The Performance of Canadian Firms that Received Venture Capital Financing

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Industry Canada’s Small Business Branch (SBB) initiated and managed this project, worked with Statistics Canada and Thomson Reuters to design and build the dataset, and performed the descriptive analysis in the report. The SBB team consisted of Younes Errounda, Shane Dolan, and Jim Valerio.

Industry Canada’s Economic Research and Policy Analysis Branch (ERPA) designed the econometric methodology and performed the econometric analysis for this report. The ERPA team consists of Ryan Kelly and Hankook Kim.

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Note: Some of the data used in the research and analysis in this study were provided by Statistics Canada. The opinions expressed herein do not represent the views of Statistics Canada.
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Executive Summary

Industry Canada, in partnership with Canada’s Venture Capital and Private Equity Association (CVCA) and Statistics Canada, and using research data provided by Thomson Reuters, Statistics Canada, and the National Research Council of Canada, undertook this study to assess the impacts of Venture Capital (VC) on the performance of Canadian firms.

In particular, this report sheds light on this question: *Are the suggested benefits of venture capital (namely sustained growth of firms, high quality employment, and research performance in priority sectors of the economy) demonstrated in the performance of VC-backed firms?* Using robust and reliable data provided from the sources mentioned above and applying sophisticated methods to track firms through time, the research team addressed this question using two separate lines of inquiry.

First, the group of VC-backed firms in this study’s database that were still operating in 2009 and that had not undergone a significant merger or acquisition, was compared to the general population of firms. This analysis found that these firms posted:

- **higher levels of research and development (R&D) intensity** – VC-backed firms had higher R&D expenditures relative to revenues when compared to all other firms that conduct R&D;
- **higher average wages** – particularly higher average wages for VC-backed firms in the ICT sector, but also higher average wages for all VC-backed firms; and
- **higher survival rates over periods of one to five years** – by the fifth year, VC-backed firms had survival rates higher than all firms in the professional, scientific, and technical group, higher than all small and medium enterprises earning over $30,000, and higher than all manufacturing firms.

Second, econometric methods were applied to assess whether firms that received VC funding experienced higher growth than a comparable set of non-VC-backed firms. The statistically significant results of this analysis show that the average performance of Canadian VC-backed firms over time is notably superior to comparable non-VC-backed firms on the following measures:

- **stronger revenue growth, sales growth, employee growth, and asset growth** – cumulatively over periods of one, three and five years, respectively.
- **higher cumulative wage growth** – over time this wage growth is higher among VC-backed firms, suggesting that these firms do more high value-added employment than non-VC-backed firms.
- **higher R&D expenditure growth** – VC-backed firms performed better although only the one-year growth rate was statistically significant.

Based on the empirical analysis performed in this study, this report concludes that the suggested benefits of VC are indeed demonstrated in the performance of Canadian VC-backed firms. These results are also corroborated by earlier studies which measured the impacts of VC, such as a survey-based report published by CVCA in 2009, reports authored by industry associations in other countries similar to CVCA, and academic research papers based on administrative data. These studies confirm the positive effect of VC on innovation and as a catalyst for growth of employment and revenue.

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1.0 Introduction

Industry Canada in partnership with Canada’s Venture Capital and Private Equity Association (CVCA) and Statistics Canada, and using data provided by Thomson Reuters, Statistics Canada, and the National Research Council Canada, undertook this study to assess the impacts of venture capital (VC) on the performance of Canadian firms. In particular, this report sheds light on this question: Are the suggested benefits of venture capital (namely sustained growth, high quality employment, and research performance in priority sectors of the economy) demonstrated in the performance of VC-backed firms?

1.1 What is Venture Capital?

VC is a form of private equity financing that is suited to privately-held innovation-based early-stage technology firms with high potential for growth, but also with high investment risk. This risk deters conventional sources of financing, such as banks, from issuing loans to these firms.

Instead of providing loans, VC investors place investments in firms in exchange for a share of ownership and influence over business decisions. They typically target early-stage high growth oriented firms that are developing an innovative product or service with potential for high revenue growth. These young firms typically operate in high-technology sectors and spend heavily on R&D and new product development. Venture capitalists only invest in the few firms that they believe offer the potential for very large financial returns.

In addition to capital, VC investors bring specialized skills to the enterprises in which they invest. VC fund managers are able to evaluate new technologies and their market potential, allowing them to select, invest in, and mentor innovative start-up firms. These fund managers spend a great deal of time researching markets and opportunities, and carefully selecting companies for investment. This involves evaluating the aptitude of each company’s management team alongside the technical and market potential of the company’s technology, product, or service. Successful VC fund managers have sound financial management expertise and experience operating a successful start-up. This allows them to identify, select, invest in, mentor, and monitor the firms in their portfolio.

1.2 The Importance of Venture Capital

Promoting innovation to improve competitiveness in the private sector is critical to a healthy, growing economy, and is a key public policy objective. To this end, many governments in the developed world play an active role in fostering supportive environments that encourage business innovation. Their supportive actions include funding basic and applied research, investing in business and technology education, and subsidizing innovation-oriented activities such as private-sector R&D and commercialization.

Venture capital is generally considered to be important as a promoting factor for economic growth. Anecdotally, there are examples of VC investment having backed many highly successful multinational corporations such as Microsoft, Intel, Google, YouTube, MacDonald Dettwiler & Associates, and OpenText. Further, the academic literature has shown that venture capitalist involvement improves a firm’s product marketing strategies, human resources practices, and innovation potential.

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2 Ibid. [Duruflé, et al. 2009. Why Venture Capital is Essential to the Canadian Economy]

3 The Kelly and Kim paper (2013), Venture Capital as a Catalyst for High Growth, referenced in Annex D, summarizes the academic literature on VC investment that examines positive aggregate impacts of VC investment, such as higher patenting rates posted by industries that received more VC and higher levels of entrepreneurial activity in metropolitan areas with VC investment.
1.3 Venture Capital in Canada

The Canadian VC market has been active and it continues to develop. It attracts national private sector and public sector investment as well as significant international investment.

In 2012, $1.5 billion was invested by venture capitalists in Canada. As in other regions around the world, Canada’s VC investment is mostly placed in its largest urban areas and in technology sectors. As illustrated in Exhibit 1.1, 57 percent of those investments were placed in Toronto, Montreal and Vancouver. Exhibit 1.2 illustrates how 49 percent of those VC investments were placed in firms in the information and communication technologies sector, 25 percent in life sciences firms, and 10 percent in firms in the energy and environmental technologies sector.

Indeed, Canada has seen a number of high-profile VC-backed firms that have not only paid strong returns to their backers, but have also generated strong spin-off benefits to the Canadian economy. Two examples of such successes are highlighted in the sidebars on the following page.

1.4 Measuring the Impact of Venture Capital

Beyond the literature noted in Section 1.2 above, another important area of research consists of comparing the growth rates of a series of economic variables related to VC-backed companies, such as revenues, employment, profits, assets, R&D expenditures, exports, and productivity, to non-VC-backed companies.

Economists face a series of challenges when designing such studies. The main ones are:

- Defining an unbiased sample of VC-backed companies and retrieving reliable data for these companies. Information on VC investment can

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be found in specialized VC databases such as Thomson Reuters, but these databases do not include information on economic variables such as revenues, employment and others listed above.

- Defining a control group of comparable non-VC-backed companies and retrieving the corresponding data.

To face these challenges, a first generation of studies, generally produced by industry associations, has relied on the one hand, on surveys of VC-backed companies, with the help of association members, focusing especially on revenues and employment, and on the other hand, on publicly available statistics on the overall economy or on specific sectors for the control group. These studies show large positive differences between the average annual growth rates for VC-backed companies and control groups.

Similar studies are, however, subject to two different kinds of limitations:

- Surveys are not randomized, response rates are usually 15 to 30 percent, and responses are subject to various biases – most notably survival biases (i.e., there is a good probability that failing companies will be under represented).

- Control groups are very large and often not comparable in size, age, or other characteristics.

In order to address these issues, academics designed a second generation of studies where they:

- Linked VC databases like Thomson Reuters to official databases like the US Bureau of Census.

- Used access to these large databases to pair VC-backed companies with companies that were comparable at the time of VC investment.

Exhibit 1.3: Radian6 Success Story

Radian6 was a social-media monitoring company based in New Brunswick that delivered aggregated analytical and engagement tools for marketing professionals. The firm’s key social media product allowed customers to monitor and engage in conversations related to their brand in real time.

The company was acquired by Salesforce in 2011 for $326-million. Prior to the acquisition, Radian6 had received major funding from government & VC sources including:
- New Brunswick Innovation Foundation (NBIF)
- Summerhill Venture Partners (formerly BCE Capital)
- Brightspark Ventures
- BDC Venture Capital
- Government of Canada (NRC-IRAP)

This VC funding, knowledge, and experience resulted in:
- An excellent success story for Atlantic Canada, helping the region gain credibility for future firms.
- An exit that spawned new investors in Atlantic Canada’s entrepreneurial ecosystem, including seed funding for the New Brunswick Innovation Foundation due to a 28:1 return on their original invested capital.


Exhibit 1.4: CAN2GO Success Story

SCL Elements and its CAN2GO brand was a building automation company based in Montreal that specialized in energy efficiency and clean tech products for the small- and mid-sized building management market. The firm unified wireless building automation commercial control systems.

The SCL Elements team had no strong intellectual property barrier so sought VC funding to accelerate their growth ahead of competitors. They enjoyed many benefits from bringing smart money VC investors on board, gaining international strategic linkages, sales connections, and experienced mentors, which all contributed to:
- Exit via acquisition by Schneider Electric at an attractive valuation for the founders and senior management team, many of whom still remain with the company.
- Building a clean tech competency in Montreal where the professional and technical team are slated to remain employed in functionally similar roles.
- Building significant and enduring international linkages in the clean tech sector with Silicon Valley investors and Tier-1 global manufacturing companies including French and American powerhouses.
- Positioning Montreal as a global innovation hub for increased future clean tech spending by multinationals.

For instance, a study by Puri and Zarutskie (2009), links a private source of VC data to official sources of firm financials in the USA from 1981-2001. They find that VC-backed firms grow faster relative to non VC-backed firms in terms of employment and sales, but are less profitable on a per-sales basis.

This new study on VC in Canada includes improvements on previous studies. First, the richness of the data allowed the research team to include a wide array of controls that could affect firm growth including measures related to innovative performance of the firm, such as R&D expenditures. With these additional controls, the research team was able to construct a control group more reflective of VC-backed firms than previous efforts. Second, this is the first empirical work of its kind using official financial information to assess the performance of VC-backed firms operating in Canada.

1.5 Related Research Paper

The Economic Research and Policy Analysis Branch of Industry Canada has developed a research paper “Venture Capital as a Catalyst for High Growth” by Ryan Kelly and Hankook Kim. The econometric analysis and results summarized in this report are from that paper.

1.6 Structure of this Report

The next section of this report provides an appreciation of the research data used for this study – including sources, and the processes used to create reliable data for the analysis. Section 3 provides an overview of the characteristics of Canadian VC-backed firms – showing how they contribute to the Canadian economy, based on various economic indicators such as employment, revenues, and expenditures on R&D. Section 4 provides some highlights on the use of econometric analysis in this study, particularly in establishing a control group for comparison to the group of VC-backed firms. Section 5 presents the results of the study on relative performance of VC-backed firms compared to non-VC-backed firms in Canada. Finally, general conclusions from this study are summarized in Section 6. The Annexes provide more details on the data sources, data control and filtering processes, and econometric methodology used in the study.

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2.0 The Research Databases

This section describes the data sources that were used for this study and the rigorous processes used to ensure data quality.

2.1 The Master Research Database of VC-Backed Firms

The overarching database of known Canadian VC-backed firms, referred to here as the Master Research Database of VC-Backed Firms, covers the period from 1990 to 2009. The list of companies considered for this database, along with all of the information about the venture capital deals associated with these firms, was initially provided by Thomson Reuters. That list of 2,762 disclosed Canadian companies that had received VC funding from 1990 to 2009, and related investment details, only included information that Thomson Reuters was authorized to disclose by its agreements with its data providers.

Using the VC-Backed firm name, address, industry sector, and VC investment dates contained in this list provided by Thomson Reuters, linkages to Statistics Canada’s Business Register (BR) were possible. The BR is the central repository of information on Canadian businesses in Canada, including business names, addresses, and a BR enterprise identifier (BEID) that can be used to link to relevant and valuable firm-level micro data contained in Statistics Canada managed databases. The Statistics Canada managed databases that were approved for linkages for this project included those that contained data associated with corporate income tax return filings, employee taxation slips, and payroll remittance slips. These Statistics Canada sources contain diverse and robust data on firm-level financial, demographic, and employment characteristics.

The list of VC-backed companies from Thomson Reuters was linked to the BR by cross-referencing business names and addresses. To minimize the possibility of incorrectly linking the Thomson Reuters data to a BR entry, the research team developed a conservative data filtering process involving five steps. Each of the five steps is described in Annex B.

Due to the way the BR is designed, it is not always possible to use it to track companies over time. The research team applied novel techniques to correct for this. This process, described in Annex C, enabled the longitudinalization of the dataset and improved the accuracy of the analysis provided in this study.

The application of the five step filtering process to the initial Thomson Reuters list of 2,762 firms that received VC from 1990 to 2009 resulted in a final Master Research Database of VC-Backed Firms with 1,545 records, each correctly linked to micro-level economic data for each VC-backed firm. Further, the data coverage for each economic variable, by year, region and industry sector, satisfy the scope of analysis for this study. This significant VC funding base, the large number of firms in the Master Research Database of VC-Backed Firms, and the data coverage for each variable raises confidence and provides a robust foundation for the analysis in this study.

---

6 Only those firms that met the CVCA definition of a VC-backed firm were included in this list. According to the CVCA, only those privately-held firms that received at least one investment from a recognized VC investor are considered to be VC-backed. Firms that only received investment from private equity investors are not considered to be VC-backed.

7 This research was conducted at Statistics Canada and all of its strict privacy protection policies were observed. Measures were taken to ensure that the confidentiality of corporate and personal income tax data was maintained.
2.2 The Dataset of VC-Backed Firms for Econometric Analysis

Although the Master Research Database of VC-Backed Firms was constructed to capture information for as many firms as possible that received VC during the period of 1990 to 2009, the Statistics Canada databases that were accessible for this study only had firm level micro data for the period from 1999 to 2009.

Econometric analysis, described in Section 4 of this report, was used in this study to construct a control group of comparable non-VC backed firms. Econometric techniques were used to compare the performance of the population of VC-backed firms to comparable non VC-backed firms. Because firm level data was only available for the period from 1999 to 2009, and the construction of the control group for this study relied on identifying non-VC-backed firms that were similar to the VC-backed firms in the year they first received VC financing, the following filters were applied to the Master Database to create a Dataset of VC-Backed Firms for Econometric Analysis:

- only VC-backed firms that received their first financing during 1999 to 2009 were included;
- only those firms with values for all the variables of interest in the year of first VC funding were kept; and
- firms operating in industries with fewer than four VC-backed companies were removed.

Exhibit 2.1 illustrates the process used to create the Dataset of VC-Backed Firms for Econometric Analysis that consisted of 662 VC-backed firms and their correctly linked micro data.

In addition to having good data coverage for each economic variable in each year over the period of 1999 to 2009, the Dataset of VC-Backed Firms for Econometric Analysis also exhibited adequate data coverage over periods of five consecutive years. This data coverage is required to reliably perform the econometric analysis and measure five year growth rates for all of the variables of interest reported in Section 5.
3.0 Characteristics of Canadian VC-Backed Firms

This section of the report highlights some of the key economic characteristics and profiles of companies in the Master Research Database of VC-Backed Firms that were still operating in 2009 and that had not undergone a major merger or acquisition event. It provides a snapshot of the contributions of these companies to the Canadian economy.

Notably as a result of applying the data quality processes to the Thomson-Reuters list of 2762 known VC-backed firms, the Master Research Database of VC-Backed Firms, used to generate the results in this section, only contained 1545 of those firms. For this reason, the results presented in this section understate the actual contribution of VC-backed firms operating in the Canadian economy in 2009.

3.1 Footprint of VC-Backed Firms in the Canadian Economy

VC-backed firms represent a small portion of the entire population of Canadian firms, but their role in the Canadian economy is very significant — contributing to GDP growth and employing Canadians. Exhibit 3.1 shows that the firms in the Master Research Database of VC-Backed Firms that were still operating in 2009 and that had not undergone a significant merger or acquisition, generated almost $23 billion in revenues, employed at least 45,570 people, and reported approximately $908 million in R&D expenditures. Typically, VC-backed firms can be regarded as innovative enterprises developing new technologies and applications that contribute disproportionately to the growth of the Canadian economy.

3.2 Contribution of VC-Backed Firms by Sector

The contribution of VC-backed firms differs in terms of regional and sector impacts. Benefits of VC-backed firms tend to be concentrated in highly innovative sectors of the economy. This includes sectors that are perceived to contribute disproportionately more to economic output, job creation, productivity, and technological advancement.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Number of VC-Backed Firms</th>
<th>Average for VC-Backed Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue (millions $) 1</td>
<td>$22,676</td>
<td>732</td>
<td>$30.98</td>
</tr>
<tr>
<td>R&amp;D expenditures (millions $) 2</td>
<td>$908</td>
<td>425</td>
<td>$2.13</td>
</tr>
<tr>
<td>Number of employees 3</td>
<td>45,570</td>
<td>675</td>
<td>67.5</td>
</tr>
</tbody>
</table>

* Source: From the Master Research Database of VC-Backed Firms (see Section 2.1). Firm characteristics are derived from the number of firms posted in the Statistics Canada Business Register database linked to the Thomson Reuters database.
1 Derived from corporate income tax filings.
2 Derived from corporate income tax filings.
3 Average annual number of employees from payroll remittance.

8 One exception to this is in the analysis of survival rates shown later in Exhibit 3.7, which highlights differences in survival rates over 1, 2, 3, 4, and 5 year intervals.
Exhibit 3.2: Characteristics of VC-Backed Firms Still Operating in 2009, by Industry Sector*

<table>
<thead>
<tr>
<th></th>
<th>ICT</th>
<th>Life Sciences</th>
<th>Other Sectors</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue (millions $)</td>
<td>$17,228</td>
<td>$654</td>
<td>$4,794</td>
<td>$22,676</td>
</tr>
<tr>
<td>Number of firms</td>
<td>315</td>
<td>104</td>
<td>313</td>
<td>732</td>
</tr>
<tr>
<td>R&amp;D Expenditures (millions $)</td>
<td>$711.8</td>
<td>$131.7</td>
<td>$64.9</td>
<td>$908.4</td>
</tr>
<tr>
<td>Number of firms</td>
<td>222</td>
<td>75</td>
<td>128</td>
<td>425</td>
</tr>
<tr>
<td>Number of employees</td>
<td>22,177</td>
<td>3,011</td>
<td>20,382</td>
<td>45,570</td>
</tr>
<tr>
<td>Number of firms</td>
<td>290</td>
<td>94</td>
<td>291</td>
<td>675</td>
</tr>
</tbody>
</table>

* Source: From the Master Research Database of VC-Backed Firms (see Section 2.1). Firm characteristics are derived from the number of firms posted in the Statistics Canada Business Register database linked to the Thomson Reuters database.

1 Derived from corporate income tax filings.
2 Derived from corporate income tax filings.
3 Average annual number of employees from payroll remittance.

Exhibit 3.2 shows that of those sectors tracked, VC-backed firms operating in the ICT sector posted the strongest economic contributions. While ICT VC-backed firms represent 43 percent of the firms in the Master Research Database of VC-Backed Firms that were still operating in 2009, they accounted for 76 percent of the total revenues, 49 percent of employment, and 78 percent of all R&D expenditures. In contrast, the life sciences sector accounted for approximately 3 percent of the total revenue, about 7 percent of total employment, and about 15 percent of total R&D expenditures, respectively. All other sectors combined represent 21 percent of total revenues, 45 percent of total employment, and 7 percent of total R&D expenditures.9

Total revenue by VC-backed firms notably represents over 11 percent of the total revenue generated by the entire Canadian ICT sector, estimated at $150 billion.10 Similarly, total employment by VC-backed firms is almost 9 percent of the total employment generated by the entire Canadian ICT sector, estimated at around 550 thousand employees in 2009.

### 3.3 Contribution of VC-Backed Firms by Region

While Ontario VC-backed firms represent only 30 percent of the firms in the Master Research Database of VC-Backed Firms in 2009, they also account for 76 percent of the total revenues posted. Exhibit 3.3 shows that Ontario-based VC-backed firms had significantly higher revenues in 2009, averaging over $79 million per firm compared to $10 million per firm in Quebec, and $11 million in the rest of the country. However, the vast majority of revenues posted likely accrue to Ontario firms because some very large,

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9 In the case of VC-backed firms operating in the Life Sciences sector, many are purchased before they post revenue and their most significant contribution to the Canadian economy is not adequately captured by the analysis presented here.

successful companies that began with VC-backing are based in that province.

Innovative firms are also firms that tend to invest heavily in R&D. The R&D expenditures figures in Exhibit 3.3 follow the same pattern of concentration in Ontario and to a lesser extent in Quebec, compared to the rest of Canada. Ontario VC-backed firms account for 69 percent of R&D expenditures reported in the Master Research Database of VC-Backed Firms. VC-backed firms based in Quebec contribute the next highest proportion of R&D expenditures, accounting for 15 percent of the total as compared to 16 percent for all other regions combined.

Exhibit 3.3 also shows the distribution of employment in VC-backed firms by region in 2009. While Ontario accounts for 30 percent of all the VC-backed firms in the Master Research Database of VC-Backed Firms, it also accounts for 45 percent of all employment, Quebec 28 percent, and the rest of Canada 27 percent.

The higher incidence of employment in Ontario-based VC-backed firms is a clear reflection that proportionately larger firms are concentrated in that province. Exhibit 3.3 also shows a much higher revenue to employee ratio in Ontario which suggests that other dynamics are at play for those firms in the Master Research Database of VC-Backed Firms which are situated in Ontario, compared to those in other regions.

### 3.4 Extent of R&D Performed by VC-Backed Firms

R&D is an essential component of modern-day enterprise and business growth in any advanced economy. Important investment decisions by innovative firms are made on the basis of R&D results. The extent of R&D spending is usually a good indicator that a firm is focused on developing competitive products and processes that help it grow and contribute to the nation’s economy.

“R&D intensity” is a measure defined as the ratio of expenditures by a firm on research and development to the firm’s revenues. Exhibit 3.4 shows that R&D-intensity of VC-backed firms was greater when compared to all R&D performers across all revenue categories of firms.

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**Exhibit 3.3: Characteristics of VC-Backed Firms Still Operating in 2009, by Region**

<table>
<thead>
<tr>
<th></th>
<th>Ontario</th>
<th>Quebec</th>
<th>Other Regions</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue (millions $)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$17,269</td>
<td>$2,784</td>
<td>$2,624</td>
<td>$22,676</td>
</tr>
<tr>
<td>Number of firms</td>
<td>218</td>
<td>278</td>
<td>236</td>
<td>732</td>
</tr>
<tr>
<td>R&amp;D Expenditures (millions $)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$625</td>
<td>$134</td>
<td>$149</td>
<td>$908</td>
</tr>
<tr>
<td>Number of firms</td>
<td>141</td>
<td>146</td>
<td>138</td>
<td>425</td>
</tr>
<tr>
<td>Number of employees</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20,316</td>
<td>12,979</td>
<td>12,275</td>
<td>45,570</td>
</tr>
<tr>
<td>Number of firms</td>
<td>193</td>
<td>260</td>
<td>222</td>
<td>675</td>
</tr>
</tbody>
</table>

*Source: From the Master Research Database of VC-Backed Firms (see Section 2.1).
1 Derived from corporate income tax filings.
2 Derived from corporate income tax filings.
3 Average annual number of employees from payroll remittance.
This is most pronounced for firms with less than $1 million in revenue, which is suggestive of VC funding being invested in early-stage firms that may be involved in pre-market enterprise development, commercialization, and introduction of new products and process improvements.

Higher rates of R&D performance in VC-backed firms are further confirmed through an analysis of average R&D expenditure by VC-backed firms, compared to all R&D performers. Exhibit 3.5 on the next page shows that average expenditure on R&D by VC-backed firms is more than three times the average expenditure of all other R&D performers.

In total, VC-backed firms with positive R&D expenditures averaged over $2 million in R&D expenditures. By comparison, the average R&D expenditure for all R&D performers was $629 thousand, and for all manufacturer R&D performers it was $769 thousand.

### 3.5 Other Characteristics of VC-Backed Firms

Making comparisons of economic indicators such as revenues, employment and R&D expenditures provides useful strategic insights at one level for business decisions and for planning enterprise activities. At another level, however, the analysis of the quantity of employment, for example, should be accompanied by consideration of the quality of employment. Jobs that require more training and professional or technical expertise garner higher wages and provide a relatively bigger contribution to the Canadian economy than lower paying jobs.

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11 The term "all R&D performers" refers to all the firms in the Canadian economy that reported R&D expenditures according to the Statistics Canada 2012 Industrial Research and Development: Intentions Survey.

12 An R&D performer means a firm that has reported expenditures on R&D.
Similarly, R&D investments help businesses to build and maintain their competitive position within the economy and improve production processes and other enterprise activities.

Exhibit 3.6 shows that VC-backed firms, compared to other firms, have higher average wages. In 2009, average wages, an indicator of the quality of jobs, was $66 thousand for VC-backed firms compared to $43 thousand for all firms.

Industry sector wage differences for VC-backed versus all firms show similar differences. The figures for VC-backed firms in the ICT and the life sciences sectors were $83 thousand and $71 thousand respectively. These figures compare favourably to the average wages paid by all firms in 2009 in the manufacturing sector ($48 thousand), and to the average wages paid by all firms in professional, scientific and technical services industries ($59 thousand).

Exhibit 3.7 shows that for the 2001 cohort, VC-backed firms survive longer compared to other firms. The 2001 cohort was selected to match the most applicable existing Canadian dataset for survival rates, namely the Small and Medium-Sized Enterprises Data Warehouse. The exhibit directly compares business survival rates for VC-backed firms to other firms registered in Statistics Canada’s SME data warehouse. The comparison of firms that first received venture capital in 2001 to firms that entered the Statistics Canada business register that same year shows VC-backed firms consistently demonstrating a higher survival rate over a five-year period.

At the end of the fifth year, 76 percent of VC-backed firms survived, compared to roughly 61 percent of firms in all the other categories shown.

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Exhibit 3.6: Comparison of Average Wages, 2009

- VC-backed (All): $56,000
- VC-backed (ICT): $83,000
- VC-backed (Life sciences): $71,000
- All firms: $43,000
- All firms in manufacturing: $48,000
- All firms in professional, scientific & technical services: $59,000

Note: Source for the VC-backed firms indicated in the chart is the Master Research Database of VC-Backed Firms (see Section 2.1). Source for all other firm groupings indicated in the chart is: Statistics Canada Table 281-0047 – Employment and average weekly earnings including overtime, seasonally adjusted, for all employees by industries classified using the North American Industry Classification System (NAICS), Canada, 2009.

Exhibit 3.7: Comparison of Survival Rates*

- VC-backed firms
- All professional, scientific & technical
- All SMEs over $30k
- All manufacturing

Percentage Surviving Since 2001

Survival Rates

1 year later: 92% (VC-backed), 95% (All professional), 88% (All SMEs over $30k), 76% (All manufacturing)
2 years later: 89% (VC-backed), 92% (All professional), 86% (All SMEs over $30k), 72% (All manufacturing)
3 years later: 86% (VC-backed), 91% (All professional), 84% (All SMEs over $30k), 69% (All manufacturing)
4 years later: 82% (VC-backed), 88% (All professional), 80% (All SMEs over $30k), 72% (All manufacturing)
5 years later: 76% (VC-backed), 76% (All professional), 76% (All SMEs over $30k), 61% (All manufacturing)


Note: Source for the VC-backed firms indicated in the chart is the Master Research Database of VC-Backed Firms (see Section 2.1). Source for all other firm groupings indicated in the chart is: Small and Medium-Sized Enterprises Data Warehouse, Statistics Canada, 2008.
4.0 Use of Econometric Analysis

The analysis in Section 5 is based on econometric techniques. The principal use of econometric analysis in this study was to enable the measurement of the impact of VC-backed firms (the treatment group) by comparing their performance to the performance of a population of similar firms that did not receive VC financing (the control group). The initial list of VC-backed firms considered for the treatment group was the Dataset of VC-Backed Firms for Econometric Analysis, as described in Section 2.2.

4.1 Overview

In order to achieve an accurate and reliable comparison for this study, it was necessary to identify a control group that is identical to the treatment group for the measurable parameters that can affect performance, other than not having received VC.

This is important because, as shown in Section 3, the population of companies that have received VC investments tend to pay higher average wages and have higher average levels of R&D intensity when compared to the general population of firms. Furthermore, the population of firms in the Dataset of VC-Backed Firms for Econometric Analysis, in their first year of financing, have been shown to be significantly different from the general population of firms in Canada across several other key variables that could determine firm performance, such as sales, number of employees, assets, age, and profitability.14

Given the number of factors which must be controlled for in order to establish a good control group of comparable firms, simply selecting firms that share near-identical values for each control variable is not possible as few firms would match perfectly, resulting in a poor match rate and thus a very small control group. Instead, sophisticated matching methods are often required to select the best match for each treatment observation among the general population. The matching method used in this study is described in Section 4.2.

4.2 Establishing the Control Group

The data sources used for this study provide a solid basis to conduct the process of matching VC-backed firms to non-VC-backed firms with similar characteristics. The matching process used the propensity score matching method widely used in similar studies and in various scientific fields.15

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14 Ryan Kelly and Hankook Kim, Venture Capital as a Catalyst for High Growth, Industry Canada, 2013.

15 The 2013 Industry Canada research paper: Venture Capital as a Catalyst for High Growth, by Kelly and Kim provides an explanation of the propensity score matching method used in this study.
For this study, the firm characteristics listed in Exhibit 4.1 were used as modelling variables in the application of the propensity score matching technique. The technique was applied to the treatment group and the general population, to develop a model that estimates the probability a firm would receive VC financing. The Dataset of VC-Backed Firms for Econometric Analysis, described in Section 2.2 was used as the basis for the treatment group. Once the probability a firm would receive VC financing is computed, which is called a propensity score, each VC-backed firm in the treatment group is matched to a non-VC-backed firm from the general population with a similar score. Note that this score is computed for VC-backed firms at the time of first financing. Firms that are similar at the time of investment are matched and then subsequently compared on how they diverge following the investment.

When this matching methodology was applied at the time of first financing, an 82 percent match rate was achieved, resulting in 544 matched pairs for the analysis of firm performance and comparisons between treatment and control groups. The resulting control group is not statistically different from the treatment group across each of the included variables at the time of first financing.
5.0 The Relative Performance of Canadian VC-Backed Firms

This section examines whether VC-backed firms grow faster than non-VC-backed firms using econometric methods. Specifically, the analysis compares a set of VC-backed firms to a control group of non-VC-backed firms that is similar across financial, demographic, and geographic characteristics. The process used to generate these two sets of 544 matched firms is described in section 4.0.

5.1 Comparisons of Growth Performance

The analysis showed that the growth of VC-backed firms was greater than that of the non-VC-backed firms across all of the variables examined. The variables used were revenues, sales, number of employees, and assets. The results shown in exhibits in this section are statistically significant.16

Exhibit 5.1 shows that VC-backed firms performed better in cumulative revenue growth over periods of one year, three years, and five years. The cumulative growth in revenues for VC-backed firms was markedly higher in the first year, 53 percent versus 29 percent, but the difference was even more dramatic after three and five years of growth, more than doubling the growth of non-VC-backed firms cumulatively in those time intervals. Note that in Exhibit 5.1, and in subsequent Exhibits in this section, average growth figures indicated are cumulative over time.

While Exhibit 5.1 shows that the performance of VC-backed firms in cumulative revenue growth was relatively more than that of non-VC-backed firms, this could be conjectured to be due to outside sources of revenue unrelated to sales and actual commercialization performance (such as financial aid or grants).17 However, as Exhibit 5.2 shows, VC-backed firms also experienced higher growth in cumulative sales, rising from 49 percent cumulative growth after the first year to 137 percent cumulative growth by the fifth year.18 By comparison, non-VC-backed firms showed much less intense sales growth, increasing by only 56 percent in total over the five-year period.

As in the case of revenue growth, employment for VC-backed firms in the treatment group cumulatively

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16 Statistical significance at the 0.05 level was observed for all these comparisons, and most are highly significant at the 0.01 level. See Kelly and Kim (2013) for explanation of what these statistical significances imply.

17 Note, however, that in deriving the control and treatment groups, funding from the Industrial Research Assistance Program (IRAP) was accounted for and used as a filtering variable to control for small innovative firms (see Annex A). IRAP is one of the most important government funding sources for small innovation firms.

18 Note that the sales variable in the analysis generally includes only revenue from a company’s principal activities. It excludes, for example, grants and subsidies that may be included in the revenue variable.
The Performance of Canadian Firms that Received Venture Capital Financing

Exhibit 5.2: Average Sales Growth

Source: Ryan Kelly and Hankook Kim, Venture Capital as a Catalyst for High Growth, Industry Canada, 2013.

Exhibit 5.3: Average Employment Growth

Source: Ryan Kelly and Hankook Kim, Venture Capital as a Catalyst for High Growth, Industry Canada, 2013.

grew steadily over one, three and five year intervals. Exhibit 5.3 shows that employment growth for the non-VC-backed control group was negative or modest. On the other hand, the VC-backed firms were able to maintain a steady and consistent cumulative growth in employment over one, three and five year intervals – with a cumulative increase by the fifth year of 51 percent.

Growth in company assets is also an indicator of performance and successful enterprise development. Exhibit 5.4 shows that the treatment group of VC-backed firms grew their assets steadily and consistently over the one, three, and five year intervals that were measured, from a cumulative growth of 20 percent in the first year to a cumulative growth of 54 percent in the fifth year. On the other hand, the firms in the control group performed poorly in terms of asset growth, suggesting that their capacity to scale-up and develop their enterprise base at the same pace as the firms in the treatment group could have been diminished by having failed to or chosen not to receive VC assistance.

5.2 Improvement in Wages

The development and commercialization of firms in their early stages of growth usually requires highly qualified personnel (HQP) with advanced training and education. The success or failure of an early stage firm depends to a great extent on the value-added

Exhibit 5.4: Average Asset Growth

Source: Ryan Kelly and Hankook Kim, Venture Capital as a Catalyst for High Growth, Industry Canada, 2013.
that its employees bring to the enterprise. Consequently, the anticipation and attainment of high personnel performance could be expected to result in higher wages, particularly for firms experiencing successful growth.

Exhibit 5.5 shows the results of comparing cumulative wage growth between the treatment and control groups. Only the one year and five year interval measurements are shown here as these two periods provide the only statistically significant results from the analysis of wages. The results are not as dramatic as is the case in the economic growth indicators shown in Section 5.1 above. However, cumulative growth of average wages for the VC-backed firms was still greater than for the non-VC-backed firms – cumulatively from 8 percent in year 1 to 29 percent in year 5 for the treatment group, compared to cumulative growth from 5 percent to 19 percent for the control group. This is perhaps an indication that the VC-backed firms created more high value-added employment than non-VC-backed firms.

On balance, VC has a positive impact on growth in wages of the VC-backed firms, growing cumulatively more than those of the non-VC-backed firms. The results of the analysis also suggest the impact is not purely driven by the infusion of new funds over the short-run. VC-backed firms appear to enjoy superior wage growth over the entire five year period.

5.3 Improvement in R&D

As mentioned earlier in Section 3.4, R&D is an essential component of modern-day enterprise and business growth. Strategic investments and business decisions are made on the basis of R&D results. The extent of R&D spending by a firm is usually considered a good indicator that the firm is developing competitive advantages by building an innovative base of products and processes that will help it grow over the long run.

The comparison of relative performance for R&D spending was not as definitive as the analysis done for the other economic indicators. On balance, VC has positive impact on R&D expenditures, but only as confirmed in the one year measurement interval. The difference in growth of R&D expenditures, shown in Exhibit 5.6 for only a one year interval, was not
statistically significant for the three and five year periods. This suggests, particularly in light of the impact of VC on growth in sales, that VC accelerates the innovation and commercialization process by raising the R&D efforts at least at the early stage of firm growth.

5.4 Improvement in Profitability

Profitability is another indicator of success for firms in their early stages, as they grow to maturity and as they establish and broaden their commercial presence in the market, selling their products and services and investing in future growth. The comparison of profitability between the VC-backed firms and the control group were not statistically significant enough to draw any concrete conclusions.

The cumulative growth indicators examined earlier clearly show that VC-backed firms grew relatively more than the control group over the one, three, and five years intervals since their initial VC financing. This suggests that at their early stages, these firms focused their efforts and enterprise activities on growth and scale rather than on profitability per se. This result is consistent with the findings of other works in the academic literature, such as Puri and Zarutskie (2009).
6.0 Conclusions

With the active management style and the timely access to funding that they provide, VC investors help entrepreneurs and early-stage firms scale-up their operations, commercialize their products and services, and grow their businesses at a pace they may otherwise not have been able to achieve. This study, using credible longitudinal taxation and business data from reliable sources, and controlling for firm characteristics unavailable in previous empirical work, has provided evidence that VC-backed firms perform better than non-VC-backed firms in growing their businesses, at least over the one-year, three-year, and five-year timeframes subsequent to their initial VC investment.

The comparison of VC-backed to non-VC-backed firms showed that VC-backed firms demonstrated superior performance across several measures – exhibiting stronger sales growth, revenue growth, employee growth, and asset growth. There is also evidence shown in this study that average wage growth over time is higher among VC-backed firms – suggesting that these firms contribute more high value-added employment than non-VC-backed firms.

In general, based on the empirical analysis performed in this study, this report concludes that the suggested benefits of venture capital are indeed demonstrated in the performance of VC-backed firms.
Annex A – Data Sources Used for this Study

Thomson Reuters

This study was based on a list of VC-backed companies provided by Thomson Reuters. This list included 2,762 companies that had received VC from 1990 to 2009. These data included the name, address and industry sector of the companies, and information on the date and amount of VC funding. The list also included information on whether the company was acquired. Thomson Reuters collects these data using quarterly surveys of VC fund managers.

Industrial Research Assistance Program

The National Research Council of Canada provided the researchers with a list of companies that had received funding from the Industrial Research Assistance Program (IRAP). This list included the company name and the date that funding was received by each firm. In deriving control and treatment groups in this study, funding from IRAP was accounted for and used as a control variable for small innovation-based firms.

Statistics Canada Business Register

The Statistics Canada Business Register (BR) is the central repository of information on businesses in Canada. It contains basic information on firms such as their industry and location. The BR also contains a business register enterprise identifier (BEID) for each company which researchers can use to find companies across different Statistics Canada databases, such as those containing the data from T4 and T2 forms described below.

Statement of Remuneration Paid (T4)

Data on employment for this study originated from the tax statements of remuneration paid (T4) that are filed annually by employers for each of their employees. This source was used to identify wages. It was also used to identify the number of employees – each T4 statement filed by a company was counted as one employee for that company. However, for individuals who worked in multiple enterprises in a given year, their one employment unit gets split across firms according to the payroll they earned in each firm.

Corporate Income Tax Returns (T2)

Corporate balance sheet information and income statement data are provided from the annual corporate income tax returns (T2). The variables that were made available from this source are: revenue, sales, gross margin, gross profit, net income, assets and retained earnings.

Research & Development Expenditures

This study used the amount that companies claimed for the Scientific Research and Experimental Development tax credit. The associated data for this study were taken from corporate income tax returns (T2).

Payroll Remittance Forms (PD7)

Data from payroll remittance forms were used in this study as an indication of whether a company was active in a given year, and as a measure of employment for certain tables in Section 3. Employers are typically required to remit payroll information to the Canada Revenue Agency each month or each quarter.
Annex B – Linking VC-Backed Firms to Statistics Canada Databases

A set of rules were adopted for filtering and linking the VC-backed companies to Statistics Canada’s Business Register and other databases. This approach ensured that the research database developed for this study linked VC-backed firms to their corresponding Business Register entries. Exhibit B.1 shows the filtering steps based on the rules described in this Annex. This filtering process resulted in 1,545 VC-backed firms in the Master Research Database of VC-Backed Firms. The final step involved a longitudinalization and exit analysis which is described in Annex C.

The Timely Match Rule

Firms that receive VC are expected to file administrative documents and therefore be registered in the BR. As a result, matched firms that did not appear in the BR in the year they received first VC financing, or in the following year, were removed from the dataset of VC-backed firms. For VC-backed firms that received first financing during the period from 1990 to 1998, those that were matched to the BR in 1999 or 2000 were considered to be a timely match.

The Successful Match to the BR Rule

Statistics Canada developed an algorithm to link the records contained in Industry Canada’s dataset to entries in Statistics Canada’s Business Register (BR). The algorithm was run for each January version of the BR, from 2000 to 2010. Only enterprises active according to the BR were considered for a match. The quality of each match was assessed by the algorithm based on the similarity between corresponding firm names and addresses contained in the records of both files. Records that did not have identical names entries or did not share part of their addresses were subjected to a manual review process.

The Economic Activity Rule

Firms that received first financing in a given year were expected to be active and have filed a T4, T2, or PD7 statement in the year they first received VC financing, or in the following year.

The Outliers at First Financing Rule

Firms with revenues exceeding $50 million at the time of first VC financing were considered to be either an erroneous match or an atypical VC investment that could distort the analysis.
In order to create a robust dataset for this study which would be properly suited to addressing the key research question, it was vital to develop a rigorous longitudinalization process. Firms listed in the Statistics Canada Business Register (BR), can be tracked over time and across databases via their enterprise ID. However, using the BR enterprise ID alone would not have been sufficient in the case of this study because a company’s BR enterprise ID can be changed by several types of non-exit events.

To partially resolve this concern, Statistics Canada used taxation data (from company T4 remuneration statements) to track the movement of employees from one BR enterprise ID entry or exit to another. For example, in cases where a firm identified by one BR enterprise ID entry stopped filing T4 statements in a year (its apparent death) or started filing them (its apparent birth), Statistics Canada created a special link to the firm in their database when strong employment evidence existed.

The longitudinalization process developed for this study made effective use of these pre-existing links to determine whether a company with a particular enterprise ID in the BR in one year had in fact continued under a different enterprise ID in subsequent years.

The following rules were applied to the companies in the control group (the non-VC-backed companies) and in the treatment group (the VC-backed companies) in order to carry out this matching of firms over time. Companies were tracked over time on the basis of:

- whether a substantial number of employees from the candidate predecessor firm had moved to the candidate successor firm;
- whether the firms identified by distinct BR enterprise ID entries operated under the same or similar names;
- whether these two firms had the same or similar mailing addresses;
- whether the candidate predecessor firm and candidate successor firm had ever been actively reporting to CRA simultaneously (suggesting that the two firms identified by separate enterprise IDs were separate unrelated entities);
- whether the candidate successor firm started reporting to CRA immediately after the candidate predecessor firm ceased reporting to CRA (suggesting that one company was likely to have changed its enterprise ID and continued operations under the new identifier); and
- exclusively for those firms in the treatment group (the VC-backed firms), whether specific additional data from Thomson Reuters on mergers, acquisitions, and companies marked as “out of business” identified that the firms had undergone another type of exit.

This process was successfully applied to the dataset as the final filtering process to create the Master Database of VC-Backed Firms for Econometric Analysis.
Annex D – References


**Rostum, Sam.** 2013. *Impacts of Foreign Equity Investment in Canadian Firms.* Vancouver and Ottawa: Wavefront and Industry Canada.
