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A Comparative Study of Venture Capital Performance in the US and Europe

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For the past fifty years in the United States, venture capital (VC) has provided initial funding to innovative entrepreneurial enterprises, while the European venture capital industry has only really emerged over the past decade. Using quarterly data from 1993 to 2003, this paper examines and compares the return and risk performance of venture capital funds in US and Europe. Several results are noteworthy. First, pooled venture capital returns in US and Europe are 3.273% and 0.765% (on a quarterly basis) above the CAPM market risk-adjusted returns, respectively. Second, US venture capital fund performance dominates that of Europe in all measures: mean return, total-risk adjusted return, and market-risk adjusted return. Third, the linkage between US VC fund performance and the US stock market is much stronger than the co-movement between the European VC and European stock market. Finally, the introduction of Euro.NM in 1997 has substantially enhanced the relationship between the venture capital and stock market performance in Europe.

I. Introduction

Venture capital funds have traditionally invested in new and rapidly growing enterprises that do not yet have access to the public equity market or debt market. For the past 50 years in the United States, venture capital (VC) has provided initial funding to companies like Microsoft, Apple, Intel, Lotus, Sun Microsystems, Federal Express, and has established itself as the "engine" for innovative entrepreneurial enterprises. The success of many VC-backed innovations, in turn, has generated tremendous returns for venture capital funds in the US.

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Such returns, however, are generally associated with higher risk, lower liquidity, longer investment horizon, and higher information asymmetry than the public equity investments.

Venture capital funds specialize in long-term private equity investments in startup and super-growth companies that offer high potential returns and substantial risk. Since venture capital investments are made in non-publicly traded companies that are characterized by a high level of information asymmetry between entrepreneurs and investors, venture capitalists are actively involved in monitoring, strategic management, planning and decision-making of the portfolio companies they fund. Venture capitalists usually provide capital infusion in well-defined stages tied to significant development of the company's products, market and profitability. In addition, venture capitalists typically take an active role in guiding an exit decision, such as initial public offerings or mergers and acquisitions.

By comparison with US, venture capitalism in Europe is still underdeveloped. A decade ago, Europe was substantially lagged behind the US in providing a nurturing environment for innovative entrepreneurial activity, with small and medium enterprises often finding it difficult to get started and grow due to the lack of "risk capital". The European venture capital industry has only really emerged over the past decade, especially in UK, France, Germany, Italy, Netherlands and Sweden. The recent development of the venture capital industry in Europe, to some extent, has been inspired by the success of VC-backed innovations in the US. The growing integration of Europe in terms of international trade, currency and monetary policy has enhanced the competitiveness of European Economy and further encouraged the development of venture financing across Europe.

The objective of this paper is to examine and compare the performance of venture capital funds in US and Europe for the past decade. Our study is important for two reasons. First, despite its remarkable growth of VC in Europe in the past ten years, there is still a lack of empirical work in the European venture capital industry. According to Thompson Financial, in 2003, 29 billion (Euros) of venture capital were invested in Europe, while only 18 billion (US dollars) VC were invested in the US. In terms of funding commitments, 20 billion (US dollars) were raised in US, less than the 27 billion (Euros) raised in Europe. These latest industry statistics illustrate the growing significance of the European VC industry and the immediate need to understand its performance. A few existing studies on the European VC industry (see Healy [1991], Sapienza, Manigart, and Vermeir [1995], and Martin, Sunley, and Turner [2002]) are descriptive in nature and largely focused on the structure and raw statistics of the industry.

Second, despite the importance of venture capital in entrepreneurial financing, very little attention has been paid to risk and return performance of this alternative investment vehicle. Prior research in the US and UK venture capital industry, pioneered by Barry et al. [1990], Lerner [1994, 1995], Gompers [1995, 1996, 2000], Gompers and Lerner [1998, 1999], and Brav and Gompers [1997], has examined the economics of the venture capital cycle (including venture capital fundraising, investing, and exiting), focusing on the mechanics of the venture capital industry. Available evidence on the investment performance of venture capital funds has been limited to a small number of descriptive studies (Bygrave and Tymmons [1992], Wright and Robbie [1998], and Moskowitz and Vissing-Jorgenson [2000]) and some raw figures on Investment Horizon Performance produced by Venture Economics. Exhibit 1 illustrates aggregate source of VC in US and Europe for the past two decades. While pension funds (21.2%) and endowments (18%) play a dominant role in supplying capital to venture capital funds in the US, corporations (20%) and Banks (18.2%) represent the largest institutional investors in European VCs. The US is certainly more investment driven and less

bank-centered in comparison with Europe (see Black [1998]). High net-worth individuals are important sources of capital for venture capital, but the dominant venture capital investors are clearly the institutional investors. This is true in both US and Europe, although their sources of VC institutional funding are dramatically different. Given that most institutional investors invest in public equity through the stock market and diversify their portfolios by investing in venture capital funds, the market risk-adjusted performance of venture capital funds in US or Europe should be of great concern to global institutional investors.

II. Data

Data on the US and European venture capital funds are obtained from the Venture Economics database. We use the time-weighted quarterly returns from 1993 to 2003 in comparing the risk and return characteristics of VC funds in US and Europe.[1] Time-weighted return calculates a return for each quarter using net asset value at the beginning and end of period and cash flows to and from the fund's investors between periods. Capital contributions (also called "takedowns" or "capital calls") are treated as negative cash flows, while distributions are treated as positive cash flows. The Net Asset value (NAV) reflects the value of the portfolio companies and is net of fees and carried interest and treated as terminal value. Since portfolio companies of venture capital funds are not traded in the market, periodic NAVs and returns are heavily dependent on valuations. These returns are also under the assumptions that money can come and go freely at the beginning and end of each period, although in practice, venture capital funds are illiquid investments with a typical investment horizon of 7 to10 years. When a venture capital fund cashes out of a certain portfolio company through an IPO or acquisition by another company, it is called exit or divestment. Successful venture capital exits through IPOs and M&As bring returns and liquidity to a venture capital fund, but it is still much more illiquid relative to public equity portfolio with securities traded in the secondary market.

Three types of time-weighted returns are obtained from Venture Economics: pooled (portfolio return by pooling cash flows across all sample funds during the period), average (arithmetic mean return across all sample funds during the period), capital-weighted (portfolio return weighted by fund size). The pooled return is calculated by treating all funds as a single "fund" by summing their monthly cash flows together. This cash flow series is then used to calculate a rate of return. This method implicitly would create an investment-weighted return and most closely matches the method that many investors used in measuring the return on their portfolio. Similar to a market-value weighted index in the equity market, this pooled method is considered the most appropriate method for presenting the aggregate performance of private equity funds.

For stock market benchmarks, we use the MSCI (Morgan Stanley Capital International) indices that match the venture capital funds' target markets. MSCI indices are widely used benchmarks for global portfolio managers. MSCI uses a consistent and transparent index construction and maintenance methodology, ensuring accurate representation of each country or region's underlying industry group distribution and market capitalization. The quarterly MSCI US gross return index (including both price return and dividend return) and MSCI Europe gross return index are used as the stock market return indicators in this study.

Table II presents the descriptive statistics for the U.S. and European venture capital funds and public equity indices. The mean pooled VC return in the US, is 4.86% on a quarterly

[1] We exclude earlier data due to the small sample size of European VC funds prior to 1993.

basis from 1993 to 2003. This is more than 4 times the corresponding VC return average (1.15%) in Europe. However, the standard deviation of pooled VC return in the US is only 1.3 times the standard deviation in Europe, resulting in a US VC Sharpe ratio that is more than three times higher than that in Europe. Although pooled, average and capital-weighted VC returns offer different statistics, the resulted Sharpe ratios computed based on all three methods (see Table III) show that the US VC returns have higher Sharpe ratios in comparison with Europe during the same period.

Table IV describes the investment horizon performance of US and European VC funds as of December 2003. On a raw return basis, the five-year, ten-year and twenty-year investment horizon performance of US VC funds is significantly better than that of the European VC or the US stock market. The three-year investment horizon performance of US VC, however, is worse than either the European counterpart or the US stock market. Table V presents the correlation matrix between VC returns and stock market returns in both US and Europe. The US VC returns show a much stronger correlation with the public equity market returns than the case in Europe.

III. Model and Empirical Results

Our analysis of venture capital performance uses three models for comparison.

$$\text{Model 1: } R_{jt} = \alpha_{1j} + \beta_j R_{mt} + \varepsilon_{jt} \qquad (1)$$

$$\text{Model 2: } R_{jt} = \alpha_{2j} + \beta_{1j} R_{mt} + \beta_{2j}(R_{mt} \times D_t) + e_{jt} \qquad (2)$$

$$\text{Model 3: } R_{jt} = a_{3j} + \beta_{3j} R_{mt} + \rho R_{j,t-1} + \delta_{jt} \qquad (3)$$

where R_{jt} is the excess return on venture capital fund index j in quarter t and R_m is the excess return on the market benchmark index. D is a dummy variable that equals -1 during the declining markets (i.e., $R_m < 0$) and 0 otherwise.

Model 1 is the traditional Capital Asset Pricing Model (CAPM), which conditions the excess return of the venture capital fund on the excess return of the overall stock market index. Model 2 is the market-timing model developed by Henriksson and Merton (1981) and Merton (1981), to separate fund managers' broad market macro-forecasting (market-timing) ability from their micro-forecasting (security selection) ability. Model 2 is widely used in researches on the mutual fund and hedge fund performance [Henriksson (1984) and Fung, Xu and Yau (2002)]. Model 3 is the adjusted CAPM model with an added autoregressive (AR) term.

Table VI reports the regression results for the above three models. Panels A and B present the model estimates for venture capital funds in US and Europe, respectively. The US pooled venture capital excess returns have a highly significant and positive beta (0.839) with the stock market excess returns, while the market risk-adjusted excess return (alpha) is 3.273% for the pooled venture capital returns. Results from European VC in Panel B show a different pattern. The beta with the Europe MSCI stock market index is only 0.293, while the alpha is only 0.765%. Although the regression estimates vary when using the average or capital-weighted VC returns, the relative pattern between US and European VC performance are robust

regardless of the computation method: US dominates Europe in both market-risk adjusted return and co-movement with the stock market.

Estimates from model 2 indicate that the venture capital funds in the US are not significantly different in its co-movement with the stock market during up and down markets, as evidenced by the insignificant β_2 estimates. The European VC returns, however, show marginally negative market timing performance as evidenced by the negative and slightly significant β_2 coefficients. Model 3 estimates indicate that the VC fund excess returns have positive first order autocorrelation in both US and Europe, with the exception of the pooled US VC excess returns. This autocorrelation pattern could be largely induced by the illiquid nature of VC capital investments.

The launch of the "new market (nm)" for European public equity capital, formally called Euro.NM, was launched in 1997. The Euro.NM, similar to that of NASDAQ in the US, is a circuit of stock exchanges that intend to attract the listing of growth and innovative high-tech company stocks. The development of Euro.NM has spurred the development of VC in Europe and provided a better environment for venture capital funds to exit their investments to the public equity market through IPOs. We hypothesize that the VC performance in the post-Euro.NM period be more closely tied to the public equity market, in comparison with the pre-Euro.NM period.

To test the above hypothesis, we split the sample in to pre- (1993-1997) and post- (1997-2003) Euro.NM periods. Table VII shows a dramatic difference in VC betas between the two periods in Europe. The European VC return has insignificant relationship with the stock market return in the pre-Euro.NM period, while the relationship is very strong in the post-Euro.NM period. Such pattern is robust regardless of the use of pooled, average or capital-weighted European VC returns. Same split sample analysis is performed on the US, but no significant difference between the two periods can be found in terms of comovement between VC and stock market returns. This is consistent with expectation since NASDAQ has been in existence long before the start of the sample period.

IV. Conclusion

Using quarterly data from 1993 to 2003, this paper examines and compares the return and risk performance of venture capital funds in US and Europe. Several results are noteworthy. First, pooled venture capital returns in US and Europe are 3.273% and 0.765% (on a quarterly basis) above the CAPM risk-adjusted returns, respectively. As noted in Xu (2004), these results may be subject to biases due to potential income smoothing in the reporting process, illiquidity of private equity investments, and heterogeneity of fund returns.

Second, during the sample period, the US venture capital fund performance dominates that of Europe in all return performance measures: mean return, total-risk adjusted return (Sharpe ratio), and market-risk adjusted return (alpha). Figure 1 illustrates the efficient allocation between public equity and venture capital (private equity) in US and Europe. The optimal risky portfolio in US includes 66.78% venture capital and 33.22% public equity if investors are able to realize the pooled VC return, whereas the VC portion is only 25.7% in an optimal risky portfolio in Europe.

Third, our study indicates that the linkage between US VC fund performance and the US stock market is much stronger than the co-movement between excess returns on European VC and European stock market. Further analysis shows that the introduction of Euro.NM

(high-tech friendly stock market in Europe) in 1997 has substantially enhanced the relationship between the private and public equity performance in Europe.

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Table I

Source of Venture Capital Funds in US and Europe (1980 to 2003)

Investor Type	US	Europe
Banks	7.2%	18.2%
Insurance Companies	5.8%	7.0%
Corporations	15.5%	20.0%
Pension Funds	21.2%	14.8%
Individuals	15.9%	15.4%
Endowments	18.0%	3.7%
Intermediaries	7.5%	13.8%
Foreign Investors	4.6%	2.8%
Others	4.3%	4.3%

Table II

Descriptive Statistics of Quarterly Venture Capital Returns: 1993-2003

Statistics	Pooled Fund Return	Average Fund Return	Capital-weighted Fund Return	Risk Free Rate	Stock Market Return	Pooled Fund Excess Return	Average Fund Excess Return	Capital-weighted Fund Excess Return	Stock Market Excess Return
Panel A. US									
Mean	5.85	1.53	2.38	1.00	3.02	4.86	0.53	1.38	2.03
Std Dev	14.30	6.93	7.49	0.40	8.64	14.14	6.74	7.30	8.61
Skewness	2.23	0.01	0.23	-0.78	-0.35	2.28	0.00	0.25	-0.31
Kurtosis	9.66	0.73	0.70	-0.79	0.23	9.98	0.90	0.83	0.14
Median	4.80	2.00	3.70	1.15	3.50	3.85	1.27	2.45	2.30
Minimum	-16.60	-13.20	-11.90	0.23	-17.27	-18.04	-14.64	-12.56	-17.68
Maximum	71.70	21.10	24.80	1.50	21.90	70.40	19.80	23.50	20.80
Panel B. Europe									
Mean	2.25	0.65	0.55	1.10	2.92	1.15	-0.45	-0.55	1.82
Std Dev	10.92	6.73	7.28	0.45	10.10	10.74	6.51	7.07	10.05
Skewness	0.53	0.39	0.15	-0.72	-0.50	0.51	0.43	0.18	-0.46
Kurtosis	0.86	-0.62	-0.63	-0.91	0.76	0.99	-0.53	-0.59	0.64
Median	1.30	0.00	0.40	1.30	3.79	-0.08	-1.07	-0.99	2.44
Minimum	-22.30	-10.80	-13.30	0.26	-23.80	-23.68	-11.58	-13.64	-24.24
Maximum	35.10	14.50	16.10	1.68	23.28	33.74	12.97	14.67	21.76

Note: All statistics are in percentage. Excess Returns are computed as raw returns minus the risk free rate.

Table III

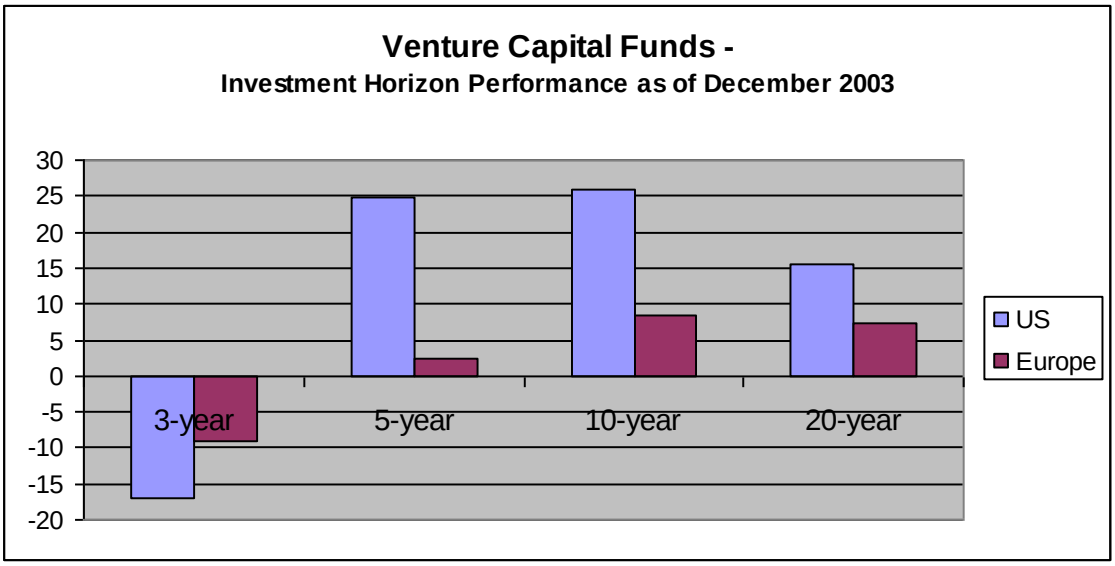
Sharpe Ratios of Quarterly Venture Capital Returns: 1993-2003

	Pooled VC Fund	Average VC Fund	Capital-weighted VC Fund	Stock Market
US	0.34	0.08	0.19	0.24
Europe	0.11	-0.07	-0.08	0.18

Table IV

Investment Horizon Performance as of December 2003

	3-year	5-year	10-year	20-year
US Venture Capital	-16.9	24.7	25.8	15.6
MSCI – US Stock Index	-4.2	-1.2	11.2	13.0
European Venture Capital	-9.0	2.3	8.3	7.2
MSCI – Europe Stock Index	-10.6	-1.8	7.6	11.8



Note: All statistics are in percentage.

Table V

Correlation Matrix: 1993-2003

	US VC Pooled Excess Return	US VC Average Excess Return	US VC Capital Weighted Excess Return	US Stock Market Return	European VC Pooled Excess Return	European VC Average Excess Return	European VC Capital Weighted Excess Return	Europe Stock Market Return
US VC Pooled Excess Return	1							
US VC Average Excess Return	0.91**	1						
US VC Capital Weighted Excess Return	0.92**	0.97**	1					
US Stock Market Return	0.51**	0.59**	0.60**	1				
European VC Pooled Excess Return	0.60**	0.64**	0.64**	0.33**	1			
European VC Average Excess Return	0.63**	0.71**	0.67**	0.31**	0.70**	1		
European VC Capital Weighted Excess Return	0.68**	0.78**	0.74**	0.33**	0.76**	0.91**	1	
Europe Stock Market Return	0.52**	0.58**	0.57**	0.88**	0.27*	0.33**	0.37**	1

** Significant at 5%; * Significant at 10%

Table VI

Relationship between Venture Capital Excess Return and Benchmark Stock Market Excess Return

$$\text{Model 1: } R_{jt} = \alpha_{1j} + \beta_j R_{mt} + \varepsilon_{jt} \quad (1)$$

$$\text{Model 2: } R_{jt} = \alpha_{2j} + \beta_{1j} R_{mt} + \beta_{2j}(R_{mt} \times D_t) + e_{jt} \quad (2)$$

$$\text{Model 3: } R_{jt} = a_{3j} + \beta_{3j} R_{mt} + \rho R_{j,t-1} + \delta_{jt} \quad (3)$$

where R_{jt} is the excess return on venture capital fund index j in quarter t and R_m is the excess return on the market benchmark index. D is a dummy variable that equals -1 during the declining markets (i.e., $R_m < 0$) and 0 otherwise.

Panel A: US Venture Capital Quarterly Returns: 1993-2003

Dependent Variable: US Venture Capital Fund Index Excess Return (Pooled)

	Constant	R_{mt}	$R_{mt^*}D$	$R_{j,t-1}$	F test	Adjusted R^2
Model 1	3.273*	0.839**			14.48**	24.3%
	(1.68)	(3.81)				
Model 2	4.210	0.712*	-0.274		7.16**	22.7%
	(1.34)	(1.78)	(-0.38)			
Model 3	2.704	0.842**		0.314	8.43**	26.1%
	(1.38)	(3.87)		(1.42)		

Dependent Variable: US Venture Capital Fund Index Excess Return (Average)

	Constant	R_{mt}	$R_{mt^*}D$	$R_{j,t-1}$	F test	Adjusted R^2
Model 1	-0.364	0.460**			21.58**	32.9%
	(-0.42)	(4.65)				
Model 2	1.553	0.200	-0.561*		13.04**	36.4%
	(1.15)	(1.16)	(-1.82)			
Model 3	-0.803	0.463**		0.242**	15.54**	40.9%
	(-0.96)	(4.98)		(2.56)		

Dependent Variable: US Venture Capital Fund Index Excess Return (Capital-weighted)

	Constant	R_{mt}	$R_{mt^*}D$	$R_{j,t-1}$	F test	Adjusted R^2
Model 1	0.413	0.508**			23.01**	34.4%
	(0.44)	(4.80)				
Model 2	1.875	0.310	-0.428		12.48**	35.3%
	(1.27)	(1.64)	(-1.27)			
Model 3	-0.045	0.511**		0.253**	16.06**	41.8%
	(-0.05)	(5.12)		(2.49)		

Table VI (Continued)

Panel B: European Venture Capital Quarterly Returns: 1993-2003

Dependent Variable: European VC Capital Fund Index Excess Return (Pooled)

	Constant	R_{mt}	$R_{mt^*}D$	$R_{j,t-1}$	F test	Adjusted R^2
Model 1	0.765	0.293*			3.34*	5.3%
	(0.47)	(1.83)				
Model 2	3.702	-0.086	-0.761		3.00*	8.7%
	(1.51)	(-0.30)	(-1.59)			
Model 3	0.282	0.307**		0.287*	3.42**	10.3%
	(0.18)	(1.96)		(1.82)		

Dependent Variable: European VC Fund Index Excess Return (Average)

	Constant	R_{mt}	$R_{mt^*}D$	$R_{j,t-1}$	F test	Adjusted R^2
Model 1	-0.581	0.226**			6.15**	10.9%
	(-0.63)	(2.48)				
Model 2	1.246	-0.009	-0.474*		4.77**	15.2%
	(0.90)	(-0.06)	(-1.75)			
Model 3	-0.984	0.238**		0.239**	7.51**	23.7%
	(-1.13)	(2.81)		(2.80)		

Dependent Variable: European VC Fund Index Excess Return (Capital-weighted)

	Constant	R_{mt}	$R_{mt^*}D$	$R_{j,t-1}$	F test	Adjusted R^2
Model 1	-0.886	0.270**			7.14**	12.8%
	(-0.86)	(2.67)				
Model 2	1.121	0.011	-0.520*		5.26**	16.9%
	(0.73)	(0.06)	(-1.74)			
Model 3	-1.380	0.284**		0.293**	9.45**	28.7%
	(-1.47)	(3.11)		(3.19)		

Note: The t-statistics in parentheses are computed using White's heteroskedasticity-consistent variance-covariance estimator.

** Significant at 5%; * Significant at 10%

Table VII

Relationship between Venture Capital Excess Return and Benchmark Stock Market Excess Return: Before and After Euro.nm:

$$R_{jt} = \alpha_{1j} + \beta_j R_{mt} + \varepsilon_{jt}$$

where R_{jt} is the excess return on venture capital fund index j in quarter t and R_m is the excess return on the market benchmark index.

Panel A: US Venture Capital Quarterly Returns: 1993-1997 and 1998-2003

	Constant	R_{mt}	F test	Adjusted R^2
Period 1: 1993-1997 (Before Euro.NM)				
Pooled	3.368**	0.722**	10.35**	33.0%
	(2.59)	(3.22)		
Average	1.719**	0.249	2.52	7.4%
	(1.90)	(1.59)		
Capital-weighted	1.999**	0.505**	9.05**	29.8%
	(2.06)	(3.01)		
Period 2: 1998-2003 (After Euro.NM)				
Pooled	3.340	0.858**	7.24**	21.4%
	(0.99)	(2.69)		
Average	-1.495	0.457**	11.95**	32.3%
	(-1.07)	(3.46)		
Capital-weighted	-0.984	0.468**	11.00**	30.3%
	(-0.66)	(3.32)		

Panel B: European Venture Capital Quarterly Returns: 1993-1997 and 1998-2003

	Constant	R_{mt}	F test	Adjusted R^2
Period 1: 1993-1997 (Before Euro.NM)				
Pooled	3.835	-0.178	0.14	-4.8%
	(1.27)	(-0.37)		
Average	0.956	-0.019	0.00	-5.5%
	(0.54)	(-0.07)		
Capital-weighted	1.845	-0.012	0.00	-5.5%
	(1.18)	(-0.05)		
Period 2: 1998-2003 (After Euro.NM)				
Pooled	-0.639	0.332**	3.79*	10.8%
	(-0.31)	(1.96)		
Average	-1.636	0.227**	5.08**	15.1%
	(-1.31)	(2.25)		
Capital-weighted	-2.593*	0.266**	5.19**	15.4%
	(-1.79)	(2.28)		

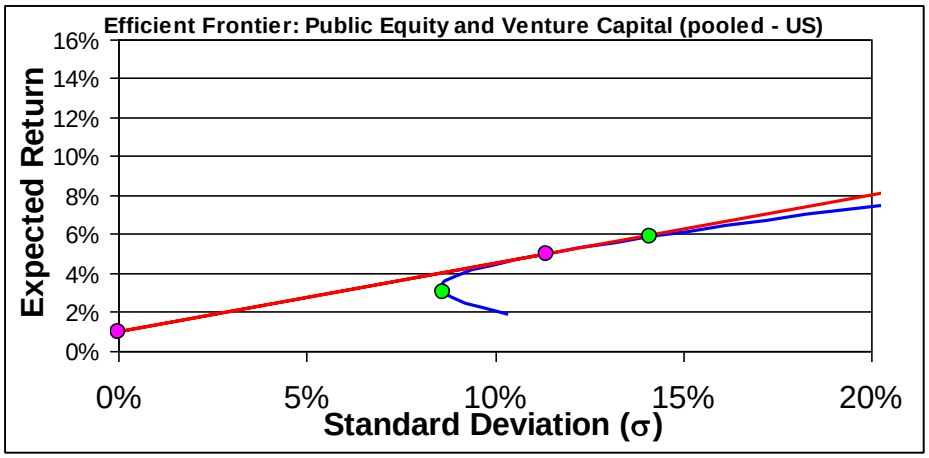
Note: The t-statistics in parentheses are computed using White's heteroskedasticity-consistent variance-covariance estimator.

** Significant at 5%; * Significant at 10%

Figure 1

Efficient Frontiers: Optimal allocations between stocks and venture capital

Panel A. US



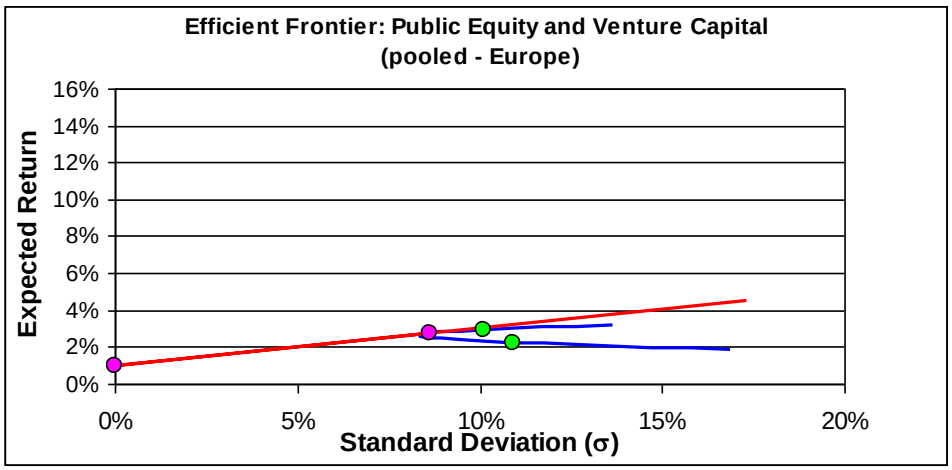
Proportion in stocks: 33.22%

Proportion in Venture Capital (using pooled return): 66.78%

Expected Return of the optimal risky portfolio: 4.4%

Standard Deviation of the optimal risky portfolio: 8.2%

B. Europe



Proportion in stocks: 74.3%

Proportion in Venture Capital (using pooled return): 25.7%

Expected Return of the optimal risky portfolio: 2.7%

Standard Deviation of the optimal risky portfolio: 8.7%