

The Significance of Venture Capital for Firm Growth

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Abstract

The aim of this paper is to determine whether venture-backed firms outperform non-venture-backed firms. The hypothesis that this is the case follows from the specialised investment approach that venture capitalists take. From pre-investment screening to monitoring and value-adding services, venture capitalists are believed to have a comparative advantage in making investments where informational asymmetries are substantial. This is true in particular for early-stage firms and firms operating in high-tech industries. Consistent with this hypothesis, the results show, based on data from Danish firms, that venture-backed firms sustain faster employment growth than non-venture-backed firms. The difference between the two kinds of firms is particularly strong in early-stage, high-tech firms, where annual job growth rates are 70% on average compared to 10% for a comparable sample of firms financed by non-venture capital investors. The implications for enterprise policy are twofold. First, the results corroborate the claim that venture capital investment is a powerful source of job creation. Secondly, it indicates how policy efforts should be dedicated to designing an institutional and macroeconomic framework that is conducive to expanding the venture capital community.

1. Introduction

One of the most important resources needed to get a firm off the ground is funding. This is why the availability of both equity capital and loan finance in a society constitutes a crucial element in determining the level of entrepreneurship. Equity is particularly crucial for innovative start-ups. It provides a cushion against those unforeseen changes that start-ups have to cope with on their way to building a market for their product. Loan finance, by contrast, requires a steady stream of revenues to cover interests and amortisation, which innovative start-ups typically cannot provide. Moreover, many start-ups have difficulties putting up the level of collateral that banks require when lending out money. This is why equity finance is often the preferred type of funding for innovative start-ups.

But not all equity funding is the same. Venture capital stands out from other types of equity finance because of its unique combination of capital and hands-on involvement. Timmons et. al. (1977) define venture capital as unsecured capital invested in an unlisted firm as equity (or debt securities with equity features) to capture the rising market value of the rapidly growing firm.

Venture capital investors (VCs) typically are seasoned investors, who have earned their credentials by setting up their own firms and leading them to success or by working as high-level managers in industry or investment banking. Based on their extensive professional experience, VCs normally take an active role in managing the development process of their portfolio companies. They closely monitor the business activities of portfolio firms and seek to provide value-creating services besides their financial involvement. This helps to close the gap in non-technical skills, which is often found in innovative start-ups (Amit et al. (1998), Berger and Udell (1998), Gompers and Lerner (1999)).

In Denmark, venture capital firms have recently emerged as a strong source of innovation finance. Between the end of 1998 and the end of 2002, the amount of capital under management by Danish VCs grew from DKK 3.5 billion (€ 0.5 billion) to DKK 16.2 billion (€ 2.2 billion). The rate of new investment by VCs also grew substantially, rising from DKK 0.8 billion (€ 0.1 billion) in 1998 to DKK 3.4 billion (€ 0.5 billion) in 2001. However, the amount of investments fell to DKK 2.1 billion (€ 0.3 billion) in 2002 as a result of the global economic downturn.¹

Drawing on data from the Danish venture capital market, the aim of this paper is to examine whether venture-backed firms perform better than non-venture-backed firms, given the nature of the investors.

¹ VækstFonden (2003a)

2. The Impact of Venture Capital - *theory and hypothesis*

It seems reasonable to argue that if there is a difference in performance between venture-backed and non-venture-backed firms, it should arise from the ability of VCs to handle informational asymmetries.

Informational asymmetries generally take two forms in an investment situation. One form, sometimes referred to as "hidden information", occurs when one party to a transaction possesses relevant information that is not known to the other party. This phenomenon is called "adverse selection". Potential investors understand that adverse selection exists and may therefore be wary of funding endeavours, where it is difficult or costly to monitor the entrepreneur's actions. The other form of informational asymmetry is often described as "hidden action". This occurs, when one party to a transaction cannot observe relevant actions taken by the other party. This problem leads to what is called "moral hazard". The informed party then has an incentive to act out of self-interest, even if such actions impose high costs on the other party (Amit, 1998).

When deciding on an investment in a start-up, VCs are expected to exercise superior assessment capabilities compared to other investors.

Firstly, VCs stand a better chance than other investors at mitigating adverse selection due to their industry experience and expertise. Secondly, VCs monitor investee firms closely post-investment. This potentially enhances information availability and early problem-detection, while also significantly improving decision-making (Mitchell et al. 1997). This should alleviate the effects of moral hazard problems.

The ability of VCs to screen and monitor firms is thus crucial to reduce informational asymmetries. Equally beneficial are such services as the VCs providing access to networks of professionals, moral support, and general business knowledge and discipline.

Compared to other investors, who can potentially invest in the same firms, VCs differentiate themselves by being highly specialised within certain industries. VCs should thus be able to attract and select the most promising projects - and enhance the development of these firms through active, value-creating involvement. If VCs have the necessary skills, then this should lead to:

Hypothesis 1: Venture-backed firms perform better than comparable non-venture-backed firms.

The combination of strong specialisation 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, 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 leads to:

Hypothesis 2: The impact of venture capital is greater for early-stage firms compared to later-stage firms.

Informational asymmetries are also assumed to be more critical for firms in high-tech industries compared to low-tech industries. In many high-tech industries, a large share of value-creation is generated from intangible assets, which are difficult to assess by non-specialised investors. Fierce competition moreover means that many high-tech firms continuously focus on developing new products. This leads to greater attention from investors as well as more intensive monitoring of business activities (Engel, 2002).

Thus:

Hypothesis 3: The impact of venture capital is greater for firms in high-tech industries compared to firms in low-tech industries.

When testing if venture-backed firms perform better than firms financed by other sources, the issue of firm survival rates needs to be taken into account. Several studies on the impact of venture capital are contaminated by survival bias (Manigart et al, 2002). The significance of this is illustrated by the finding from these studies that surviving venture-backed firms achieve higher growth rates than firms backed by other sources, while venture-backed firms do not have a higher probability of surviving compared to non-venture backed firms.

3. Research Method

The potentially distorting effect of non-survivals is reduced in this study by including both surviving and non-surviving firms.

3.1 Selection of the Samples

The sample of Danish venture-backed firms is based on annual reports collected from Danish VCs. All Danish firms that received their first infusion of venture capital investment from Danish VCs in the period 1994-2001 are included. A total of 443 venture-backed firms were identified this way. Accounting data was available for 329 of these firms, which makes it the largest sample of Danish venture-backed firms to date.

Accounting data are mainly collected from the database provided by Købmandsstandens Oplysningsbureau². To the extent it has been possible, the data have been supplemented by annual reports from VCs.

A profile based on the legal form, industry, age and size of venture capital portfolio companies was designed in order to identify a control sample with a similar profile. VCs generally invest in "aktieselskaber" (77,8%) and "anpartsselskaber" (21,6%).³ As a result, only incorporated firms are included. The control sample was limited to firms that received equity finance (but not venture capital) in the period 1996-2001. In order to be included in the sample, accounting data had to be available, the nominal value of stocks issued had to have increased, and the increase in the book value of equity minus operating income before tax had to exceed DKK 250,000. This produces a control sample of 838 firms.

3.2 Description of the samples

To test hypotheses 2 and 3, the selected firms have been grouped according to development stage and technology level. High- and low-tech classifications are based on standard NACE-nomenclature (see appendix).

² Denmark's largest provider of financial information.

³ The public limited company (in Danish 'aktieselskab', abb. 'A/S') and private limited company (in Danish 'anpartsselskab', abb. 'ApS') are regulated by different acts, although there are many similarities. One important distinction is, however, that the capital requirement for the A/S is 500,000 DKK while it is 125,000 DKK for the ApS. Another distinction is that an A/S is required to have a two-tier management system consisting of an executive committee and a board of directors. The ApS can have a one-tier management. An ApS can easily be transformed into an A/S and vice versa.

Most of the venture-backed firms are in Software, Communications, and R&D services in natural sciences (42%), while 15% belong to Other manufacturing and 11% are in R&D intensive manufacturing, see table 1. The distribution between high- and low-tech industries for the sample of venture-backed firms is 62% and 38% respectively.

Table 1: Venture-backed firms and control sample grouped by industry

Industry	venture-backed	Control sample	Distribution of venture-backed firms	Distribution of control sample
Software, Communications, R&D services in natural sciences ¹⁾	137	170	42%	22%
R&D intensive manufacturing 1)	35	60	11%	8%
Hardware, technical consulting ¹⁾	16	34	5%	4%
Non-technical consulting, advertising ¹⁾	16	60	5%	8%
Other manufacturing	48	154	15%	20%
Real estate activities, Credit/Insurance	19	7	6%	1%
Wholesale and retail trade	30	186	9%	24%
Sale, maintenance and repair of vehicles, retails trade	8	38	2%	5%
Traffic, Renting of equipment, sewage, and refuse disposal, other business-oriented services	12	19	4%	2%
Health services, Recreational, cultural, sporting activities, other consumer-oriented services	7	12	2%	2%
Construction	1	26	0%	3%
Sum	329	766	100%	100%

Source: VækstFonden

The single largest industry in the control sample is Wholesale and retail trade (24%). Software, Communications, and R&D services in natural sciences account for 22%, while 20% is in Other manufacturing. The distribution between high- and low-tech industries for the control sample is 42% and 58%, respectively.

The age of the portfolio company at the time of the first venture capital investment is used as a proxy for the development stage. Early-stage investments are defined as investments made in firms less than 4 years old. This corresponds to the definition used in other studies (Engels, 2002).

62% of the venture-backed firms can be grouped as early-stage. As regards the control sample, 52% of the firms received additional funding within four years after inception, see table 2.

Table 2: Venture-backed firms and control sample grouped by time-lag between investment and foundation date

Time-lag between investment and foundation date	Number of venture-backed firms	Control sample	Distribution of venture-backed firms	Distribution of control sample
<1 year	100	294	30%	38%
1-2 years	60	53	18%	7%
2-3 years	24	32	6%	4%
3-4 years	19	29	6%	4%
4-5 years	13	12	4%	2%
5-6 years	7	20	2%	3%
>=6 years	106	326	32%	43%
Sum	329	766	100%	100%

Source: VækstFonden

To analyse the relative performance of venture-backed firms, the average annual percentage growth in the number of employees is used. The advantage of using this parameter is that it is available for most firms. Another indicator on activity, annual turnover, is available only for a tiny share of the selected firms. Hence, turnover is not used in the analysis, which is consistent with other similar studies on the impact of venture capital.

With only one variable to test, the null hypothesis is that no significant difference exists between average annual employment growth rates for venture-backed firms and non-venture-backed firms. A standard Z-test is used like in other similar studies (Christensen, 2000). A positive Z-value indicates that the venture-backed firms perform better, while a negative Z-value implies that the firms financed by other sources perform better.

4. Results

4.1 Venture-backed vs. non-venture-backed firms

The **first hypothesis** to be tested is whether or not venture-backed firms perform better than non-venture-backed firms regardless of the stage of development and the technology level.

The average annual employment growth rate for venture-backed firms is 29%, while the corresponding growth rate for the control sample is 5%, see table 3a. Thus, firms financed by venture capital seem to be achieving growth rates that are up to six times higher than the growth rates achieved by firms financed by other investment sources.

Table 3a: Average annual growth rates for employment

Venture-backed			Control sample			z-value
Mean	Median	N	Mean	Median	N	
29%	0%	329	5%	-4%	766	2.73***

Note: "**", "***" and "****" mean the result is significant at 10%, 5% and 1% level respectively.

The result is statistically significant, as the null hypothesis is rejected at the 1% level. The z-value is 2.73, compared to a critical level of 2.33.

As expected, there is substantial variation in the growth rates exhibited by venture-backed firms. The upper quartile of venture-backed firms achieves growth rates in excess of 40%, the median is 0%, while the lower quartile is -25%, see table 3b.

Table 3b: Average annual growth rates for employment

	VC-backed	Control sample
Upper quartile	40%	11%
Median	0%	-4%
Lower quartile	-25%	-31%

Source: VækstFonden

Considerable variation is found also in the growth rates of firms financed by non-venture capital investors. The average growth rate in the upper quartile is 11%, the median is -4%, while the lower quartile is -31%.

Although the statistical method does not reveal the nature of the causal relationship, it provides evidence of a strong positive correlation between venture capital investment and job growth. The finding that a venture-backed firm grows six times faster than a non-venture-backed firm is thus indicative of a positive effect arising from the hands-on involvement of VCs.

4.2 Stage of Development

The **second hypothesis** to be tested is whether the impact of venture capital is greater for firms in early-stages compared to those in later-stages. Early-stage venture-backed firms achieve average annual employment growth rates of 49%, which is five times higher than the corresponding growth rate for early-stage firms in the control sample, see table 4.

Table 4: Average annual growth rates for employment

	Venture-backed			Control sample			z-value
	Mean	Median	N	Mean	Median	N	
Early-stage	49%	0%	203	10%	-20%	408	2.68***
Later-stage	-3%	1%	126	-2%	-1%	358	-0.28

Note: "**", "***" and "****" mean the result is significant at 10%, 5% and 1% level respectively.

By contrast, no statistically significant difference can be found for job growth in venture-backed firms and non-venture backed firms in the later-stage segment. Growth rates are negative in the 2-3% range for both sub-segments.

This corroborates the hypothesis that venture capital and job growth rates are more strongly correlated for early-stage firms.

The negative correlation for later-stage firms might be an indication that VCs investing in this segment focus on restructuring in order to cut superfluous resources and trim production. Cost-reduction, which is usually a part of this process, thus leads to a decline in the number of employees, especially in the short run. After a few years, when the restructuring process is completed, the number of employees might rebound above initial level. In fact, a closer examination of the early-stage segment reveals that more than half of the firms receiving venture capital actually have achieved positive job growth in the longer term.

4.3 Level of technology

The **third hypothesis** states that the impact of venture capital on job growth is greater for firms in high-tech industries compared to firms in low-tech industries.

Consistent with the above hypothesis, table 5 illustrates that venture-backed firms in high-tech industries achieve average annual job growth rates of 48% compared to a rate of 6% for high-tech firms in the control sample. The difference is statistically significant.

Table 5: Average annual growth rates for employment

	Venture-backed			Control sample			z-value
	Mean	Median	N	Mean	Median	N	
High-tech	48%	2%	204	6%	-8%	328	2.95***
Low-tech	-2%	0%	125	4%	-2%	438	-0.91

Note: "**", "***" and "****" mean the result is significant at 10%, 5% and 1% level respectively.

High-tech firms financed by venture capital thus achieve average annual growth rates, which are eight times higher than those achieved by firms financed by other investors.

Venture-backed firms in low-tech industries, however, achieve negative average annual growth rates (-2%), while the corresponding growth rate for low-tech firms in the control sample is 4%, see table 5. This result is not statistically significant though.

A closer inspection of the firms in low-tech industries reveals that many of them are older firms, where the VCs' strategy often involves some restructuring to increase efficiency and profitability. Thus, the job-shedding that is typically a part of the restructuring process produces a short-run decline in employment. This highlights the partial nature of hypotheses 2 and 3, where the effects from stages and technology are treated separately.

5. The Impact from Technology and Development Stage

In order to merge the analysis of technology and stage, each of the two samples is broken down into four groups: high-tech/early-stage, high-tech/later-stage, low-tech/early-stage and low-tech/later-stage.

Venture-backed firms in the high-tech, early-stage segment achieve average annual growth rates of 70%, while the growth rate for non-venture-backed firms in the same category is 10% (see table 6). The difference in growth rates is statistically significant at the 1% level.

Table 6: Average annual growth rates for employment

	Venture-backed			Control sample			z-value
	Mean	Median	N	Mean	Median	N	
High-tech / early-stages	70%	11%	146	10%	-20%	218	3.02***
High-tech / later-stages	-6%	-2%	58	-2%	-2%	110	-0.67
Low-tech / early-stages	-5%	-10%	57	11%	-9%	190	-1.24
Low-tech / later-stages	0%	4%	68	-1%	-1%	248	0.30

Note: "**", "***" and "****" mean the result is significant at 10%, 5% and 1% level respectively.

The growth rates for venture-backed firms in either low-tech industries or later stages of development are not significantly different from the rates achieved by non-venture-backed firms. Thus, the results show that the *only* statistically significant correlation between venture capital and growth rates occurs in high-tech, early-stage firms.

The finding that venture capital is a driving force behind firm growth is further investigated in a multivariate regression model. This combines the four variables - GROWTH (annual change in employees), TYPE (1 if the firm received venture capital, 0 if it did not), STAGE (1 if firm up to 4 years old at time of investment, 0 if older), and TECH (1 if firm categorised as high-tech, 0 if low-tech). The regression model looks as follows:

$$\text{GROWTH} = a + b \text{ TYPE} + c \text{ STAGE} + d \text{ TECH}$$

The underlying hypothesis is that GROWTH may be explained by TYPE, STAGE, and TECH in combination. Consistent with the three hypotheses, coefficients b, c, and d are found to be positive and significant at the 5%-level, as table 7 shows.

Table 7. Growth determinants - regression analysis coefficients

Variable	Coefficient	Value	Probability Value
TYPE	B	20.8	0.005
STAGE	C	18.0	0.009
TECH	D	12.6	0.046
Constant	A	-10.6	0.046

$R^2 = 0.02$

The interpretation of the regression results is that venture capital acts as a significant growth-driver in the sample even after controlling for the growth-impact from stage and technology.

Combined with the partial analyses above, it clearly emerges that a firm can materially enhance growth by taking in venture capital. At the macroeconomic level, the biggest boost to job creation therefore is expected to occur where specialised VCs invest in high-tech, early-stage firms.

6. Concluding Remarks

Based on data from Danish firms, the above analysis demonstrates that firms financed by venture capital achieve much higher employment growth when measured against a comparable sample of firms that are funded by other types of investors. The average annual growth rate achieved by a venture-backed firm is 29%, which is six times greater than the average growth rate for a non-venture-backed firm. Narrowing down the sample to the high-tech, early-stage segment, employment grows by 70% in firms receiving venture capital compared to 10% for non-venture backed firms in the same segment.

It clearly emerges from the analysis that venture capital investment may be a highly significant source of job creation in an economy. The recent expansion of activity in the national market for venture capital therefore bodes well for the Danish economy. But VækstFonden (2003b) shows that at least another DKK 11-12 billion (€1.5-1.6 billion) must be raised by Danish VCs in order to satisfy expected demand for funding up to 2008. If this capital is raised and invested, the macroeconomic impact will be immense judging from the finding that venture capital is strongly associated with job growth.

Adequate funding is only part of the equation though. VækstFonden (2003b) also highlights that several other elements have to be in place to ensure a self-sustaining source of innovative start-ups in Denmark. Specifically, exit channels must be strengthened, the commercialisation of research must be streamlined, and the regulatory infrastructure must be improved to enhance incentives for entrepreneurs. As regards VækstFonden, which is the main state-owned investment vehicle, it should seek to maximise its impact by continuing to co-invest with Danish VCs in undercapitalized market segments, actively assisting in raising capital for new and existing venture capital funds, and expanding its international network in order to bring in more foreign VCs as co-investors.

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Appendix - NACE-codes

	NACE-codes (Rev. 1)
High-tech industries and Knowledge intensive industries	
Software, Communications, R&D services in natural sciences	642, 742, 723, 724, 726, 731
R&D intensive manufacturing	2233, 233, 2411-2414, 2417, 242, 243, 244, 2461-2464, 2466, 291, 293, 294, 2952-2956, 296, 300, 322, 323, 311, 314, 315, 3162, 321,331, 332, 333, 334, 341, 343, 352, 353
Hardware, technical consulting	721, 725, 742, 743
Non-technical consulting, advertising	732, 741 without 7415, 744
Low-tech industries	
Other manufacturing	15...37 without digit codes of high-technology industries
Real estate activities, Credit/Insurance	65-67, 70
Wholesale and retail trade	51, 52484
Sale, maintenance and repair of vehicles, retails trade	50, 52 without 52484
Traffic, Renting of equipment, sewage, and refuse disposal, other business-oriented services	60-64, 745-748 without 7415 and 74847, 90
Health services, Recreational, cultural, sporting activities, other consumer-oriented services	85, 92, 93
Construction	10-14, 40, 45