The Firm-Level Societal and Economic Impact of Private Equity in Finland

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HELSINKI SCHOOL OF ECONOMICS (HSE) **SUMMARY**
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THE FIRM LEVEL SOCIETAL AND ECONOMIC IMPACT OF PRIVATE EQUITY IN FINLAND

RESEARCH OBJECTIVES

This study addresses the lack of comprehensive research on the economic and societal impact of private equity in Europe and especially in Finland. The thesis has two-fold research objective; (1.) to build a solid understanding on how the societal and economic impact can be assessed in Finland based on existing literature and (2.) to empirically examine what can we say about the firm-level societal and economic impact of the investing activities of the members of Finnish Venture Capital Association in Finland.

DATA

This study uses a unique hand collected dataset on the companies that have received their first-ever private equity investment from a member of Finnish Venture Capital Association in 2002-2004. The sample includes all Finnish companies (191) that have received a first-ever private equity investment by a member of FVCA during this period. Data is collected from the National Board of Patents and Registration of Finland databases for the investment year and the three following years and it includes the following firm-level measures: sales, number of employees, total assets and intangible assets, corporate taxes and gross margin. Based on NBPR data growth figures can be calculated for 146 companies of the sample (77%).

The control group is collected by matching the profile of the private equity financed companies to Finnish companies that did not receive private equity financing. Main line of operations, sales and registration date to the trade register are used for matching.

RESEARCH RESULTS

The growth of sales and personnel of the PE-funded companies in Finland is faster than the growth of non-PE-funded companies based on comparative statistical analysis and basic OLS regression models. The results of the OLS regression models also suggest an association between PE-funding and faster intangible assets and total assets growth.

The faster growth of the PE-financed companies firm-level measures may be a result of the VCs being able to select portfolio companies that have comparatively larger growth potential instead of the true added value VCs are often argued to supply. Also both of these sources may apply, but we cannot fully reliably identify the actual value adding impact separated from the VC target selection effects.

The comparative growth of sales, personnel, intangible assets and total assets are stronger for PE-funded companies operating in high-tech industries, especially within knowledge intensive services sector, and/or receiving PE-funding in seed investment stage.

KEY WORDS

Private Equity, Venture Capital, Buyout, Economic Impact, Societal Impact

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1 Introduction

1.1 Background for the Research

”*Venture capitalists are in it just for the money. Most are not out to do good for the world. They manage money on behalf of pension funds, insurance companies, educational endowments, and wealthy individuals. Their concern is not for your employees and customers, or to build a long-term business.*” – Vivek Wadhwa, Wertheim Fellow at the Harvard Law School. (BusinessWeek, 17.7.2006)

The European private equity investments hit an all-time high in 2007 rising up to €74 billion (EVCA, 2007). The World Economic Forum estimates that the total value of the firms acquired globally in the leveraged buyout transactions in 1970-2007 is $3.6 trillion, out of which $2.7 trillion represent LBOs undertaken after 2000 (World Economic Forum, 2008). It is easy to see that the growth of the private equity industry and it´s economic and societal relevance has been fast in the recent years. The vast growth of private equity industry has increased public interest regarding the effects of these investments on economy and on larger society as whole.

Many concerned voices have also risen in the international press about the negative impacts of private equity investments, blaming venture capitalists for example of only seeking fast cash and not caring about the long-time development of the business. This public discussion has awakened national and international private equity associations as well as academics to take part in the game. As a result research around the economic and societal impact of private equity has begun to emerge (Achleitner & Klöckner, 2005; Alemany & Martí, 2005; Engel, 2002; Engel & Keilbach, 2007; EVCA, 2007; Global Insight, 2007; Kjærgaard, 2004; Kortum & Lerner, 2000; Peneder, 2007; Romain & van Pottelsberghe, 2004; World Economic Forum, 2008). The studies range from industry wide impact studies to firm-level studies. However, the results of the former group of studies are often limited by their focus on aggregate industry level and by the limited availability of measures.

The main focus of the studies in the field of economic and societal impact of private equity has been the development of employment or innovation in the companies that have received

private equity funding. Whereas the national and international venture capital associations have usually presented the growth figures within the VC-industry, the academics have had a broader focus. In their studies the development in the private equity financed companies is usually compared to the development in the control group that has not received equity financing.

The impact research has faced many challenges and at least partially due to these the research activity has still remained relatively low. The problems that research has faced are often related to the very few possibilities of acquiring good quality unbiased data, especially with multiple measures of economic impact, or to the problems faced in defining the control group in order to reliably measure the impact of private equity. Also on the methodological side the problem with the non-randomness of the VC selection process has caused many concerns among the academics.

This study addresses the lack of prior multiple measure research on the societal and economic impact of private equity. This thesis is also one of the first pieces of literature concerning the comprehensive firm-level impact of private equity in Finnish society and economy. The aim of this study is to develop understanding on the firm-level measures of economic and societal impact of private equity and how to assess this impact reliably in Finnish context. This study further seeks to evaluate the impact of the private equity investments of the member organizations of the Finnish Venture Capital Association (FVCA) with the developed methods. The thesis seeks to provide an objective analysis of the firm-level impact of private equity on Finnish society and economy using multiple different measures.

The used data is combined from two different sources. I will use the archival data on the first-ever private equity investments of the members of FVCA in 2002-2004. Based on this archival data the actual panel data is collected for 191 portfolio companies for year they received the private equity investment and the three consecutive years. This data consist of the portfolio companies' historical financial information. The control group for the study is collected using matching based on the data on the portfolio companies. Sufficient data is obtained for 146 companies that are included in the analysis.

1.2 Research Gap

Private equity as a research topic has not been widely studied compared to different publicly traded financial markets, such as stock markets. Two general reasons can be identified for low research activity in this field. The first reason has been, and still is, the non-public nature of private equity markets. Information and data about the transactions is not publicly available and researchers have had to collect the data with questionnaires often resulting in low response rates. Another reason for low research activity has been the fact that institutional private equity investors and private equity markets are still relatively young phenomena, especially in Europe, so not much information has been available altogether.

However, as the private equity market has developed and the private equity investors have been releasing more data about their activities, the research topic has been receiving growing attention in the recent years. Often national and multinational venture capital associations have been in a major role as data providers and facilitators of research project in this field. Europe is still far behind the US in both the academic and the non-academic research conducted in the field of private equity.

The studies related to effects of private equity can be divided clearly into two broad lines of research as pointed out by Alemany and Martí (2005). The first and by far the most researched, line tries to explain the expected superior performance of VC-backed companies with different rationales. The second, less researched, line is concerned with the overall economic and societal impact of VC-funded companies and identifying this impact. Within the second line of research most of the studies are conducted by national and international venture capital associations and they have focused purely on specific research subjects such as innovation and job creation. Studies which take more than just one or few measures of economic performance into account are almost non-existent. An exception for this general rule is the research conducted by Alemany and Martí (2005), which takes into account multiple firm-level financial measures.

One of the most recent impact studies employing relatively evolved methodologies is the research conducted by Bottazzi et al. (2007). The authors obtain four measures of VC activism, namely involvement in recruiting the management, helping in assembling the board of directors, assistance in obtaining additional financing and interaction with the portfolio

company, and succeed at identifying significant value added through corporate governance and participation. Engel (Engel, 2002 and Engel & Keilbach, 2007) has researched the firm-level impact of venture capital extensively with methodologies seeking to overcome the often faced challenges of impact research. His studies on venture capital and firm growth as well as on the broader implications of VC funding on early stage firms have expanded the general knowledge on the impact of VC financing substantially. The most recent publication that has received attention especially within the global private equity fraternity has been the report published by the World Economic Forum (2008) on the global economic impact of private equity. This report is compiled from several studies conducted by the most recognized authors seeking to approach the impact of PE-funding from various perspectives with a variety of methodologies. Not many of these studies published by WEF, however, lay significant interest on overcoming the methodological challenges of the impact research.

In Finland the Finnish Venture Capital Association (FVCA) has published in 2007 a short report on the impact of venture capital. This report is based on evaluating only the development of turnover and number of personnel in the VC-backed companies in Finland and the analysis is based solely on the VC-backed companies' development and not on comparison to non-VC-backed companies. Some more analytical depth is obtained in the master's thesis conducted by Lähdemäki (2007) about the economic and societal impact of the investments of CapMan Plc[1]. This research is, however, limited to investments made by only one VC investor and the data consists of only 75 investments.

Profound research on the effects of private equity in Finland, as presented above, is almost nonexistent. The few studies and reports that have been conducted in the field of economic impact of private equity in Finland are limited to only one or few VC investors and only few indicators of economic impact. None of the studies conducted in Finland have been based on a carefully selected control group or obtain more methodological depth than basic statistical analysis.

This master's thesis addresses the lack of prior research on the comprehensive economic and societal impact of private equity market in Finland. It drills down to the societal and economic impact of Finnish private equity industry using multiple variables such as net sales,

[1] CapMan Plc. is a private equity investor listed in the Helsinki Stock Exchange since 2001. CapMan invests in companies that principally operate in the Nordic countries (Lähdemäki, 2007).

employment, total assets, gross margin, intangible assets and corporate taxes. The analysis is based on a unique data on the Finnish first ever VC investments in 2002-2004 and a carefully selected control group of companies to whose the development of VC-backed companies is compared. The selected methodologies also seek to overcome the general problem with the VC selection effects.

1.3 Research Question and Objectives

The first objective of this thesis is to build a solid basis for understanding the firm-level impact of private equity investments toward the economy and larger society. The second objective is to empirically examine the impact of Finnish private equity investments by analyzing the investments made to Finnish based companies by the member institutions of the Finnish Venture Capital Association (FVCA). The research question derived from these objectives can be stated as follows:

How can the firm-level societal and economic impact of private equity be assessed in Finland and what can we say about the firm-level societal and economic impact of the investing activities of the members of Finnish Venture Capital Association?

The first part of the question is more theoretical and we will focus on it in the literature review part of this thesis. Different methodologies and ways for analysis are presented and evaluated in order to build a comprehensive understanding of measuring the societal and economic impact of private equity. The answer to the first part of the question should be a reasoned research approach and design based on the current literature. Furthermore the chosen methodologies should be implementable in the Finnish context and data will have to be available with reasonable cost and effort. The selected measures will have to be chosen in a way that they are valid and that they measure what they're supposed to measure. In this study one key point of interest will be the selection of the control group.

The second part of the research question is answered in the empirical part of this thesis and this part is awaited to add value to the Finnish private equity impact research. The question will be answered using the methodologies and measures presented and chosen when answering to the first research question. Concerning this part of the research it is highly

important to try to tackle the possible biases and the general endogeneity problem faced in the impact research.

The investments conducted by the members of FVCA will be analyzed all together and in separate groups based on the investment stage and whether the company operates in high-tech or low-tech industry. The classification to different investment stages will be done in two separate ways based on (1.) the methodology by EVCA (2008) and (2.) simple categorization to venture capital and buyout investments as suggested by FVCA. The development of the portfolio companies is most likely to differ between different development stages of the portfolio companies. The base-point for the analysis will be the initial state of the VC-backed company before the investor has affected it.

When conducting the actual analysis the selection of the control group will be one of the main challenges. Control group is needed for comparing the development in the portfolio companies to other companies and to verify the fact that the outcome would have been different without financing from an outside venture capitalist.

1.4 Scope and Limitations

This thesis and its results are limited by geography, time and investor type. The research is limited to companies that are originated in Finland and have received their first-ever private equity investment during the period between January 1, 2002 and December 31, 2004. Moreover only companies that have received investments from the full members of the Finnish Venture Capital Association (FVCA), meaning the pure venture capital organizations, are included in the study. The list of the full members of FVCA can be found in the Appendix 1.

The study is limited by the methodological challenges in assessing the societal and economic impact of private equity. The general problem faced in the impact research is the endogeneity problem caused by the selection effects that can affect the future development of the impact measures. The question that remains is whether the VCs are able to select the companies that would have developed in the similar manner also without VC financing. The challenge is that when the impact of an investment (treatment) is assessed we would have to find an identical

company that did not receive the treatment for a full reliability of the results. This is of course not possible since no identical counterparties exist for the companies that have received private equity financing. However, most sophisticated methods that Finnish databases allow for matching are used in order to determine a valid control group for the private equity financed companies in order to at least partially diminish the endogeneity problem. The problem is taken into account also in the methodological selections.

Finally, the study is limited by the quality of the datasets that are used. The dataset has been compiled from first-ever investment data of FVCA and data from the annual reports in Suomen Asiakastieto databases. Despite good overall coverage of the sample some challenges are faced because of points of discontinuity in some companies' data for example because the company has not sent its annual financial information to the NBPR database or due to a change in the corporate structure of the company. However, the number of these challenges is relatively small and altogether data on 146 companies (77% of the sample) can be included in the analysis.

1.5 Research Design and Methods

This research is conducted as a firm-level analysis on the impact of private equity investments. The approach is to analyze the firm-level impact of private equity not just based on a single or few measures, as common in the current literature[2], but to use various measures of firm-level impact in order to obtain a comprehensive view on the topic. The research includes individual firm-level measures for company size, employment, innovation, profitability, total assets and government direct income as these measures clearly carry a broad impact on the Finnish economy and society surrounding the company.

The data is collected for companies that have received their first-ever PE investment from a Finnish based VC between 2002 and 2004. The data is collected for the investment year and three following financial years. After collecting the data for the actual sample group each PE-funded company is matched to a non-PE-funded counterparty by the main line of operations, by investment year sales and by the age of the company. After this the data on the same firm-level measures is collected for the control group as well.

[2] See e.g. Achleitner and Klöckner (2005), Kjærgaard (2004), Engel and Keilbach (2007) and Peneder (2007).

The methodology part of this thesis is divided into three separate parts: (1.) descriptive analysis on the data, (2.) statistical analysis on the differences between companies that have received their first-ever PE investment and their matched counterparties and (3.) regression analysis seeking to identify the actual association between PE-funding and development of these measures.

The primary analyses are conducted across different data categories using the absolute growth of sales, personnel, intangible assets and total assets as well as cumulative taxes during the observation period. Also a gross margin measure at the end of the observation period is included to reflect the profitability of the companies. Absolute growth figures are used due to many zero values in the beginning of the observation period especially for companies in early investment stages. However, some additional analyses use relative growth figures in order to gain further insight into the subject.

The regression analysis part is further divided into two separate methodological parts. The first one employs basic ordinary least squares regression models in order to identify if the PE-funding is associated with the development of the chosen measures without any correction for the VC target selection effects. This analysis seeks to identify whether the PE-funded companies measures grow faster than for the control group but it does not reveal the actual added value of VCs as the possible faster growth may be also due to the selection effects. The second part of the regression analysis seeks to reveal more about the actual value added by the PE investors by employing a two-step procedure introduced by Heckman (1979) for excluding the selection effects from the analysis.

1.6 The Most Relevant Findings

All in all the most relevant and reliable conclusion of this study is that the growth of sales and personnel of the PE-funded companies in Finland is significantly faster than the growth of non-PE-funded companies. This result is based on statistical comparison and basic OLS regression analysis between PE-funded companies and their non-PE-funded counterparties matched by industry sector, sales and company age. The results are statistically significant.

The results of the basic OLS regression models also suggest a statistically significant association between PE-funding and faster intangible assets and total assets growth. These differences, however, do not quite reach 95% confidence level in the statistical analysis. Thus, we must conclude that the growth of intangible and total assets seems to be associated with PE-funding but this dataset does not give fully unambiguous verification for this.

However, the faster growth of the PE-financed companies firm-level measures presented in the previous paragraphs may be result of the VCs being able to select portfolio companies that have comparatively larger growth potential instead of the true added value VCs are often argued to supply. Also both of these may apply. We cannot fully reliably conclude whether the exact source of the faster growth truly is the operations of PE investors within the company after selecting their investment targets. The final regression analysis employing Heckman (1979) two-step procedure, however, seeks to exclude the selection effects from the value adding impact. The results of this analysis are consistent with possibility of true value adding impact of VCs resulting in faster growth of sales compared to other companies. For growth of personnel, intangible assets or total assets no statistically significant value adding impact is identified but this does not rule out the possibility of such value adding impact to exist. The applied regression model seeking to exclude the selection effects supposes that the VCs selection can be modeled solely based on the financial information on the companies, which is perhaps not fully realistic assumption, as the VC selection process may be driven by unobservable variables such as business plan and management team quality.

The result of comparatively greater growth of PE-funded companies' sales, personnel, intangible assets and total assets is even stronger for firms operating in high-tech industries, especially within knowledge intensive services sector, and/or receiving PE-funding in seed investment stage. These qualifications of a PE-funded company seem to be associated with even faster relative growth compared to the matched non-PE-funded companies. The results are based on the statistical analysis on the comparative growth across different data categories.

1.7 Key Terms and Definitions

Buyout

Buyout refers to a transaction in which a business, business unit or company is acquired from the current shareholders. Thus buyout investments are also a subset of private equity investments and when the term `private equity` is used it is assumed to include buyout investments. Different types of buyouts include management buyout (MBO), management buyin (MBI) and institutional buyout (IBO). Buyouts are the most common type of later stage private equity investments.

First-ever Private Equity Investment

First-ever private equity investment refers to a first private equity investment that any venture capitalist makes to a specific portfolio company. Private equity financed companies receive equity financing usually in multiple financing rounds over the life cycle of the company. Thus first-ever private equity investment refers to the first private equity investment of the first financing round.

Investment Stage

Investment stage is used to simultaneously refer to the development stage of the company when it receives the first-ever private equity investment and to the transaction type of the investment. The classification of the investment stages is applied in two ways.

The main classification followed in this paper is the definition of suggested investment stages by EVCA. This definition of each investment stage is presented in the Appendix 2 (FVCA, 2008).

The second classification of investment stages is simple categorization of the investments to either venture capital or buyout class as often done among the industry in Finland.

Portfolio Company

Company in which a venture capitalist has invested in is called a portfolio company before the venture capitalist exits the investment. The investment may be a mezzanine loan granted to the company or a direct equity investment.

Private Equity

Private Equity (PE) refers to private equity capital and private equity investments in general.

Finnish Venture Capital Association (FVCA) defines a private equity investment as follows: "Private equity investment means investing in companies not quoted on stock markets, but which have good potential for development. Private equity can be used to start a new company, to expand operations, to make acquisitions, to restructure a company or to significantly alter a business. It can also resolve ownership and management issues, and for example succession in family owned companies or a buy-out or buy-in of a business by experienced managers may be achieved with private equity funding." (FVCA, 2008)

According to the European Private Equity and Venture Capital Association (EVCA) a private equity investment refers to financing of unquoted companies with growth potential. Private equity in general comprises all stages of financing: seed, start-up, expansion, replacement capital and buyouts. (EVCA, 2007)

In this study the term `private equity` (PE) refers to the private equity field in general and investments are specified as private equity investments.

Venture Capital

Venture Capital (VC) refers to equity financing that is provided for company which is in a seed, start-up, other early or expansion stage. Thus VC is a subset of private equity and when the term `private equity` is used it is assumed to include venture capital investments.

Venture Capitalist

Venture Capitalist is used to refer to an organization or person making not just a venture capital investment but any investment in the private equity field.

1.8 Structure of the Thesis

This thesis is structured as follows. Chapter two is a literature review that begins by introduction to private equity and continues by reviewing two partially overlapping fields, the value added literature and the impact literature. The third chapter presents the hypotheses of the study and the reasoning behind them. The fourth chapter states the research approach and describes the data as well as the control group selection. It continues by discussing the methodology and the different firm-level measures included in the analysis. The actual results of the analysis are presented in the fifth chapter. This chapter begins by presenting descriptive analysis of the data, which is followed by statistical analysis with respect to control group development as well as regression analysis. The final chapter draws conclusions and suggests some avenues for future research.

2 Literature Review

The aim of this literature review is to review the research on the effects of venture capitalists activities and to build a solid theoretical foundation for analyzing the societal and economic impact of private equity in Finland.

This literature review is mainly focused on venture capital, since this has been the focus of the vast majority of academics. Other forms of private equity are by no means discriminated as also some studies on buyout stage of private equity are cited. The research on venture capital in highly relevant for studying private equity in general and the methods applied in VC studies are also applicable for analyzing the impact of private equity in a broader context.

According to Alemany and Martí (2005) the research on the effect venture capital can be divided into two lines of research. The first line of research focuses on the added value venture capitalists activities generate and tries to explain the superior performance of VC backed companies. The research in this field is concerned for example about the role of target selection, the changes in the monitoring and board structures of the portfolio companies and the networks of the venture capitalists. The second and less studied line relates to the larger economic impact of venture capital trying to measure the impact of VC financing. In this line the literature is split up between studies focusing on only one of few specific subjects such as innovation or job creation and studies focusing on impact of VC-backed firms in broader scope. The goal of this thesis is to primarily follow the second line or research. However, also the added value insight of venture capital is covered in the literature review because it precedes the impact literature.

The categorization of literature introduced by Alemany and Martí (2005) does not directly match all the different functions by which venture capital might exert an influence. Also some of the most recent studies about the effect of venture capital partially overlap between the categories introduced by Alemany and Martí (2005). However, as most of the overall research on the effect of venture capital clearly falls under one of the categories we will adopt this classification of literature in this literature review.

After an introduction to private equity in general and to the different functions of venture capital this literature review proceeds to reviewing the literature about the added-value by venture capitalists. This section is followed by a section discussing the impact research and reviewing this line of research in more detail. Also the different problems faced in the research on the impact and value added of PE-funding as well as different methodologies used are reviewed in this section.

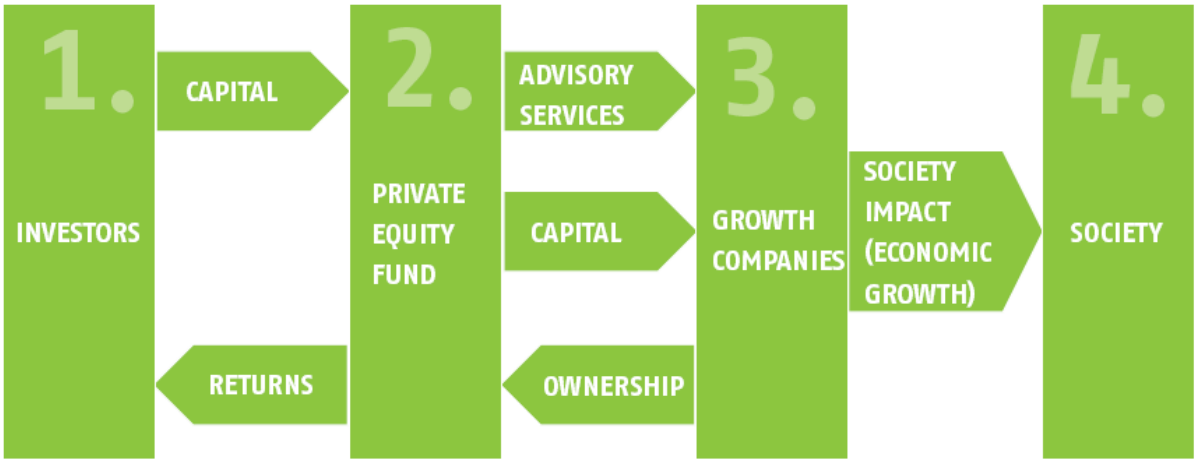
2.1 What is Private Equity?

EVCA (2007) defines in the short that private equity is equity financing provided to unquoted companies with growth potential. To deepen the understanding of the different aspects and characteristics of private equity the Finnish Venture Capital Association (FVCA) illustrates private equity with "The Private Equity Ecosystem" that is presented in the Figure 1. (FVCA, 2008)

In this ecosystem the first step involves the fundraising phase, where a private equity fund gathers capital from various sources, with institutional investors such as retirement funds and insurance companies typically representing the majority of funds raised. After the fundraising is complete, the private equity fund begins seeking suitable businesses to invest in. In addition to providing the company with capital, the investors also offer valuable expertise and take an active interest in developing the business. This is typically achieved through working as a member of the board. The entrepreneur thus effectively exchanges part of his or her ownership in the company for the capital and the advisory services provided by the fund. (FVCA, 2008)

The private equity fund then proceeds to develop and expand the business, thus increasing the value of its investment. This added value is later realized in the exit phase, after which the investors of the fund are compensated according to the returns realized in the exits from the companies in the portfolio of the fund. In addition to providing returns to the investors of the fund, private equity investors argue that they also benefit the economy as a whole. (FVCA, 2008)

Figure 1: The Private Equity Ecosystem (FVCA, 2008)



Private equity investments can be divided into two different types of investments. These types are venture capital and buyout investments (EVCA, 2002).

Venture capital (VC) is a source of financing whereby a financial investor takes an equity stake in a private company that, in general, is starting up or will grow fast in the following years (Gorman & Sahlman, 1989). From entrepreneur's perspective, VC funds are often the only available source of additional financing to start up a company, especially if intangible assets are at the core of the business.

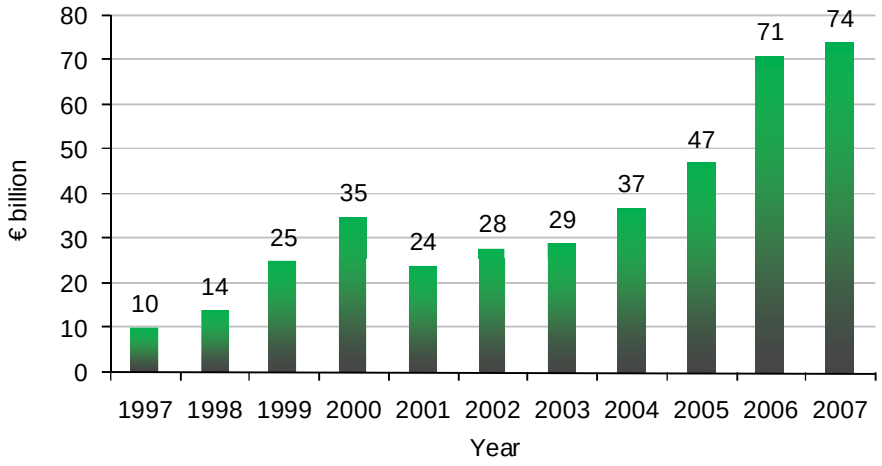
Buyout refers to a transaction in which a business, business unit or company is acquired from the current shareholders. Buyout investments are the most common type of later stage private equity investments. Leveraged buyout (LBO) refers to a buyout in which the capital structure of the company incorporates a particularly high level of debt, much of which is normally secured against the company's assets. Jensen (1986) identifies firms or divisions of larger firms that have stable business histories and substantial free cash flow as the most desirable buyout candidates.

Different types of buyouts, such as management buyout (MBO), management buyin (MBI) and institutional buyout (IBO), can be identified. In an MBO external managers take over the company. Financing is provided to enable a manager or group of managers from outside the target company to buy into the company with the support of private equity investors. An MBI is otherwise a similar transaction with the exception of the management coming from outside the target company. Institutional buyout refers to outside financial investors buying the

business from the vendor. The existing management may be involved from the start and purchase a small stake. (EVCA internet, 2008)

In the recent years the private equity market in Europe has experienced tremendous growth. The annual volume of total private equity investments in Europe has increased from €10 billion in 1997 to €74 billion in 2007 making private equity market as one of the most important financial market in the Europe. (EVCA, 2007)

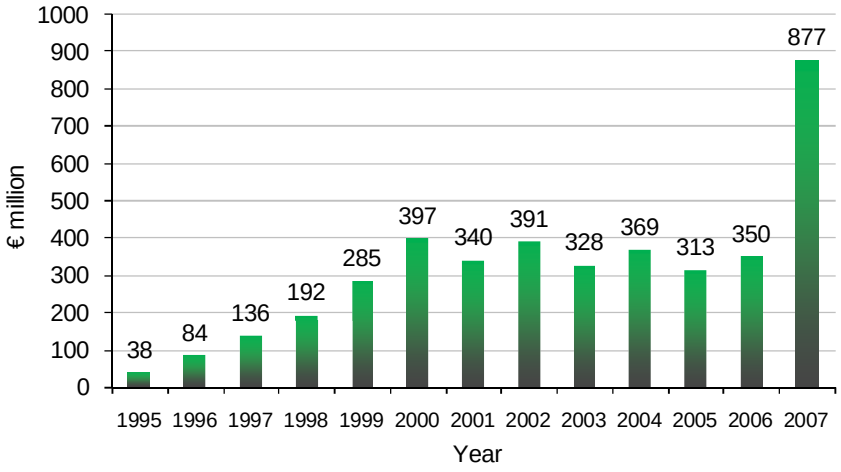
Figure 2: Annual PE Investments in Europe 1997-2007 (EVCA, 2007)



2.1.1 Private equity in Finland

Due to the strong government control and late opening of the financial markets in the 1990s the private equity market in Finland has developed late compared to the US and the mainland Europe. The annual volumes of the private equity investments were marginal in the beginning of 1990s and the formation of the Finnish private equity industry can be seen to have emerged in the years 1995-2000. During this period the annual volume of the private equity investments rose from €38 million to €397 million in Finland. During this period the share of public investments has decreased from 47.3% in 1995 to 11.6% in 2000 when comparing public and private share of total investments. (FVCA, 2006)

Figure 3: Annual PE Investments in Finland 1995-2007 (FVCA, 2008)

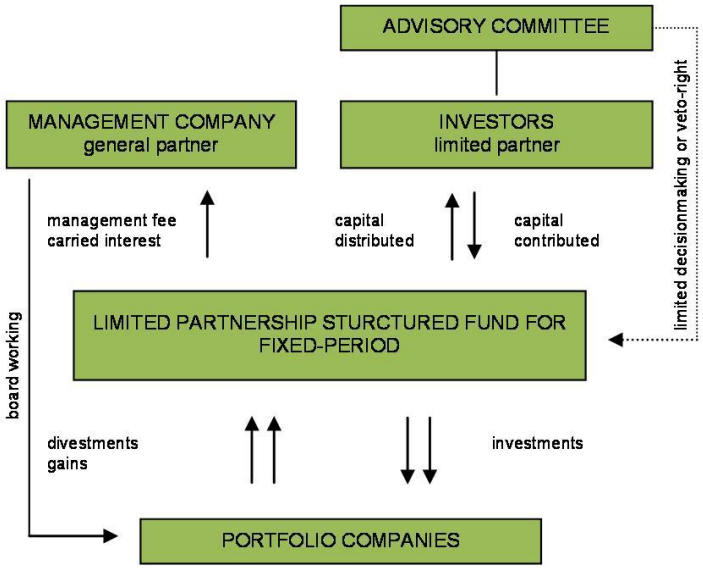


Despite the late emergence of the Finnish private equity industry the Finnish Venture Capital Association (FVCA) has been founded already in 1990 to represent and develop the industry. The association began collecting its own annual statistics of the Finnish private equity industry already in 1990 but more systematical collection began in 2002 and from this onwards some parts of the data has been made publicly available. (FVCA, 2006)

Today Finnish private equity industry consists of various types of investors but the market is dominated by investors in the private sector. 37 Finnish institutions have received a full membership in the FVCA and 74 are listed as associated members. Only institutions operating in the Finnish private equity market as their primary form of operation can be given the full membership on in FVCA. The full members of FVCA are presented in the Appendix 1. (FVCA, 2008)

Private equity companies operate in the Finnish private equity market usually through individual private equity funds. Companies collect capital to PE funds from various institutional investors and further invest this capital into the portfolio companies. The structure of a limited partnership fund is presented in the Figure 4. (FVCA, 2008)

Figure 4: Limited Partnership Fund Structure (FVCA, 2008)



Finnish private equity investments peaked in the year 2007 as the total volume of new investments was more than doubled from the previous year (FVCA, 2008). Due to the vast growth of the private equity market in Finland the social and economic impact of private equity remains a highly topical theme despite the fact that the investment activity is likely to decrease significantly in 2008 and 2009 as the overall economy is sloping downwards.

2.1.2 Functions of Venture Capital

The research on the economic impact of venture capital is yet small but swiftly growing as the awareness of this area finance rises and more data becomes available. However, the current research already differs substantially and the scope of the analysis ranges from macroeconomic panel estimations (e.g. Romain and van Pottelsberghe, 2004) to estimations strongly based on sectoral data (e.g. Kortum and Lerner, 2000) as well as to microeconometric research (e.g. Hellmann and Puri, 2000, 2002; Engel, 2002; Engel and Keilbach, 2007). One often common denominator for the impact studies is the fact that they rarely include companies not yet listed on the stock market because of the lack of available data (Peneder, 2007).

Because of the varying contexts of different national markets as well as heterogeneous data sources, methods and control variables, one has to be cautious about drawing general

conclusions about the functions of venture capital. Peneder (2007) has, however, identified three different functions, based on the current literature, by which venture capital may exert and influence on overall economic performance. These different transmission mechanisms seem to gasp most of the current impact literature's views on the functions of venture capital. The financing function of venture capital refers to the specific function of providing adequate financial resources for business cases that would have had no access to financing through traditional sources of capital. Through this financing function venture capital generates new business cases that would not had emerged without VC financing. (Peneder, 2007)

The second specific function is named the selection function of venture capital by Peneder (2007). This function involves the allocation of financial resources to the most profitable uses when uncertainty and problems of asymmetric information are particularly high. The selection function relates to the notion that the screening and selection process of venture capitalists leads to selecting the most potential targets for venture capital financing. The research conducted by Admati and Pfleiderer (1994) focuses on the selection function in the light of inside information that is available to the venture capitalists when they make the investment decisions.

Finally Peneder (2007) presents the broader value adding function that the venture capital firms often claim to fulfill. The value adding function of venture capital refers to all the activities after selecting the target companies and providing the financial resources.

The value adding function is the broadest of the three presented by Peneder (2007) and many other academics have suggested other more specific functions for venture capital that fall under this more general value adding function. Examples for the sources of added value, that can be seen often also as individual functions, can be for example managerial and recruiting experience, access to informal networks and even future possibilities based on the reputation of the venture capitalist.[3]

Gompers (1995) focuses on particular monitoring function of venture capital that can be seen to fall under the broader value adding function. His regression study shows that venture capitalists are monitoring their portfolios closely due to concern that entrepreneurs with

[3] See, for instance, Kaplan and Strömberg (2004), Hellman and Puri (2002), Hochberg et al. (2007) and Hsu (2004).

private information and large private benefits will not want to liquidate a project even if they have information that the project has a negative net present value for shareholders. Entrepreneurs may also pursue strategies that enrich their reputation at shareholders' expense. Gompers (1995) concludes that venture capitalists monitor entrepreneurs with increasing frequency as expected agency costs rise.

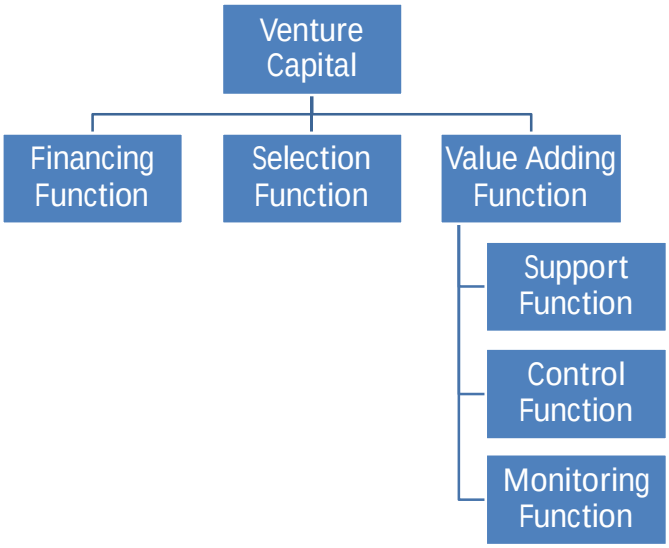
A research conducted by Lerner (1995) also focuses on the monitoring function of venture capital by studying the board composition of the VC backed companies. The study reveals that the monitoring activities increase when the need for oversight is greater. This is identifies for example as the venture capitalists' representation on the board increases around the time of chief executive officer turnover, while the number of other outsiders remains constant. Papers conducted by Gompers (1995) and Lerner (1995) use samples that contain only VC-backed companies and thus rely on changes over time and differences within VC-backed companies. Opposed to these papers and methodologies are studies that concentrate on the differences between the VC-backed and non-VC-backed companies.

Hellman and Puri (2002) have studied a support function of venture capital on team building or CEO turnover by comparing the VC-backed and non-VC-backed companies. They include in the team building part for example analysis on differences in recruiting practices, human resource policies, stock option plans and hiring of a vice president of sales and marketing. In the CEO turnover part of the study focus of the analysis is on hiring an outside CEO, support versus control in CEO turnovers and the state-contingent nature of venture capital involvement. The research conducted by Hellman and Puri (2002) clearly identifies the support function of venture capital in light of multiple organizational milestones, such as the formulation of HR policies or adoption of stock option plans. Also recruitment of an outside CEO is often enhanced by venture capitalists supporting a company.

In their recent study on the value added by venture capitalists Bottazzi et al. (2007) suggest that in addition to monitoring and supporting portfolio companies VCs also have direct control over some matters in their portfolio companies. Hellman and Puri (2002) also identified the control function of venture capitalists in addition to the already mentioned functions of VC.

As the control function, the support function and the monitoring function clearly fall under the broader value adding function of venture capital presented by Peneder (2007) we can picture the different functions of venture capital as presented in the Figure 5 below. This illustration is not designed as a comprehensive sub-categorization of different aspects of the value adding function but merely as an illustration of the most relevant functions of venture capital and their interconnectedness.

Figure 5: Functions of Venture Capital



2.2 Research on the Value Added by Venture Capitalists

This section focuses on reviewing the academic research and the used methodologies in the studies concerning the evaluation of the superior performance of VC-backed companies.

According to Alemany and Martí (2005) the explanations behind the added value by venture capitalists can be divided into three sources: (1) VCs select those companies that have more potential and whose management is interested in fast growth, (2) VCs add value using corporate governance to take an active role in monitoring and, when needed, participation for example through the Board of Directors, and (3) the network of contacts, the portfolio of companies already invested in and other intangible assets that build up the venture capitalist's reputation.

The literature in this field can be broadly categorized under these different sources of added value based on the research objective or on the most important conclusions. Of course most of the more general research identifies multiple sources for added value by venture capitalists but usually one of these sources is found out to be more important than others.

2.2.1 Value Added through Target Selection

The research conducted in the field of added value through target selection has focused on how VCs screen and, supposedly, select the best firms in order to understand the process followed by them. The key assumption behind these studies is that the VCs are able to identify the best companies and do not often consider the effect that these selection criteria could have in the posterior development of VC-backed companies (Sepherd and Zacharakis, 2001). Some of the key studies related to the value added through target selection are summarized in the Table 1.

Table 1: Research Papers related to Value Added through Target Selection

Study	**Baum and Silverman (2004)**	**Sepherd and Zacharakis (2001)**	**Zacharakis and Meyer (2000)**	**Zacharakis and Meyer (1998)**
The most important research topic	Do VCs' emphasize picking winners or building them?	Can decision aids improve VCs decision process and decision accuracy and speed up the acquisition of expertise?	Can actuarial decision aides be used to assist in the VC screening process?	What decision criteria do VCs use to make their investment decisions and do they understand the decision process themselves?
Methodology	Regression analysis based on the companies annual reporting to Canadian Biotechnology.	Mail and direct questionnaire. Bootstrapping model based on conjoint analysis and OLS regression.	Decision experiment and comparison of VC decisions on predictions of the actuarial models (regression analysis) on 25 actual ventures.	Policy capturing decision experiment for capturing stated decision process compared to actual decision process identified by regression analysis.
Sample	204 biotechnology start-ups founded in 1991-2001 in Canada.	66 individual VCs representing 47 companies. Response rate 65%.	Experiment results from 53 VCs (Colorado Front Range and Silicon Valley area) and actual 25 ventures results	Experiment results from 53 VCs (Colorado Front Range and Silicon Valley area) and 50 actual VC financing decisions

VC decision making has received tremendous attention in the literature and the results of various studies show that VC-backed companies survive at higher rate than those ventures

backed by other sources (Kunkel and Hofer 1991; Sandberg 1986; Timmons 1994). Nonetheless the failure rate of VC-backed companies is still surprisingly high 20% (Shepherd and Zacharakis, 2001), which indicates that the decision process is still far from perfect. VCs try to make sure they pick the best companies from those available but sometimes these ventures fail and presumably not all the successful ventures receive VC financing in the first place. Alemany and Martí (2005) also point out that VCs do not have access to all the companies looking for financing. It is quite clear that VC-backed firms do not perform better merely because they have been selected by experienced venture capitalists.

The literature identifies that venture capitalists can affect the selection as a ‘‘scout’’ able to identify potential and as a ‘‘coach’’ that can help realize it (Baum and Silverman, 2004). The term scout refers to the selection of high potential firms for receiving financing in the first place and leaving lower potential companies without VC financing. These different roles, that may exist also simultaneously, are also the root of the problems in identifying the actual value adding impact over the selection effects that is discussed later in this thesis.

The hypothesis behind the scout role is that rather than waiting for direct selection to determine the success or failure of a startup, investors rely on VCs to identify startups that give off signals predictive of future success and to enhance the performance of startups that they select for funding. VCs that acquire effective vicarious selectors thrive as a result, and successful selectors may subsequently diffuse through the VC industry. VCs thus shape the environment within which new ventures evolve and are themselves subject to selection processes at a higher level. (Baum and Silverman, 2004)

2.2.2 Value Added through Corporate Governance and Participation

In general the topic of venture capitalists involvement in corporate governance and VC participation has been studied relatively extensively compared to other research on the effects of venture capital. This research stream focuses on how VCs use corporate governance to ensure monitoring of the portfolio companies and how the investors participate in the decision making and steering of the company for example through the Board of Directors (Sahlman, 1990; Sapienza and Gupta, 1994; Gompers, 1995; Lerner, 1995; Kaplan and Strömberg,

2004). The VCs rights to monitor and participate are usually specified by contracts between the VC and the portfolio company.

Despite the extensive research about the overall corporate governance and participation of venture capitalists, the direct impact of these activities for the portfolio companies' performance has not been studied as much. In the recent years, however, some studies have been conducted related directly to the value added through these operations (MacMillan et al., 1989; Hellman and Puri, 2002; Bottazzi et al., 2007). Key studies that seek to identify the value added through corporate governance and VC participation through the Board of Directors or through recruiting the management are summarized in the Table 2.

Table 2: Research Papers identifying the Value Added through Corporate Governance and Participation

Study	**Bottazzi, Da Rin and Hellman (2007)**	**Kaplan and Strömberg (2004)**	**Hellman and Puri (2002)**	**MacMillan, Kulow and Khoylian (1989)**
The most important research topic	What investor characteristics may lead to more investor activism and does an active investment style matter for the success of portfolio companies?	How conflicts between a VC and a start-up entrepreneur affect ex ante information collection, contract design, and ex post monitoring of a company?	What kind of impact venture capitalists have on the development and professionalization of new firms?	To what extent are VCs involved in the portfolio companies and how does this affect the performance of the companies?
Most important forms of influence or assistance	• Role in recruiting the management • Role in assembling the board of directors • Role in obtaining extra financing • Interacting with the company	• Active role in recruiting of the management • Active role in formation of strategy/business model	• Recruiting practices • HR Policies • Adoption of Stock Option plans • Hiring of a VP of Sales and Marketing	• Serving as a sounding board • Obtaining extra financing • Interfacing with the investor group • Monitoring the performance
Methodology	Hand-collected dataset of European VC investments and survey to VC firms. Multivariate regression analysis across companies and within companies.	Creating a classification scheme for investment strengths and risks. Regression analysis.	Hand-collected dataset on Silicon Valley start-ups. Regression analysis on different variables.	Questionnaire and regression analysis on the results.
Sample	Information on 119 VC firms, 503 partners and 1652 portfolio companies.	Information on 67 portfolio companies of 11 VCs	Sample consists of 173 start-ups and data is collected from various sources.	Information on 62 VCs (18% response rate).

One of the earliest pieces of research that identifies the value added through VC involvement is the survey research conducted by MacMillan et al. (1989). In their study the researchers

conduct a survey to venture capitalists about their involvement in the portfolio companies and identify three distinct levels of involvement. Their research suggests that some of the VC involvement, such as development of a support group or conducting monitoring operations through the Board of Directors, result in a positive correlation with performance of the portfolio company. Surprisingly, however, they also found out that VC involvement in the recruiting of the management resulted in a negative correlation with the company performance. The study conducted by MacMillan et al. (1989) has several limitations due to the low response rate of the survey and possible bias caused by this. However, it is one of the earliest academic studies directly related to the value added through corporate governance and participation of venture capitalists and though can be seen as a pioneer in this field of VC research.

The often faced challenge in the VC research based on surveys is a low response rate and possible bias caused by this. Hellman and Puri (2002) have resolved this problem with handcollected dataset in their research on the impact of venture capitalists on the development and performance of a new venture. In their research they empirically examine the hypothesis that venture capitalists foster the development of human capital in start-ups.

Analysis conducted by Hellman and Puri (2002) use a combination of survey and interview data as well as commercial and publicly available databases. The research focuses on new private ventures, contrary to most of the existing literature in this field that focuses only on publicly listed companies because of data constraints. Contrary to papers using only time series data on the VC-backed companies[4], Hellman and Puri (2002) use a control group that has not received venture capital financing in order to monitor the true added value generated by VCs. Their main conclusion is that a closely involved investor can have a broad impact on the development of the companies they finance, suggesting that there are value-added inputs that venture capitalists provide that go beyond that suggested by traditional financial intermediation theory.

In the most recent article that identifies significant value added through corporate governance and participation Bottazzi et al. (2007) obtain four measures of venture capitalists activism which are involvement in recruiting the management, helping in assembling the board of

[4] See e.g. MacMillan et al. (1989), Gompers (1995) and Lerner (1995).

directors, assistance in obtaining additional financing and interaction with the portfolio company. Their survey approach allows construction of several measures of human capital and the analysis show that human capital and organizational structure are closely related to investor activism.

When assessing the effect of investor activism to performance Bottazzi et al. (2007) face challenges in both, measurement and identification of the performance. As common in the research in this field the investor returns are not accessible by the researchers so the researchers resolve this challenge by measuring performance by whether the invested companies experience a successful exit, defined either as an IPO or an acquisition. The second problem of identification is extended by the possible endogeneity of the simply regression of exits on investor activism. Bottazzi et al. (2007) seek to resolve this problem by introducing instrumental variable framework into the analysis and alternatively through a sample selection model proposed by Heckman (1979) with minor adjustment. In the instrumental variable framework they use local availability of investor business experience as an instrumental variable in their analysis. The key identifying assumption behind the logic of Bottazzi et al. (2007) is that the characteristics of venture capital firms do not affect the companies' outcomes directly, but affect them indirectly through their actions, i.e., their level of activism. Bottazzi et al. (2007) identify a positive relationship between investor activism and the success of portfolio companies, a finding which highlights the economic importance of human capital for financial intermediation.

In addition to the specific research identifying the value added through venture capitalists corporate governance and participation, a wide range of studies focus on venture capitalists participation on more general level. For example Kaplan and Stömberg (2004) study how the conflicts between different parties affect the monitoring and participation of venture capital investors in their portfolio companies. These more general studies are not covered more in detail in this literature review.

The studies that identify the value added by venture capitalists through corporate governance and participation differ often in the way that data is obtained and in the methodologies that are used. The earlier research on the topic is mostly related to survey data resulting in lower coverage of the sample than in the other forms for data collection. The earlier research is also often based solely on VC-backed firms and thus relies on changes over time and differences

within these companies. More recent studies use more developed methods for both, data collection and identification of the value added by VCs. These studies implement more demanding data collection methods with increased data coverage and validity as well as comparisons between VC-backed and non-VC-backed companies.

2.2.3 Value Added through Intangible Support

The categorization of literature between the value added from corporate governance and participation and the value added through intangible support is not always easy due to many studies identifying both sources of added value. However some studies focus clearly solely on non-traditional ways through which VCs influence their portfolio companies and identify the value added in these efforts. Key sources for the intangible support and value added that recur in the literature are VCs network of contacts, VCs reputation and already existing portfolio of invested companies (e.g. Hochberg et al., 2007; Hsu, 2004; Davila et al., 2003). Some key studies concerning the value added through the intangibles that venture capitalists offer for the portfolio companies are summarized in the Table 3.

Table 3: Research Papers related to Value Added through Intangible Support

Study	**Hochberg, Ljungqvist and Lu (2007)**	**Hsu (2004)**	**Davila, Foster and Gupta (2003)**	**Gorman and Sahlman (1989)**
The most important research topic	What are the performance consequences of established strong relationships and networks when VCs syndicate portfolio company investments?	Is there a market for affiliation with reputable VC partners? If so, what are the prices for such affiliation?	What role of VC funding in explaining the growth of startup companies? What is the signaling value of VC funding events as well as the credibility of the signal?	How do VCs spend time with their portfolio companies and what roles do they play? What happens to the relationship between VC and portfolio company during periods of adversity?
Methodology	Network analysis that uses graph theory. Data is collected from Thomson Venture Economics database on investments and syndicate structures (networks). Regression analysis on the network and portfolio company performance.	Collecting survey data on bundles of VC offers made to start-ups that are accepted to E-Lab program of MIT Entrepreneurship Program. In the analysis offer is the unit in the analysis. Regression analysis.	Study is based on signaling theory and several proprietary databases are used to collect data on headcount and financing rounds. Regression analysis on headcount development around (+/- 3 months) each financing round.	A detailed survey to 100 VCs in the beginning of 1984. Statistical analysis on the results of the survey.
Sample	3469 VC funds that are managed by 1974 VCs and 16315 portfolio companies	249 financing offers made to 149 start-up companies	494 start-ups of whom 193 are VC-backed and 301 non-VC-backed	100 venture capitalists (response rate 49%).

One of the earlier academic studies that identify intangible assets VCs bring to the table that end up adding value to the portfolio companies is the study conducted by Gorman and Sahlman (1989). They are one of the first academics that focus on how VCs spend their time with portfolio companies and what happens in the relationship when a portfolio company faces challenges. This early joint-study conducted by an author from McKinsey & Company and another from Harvard Business School has also been widely cited in the later studies that have followed in this field.

The value of the study conducted by Gorman and Sahlman (1989) is not in the use of highly developed quantitative methodologies – actually they just conduct simple statistical analysis on the results on their survey. The academic value of their research, taking into account that the study is conducted already in 1989, lies in the way to conduct a survey to receive a unique data and the response rate that is as high as 49%. The study exquisitely addresses the relevance of access to unique data as the source of added value in this field of research.
More recent studies focus more explicitly on the added value of the intangible assets that VCs offer for the portfolio companies. These studies are usually narrower and more focused when comparing against the earlier literature.

One of the recent studies conducted by Davila et al. (2002) addresses the reputation of venture capitalist as a possible source of value added in the operations of portfolio companies. They use unique dataset collected from various databases and methodology drawn from the signaling theory in order to identify the signaling impact of venture capital investments on the company growth. With highly sophisticated methodology they identify clear signaling effect both before the VC investment and when the actual transaction occurs. However, as the data for the study is collected from the period 1994–2000 mostly from Silicon Valley-based companies the results can be questionable to some extent. This period has been characterized as unique and, accordingly, generalizing the results to other time periods should be done with care. (Davila et al., 2002)

Another intangible asset that is identified in the current literature to add value to portfolio companies operations is the reputation of the venture capitalist providing financing. A study conducted by Hsu (2004) focuses on this added value through VC reputation. He uses sample of portfolio companies that have received multiple financing offers in order to identify whether reputation of a VC is a decision criteria for the portfolio companies when evaluating

their alternatives and whether portfolio companies are willing to turn down financially more attractive offer in order to accept an offer from a VC with better reputation.

The regression study conducted by Hsu (2004) identifies empirically that offers made by VCs with a high reputation are three times more likely to be accepted, and high-reputation VCs acquire start-up equity at a 10–14% discount. The evidence suggests that VCs' "extrafinancial" value may be more distinctive than their functionally equivalent financial capital. Hsu (2004) concludes that these extra-financial services can have financial consequences.

One of the most recent studies in the field of VCs' value adding intangible assets is the study conducted by Hochberg et al. (2007). The authors conduct a study seeking to identify the performance consequences of the magnitude of VC's relationships and networks for portfolio companies. Their analysis on the syndicate investments and the performance of portfolio companies suggests that better-networked VC firms experience significantly better fund performance, as measured by the proportion of investments that are successfully exited through an IPO or a sale to another company. Similarly, the portfolio companies of better networked VCs are significantly more likely to survive to subsequent financing and eventual exit. Based on the strong results by Hochberg et al. (2007) it can be concluded that also relationships and networks of VCs may add significant value for portfolio companies operations.

The research in the field of intangible assets that venture capitalists bring to the table, just as the research about the target selection or corporate governance and participation, shows that there are multiple ways that venture capital and venture capitalists influence their portfolio companies. This influence, whether planned or hidden, often adds value to the portfolio company's future performance and the window of opportunities may open up for future success.

However, often even identifying the positive influence may be hard due to the VC selection effects as well as many forms and ways of VCs operations toward the portfolio companies. Also the non-public nature of the operations and low availability of data incurs difficulties for identifying and measuring the value added. The most precious studies in this field are either conducted using unique datasets that have been received from VCs or collected through

surveys or implementing methodologies new for this field of research for data from publicly available databases.

2.3 Research on the Impact of Venture Capitalists

Is it true that venture funded firms are performing better in terms of turnover and employment growth than non-venture funded firms? Is their innovative output larger than those of their counterparts not receiving private equity financing? Whereas the studies in the field of added value try to explain the superior performance of VC-backed companies the research on the impact of venture capital seeks to identify the impact, whether positive or negative, on the portfolio companies altogether. Researchers have a lot of work to do in the field since it is challenging to demonstrate the causal relationship between the presence of venture capital and employment growth, innovation or other impacts (Gompers and Lerner, 2001). The challenges faced in the impact research are discussed in more detail in section 2.3.4 of this thesis.

The research on the impact of venture capital belongs to the foundations of the research on private equity. Logically the identification of the superior performance of the firms should be a perquisite for the whole research explaining the superior performance of VC-backed companies. However, the real world is quite different as the value added literature actually often precedes the impact literature. Also the volume of the value added research clearly exceeds the volume of impact literature. (Alemany and Martí, 2005)

Alemany and Martí (2005) suggest that current literature on the impact of venture capital can be grouped in two: (1) specific research in subjects such as innovation and job creation; (2) studies focusing on a more comprehensive impact of VC-backed firms in the economy. This categorization is accurate and most of the literature, especially the firm-level studies, seem to fall under the first category (e.g. Achleitner and Klöckner, 2005; Engel, 2002; Engel and Keilbach, 2007; Kortum and Lerner, 2000; Romain and van Pottelsberghe, 2004). However, also the number of more comprehensive studies, especially non-academic studies conducted by the national and cross-national VC-associations, has been increasing (e.g. Alemany and Martí, 2005; Global Insight, 2004; EVCA, 2002) as private equity has been a topic of active public discussion. One recent contribution to this discussion has been a report on the global

economic impact of private equity published by the World Economic Forum in January 2008 (World Economic Forum, 2008). Usually a common denominator studies falling under the second impact study group is the use of more than only one or few indicators of economic impact. The objective of this thesis clearly categorizes this paper under the comprehensive impact literature.

Despite the general categorization of literature on the effects of venture capital there are some recent studies with broader scope than only identifying the impact of venture capital. These papers combine, at least to some extent, views from both, the current impact literature and literature on the value added by venture capital (e.g. Peneder, 2007). These studies should not be left without notice so they are reviewed in this part of the thesis.

2.3.1 Job Creation

Employing people is thought to be positive for the economy and society. Employees pay large amount of taxes that benefit the whole society, as do the earnings that employees earn while producing valuable inputs and then use in their day-to-day life. Based on this logic companies employing lots of people are thus thought to be more beneficial to the economy, especially when unemployment is present in the economy, than companies where most of the work is automated.

Based on the reasoning above the research on the VC-financing and employment growth has been the most important specific research area within the impact literature. The research has focused either on the macro-economic estimation of employment growth effects (e.g. Belke et al., 2003) or on firm-level implications concerning employment growth (e.g. Engel, 2002; Kjærgaard, 2004). We focus especially on the latter group of research since this thesis is conducted as a detailed firm-level study covering major part of the VC-backed companies in Finland during certain period. Some of the most important studies concerning the employment effects of private equity are summarized in the Table 4.

Table 4: Research Papers on the Employment Effect of Private Equity

Study	Achleitner and Klöckner, 2005	Kjærgaard, 2004	Belke, Fehn and Foster, 2003	Engel, 2002
The most important research topic	What is the contribution of the private equity and venture capital sector to European employment?	Do venture-backed firms outperform non-venture-backed equity financed firms in terms of employment growth?	Does venture capital investment spur employment growth?	What is the impact of venture capitalists on employment growth of new founded firms?
Methodology	Statistics from EVCA and other European private equity and venture capital associations and online survey data. Statistical analysis on the total employment, employment growth and research activity.	Accounting data analysis on Danish VC-backed companies. Descriptive statistics and statistical analysis as well as a multivariate regression model for explaining the growth.	Building a macro-model for matching VCs and portfolio companies. Regression analysis based on the empirical data to identify the macro-economic impact of VC-financing to employment.	Model building and micro-level econometric analysis for calculating growth for portfolio companies.
Sample	In the online survey 1000 VC funds representing 94% of total European investment activity. 99 BO and 102 VC provided sufficient information.	443 Danish VC-backed companies of which 329 could be included in the analysis. Also control group sample.	Macro-data including macro-economic time series, institutional labor market variables, VC investment time series and institutional variables	Firm specific data by Creditreform about EVCA member companies portfolio investments. Sample of 777 VC-backed companies of which 339 growth figures can be calculated.

As already mentioned, the national and cross-national private equity and venture capital associations have been active researchers of the impact of private equity. Especially the European Venture Capital and Private Equity Association (EVCA) has been productive in this field. The study conducted for EVCA by Achleitner and Klöckner (2005) about the employment contribution of private equity in Europe is a good example of a study focusing solely on the contribution of VC on employment.

Achleitner and Klöckner (2005) use statistics provided by EVCA in order to estimate the total employment contribution of private equity financed companies in Europe. In addition they conduct an online survey to the VC investors in order to estimate the employment growth in their portfolio companies. Just as many other papers on the economic and societal impact of private equity Achleitner and Klöckner (2005) employ statistical analysis on the data without regression analysis or other more complex research methods. Their main findings on the employment growth is that private equity financed companies created 1 million new jobs between 2000 and 2004 and that the employment growth in the private equity financed companies was eight times the annual growth rate of total employment in the EU 25.

However, their findings can be, at least partially, questioned due to possible bias occurring from low response rate of their online survey.

Kjærgaard (2004) examines the impact of VC-financing on firm growth using employment growth as a proxy for firm growth. His study that uses data from Danish venture capital market is based on statistical analysis and multivariate regression model. His basic assumption is that employment growth can be explained by VC funding, company age and high-tech vs. low-tech division. Kjærgaard uses a control group of firms that have received equity financing but not venture capital and compares the development of VC-backed companies to the development in the control group. He finds out that the annual employment growth in VC-backed companies is 29%, which is six times greater than the average growth rate for other equity financed companies.

Engel (2002) examines the impact of VC financing on employment growth of new ventures. He takes an econometric approach for analyzing the employment growth and employs a German dataset of 632 VC-backed new founded companies that can be included in the analysis. Engel seeks to tackle the often faced endogeneity problem in the regression analysis by implementing an extension of Heckman´s (1979) selection approach from univariate selection to a bivariate selection. Just like Kjærgaard (2004) also Engel (2002) distinguishes between high-tech and low-tech companies. He finds out that VC-backed companies employment growth was 42% whereas non-venture-backed companies equivalent growth rate was only 14%. Based on his analysis he also concludes that pre-investment screening procedure, provided services and monitoring by venture capitalist affects new firm employment growth positively.

Employment is clearly an important indicator of economic and societal impact of private equity. However, the employment growth is not the sole driver of economic growth and welfare. In many industries the number of employees has been stable or decreased and the output of the industry has still increased. This is due to productivity, which is another important driver of economic growth. This suggests that employment should not be used as a single measure for the impact of private equity.

2.3.2 Innovation

In the recent years the academic research has seen a rise of the empirical literature studying the determinants of R&D activities and innovations. However, studies combining the influence of financing or financial institutions with innovations or innovativeness have been rare, most likely because of the difficulty of studying the subject (Tykvová, 2000).

Despite the difficulties in studying the subject, the impact of venture capital on innovation has yielded some studies that enlighten the effect of VC-financing on innovation growth. Just as in the employment growth section the studies range from macro-economic industry-level estimations (e.g. Romain and van Pottelsberghe, 2004) to firm-level studies (e.g. Engel and Keilbach, 2007). The key studies related on VC impact on innovation are summarized in the Table 5.

Table 5: Research Papers related on the Impact of Venture Capital on Innovation

Study	**Engel and Keilbach, 2007**	**Peneder, 2007**	**Romain and van Pottelsberghe, 2004**	**Kortum and Lerner, 2000**
The most important research topic	What is the impact of venture capital finance on growth and innovation activities of young German firms?	Are there differences in growth and innovation between VC-financed and non-VC-financed firms? If so, is this due to diligent screening and selection process or do VCs add value?	What is the macroeconomic impact of VC based on innovation growth and absorptive capacity?	What is the influence of venture capital on patented inventions in the United States?
Methodology	Creditreform data on young VC-funded companies employment growth and patent applications. Statistical matching procedure to find the control group. Statistical analysis and testing.	Australian data on VC-financed companies and control group. Actual data collected by survey. Statistical and econometric analysis (regression model).	Macro-economic regression analysis using panel data for 16 OECD countries. The researchers use VC as an additional source of knowledge in a traditional knowledge production function.	Annual data for twenty manufacturing industries in the US. Regression analysis based on an estimated patent production function.
Sample	Sample of 50 000 German companies of which roughly 1% is VC-funded.	Sample of 174 VC-financed and 663 non-VC-financed companies (51% response rate for the test group).	Panel data for 16 OECD countries for years 1990-2001.	Data (patent applications, R&D exp., VC fundraising and disbursements) for 20 industries in 1965-1992.

One difficulty in studying VC impact on innovation is finding a reliable measure for innovation that really leads to the development of new business opportunities or to increases in the productivity. The number of patents or patent applications is often used without much

consideration between patents and actual innovation. Patents are used as there is data available, despite the fact that venture capital may spur patenting without necessarily any impact on innovation (Kortum & Lerner, 2000). In their study Kortum and Lerner (2005) find out that companies searching VC-financing may also patent as they want to impress the potential investors or they may fear that the potential venture investors will exploit their ideas in some other venture.

Kortum and Lerner (2000) use patent applications as a measure of innovative output of a company despite the identified challenges. They identify, in addition to other problems, that patenting may also be related to the arrival of technological opportunities. As the arrival of technological opportunities will also lead to higher R&D expenditures Kortum and Lerner (2000) use R&D expenditures as a control variable of these opportunities.

The study conducted by Kortum and Lerner (2000) adds significant value to the current research also on considering the methodological side of the analysis and the often causality problem. They identify that the mechanisms behind the venture capital funding and patenting and the extent to which their estimates of the impact of venture funding may be inflated by unobserved factors cannot be addressed easily. Due to this possible endogeneity problem Kortum and Lerner (2000) implement a specific leagal change that has affected the patenting as an instrumental variable into their equation in order to control for the possible bias in the equation.

Kortum and Lerner (2000) also take in to account the possibility of companies applying for VC-financing patenting only to impress the potential investors. They measure the quality of the patents for example by observing the citations and following law suits. Kortum and Lerner (2000) find out that VC-financed firms not only receive larger number of patent awards but also higher scores concerning different value correlated variables. They take these findings as evidence in favor of the hypothesis that venture funded firms are more innovative, producing a larger and higher valued stock of patents.

Engel and Keilbach (2007) study the impact of venture capital on growth and innovation of young German firms. They go along with Kortum and Lerner (2000) in the critique of using patenting as such as a sole measure of innovation due to three observations, which are (1.) not all innovations can be patented, (2.) the duration of the patenting procedure is often too long

for innovation cycle and (3.) patenting procedure discloses some part of the knowledge that is imbedded in the innovation. Nevertheless, they conclude that patent application is still the dominant approach to measuring innovative output since it is the most detailed and best documented data available. Engel and Keilbach (2007) find a significant impact of VC into firm growth but monitor no significant increase in their innovativeness based on patenting. Venture funded firms do show significantly larger number patenting applications, but they do so already before the engagement of a venture capitalist.

Peneder (2007) has conducted a remarkable study on the growth and innovation effects of VC-financing on Australian companies. He combines data from public databases and his own survey in order to measure the innovative output not based on patenting but based on a subjective evaluation by the companies themselves. Peneder (2007) collects a control group for his study using econometric matching procedure in order to analyze whether the possible impact of VC-financing arises from the selection and screening process or from actual value added by VCs.

Based on the results of his survey Peneder (2007) concludes that venture capital backed firms generally appear to have a stronger orientation towards international markets, a more frequent introduction of new products, and a greater inclination to protect their innovations. However, the observed differences in innovation performance prove to be the result of pure selection effects and not the direct causal impact of VC-financing on innovation. The latter result increases the reliability of the study as this result is hard to question with an argument suggesting biased data.

As presented in this section the innovative output, no matter if measured with patent applications, R&D expenditures or survey results, is a relevant indicator of economic and societal impact of private equity. However, the problems associated with all different measures of innovative output have to be taken into account when assessing the VC impact on innovation. Also using innovative output as the sole measure of economic and societal impact would result in a relatively narrow picture on the total impact of VC on economy and society.

2.3.3 Studies Focusing on the Impact in the General Economy

The impact studies that have focused in the general impact on economy and society in a broader context have been dominated by the research conducted by/for the different venture capital and private equity associations. The first impact study, to my knowledge, dates back to 1982 and was undertaken by Venture Economics Inc. (1982) for the US General Accounting Office. This study was followed by a similar one conducted in the UK in 1987. The problems in these early studies were the use of limited datasets that represented only less than 10% of the population and the possible positive bias of the data due to survey method that only considered the companies that were still in the business and doing well enough to be interested in reporting their results. These studies also didn´t take the timing of the VC financing event into account or compare the development of the VC-backed companies against the development in a control group as the more recent studies do. Some of more recent studies that have followed are presented in the Table 6.

Table 6: Studies focusing on the Private Equity Impact in General Economy

Study	**Global Insight, 2007**	**Alemany and Martí, 2005**	**Global Insight, 2004**	**EVCA, 2002**
The most important research topic	What is the importance of venture capital backed companies to US economy?	What is the economic impact of Spanish VC-backed companies?	What is the importance of venture capital and its benefits to US economy?	What is the economic and societal impact of VC in Europe?
Measures used	• Employment • Sales	• Employment • Net sales • Gross margin • Total assets • Intangible assets • Corporate taxes	• Employment • Sales • Wages • R&D	• Overall existence • Employment • Turnover • EBIT • Destination of VC-funding • Involvement of VCs • Management and employee remuneration
Methodology	Statistical analysis (Whole US level, which is broken down and analyzed by industry sector and region) and comparison to industry sector and region averages.	Statistical analysis and comparison to matched control group. Econometric regression model for testing the relationship between VC funding and evolution of different variables.	Statistical analysis (Whole US level, which is broken down and analyzed by industry sector, state, and region) and comparison to industry sector, state and region averages.	Statistical analysis on the different focused measures that the respondents reported based on a questionnaire.
Sample	Database of 23 580 VC-backed companies in US.	323 VC-funded Spanish firms.	Database of over 20 000 companies.	2 908 questionnaires with 364 respondents in expansion or seed/start-up investment stage.

The recent studies have improved from the earlier days in many ways but the most significant improvement is the comparison of the results of the private equity-backed companies with some kind of control group (Alemany and Martí, 2005; Global Insight, 2004, 2007; World Economic Forum, 2008). However, the research conducted by the private equity and venture capital associations still often suffers from possibly biased survey techniques and the control group, if any, is not designed to reflect the nature of the VC-backed companies. These studies usually benchmark their sample results only to average results of public data (e.g. FTSE-100, average of private companies, average of industry sectors). This problem arises from very limited availability of any databases that allow statistical matching or econometric techniques for defining a control group that would reflect the actual sample.

The research conducted by the academics is usually more evolved methodologically and control group wise than the studies conducted by the private equity associations. These studies are still few, but one remarkable academic example is the study conducted by Alemany and Martí (2005). These researchers, just like many of the earlier reviewed studies that focus only on one or few measures of economic impact, use a matched control group against which the development of private equity-funded companies is compared. Alemany and Martí also use significant number of different measures not focusing only on the traditional impact measures. Their measures include in addition to the commonly used employment and sales also total assets, gross margin, corporate taxes and net investment in intangible assets which is used as a proxy on innovation. In addition to the statistical analysis on the economic and societal impact Alemany and Martí (2005) also build a regression model after in order to analyze the actual relationship between private equity funding and development of various set of measures. They seek to resolve the causality problem resulting potentially endogenous variables through panel data techniques and the evolution of the variables compared to the cumulative VC investment.

Alemany and Martí (2005) identify positive economic impact of venture capital for employment, net sales, gross margin, total assets and intangible assets growth. This impact is statistically significant at 1% level for all these variables except for total assets and employment for the companies in the start-up stage. As for the results of their regression model clear evidence is found of positive impact of the intervention of VCs on employment, on the volume of total assets and on the amount of corporate taxes paid. On the other hand the coefficient of the variable that equals 1 while a VC remains as a shareholder in the company

is positive and significant in the specifications that explain the growth of sales, gross margin, total assets and intangible assets.

Despite the lack of the evolved selection of control group or modern methodologies, the recent studies conducted by the private equity associations have some areas where they often surpass their academic counterparties. These areas are the data quality in terms of absolute volume and especially the scope of the information that allows analysis to drilldown for example into specific industry sectors or geographical regions.

Good examples of the studies where the data volume and representation is high and the analysis drills down into specific industry sectors and regional areas are the Venture Impact-studies conducted by the Global Insight Inc. (2004 and 2007) for the National Venture Capital Association. These studies focus on evaluating the impact of venture capital in U.S. economy and they are conducted in a similar manner updating the basic research scheme with new information on more than 23 000 companies in every three years. The most recent study conducted in 2007 concludes that the total revenue of VC-backed companies is 17.6% of the U.S. GDP and these companies employ 9.1% of the whole U.S. private sector employees. It also finds out that the annual employment growth was 3.6% and sales growth was 11.8% in 2003-2006 for the VC-backed companies while equivalent growth rates for the total U.S. private sector were 1.4% and 6.5%.

Also the European Private Equity and Venture Capital Association has researched the impact of private equity in Europe (2002). The research method in this study is a survey study sent to the VCs operating in Europe. The applied survey method causes also the major drawbacks of the study due to the low response rate of 12.5%. The survey method can also result in positive bias in the dataset because it is likely that only those firms performing well have any interest in reporting their results (Alemany and Martí, 2005).

The advantage of the survey study method and the research conducted by EVCA (2002) and is the possibility to collect relatively easily data on various measures of economic impact. This way the study may approach the economic and societal impact of private equity from many new directions not just focusing on the traditional employment and sales growth. Some of these measures are common in the value added literature, such as the involvement of the

VC and the board composition, but some of them are new altogether. One of these new measures is for example the use of VC funding within the company.

Maybe the most comprehensive recent report on the societal and economic impact of private equity is published by the World Economic Forum (2008). Their Global Economic Impact of Private Equity Report 2008 approaches the global impact of private equity from multiple directions with various datasets and research methodologies through four previously unpublished large-sample studies and six private equity case-studies, two of which are from Europe, two from China and two from India. The large-sample impact studies in the World Economic Forum report are summarized in the Table 7.

Table 7: Large-sample Impact Studies Published by World Economic Forum in the Global Economic Impact of Private Equity Report 2008

Study	**The new demography of private equity (Strömberg)**	**Private equity and long-run investment: the case of innovation (Lerner, Sørensen and Strömberg)**	**Private equity and employment (Davis, Haltiwanger, Jarmin, Lerner and Miranda)**	**Private equity and corporate governance: do LBOs have more efficient boards (Cornelli and Karakas)**
The most important research topic	What are the demographics of global leveraged buyout activity, exit behavior and holding periods and how have they developed over time?	What is the impact of private equity investment in innovative activities?	What are the employment outcomes of PE in terms of +/- 5 years path around the investment and in terms of greenfield job creation?	How do boards with private equity investors function and are they more effective than their counterparties?
Methodology	Statistical analysis for the evolution of the LBO market. Statistical and regression analysis for the longevity of LBO exits and for the holding periods.	Multivariate regression analysis on patent importance, fundamental nature of patents, patent quality and level of patenting. Statistical analysis on patent portfolios.	Statistical analysis for basic comparative analysis. Regression analysis for analysis on firm-level changes. Comparison to control group defined by matching by firm age, industry and corporate structure.	Statistical analysis and testing of the board composition and evolution of the board after the buyout.
Sample	Sample of 21 397 buyout transactions in 1.1.1970-30.6.2007 from Capital IQ database.	PE-transactions matched to US patent records. Sample of 6 398 patents awarded up to 495 PE-backed firms.	5 000 U.S. private equity acquired firms and about 300 000 establishments operated by these companies.	142 public-to-private transactions that took place in the UK 1.1.1998-1.10.2003. 88 LBOs, 42 MBOs and 12 other.

The studies published in the report published by the World Economic Forum (2008) are conducted by the top-of-the-notch core research team lead by Josh Lerner who is a professor of investment banking at Harvard Business School. The results of the studies build together a clear and comprehensive cross-section of the global impact of private equity investments.

Despite the generally high level of the report some published by the World Economic Forum (2008) notions should be made. Firstly one needs to notice that as the report focuses on the impact of private equity on the global level the conducted studies do not drill down into specific geographical areas or industry sectors. Another attention, that is especially relevant for this thesis, is about the used datasets in the large-sample studies: The data for the conducted studies covers mainly private equity transactions made in the U.S. and the UK. Also the general problem with possible endogeneity is paid only little attention in the studies conducted for the World Economic Forum. We can conclude that the report by the World Economic Forum, despite its significant added value, still leaves considerable room for further research on the subject.

2.4 Common Challenges in the Impact Literature

The challenges of impact research are not just present when studying the impact of private equity, but in other fields of impact research as well. The main problems and possible biasedness arises from two issues that are interconnected; the research methods and the choice of sampling. The more advanced methods have been identified and the methodologies develop further all the time. These methods can, however, not often be fully employed due to the need for compromises because of the required data is not available.

This part of the literature review discusses the most common challenges and sources of bias in the impact literature and the ways that research has employed in order to tackle these challenges. It also drills down to certain methodological choices made in order to tackle these challenges.

2.4.1 Selection Bias and Endogeneity

In a private equity context, as Lähdemäki (2007) identifies, a ´selection bias´ does not usually refer to the researchers mistakes in the sample selection but is a consequence of the dynamics of the private equity industry and target selectiveness, which make the selection bias unavoidable.

As already identified in the sections 2.1 and 2.2 of this thesis the target selection plays a crucial role in venture capital activities. The venture capitalist has often an opportunity to choose the company which they will invest in or at least they may refuse to make investments to any available companies. Through the screening and selection process the companies that potentially benefit the VCs the most, i.e. the companies that carry superior growth potential, get financed. The companies that do not receive VC funding may not be started at all or they face a challenge of obtaining financing from elsewhere. Failing in doing so can result in more modest growth than their VC-financed counterparties. On the other hand, VC-financed companies might have got funding from elsewhere and performed as well or even better without VC funding.

As the selection process of private equity investors is not random and the investments are based on the predictions of the growth potential the investments decisions done by VCs are found out to be "endogenous" (Engel, 2002). This issue of endogeneity causes selection bias at least to some extent in most cases of impact research.

The selection bias caused by the endogeneity of the investment decisions is most obvious when the development of VC-funded companies is compared against the development of broad control groups such as the averages of different industries. Engel (2002) however identifies that the evaluation of the impact during the time of venturing is only possible is effects resulting from the pre-investment screening procedure are excluded. The bias decreases when the comparison group is made smaller and more similar to the portfolio companies but reducing the bias to zero through target selection would mean finding perfect non-VC-financed matches for each VC-funded company. This is, of course, not possible and the research thus also employs different econometric analysis techniques in order to tackle the problem with endogeneity.

Also another kind of selection, namely the self-selection by the companies themselves, can cause biasedness in the impact research. This occurs when a potential company that could receive private equity funding decides not to apply for funding because of whatever reason. The reasons for willing to apply for PE-funding can be many, such as existence of other more attractive sources of financing or will to retain the full control over the company within the current owners, and indeed many companies decide not to rely on private equity financing. In order to completely remove this bias the control group selection should be limited to

companies that applied but did not receive private equity funding. This, on the other hand, would result in significantly reduced pool of companies for control group selection.

2.4.1.1 Reducing Selection Biasedness through Control Group Selection

The methodology for defining the control group against which the VC-funded companies are compared is highly relevant for the problem with endogeneity. In the current research the methodologies applied for selecting the control group are limited significantly more by the lack of access to databases that allow the use of sophisticated matching techniques than by the lack of sophisticated matching methodologies themselves.

The most unrefined methodologies for defining the control group are comparisons of portfolio company development against the growth in GNP or the aggregated development of different industries nationally. Lähdemäki (2007) employs comparison against aggregated development of industries in Finland due to the lack of databases allowing more sophisticated matching. Industry average comparisons are applied also in the large sample study conducted by Global Insight (2004) for the National Venture Capital Association in United States due to a sample of over 26,000 VC-funded companies that would have not allowed more sophisticated matching.

Kjaergaard (2004) studies the differences between VC-financed and other equity-financed companies performance in his study. He collects the original data for portfolio companies from annual reports of Danish VCs and selects the control group from national database of companies accounting data. He limits the control group to companies that have received non-venture-capital private equity financing. Comparisons and testing was carried out within different investment stages and level of technology within the companies. Whereas the methodology manages to eliminate the self-selection bias well, the actual selection bias in the analysis is most likely significant due to incomplete matching which does not take for example the different industries or size of companies into account.

More evolved matching method is introduced by Alemany and Martí (2005) as they identify the relevance of firm specific industry and size components for selecting the control group. In their research Alemany and Martí (2005) match each VC-backed company with a non-VC-

backed company based on four consecutive steps: (1) they pick the companies operating in the same province, (2) they select the companies with the same activity code, (3) they filter the companies within the same range of sales and finally (4) they select the company that is closer in age to that of the VC-funded company. The method applied by Alemany and Martí (2005) yields good outcomes when there are only few variables to be matched but a question remains whether these variables are sufficient and all the other variables can be ignored. On the other hand if the number of variables used in the matching is increased the task of finding good matches becomes significantly harder.

Peneder (2007) and Engel and Keilbach (2007) use propensity matching for identifying the control group in their research as this method allows taking multiple variables into account by estimating the conditional probability to be subject to venture funding for each firm. After this the matching procedure simplifies to finding for each venture funded firm a non-VC-funded counterpart through nearest-neighbor matching (Heckman et al., 1999, p. 1953). Peneder (2007) decides to include the four closest matching companies for each VC-funded company in the control group, thus increasing the size of the control group. All in all this method is backed by superior methodological support compared to the previous matching methods.

2.4.1.2 Other Econometric Methodologies for Tackling Selection Bias

Despite the methodological evolution in the control group selection the selection bias cannot be fully removed through the matching procedure of VC-financed companies to the non-VC-financed companies. This has led to a quest for other research methodologies, not related directly to the matching, that can be used to tackle the potential problem with endogeneity.

The classical solution to the selection bias is based on the use of instrumental variable regression instead of normal OLS regression in the analysis. In this method the defective explanatory variable is semi-replaced with one that is not correlated with the disturbance term. In the case of an impact study the instrumental variable would have to be related to the variables used analyzing the impact but not correlated with the venture capital presence.

Often finding an instrumental variable that meets these qualifications is difficult, especially in the studies using multiple variables. This methodology has been, however, used for example

by Bottazzi et al. (2007) in their study on the value added by venture capitalists. They implement instrumental variable which is often a common choice in the instrumental variables approach: A measure of the local availability of the selected characteristic. In the research by Bottazzi et al. (2007) this means instrumenting endogenous experience of selected individual VC investors by the exogenous local availability of experienced investors in general.

Another common methodology for solving the problem with sample selection bias is to use a methodological procedure originally employed by Gronau (1974) but developed further by Heckman (1979). The Heckman two-step procedure is based on first estimating the omitted variable, meaning the selection bias, from the results of probit analysis of selection. This is followed by second step where the estimated omitted variable is included as an explanatory variable in the OLS regression equation which now yields consistent estimates. Heckman (1979) two-step model has been used in VC impact studies for example by Engel (2002). Also Bottazzi et al. (2007) discuss an extension of this procedure based on the research by Sørensen (2007) in their analysis.

2.4.1.3 Most Recent Studies Seeking to Overcome Selection Effects

The most recent research methodologies for overcoming the problem caused by non-random selection are actually more of a total turnaround in the research approach of economic studies than a treatment solely for this problem. The problem with endogeneity can be avoided if experiments and selection are random. In the most recent economic studies conducted by researchers from Harvard University and Massachusetts Institute of Technology (MIT) have begun to champion the latest thing in economics: The randomized evaluations (The Economist, 12.6.2008).

In these studies different policies are tested by randomly assigning them to different groups and thus no sample selection bias occurs in the observed results. These randomized evaluations are a good way for assessing microeconomic questions but are of limited potential for macroeconomic studies. At least to my knowledge no studies have assessed the impact of VC financing on economy before and this is clearly a challenging task since randomizing the selection of investment targets is most likely not a good policy for VC investors willing to

succeed in their business. Nevertheless a randomized evaluation may succeed in assessing the impact of VC financing in the future without concern for selection bias or endogeneity.

2.4.2 Survey Bias

Many challenges faced in the research on the impact of private equity are often related to the data that is used. Often the non-public nature of the private equity data causes problems for academic research and even the private equity investors and the associations looking after their interest have limited access to representative datasets. Different surveys are often employed in order to achieve data for impact research but this method for collecting the data yields a concern for possible biasedness.

Survey biases may arise from several factors. Questionnaire studies suffer often from a low response rate and are probably positively biased due to the companies performing well may be more inclined to answer the questionnaires sent to them. As Alemany and Martí (2005) also point out that survey bias may be caused also by biased opinions of the person or persons providing the answers.

2.4.3 Survivorship Bias

Survivor bias results in from the tendency to include to the firm level impact studies, measuring the development within certain timeframe, only those companies which were successful enough to survive until the end of the period. If the failed companies are excluded from the impact studies because they no longer exist the results of such studies skew higher, thus, resulting in a positive bias.

In the real life some companies that receive VC-funding are terminated for example through bankruptcy or an acquisition. Survivorship bias is common due to the fact that many databases include information only on the existing companies, and when collecting data through questionnaires only existing companies can provide answers. Many researchers also leave companies that receive VC financing but fail shortly afterwards out of the analysis because complete data for their research period is not available. If all the companies that received VC funding can be included in the research the survivorship bias can be avoided.

3 Hypotheses

It seems reasonable to argue that if there is a difference in performance between venture backed and non venture backed companies it should arise from some of the functions by which VCs can exert an influence towards their portfolio companies. As presented in the section 2.1.2. Peneder (2007) identifies three broad functions for venture capital.

The first function is the financing function of venture capital. It refers to providing adequate financial resources for business cases that would have had no access to financing through traditional sources of capital and thus creating additional value.

Second function, by which VCs can exert an additional influence, is the selection function. This means the allocation of financial resources to the most profitable uses when uncertainty and problems of asymmetric information are particularly high. This function is based on an assumption that the screening and selection process of venture capitalists leads to selecting the most potential targets for financing. Main reasoning behind this assumption is the vast experience about the industry, evaluation process and business in general that VCs possess.

The third, and by far the broadest, function by which VCs can exert an influence toward investee companies is the value adding function. This value adding function refers to the operations conducted by VC after the investment in order to enhance the growth of the portfolio company. These operations relate to VCs monitoring or supporting the portfolio companies operations or taking control over some matters in the company. The value adding function is of special interest here as this thesis seeks to identify the actual economic and societal impact of private equity through various firm-level economic measures. The most severe difficulty will most likely be how to exclude the selection function value adding effect from the other impact of the various functions.

If VCs have the necessary financial resources, skills and possibilities to participate then this should lead to:

H1. There is a positive relationship between private equity funding and the growth of sales, employment, innovation, profitability, total assets, and corporate taxes of a company and the

differences between the private equity backed companies and non private equity backed companies are statistically significant.

According to Kjærgaard (2004) the combination of strong specialization and profound involvement in company management suggests that VCs have a comparative advantage in handling firms where informational asymmetries are particularly pronounced. The stage of development is believed to have an impact in this respect.

In fact Kjærgaard (2004) argues that the brevity of an early-stage firm's track record aggravates the effects of adverse selection and moral hazard compared to later-stage firms. Thus, to the extent that VCs are distinctly skilled in mitigating asymmetric information this should lead to:

H2. The relationship between private equity funding and growth of the chosen firm-level measures is stronger for early stage companies compared to later stage companies.

Another important classification is made by both Engel (2002) and Kjærgaard (2004). These studies distinguish between high-tech and low-tech industries in order to validate whether the impact of private equity is more significant for high-tech industries. The hypothesis in both studies is that the impact is greater for firms operating in high-tech industries.

The most solid reasoning behind this hypothesis is that a higher risk of insufficient market acceptance of new products at the market entry leads to more attention, monitoring the business activities of innovative firms and provided services by venture capitalists or other investors. Given a positive association between provided services and the performance of the portfolio company, the impact on firm performance is supposed to be larger in firms with a high innovation level. Kjærgaard (2004) points out that the informational asymmetries are also assumed to be more critical for firms in high-tech industries compared to low-tech industries which should lead to the same conclusion. Therefore, the hypothesis seems to be testable on the level of industries and is:

H3. The relationship between private equity funding and growth of the chosen firm-level measures is stronger for companies in high-tech industries compared to companies in low-tech industries.

4 Data and Methodology

4.1 Research Approach

This study focuses on analyzing the firm-level impact of private equity as the possible general economic and societal impact of VCs is supplied though individual companies in which they invest in. Another possibility would be a macro-economic study but finding suitable data on venture capitalists activities for this is a challenging task as Finnish VCs do not disclose their activities or data on them publicly. However, many challenges are also faced in the firm-level approach.

As presented in the previous sections the general problem with identifying the impact of a private equity investment (treatment) on a company is that there is no identical company that did not receive this investment. Of course many companies can be found that did not receive the treatment and many that did, but the question remains how to reliably identify the actual impact as these groups differ significantly. This underlines the general problem in treatment studies and results in this case a problem with endogeneity in the analysis.

The data available for the impact study is non-experimental as the private equity investors indeed select their portfolio companies carefully. This fact undermines the possibility to use methods developed for random experiment studies. In random experiments the randomness has to be present in the experiment from the beginning and the general method is to use a random sample as an input and observe the impact on the output. In this case the private equity investments would have to be given randomly to companies without them applying for one and without considering the companies characteristics.

From the preceding discussion on the impact of private equity one can easily conclude that tackling the general problem with endogeneity is related to the careful selection of a control group against which the private equity funded companies are compared. The control group selection is in this case limited by the availability of Finnish databases that allow the use of sophisticated control group selection techniques. This research nevertheless succeeds at defining the control group based on statistical matching that significantly reduces the problem with endogeneity compared for example to analysis using the industry aggregate development as a control reference. However, succeeding in the control group selection does not by any

means completely solve the problem with endogeneity and thus it has to be taken into account when selecting the analysis methodologies and interpreting the results.

This research is conducted as a firm-level analysis on the impact of private equity investments but the approach does not narrow down the selection of the firm-level measures which we observe in order to analyze the impact. I will seek to analyze the firm-level impact of private equity not just based on a single or few measures, as common in the current literature[5], but on a more comprehensive level through various measures. I will include individual firm-level measures for company size, employment, innovation, profitability, total assets and government direct income in the analysis as these measures can clearly carry a broad impact on the Finnish economy and society surrounding the company. Some of the most severe outliers of the data are excluded from the used data in order to be conservative in the analysis of the firm-level impact of PE-funding.

4.2 Data

4.2.1 Sample and Data Classification

The chosen sample for this study includes all first-ever private equity investments made by the full members of FVCA in Finland. Although approximately 40% of the investments made by these companies are made to companies based abroad this selection was done in order to narrow the scope of this study solely to the firm-level impact of private equity into Finnish economy and society.

The companies that received their first-ever private equity investment were chosen as the sample group in order to monitor the possible changes in the portfolio companies after they have received private equity financing for the first time ever. In the becoming financing rounds the impact of private equity is not identifiable as the effect of the new investment is mixed with the effects from earlier private equity financing rounds. Possible exit was not considered as also active investments were included in the data. This is logical as the chosen research method considers the development of the portfolio companies over time – not on the exit event specifically.

[5] See e.g. Achleitner and Klöckner (2005), Kjærgaard (2004), Engel and Keilbach (2007) and Peneder (2007).

The sample was drawn from first-ever private equity investments that were made between years 2002 and 2004 and this timeframe was chosen as FVCA data on the first-ever private equity investments was available only from 2002 onwards. The distribution of the investments between different years and investment stages is illustrated in the descriptive analysis sub-chapter 5.2.1 of this thesis. For the actual data collection on the chosen measures for the sample group only certain databases could be considered as a survey would have yielded most likely a relatively low response rate. The Finnish databases that are accessible are certain commercial databases, such as Suomen Asiakastieto´s database, and the enterprise database of Statistics Finland. Statistics Finland´s database is the only database that also includes detailed background information about individual companies but the information on individual companies is concealed because it includes non-public tax administration information. Commercial databases on the other hand are limited mostly to the accounting information collected by the National Board of Patents and Registration of Finland and have no comprehensive background information on the companies.

Survivorship bias is avoided in the research by including all the companies that received their first-ever PE investment during the chosen timeframe. In other terms the data includes also companies that have ever since receiving their first-ever PE investment defaulted or otherwise ceased to exist. Including these companies in the analysis is possible as the potential databases include the historical financial information on the companies that do not operate anymore.

The classification of data is based on the investment stage in which different companies receive their first-ever private equity investment as well as on the primary industry where the company operates. The aim of the first classification is to seek whether the impact of private equity differs across different development stages of portfolio companies. Classification to different investment stages will be based on two different methodologies (1.) the one introduced by EVCA (2008) and (2.) the simple categorization to venture capital and buyout investments as suggested by FVCA. EVCA (2008) classification methodology is presented in Appendix 2.

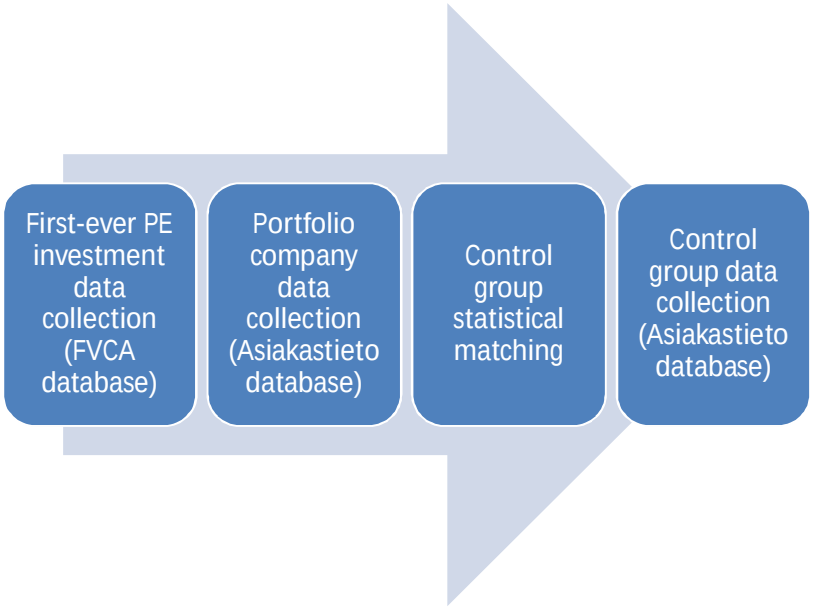
The aim of the second classification is to seek whether the impact of private equity differs between high-tech and non-high-tech industries. In this classification I will use the high-tech industry sector definition by OECD in order to identify the sample and control group

companies that operate either in a high-technology manufacturing sector or in knowledge intensive services sector (Statistics Finland, 2004). I will consider both of these sectors belonging to high-tech industries. In addition to these most relevant classifications data is also classified based on the age of the companies. This categorization is conducted by the registration date to the Finnish trade register.

4.2.2 Data Collection and Estimations

The data collection for the study is conducted in four individual steps that are presented in the Figure 6 below.

Figure 6: Data Collection Process



The data collection begins by collecting the basic data on the companies that received their first-ever private equity investment form a member of FVCA between 2002 and 2004. This data is collected from the FVCA archives and includes, in addition to the company name and time of the private equity investment, also information on the investment stage and main line of operations of the portfolio company.

The next step is to collect the actual data on chosen measures for the VCs portfolio companies. Taken into account that company level information from Statistics Finland´s database is not available the commercial databases are the only suitable option. Based on the

earlier studies conducted in Finland (Lähdemäki, 2007 and FVCA, 2007) Suomen Asiakastieto´s database is the most comprehensive database that discloses the needed company level financial information so this database is selected as a primary data source. Asiakastieto´s database includes all the annual reports that Finland based companies have submitted to the National Board of Patents and Registration of Finland.

Data is collected for each portfolio company for the year the company received it´s first-ever PE investment, the "year 0", and three consequent years "1", "2" and "3". Three year observation period is chosen because this way we can include all the companies that received their PE investment between 2002 and 2004 in the sample. Alemany and Martí (2005) also find out that the average holding period of private equity investors, although not considered more in detail in this research, is close to three years. This supports the selection of close to three year observation period in order to monitor the impact of private equity investment on the company. The data collected for the sample companies includes data for all the chosen measures for years 0, 1, 2 and 3 as well as some basic information on the company, such as the registration date when the company has been added to the Trade Register of Finland maintained by NBPR.

In the third part of the data collection process the control group companies are defined based on the methodology fully described and analyzed in the next sub-chapter.

The final part of the data collection is to collect the whole data on chosen measures for the control group companies from Asiakastieto´s database. The data for each control group companies is collected for years 2002-2007 and after this the data for years 0-3 of each control group company is registered based on the first-ever PE investment year of each sample group company.

The applied data collection method avoids the concern with selection bias often faced in the impact literature as the data is collected entirely from databases that are not subject to questionnaire answers or voluntary disclosure of information. However, some problems are faced in the quality of the data, mainly due to some companies not reporting their complete financial information to the NBPR. The reporting to NBPR, despite being mandatory, is not enforced very well the time series have some gaps and for some companies the data is missing altogether. The data is supplemented by data from secondary databases, but even after this the

whole or significant amount of data is missing for about 20% of the sample companies and they have to be left outside the analysis. In addition the original sample includes four companies that operate solely as holding companies based on their industry code. These companies do not report any sales during the observation period and are clearly defined to act for some special purpose instead of normal business operations. These companies are left out from the analysis due to their non-normal nature. Finally I will exclude some of the most severe outliers in the PE-funded companies group from the data in order to receive more conservative results of the firm-level impact. The total number of companies left out from the final data due to shoving significantly higher values than the other companies is three.

After the special purpose holding companies, the most severe outliers and the companies with completely missing or considerably limited data are left out from the sample we are left with data on 146 companies which represents 77% of the total sample. Compared to survey studies and impact studies in general this can be considered as a highly representative dataset. There are, however, some single missing values in the data of these companies as well. This is especially the case for a small amount of companies that received their first-ever PE investment in 2004 and had not yet reported their financial year 2007 data to NBPR as the data collection took place. For them the values for year 2007, i.e. year 3, are missing. In the case of one or few missing values in the data the values are estimated based on the estimation procedure presented in the Table 8 below. Altogether less than 5% of the values have to be estimated.

Table 8: Estimation of Missing Data Values

This table presents the estimation procedure for missing data values based on the type of missing value and the type of the company for which the value is missing. Estimation is used only if the missing values can be estimated with high reliability; otherwise the missing values are not estimated but companies are left out from the final analysis. Estimation procedure is designed to generate estimates for missing sample company data values that lead to conservative growth rates of estimated measures.

Type of missing value	**Estimation procedure**
First value missing/zero in case of MBI or MBO	First value is considered as the next reported value
First value missing/zero in case of Seed, Start-up or other early stage	First value is considered as zero
Missing value is between two existing values	Missing value is linearly interpolated
Missing value is the last value and company operates	Missing value is the last reported value
Missing value is the last value and company does not operate	Missing value is zero

Another challenges faced with the final data are the differences in the financial cycle of different companies. Indeed, some portfolio and control group companies do not follow the financial year beginning in January and lasting until December. However, if the duration of the financial year in these cases is normal, i.e. 12 months, the problem is solved by setting the actual reported numbers to represent the normal financial year that is closest to the reported year. For example a reported financial year 1.10.2003-31.9.2004 for a control group company is considered as match for a sample group company´s financial year 1.1.2004-31.12.2004. If the reported financial period is irregular in duration, for example 1.10.2003-31.12.2004 due to a change in the reporting cycle, the data is linearly calibrated to represent 12-month equivalent. After this the closest normal annual year is considered as a matching reporting year.

4.2.1 Control Group Selection

The main purpose for a control group in this impact study is to act as a reference against which the companies that have received private equity investment are compared in order to identify the effects of private equity investment. Thus the main goal of the control group selection is to identify a control group that resembles the actual sample as well as possible in every other aspect excluding PE financing. Success in the control group selection reduces the general endogeneity problem that is faced in the research on the impact of PE-funding. The problem with endogeneity cannot, however, be overcome solely through control group selection as this would require a control group that is identical to the actual sample in every other aspect than the presence of PE-funding.

Due to the limitations of accessible Finnish databases the most sophisticated econometric methods, such as propensity score matching used by Peneder (2007) and Engel and Keilbach (2007), are not applicable for control group selection. Using one of these methods would require detailed information, such as information on ownership and management structures, on the portfolio companies and this kind of information is not available in any of the accessible Finnish databases. Potential source for this kind of more detailed information on the sample companies could of course be the PE companies themselves but most likely all of the companies are not willing to disclose information on their portfolio companies. This would result in reduced the representativeness of the control group.

Despite some missing values the information in database of Suomen Asiakastieto allows the statistical matching of sample and control group companies as suggested by Alemany and Martí (2005). This methodology seems to be next best alternative for propensity score matching in the evolution PE impact studies. The matching is based on chosen most important characteristics of sample companies that are considered in consecutive but separate matching rounds for each individual sample group company in order to narrow down the focus to one sole suitable match. The matching process is presented in the Table 9 below.

Table 9: Control Group Matching Procedure

This table presents the matching process through which a matching non-private equity financed counterparty is selected for each individual private-equity funded company of the sample. This methodology is originally applied by Alemany and Martí (2005) and it is based on several firm characteristics that are considered in consecutive order based on their importance. All the companies in the actual sample and the control group are registered and operate in Finland.

Matching stage	Measure	Description
1. Industry	Industry code	The first stage is to rule out all the companies operating in different industry so only companies with matching industry codes are considered.
2. Company size	Year 0 sales	In the second stage the company size is considered and sales in year 0 are considered as the size measure for each sample group company. Other than the closest 3-7 non-private-equity-funded companies based on year 0 sales are ruled out. If there are more than 7 companies in the +/-10% range of year sales these are narrowed further based on sales but if not, all of these are taken further to the next step.
3. Company age	Registration date	The final match is selected based on the company age. Within the 3-7 companies with year 0 sales closest to the sample company the final match is decided based on the Trade Register registration date.

Despite Asiakastieto´s database includes all the needed information for the statistical matching it does not allow direct implementation of this procedure. The challenge is overcome by first selecting for each sample company a large pool of companies that operate in the same industry sector i.e. separating a large amount of companies from the first matching stage. The whole data on these companies is transferred to MS Excel where the actual statistical matching is conducted.

The matching process does not yield perfect matches for all the PE-funded companies and especially for companies operating in small industry sectors no perfect matches are found. Thus, the success in matching the sample group companies with similar non PE-funded companies based on chosen characteristics has to be analyzed. The results of this analysis are presented in the Table 10 below. Of course one could also argue that considering only the company operating region, industry, size and age is not sufficient but these are the most

profound characteristics that usually differ between companies. Increasing the number of considered characteristics would also have made it more difficult to find well matching companies for each sample group company as the number of Finnish companies operating in specific industries is limited.

Table 10: Successfulness of the Control Group Matching

The success in the control group definition is analyzed by monitoring the differences in main line of operations, the year 0 turnovers and the registration dates for sample companies and their control group counterparts. The first two columns present the matching stage, the next two present the average and median sizes and registration dates of the actual sample, the three next columns present the relative differences compared to the control group and the last three columns present the absolute differences compared to the control group. The conclusions are that all the companies are matched to a company operating in the same industry, half of the matches differ less than 8.9% in year 0 turnover and half of the matches differ less than 2.2 years in registration dates. However some matches, especially companies operating in small industries, differ significantly more than this.

Matching stage	Measure	Average	Median	Median of difference	Average of difference	Standard deviation	Median of absolute difference	Average of absolute difference	Standard deviation
1. Industry	Industry code	-	-	0	0	0	0	0	0
2. Company size	Year 0 sales (€)	4,911,000	480,000	0.3%	4.7%	60.9%	8.9%	29.3%	53.5%
3. Company age	Registration date	23.2.1997	23.3.2000	0.9 years	0.55 years	8.5 years	2.2 years	4.6 years	7.2 years

4.3 Methodology

The methodology part of this thesis can be divided into three separate parts where the first presents the descriptive analysis on the data, the second studies the observed statistical differences of selected measures by comparing the development between companies that have received their first-ever PE investment and their matched counterparties and the third seeks to identify the association between VC funding and development of these measures through regression analysis.

The first part of the methodology is relatively straightforward. In the descriptive analysis part of this thesis begins with industry level descriptive statistics and continues by analyzing the actual sample data in terms of categorization of companies to different subsamples and presenting different statistical measures. Also correlations between the actual measures included in the analysis are presented in this part. The aim of the descriptive analysis is to provide a good overall picture on the dataset. This is necessary for both conducting the actual

analysis and the interpretation of the final results as both of these depend highly on the used data.

4.3.1 Statistical Analysis

The aim of the first actual analysis is to compare the development between companies that received their first ever private equity investment between 2002 and 2004 to the development of the matched control group. The basic idea is to analyze and compare the development of these groups within three years following the PE investment. Through the statistical analysis and testing we can conclude whether the development of chosen measures has been different for the sample group companies and the control group companies in the chosen timeframe. This part of the analysis, however, does not take the endogeneity problem into account and thus does not reliably provide insight on if the PE-funding has actually been the cause of the observed differences.

Possible exit is not considered and both active and exited investments are included in the data. This reduces biasedness of the analysis as analyzing the exited companies over a longer period after the exit would measure the real impact which can be seen to realize in the longer term. Including all the companies that received the PE investment to the sample also removes bias caused by the "living dead" companies that are not developing and are held in the investor´s portfolio to await better times.

The analysis is conducted using multiple firm-level measures on economic and societal impact for the following three reasons: (1) Including only the most commonly used measures, such as sales and personnel growth, in the analysis draws a relatively narrow picture on the economic and societal impact of the development of the company. (2) The studies on the impact of PE on corporate taxes, gross margin, intangible assets and total assets are almost non-existent. (3) Whereas VC funding is often shown to have a positive impact on for example employment and sales the results for corporate taxes and innovations are often contradictory (Alemany & Martí, 2005 and Engel & Keilbach, 2007).

I will seek to study company growth, employment, innovation, profitability, total assets and corporate taxes in this thesis. Development of all these measures can be seen to have a clear

impact on the surrounding economy and society. However, considering the previous research on the subject, the company size (sales), employment (no. of personnel) and innovation (intangible assets) will be the most important measures for the general economy (e.g. Engel, 2002; Engel & Keilbach, 2007 and Peneder, 2007). The Table 11 below describes and defines the economic measures that are included in the analysis to portray different aspects of firm level societal and economic impact of private equity.

Table 11: Firm-level Measures of the Economic and Societal Impact of PE

This table presents the different firm-level economic measures that are included in the analysis and the aspects of firm-level economic and societal impact they are derived from. The table further presents detailed description of each measure and it´s mathematical formula.

Aspect of firm-level impact	**Measure**	**Detailed description of firm-level measure**	**Mathematical formula***
Company size	Sales growth	Absolute growth of sales	$S_{i,3} - S_{i,0}$
Employment	Increase in number of personnel	Absolute increase in personnel	$P_{i,3} - P_{i,0}$
Innovation	Intangible assets growth	Absolute growth of intangible assets	$I_{i,3} - I_{i,0}$
Government direct income	Corporate taxes	Cumulative corporate taxes	$\sum_{t=1}^{i} T_t$
Total assets	Total assets growth	Absolute growth of total assets	$A_{i,3} - A_{i,0}$
Profitability	Gross margin	Year 3 gross margin	$GM_3 = \frac{OP_{i,3} + D_{i,3}}{S_{i,3}}$

* *S*=Sales, *P*=Number of personnel, *I*=Intangible assets, *OP*=Operating profit, *D*=Depreciation and amortization, *A*=Total assets, *T*=Corporate taxes, *GM*=Gross margin

The absolute growth is used for sales, personnel, intangible assets and total assets. The decision to use the absolute growth over the relative growth is based on the fact that the PE-funded companies are matched to the control group companies by their size (year 0 sales) among other things as described in the previous chapter 4.2.1. This means that the sample and control groups are relatively equal in terms of company size, which allows the use of absolute measures. In addition the use of absolute growth figures over the relative ones is easily reasoned by the fact that we are willing to observe the firm-level impact of PE to the surrounding economy and society so the analysis should focus on the absolute impact. Finally the use of absolute figures can be justified by the fact that the absolute values yield more conservative growth for the actual sample companies when compared to the control group.

This is caused by the fact that many of the companies receiving their first-ever PE investment have just begun their operations so relative growth rates are artificially high.

Balance sheet intangible assets is used as a proxy measure for innovation in the analysis and this choice can be questioned based on the difficulties at measuring innovation as discussed in the subchapter 2.3.2. However, the annual financial data available does not include data on patent applications or other patent measures and the use of patenting as a measure can be questioned as presented earlier even if the data would be available. The current literature goes along with the view that also R&D expenditure and net investment to intangible assets capture relevant aspects of innovative activities of a company even if they cannot be considered as comprehensive measures on innovation[6].

Government direct income from companies plays significant role when assessing the firm-level impact of private equity to the surrounding society. We employ the cumulative corporate taxes, as reported in the income statements from year 0 to year 3, as a measure for the direct government income from a company. The use of cumulative absolute measure is reasoned by the fact that the amount of paid taxes varies significantly between different years for example by dropping to zero for one year and increasing again rapidly in the next year. Thus calculating growth figures or employing taxes from sole year are not reliable options.

Gross margin is used as a measure of profitability for the sample and control group companies. However, the analysis does not focus on the profitability increase after the PE investment but rather on the absolute profitability level after three years of the firms have received their first-ever PE investment. The absolute profitability in year 3 provides us with more reasonable picture on the overall profitability of the sample and control group companies than the change from year 0 to year 3 would as many of the companies are relatively young. Also one can argue that the profitability increase does not yield significant societal and economic impact if the operation still remains heavily nonprofitable. The absolute profitability of companies is definitely relevant to the surrounding economy at least to some extent.

[6] See e.g. Kortum & Lerner (2000) and Alemany & Martí (2005).

All the measures are calculated for each firm in the actual sample and in the control group. This is followed by conducting a paired sample t-test in order to compare the mean of each measure between PE-funded companies and their non PE-funded matches. Paired sample t-test is a dependent t-test and it is used when two groups are matched on a particular variable or variables as in this case. The test calculates the difference between the matched variables and uncovers whether the average difference is significantly different from zero. I will conduct the testing using 95% confidence interval.

For selected firm-level measures also additional analysis is conducted solely within the PE-funded companies. The additional analysis is conducted in order to observe the differences in the growth between different sub-categories of the data within the actual PE-funded companies' sample. The observed differences are further validated by using two-group t-test. The comparison between different data categories solely within the PE-funded companies hopefully helps in the interpretation of the results of other analyses and may validate some of the findings further.

4.3.2 Regression Analysis

The regression analysis methodology part of this thesis seeks to analyze the actual association between PE-funding and development of certain firm-level economic measures that are determined in the earlier chapters. The regression analysis is based on the knowledge and results from the statistical analysis and I will focus on the measures for which the results in the previous section yield statistically significant or nearly significant results. All the measures are defined as presented in the statistical analysis part unless otherwise stated.

In the first part of the regression analysis a basic ordinary least squares (OLS) regression model without the correction for VC selection process is run for all the included firm-level measures. Basic OLS regression results provide interesting insight into the development of PE-funded companies compared to control group companies that includes the selection effects i.e. the growth potential before the VCs lay any impact on the company. The formulation of the standard model is as follows:

$$Y_i = \beta_1 + \beta_2 X_2 + ... + \beta_k X_k + u \qquad (1)$$

where

Y_i is the firm-level economic measure that is analyzed

$X_1, X_2, ..., X_k$ are the variables included in the analysis

u = error term

The different regression variables employed in the analysis are presented in the sub-chapter 4.3.2.2.

4.3.2.1 Selection Bias corrected Regression Model

The general selection biases deriving from the pre-investment screening procedure of VCs that cause the endogeneity within the VC impact studies have to be taken into account in the analysis on the actual value added by the PE investors. I will seek to overcome the problem by excluding the effects of pre-investment screening and selection process in a formulation of second regression model in order to reliably evaluate the actual impact of PE-funding.

In order to tackle the selection bias I employ, instead of a normal OLS regression, a two-step estimation method introduced by Heckman (1979) and already briefly discussed in the sub-chapter 2.4.1.2. Many variations and extensions of Heckman two-step selection model[7] have been used in the VC impact literature (see e.g. Bottazzi et. al (2007) and Engel (2002)) but the general principle for the two-step approach remains unchanged. I will first estimate a selection model of VC-financed companies, whose results are further used in the actual OLS regression for the value adding impact of VC funding on the chosen firm-level measures.

Engel (2002) states that as VC funding decisions are based on screening the growth potential of a company, which is in turn determined by firm-specific and management specific characteristics as well as firm´s environment. The matching process conducted earlier in order to define the control group should exclude the effects of the firm environment as the companies are matched to same sized companies operating in the same industry sector. I seek to follow Engel (2002) on including firm-specific characteristics that are relevant for the VC

[7] See e.g. Dougherty, 2007 for through revision of the Heckman two-step procedure

selection process into a probit model of the VC selection (the first step). This will be difficult, however, for the dataset at hand as little management specific information is available for the sample or control group companies. The probit model variables that have been used in the recent impact literature have been for example the business experience of management team and the availability of experienced VC investors within certain geographical areas but I have no access to this kind of information on the sample.

The probit model includes an unobservable (latent) variable PE_i^* and an observed variable PE_i . The observed variable PE_i receives value 1 if the company is private equity financed and 0 if the company is a control group company i.e. has not received PE-funding. The regression relationship is formulated in terms of PE_i^* as follows:

$$PE_i^* = \delta_j Q_{ji} + \varepsilon_i \qquad (2)$$

where

Q_{ji} = Set of variables affecting probability of company i to be PE-funded

ε_i = Error term

$PE_i = 1$ for $PE_i^* > 0$

$PE_i = 0$ for $PE_i^* \leq 0$

This further gives probability function

$$p(PE_i^* = 1) = p(\varepsilon_i > -\delta_j Q_{ij}) \qquad (3)$$
$$= 1 - F(-\delta_j Q_{ij})$$

where F is the cumulative distribution function for the error term ε_i. The probit model assumes that the ε_i is normally distributed. The likelihood function to be estimated is as follows:

$$L = \prod_{PE_1=0} F(-\delta_j Q_{ij}) \prod_{PE_i=1} (1 - F(-\delta_j Q_{ij})) \qquad (4)$$

The first step of the two-step process (Heckman, 1979) the Equation 2 is estimated followed by calculating the inverse Mill´s ratios λ_i defined as:

$$\lambda_i = \frac{\phi(\delta_j Q_{ji})}{\Phi(\delta_j Q_{ji})} \tag{5}$$

where ϕ and Φ are, respectively, density and cumulative distribution function.

The second step of Heckman (1979) procedure is to estimate an OLS model employing the inverse Mill´s ratio λ_i as an explanatory variable for the impact of PE-funding.

Defining the variables used in estimating the probability of company receiving PE-funding causes some concern. The good news in defining the variables is the fact that the variables concerning the environment the companies operate in can be left out as they are identical for the sample and control group companies. The challenge is, however, that the firm-specific variables should ideally be identical to the screening process of VCs when they evaluate a company for funding. These variables of course differ between VCs and between companies that are screened. Based on the dataset at hand finding any variables that describe the qualitative side of company´s operations, such as for example management team experience, is difficult. However, we have a wide range of quantitative measures on the sample and control group companies.

The chosen firm-level variables are total assets before the investment, sales before the investment, number of personnel before the investment, intangible assets before the investment, gross margin before the investment and sales to balance sheet ratio. The variables are further defined in the following sub-chapter. All of the chosen measures can be intuitively seen to potentially affect the VC selection process at least to some extent but not even close to everything that affects the VC decision can be included in this analysis.

4.3.2.2 Variables Used in the Regression Models

In this thesis, as presented earlier in this chapter, I will employ two different regression models for analyzing the sample and control group companies. The first models presented in Equation 1 are the plain OLS regressions without any corrections for the VC selection effects. These basic OLS models are referred to as model group $M1$. The second model group consists of OLS models seeking to exclude the selection effects through the Heckman (1979) two-step procedure as explained earlier. The Heckman models are referred to as $M2$ and the individual steps of the Heckman (1979) procedure are referred to as $M2-1$ (the first step) and $M2-2$ (the second step). The detailed summary on the specifications of the regression models is presented in the sub-chapter 5.3.1.

The variables used in the first- The following firm-level variables are used in the regression analysis.

PE: A dummy variable for company private equity funding. Takes a value of 1 if company has received the first-ever PE investment and thus belongs to the actual sample and 0 otherwise (company belongs to the control group). Used in $M1$ and $M2-1$.

λ_i: Inverse Mill´s ratio, estimated as first-step of the Heckman (1979) two-stage model. This variable is included in the actual OLS model $M2-2$ in order to overcome the selection bias arising from the VC selection effects.

S_0 / A_0: An efficiency ratio indicating how efficiently the company generates sales on each euro of assets. Year 0 numbers before the PE investment are used for calculating the ratio. Used in $M2-1$.

GM_0: Gross margin in year 0. Used in $M1$ for gross margin growth as well as in $M2-1$.

I_0: Absolute intangible assets in year 0. Used in $M1$ for intangible assets growth as well as in $M2-1$ and $M2-2$.

A_0: Total assets in year 0. Used in $M1$ for total assets growth as well as in $M2-1$.

S_0: Sales in year 0. Used in $M1$ for sales growth as well as in $M2-1$ and $M2-2$.

P_0: Number of employees in year 0. Used in $M1$ for personnel growth as well as in $M2-1$ and $M2-2$.

INDG: A measure indicating an average growth of the industry for a company of equivalent size. The measure is calculated for each company by formula $(S_{i,3} - S_{i,0}) \times X$ where X = Industry average sales growth percentage from year 0 to year 3. Used in $M1$ and $M2-2$.

HIGHMAN: Is a dummy variable which takes the value 1 if company operates in high technology manufacturing industry sector and zero otherwise. Used in $M1$ and $M2-2$.

KNOWSER: Is a dummy variable which takes the value 1 if company operates in knowledge intensive services sector and zero otherwise. Used in $M1$ and $M2-2$.

SEED: Is a dummy variable which takes the value 1 for PE-funded companies seed investment stages as well as for matched control group companies of these seed stage companies and zero otherwise. Used in $M1$ and $M2-2$.

5 Analysis and Results

5.1 Descriptive Analysis

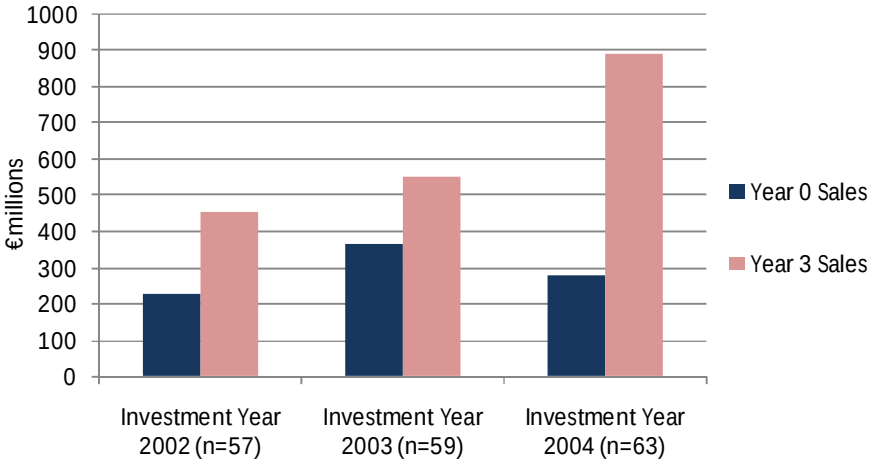
This chapter summarized the key properties of the data. The first sub-chapter presents broad industry-level statistics seeking to describe the Finnish PE industry in general. Considering the final sample the properties presented are the actual time of PE investments categorized to the corresponding investment stages, the sample distribution across different data categories, the overall data statistics from the time of the PE investment (year 0) for sample and control group, and finally the correlations between the economic measures used in the actual analysis.

5.1.1 Industry Level Descriptive Statistics

The first descriptive analysis seeks to present some industry-wide statistics in order to describe the Finnish PE industry in general from the PE-funded companies' perspective. The data used in this section includes altogether 179 companies that received their first-ever PE investment between 2002 and 2004 for which the year 0 and year 3 figures could be calculated or reliably estimated. This is more than in the actual comparative analysis in the following sections as the analysis in this part does not include any comparison to the control group companies and the measures included are only sales, personnel, corporate taxes and total assets. Thus, not as many companies have to be dropped out due to data constraints and also the outliers that are not included in the actual analysis are included in this descriptive part.

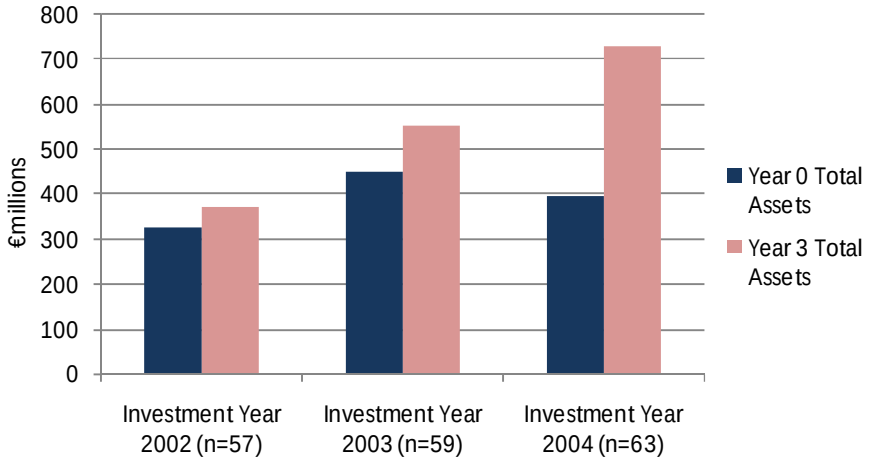
The 179 companies included in this section represent 94% of all the companies that received their first-ever PE investment between 2002 and 2004 and due to this high representation the figures describe the whole Finnish PE industry from the portfolio companies perspective relatively well. Figure 7 presents the total sum of sales and Figure 8 the sum total assets for PE-funded companies at the time of the PE investment and three years after the investment. The tables are categorized to different investment years in order to monitor the annual magnitude of the investing activities.

Figure 7: Industry Level* Sales of Portfolio Companies



*Includes 94% of the total new Finnish portfolio companies during the selected period

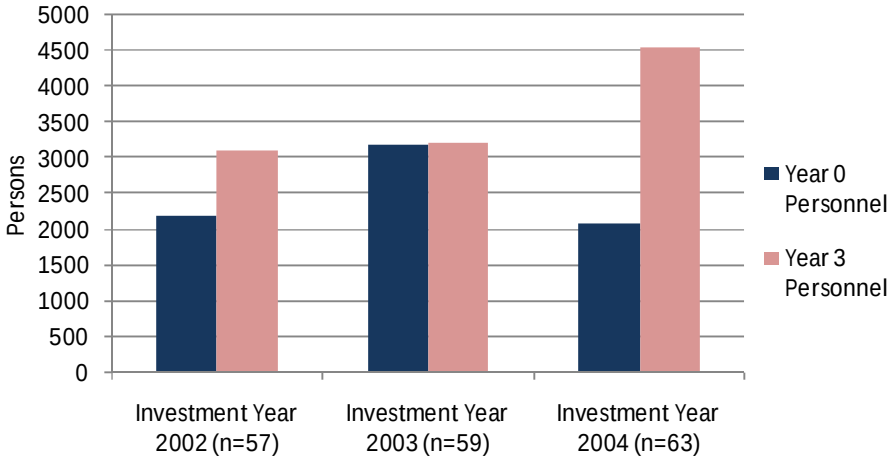
Figure 8: Industry Level* Total Assets of Portfolio Companies



*Includes 94% of the total new Finnish portfolio companies during the selected period

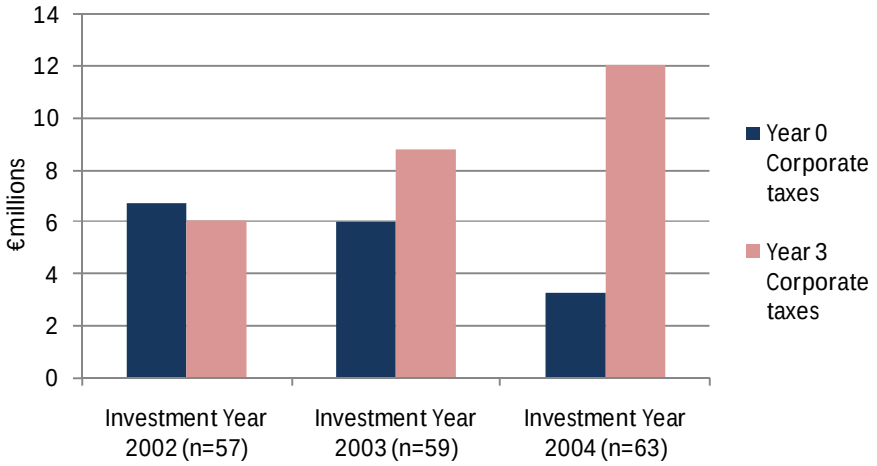
From the graph we can identify the vast growth of sales and total assets of the portfolio companies on the industry level. We can also see that the growth of the portfolio companies that received the investment in 2004 has been fastest, i.e. during the observation period from year 2004 to 2007. The faster growth can at least partially be explained through the overall slowdown in the Finnish and global economy and investments in 2000-2003. Figures 9 and 10 present the same kind of industry level analyses for employment and corporate taxes. The same general conclusions can be drawn also from these tables.

Figure 9: Industry Level* Employment of Portfolio Companies



*Includes 94% of the total new Finnish portfolio companies during the selected period

Figure 10: Industry Level* Corporate Taxes of Portfolio Companies



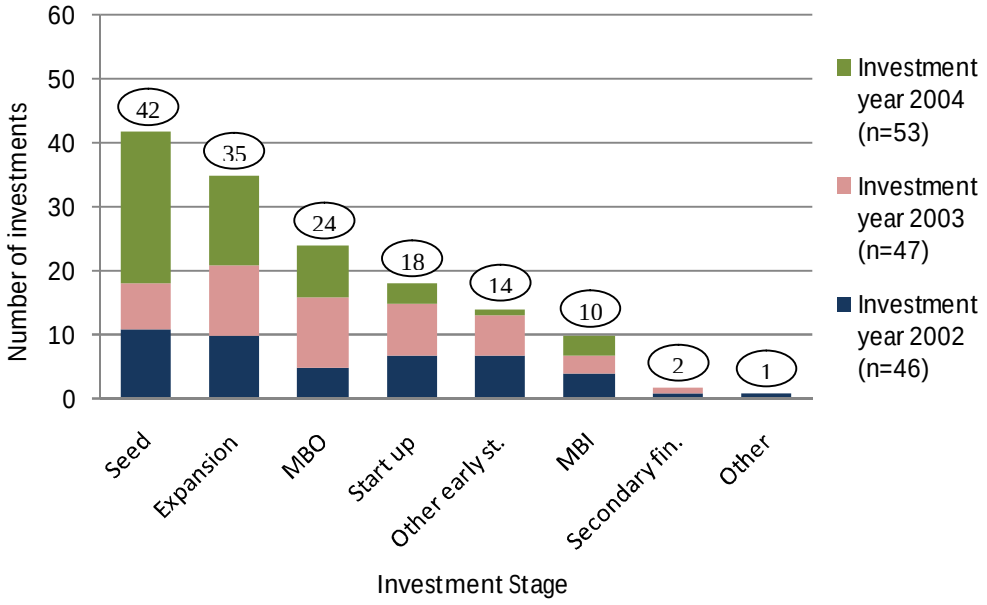
*Includes 94% of the total new Finnish portfolio companies during the selected period

The general remark about the new portfolio companies of Finnish based PE investors is that the portfolio companies clearly have an importance for the Finnish economy in terms of overall economic activity, employment effect as well as corporate tax income. Generally the magnitude seems to increase after the PE investments but we cannot draw conclusions based on this analysis on whether PE-funding is the actual source of this growth.

5.1.2 Investments at Different Investment Stages

The final sample includes 146 companies that received their first-ever PE investment and can be included in the further analysis. These investments divide relatively evenly between the investment years 2002, 2003 and 2004. The investments can be further divided into different investment stages according to the EVCA classification which is presented in the Appendix 2. The yearly investments categorized to EVCA investment stages are presented in the Figure 11 below.

Figure 11: Yearly Investments Categorized to EVCA Investment Stages



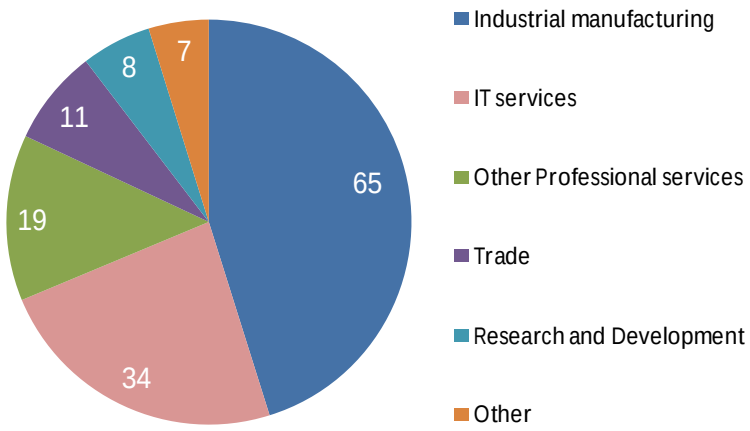
One can easily observe that early stage investments, which include the seed, start-up and other early-stage investments, sum up to 74 investments. This represents 51% of the final sample. Mid-stage investments represent approximately 25% and later stage buyout investments approximately 24% of the total sample.

In comparison to recent years the sample seems to represent the general division of Finnish first-ever PE investments between early-, mid- and late-stage investment relatively well. During the year 2007 the number of the early-stage investments is 53%, the mid-stage 20% and the late-stage 27% of the total first-ever PE investments (FVCA, 2008). Of course one should notice, that in financial terms the late-stage investments dominate the market as the average deal size is significantly larger than in the earlier stages.

5.1.1 Distribution of Investments across Industry Sectors

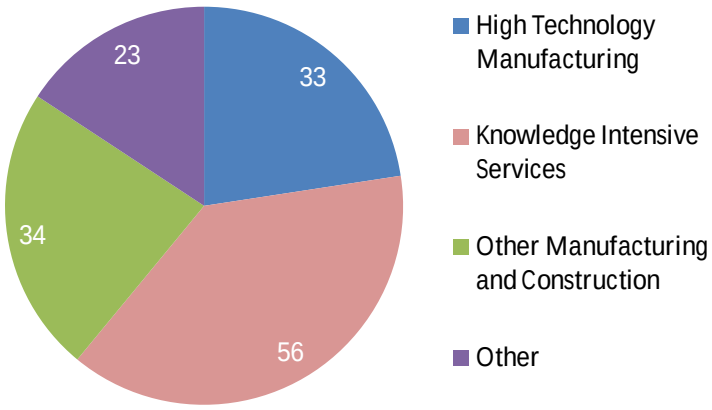
The distribution across different industry sectors depends on how narrow definition is used at defining different industry sectors. The distribution in this case is also dependent on for which purpose the industry classification is done. Figure 12 presents a general distribution among different industry sectors for a purpose of simply portraying the qualities of the final sample. For this purpose the industry sector definitions are used as presented in the Statistics Finland´s standard industrial classification published in 2002 (Statistics Finland, 2002). I will, however, split the professional services further to IT services, R&D services and other professional services due to their high numbers.

Figure 12: Sample Distribution across Standard Industrial Sectors



For purposes of analyzing H.3 I will need another distribution across different industry sectors as defined earlier in the sub-section 4.2.1. Figure 13 presents the distribution of first-ever PE investments to high-tech sectors, namely high-tech manufacturing and knowledge intensive services, and low-tech sectors. More than 75% of the sample companies classified to the knowledge intensive services sector operate in software-, IT- and medical R&D sectors.

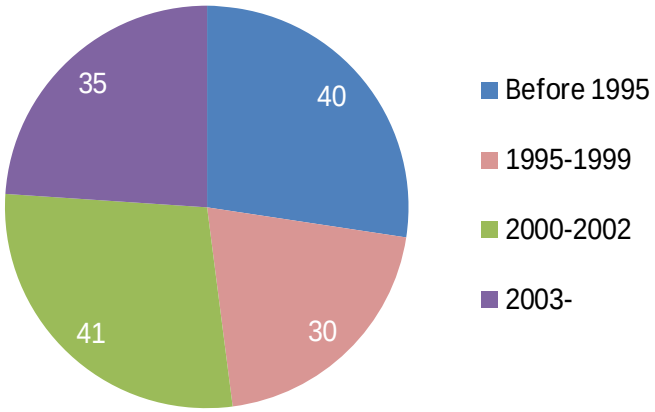
Figure 13: Sample Distribution across High-tech and Low-tech Industries



The sample distributions clearly highlight the fact that relatively high proportion of the first-ever PE investments are made to IT services and/or knowledge intensive services sectors. Almost half of the investments are, however, made to the industrial manufacturing sector. Only three investments are made to education, healthcare or social services sectors, which emphasizes the fact that these services are in Finland governmentally organized and financed to a high extent.

The next distribution will be based on the age of the PE-funded companies. The Figure 14 presents the age of the PE-funded companies based on their registration dates to the Finnish trade register. We can easily see that most of the companies are relatively young at the time they receive their first ever PE investment as more than 50% of the companies that received their first-ever PE investment between 2002 and 2004 have been founded in the 21st century. One should, however, notice that the registration date is not fully reliable measure of company age as some of the companies may have begun operating in real terms before the registration. Also a VC may have made the investment decision in some cases before the registration date especially within the seed investment stage.

Figure 14: Sample Distribution across Company Age Categories



5.1.1 Investment Year Key Statistics

Table 12 summarizes the central descriptive statistics regarding the used firm-level measures of economic and societal impact of PE-funding. The statistics are combined from companies´ figures for the year that sample companies have received their first-ever PE investment and thus they are so-called year 0 values. The statistics are presented for both sample and control group separately.

Table 12: Year 0 Key Statistics

This table presents the central descriptive statistics regarding the used firm-level measures of economic and societal impact of PE-funding. The statistics are combined from companies´ figures for the year that sample companies have received their first-ever PE investment and thus they are so-called year 0 values. Gross margin for year 0 is not presented as it can be calculated for relatively low number of companies due to zero values. The statistics are presented for both sample and control group separately.

	N	Mean	St. Dev.	Min	1st quart.	Median	3rd quart.	Max
Sales (k€)								
Sample group	146	4,911	11,649	0	52	480	4,044	85,714
Control group	146	4,387	11,438	0	78	478	3,724	100,510
Personnel								
Sample group	146	43	96	0	3	10	37	810
Control group	128*	29	54	0	2	6	37	415
Intangible assets (k€)								
Sample group	146	6,122	15,931	0	294	1,113	4,590	134,089
Control group	146	4,086	14,581	3	40	332	2,316	144,554
Corporate taxes (k€)								
Sample group	146	85	328	-61	0	0	7	2,807
Control group	146	48	105	-49	0	3	33	603
Balance sheet (k€)								
Sample group	146	1,127	5,839	0	3	60	235	56,262
Control group	146	753	6,657	0	0	0	18	78,424

*18 control group companies do not report the number of personnel to the NBPR as part of their annual figures

5.1.1 Correlations between the Measures

Table 13 presents the correlation coefficients between different measures used in the analysis as defined in the sub-chapter 4.3.1.

Table 13: Correlations between the used Measures

This table presents the correlations between different measures used in the analysis as defined in the sub-chapter 4.3.1. The interpretation of correlation coefficient depends on the context and purposes but generally in social sciences a correlation between 1.0 and 0.5 (-1.0 and -0.5) can be considered a high positive (negative) correlation, a correlation between 0.5 and 0.3 (-0.5 and -0.3) can be considered a medium positive (negative) correlation and a correlation between 0.3 and 0.1 (-0.3 and -0.1) a low positive (negative) correlation (Cohen, 1988). The correlations are calculated from the sample and the control group combined (n=292).

	Sales growth	Personnel growth	Intangible assets growth	Cumulative taxes	Total assets growth	Year 3 Gross Margin
Sales growth	1.00					
Personnel growth	0.67	1.00				
Intangible assets growth	- 0.22	0.15	1.00			
Cumulative taxes	0.54	0.19	- 0.03	1.00		
Total assets growth	0.37	0.44	0.40	0.39	1.00	
Year 3 Gross Margin	0.05	0.02	- 0.02	0.05	0.01	1.00

The table above shows high positive correlation between sales growth and personnel growth as well as cumulative taxes. This is natural as usually the number of personnel increases as the firm sales increase. Increased sales also may lead to higher profit which in turn increases the corporate taxes.

Medium positive correlation can be identified between the increase in total assets and sales, personnel and intangible assets growth. Total assets growth has also medium positive correlation with cumulative taxes. Correlations between the growth of total assets and company other growth figures are easily intuitively reasonable.

The most interesting findings are the low correlation of year 3 gross margin figure with any of the other economic measures as well as the low negative correlation between sales growth and intangible assets growth. Year 3 gross margin may have a low correlation since it is a static profitability measure calculated solely for one year of the observation period. This measure may not offer a lot of insight into the true nature of a company that is in the early stage of its operations.

5.2 Statistical Analysis

This part of the thesis presents the statistical analysis on the development of the firm-level economic measures between the PE-funded companies and the control group. Conducted statistical analyses present reliably the actual observed differences between these two groups and thus lead the way for more detailed regression analyses. The most relevant observations are rationalized and additional analyses are conducted when necessary.

5.2.1 Company Growth

Table 14 presents the average absolute sales growth for the sample group companies and control group companies three years after the first-ever PE investment. The table also presents the p-value of the paired-sample dependent t-test in order to define if the difference between the means for the selected timeframe is statistically significant. The first, and the most important, notice for the results is that for the whole sample the average growth of PE-funded companies has been close to four-fold when compared to the control group companies. The difference is statistically significant at 99.9% confidence level.

The results across different sub-categories are in line with the general finding about statistically significantly greater mean growth for PE-funded companies. For later stage investment, especially MBOs and MBIs the difference in means in absolute terms is larger than for earlier investment stages. For earlier investment stages the mean growth on the other hand is relatively larger when compared to control group companies.

For companies that have been founded before the year 1995 the average growth seems actually almost equal between the sample and the control group without a clear explanation.

Table 14: Year 0 - Year 3 Average Sales Growth

This table presents the average growth of sample and control group sales from year 0 to year 3 as well as the result of the paired sample dependent t-test in the form of p-value. This p-value presents the probability that the mean for the actual sample is lower than the corresponding mean for the control group. P-value of less than 0.05 indicates a statistically significantly higher sample group mean at 95% confidence level(*), p-value less than 0.01 a statistically significantly higher sample group mean at 99% confidence level(**) and p-value less than 0.001 a statistically significantly higher sample group mean at 99.9% confidence level(***).

		Average Growth (k€)		
	N	PE-funded	Non-PE-funded	p(Non-PE > PE)
All Firms	146	4,652	1,264	0.0001***
By Industry Affiliation				
High Technology Manufacturing	33	8,724	3,028	0.0166*
Other Manufacturing and Construction	34	3,271	1,482	0.0469*
Knowledge Intensive Services	56	2,522	52	0.0074**
Other	23	6,035	1,361	0.0635
By Investment Year				
2002	46	4,889	932	0.0114*
2003	47	3,516	698	0.0110*
2004	53	5,453	2,054	0.0182*
By Founding Year				
Before 1995	40	1,648	1,830	0.5774
1995 - 1999	30	4,736	1,567	0.0042**
2000 - 2002	41	4,435	788	0.0237*
After 2002	35	8,267	914	0.0025**
By EVCA Investment Stage				
Seed	42	532	90	0.0004***
Start-up	18	735	553	0.3622
Other Early stage	14	646	53	0.0500*
Expansion	35	5,610	619	0.0130*
MBI	10	5,134	1,641	0.0784
MBO	24	13,700	4,609	0.0147*
By FVCA Investment Stage				
VC	111	2,371	322	0.0026**
Buyout	34	10,900	3,736	0.0066**

Based on the results across the industry sectors one may notice that the difference and it´s significance is greater also for companies operating in high-tech industries than for companies operating in other industries. This means that PE-funded companies operating in high-tech industries grow even faster than other PE-funded companies when compared to control group. These results would suggest that for this sample group H.2 and H.3 seem to hold for the selected time period when it comes to the absolute sales growth comparison to the control group companies.

An analysis focusing solely on the PE-funded companies could enlighten the observed differences further and provide help in the interpretation the results. A statistical analysis on

the relative sales growth solely within the PE-funded companies sample is presented in the Table 15.

Table 15: Year 0 - Year 3 Relative Sales Growth within PE-funded Companies

This table presents the average relative sales growth within PE-funded companies for different data categories. Two-group t-test is conducted for each data category for comparison of means. As the sales is for many of the PE-financed companies low for year 0 the growth rates are on average high and the standard deviations are large. Thus, none of the differences arises to statistical significance despite large differences in relative average sales growth across the categories.

	N	Average growth %	p(0 > I)
All Firms	143	1102%	-
By Technology Affiliation			
High-tech Industries (I)	86	1156%	0.4302
Other Industries (0)	57	1021%	
By EVCA Investment Stage			
Seed (I)	40	1006%	0.5634
Other (0)	103	1139%	
Expansion (I)	35	1580%	0.2338
Other (0)	108	947%	
MBO (I)	24	1826%	0.1925
Other (0)	119	956%	
Start-up (I)	17	218%	0.8072
Other (0)	122	1221%	
Other Early stage (I)	14	56%	0.8214
Other (0)	129	1216%	
MBI (I)	10	1343%	0.4300
Other (0)	129	1084%	
By FVCA Investment Stage			
VC* (I)	108	928%	0.7922
Buyout (0)	35	1637%	

*VC stage = following EVCA investment stages: Seed, Start-up, Expansion and Other Early stage

The above analysis is conducted using the relative growth figures instead of the absolute growth, as the companies differ substantially in size across industry sectors and investment stages. Relative growth has to be used as these differences are not corrected by matching the companies with same sized counterparties when focusing solely on the PE-funded companies.

Within the PE-funded companies there seems to be clear differences in average growth rate of sales only between VC and buyout investments. However, not even this difference is close to a statistical significance so this further analysis reveals only little about the possible differences in the relative growth rate within the PE-funded companies.

Based on the statistical analysis on firm-level sales growth we can conclude that the average growth for companies that have received PE-funding is statistically significantly greater than

for the matched control group companies during the observation period. We can also conclude that for our sample the differences are larger for early-stage and high-tech companies when compared to the matched control group. Nothing fully explicit can be said, however, on the possible general relationship between PE-funding and sales growth solely based on this statistical analysis. Sales, being undoubtedly one of the most important measures for firm-level economic and societal impact, should definitely be included in the regression analysis part as well.

5.2.2 Employment

Table 16 presents the average absolute personnel growth for the sample group companies and control group companies three years after the first-ever PE investment. The table also presents the p-value of the paired-sample dependent t-test in order to define if the difference between the means for the selected timeframe is statistically significant. The most relevant finding is, similarly to the sales growth in the previous sub-chapter, that the mean personnel growth for PE-funded companies is statistically significantly higher at 99.9% confidence level. The mean for companies that have received their first-ever PE investment between 2002 and 2004 is in this sample over to six-fold compared to the control group.

For personnel growth the variance within the sample is larger than for sales growth. Thus the difference between the means does not reach statistical significance for all the sub-categories. Within the knowledge intensive services sector the difference is, however, statistically significant and for high-tech manufacturing sector the difference is closer to statistical significance than for the other industry sectors.

Table 16: Year 0 - Year 3 Average Personnel Growth

This table presents the average growth of sample and control group personnel from year 0 to year 3 as well as the result of the paired sample dependent t-test in the form of p-value. This p-value presents the probability that the mean for the actual sample is lower than the corresponding mean for the control group. P-value of less than 0.05 indicates a statistically significantly higher sample group mean at 95% confidence level(*), p-value less than 0.01 a statistically significantly higher sample group mean at 99% confidence level(**) and p-value less than 0.001 a statistically significantly higher sample group mean at 99.9% confidence level(***).

		Average Growth (persons)		
	N	PE-funded	Non-PE-funded	p(Non-PE > PE)
All Firms	124	14.1	2.1	0.0009***
By Industry Affiliation				
High Technology Manufacturing	29	12.8	3.9	0.0819
Other Manufacturing and Construction	32	13.1	2.4	0.1219
Knowledge Intensive Services	44	15.4	0.4	0.0139*
Other	19	14.7	2.7	0.0608
By Investment Year				
2002	40	21.8	0.1	0.0024**
2003	38	10.4	2.7	0.1584
2004	46	10.5	3.4	0.0676
By Founding Year				
Before 1995	37	7.5	4.8	0.2693
1995 - 1999	25	14.6	1.9	0.1102
2000 - 2002	34	22.2	0.7	0.0062**
After 2002	28	12.5	0.3	0.0672
By EVCA Investment Stage				
Seed	33	5.2	0.4	0.0182*
Start-up	14	-2.4	-2.4	0.4947
Other Early stage	13	4.6	0.1	0.0827
Expansion	32	31.5	2.3	0.0056**
MBI	9	9.6	3.2	0.1248
MBO	21	19.8	9.2	0.2078
By FVCA Investment Stage				
VC	94	13.3	0.4	0.0010**
Buyout	30	16.7	7.4	0.1540

Also for early stage VC investments the difference in means and the statistical significance is substantially higher than for the later stage buyout investments. The difference between the FVCA defined investment stages seems even higher than for the sales growth in the earlier sub-chapter. Again these findings seem to be in line with H.2 and H.3 for this sample.

An analysis focusing solely on the PE-funded companies could enlighten the observed differences further and provide help in the interpretation the results. Thus, I will conduct a similar analysis focusing only on the PE-funded companies as earlier with sales growth. A statistical analysis on the relative personnel growth solely within the PE-funded companies is presented in the Table 17.

Table 17: Year 0 - Year 3 Relative Personnel Growth within PE-funded Companies

This table presents the average relative personnel growth within PE-funded companies for different data categories. Two-group t-test is conducted for each data categories for comparison of means. As the number of employees is for many of the PE-financed companies low for year 0 the growth rates are on average high and the standard deviations are large. Thus, none of the differences arises to statistical significance. The number of observations is higher than in the Table 16, since in the earlier analysis a number of matched pairs had to be left out due to a control group company not reporting the number of employees to the NBPR.

	N	Average growth %	p(0 > I)
All Firms	143	244%	-
By Industry Affiliation			
High-tech Industries (I)	86	218%	0.6644
Other Industries (0)	57	283%	
By EVCA Investment Stage			
Seed (I)	40	269%	0.4169
Other (0)	103	234%	
Expansion (I)	35	322%	0.2760
Other (0)	108	218%	
MBO (I)	24	327%	0.3083
Other (0)	119	227%	
Start-up (I)	17	139%	0.6971
Other (0)	122	258%	
Other Early stage (I)	14	101%	0.7353
Other (0)	129	259%	
MBI (I)	10	112%	0.6855
Other (0)	133	254%	
By FVCA Investment Stage			
VC* (I)	109	238%	0.5597
Buyout (0)	34	264%	

*VC stage = following EVCA investment stages: Seed, Start-up, Expansion and Other Early stage

The above analysis is conducted using relative figures in order to bypass the bias arising from differences in sizes of the sample companies. For employee growth this additional analysis reveals even less than for the sales growth as the means are close to each other and significance levels for differences are low.

We can conclude the statistical analysis on the personnel growth by stating that the average growth for companies that have received PE-funding is statistically significantly greater than for the matched control group companies during the observation period. We can also conclude that for our sample the differences are larger for VC investment stage and knowledge intensive services sector when compared to the matched control group. On the general relationship between PE-funding and employee growth little certain is revealed. Employment is an important firm-level measure for economic and societal impact of PE and the results of these analysis supports inclusion of employment also in the regression analysis.

5.2.3 Innovation

Table 18 presents the average absolute balance sheet intangible assets growth for the sample group companies and control group companies three years after the first-ever PE investment. The table also presents the p-value of the paired-sample dependent t-test in order to define if the difference between the means for the selected timeframe is statistically significant.

Table 18: Year 0 - Year 3 Average Intangible Assets Growth

This table presents the average growth of sample and control group intangible assets from year 0 to year 3 as well as the result of the paired sample dependent t-test in the form of p-value. This p-value presents the probability that the mean for the actual sample is lower than the corresponding mean for the control group. P-value of less than 0.05 indicates a statistically significantly higher sample group mean at 95% confidence level(*), p-value less than 0.01 a statistically significantly higher sample group mean at 99% confidence level(**) and p-value less than 0.001 a statistically significantly higher sample group mean at 99.9% confidence level(***).

		Average Growth (k€)		
	N	PE-funded	Non-PE-funded	p(Non-PE > PE)
All Firms	145	61	-318	0.0937
By Industry Affiliation				
High Technology Manufacturing	33	-495	-1,219	0.2664
Other Manufacturing and Construction	33	-52	-6	0.7269
Knowledge Intensive Services	56	620	5	0.0101*
Other	23	-342	-261	0.5753
By Investment Year				
2002	46	-104	-996	0.1514
2003	47	-33	-27	0.5117
2004	52	291	18	0.0513
By Founding Year				
Before 1995	40	-40	-138	0.1859
1995 - 1999	30	156	-1,141	0.1273
2000 - 2002	41	9	-160	0.3745
After 2002	34	157	5	0.3258
By EVCA Investment Stage				
Seed	42	199	7	0.0040**
Start-up	18	163	2	0.0525
Other Early stage	14	-5	-1	0.5331
Expansion	34	-128	-74	0.5379
MBI	10	102	-655	0.1366
MBO	24	134	-114	0.3523
By FVCA Investment Stage				
VC	110	58	-20	0.3304
Buyout	34	124	-273	0.2118

The analysis suggests that the mean for PE-funded company´s intangible assets growth for the whole sample is larger than the mean for the control group but the difference is not statistically significant. The difference, however, reaches statistical significance for knowledge intensive services sector and for the seed investment stage just as in the earlier

sub-chapters with sales and personnel growth. In this case the higher growth rate for seed investment stage might be due to the fact that despite the matching with control group companies is based also on the registration date no perfect match based on this criterion is found for every seed investment stage company. This is merely because the sample includes some seed-stage companies which are founded only few months before the PE investment.

I will conduct the drilldown analysis focusing solely on the PE-funded companies also for relative intangible assets growth. The results are presented in Table 19 below.

Table 19: Year 0 - Year 3 Relative Intangible Assets Growth within PE-funded Companies

This table presents the average relative intangible assets growth within PE-funded companies for different data categories. Two-group t-test is conducted for each data categories for comparison of means. The number of observations is smaller than earlier due to some PE-funded companies having zero sales in year 0.

	N	Average growth %	p(0 > I)
All Firms	127	1134%	-
By Industry Affiliation			
High-tech Industries (I)	74	1718%	0.0789
Other Industries (0)	53	318%	
By EVCA Investment Stage			
Seed (I)	32	2045%	0.1400
Other (0)	95	827%	
Expansion (I)	33	1537%	0.3129
Other (0)	94	992%	
MBO (I)	23	115%	0.8361
Other (0)	104	1359%	
Start-up (I)	16	1281%	0.7861
Other (0)	111	111%	
Other Early stage (I)	12	161%	0.7488
Other (0)	115	1240%	
MBI (I)	8	2583%	0.2216
Other (0)	119	1037%	
By FVCA Investment Stage			
VC (I)	96	1257%	0.3290
Buyout (0)	31	752%	

The relative growth analysis focused on the actual sample companies suggests that the mean innovation growth for the high-tech industries is higher than the mean growth for other industries. The mean difference is large also for earlier investment stages than for later ones. None of these differences is, however, statistically significant.

We can conclude the statistical analysis on the intangible assets growth by stating that the average growth for companies that have received PE-funding is not statistically significantly

different from the control group companies without PE-funding. Despite this general conclusion the differences seem statistically significantly larger for knowledge intensive services industry sector and seed investment stage PE-funded companies.

5.2.4 Government Direct Income

The growth of government direct income i.e. the firm-level corporate taxes is analyzed in the Table 20. The table presents the cumulative corporate taxes for the next three years after the initial PE investment and compares the cumulative taxes to the control group. The table also presents the statistical test results similarly to other economic measures presented in the previous sub-chapters.

Table 20: Year 0 - Year 3 Average Cumulative Corporate Taxes

This table presents the average cumulative corporate taxes of sample and control from year 0 to year 3 as well as the result of the paired sample dependent t-test in the form of p-value. This p-value presents the probability that the mean for the actual sample is lower than the corresponding mean for the control group. P-value of less than 0.05 indicates a statistically significantly higher sample group mean at 95% confidence level(*), p-value less than 0.01 a statistically significantly higher sample group mean at 99% confidence level(**) and p-value less than 0.001 a statistically significantly higher sample group mean at 99.9% confidence level(***).

		Average Growth (k€)		
	N	PE-funded	Non-PE-funded	p(Non-PE > PE)
All Firms	146	306	238	0.2303
By Industry Affiliation				
High Technology Manufacturing	33	665	530	0.3548
Other Manufacturing and Construction	34	344	234	0.1731
Knowledge Intensive Services	56	80	42	0.1723
Other	23	283	299	0.5301
By Investment Year				
2002	46	359	238	0.3159
2003	47	204	150	0.2170
2004	53	348	315	0.3863
By Founding Year				
Before 1995	40	129	384	0.9607
1995 - 1999	30	720	291	0.1171
2000 - 2002	41	164	143	0.4184
After 2002	35	318	116	0.0474*
By EVCA Investment Stage				
Seed	42	0	11	0.9944
Start-up	18	77	164	0.8922
Other Early stage	14	16	120	0.9856
Expansion	35	159	133	0.6448
MBI	10	166	398	0.8338
MBO	24	1,032	790	0.2282
By FVCA Investment Stage				
VC	111	70	106	0.9043
Buyout	34	777	675	0.3334

The main finding is that the average cumulative corporate taxes between PE-funded and non PE-funded companies, despite looking larger for PE-funded companies, is not statistically significant. This finding gives little spur for deepening the analysis on the subject and thus we can conclude that the cumulative taxes are not statistically significantly affected by the presence of PE investor within the first three years after the investment.

The fluctuations in the average cumulative taxes observed across different investment years are not noteworthy but across different founding years the fluctuation seems remarkable. These fluctuations, however, may be due to random variation or the fact that the analysis assumes the control group companies to be founded in the exactly same year as the corresponding PE-funded companies they are matched to. This is not exactly the case for every company as pointed out in the sub-section 4.2.1.

It would be interesting to analyze the relative growth of corporate taxes within the PE-funded companies between different investment stages as done earlier with sales, personnel and intangible assets growth in sub-sections 5.2.1-5.2.3. However, the corporate taxes fluctuate between different years heavily and for many companies the year 0 value is zero this cannot be done. The nature of corporate taxes is also rather discrete between different years which do not support relative growth analysis.

5.2.5 Total Assets

The average growth of total assets from year 0 to year 3 is presented in the Table 21 below. The testing is conducted with t-test for paired sample in a similar manner as for other firm-level measures.

Table 21: Year 0 - Year 3 Average Total Assets Growth

This table presents the average growth of sample and control group total assets from year 0 to year 3 as well as the result of the paired sample dependent t-test in the form of p-value. This p-value presents the probability that the mean for the actual sample is lower than the corresponding mean for the control group. P-value of less than 0.05 indicates a statistically significantly higher sample group mean at 95% confidence level(*), p-value less than 0.01 a statistically significantly higher sample group mean at 99% confidence level(**) and p-value less than 0.001 a statistically significantly higher sample group mean at 99.9% confidence level(***).

		Average Growth (k€)		
	N	PE-funded	Non-PE-funded	p(Non-PE > PE)
All Firms	146	910	108	0.0552
By Industry Affiliation				
High Technology Manufacturing	33	282	367	0.5195
Other Manufacturing and Construction	34	939	383	0.1612
Knowledge Intensive Services	56	1,282	154	0.0149*
Other	23	860	-782	0.1241
By Investment Year				
2002	46	996	-1,090	0.0377*
2003	47	-39	349	0.7016
2004	53	1,676	934	0.1387
By Founding Year				
Before 1995	40	421	-259	0.1542
1995 - 1999	30	1,312	88	0.2339
2000 - 2002	41	908	312	0.1153
After 2002	35	1,124	307	0.2543
By EVCA Investment Stage				
Seed	42	500	70	0.0055**
Start-up	18	427	-169	0.2069
Other Early stage	14	161	413	0.7611
Expansion	35	1,071	-648	0.0448
MBI	10	1,474	649	0.1414
MBO	24	963	2,111	0.7314
By FVCA Investment Stage				
VC	111	707	-128	0.0084
Buyout	34	1,113	1,681	0.6661

The conclusion is that the mean for PE-funded company´s total assets growth for the whole sample is larger than the mean for the control group but the difference is not statistically significant as also in the case of intangible assets. However, the difference in mean approaches statistical significance so the result is not completely evident. Similarly to the intangible assets the difference in means of total assets reaches statistical significance for knowledge intensive services sector and for seed investment stage.

I will further analyze the possible differences within the PE-funded companies as presented also for sales, personnel growth and intangible assets in the Table 22.

Table 22: Year 0 - Year 3 Relative Total Assets Growth within PE-funded Companies

This table presents the average relative total assets growth within PE-funded companies for different data categories. Two-group t-test is conducted for each data categories for comparison of means. P-value of less than 0.05 indicates a statistically significantly higher sample group mean at 95% confidence level(*), p-value less than 0.01 a statistically significantly higher sample group mean at 99% confidence level(**) and p-value less than 0.001 a statistically significantly higher sample group mean at 99.9% confidence level(***). P-value of more than 0.95 indicates a statistically significantly lower sample group mean at 95% confidence level(*).

	N	Average growth %	p(0 > I)
All Firms	146	74%	-
By Industry Affiliation			
High-tech Industries (I)	89	87%	0.1363
Other Industries (0)	57	55%	
By EVCA Investment Stage			
Seed (I)	42	144%	0.0009***
Other (0)	104	46%	
Expansion (I)	35	73%	0.5147
Other (0)	111	75%	
MBO (I)	24	15%	0.9666*
Other (0)	122	86%	
Start-up (I)	18	28%	0.8887
Other (0)	128	81%	
Other Early stage (I)	14	42%	0.7699
Other (0)	132	78%	
MBI (I)	10	48%	0.6906
Other (0)	136	76%	
By FVCA Investment Stage			
VC (I)	112	89%	0.0282*
Buyout (0)	34	25%	

The results of the drilldown analysis focusing solely on the PE-funded companies sample are different compared to the earlier drilldown analysis on other firm-level economic variables. The most substantial difference is that the average relative total assets growth is statistically significantly higher at 99.9% confidence level for companies receiving PE financing in seed investment stage. After few thoughts one can easily see the reasoning behind this: In the case of seed financing the founded company has most likely few or no assets in the balance sheet and the PE investment will boost up the balance sheet extensively especially in relative terms.

We can conclude from this sub-chapter that the average total asset growth for companies that have received PE-funding is not statistically significantly different from the control group companies. The difference, however, approaches statistical significance. Despite this general conclusion the differences seem statistically significantly larger for knowledge intensive services industry sector and seed investment stage PE-funded companies.

5.2.6 Profitability

Profitability is analyzed by the year 3 gross margin as the use of growth figure is not reasonable as argued in the sub-section 4.3.1. The comparative analysis between PE-funded companies' profitability and the control group is presented in the Table 23 below.

Table 23: Year 3 Average Gross Margin

This table presents the average gross margin of sample and control group companies in year 3 as well as the result of the paired sample dependent t-test in the form of p-value. This p-value presents the probability that the mean for the actual sample is lower than the corresponding mean for the control group. P-value of more than 0.95 indicates a statistically significantly lower sample group mean at 95% confidence level(*), p-value more than 0.99 a statistically significantly lower sample group mean at 99% confidence level(**) and p-value more than 0.999 a statistically significantly lower sample group mean at 99.9% confidence level(***).

		Average year 3 gross margin %		
	N	PE-funded	Non-PE-funded	p(Non-PE > PE)
All Firms	137	-52%	15%	0.9982**
By Industry Affiliation				
High Technology Manufacturing	33	-54%	14%	0.9541*
Other Manufacturing and Construction	33	-29%	21%	0.8901
Knowledge Intensive Services	50	-86%	11%	0.9701*
Other	21	-7%	16%	0.9748*
By Investment Year				
2002	44	-44%	-3%	0.8599
2003	42	-38%	38%	0.9606*
2004	51	-72%	11%	0.9808*
By Founding Year				
Before 1995	40	-32%	34%	0.9617*
1995 - 1999	25	4%	-17%	0.2676
2000 - 2002	39	-55%	9%	0.9673*
After 2002	33	-171%	23%	0.9753*
By EVCA Investment Stage				
Seed	38	-155%	-11%	0.9858*
Start-up	14	-62%	13%	0.8033
Other Early stage	13	-79%	88%	0.9166
Expansion	35	7%	16%	0.9829*
MBI	10	11%	15%	0.8735
MBO	24	10%	15%	0.8342
By FVCA Investment Stage				
VC	102	-74%	15%	0.9979**
Buyout	34	10%	15%	0.9000

Statistical analysis on the year 3 gross margin yields an interesting and extraordinary result. The conclusion is that the profitability of the PE-funded companies is on average lower three years after receiving the PE investment compared to the control group. The result is significant at a 99% confidence level for the whole sample and generally holds well also for different sub-categories. An interesting finding is the fact that the average gross margin is

even lower for the sub-categories, i.e. for seed investment stage and knowledge intensive services sector, than for other data categories. These are the same companies that enjoy comparatively even greater absolute sales and personnel growth figures than other PE-funded companies. The result presents a new question of whether the VCs, especially in early investment stage companies and within knowledge intensive services sector, seek higher growth of sales and are willing to sacrifice the profitability, at least for the first three years after their investment.

I will begin deepening the analysis, as also in the earlier sub-chapters, by analyzing the year 3 gross margins within the PE-funded companies across different data categories as presented in the Table 24.

Table 24: Year 3 Gross Margin within PE-funded Companies

This table presents the average year 3 gross margin within PE-funded companies for different data categories. Two-group t-test is conducted for each data categories for comparison of means. P-value of more than 0.95 indicates a statistically significantly lower sample group mean at 95% confidence level(*), p-value more than 0.99 a statistically significantly lower sample group mean at 99% confidence level(**) and p-value more than 0.999 a statistically significantly lower sample group mean at 99.9% confidence level(***).

	N	Average %	p(0 > I)
All Firms	137	-52%	-
By Industry Affiliation			
High-tech Industries (I)	83	-73%	0.8895
Other Industries (0)	54	-21%	
By EVCA Investment Stage			
Seed (I)	38	-155%	0.9990***
Other (0)	99	-13%	
Expansion (I)	35	7%	0.0484
Other (0)	102	-73%	
MBO (I)	24	10%	0.0852
Other (0)	113	-66%	
Start-up (I)	14	-62%	0.5618
Other (0)	123	-51%	
Other Early stage (I)	13	-79%	0.6614
Other (0)	124	-49%	
MBI (I)	10	11%	0.1995
Other (0)	127	-57%	
By FVCA Investment Stage			
VC (I)	103	-73%	0.9572*
Buyout (0)	34	10%	

The result of the year 3 gross margin suggests that indeed the earlier investment stage companies that often operate in the high-tech industries, enjoy lower profitability than other PE-funded companies. The fact that the year 3 gross margin is significantly lower for early investment stage PE-funded companies than their matched counterparties with similar industry and age suggests looking the time before the year 3. I will conduct a similar analysis as presented for year 3 in the table 22 also for the investment year 0. The results are presented below in the Table 25.

Table 25: Year 0 Average Gross Margin

This table presents the average gross margin of sample and control group companies in year 0 as well as the result of the paired sample dependent t-test in the form of p-value. This p-value presents the probability that the mean for the actual sample is lower than the corresponding mean for the control group. P-value of more than 0.95 indicates a statistically significantly lower sample group mean at 95% confidence level(*), p-value more than 0.99 a statistically significantly lower sample group mean at 99% confidence level(**) and p-value more than 0.999 a statistically significantly lower sample group mean at 99.9% confidence level(***).

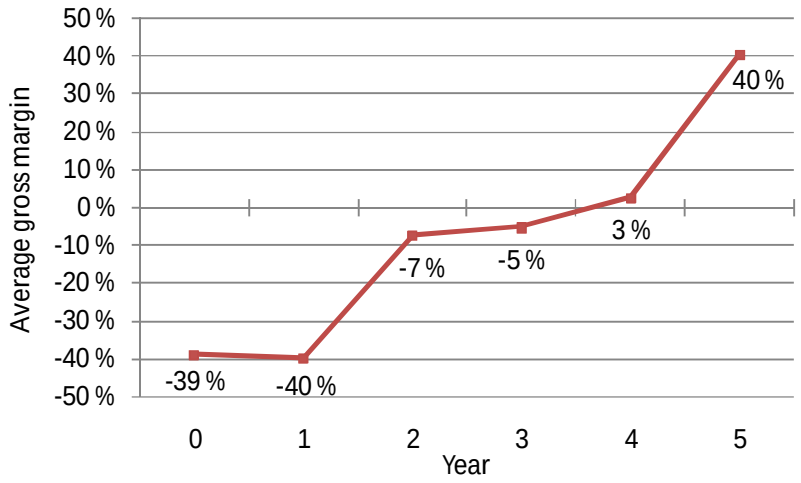
		Average		
	N	PE-funded	Non-PE-funded	p(Non-PE > PE)
All Firms	127	-106%	16%	0.9999***
By Industry Affiliation				
High Technology Manufacturing	32	-150%	16%	0.9919**
Other Manufacturing and Construction	31	-46%	19%	0.8985
Knowledge Intensive Services	42	-151%	18%	0.9917**
Other	22	-39%	7%	0.9531*
By EVCA Investment Stage				
Seed	30	-310%	6%	0.9986**
Start-up	14	-208%	23%	0.9651*
Other Early stage	13	-104%	29%	0.8621
Expansion	34	-1%	12%	0.9046
MBI	9	9%	18%	0.8801
MBO	24	2%	21%	0.9034
By FVCA Investment Stage				
VC	93	-146%	14%	0.9999***
Buyout	34	4%	20%	0.9356

Based on the analysis above one can easily observe that the profitability difference between the PE-funded companies and control group companies, especially for the earlier investment stages, is rooted in a profitability difference also in the investment year 0. The results clearly show that the companies that have received PE-funding are on average not as profitable, in terms of gross margin, as their matched counterparties. This result is quite intuitive as venture capitalists often state their willingness to change companies they finance. However, the questions on the future development of the profitability and growth vs. profitability remain. I will try to analyze the future development of the profitability focusing solely to the companies that have received their first-ever PE investment in 2002 as described below.

The Figure 15 below describes the gross margin for PE-funded companies that received their first-ever PE investment in 2002 and which operate in knowledge intensive services sector. The R&D sector, however, has to be left out from the knowledge intensive services sector due to large amount of gaps in the gross margin data for years after the year 3. This increases the gross margins for this group.

Figure 15: Average Gross Margin Development from Year 0 to Year 5

This chart presents the average gross margin for PE-funded companies operating in knowledge intensive services sector that have received their first-ever PE investment during 2002. The average is presented for year 2002 and the five following years. The companies operating in R&D industries are, however, left out due to serious gaps in their gross margin data after the year 2. This increases the overall average gross margin. Altogether 12 companies are included in the analysis



Based on this simple analysis on just 12 companies belonging to the selected sub-category few general conclusions can be drawn about the profitability of the PE-funded companies after the year 3. However, within this small group the profitability seems to increase later in time. Of course, one should notice that few companies operating in R&D industry sector had to be left out from this analysis due to serious gaps in the data.

On general level we can conclude that the companies receiving PE-funding are less profitable than their counterparties as they receive PE-funding. This difference is even larger for recently founded companies. The difference remains three years after the PE investment but the difference for later investment stage companies has become smaller. The profitability of PE-funded early investment stage companies remains low.

5.3 Regression Analysis

5.3.1 Regression Model Specifications

The OLS regression models used in the analysis are presented in the Table 26 below. The firm-level economic measures that are included in $M2$ are selected based on $M1$ results. This means that cumulative corporate taxes as well as year 3 gross margin are dropped out as the impact of PE-funding is not significant based on the basic OLS regression ($M1$) results.

Table 26: The Detailed Specifications of the OLS Regression Models

This table presents the regression model specifications for each model group and firm-level economic impact that is explained through regression model. Some of the variables in the model groups are left out in some of the models within each model group as can be seen in the result tables. The variables are defined in sub-chapter 4.3.2.2.

Model	Form of impact	Firm-level measure	Model specification
$M1$	Company size	Absolute growth of sales	$S_3 - S_0 = \beta_1 + PE\beta_2 + HIGHMAN\beta_3 + KNOWSER\beta_4 + SEED\beta_5 + INDG\beta_6 + S_0\beta_7 + u$
$M1$	Employment	Absolute increase in personnel	$P_3 - P_0 = \beta_1 + PE\beta_2 + HIGHMAN\beta_3 + KNOWSER\beta_4 + SEED\beta_5 + INDG\beta_6 + P_0\beta_7 + u$
$M1$	Innovation	Absolute growth of intangible assets	$I_3 - I_0 = \beta_1 + PE\beta_2 + HIGHMAN\beta_3 + KNOWSER\beta_4 + SEED\beta_5 + INDG\beta_6 + I_0\beta_7 + u$
$M1$	Total assets	Absolute growth of total assets	$A_3 - A_0 = \beta_1 + PE\beta_2 + HIGHMAN\beta_3 + KNOWSER\beta_4 + SEED\beta_5 + INDG\beta_6 + A_0\beta_7 + u$
$M1$	Government direct income	Cumulative corporate taxes	$\sum_{t=1}^{i} T_t = \beta_1 + PE\beta_2 + HIGHMAN\beta_3 + KNOWSER\beta_4 + SEED\beta_5 + INDG\beta_6 + T_0\beta_7 + u$
$M1$	Profitability	Year 3 gross margin	$GM_3 = \beta_1 + PE\beta_2 + HIGHMAN\beta_3 + KNOWSER\beta_4 + SEED\beta_5 + INDG\beta_6 + GM_0\beta_7 + u$
$M2\_2$	Company size	Absolute growth of sales	$S_3 - S_0 = \beta_1 + \lambda\beta_2 + HIGHMAN\beta_3 + KNOWSER\beta_4 + SEED\beta_5 + INDG\beta_6 + S_0\beta_7 + P_0\beta_8 + I_0\beta_9 + u$
$M2\_2$	Employment	Absolute increase in personnel	$P_3 - P_0 = \beta_1 + \lambda\beta_2 + HIGHMAN\beta_3 + KNOWSER\beta_4 + SEED\beta_5 + INDG\beta_6 + S_0\beta_7 + P_0\beta_8 + I_0\beta_9 + u$
$M2\_2$	Innovation	Absolute growth of intangible assets	$I_3 - I_0 = \beta_1 + \lambda\beta_2 + HIGHMAN\beta_3 + KNOWSER\beta_4 + SEED\beta_5 + INDG\beta_6 + S_0\beta_7 + P_0\beta_8 + I_0\beta_9 + u$
$M2\_2$	Total assets	Absolute growth of total assets	$A_3 - A_0 = \beta_1 + \lambda\beta_2 + HIGHMAN\beta_3 + KNOWSER\beta_4 + SEED\beta_5 + INDG\beta_6 + S_0\beta_7 + P_0\beta_8 + I_0\beta_9 + u$

The specification of the regression equations with multiple variables brings out the question of possible complications that may affect the reliability of the results. The two possible complications that the regression equations in this case may suffer from are possibilities of multicollinearity and heteroscedasticity. Intuitively the variables that are chosen should not affect the variance of the error term which, hence, can be assumed constant. Following conclusion is that the regression should not suffer from heteroscedasticity.

Multicollinearity, however, has to be tested by calculating the correlation between some of the explanatory variables. The table 27 presents correlations between the explanatory variables. As a conclusion year 0 total assets is dropped off from all the $M2\_2$ equations as the correlation is significant with year 0 personnel and year 0 intangible assets. After this none of the equations include both year 0 personnel or intangible assets and year 0 total assets as the correlation between these measures is significantly high. In addition the regressions might suffer from some multicollinearity also between year 0 sales and year 0 personnel, but the level of multicollinearity should not affect the results severely.

Table 27: Correlation between Independent Variables

This table presents the correlations between the independent variables employed in the regression models. The Year 0 total assets are not included in the same model as year 0 personnel or year 0 intangible assets as these correlations are high and might cause a problem with possible multicollinearity in the regression equation.

	PE-funded	High Technology Manufacturing	Knowledge Intensive Services	Seed investment stage	Industry growth variable	Year 0 Sales	Year 0 Personnel	Year 0 Intangible Assets	Year 0 Total Assets
PE-funded	1								
High Technology Manufacturing	-0.02	1							
Knowledge Intensive Services	0.03	-0.42	1						
Seed investment stage	0.03	-0.01	0.36	1					
Industry growth variable	0.06	0.14	-0.18	-0.15	1				
Year 0 Sales	-0.00	0.22	-0.29	-0.25	0.46	1			
Year 0 Personnel	0.09	0.21	-0.25	-0.25	0.65	0.68	1		
Year 0 Intangible Assets	0.02	0.16	-0.11	-0.09	0.11	0.51	0.59	1	
Year 0 Total Assets	0.05	0.20	-0.21	-0.20	0.51	0.68	0.82	0.75	1

5.3.2 Basic OLS Regression Results

The results of the $M1$ regression models are presented in the Table 28 below.

Table 28: Results of the Absolute Growth Basic OLS Regression Models

This table presents the results of the basic OLS regression models in the model group $M1$. The first column presents the different variables employed in the models. The next two columns present the estimated coefficient and the p-value of model 1 within $M1$. The next two columns present the estimated coefficient and the p-value of model 2 within $M1$. The final two columns present the estimated coefficient and the p-value of model 3 within $M1$.

	Model 1		**Model 2**		**Model 3**	
	Coefficient	p	Coefficient	p	Coefficient	p
Sales growth	Adj. R^2=0.322, n=292		Adj. R^2=0.317, n=292		Adj. R^2=0.098, n=294	
PE-funded	3.05E+06	0.000***	3.04E+06	0.000***	3.39E+06	0.000***
High Technology Manufacturing	1.97E+06	0.080			3.63E+06	0.005**
Knowledge Intensive Services	1.22E+06	0.241			-1.39E+05	0.907
Seed investment stage	-1.71E+06	0.093			-3.60E+06	0.002**
Industry growth variable	1.87E-01	0.013*	1.94E-01	0.011*		
Year 0 Absolute Value	3.22E-01	0.000***	3.38E-01	0.000***		
Constant	-7.70E+05	0.349	-4.29E+05	0.481	1.53E+06	0.092
Personnel growth	Adj. R^2=0.107, n=248		Adj. R^2=0.111, n=248		Adj. R^2=0.035, n=248	
PE-funded	1.01E+01	0.008**	1.01E+01	0.007**	1.20E+01	0.002**
High Technology Manufacturing	2.99E-01	0.951			1.90E+00	0.709
Knowledge Intensive Services	5.44E+00	0.248			3.19E+00	0.509
Seed investment stage	-4.04E+00	0.391			-8.48E+00	0.076
Industry growth variable	6.91E-07	0.122	-7.21E-07	0.105		
Year 0 Personnel	1.68E-01	0.000***	1.67E-01	0.000***		
Constant	-2.39E+00	0.520	-1.39E+00	0.614	2.78E+00	0.441
Intangible Assets growth	Adj. R^2=0.800, n=290		Adj. R^2=0.7994, n=290		Adj. R^2=0.023, n=290	
PE-funded	5.07E+05	0.000***	5.08E+05	0.000***	3.79E+05	0.199
High Technology Manufacturing	3.86E+04	0.831			-7.45E+05	0.060
Knowledge Intensive Services	2.95E+05	0.076			3.88E+05	0.288
Seed investment stage	-2.25E+05	0.164			1.60E+05	0.652
Industry growth variable	3.02E-03	0.783	1.89E-03	0.860		
Year 0 Intangible Assets	-3.60E-01	0.000***	-3.61E-01	0.000***		
Constant	-1.06E+05	0.410	-4.69E+04	0.623	-3.45E+05	0.220
Total Assets growth	Adj. R^2=0.206, n=292		Adj. R^2=0.193, n=292		Adj. R^2=-0.001, n=292	
PE-funded	1.08E+06	0.017*	1.06E+06	0.021*	8.02E+05	0.114
High Technology Manufacturing	8.65E+05	0.158			1.08E+04	0.987
Knowledge Intensive Services	2.15E+05	0.701			5.23E+05	0.405
Seed investment stage	-1.32E+06	0.017*			-5.22E+05	0.392
Industry growth variable	-1.45E-02	0.731	-6.87E-03	0.871		
Year 0 Total Assets	-1.33E-01	0.000***	-1.23E-01	0.000***		
Constant	7.68E+05	0.079	6.17E+05	0.060	5.50E+04	0.909
Cumulative Taxes	Adj. R^2=0.521, n=292		Adj. R^2=0.516, n=292		Adj. R^2=0.058, n=292	
PE-funded	-2.37E+04	0.479	-4.61E+04	0.544	6.79E+04	0.520
High Technology Manufacturing	7.87E+04	0.080			3.69E+05	0.010*
Knowledge Intensive Services	5.47E+03	0.895			-9.25E+04	0.480
Seed investment stage	-5.07E+04	0.213			-3.31E+05	0.010*
Industry growth variable	6.51E-03	0.018*	1.56E-02	0.011*		
Year 0 Corporate Taxes	-1.03E-01	0.143	2.68E+00	0.000***		
Constant	4.29E+04	0.184	9.29E+04	0.088	2.85E+05	0.005**
Year 3 Gross Margin	Adj. R^2=0.364, n=246		Adj. R^2=0.33658, n=246		Adj. R^2=0.062, n=274	
PE-funded	-2.25E-01	0.270	-2.13E-01	0.295	-6.72E-01	0.003**
High Technology Manufacturing	1.09E-01	0.665			-3.37E-02	0.907
Knowledge Intensive Services	2.81E-02	0.910			-2.66E-02	0.923
Seed investment stage	-3.69E-01	0.154			-8.76E-01	0.001**
Industry growth variable	-1.05E-09	0.944	2.56E-09	0.861		
Year 0 Gross Margin	4.39E-01	0.000***	4.51E-01	0.000***		
Constant	1.81E-01	0.333	1.25E-01	0.372	4.09E-01	0.052

Statistically significant at *95%, **99% and ***99.9% confidence level.

The results of the basic OLS regression models without any correction for the selection effects seem to be mostly in line with the main conclusions from the statistical analysis part presented in the chapter 5.2 of this thesis. The most relevant finding to be further analyzed through the selection bias corrected regression model is the statistically significant association between PE-funding and sales, personnel, intangible assets and total assets growth. For sales and personnel growth the results seem even more robust than for intangible or total assets.

As the selection effects are not excluded we cannot say anything yet especially about the valued adding impact of VCs but we can conclude that the companies that have received PE-funding do grow faster in terms of sales, personnel, intangible assets and total assets. This faster growth is due to one of the functions of venture capital presented in the Figure 5 earlier in this thesis but we cannot identify the exact sources of this faster growth.

There, however, seems to be no association whatsoever between PE-funded and non-PE-funded companies in terms of cumulative taxes or gross margin three years after the PE investment. The lower profitability of the PE-funded companies three years after the investment is explained to a great extent by lower profitability levels also at the time of the investment.

The sales growth from year 0 to year 3 are positively related to the sales in year 0 and the personnel increase from year 0 to year 3 is positively related to the number of personnel in year 0. Sales growth is also positively related with the industry development. Furthermore intangible assets growth is positively related to year 0 intangible assets. These results are quite easy to intuitively understand. However, the growth of total assets seems to be negatively related to the total assets in year 0. This finding is statistically significant at 99.9% confidence level so there results cannot be easily questioned.

In order to validate the basic OLS regression outcomes further I will conduct analysis with basic OLS regression on the relative percentage growth of sales, personnel, intangible assets and total assets. The employed OLS regression models are identical to the Table 28 OLS regression model except that the dependent variable is changed to the relative growth instead of absolute growth. These results are, however, not as reliable as those presented in the Table 28 as the number of observations is significantly lower due to the lack of relative growth figures for many companies. Also the standard deviations are higher and the goodness of fit-

figures as well as number of observations lower than in the previous analysis. The results of the relative growth regression models are presented in the Table 29 below.

Table 29: Results of the Relative Growth Basic OLS Regression Models

This table presents the results of the basic OLS regression models for the relative growth dependent variables in the model group $M1$. The first column presents the different variables employed in the models. The next two columns present the estimated coefficient and the p-value of model 1 within $M1$. The next two columns present the estimated coefficient and the p-value of model 2 within $M1$. The final two columns present the estimated coefficient and the p-value of model 3 within $M1$.

	Model 1		**Model 2**		**Model 3**	
	Coefficient	p	Coefficient	p	Coefficient	p
Sales growth	Adj. R^2=0.035, n=286		Adj. R^2=0.0245, n=286		Adj. R^2=0.016, n=286	
PE-funded	2.02E+01	0.004**	2.02E+01	0.003**	1.98E+01	0.004**
High Technology Manufacturing	1.54E+00	0.868			-1.23E-01	0.989
Knowledge Intensive Services	3.18E-01	0.971			1.65E+00	0.846
Seed investment stage	1.95E+00	0.818			3.88E+00	0.641
Industry growth variable	-2.42E-07	0.696	-2.46E-07	0.689		
Year 0 Sales	-3.01E-07	0.389	-3.10E-07	0.351		
Constant	1.32E+00	0.845	2.39E+00	0.634	-9.42E-01	0.884
Personnel growth	Adj. R^2=0.038, n=248		Adj. R^2=0.036, n=248		Adj. R^2=0.034, n=248	
PE-funded	2.08E+00	0.002**	2.07E+00	0.002**	1.94E+00	0.003**
High Technology Manufacturing	-1.16E+00	0.180			-1.25E+00	0.146
Knowledge Intensive Services	-1.41E+00	0.087			-1.20E+00	0.143
Seed investment stage	8.16E-01	0.323			1.15E+00	0.155
Industry growth variable	-3.16E-08	0.687	-2.42E-08	0.757		
Year 0 Personnel	-9.03E-03	0.156	-9.09E-03	0.137		
Constant	9.38E-01	0.151	3.76E-01	0.437	5.26E-01	0.338
Intangible Assets growth	Adj. R^2=0.027, n=188		Adj. R^2=-0.001, n=188		Adj. R^2=0.004, n=188	
PE-funded	9.89E+00	0.156	1.09E+01	0.114	9.82E+00	0.157
High Technology Manufacturing	7.98E+00	0.350			7.26E+00	0.387
Knowledge Intensive Services	6.62E+00	0.446			6.91E+00	0.422
Seed investment stage	6.03E+00	0.512			6.58E+00	0.469
Industry growth variable	-1.89E-07	0.667	-1.91E-07	0.662		
Year 0 Intangible Assets	-1.89E-07	0.667	-1.79E-07	0.678		
Constant	-2.89E+00	0.665	2.01E+00	0.717	-3.42E+00	0.601
Total Assets growth	Adj. R^2=0.020, n=292		Adj. R^2=-0.006, n=292		Adj. R^2=0.006, n=292	
PE-funded	-1.30E+00	0.357	-1.24E+00	0.383	-1.29E+00	0.357
High Technology Manufacturing	-4.42E-01	0.817			-4.32E-01	0.818
Knowledge Intensive Services	1.34E+00	0.444			1.33E+00	0.445
Seed investment stage	2.56E+00	0.138			2.55E+00	0.133
Industry growth variable	1.26E-08	0.924	-1.17E-08	0.929		
Year 0 Total Assets	-1.38E-09	0.980	-2.32E-08	0.666		
Constant	8.77E-01	0.520	2.14E+00	0.036	8.91E-01	0.504

Statistically significant at *95%, **99% and ***99.9% confidence level.

The results of the relative growth OLS regression models seem to yield the same conclusions as the absolute growth models for association of PE-funding and sales as well as personnel growth. However, for intangible assets and total assets growth the result shows no association with PE-funding. The year 0 figures are in general terms not explanatory for the relative growth figures as they were for the absolute growth.

All in all the results of the basic OLS regression analyses suggest further analysis for sales, personnel, intangible assets and total assets growth with the model seeking to correct the selection effects through Heckman (1979) two-step procedure. This analysis seeks to more reliably verify the impact of the value adding function of venture capital on these firm-level measures.

5.3.3 Heckman Two-step Model Results

The Heckman (1979) regression model procedure seeks to validate the actual impact of PE-funding on the financed companies. The first-step is used to estimate the inverse Mill´s ratio, which is further used in the second-step OLS regression models as an explanatory variable to exclude the selection effects from the regression model and in order to seek to identify the actual value adding impact of PE-funding.

The variables used in estimating the inverse Mill´s ratio are, as already explained in the sub-chapter 4.3.2.2, sales to balance sheet-ratio as well as year 0 absolute values for sales, personnel, intangible assets, total assets and gross margin. These variables are chosen as they can be seen to affect the selection of VCs at least to some extent. The difficulty in implementing the Heckman (1979) two-step OLS regression is how to identify numeric measures affecting the actual selection of VCs. As everything included in the selection process cannot be explained by observing numeric measures the results of this analysis cannot be fully reliably concluded to reflect the value added of PE-funding. This analysis, however, seeks to exclude the selection effects as well as possible and clearly yields insight into the association between PE-funding and the development of the funded companies.

Table 30 presents the results for the Heckman (1979) two-step OLS regression models.

Table 30: Results of the Heckman Two-step OLS Regression Models

This table presents the results of the Heckman two-step procedure OLS regression models in the model group $M2$. The first column presents the different variables employed in the models. The next two columns present the estimated coefficient and the p-value of model 1 within $M2$. The next two columns present the estimated coefficient and the p-value of model 2 within $M2$. The final two columns present the estimated coefficient and the p-value of model 3 within $M2$. The variables used in estimating the Inverse Mill´s ratio are sales to balance sheet-ratio as well as year 0 absolute values for sales, personnel, intangible assets, total assets and gross margin.

	Model 1		**Model 2**		**Model 3**	
	Coefficient	p	Coefficient	p	Coefficient	p
Sales growth	Wald chi2=142***, n=242		Wald chi2=136***, n=242		Wald chi2=139***, n=242	
Inverse Mill´s ratio	5.45E+06	0.028*	5.44E+06	0.022*	4.49E+06	0.067
High Technology Manufacturing	3.03E+06	0.101			3.41E+06	0.069
Knowledge Intensive Services	2.71E+06	0.132			3.09E+06	0.091
Seed investment stage	-1.69E+06	0.394			-2.52E+06	0.201
Industry growth variable	-1.01E-01	0.447	-1.21E-01	0.368		
Year 0 Sales	2.60E-01	0.003**	2.52E-01	0.003**	3.65E-01	0.000***
Year 0 Personnel	3.32E+04	0.057	3.76E+04	0.030*		
Year 0 Intangible Assets	7.26E-01	0.000***	7.02E-01	0.000***	9.72E-01	0.000***
Constant	-2.83E+06	0.172	-1.64E+06	0.325	-1.86E+06	0.358
Personnel growth	Wald chi2=34***, n=227		Wald chi2=31***, n=227		Wald chi2=27***, n=227	
Inverse Mill´s ratio	-2.73E+00	0.848	4.01E+00	0.762	-5.16E+00	0.719
High Technology Manufacturing	1.40E-01	0.989			3.69E-01	0.971
Knowledge Intensive Services	1.19E+01	0.231			1.28E+01	0.207
Seed investment stage	-1.40E+01	0.211			-1.85E+01	0.095
Industry growth variable	-8.50E-07	0.296	-8.42E-07	0.306		
Year 0 Sales	-6.21E-07	0.307	-7.03E-07	0.246	-1.98E-07	0.654
Year 0 Personnel	2.09E-01	0.054	2.38E-01	0.026*		
Year 0 Intangible Assets	-2.14E-07	0.829	6.45E-08	0.948	1.75E-06	0.006**
Constant	1.09E+01	0.379	7.32E+00	0.440	1.65E+01	0.173
Intangible Assets growth	Wald chi2=238***, n=241		Wald chi2=219***, n=241		Wald chi2=179***, n=241	
Inverse Mill´s ratio	1.02E+05	0.798	2.43E+05	0.527	-2.03E+05	0.636
High Technology Manufacturing	-6.56E+04	0.829			5.65E+04	0.864
Knowledge Intensive Services	6.57E+05	0.028			8.04E+05	0.013*
Seed investment stage	-3.25E+05	0.314			-6.24E+05	0.072
Industry growth variable	-7.57E-02	0.000***	-7.92E-02	0.000***		
Year 0 Sales	-3.80E-02	0.004**	-4.33E-02	0.001**	-7.87E-03	0.493
Year 0 Personnel	1.32E+04	0.000***	1.38E+04	0.000***		
Year 0 Intangible Assets	-3.49E-01	0.000***	-3.55E-01	0.000***	-2.52E-01	0.000***
Constant	3.83E+04	0.909	1.03E+05	0.696	3.70E+05	0.300
Total Assets growth	Wald chi2=84***, n=242		Wald chi2=77***, n=242		Wald chi2=26***, n=242	
Inverse Mill´s ratio	5.92E+05	0.597	1.14E+06	0.287	1.67E+06	0.205
High Technology Manufacturing	4.38E+04	0.959			-2.08E+05	0.838
Knowledge Intensive Services	1.11E+06	0.188			1.01E+06	0.311
Seed investment stage	-1.37E+06	0.135			-7.69E+05	0.471
Industry growth variable	-2.35E-01	0.000***	-2.45E-01	0.000***		
Year 0 Sales	1.85E-01	0.000***	1.81E-01	0.000***	6.38E-02	0.076
Year 0 Personnel	-1.17E+04	0.128	-9.44E+03	0.219		
Year 0 Intangible Assets	-9.68E-02	0.219	-1.11E-01	0.166	-1.87E-01	0.005**
Constant	7.00E+05	0.452	4.20E+05	0.568	-2.23E+05	0.837

Statistically significant at *95%, **99% and ***99.9% confidence level.

The results of the Heckman (1979) two-step regression models differ to some extent from the results of the basic OLS regression. The first conclusion is, however, that as the coefficient for the PE dummy is positive at a statistically significant level in the models explaining sales growth. It seems that PE-funding results in faster sales growth even when the selection effects are excluded taken that we have succeeded at excluding the selection effects reliably.

This is, however, perhaps not fully realistic assumption, as this model supposes that the VCs selection can be modeled solely based on the financial information on the companies and in reality the VC selection process may be driven by unobservable variables such as business plan and management team quality. Thus, the success of the Heckman (1979) two-step regression models can be questioned.

For growth of personnel, intangible assets or total assets no statistically significant value adding impact is identified based on this analysis. However, as there remains some doubt about the successfulness in excluding the selection effects correctly we cannot rule out the possibility of such value adding impact to exist.

6 Conclusions

This thesis seeks to examine how the firm-level societal and economic impact of private equity can be assessed in Finnish context by carefully reviewing the current literature and the presented methodologies. This leads the way to answering to the second part of the research question when selected approach and methodologies are empirically implemented in order to analyze what can we reliably say about the firm-level societal and economic impact of the investing activities of the members of Finnish Venture Capital Association.

The most severe challenges in conducting a reliable and valid research on the subject are, in addition to the limited availability of suitable data, the difficulty in defining a control group against which the PE-funded companies are compared and overcoming the selection biasedness arising from the non-random nature of the VCs investment decisions.

The empirical drilldown to the subject begins by comparative statistical analysis between companies that have received their first-ever PE investment in 2002-2004 and non-PE-funded control group companies. The analysis on the development of these companies from the investment year 0 to third year after the investment reveals explicit differences in the development of the selected companies. The association between the development of the chosen firm-level measures and PE-funding is further analyzed through various regression models

The most relevant and reliable conclusion of this study is that the growth of sales and personnel of the PE-funded companies in Finland is significantly faster than the growth of non-PE-funded companies. During the study period the average sales growth of PE-funded companies is €4.6 million whereas the equivalent average for non-PE-funded companies is €1.2 million. Average personnel growth is 14.1 employees for PE-funded companies but only 2.1 employees for the control group companies. The difference is statistically significant at 99.9% confidence level and the conducted OLS regression analysis further validates these results.

The average growth of balance sheet intangible assets is €61,000 for PE-funded companies whereas the equivalent for non-PE-funded companies is €-318,000. Mean growth of total

assets is €910,000 for PE-funded companies and €108,000 for the control group. These differences, however, do not quite reach 95% confidence level. In any case the basic OLS regressions suggest a statistically significant association between PE-funding and faster intangible assets and total assets growth. Thus, the growth of intangible and total assets seems to be associated with PE-funding but this dataset does not give fully unambiguous verification for this.

The faster growth of the PE-financed companies firm-level measures presented in this thesis may be result of the VCs being able to select portfolio companies that have comparatively larger growth potential instead of the true added value VCs are often argued to supply. Also both of these may apply. We cannot fully reliably conclude whether the exact source of the faster growth truly is the operations of PE investors within the company after selecting their investment targets. The final regression analysis employing Heckman (1979) two-step procedure, however, seeks to exclude the selection effects from the value adding impact. The results of this analysis are consistent with possibility of true value adding impact of VCs resulting in faster growth of sales compared to other companies. For growth of personnel, intangible assets or total assets no statistically significant value adding impact is identified but this does not rule out the possibility of such value adding impact to exist. The applied regression model seeking to exclude the selection effects supposes that the VCs selection can be modeled solely based on the financial information on the companies, which is perhaps not fully realistic assumption, as the VC selection process may be driven by unobservable variables such as business plan and management team quality.

The result of comparatively greater growth of PE-funded companies' sales, personnel, intangible assets and total assets is even stronger for firms operating in high-tech industries, especially within knowledge intensive services sector, and/or receiving PE-funding in seed investment stage. These qualifications of a PE-funded company seem to be associated with even faster relative growth compared to the matched non-PE-funded companies. The results are based on the statistical analysis on the comparative growth across different data categories.

There seems to be no statistically significant positive association between corporate taxes and PE-funding. The PE-funded companies also seem to be less profitable three years after the PE investment than their non-PE-funded counterparties. The lower profitability arises especially

from early investment stage companies' low profitability and these companies seem to be also less profitable at the time they receive the PE investment. Based on the knowledge of the PE industry we can conclude that the investors most likely seek less profitable companies with large future potential instead of highly profitable companies already at the time of the investment.

The findings are summarized around the hypotheses in the Table 31 below.

Table 31: Summary of the Findings

This table summarizes the key findings of the thesis.

Hypothesis	Conclusions
H1. There is a positive relationship between private equity funding and the growth of sales, employment, innovation, profitability, total assets, and corporate taxes of a company and the differences between the private equity backed companies and non private equity backed companies are statistically significant.	Based on statistical analysis and regression analysis we can conclude that the growth of sales and personnel of the PE-funded companies in Finland is significantly faster than the growth of sales and personnel of the matched non-PE-funded companies. Based on the regression analysis results the growth of intangible and total assets seems to be associated with PE-funding based but this dataset does not give fully unambiguous verification for this, as the results of the statistical analysis do not quite reach 95% confidence level. The faster growth of the PE-financed companies firm-level measures presented above may be result of the VCs being able to select portfolio companies that have comparatively larger growth potential instead of the true added value VCs are often argued to supply. Also both of these may apply. There seems to be no statistically significant positive association between corporate taxes and PE-funding. The PE-funded companies also seem to be less profitable three years after the PE investment than their non-PE-funded counterparties. The lower profitability arises especially from early investment stage companies' low profitability and these companies seem to be also less profitable at the time they receive the PE investment.
H2. The relationship between private equity funding and growth of the chosen firm-level measures is stronger for early stage companies compared to later stage companies.	The result of comparatively greater growth of PE-funded companies sales, personnel, intangible assets and total assets is stronger for firms operating in seed investment stage. The results are based on the statistical analysis on the comparative growth across different data categories. Based on the same analyses the lower values for PE-funded companies' cumulative taxes as well as the year 3 profitability seem to be even stronger for firms operating in seed investment stage.
H3. The relationship between private equity funding and growth of the chosen firm-level measures is stronger for companies in high-tech industries compared to companies in low-tech industries.	The result of comparatively greater growth of PE-funded companies sales, personnel, intangible assets and total assets is stronger for firms operating in high-tech industries, especially within knowledge intensive services sector. The results are based on the statistical analysis on the comparative growth across different data categories. There seems to be no significant difference in case of cumulative taxes or year 3 profitability of these companies.

This research has been one of the first ones to reveal the curtain behind the venture capital industry in Finland and how the investing activities of PE investors affect their portfolio companies. The unique hand collected dataset and employed methodologies indeed result in a result that adds value to the current understanding of the association between PE-funding and development of the portfolio companies in Finland. This thesis should, however, be seen

merely as the first melody reflecting the impact of private equity funding instead of a complete symphony on the topic. Many possible courses for additional compositions could be identified along the way of conducting this one.

As mentioned earlier many different methodologies for excluding the impact of VC selection effects could be implemented. The results of a research that utilizes suitable instrumental variables for overcoming the endogeneity problem could shed additional light on the actual value adding impact of PE-funding. Finding such variables and furthermore collecting data on them could, however, be a challenging task. Possibly even more interesting would be a randomized experiment on the topic if certain VC investors would agree on selecting their investment targets randomly for example from certain group of companies. This, however, is most likely an unrealistic expectation to happen naturally since VCs are most likely also in the future able and willing select their exact investment targets carefully.

In a broader global context there are many interesting possibilities for future research as well. One possible source of added value that emerged from the discussions with the members of FVCA is the possibility of an increase in credibility and trustworthiness of a portfolio company as it receives funding from a well established PE investor with good reputation. This could be possibly studied more closely through a survey study directed to the various interest groups of selected portfolio companies.

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Appendix

Appendix 1

Full members of the Finnish Venture Capital Association (7.12.2008)

3i Nordic Plc
Aboa Venture Management Oy
Ahlström Capital Oy
Amanda Capital Oyj
Aura Capital Oy
Bio Fund Management Oy
CapMan Group
Conor Venture Partners Oy
EQT Partners Oy
Eqvitec Partners Oy
Fenno Management Oy
Helmet Business Mentors Oy
Innofinance Oy
Intera Equity Partners Oy
Inventure Oy
Korona Invest Oy
MB Rahastot Oy
Midinvest Management Oy
Nexit Ventures Oy
Nordia Management Oy
Nordic Growth
Nordic Mezzanine
Nordic Venture Partners
Pohjola Capital Partners Oy
Pohjola Private Equity Funds Oy
Profita Management Oy
Sentica Partners Oy
Sponsor Capital Oy
Stora Enso Ventures
Suomen itsenäisyyden juhlarahasto Sitra
Suomen Teollisuussijoitus Oy
Teknoventure Management Oy
Tutor Invest Oy
Veraventure Oy
Virtaa Hämeeseen Oy
VNT Management Oy
Wedeco Management Oy Ab

Appendix 2

EVCA definition of investment stages (FVCA, 2008)

Seed: Financing provided to research, assess and develop an initial concept before a business has reached the start-up phase.

Start-up: Financing provided to companies for the product development stage, and further funds are required in order to initiate commercial manufacturing and sales. These companies do not generate profits yet.

Other early stage: Financing provided to companies that have begun initial marketing and related development and that require financing to achieve full commercial production and sales.

Expansion: Financing provided for the growth and expansion of an operating company, which may or may not be breaking even or trading profitably. The capital may be used to finance increased production capacity, market or product development and/or to provide additional working capital.

Bridge financing: Financing made available to a company in the period of transition from being privately owned to being publicly quoted.

Secondary financing: The purchase of existing shares in a company from another private equity investment organisation or from another shareholder or shareholders.

Rescue/Turnaround: Financing that is made available to an existing business which has experienced trading difficulties with a view to re-establishing prosperity.

Refinancing bank debt: To reduce a company's level of gearing.

Management buyout (MBO): Financing provided in order to enable a company's current operating management and investors to acquire an existing product line or business.

Management buy-in (MBI): Financing provided to enable a manager or group of managers from outside the company to buy-in to a company with the support of private equity investors.

Venture purchase of quoted shares: The purchase of quoted shares with the purpose of delisting the company.

Other purchase of quoted shares: The purchase of shares on a public stock market.