CHAPTER 8

Externalities, Consumers' Surplus, and the Long-Term Return on Investments by VC Funds

Abstract All the literature that deals with the definition of the measurement of the return on the investment in VC funds measures the return to the LPs over the relevant horizon of VC funds. Most measurements show insufficient risk-adjusted return. We show that this is an incomplete measurement. A complete measurement should take into account externalities due to spillovers that increase the return on the total portfolio held by institutional investors that allocate capital to VC funds. There is a difference between the return to the LPs in a VC fund and the returns to the institutional investors that invested the capital through the LP. The total long-term return to the institutional investors is congruent with the total return to the beneficiaries, in terms of their long-term consumption.

Keywords Return on investment externalities

8.1 Introduction

The modern valuation model is derived on the basis of a complete and perfect market. The main assumption is that investors are holding a well-diversified portfolio, called the market portfolio. The return and the risk of any given financial asset is measured relative to the risk and return relation of the market portfolio. The well-known capital asset pricing model (CAPM) is an example of the measurement of the risk and return of specific assets relative to the market. In the case of the return on

T. Agmon, S. Sjögren, *Venture Capital and the Inventive Process*,
DOI 10.1057/978-1-137-53660-0_8

Table 8.1 US VC funds pooled return compared to public market returns, 2014

Index	*5 years*	*15 years*	*20 years*
US VC funds	16.07	4.84	35.44
S&P 500	15.34	6.21	9.36
NASDAQ	16.97	5.85	10.85

Source: Cambridge Associates (2014)

VC funds, this is often practiced by comparing the measured return on a sample of VC funds to the return on an equity index like the S&P 500 for the same period. A recent example is provided by Cambridge Associates (2014). The data compiled and published by Cambridge Associates compares the pooled return of U.S. VC funds over various length periods to the return on S&P 500 and NASDAQ over the same periods. Table 8.1 below presents the commuted returns for durations of 5, 15, and 20 years.

In a different study of the return on investment by about 1500 VC funds over the period 1996–2005, Smith, Pedace, and Sathe (2010) reported an average return on the total investment of 13.7% with a standard deviation of 37%. The data suggests a high risk on the investment in VC funds by institutional investors and others represented by LPs in VC funds. Moreover, unlike the measurement of the return on other asset classes like equity which is done on the basis of short period, the relevant horizon of VC funds is measured in years in which there are inflows and outflows of capital. As was discussed in earlier chapters, VC funds are the financial market's response to specific planned intervention by the government, with the purpose of promoting radical ideas in technology.

8.2 The Controversy About the Return on Investment in VC Funds

In a publication titled, "Venture Capital Outperformed Major Stock Indices during Third Quarter of 2014" (January 30th 2015), Bobby Franklin, President and CEWO of NVCA, states, "*Driven by a strong exit market for VC backed companies on the cutting edge of innovation, venture capital continues to prove its worth as investible and strong performing asset class*" (p. 1). In a Harvard Business Review (2013), Diane Mulcahy, one of the authors of the Kauffman Foundation report on VC funds says, *"Although*

investors in VC funds take on high fees, illiquidity and high risk, they rarely reap the reward of high returns" (p. 1). The two quotes demonstrate the controversy about the return on investment in VC funds by the providers of the capital, the LPs of the VC funds. The academic literature on the valuation of VC funds based on the return to capital invested in VC funds is inconclusive. Harris, Jenkinson, and Kaplan (2014) conducted a thorough study on the return on the investment in PE funds and in VC funds. They reported that investment in the top one-half of VC funds since the 1990s yielded appropriate return relative to the relevant public market equivalent (PME). They also reported that the investment in VC funds in the 1990s yielded above PME returns whereas investment in VC funds in the 2000s yielded below PME return. As the authors of the study say, institutional investors have no ability to choose the better-performing VC funds as this is determined at the end of the life of the funds. Therefore, the appropriate measure for the evaluation of the return on the capital invested in VC funds is the average return over all funds over their horizons. Kaiser and Westarp (2010) provide an analysis of the distribution of the returns on investment of LPs in VC funds. Kaiser and Westarp show that unlike the bell-shape distribution of returns on capital assets at large, the return on the capital invested in VC funds by LPs is highly skewed. The pooled average annual return in their sample is 15.9%, but more than half of the VC funds in the sample report return between 0% and (–100%), about 10 % of the VC funds in this period have reported returns of more than 40% and about 5% of the VC funds in the sample reported annual return of more than 100%. This data is also consistent with the data reported in the Kauffman Report (Kauffman Foundation, 2012). The authors of the Kauffman Report used the data of the Kauffman Foundation, an investor in VC funds in the U.S. The Kauffman Report is based on a sample of 100 VC funds. Only 20 of the 100 VC funds in the sample reported return that exceeds the relevant PME by 3% or more. 10 of these funds were founded before 1995. (This is consistent with data reported from a bigger sample by Harris et al., 2014). 62 of the VC funds in the Kauffman Report sample reported return below the relevant PME. In the sample, 30 VC funds were large VC funds, above $400 million. Only four of these VC funds yielded return above the return on the small-cap common stock index for the same period.

Yet, even in the face of what seems to be less than expected return considering the risk and the illiquidity and what look like negative sentiment institutional investors continue to invest in VC funds. The reason for

the investment in VC funds is that the measurement of the return to the capital invested in VC funds as the return to the LPs is incomplete. The missing return is the result of externalities that accrue to the institutional investors, but not directly to the LPs in the VC funds. The externalities come from the specific and different nature of the assets in which VC funds invest. The nature of the assets and how they affect the valuation of VC funds is discussed in the next section.

8.3 The Specific Risk of Assets Based on Radical Ideas

In earlier chapters, we referred to investments by VC funds as investments in "assets in process". Sudarsanam, Sorwar, and Marr (2003) present a map of what they call "knowledge assets". They distinguish between "structural resources" and "stakeholders' resources" where the former reflects the intellectual assets of the organization and the latter reflects the intellectual assets owned by individuals. Sudarsanam et al. argue that in the knowledge economy there is a process whereby the "stakeholders resources" are becoming "structural resources". A possible way to interpret this model is that ideas are becoming assets, similar to "assets in process". In almost all asset classes, institutional investors and other managers of savings (including foundations) select assets out of existing asset "inventory". VC funds invest in import new assets to the market by making new radical stakeholders' assets into structural assets. The addition of new assets to the market by IPOs of VC backed company is small relative to the stock of existing assets. However, over the years the number of assets in the market portfolio that began as VC backed IPOs is growing. An example is the NASDAQ with a total value of $6.5 trillion in 2104. The added value from IPO that year was about $22 billion.

The difference in the process of investment between assets based on radical ideas and assets already traded in the market is expressed by a different probability distribution of the future cash flows to be generated by them. Financial intermediaries that manage investment for households (savers) act as if they hold a well-diversified portfolio and they measure risk relative to the market portfolio. The market portfolio and therefore the measured risk (defined in the finance literature as systematic risk) represents the existing portfolio. The assets in which VC funds invest are different. The process of turning radical ideas into assets

Table 8.2 Statistics of the distribution of success measures given exit, 1996–2005

Measure	*Mean*	*Median*	*Skew*
Internal rate of return (IRR) (%)	13.7	9.6	5.7
Cash on cash (multiple)	1.79	1.29	8.48

Source: Smith et al. (2010)

traded in the market can be described by a binomial probability distribution. There are two stages in the process: first, the investment is either successful or not. Successful investment by VC funds ends with an exit (either an IPO or an acquisition). Unsuccessful investment ends with no exit. Data presented in Chap. 2 shows that a substantial proportion of investment projects by VC funds end with no exit. Given an exit, there is a distribution of value generated by the exit. Unlike the return on the already existing assets in the capital market, the probability distribution of value generated by exits of VC funds is not symmetric. Smith et al. (2010) estimated the distribution of outcomes given exit for a sample of 1258 VC funds for IRR and 1438 for cash on cash ratio[1] or investment multiples at the time of the exit. In Table 8.2 below, we present the statistics for the distribution of the measures of success given exit in the Smith et al. study.

The distribution reported by Smith et al. continues in later years. In 2012 the value of the top 38 VC- backed IPOs was slightly more than $100 billion. The range of the values of this group was between $56.9 billion (Facebook) and $45 million (Envivio). The mean value was $2.64 billion and the median was $798 million: a highly skewed distribution. In the following section, we will see that the nature of the distribution of value, given success, is functional and it is the result of the contract between the GPs and the LPs of VC funds. Once the "new assets" join the market portfolio the probability distribution of the returns become congruent with the common risk-return relations in the market. In terms of asset class, successful IPOs are no longer part of VC funds' asset classes and become part of the equity market.

Ritter (2014) reports price behavior of shares issued by new companies through IPOs relative to price behavior of shares of comparable companies who have been listed on public stock exchanges in the U.S. for at least five years. In Table 8.3 below, we bring Ritter's data on a comparison between the 1st day return of the new IPOs and the three-year buy and hold return (BHR) on the new IPOs that survived for three years relative

Table 8.3 A comparison between VC backed new IPO and non-VC new backed IPOs 1980–2012

Company	*IPO (number of)*	*Average first day return*	*Buy-and-hold return 3 Years comparable*
VC backed	2773	24.8	0.6
Non-VC backed	4927	12.6	(11.6)

Source: Ritter (2014)

Table 8.4 The volatility of VC backed 1st day return and 3 years BHR by sub periods 1980–2012

	1980–1989	*1990–1998*	*1999–2000*	*2001–2012*
Number of IPOs	518	1258	517	480
First day return (%)	8.5	17.4	81.4	16.2
3 years BHR				
Comparable return (%)	14.9	25.8	(61.7)	(14.0)

Source: Ritter (2014)

to comparable already listed companies that were listed for at least 5 years. The comparison is done based on market cap and book-to-market ratio.

VC-backed returns were volatile. In periods of high exit return as measured by the average first day return, the comparable three-year BHR was low. The comparable three-year BHR of non-VC- backed new IPOs behaves in an opposite manner. This data is presented in Table 8.4 below.

The data presented in Table 8.4 show great volatility in the first-day return and the return over time (three-year holding period). High first day return was adjusted by a decline over the longer holding period return.

8.4 The Risk Preferences of GPs, LPs and the Beneficiaries of Institutional Investors

A common assumption in economics is that the welfare of the individual is the objective of the economic system. Intermediaries in institutional investors and instruments of institutional investors like VC funds are supposed to serve this goal. Yet, managers of financial institutions like pension funds and specific financial intermediaries like VC funds are individuals,

and individuals may and do have different preferences. The preferences of households (savers) were discussed in Chap. 7 in the context of the life-cycle savings model. In general, it is assumed in economics and finance that individuals behave as if they are risk-averse. Yet, there are dynamic situations where allocating small portion of savings for investment in a risk-loving fashion is congruent with a long-term maximization of utility. Friedman and Savage (1948) discuss such behavior in the context of lotteries. Under contracts with payoffs that encourage risk taking, risk-averse individuals may make investment decisions resembling a risk loving behavior. VC funds in high-risk projects with a binomial probability distribution of success (e.g., either no success or a skewed probability distribution given success) is an example of the behavior described and discussed by Friedman and Savage. In this case the motivation of GPs to select projects for investment on the basis of maximizing return conditional on success is an outcome of their contract with the LPs in the framework of VC funds. This point was discussed in Chap. 6.

The preferences of the managers of institutional investors and other managers of savings reflect their fiduciary obligations to their beneficiaries and, in case of public pension funds, they have obligations to society at large as well. CalPERS, the largest pension fund in the U.S. publishes its investment objectives. We use CalPERS, an example for risk preferences and investment policies for all institutional investors. CalPERS is the largest pension fund in the U.S. and the largest single investor in VC funds in the U.S. and the global markets. The Board of CalPERS states that: *"The overall objective of CalPERS investment program is to generate returns at an appropriate level of risk to provide members and beneficiaries with benefits as required by law"* (CalPERS, 2015, p. 3). The risk and the return are measured in terms of the portfolio of all the assets. Large institutional investors like CalPERS used to say that due to their size (CalPERS' portfolio exceeds $300 billion) they mimic the market. Yet, CalPERS considers the long-term implications of current investment decisions. In an appendix titled, "Investment Beliefs" the Board of CalPERS states that the investment policy of CalPERS is long-term and that the fund "*considers the impact of its actions on future generations of members and taxpayers*" (CalPERS, 2015, Appendix 3). One can say that large institutional investors act as risk-averse investors in the context of the current market portfolio, but they are willing to invest in higher risks to increase the welfare of future generations. They do that by investing in VC funds. We will see in the next section that the long horizon and

the potential additions to the market portfolio affect the return on their investments in VC funds.

The preferences of GPs of VC funds are different. As was discussed in Chap. 6, the contract between GPs and LPs is aimed at creating payoff for the GPs, a payoff that will make GPs looking for the highest potential return give success of a project almost regarding of the probability of success. GPs are looking for projects that, if successful, will yield IPO value like Facebook and not like Envivo even if the expected value of Envivo prior to the investment was higher than that of Facebook.

8.5 Direct and Indirect Considerations in Measuring the Return on Investment by Institutional Investors in VC Funds

The most important difference in measuring the return on the investment of VC funds from the point of view of the partners of VC funds and providers of capital to VC funds is the length of the horizon. Limited partners and general partners of VC funds are contractually bound by the horizon of the funds. There is a difference between the GPs and the LPs in VC funds. GPs (also referred to as Venture Capitalists) are usually organized as limited liabilities companies. Most if not all GPs want to raise a number of consecutive VC funds. Sequoia, the biggest GP firm (VC firm) in the U.S. has raised more than $6 billion over the years since its foundation in 1972 and has managed many VC funds in the U.S. and globally. Therefore GPs (VC firms) have no limited horizon. LPs in VC funds are legal structures set up as instruments to invest money and they do not have any objectives different than the objectives of the institutional investors that set them up. Institutional investors have long horizons congruent with the average duration of their obligations to their beneficiaries. The difference in the horizon makes the measurement of the return on investment in VC funds different for the providers of the capital (represented in VC funds by LPs) and the GPs of VC funds. Consider the following simple example: assume a two-period world. Investment takes place in the first period. The outcomes of the investment are received in the second period. There is one institutional investor that manages savings for all consumers and one VC fund. The VC fund raised $1000 from the institutional investor and invests it all in one start-up with a probability of success p. If successful the start-up will go public at a market value of $3000. The GP of the

VC fund will receive 20% of the profits of the VC fund. The existing companies in the economy issue equity. The institutional investor holds equity in all the companies relative to their weight in the market portfolio. After the IPO the startup become a part of the market portfolio and it is traded in fair market price relative to its expected return and its systematic risk. Assume further that the new company is based on a radical idea that contributes to economic growth. From the point of view of the economy the success of the VC-backed start-up is similar to a successful R&D operation by the economy. Nadiri (1993) summarizes the literature on the return on investment in R&D by incumbent companies and on the spillover of R&D in one industry on the profits of other unrelated industries. Nadiri reports that the spillovers are substantial and range from 20% to 110% with an average of about 50% relative to the contribution of the R&D to the industry that invests in the R&D. Assume that the new start-up after successful IPO generates spillover value equal to 10% of its value at the IPO. Given this assumption, it is possible to compute the return on the successful investment to the GP of the VC fund and to the provider of the capital the institutional investor.

- The return to the LPs:
  Given the simplifying assumption of the example above the LPs invest $1000 and realize value of $3000 one year later. The LP paid the GP a carryover of 20% of their profits: $(\$2000)\times 20\% = \$400$. The after carry over profits of the LP was $1600, an annual IRR of 160%, or cash-on-cash of $\$2600/\$1000 = 2.6X$.
- The return to the institutional investor:
  As was discussed above, the LPs are an instrument of the institutional investor and the profit of $1600 go to the institutional investor. However, the institutional investor holds the market portfolio. The IPO of the successful investment of the VC fund was added to the market portfolio. The new addition to the market portfolio increases its value by 10% of the increase in the value of the VC fund, $\$2000\times 0.1 = 200$. This value is part of the return on the investment of the institutional investor on its investment in the VC fund. The total return on the investment of the institutional investor in the VC funds is equal to the direct return accrued to the LP after fees plus the externalities (spillover effect) of the success of the investment by the VC fund. In the example this is equal to: $\$2000-(\$2000\times 0.2)+(\$2000\times 0.1) = \$1800$

- The return to the GP:
  Given our simple two period model the GP can raise only one fund. Therefore its return is directly related to the profits of the VC funds without the externality. In the example described above the payment to the GP is $2000 \times 0.2 = 400$.

Measuring only the direct return to the LPs after fees as the total return to the providers of the capital is incomplete measurement. This is so as the institutional investor realizes additional return through the spillover effect over the measured return by the LPs in the VC fund. All the literature on the return on investment in VC funds focuses on the direct return to the LPs after management fees and carries over payments to GPs. There is an incongruity between insufficient risk-adjusted return over long periods of time like those reported by Harris et al. (2014), Smith et al. (2010), and the Kauffman Report (Kauffman Foundation, 2012) and further discussed in Hall and Lerner (2009) and the continuous investments in VC funds. The reported return on total investment by institutional investors in all VC funds is not high enough to pay for the risk. Institutional investors continue to allocate capital to VC funds by mimicking the market and reducing the free rider problem. Moreover, the continuous investment by institutional investors in VC funds is explained by the added indirect return due to positive externalities.

Required return is specified in terms of risk and return by measures like risk-adjusted return. Successful investment by VC funds may change the risk as well as the return in the market. The risk and the return effect relates to the transition of the asset from the "outside" to the "inside" of the market. Before the exit, there is still a high probability $(1 - p)$ that the investment of the VC funds will end with a loss of the capital invested by the institutional investor (a return of minus 100%). In this case, there is no change in the market portfolio. Given success of the investment project of the VC fund the start-up will go public and the new company will join the market portfolio. Both the return and the risk of the market portfolio will change as the result of the addition. The discussion of the semiconductor industry in Chap. 3 and the contribution of companies like Microsoft, Apple, Facebook and eBay as well as many other innovative companies discussed briefly in Chap. 2 are specific and concrete examples to the contribution of VC backed IPOs to the return of institutional investors through externalities.

8.6 Summary: The Market Is Right

The major thesis of this book is that by investing in assets based on radical ideas, VC funds fulfill an important role in the process from idea to consumption, a process that drives economic growth. Given the contribution of VC funds to economic growth, one would expect that those who manage, finance, and support VC funds will be compensated for their effort. Given the specific high risk of assets based on radical ideas as discussed in Sect. 8.3, one expects high returns for capital and for labor employed in VC funds. The literature on the return of investment in VC funds is inconclusive at best. A number of researchers and industry analysts claim that the return to capital allocated to VC funds is insufficient and that the return to GPs is too high. In Chap. 6 we show that the payment structure and the level of payments to GPs are welfare-increasing. In this chapter, we have shown that if correctly identified and measured, the return to the providers of the capital over the long horizon is substantially higher than the partial return to LPs discussed in most research. The post-exit measurement including externalities is congruent with the measurement of consumers' surplus discussed in Chap. 7. The payments to GPs, the return on the capital allocation of institutional investors over their long horizon, the real return to the beneficiaries of the institutional investors that allocate capital for VC funds, as well as the interest of the taxpayers that pay for the government support of VC funds through IP laws, funding basic research, and tab benefits to institutional savings all play a role in making VC funds a useful instrument of economic growth.

Note

1. Cash on cash is the amount the VC receives at exits divided by the amount of total investment.

References

CalPERS. (2015, July). *Total fund investment policy.*

Cambridge Associates. (2014, December). *U.S. venture capital index® and selected benchmark statistics.*

Friedman, M., & Savage, L. J. (1948). The utility analysis of choices involving risk. *Journal of Political Economy, LVI*(4), 279–304.

Hall, B. H., & Lerner, J. (2009). The financing of R&D and innovation. In *Handbook of the economics of innovation* (Vol. 1, pp. 609–639).

Harris, R. M., Jenkinson, T., & Kaplan, S. N. (2014). Private equity performance: What do we know? *Journal of Finance, 69*(5), 1851–1852.

Kaiser, K., & Westarp, C. (2010). *Value creation in the private equity and venture capital industry* (Faculty & Research Working Paper). Insead.

Kauffman Foundation. (2012, May). *"WE HAVE MET THE ENEMY… AND HE IS US" lessons from twenty years of the Kauffman foundation's investments in venture capital funds and the triumph of hope over experience* (Kauffman Report).

Mulcahy, D. (2013, May). *Six myths about venture capitalist*. Harvard Business Review.

Nadiri, I. M. (1993). *Innovations and technological spillovers* (Working Paper Series, No. 4423). National Bureau of Economic Research.

Ritter, J. (2014). *Home page for Jay Ritter. Warrington College of Business, University of Florida*. IPO data. Retrieved from https://site.warrington.ufl.edu/ritter

Smith, R., Pedace, R., & Sathe, V. (2010). *Venture capital fund performance: The effects of exits, abandonment, persistence, experience, and reputation* (Working Paper). Retrieved from http://ssrn.com/abstract=1432858

Sudarsanam, S., Sorwar, G., & Marr, B. (2003, October 1–2). *Valuation of intellectual capital and real option models*. In Proceeds from PMA Intellectual Capital Symposium, Cranfield University.