dummy	–	-25.82**	-10.01			-24.08**	-3.84	-23.39**	-3.89
Favorable location dummy	+	5.59*	2.27			2.48	1.09	2.28	0.99
Portfolio size									
Ln(Firm capital under management)	+	1.71*	2.53			2.14**	2.88	1.96**	2.76
Ln(Fund size)	+			3.07**	3.08	2.26*	2.18	2.63*	3.17
Portfolio composition									
Seed stage fund dummy	–			-2.68	-0.66	-1.84	-0.48	-2.43	-0.64
Early-stage fund dummy	–			0.17	0.06	1.88	0.72	1.30	0.48
Expansion fund dummy	+			14.16*	2.30	14.45**	2.63	14.37**	2.84
Later stage fund dummy	+			1.67	0.30	1.27	0.25	1.49	0.28
Traditional industry focus dummy	?			-10.42*	-2.16	-5.12	-0.99	-3.59	-0.81
Medical focus dummy	?			-5.01	-0.85	-2.50	-0.44	-1.95	-0.35
Timing									
IPOs 5-10 years from fund start	+	0.0026	1.18			0.0001	0.05		
Fund lifetime	?			-0.35	-1.90	-0.40	-1.47	-0.07	-0.30
Adjusted R^2		0.13		0.12		0.22		0.38	
F-statistic		3.20**		3.07**		3.16**		5.97**	
N		133		133		133		133	

Figure 1

The distribution of successful exits

Figure 1 shows a histogram of the rate of successful exits, defined as [Number of successful exits / Number of portfolio companies]. The sample includes 138 liquidated U.S. venture capital funds that have 10 portfolio companies or more. The definition of successful exit includes four classes of exits (outcomes 1 to 4) in Table 3. These are IPO only, sale of listed equity, M&A transaction only, and M&A transaction followed by listing. The histogram classes include lower but not upper bounds.