

**An Investigation into Modern
Financial Valuation Theory in the
Venture Capital Setting**

by

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An honors thesis submitted in partial fulfillment
of the requirements for the degree of
Bachelor of Science
Undergraduate College
Leonard N. Stern School of Business
New York University

May 2002

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ABSTRACT

The following is a detailed study of modern financial valuation theory in the venture capital setting. It begins with an analysis of the history of venture capital, leading in to the process through which venture capital investment takes place. This allows one to become familiar with the venture capital industry dynamics and aids in the understanding of the following sections. The next section begins with an analysis of modern valuation theory and its foundation, the theory of free cash flow. The theory of free cash flow is then applied to the venture capital setting where it becomes evident that the ability of the venture capitalist to estimate free cash flows is a great source of error in the valuation of these early stage companies. This finding leads to the hypothesis that what the venture capitalist expects to receive from their investments in start-ups will not be what is received when the investment is finally exited. The statistical analysis refutes this hypothesis and indicates that there must be some aspect of the investment or investment process other than the financial analysis that contributes to the return of the venture capitalist. This is determined to be the monitoring and value added activities that the venture capitalist performs for and on the company. The last section goes deep into the reasons why this monitoring is needed and why its payoff might exceed the error generated by the estimation included in the financial analysis. It wraps up with a discussion about the high degree of skill required to perform this type of monitoring and the delicate balance that must be maintained in order to not subjugate the company into failure. This leads to the conclusion of the study which ultimately proves that successful venture capitalists specialize in the monitoring of start-up companies and this skill is more valuable in the venture capital setting than the financial valuation.

OVERVIEW OF VENTURE CAPITAL

HISTORY

Venture capital has since the time of Hammurabi¹ represented a solution to the separation of entrepreneurial talents and the funding required by a start-up venture. Although less than 3000 of the roughly 700,000 companies started each year in the U.S. receive venture capital financing,² this remains a critical means of funding innovative start-ups. Most companies secure bank loans or use other types of debt to fund themselves but the true venture capital candidate usually lacks assets and/or is moving in to an untested product or area of business,³ the result is that debt financing is virtually unattainable. Because these companies are high risk most normal types of funding distance themselves from these companies but not the venture capitalist. This is the realm in which the venture capitalist has focused his/her talents and desires the high potential profits of the occasional success.

The venture capital industry in the United States, long considered to be the most developed in the world, has demonstrated rapid growth in the last several years.⁴ Much of this growth has been attributed the increase in funds caused by the wild venture capital successes in technology and telecommunications. The huge initial public offering window that has seemed to only have recently closed has helped to make these successes possible. The long standing establishment of very well developed capital markets has

¹ Gompers, Paul A. and Josh Lerner. *The Venture Capital Cycle*. Massachusetts: The MIT Press, 1999, p.5

² Sahlman, W.A. "The Structure and Governance of Venture-Capital Organizations." *Journal of Financial Economics* 27 (1990): 475

³ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.5

⁴ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.10

aided the U.S. in maintaining an active and robust venture capital industry for more than the last 30 years.⁵

What is considered to be the first modern venture capital firm was founded in 1946, American Research and Development. Due to the difficulty in finding investors it was marketed mainly to individuals as a public closed-end fund. The firm was created by professors of Harvard and MIT to capitalize on some of the technological developments created during World War II. American's most successful investment, still considered today to be one of the most outstanding venture investments of all time, was its \$70,000 investment in Digital Equipment Company which grew to be valued at \$355 million.⁶ The difficulty experienced by American in finding investors was not to last forever.

A major factor influencing the growth of the venture capital industry took place in 1979 when the government altered the Employee Retirement Income Security Act by adding the "prudent man" rule.⁷ This opened the door to investment in venture capital funds by pension funds all across the United States. Today pension funds, as a group, are the largest investor in venture capital funds.⁸ This change had great influence on the organizational form to be taken by the venture capital organizations as time moved forward.

As the 1980's progressed, limited partnerships began to make up the majority of venture capital organizations. These partnerships evolved to become the most effective structure for operating in the venture capital industry. This is most likely because of the regulations on their main investors, pension funds, which are tax exempt. One of the

⁵ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.97

⁶ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.6

⁷ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.7

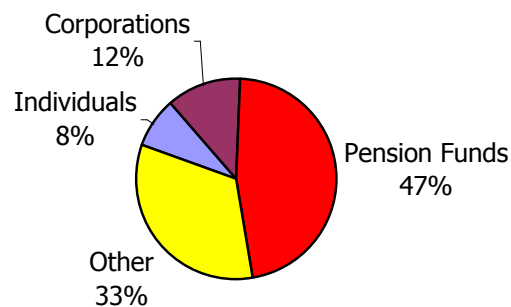
⁸ Sahlman, W.A. Loc. Cit. p.476

main characteristics of a partnership is its ability to have pass through taxation,⁹ this allows for zero taxation on the earnings going to the pension funds.

WHERE THE MONEY COMES FROM

These partnerships receive funds from the venture capitalist, usually the general partner and the limited partners, many of whom are pension funds, corporations and high net worth investors (See below).¹⁰ These funds usually have an active life of ten years with the option to extend for two to three more. The venture capitalists have historically started a fund every three to five years.¹¹

Source of Total Funds Raised as a Percent



Of the funds paid invested by venture capitalist in the three years preceding 1990 only 15 percent of the capital went to first and second stage companies whereas 65 percent went to third and fourth stage investments.¹² The same continued to hold true

⁹ Clarkson, Kenneth W., Rodger Leroy Miller, Gaylord A. Jentz and Frank B. Cross. West's Business Law: Text, Cases, Legal, Ethical, International, and E-commerce Environment 8th edition. United States: 2001 p. 616-636

¹⁰ Black, Bernard S. and Ronald J. Gilson. "Venture Capital and the Structure of Capital Markets: Banks vs. Stock Markets." Corporate Governance Today: The Sloan Project on Corporate Governance at Columbia Law School May 1998: 8

¹¹ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.5

¹² Sahlman, W.A. Loc. Cit. p.475

from 1992 to 1994.¹³ The last 20 percent of invested funds seems to have gone into portfolio companies that were in need of additional funding. Venture capital investment reached an all time high with the explosion of the tech boom in the late 1990's. Investment levels exceeded \$3.5 billion. While the number of venture capitalist was also growing some wonder if the rate of investment was outstripping the ability of the venture capitalist to monitor and make good investments.

WHAT A VENTURE CAPITALIST DOES

The venture capitalists duties in this cycle are many, from managing the partnership to taking portfolio companies public. It all begins with the venture capitalist raising money from the investor group stated above. Once they have completed the raising of the fund they begin to seek out investments for the fund in which they can obtain a concentrated equity position. They attempt to build a portfolio of selected entrepreneurial ventures that will allow them to take advantage of their information specialization but at the same time provide them with some of the benefits of diversification. Sometimes venture capitalists will see hundreds of business plans before choosing to invest in any one. Once the decision to invest in a plan has been made, the venture capitalist will usually disperse the funds in well-defined stages. These stages correspond to critical advances in a company's life such as, meeting a certain goal or having a product approved. Sometimes these investments are done through a syndicate that includes additional venture capitalist. This is done in order to spread out the risk involved in an exceptionally risky venture.

In addition to providing funding, the venture capitalists monitor these investments carefully to reduce agency costs and even provide "value added" services. These services

¹³ Black, Bernard S. and Ronald J. Gilson. Loc. Cit. p.9

vary widely but most of the time they consist of help with recruiting key individuals, finding suppliers and breaking into new markets. Much of this assistance comes through the leveraging of the venture capitalists well-developed relationships within the industry but many venture capital firms keep a staff of well-trained consultants to help their portfolio companies through tough situations.¹⁴ The final stage of a venture capital investment is the exit. There are several ways they can exit an investment but some are considerably more profitable than others.

HOW VENTURE CAPITALIST GET THEIR MONEY BACK

The goal of the venture capitalist is to cultivate an investment to the point where they can successfully exit the investment with a positive return. There are several ways that the venture capitalist can exit an investment. In the exhibit below the four most common are seen with their return metrics. From 1993 to 1999 the initial public offering

Method of Exit	Percent of Total Exits	Return Stats	
IPO:	22%		
Acquisition:	20%		
		IPO and Acquisition Combined	
		Modal Rtn:	25%
		Top 15% Rtn @	1000%
		35% Rtn @ under	100%
		Bottom 15% Rtn @	<0%
Remains Private:	49%	No Info	
Out of business:	9%	Avg Rtn:	0%

(IPO) was the preferred method of exit.

Of the companies that a venture fund is invested in the venture capitalist only expects to take 20 to 35 percent of these public.¹⁵ Of the remaining companies the

¹⁴ Barry, Christopher B., Chris J. Muscarella, John W. Peavy III and Michael R. Vetsuypens. "The Role of Venture Capital in the Creation of Public Companies." *Journal of Financial Economics* 27 (1990): 447-471

¹⁵ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.6

venture capitalist expects to have about 35 percent be a partial to total loss and the remainder to return a zero or small profit.¹⁶ Going public is not the only means of successful exit available to the venture capitalist but recently it has become the most desirable and profitable. As stated earlier only a small portion a venture capitalist investments reach a level where they can have an IPO but when they do, they produce some of the highest returns (59.5% per year on average as compared to 25% when combined with acquisitions).¹⁷ Other methods of exit are to sell the investment to another company, a management buyout for companies that stay private or mainly for failures, liquidation. Venture capitalists are given strong incentives through the structure of the partnership to try and have every investment exit as successfully as possible.¹⁸

¹⁶ Sahlman, W.A. Loc. Cit. p.484

¹⁷ Gompers, Paul A. Loc. Cit. p.1463

¹⁸ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.81

DIFFERENCES BETWEEN VALUATION IN THE STANDARD FINANCE SETTING VS. THE VENTURE CAPITAL SETTING

THREE MAIN METHODS FOR VALUATION

Modern valuation theory provides many different techniques for valuation. The three most widely used are: net present value of discounted cash flow (DCF), option pricing model from Black and Scholes, and comparable company analysis. All three vary but they also have much in common.

The reason that Black and Scholes is one of the most widely used is that compared to other option valuation techniques, such as the binomial model it has a much lower information requirement to still be accurate.¹⁹ The Black and Scholes option valuation model has only five inputs. All of these inputs seem to be equally important to the accuracy of the model and so it is critical to keep error to a minimum for all of the variables. The variable stock price (S),²⁰ seen below, also referred to as the present value of the expected future cash flows generated by the company when using real option theory, is the variable in which most of the estimation occurs.

$$C = Se^{-rt}N(d1) - Ke^{-rt}N(d2) \text{ where } d1 = \{\ln(S/K) + [(r+(\sigma^2/2))*t]\} / (\sigma\sqrt{t})$$

$$d2 = d1 - (\sigma\sqrt{t})$$

Comparable company analysis is considered by many to be a quick and dirty way to determine the value of a company without having to forecast the exact cash flows. The

¹⁹ Damodaran, Aswath. Damodaran on Valuation: Security Analysis for Investment and Corporate Finance. New York: John Wiley & Sons, Inc., 1994, p. 328

²⁰ Damoderan, Aswath. Loc. Cit. p. 329

idea behind comparable company analysis is that one can find other firms that “display similar value characteristics”²¹ and compare them to the company that you are trying to value using a variety of ratios. The main assumption in this method is that the company that you are using as the comparable is accurately valued.

The last and most common method is the discounted cash flow (DCF) method. This is where one estimates the free cash flow to the firm (FCFF) and discounts that back to the present time using a discount rate, composed of risk and opportunity cost components, to come up with a present value of the firm. This present value can be used for many applications such as determining the stock price or the percent of the company needed to receive a certain return. The derivation of FCFF is below.

$$FCFF_t = EBIT_t * (1-t) + DEPR_t - CAPEX_t - \Delta NWC_t + other_t$$

THE IDEA OF FREE CASH FLOW

Free cash flow, as seen above, is a number created in an attempt to measure the value created by a firm at any one time. It ignores the accounting rule of matching and only includes real expenditures; no non-cash expenses such as depreciation are included in FCFF. In a more basic sense, when valuing a firm it is the cash that the firm generates after it has paid all of its operating expenses and made any capital expenditures that it might need to sustain the business. This is also the money that the firm has available to reward its stakeholders (either equity or debt) or as funds for additional investment.

²¹ Lerner, Josh and John Willinge. A Note on Valuation in Private Equity Settings No. 0-297-050. Boston: HBS Publishing, 1996, p.1

The easiest way to think about free cash flow is through an example like the following:

A bar purchases a bottle of vodka. Each bottle holds 40 shots. This bottle will only be used to serve shots. The bar sells shots for \$5.00 each for a total income from the bottle of \$200.00. While the bottle is in use it must be chilled for \$20.00 and someone must be paid to pour the shots \$100.00, for a total expense of 120.00. Assuming that there are no taxes or other expenses associated with the bottle of vodka the free cash flow from this bottle is \$80.00. This is money that can be paid to the owner to compensate him/her for the risk and the initial cash outlay for the purchasing of the bottle.

Example 1	
Revenue per shot	\$5.00
Number of shots	\$40.00
Total revenue	\$200.00
Chilling costs	(\$20.00)
Wage for server	(\$100.00)
Free cash flow	\$80.00

In this simplified world it makes sense that the owner would be willing to pay \$80.00 for this bottle of vodka if he/she felt that there was no risk or time involved in selling the shots. The \$80.00 is the net present value of the bottle and if this were a company one would divide by the shares outstanding (assuming no debt) to determine the share price. In this case if there were 10 shares they would each be worth \$8.00. It can be seen how this is a good measure of the monies available to the owner.

Free cash flow is a major component for all three of the above valuation techniques. In the option valuation method, S or the present value of expected future cash flows is a direct result of the estimation of future cash flows. As was stated earlier

all five of the option valuation methods inputs are equally critical to the ending value. This means that cash flow estimation is critical to the valuation using the option method.

Comparable company analysis implicitly assumes that the comparable companies have been accurately valued by the market or through the discounted cash flow method. Assuming that you can find a good comparable company, which is not always an easy thing to do, the two methods that would have been used to derive the value of the comparable company rely heavily on free cash flow. The first being a market valuation where the value of the company is set by what the shareholders of the company would be willing to pay for the return they expect. What the shareholders look at to evaluate what could be their return is free cash flow, what is left over to give to the stakeholders of which shareholders are one. The second is the DCF, which will be discussed below. The essence of the argument is that comparable company analysis is heavily reliant upon the estimation of cash flows.

The discounted cash flow method used either alone or as part of the comparables method is totally reliant upon the estimation of cash flow. The output of this method is referred to as the net present value (NPV) and is a sum of discounted, estimated cash flows. The equation is seen below where the discount rate is r and the equation for FCFF is below it. This makes it very apparent that this method is dependent upon a good estimation of FCFF.

$$NPV = [FCFF_1/(1+r)] + [FCFF_2/(1+r)] + [FCFF_3/(1+r)] + \dots + [(FCFF_t + TV)/(1+r)]$$

$$FCFF_t = EBIT_t * (1-t) + DEPR_t - CAPEX_t - \Delta NWC_t + other_t$$

The DCF analysis is considered the most accurate because it has the most inputs and allows for all contingencies that a company could face. Because of this, it is the workhorse of modern valuation and will be the technique that is focused on for the rest of this paper.

All of the valuation techniques that have been discussed so far have been proved to be reliant upon the values estimated for free cash flow. This indicates that accurate estimation of these values is critical in creating correct final values for projects, assets and firms.

HOW FREE CASH FLOW IS DERIVED

The standard setting and the venture capital setting for the application of modern finance valuation theory are very different. The standard setting involves companies or projects that have been tried before or have been around for a while whereas in the venture capital setting there are no true comparisons or it is a totally new and untested idea. This proves to be a challenging issue for modern finance.

In both the standard finance and the venture capital setting the creation of free cash flow numbers requires the estimation of the inputs to FCFF seen below.

$$FCFF_t = EBIT_t * (1-t) + DEPR_t - CAPEX_t - \Delta NWC_t + other_t$$

In the standard setting the estimation of these numbers is tricky but can, with some in-depth research be predicted with a small amount of error. For example a company wishes to forecast the free cash flows from a new food cart that will specialize in selling spicy hot dogs. This company already owns an identical cart, which is located

in front of NYU's Stern school of Business. Because they already have a cart all they have to do is locate the placement of the new cart and study the foot traffic to create an estimate for free cash flow. They already know much of the information going in to the free cash flow formula, so it is a fairly easy task to keep the error as small as possible. This allows the formula to closely approximate what is below. This is not the case in the venture capital setting.

$$NPV = [FCFF_1/(1+r)] + [FCFF_2/(1+r)] + [FCFF_3/(1+r)] + \dots + [(FCFF_t + TV)/(1+r)]$$

In the venture capital setting estimating the cash flows can prove to be a much more difficult task. Due to the nature of the companies being funded and the uncertainty associated with their performance, predicting cash flows is impossible and if it is possible they are encased with error. The formula for the DCF method in the venture capital setting looks like the following:

$$(NPV+\epsilon) = [(FCFF_1+\epsilon)/(1+r)] + [(FCFF_2+\epsilon)/(1+r)] + [(FCFF_3+\epsilon)/(1+r)] + \dots + [((FCFF_t+\epsilon) + TV)/(1+r)]$$

Because there is error going in to each of the FCFF the resulting NPV will have greater error contained within it. This means that the valuation will not be accurate. As the estimation for the FCFF gets more difficult, with younger and more untested companies and technologies, the error for each of the FCFF gets larger. For example when 3Com was funding PALM to construct its hand held organizer they had to estimate the FCFF

from the Palm. Some said that they originally thought that everyone who had a black book would purchase a Palm Pilot.²² Today about five years later this is known not to be true. Many people who had black books still have black books and many people who had nothing now use the Palm device, although many who had black books now use the Palm. This example illustrates the difficulty in estimating cash flow when it is difficult to estimate market size and usage. In venture capital many situations like this exist especially with innovator firms.

Modern finance valuation theory's reliance on being able to accurately predict cash flows hurts valuation in the venture capital setting, making most results difficult to have faith in due to the high levels of error.

DISCOUNT RATES

The discount rates used in the DCF valuation method vary from the standard setting to the venture capital setting. When using the DCF valuation technique a discount rate (r) must be applied to the free cash flows to compensate for the fact that they are future cash flows and are not received immediately. Additionally, they come with risk and this must be compensated for.

In the standard setting the discount rate is a summation of the opportunity cost and a risk premium. The opportunity cost is the rate the invested money could be earning if it were invested at the risk free rate. This is the base of what the investor would demand assuming that there was no risk. The risk premium for the discount rate in the standard setting is attempting to make up for the risk inherent to the market, the

²² Perlin, R. Scott. Fall 2001, NYU, Venture Capital Financing: Class Lecture

systematic risk.²³ With both of these, one gets the rate that would compensate an investor for an investment in a company.

$$r_{\text{std}} = [\text{Time Value}] + [\text{Systematic Risk Premium}]$$

In the standard setting this is a fairly straightforward calculation that contains little to no error.

In the venture capital setting the discount rate contains the same two factors plus several more. The additional factors within the discount rates used by venture capitalist in valuing start-up companies cause them to be significantly higher than in the standard situation. Many have tried to reason why these discount rates are so high but it is best put by Scherlis and Sahlman.²⁴ They state that the discount rate is a creation of several premiums stacked upon the risk free rate. They state that these additional premiums are: unsystematic risk (company specific), liquidity, value added and cash flow adjustment.

$$r_{\text{vc}} = [\text{Time Value}] + [\text{Systematic Risk}] + [\text{Unsystematic Risk}] + [\text{Liquidity}] + [\text{Value Added}] + [\text{Cash Flow Adjustment}]$$

The reasoning behind these additions is fairly easy to see. The venture capitalist is investing in a very different market when compared to the standard setting and so they are exposed to more types of risk and they have less opportunity to diversify this new risk away. The one factor that is of the most interest in this situation is the cash flow adjustment. The cash flow adjustment is an addition to the discount rate set by the venture capitalist based upon past experience to adjust the numbers more to their liking. By having a portion of the discount rate set by the VC's themselves with no basis they

²³ Damoderan, Aswath. Loc. Cit. p. 10

²⁴ Sahlman, William A. and Daniel R. Scherlis. A Method for Valuing High-Risk, Long-Term Investments: The "Venture Capital Method" No. 9-288-006. Boston: HBS Publishing, 1987, p. 13-15

open the DCF method up to more human error. The resulting DCF formula in the venture capital setting would be:

$$(NPV+\epsilon) = [(FCFF_1+\epsilon)/(1+(r_{vc}+\epsilon))] + [(FCFF_2+\epsilon)/(1+(r_{vc}+\epsilon))] + \\ [(FCFF_3+\epsilon)/(1+(r_{vc}+\epsilon))] + \dots + [((FCFF_t+\epsilon) + TV)/(1+(r_{vc}+\epsilon))]$$

This results in even greater error in the DCF result, making it an even less trustworthy metric. The following is an example of the discount rates used by venture capitalist and these are the rates used in the data to follow. These rates are an average of the range given for each stage by Scherlis and Sahlman.²⁵

Discount Rates by Stage	
Seed	0.800
Startup	0.600
First Stage	0.500
Second Stage	0.450
Third Stage	0.325
Fourth Stage/Bridge	0.275

* These are the rates used in the data analysis.

DISCUSSION OF FINANCIAL ANALYSIS

The discounted cash flow method, the most accurate of the above methods in the standard setting contains a large amount of error in the venture capital setting. This is evidenced by the above discussion that led to the creation of the formula below as the working formula for the DCF when used in the venture capital setting.

$$(NPV+\epsilon) = [(FCFF_1+\epsilon)/(1+(r_{vc}+\epsilon))] + [(FCFF_2+\epsilon)/(1+(r_{vc}+\epsilon))] + \\ [(FCFF_3+\epsilon)/(1+(r_{vc}+\epsilon))] + \dots + [((FCFF_t+\epsilon) + TV)/(1+(r_{vc}+\epsilon))]$$

²⁵ Sahlman, William A. and Daniel R. Scherlis. Loc. Cit. p. 6-12

This error causes the financial analysis conducted by venture capitalist to result in incorrect metrics that should lead to bad investment decisions.

STATISTICAL ANALYSIS OF RETURN

HYPOTHESIS

The hypothesis of this study is that the expected return ($E(x)$) will not equal the actual return (x) to the venture capitalist. This hypothesis stems directly from the above arguments. If the venture capitalists are using the discounted cash flow method to evaluate their investments, which makes sense because it is the most accurate method available, then the expected value should contain error. If they are accurate then the expected value should not contain error and should equal the actual value, resulting in a difference of zero between the two results. Because the DCF model has been shown to contain error when used in the venture capital setting this paper believes that the two values, expected value and actual value, will not be equal.

$$H_0: E(x) = x \quad H_A: E(x) \neq x$$

METHODOLOGY

To test this hypothesis the following methodology was used:

The data was gathered from the SDC database. The first group of data that was desired was the implicit valuation on the initial public offering (IPO) date. Needed for this was the IPO date, price, number of shares outstanding after the IPO. Next, information about the rounds of investment that went into each company was needed. The data from SDC provided the date of each round, the amount of each round and the number of investors. This study has made the assumption that each investor invested an equal amount of the total for each round in which they participated. For example if there

were two investors and the round value was 1000 then each investor invested 500. I next found the amount of ownership that each investor had after the IPO as stated in the S-1 documents submitted to the Securities and Exchange Commission and published online at www.edgaronline.com. These components made up the parts that were needed to enable an adequate analysis of the problem.

The data was manipulated in the following way:

A holding period was created for each investment stage using the round date and the IPO date. The amount invested on each round date was grown by the below discount rates for the holding period of the round to come up with an expected value for that investment. The rounds were classified by SDC. See the growth formula below:

Discount Rates by Stage	
Seed	0.800
Startup	0.600
First Stage	0.500
Second Stage	0.450
Third Stage	0.325
Fourth Stage/Bridge	0.275

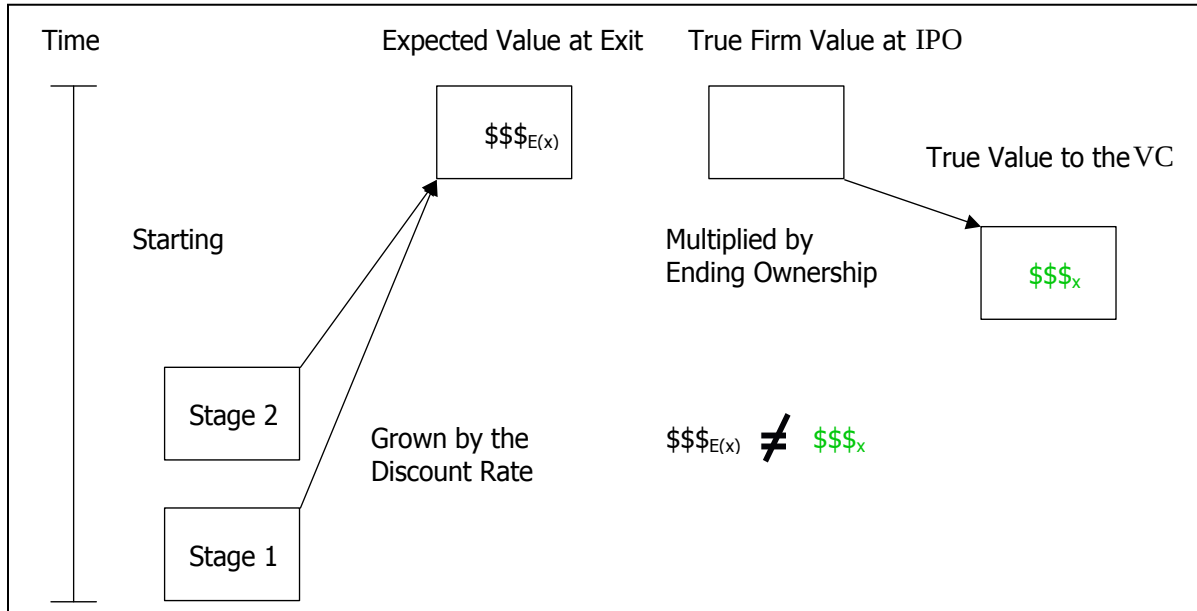
$$(\text{investment}) * (1 + (\text{chosen discount rate}))^{(\text{holding period in years})}$$

This makes the assumption that all venture capitalist use the same discount rate. After each investment was grown out, an expected value for each company investment was created for each venture capitalist. This was done by summing the expected value of each round in which the venture capitalist participated. This expected value was then subtracted from the actual value to create a difference from the actual value. The absolute value was then taken of these differences to find the deviation from zero. This deviation is what was tested to determine if the above hypothesis holds true.

After the data was reworked the tested hypothesis became:

$$H_0: \mu = 0 \quad H_A: \mu > 0$$

Below is a picture depicting the methodology:



DATA AND DATA ANALYSIS

The data retrieved from the SDC database consisted of 853 companies that had an IPO between 1997 and 2000. This dataset was narrowed down to 240 companies for use in the study. Each company had several venture capitalists, creating a wide array of venture capitalist exposure and the companies were involved in many different industries.

This yielded 96 multi-staged venture investments made between 1972 and 1999.

The data proved to be quite interesting. As can be seen in figure 1 the data was not normal according to the standard Anderson-Darling test. If the data had been normal it would have lined up along the red line. This limited the possible future testing of the data to derive additional conclusions. In figure 2 one can see the descriptive statistics of the dataset. It is obvious that the data is heavily skewed from the extreme differences in the

mean and median. This led to the graphing of the data in figure 3 where one can see that there seem to be two extreme outliers. When the outliers are removed and the data is graphed again the dataset looks to be very random in nature. This is a good indication that there are no additional variables affecting the data. Additionally, this looks bad for the hypothesis because the differences between $E(x)$ and x could just be random error or “white noise.” This white noise could indicate that it is normal error to be expected in all situations.

Figure 1.

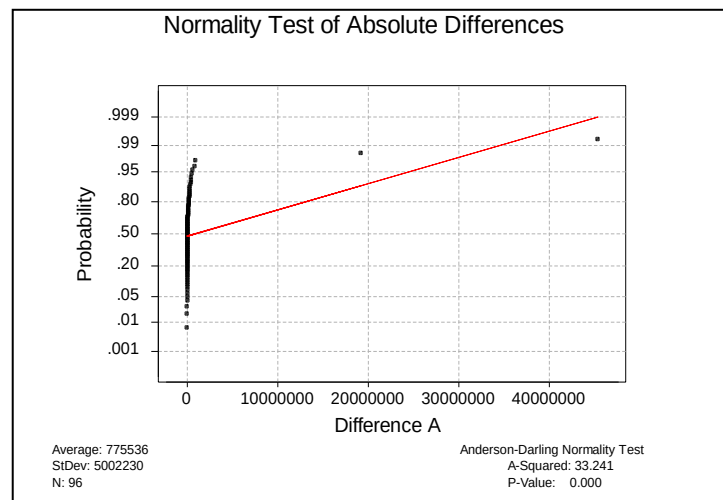


Figure 2.

Absolute Difference	
Mean	775536.373
Standard Error	510537.9777
Median	33736.94848
Mode	#N/A
Standard Deviation	5002230.159
Sample Variance	2.50223E+13
Kurtosis	70.01553337
Skewness	8.170847218
Range	45402894.58
Minimum	381.1878226
Maximum	45403275.77
Sum	74451491.8
Count	96
Confidence Level(95.0%)	1013545.307

Figure 3.

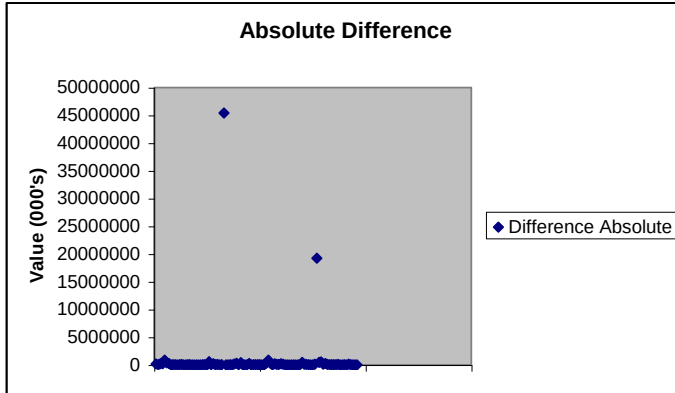
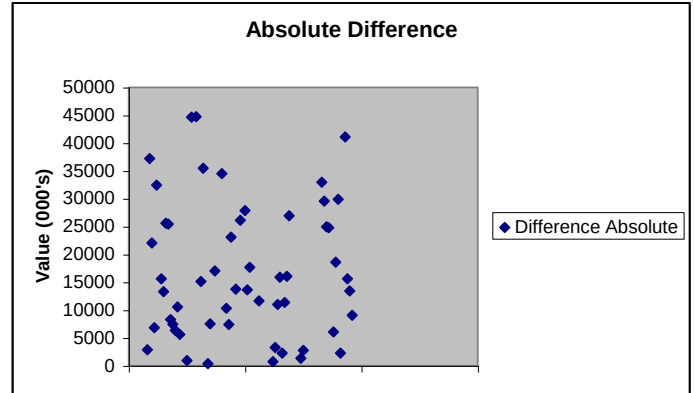


Figure 4.



CONCLUSION OF THE STATISTICAL ANALYSIS

A one tailed t-test was run on the absolute differences between $E(x)$ and x . Below is the test output. The P-value resulted was .132 meaning that this test is not significant at either the .05 or .10 level of significance. This result goes against the hypothesis of

One-Sample T: Absolute Difference

Test of $\mu = 0$ vs. $\mu \neq 0$

Variable	N	Mean	StDev	SE Mean
Abs Difference	96	775,536	5,002,230	510,538
Variable	95.0% CI	T	P-value	
Abs Difference	(-238,010, 1,789,082)	1.52	0.132	

this paper indicating that the venture capitalist on average, as a group, seem to be achieving their expected returns over the period studied from 1997 to 2000.

The data used in the analysis above did exhibit some symptoms of error. First and most importantly, the data was taken from a group of investments that had reached a level of success that allowed them to IPO. As was stated earlier the IPO stage is something that only the top 20% of venture backed companies reach. Even though there was a diverse sampling of venture capital funds, this could be a sample of only the top funds because of the large number of venture funds in existence. The resulting sample

bias could contribute to the test resulting the way that it did. Because there could have been an under sampling of funds that performed poorly and this could have forced the results to be biased towards success and this might help to explain the results that were created.

Second, even though there was a diverse sampling of companies by industry there were also a large number of technology and biotechnology firms. During the period studied these firms were receiving some of the highest premiums offered by the public markets. This too, could have skewed the data into producing the numbers that it produced. Between these two effects it is possible that the result could have been different and this should be investigated further but the true difference would depend on the effects of the other portfolio companies for each venture investor that are not included in this study.

COMPONENTS OF A VENTURE CAPITALIST'S RETURN

Because of the results attained above there must be more to the success of a venture capitalist than just the financial analysis. Much of the literature on venture capital agrees with this. Two ingredients of the return generated by the venture capitalist are easily identifiable, they are the financial analysis discussed above and the venture capitalist's monitoring and other value added activities.

FINANCIAL ANALYSIS

As was stated above the financial analysis contains a large amount of error and should have resulted in a significant test rejecting that $E(x) = x$.

MONITORING AND OTHER VALUE ADDED ACTIVITIES

Much research has been done to chronicle the relationship between an entrepreneur and his/her venture capital financier. The research indicates that there are many different ways for venture capitalist and entrepreneurs to tailor their relationships. Some of the more profound theories state that this relationship is heavily influenced by the supply of venture capital available and the demand for those funds by entrepreneurs. Whenever this market is out of equilibrium, one of the parties gains negotiating power over the other and is able to increase his/her ability to try and dictate the terms of their relationship.²⁶ Aside from these macro trends in the market, relationships seem to have a few threads that are the same for nearly all.

First, it must be stated that by the nature of a venture capitalist in that they invest in multiple companies, continuous monitoring is impossible and will be shown to be detrimental to innovation and so is not an option.²⁷ Second and almost unique to venture

²⁶ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.50

²⁷ Gompers, Paul A. Loc. Cit. p.1462

capital, is that the rights to cash flow, voting, board seats, liquidation and control are all allocated separately and not necessarily through the traditional means of a security but rather through the investor rights agreement.²⁸ Lastly, the two most common forms of control mechanisms are the use of convertible securities with an investor rights agreement and the staging of capital infusions.²⁹ These and several other tactics used by venture capitalist are perceived to be the best methods used to combat the high agency costs involved with an entrepreneurial venture.

THE COST OF AGENCY

The agency relationship is described as “the contractual relationship between the principal person(s) and others who render services as agents, e.g. between the stockholders of a corporation and the managers they appoint to run the firm.”³⁰ This is equivalent to the situation encountered when a company has been financed by a venture capitalist. The venture capitalist gives money to the corporation in exchange for a large equity stake, typically greater than 50 percent.³¹ The entrepreneur and the rest of the management team then become the managers and usually have a portion of the remaining ownership. This creates a situation where the interest of the managers is not identical to that of the owners. Paul Gompers clearly states why we know there are agency concerns: “If entrepreneurs pursue[d] shareholder maximizing strategies, financing [would be] simple. Venture capitalist’s would give entrepreneur’s all the money they need[ed] and entrepreneurs would decide weather to continue the project based on their information. In the case of start-ups, entrepreneurs would derive stopping rules that maximized

²⁸ Kaplan, Steven N. and Per Stromberg. Loc. Cit. p.6

²⁹ Gompers, Paul A. Loc. Cit. p.1461

³⁰ Rutherford, Donald. “Agency Theory.” Dictionary of Economics. New York, 1992 ed. p.10

³¹ Perlin, R. Scott. Fall 2001, NYU, Venture Capital Financing: Class Lecture

shareholder value... Based on their private information, they would decide whether to continue a project or not.”³²

Conflict and cost arises when the entrepreneur/management make management decisions resulting in a portion of the returns from their effort going to the venture capitalist/owners that have put forward minimal effort. According to Kaplan and Stromberg “the different financial contracting theories assume different types of conflict... [which are] (1) not exerting the optimal amount of costly effort; (2) taking actions that yield private benefits rather than monetary benefits; (3) spending resources on perks or stealing; [and] (4) holding up investors by threatening to leave the project.”³³ These actions clearly enhance the well being of the entrepreneur by exacting a cost on the venture capitalist. As a result the venture capitalist clearly strives to have control over the actions of the entrepreneurial team.

The research shows that the venture capitalist are aware of the high cost of agency problems and that one of their main goals is to effectively bring the entrepreneurs goals inline with that of themselves. They do this through control of the firm’s financial outputs and an extensive employee compensation system. Because of the nature of the venture capitalist their control is exercised through monitoring and performing value added activities so they appear to be contributing to the firm.

The effective management of these high agency costs through various methods of monitoring could be one of the sources that help to compensate for the error in the financial analysis.

³² Gompers, Paul A. “Optimal Investment, Monitoring, and the Staging of Venture Capital.” The Journal of Finance Vol. L, No. 5 (1995): 1464

³³ Kaplan, Steven N. and Per Stromberg. Loc. Cit. p.3

THREE TYPES OF MONITORING AND VALUE ADDED ACTIVITIES

The activities that venture capitalist undertakes to add value and monitor an entrepreneurial venture can be divided into three categories: active, systematic and reputation effect.

ACTIVE MONITORING

Active monitoring consists of activities that the venture capitalist performs throughout the life of an investment. One main way that the venture capitalist is actively involved in the company is through informational support. Most venture capitalist focus on making investments in an industry, or industries and in a specific geographical region. This focus allows the venture capitalist to become better informed about the technologies or processes in these industries and as a result this decrease in the informational asymmetry with the entrepreneur and allows the venture capitalist to help the company with industry expertise and competitor analysis. This informational support and the experience of having assisted other entrepreneurial ventures, allows the venture capitalist to help the firm through tough times.

The venture capitalist is also an expert in the field of start-up firms; this allows the venture capitalist to assist the entrepreneur (likely a technician) with issues involving the management team and company basics. These issues could take the form of helping to fill a vital position with a highly qualified individual or finding additional venture capitalist to invest in future rounds of investing.

Being located close to or having all of a venture capital firm's investments located in one area allows for more onsite monitoring³⁴ of the entrepreneurs and facilitates many venture capitalists ability to hold a participating seat on the board of directors. The

³⁴ Baker, Malcolm and Paul A. Gompers. Loc. Cit. p.8

probability of the venture capitalist having a seat on the board increases dramatically if they have fired the CEO of the company.³⁵ Another common aspect of active monitoring is the syndication of these investments to other venture capitalist with similar specialties and focus. This allows the venture capitalist to see if others conclusions are the same as their own and to get help from other experts. This occurs more often in early stage investments.³⁶

SYSTEMATIC MONITORING

Systematic monitoring takes the form of the contractual relationship between the entrepreneur and the venture capitalist. The preferred vehicle for investment seems to be the convertible preferred stock because of its semi-debt like qualities, especially when the investor rights agreement provides additional rights that cause it to depart from its traditional use as an equity security. Because the entrepreneur's ownership and options are in common stock, which follows the convertible preferred in liquidation rights, most of the bankruptcy risk is transferred to the entrepreneurs. The preferred stock also has a claim to the cash flow of the company immediately, which serves as a faucet for the venture capitalist to drain funds if they feel that there are excess funds that may be wasted or stolen. Traditionally preferred stock has no control rights so this increases the importance of the investor rights agreement.

The investor rights agreement is shown to vary greatly from venture capitalist to venture capitalist and slightly from funding to funding.³⁷ The rights of the venture capitalist are shown to increase in early stage funding and decrease in later stage funding

³⁵ Ibid

³⁶ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.189

³⁷ Kaplan, Steven N. and Per Stromberg. Loc. Cit. p.1-72

when the company is more tangible and contractual incompleteness decreases.³⁸ Many of the rights that the agreement provides to the venture capitalist are based upon contingencies especially in the early stage investments. What is meant by contingencies is that if the company performs poorly the venture capitalist gains more control until he/she has total control, if the company performs well the venture capitalist surrenders rights and privileges to the entrepreneur as a reward.

The movement of rights to the venture capitalist occurs much more quickly than to the entrepreneur.³⁹ The primary method for this shift in rights to or from entrepreneur occurs is through staggered conversion of the venture capitalist convertible preferred stock to common with the ratio based on company performance, poor performance indicating a larger ratio and visa versa. The move in the other direction has several avenues the most common being that the venture capitalist has the right to fire the entrepreneur and management. Commonly fitted with this clause is the right to buy the terminated employee's stock at a deep discount before they can sell it to anyone else and a non-compete clause.⁴⁰ Additionally, it is common for the venture capitalist to have the right of first refusal, preemptive rights and a put on his/her shares that can be executed any time after a certain date if an initial public offering is not imminent. Some research indicates that the entrepreneur's reaction to this contract is used as a way to measure the confidence of the entrepreneur in his/her ability and expectations for the firm.⁴¹

Included in the investor rights agreement are the terms of compensation for the entrepreneur and the management. Some of the clauses were mentioned above but the

³⁸ Kaplan, Steven N. and Per Stromberg. Loc. Cit. p.12

³⁹ Kaplan, Steven N. and Per Stromberg. Loc. Cit. p.6

⁴⁰ Sahlman, W.A. Loc. Cit. p.507

⁴¹ Sahlman, W.A. Loc. Cit. p.510

overall strategy of many venture capitalists is to pay below market fixed wages and make up for the lowered wages with a larger amount of options (amount linked to firm performance) that vest over a period of time such as five years.⁴² This serves two purposes first; if the company is successful the entrepreneur has the capability of participating in the payoff; this serves as the carrot in the compensation. Second, the entrepreneur's interest are highly aligned with the interest of the venture capitalist, this helps to reduce the agency problem. This in effect punishes the under performers by requiring that they return the unvested portion of their options at no compensation if they leave the firm or are fired.⁴³ Additionally, this serves to lower the risk of hold up by the entrepreneur and reduces the increase in bargaining power of the entrepreneur as the firm value increases; these aspects are the stick.⁴⁴

The investor rights agreement is a contract that must be enforced legally and that takes time. In this situation contractual incompleteness exists and there is little time for legal proceedings, as a result there are other avenues of enforcement built into the agreement between the venture capitalist and the entrepreneur such as the staging of funding.

Staged funding is considered by many to be the “most potent control mechanism”⁴⁵ available in the venture capitalist arsenal. Staged funding allows the venture capitalist to periodically do an in depth investigation into the activities of the entrepreneur. Although the venture capitalist regularly visits the firm in operation to monitor its progress, there is still much informational asymmetry between the

⁴² Sahlman, W.A. Loc. Cit. p.508

⁴³ Ibid

⁴⁴ Kaplan, Steven N. and Per Stromberg. Loc. Cit. p.6

⁴⁵ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.139

entrepreneur and the venture capitalist about the firm's prospects.⁴⁶ In innovator firms where this asymmetry is greater than in non-innovator firms there should be a greater need for monitoring to avoid high agency costs. Because of this the innovator firms should have a greater number of rounds of financing and they should receive less money per round. This is backed up by the research, which indicates investments that are early stage and require a greater amount of research and development receive less money per round and have more frequent rounds.⁴⁷ In addition to helping the venture capitalist to monitor their investment, the use of staged funding preserves their right to abandon the investment if its prospects turn sour. The stages also give the venture capitalist the ability to slowly remove control or give more control to the entrepreneur during each new funding if the venture is performing poorly or is exceeding expectations. Lastly, there seems to be a negative effect on reputation for the entrepreneur if the funding of the venture is removed making additional funding very difficult to attain.⁴⁸

REPUTATION EFFECT

The effect of the reputation of the venture capitalist on the entrepreneurial venture can take many forms. Some of these could be that the active activities performed by the venture capitalist are much more effective or easier to accomplish. Reputation seems to have the most effect when it comes to finding highly qualified employees at early stages, increasing the access of the financial markets to the venture and increasing the value of the initial public offering.

Studies have shown that companies which IPO and have had venture capital backing perform about 11% better than companies that have not had venture capital

⁴⁶ Gompers, Paul A. Loc. Cit. p.1464

⁴⁷ Gompers, Paul A. Loc. Cit. p.1463

⁴⁸ Sahlman, W.A. Loc. Cit. p.507

backing. Many see this as an acknowledgement of the monitoring abilities and reputation of the venture capitalist.⁴⁹ Additionally, studies show that venture capitalist because of this monitoring can bring companies public before companies that do not have venture capital backing.⁵⁰ It seems that it is beneficial to both the entrepreneur and the capital markets for a company to have had venture capital backing.

⁴⁹ Gompers, Paul A. and Josh Lerner. Loc. Cit. p.320

⁵⁰ Barry, Christopher B., Chris J. Muscarella, John W. Peavy III and Michael R. Vetsuypens. Loc. Cit. p.459

THEORY OF INCOMPLETE CONTRACTS

All of the actions of the venture capitalist that are not directed at controlling the entrepreneur seem to be directed at reducing the informational asymmetry so that the venture capitalist can more effectively understand where agency costs may be occurring.

This is a critical topic for further focus in the venture capital industry because as stated earlier 15 percent of the funds invested by venture capitalists are invested in first and second stage companies, which are classified as innovator firms on the basis that they have no revenue⁵¹ or have negative cash flow.⁵² This distinction is based on Professor Frydman's assertion during a lecture from the class Ownership and Corporate Control During Economic Transition at NYU, that increasing revenues requires innovation whereas cutting costs does not. These innovator firms are regularly only an idea without fielded products or proper test evidence on the success of a product or the validity of a market.⁵³ This results in a substantial amount of contractual incompleteness between the entrepreneur and the venture capitalist. More specifically, this incompleteness comes either from the entrepreneur's inability to specify what action he/she is going to take to compete or market the product, or from the inability of the venture capitalist to specify to the entrepreneur what actions would make the venture successful. "More generally contracts may be incomplete... [w]hen outcomes cannot be verified, it is impossible to write contracts contingent upon particular events. This makes external financing costly. ... Even when actions or outcomes are observable – investors know what the

⁵¹ Kaplan, Steven N. and Per Stromberg. Financial Contracting Theory Meets the Real World: An Empirical Analysis of Venture Capital Contracts. Chicago, 2000, p.12

⁵² Baker, Malcolm and Paul A. Gompers. Determinants of Board Structure and Function in Entrepreneurial Firms. Harvard, 1999, p.11

⁵³ Sahlman, W.A. Loc. Cit. p.478

entrepreneur did – they may not be verifiable to a court.”⁵⁴ Because of this incompleteness the innovation cannot be contracted out and so the venture capitalist is forced to relinquish some of their control of the operation to the entrepreneur.⁵⁵ The most difficult decision for the venture capitalist is determining how much control and ownership to give to the entrepreneur so that they will continue to be motivated to innovate while at the same time controlled enough that they do not have the ability to steal the funds provided by the venture capitalist.

This is a difficult balance for the venture capitalist to maintain. On one hand the venture capitalist must maintain a certain amount of control, through ownership, so that they may ensure that the funds are being used for the stated purposes and that theft, through high agency costs, is not occurring. But on the other hand if they reduce the level of ownership or keep too much control over the entrepreneur they will incur greater agency costs by turning his/her incentives away from those that make the venture successful. Part of this cost would be to stifle the entrepreneur’s ability and motivation to innovate. The result is that to have innovation there must be some level of unaccountability for the entrepreneur, which means that the venture capitalist cannot have complete control over the entrepreneur.

DELICATE BALANCE BETWEEN INNOVATION AND CONTROL

The need for the venture capitalist to have any control of the firm arises from the study of agency theory as described above, and the costs that it generates. As the venture capitalist attempts to fix some of the daunting agency problems by increasing control over the entrepreneurial team, he/she creates more problems for the company as a whole.

⁵⁴ Baker, Malcolm and Paul A. Gompers. Loc. Cit. p.3

⁵⁵ Frydman, Roman. Fall 2001, NYU, Ownership and Corporate Control During Economic Transition: Class Lecture

These new problems result from reducing the incentives to the entrepreneur and increasing his/her accountability, which we have shown tie the hands of the entrepreneur and making success through innovation difficult to attain. The resulting decrease in innovation is disturbing to the venture capitalist because they rely so highly on innovation to fuel their investments high rate of growth. Some studies show that when “controlling for industry effects, ... innovators are more likely to be financed by venture capital than are imitators”⁵⁶ The result is that it is critical for venture capitalist to be proficient in the skill of monitoring effectively.

⁵⁶ Hellmann, Thomas and Manju Puri. The Interaction Between the Product Market and Financing Strategy: The Role of Venture Capital. Stanford, 1999, p.4

CONCLUSION

The results of this study are that the financial analysis performed by venture capitalist is wrought with error through estimation but that the specialization of venture capitalist in the skills associated with monitoring and the effective use of these skills have allowed venture capitalist reduce the high agency costs associated with start-up companies and to compensate for this error allowing them to provide excellent returns, on the average, to their investors over time.

The ability of the venture capitalist to effectively monitor and structure the relationship with the entrepreneur far outweighs the error contained in the financial analysis and so it makes sense that the most successful venture capitalists would be the most adept at monitoring and relationship structuring. If it were possible for the venture capitalists to improve their ability to estimate the free cash flows to the firm for companies that they invest in they could radically improve their returns, assuming that they maintained their monitoring and value added activities. This is a goal that the specialization of venture capitalist to certain industries indicates they are attempting to accomplish.

The one notable gap in the above study is a result of the success bias in the data. Because the data is a selection of only the best investments there is significant amount of research that remains to be undertaken before this topic can be fully closed.

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**An Investigation into Modern
Financial Valuation Theory in the
Venture Capital Setting**

by

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An honors thesis submitted in partial fulfillment
of the requirements for the degree of
Bachelor of Science
Undergraduate College
Leonard N. Stern School of Business
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May 2002

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EXECUTIVE SUMMARY

The following is a detailed study of modern financial valuation theory in the venture capital setting. It begins with an analysis of the history of venture capital, leading in to the process through which venture capital investment takes place. This allows one to become familiar with the venture capital industry dynamics and aids in the understanding of the following sections. The next section begins with an analysis of modern valuation theory and its foundation, the theory of free cash flow. The theory of free cash flow is then applied to the venture capital setting where it becomes evident that the ability of the venture capitalist to estimate free cash flows is a great source of error in the valuation of these early stage companies. This finding leads to the hypothesis that what the venture capitalist expects to receive from their investments in start-ups will not be what is received when the investment is finally exited. The statistical analysis refutes this hypothesis and indicates that there must be some aspect of the investment or investment process other than the financial analysis that contributes to the return of the venture capitalist. This is determined to be the monitoring and value added activities that the venture capitalist performs for and on the company. The last section goes deep into the reasons why this monitoring is needed and why its payoff might exceed the error generated by the estimation included in the financial analysis. It wraps up with a discussion about the high degree of skill required to perform this type of monitoring and the delicate balance that must be maintained in order to not subjugate the company into failure. This leads to the conclusion of the study which ultimately proves that successful venture capitalists specialize in the monitoring of start-up companies and this skill is more valuable in the venture capital setting than the financial valuation.

The results of the study are that the financial analysis performed by venture capitalist is wrought with error through estimation but that the specialization of venture capitalist in the skills associated with monitoring and the effective use of these skills have allowed venture capitalist reduce the high agency costs associated with start-up companies and to compensate for this error allowing them to provide excellent returns, on the average, to their investors over time.

The ability of the venture capitalist to effectively monitor and structure the relationship with the entrepreneur far outweighs the error contained in the financial analysis and so it makes sense that the most successful venture capitalists would be the most adept at monitoring and relationship structuring. If it were possible for the venture capitalists to improve their ability to estimate the free cash flows to the firm for companies that they invest in they could radically improve their returns, assuming that they maintained their monitoring and value added activities. This is a goal that the specialization of venture capitalist to certain industries indicates they are attempting to accomplish.

The one notable gap in the above study is a result of the success bias in the data. Because the data is a selection of only the best investments there is significant amount of research that remains to be undertaken before this topic can be fully closed.