Credit Conditions Faced by Small and Medium-Sized Enterprises Investing in Research and Development

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Overview

Research and development (R&D)-intensive firms play an important role in job creation and firm competitiveness in Canada. However, acquiring financing for R&D activities can be challenging as such investments are inherently risky. This report uses data from the 2004 and 2007 iterations of the *Survey on Financing of Small and Medium Enterprises* to ascertain general characteristics of R&D-intensive firms and assess their access to financing. While controlling for various firm and owner characteristics via both probit single-equation and bivariate probit approaches, this study produced results suggesting that firms with high levels of R&D intensity appeared more likely to be denied debt financing than firms with no or low levels of R&D intensity. This report, therefore, provides some evidence that R&D-intensive firms have less access to financing than other firms.

Introduction

Investments in research and development (R&D) can be a critical step in the production of innovation at a firm. Regardless of whether a firm is a new entrant or a well-established business, innovation can play a vital role in improving a firm's ability to survive (Cefis and Marsili 2006, Audretsch 2006, Baldwin et al. 2002), in addition to maintaining its market share in a competitive business environment (Banbury and Mitchell 1995). In particular, Cefis and Marsili (2006) found that innovation had a considerable impact on small and young firms, a highly relevant result for Canada as 98 percent of businesses in Canada are considered small (Industry Canada 2011).[1] Given that innovation is the primary driver of productivity growth (Council of Canadian Academies 2010), enhancing the pace of innovation development can have a profound impact on the country's wealth and prosperity.

However, productivity growth in Canada has been dropping noticeably relative to other advanced economies (Council of Canadian Academies 2010). Recently, Bank of Canada Governor Mark Carney cited under-investment in innovation, especially in terms of the intensity of business R&D, as one of the factors behind Canada's recent poor productivity performance (Carney 2010). With the rising prominence of emerging economies in the global economic landscape, improvement in Canada's productivity growth becomes increasingly imperative.

R&D activities, however, can be cost-prohibitive (Baldwin et al. 1998). Furthermore, R&D activities are inherently risky, thereby making the acquisition of financing for these activities particularly challenging, especially for small and medium-sized enterprises (SMEs), which do not have as many resources as larger, more capitalized firms (Canepa and Stoneman 2002). Consequently, access to external financing can be critical for SMEs aspiring to become innovators. Without sufficient financing, these SMEs may be forced to abandon innovation projects.

This report attempts to address the following questions:

- How do the characteristics of R&D-intensive SMEs differ from those of non-R&D-intensive SMEs?
- How do the experiences of R&D-intensive SMEs differ from those of non-R&D-intensive SMEs when seeking financing?
- Do R&D-intensive SMEs have less access to financing than non-R&D-intensive SMEs?

Using data from Statistics Canada's *Survey on Financing of Small and Medium Enterprises*, this report is comprised of two major sections. The first section outlines general firm and owner characteristics of SMEs that made significant investments in R&D, followed by a simple overview of financing activities that transpired in 2004 and 2007. In the second section, an in-depth examination of credit conditions is conducted using economic models to estimate debt request and approval rates while controlling for various firm and owner characteristics.

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[1] Small businesses are defined by Industry Canada as having fewer than 100 employees.

In both the 2004 and 2007 iterations of the *Survey on Financing of Small and Medium Enterprises*, survey respondents were asked the following question: "What percentage of total investment expenditure was devoted to research and development?" To ascertain SMEs aspiring to become innovators, Industry Canada defined firms that allocated more than 20 percent of total investment expenditure toward R&D as "R&D-intensive" (RDI) SMEs. Firms that allocated 20 percent or less of total investment expenditure toward R&D

were identified in this study as non-RDI SMEs. Throughout this section, analyses will be drawn from comparisons between these two groups.

The *Survey on Financing of Small and Medium Enterprises* was part of the SME Financing Data Initiative (SME FDI), which provided researchers with the most comprehensive database on SME financing in Canada (see text box for more information).

1.1 SME Financing Data Initiative

The SME Financing Data Initiative (SME FDI) was a comprehensive program of information collecting and analysis concerning SME financing in Canada. The SME FDI's overall objective was to evaluate the state of financing for Canadian SMEs, thereby enabling the development of timely and effective public policy.

Iterations of Statistics Canada's *Survey on Financing of Small and Medium Enterprises* were conducted to study financing activities occurring in 2000, 2001, 2004 and 2007. For each iteration, the initial sampling frame was derived using Statistics Canada's *Business Register*, which contains the universe of enterprises in Canada.

For the survey, SMEs were defined as enterprises with fewer than 500 employees and less than $50 million in annual revenues. The survey's SME population excluded non-profit and government organizations, schools, hospitals, subsidiaries, co-operatives, and financing and leasing companies. The sampling frame was stratified by region, industry type, firm size (by number of employees) and age of business. While accounting for non-responses, survey results were subsequently weighted to represent the national population of SMEs remaining in the final sampling frame.

For more information on this survey, visit the SME Research and Statistics website: www.ic.gc.ca/surveys.

1.2 Owner and Business Characteristics of R&D-Intensive SMEs

Notwithstanding the potential impact of innovation on a firm's survivability and competitiveness, only a very small proportion of SMEs in Canada invest more than 20 percent of total investment expenditure on R&D. In 2007, only four percent of SMEs in Canada were RDI firms, meaning that the vast majority of Canadian SMEs (96 percent) were non-RDI firms (Figure 1). In fact, 77 percent of SMEs did not make any investment in R&D in 2007.

Figure 1:
Distribution of SMEs by R&D Intensity
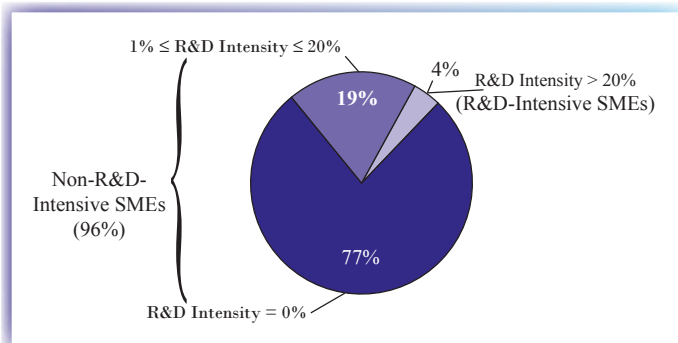
Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2007.

Survey data also reveal that RDI SMEs were more likely than non-RDI firms to be owned by a young entrepreneur. In 2007, 21 percent of RDI firms had owners who were under 40 years of age, compared with 15 percent of non-RDI firms (Figure 2). RDI SME owners also had, in general, less experience in managing or owning a business than non-RDI owners. As illustrated in Figure 3, only 59 percent of RDI SMEs in 2007 were owned by someone with more than 10 years of management or ownership experience, compared with 72 percent of non-RDI firms.

In addition to significant differences in owner characteristics, RDI SMEs differ considerably from non-RDI firms across several business characteristics, including exporting activities, firm age, stage of development, and regional and sectoral distributions. In 2007, RDI firms were more than twice as likely to report exporting activities as non-RDI firms (Figure 4).

About one out of five RDI firms exported goods and services, whereas only eight percent of non-RDI firms engaged in exporting activities in 2007.

Figure 2:
Percentage of SMEs with Owners under 40 Years of Age
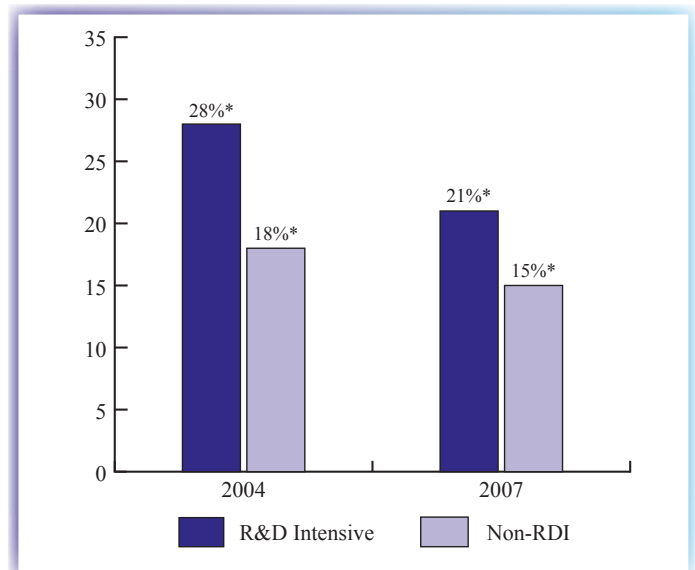
Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004 and 2007.
*Denotes statistically significant difference at 5 percent.

Figure 3:
Percentage of SMEs with Owners Who Have More than 10 Years of Management or Ownership Experience
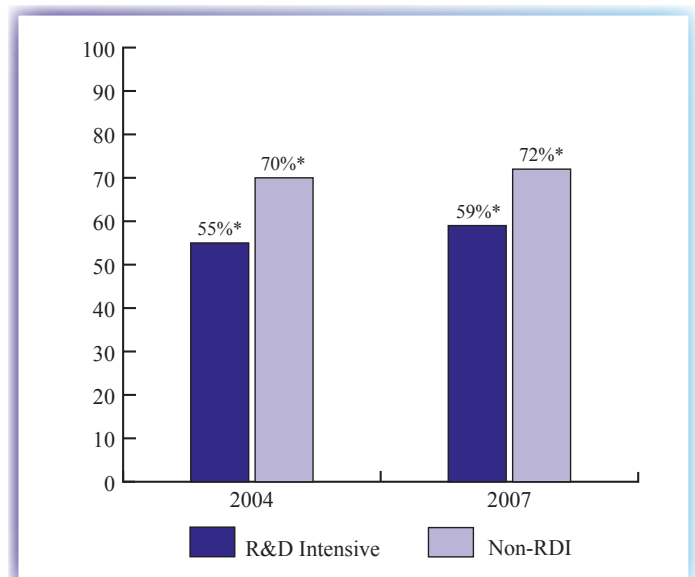
Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004 and 2007.
*Denotes statistically significant difference at 5 percent.

Figure 4:

Percentage of SMEs that Exported Goods and Services

Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004 and 2007.
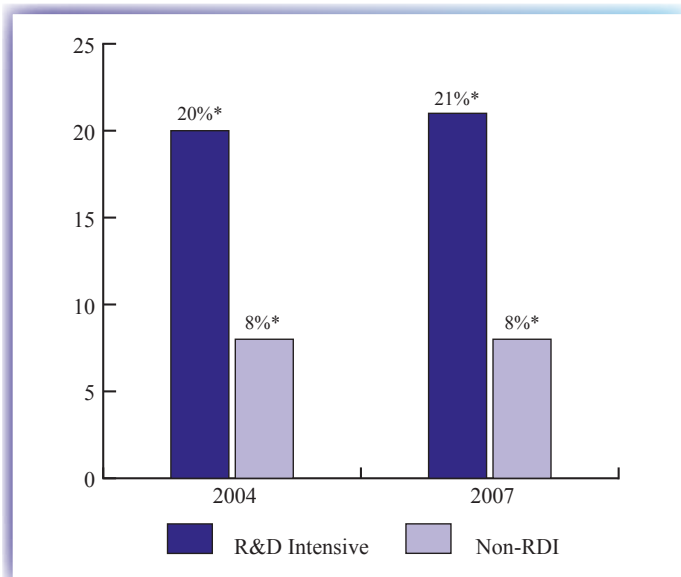*Denotes statistically significant difference at 5 percent.

As shown in Table 1, 46 percent of RDI firms surveyed in 2007 started selling goods and services after 2001, compared with 31 percent of non-RDI firms, suggesting that RDI businesses were, on average, younger than non-RDI firms. Given the younger owner and firm age profiles, RDI SMEs were naturally more likely to identify themselves as a start-up or fast-growth firm. In 2007, 46 percent of RDI SMEs declared themselves as a start-up or fast-growth firm, compared with only 13 percent of non-RDI firms. Indeed, non-RDI firms were far more likely to identify themselves as a mature or declining firm.

The regional breakdown in Table 1 reveals that RDI firms were overrepresented in Ontario in 2007, but under-represented in Atlantic Canada. By industry, RDI firms were far more likely to be in knowledge-based industries (KBIs)[2] than non-RDI firms (26 percent versus 6 percent).

Table 1:

Profile of R&D-Intensive and Non-R&D-Intensive SMEs, 2007

Characteristics	RDI	Non-RDI
	Percent	
Year Firm Started Selling Goods and Services		
Started between 2005 and 2007	*25*	*15*
Started between 2002 and 2004	*21*	*16*
Started prior to 2002	*54*	*69*
Stage of Development (as identified by owner)		
Start-up	*17*	*4*
Fast growth	*29*	*9*
Slow growth	40	39
Maturity	*12*	*37*
Decline	*2*	*11*
Region		
Atlantic	*4*	*6*
Quebec	20	21
Ontario	*47*	*38*
Prairies	*15*	*21*
British Columbia	14	14
Industry		
Agriculture/primary	*7*	*11*
Manufacturing	*7*	*4*
Wholesale/retail	*8*	*15*
Professional services	13	12
Knowledge-based industries	*26*	*6*
Tourism	*11*	*8*
Other industries	*28*	*44*

Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2007.
Note: Bold italic denotes statistically significant difference at 5 percent.

1.3 Comparison of Business Sizes

To supplement the survey data, business tax file data were linked to the 2004 and 2007 survey datasets by Statistics Canada.[3] Based on the tax file data, RDI firms were found to be smaller than non-RDI firms in terms of the number of employees, revenue and total assets in both 2004 and 2007. In 2007, RDI firms had 5.8 employees on average, whereas non-RDI firms had 6.6 employees on average. Moreover, a larger proportion of RDI firms were micro-businesses

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[2] KBIs include such industries as pharmaceutical and medical manufacturing, aerospace product and parts manufacturing, and satellite telecommunications, among others.

[3] The data included employment level, balance sheet and income statement information for incorporated SMEs. All tax file data are anonymous and cannot be traced back to a particular firm.

(fewer than five employees) compared with non-RDI firms that same year (75 percent versus 70 percent) (Table 2). Similar results were found for 2004. Such a finding may be due to the fact that total investment expenditure among micro-businesses is more likely to be small in absolute terms relative to larger firms, meaning that large R&D investments in percentage terms (i.e., intensity) could actually be small in magnitude.

Table 2:

Distribution (percentage) of Firms by Business Size (number of employees)

Number of Employees	2004		2007	
	RDI	Non-RDI	RDI	Non-RDI
0–4	84	74	75	70
5–19	13	21	19	23
20–99	3	5	5	7
100–499	<1	<1	<1	<1

Source: Tax file data linked to Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004 and 2007.
Note: Bold italic denotes statistically significant difference at 5 percent.

A comparison of revenue and total assets is presented in Table 3. RDI firms earned, on average, $651,000 in total revenue in 2007, representing an impressive 120-percent increase from the $296,000 generated in 2004. Despite this encouraging performance, RDI firms still earned significantly less revenue, on average, than non-RDI firms. Furthermore, average total expenses among RDI firms increased by a considerable amount from 2004 to 2007. As a result, the average RDI firm experienced a loss of $21,000 in 2007. In contrast, non-RDI firms posted an average net profit before tax of $80,000. The weaker profit performance could be explained, in part, by the fact that RDI firms were generally younger and more likely to be identified as a start-up compared with non-RDI SMEs (Table 1). The disparity in profit performance most likely explains why average retained earnings dropped further into deficit from 2004 to 2007 for RDI firms, while non-RDI firms saw average retained earnings grow over the same period.

The average amount of total assets among RDI firms jumped from an average of $207,000 in 2004 to $762,000 in 2007. Although still less than the average for non-RDI firms, the increase in total assets was large enough such that the difference between the two groups was no longer statistically significant in 2007. The jump

in total assets corresponded with substantial increases in both total liabilities and total equity. In particular, the average total equity among RDI firms leaped from $16,000 in 2004 to $197,000 in 2007.

Table 3:
Selected Financial Statement Figures (average $)
Source: Tax file data linked to Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004 and 2007.

	2004		2007	
	RDI	Non-RDI	RDI	Non-RDI
Total revenue	296,000	907,000	651,000	1,152,000
Total expenses	307,000	868,000	672,000	1,072,000
Net profit before tax	-11,000	39,000	-21,000	80,000
Current assets	118,000	288,000	391,000	450,000
Fixed assets	89,000	284,000	371,000	475,000
Total assets	207,000	572,000	762,000	925,000
Current liabilities	82,000	214,000	249,000	285,000
Total liabilities	191,000	392,000	565,000	584,000
Retained earnings	-101,000	126,000	-120,000	212,000
Total equity	16,000	180,000	197,000	341,000

Note: Bold italic denotes statistically significant difference at 5 percent.

1.4 External Debt Financing Activities

1.4.1 Requests for Financing

As R&D activities can require considerable amounts of financing, it is not unreasonable to expect the financing demands of RDI firms to be higher than those of non-RDI firms. Request rates by type of financing for both RDI and non-RDI SMEs are presented in Table 4. This table indicates that RDI firms were significantly more likely than non-RDI firms to request external financing in both 2004 and 2007, specifically debt financing, equity financing and government-sponsored financing programs. Interestingly, the request rate for debt financing among RDI SMEs decreased from 32 percent in 2004 to 17 percent in 2007 due to the precipitous drop in demand for short-term debt financing (from 24 percent in 2004 to 10 percent in 2007). Nevertheless, debt financing remained the most popular financing vehicle among RDI firms in 2007, followed by government-sponsored financing programs (11 percent request rate). Debt financing

was also the most sought-after type of external financing among non-RDI firms, yet interestingly only three percent of non-RDI firms applied for government-sponsored financing programs in both 2004 and 2007.

Table 4:
Request Rates (percentage) by Type of Financing

	2004		2007	
	RDI	**Non-RDI**	**RDI**	**Non-RDI**
Any financing	*36*	*23*	26	*18*
Debt	*32*	*18*	17	*13*
Long term*	8	9	8	7
Short term**	*24*	*10*	*10*	*7*
Lease	5	3	7	5
Equity	*5*	*1*	*5*	*1*
Trade credit	13	11	9	9
Government	*6*	*3*	*11*	*3*

Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004 and 2007.
*Mortgage and term loans.
**Lines of credit and credit cards.
Note: Bold italic denotes statistically significant difference at 5 percent.

Due to the long-term orientation and risky nature of R&D activities, equity financing is often cited in the literature as an important source of financing for firms aspiring to become innovators. However, only five percent of RDI firms sought equity financing in both 2004 and 2007. Nevertheless, RDI SMEs were five times more likely to request such financing in both years than their non-RDI counterparts.

1.4.2 Approval Rates

Although RDI firms were more likely to request external financing than non-RDI firms, they were also more likely to be denied financing. Approval rates by type of financing for both groups in 2004 and 2007 are presented in Table 5. In 2004, only 70 percent of RDI firms that sought external financing were approved. In contrast, the approval rate for non-RDI firms seeking external financing was 92 percent. The approval rate for RDI firms jumped to 87 percent in 2007, but it was still significantly lower than the 97 percent approval rate for non-RDI firms that year.[4]

Table 5:
Approval Rates (percentage) by Type of Financing

	2004		2007	
	RDI	**Non-RDI**	**RDI**	**Non-RDI**
Any financing	*70*	*92*	87	97
Debt	*70*	*88*	82	94
Long term*	*47*	*85*	92	94
Short term**	*58*	*82*	*75*	*94*
Lease	98	96	87	94
Equity	49	44	70	71
Trade credit	*63*	*91*	99	99
Government	–	–	*71*	*81*

Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004 and 2007.
*Mortgage and term loans.
**Lines of credit and credit cards.
Note: Bold italic denotes statistically significant difference at 5 percent.

Obtaining debt financing was particularly difficult for RDI firms in 2004. Only 47 percent of long-term debt requests made by RDI firms were approved that year, compared with 85 percent for non-RDI firms. Likewise, the short-term debt approval rate for RDI firms was only 58 percent versus 82 percent for non-RDI firms. In 2007, while the approval rate for long-term debt financing for RDI firms rose to a healthy 92 percent, the approval rate for short-term debt financing increased to only 75 percent, significantly lower than the 94 percent approval rate for non-RDI firms.

As for equity financing, being approved for such financing appeared to be a challenge for both RDI and non-RDI firms. Although both groups of firms saw equity approval rates increase considerably from 2004 to 2007, less than three quarters of equity financing requests were approved for either group. As for government-sponsored financing programs, the approval rate for RDI firms was only 71 percent in 2007, compared with 81 percent for non-RDI firms.

Average amounts of debt financing authorized in 2004 and 2007 are presented in Table 6. In 2004, the average amount of debt financing approved for RDI firms was less than half that approved for non-RDI firms. Although lower debt approval rates for RDI firms (Table 5) could largely explain the smaller

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[4] With only two data points, the long-term approval rate for RDI SMEs cannot be determined. Thus, it is not possible to ascertain if the large increase in the approval rate from 2004 to 2007 was primarily due to 2004 being a particularly difficult year for RDI firms to obtain financing or a result of the 2007 data exhibiting idiosyncratic characteristics (lending markets were highly active in 2007).

average amounts, it is also possible that RDI firms simply requested smaller amounts of debt financing. Thus, to better understand the credit conditions being faced by RDI firms, an alternative way to measure debt approval rates is to calculate the ratio of the aggregated amount of approved debt financing to the aggregated amount of requested debt financing (i.e., the sum of all approved debt financing divided by the sum of all requested debt financing). As shown in Table 6, this ratio was only 66 percent for RDI firms in 2004, compared with 89 percent for non-RDI firms, providing hints that debt financing conditions were tighter for RDI firms than for non-RDI firms during that year.

Table 6:
Approved Debt Financing (average $)

	2004*		2007	
	RDI	**Non-RDI**	**RDI**	**Non-RDI**
Average long-term debt approved	*77,000*	*203,000*	221,000	273,000
Average short-term debt approved	*42,000*	*87,000*	142,000	189,000
Average total debt approved	*36,000*	*134,000*	195,000	265,000
(Approved/ requested) total debt	66%	89%	87%	91%

Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004 and 2007.
*The averages for total debt approved include debt that could not be categorized as either long term or short term. Such non-classified debt was typically small in magnitude; thus, the average total debt amount for R&D-intensive firms can be smaller than either of the averages for long-term and short-term debt.
Note: Bold italic denotes statistically significant difference at 5 percent.

However, debt financing conditions among RDI firms were considerably different in 2007 compared with 2004. The average amount of debt financing approved for RDI firms increased by a substantial margin. Moreover, the approved-to-requested total debt ratio for RDI firms jumped to 87 percent in 2007; nonetheless, this ratio remained lower than that for non-RDI SMEs (91 percent).

1.4.3 Reasons for Being Denied

As the payoff from investing in R&D activities could take years to occur—if it occurs at all—revenue and profit generation may be particularly challenging for RDI firms, making such firms a less attractive investment for credit suppliers. In 2004, however, a poor credit history appeared to be more problematic for RDI firms than a lack of sales or income. As illustrated in Figure 5, among firms that were denied debt financing, 36 percent of RDI firms cited a poor credit history as a reason for being denied financing, compared with only 11 percent of non-RDI firms.[5] Other influences, such as the tendency to have younger owners with less management or ownership experience compared with owners of non-RDI firms (see Figures 2 and 3), could also have had a significant impact on the decision to deny debt financing to RDI firms.

Figure 5:
Reasons for Being Denied Debt Financing (percentage), 2004

Source: Statistics Canada, *Survey on Financing of Small and Medium*
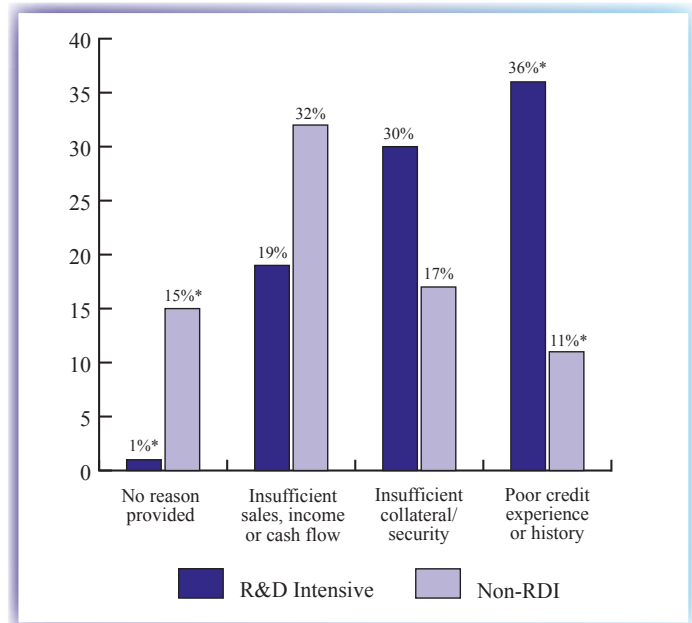
Enterprises, 2004.
*Denotes statistically significant difference at 5 percent.

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[5] Due to a lack of observations on being denied debt financing, results from the 2007 survey were deemed to be unreliable.

1.4.4 Distribution of Approved Financing

At the aggregate level, debt financing is an important source of financing for both RDI and non-RDI firms; however, debt financing plays a considerably smaller role for RDI firms than non-RDI firms as a share of total financing. As illustrated in Figure 6, debt financing constituted only 57 percent of the total amount of external financing authorized for RDI firms in 2007, compared with 77 percent for non-RDI firms. With a 20-percent share, government-sponsored financing programs constituted the second largest source of total external financing for RDI firms. In contrast, government-sponsored financing programs represented only a five-percent share of total external financing for non-RDI firms.

Figure 6:
Distribution of Approved Financing, 2007
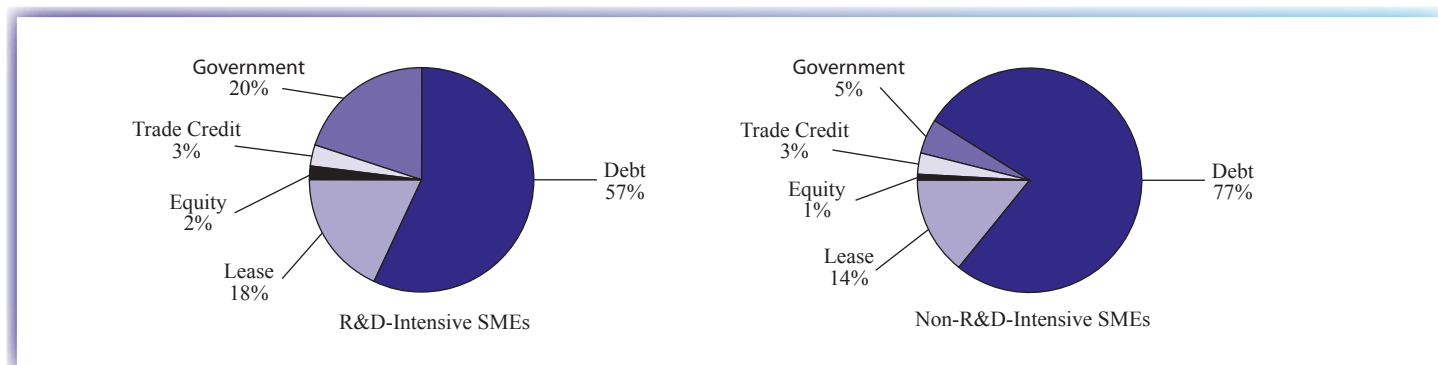
Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2007.

1.4.5 Intended Use

Not only were RDI firms more likely than non-RDI firms to request debt financing in both 2004 and 2007 (Table 4), the intended use of the requested financing differed substantially between the two groups of firms. As shown in Table 7, RDI firms were naturally more likely to use debt financing for R&D activities, but the table also reveals that RDI firms were significantly more likely to use debt financing as working capital / operating capital than non-RDI firms.

As indicated in Table 7, RDI and non-RDI firms differed significantly in the type of fixed assets acquired using debt financing. In 2007, while RDI firms were more likely to purchase computer hardware and software, non-RDI firms preferred vehicles / rolling stock, and other machinery and equipment. These results strongly suggest that the decision to engage heavily in RDI activities has a significant influence on the type of fixed assets desired by a firm.

Table 7:
Intended Use of Debt Financing (percentage)

	2004		2007	
	RDI	Non-RDI	RDI	Non-RDI
Fixed assets	*22*	*51*	*43*	*61*
Land and buildings	–	–	19	20
Vehicles / rolling stock	–	–	*5*	*21*
Computer hardware and software	–	–	22	8
Other machinery and equipment	–	–	*23*	*31*
Working capital / operating capital	*79*	*54*	*71*	*50*
Research and development	*16*	*3*	*32*	*5*
Debt consolidations	12	9	11	9

Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004 and 2007.
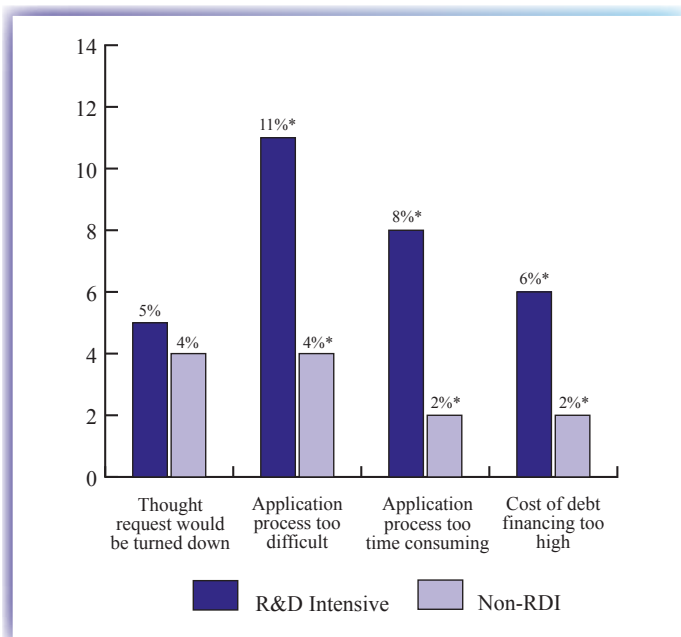Note: Bold italic denotes statistically significant difference at 5 percent.

1.4.6 Reasons for Not Applying

Due to the novelty or complexity of their R&D activities, RDI firms may encounter greater scrutiny of their debt financing requests than non-RDI firms. At the same time, owners of RDI firms may be reluctant to disclose full details of their projects out of concern that the information would reach their competitors, effectively eliminating their competitive advantage (Anton and Yao 2002). As a result, there is reason to believe that RDI firms are more likely than non-RDI firms to forgo applying for debt financing despite a need or desire for such financing. Indeed, among firms that did not apply for debt financing in 2004, RDI firms were significantly more likely than non-RDI firms to state that the application process was either too difficult or too time consuming (Figure 7). In addition, RDI firms were significantly more likely than non-RDI firms to state that the cost of financing was too high (six percent versus two percent).

Figure 7:
Reasons for Not Applying for Debt Financing (percentage), 2004**

Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004.
*Denotes statistically significant difference at 5 percent.
**Excluding firms that did not require financing, by far the most common reason for not applying for debt financing.

1.5 Future Intentions

Survey data reveal that RDI firms are significantly more likely to have growth intentions than non-RDI firms. In 2004 and 2007, 73 percent of RDI firms indicated that they intended to expand the size and scope of their business within two years, compared with less than 40 percent of non-RDI firms (Figure 8). Among RDI firms that declared growth intentions in 2007, 54 percent indicated that the firm's current financing was sufficient to fund the expansion strategy, compared with 58 percent of non-RDI firms.

Among businesses that required additional financing to fund expansion plans, RDI firms were significantly more likely than non-RDI firms to consider sharing equity in the business (52 percent versus 32 percent) (Figure 9). In addition, 42 percent of RDI firms would consider other strategies besides sharing equity or making a loan request to fund expansion, compared with only 25 percent of non-RDI firms. These results suggest that RDI firms are more flexible than non-RDI firms in their capitalization strategies to see their business grow.

Figure 8:
Percentage of SMEs Intending to Expand the Size and Scope of Their Business

Source: Statistics Canada, *Survey on Financing of Small and Medium Enterprises*, 2004 and 2007.
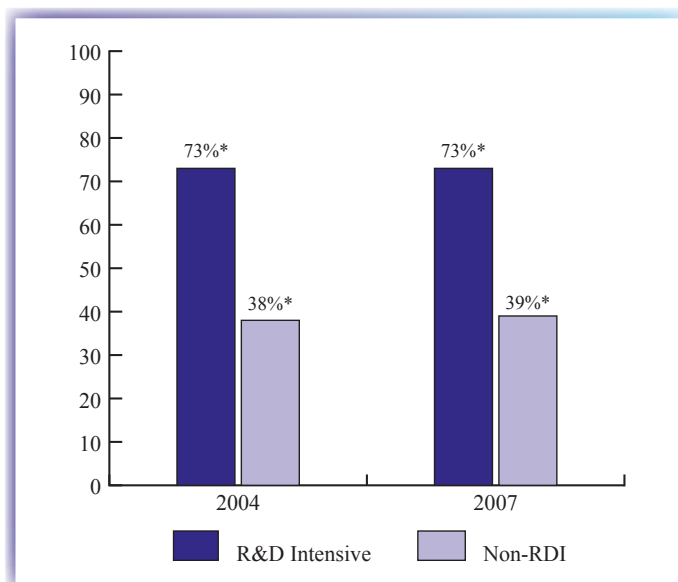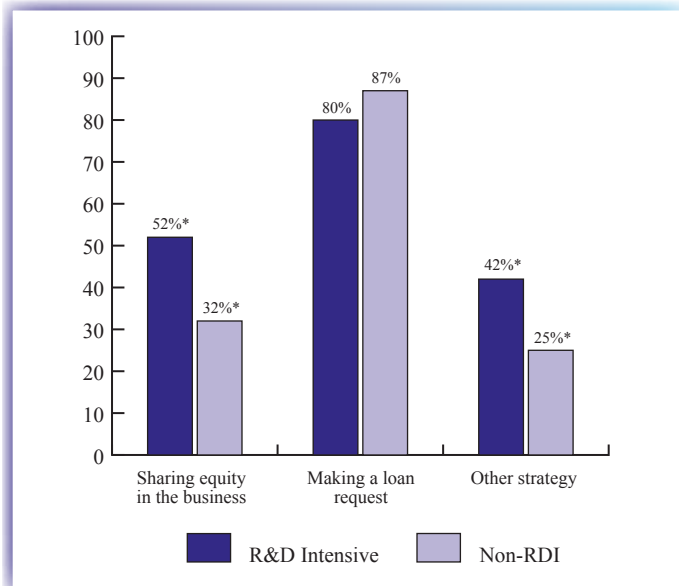*Denotes statistically significant difference at 5 percent.

Figure 9:
Capitalization Strategies Considered When Current Financing is Insufficient to Fund Expansion Plans (percentage), 2007

1.6 Perceived Obstacles to Growth

Perceived obstacles to growth identified by business owners in 2004 and 2007 are presented in Table 8. Overall, the figures suggest that RDI and non-RDI firms faced similar growth challenges. Instability of demand, rising business costs, finding qualified labour and increasing competition were all heavily cited by businesses as obstacles to growth. Levels of taxation and low profitability were also commonly cited obstacles.

Table 8:
Perceived Obstacles to Growth (percentage)

Perceived Obstacle	2004		2007	
	RDI	Non-RDI	RDI	Non-RDI
Finding qualified labour	*31*	*37*	*51*	*41*
Levels of taxation	*41*	*48*	–	–
Instability of demand	*45*	*36*	28	33
Low profitability	*43*	*38*	–	–
Obtaining financing	*42*	*19*	*24*	*17*
Government regulations	34	34	*20*	*28*
Management capacity	*23*	*13*	*17*	*11*
Insurance premiums	37	36	39	34
Environmental regulations	–	–	*7*	*12*
Rising business costs	–	–	51	56
Increasing competition	–	–	44	39

1.7 Job Creation and Salary Growth

The importance of RDI SMEs to the Canadian economy can be demonstrated by their significant contributions to job creation and total salary growth. In 2004, RDI firms employed approximately 82,000 people. By 2009, this figure grew to about 111,000 employees, representing a 35-percent increase (or an average annualized increase of 6.3 percent). Financing appears to be an important factor in job creation as the employment level among RDI SMEs that sought debt financing in 2004 more than doubled from 24,000 employees in 2004 to 53,000 employees in 2009. In sharp contrast, the employment level among non-RDI SMEs during the same period grew by only two percent (or an average annualized increase of 0.3 percent). Similarly, the aggregate total salary earned among debt-seeking RDI SMEs grew by 121 percent from 2004 to 2009 (55 percent for RDI SMEs overall), whereas the total salary earned increased by only 28 percent among non-RDI firms that sought debt financing in 2004 (25 percent for non-RDI SMEs overall).

Overall, the results presented in this section of the report show that RDI SMEs were, in general, younger and smaller than non-RDI firms, yet they were significantly more likely to engage in exporting activities and to declare growth intentions. RDI firms were also significantly more likely than non-RDI SMEs to request external financing, including debt financing; on the other hand, RDI firms were also more likely to be denied financing due to a poor credit history and other factors. Also, in spite of a considerable improvement in financing conditions from 2004 to 2007, RDI firms were significantly more likely than non-RDI SMEs to cite difficulty obtaining financing as an obstacle to growth of their business.

It is important to note, however, that the results in this section do not concurrently control for various firm and owner characteristics. Without controlling for pertinent factors, it is possible that a characteristic closely associated with R&D investment—and *not* R&D investment itself—is having a significant effect on access to financing. For example, as RDI SMEs are, in general, younger than non-RDI firms, perhaps the age of the firm is playing a larger role in the firm's ability to obtain external financing than the level of R&D intensity.

To address this issue, Section 2 estimates the impact of R&D intensity on credit conditions while controlling for various characteristics through the application of multivariate economic models. The results will be utilized to corroborate the findings presented in Section 1.

Section 2

The analysis in this section controls for various characteristics while accounting for biases that could be present in the data.

2.1 Data, Methodology and Descriptive Statistics

As in the previous section, the source of the data is Statistics Canada's *Survey on Financing of Small and Medium Enterprises*. Whereas the preceding section used both the 2004 and 2007 iterations of the survey, this section used the 2007 iteration exclusively because the data were more accommodating to the analytical methodology applied.[6]

Supplementing the 2007 dataset are linked business tax data, which were anonymous and cannot be traced back to a particular firm. The tax data contained financial information for each firm from 2002 to 2009, the latest tax year available at the time of the study.[7] Only incorporated firms are considered in this section's analyses.

In this section, the two financing activities being estimated are: 1) demand for debt financing ("SEEKDEBT"), and 2) debt financing rejection ("DENYDEBT"). These two dependent variables are binary in nature. SEEKDEBT equals 1 if the firm sought debt financing; otherwise, the variable equals 0. For firms that sought debt financing,

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[6] Unlike the 2004 iteration of the survey, data on R&D intensity are available for all survey respondents in the 2007 iteration. Thus, the number of observations is substantially larger for the 2007 reference year compared with 2004. Furthermore, the actual R&D intensity in percentage terms was recorded for the 2007 reference year, whereas the responses regarding R&D intensity were categorical for the 2004 iteration.

[7] There are two types of business tax data linked to the 2007 dataset: T2 corporate tax data files for incorporated firms and T1 personal income tax for unincorporated firms. Compared with T1 data, T2 data offered significantly more information for analysis.

DENYDEBT equals 1 if the firm received only part or none of the debt financing requested; for firms that were fully approved for debt financing, DENYDEBT equals 0. Note that this approval rate is more stringent than the approval rate used in the previous section as it considers a partial approval as a rejection. This modification was made for two reasons: 1) to recognize that a partial approval could force a firm to cancel or reduce R&D investments below optimum, and 2) to increase the number of observations that were rejected as relatively few firms were fully denied debt financing in 2007.

As both dependent variables are binary, the probit model was chosen to estimate the probability of seeking debt financing and the probability of being denied debt financing. The probit model remains one of the most popular frameworks utilized to estimate discrete choice (Greene 2003). Each probability will initially be estimated using the probit single-equation approach, which is in line with methodologies used in previous financing studies in the literature.

However, as noted by Chandler (2012) and Piga and Atzeni (2007), only a sub-sample of firms are used in the estimation of debt financing rejection as being denied financing is, of course, conditional on applying for financing in the first place. Characteristics that significantly influence a firm's need for debt financing could also be characteristics that affect its chances of being approved for that financing. As applying for debt financing is not a random occurrence, steps should be taken to account for the possible existence of selection (or sample selectivity) bias in the data. In such cases, Greene (2003) suggests a bivariate probit model, which can help determine if selection bias is indeed present. As a result, single-equation results will be compared with regression results using the bivariate probit model (see Greene (2003) and Piga and Atzeni (2007) for more information on the bivariate probit model).

Using data from a survey completed by Italian manufacturing firms with 11 to 500 employees, Piga and Atzeni (2007) applied the bivariate probit model

to better understand the relationship between R&D investment and access to external financing. In their study, R&D-performing firms were partitioned into two groups: R&D-intensive firms and low-R&D firms. Firms in the former group were also in the top quintile (i.e., 80th percentile and above) of R&D expenditures over total assets, whereas the latter group was comprised of firms in the bottom four quintiles.

Interestingly, Piga and Atzeni (2007) found that while firms with no or low R&D intensity were less likely to request financing, they were also more likely to be denied financing. The latter finding is in sharp contrast to the finding in the preceding section of this report. In an effort to compare the results of the preceding section with Piga and Atzeni's (2007) findings, partitioning of R&D-performing SMEs was accomplished using the same method as that used in Piga and Atzeni (2007) in lieu of the definition used in the previous section.

Selection of regressors was driven primarily by the variables used in Piga and Atzeni (2007) and other financing studies,[8] but the selection was constrained by the quality of the variables available in the T2 tax data. Due to a high prevalence of missing values for most of the tax variables, only the natural log of total sales, growth in net hirings and net earnings after tax over total assets (also known as return on assets (ROA)) were chosen from the T2 tax data. As financing received in 2007 can directly affect the levels of these three variables, the average of the values in the preceding two years (i.e., lagged values) was used as regressors.

Other regressors were taken from the *Survey on Financing of Small and Medium Enterprises*. Aside from R&D intensity, the acquisition of financing other than debt financing was included in the model. Alternative forms of financing considered here include equity financing, financing assistance from government and trade credit (i.e., accounts payable). Other variables chosen as regressors include export activities, age of firm, age of majority owner, a dummy variable indicating whether the majority

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[8] Examples include Chandler (2012), Neville et al. (forthcoming) and Freel (2007).

owner is a recent immigrant, and a dummy variable indicating whether the majority owner is a member of a visible minority.[9] The survey also provides information on the intended use of the debt financing. Investments in R&D are inherently riskier than investments in fixed assets or inventories; thus, the intended use of the requested debt financing can play a significant role in credit approval. An overview of the variables used in the models is provided in Table 9. Inspection of the correlation matrix (not shown) found no pairwise correlation value above 0.5 among regressors, revealing no direct concern of multicollinearity.

Table 9:
Definitions of Variables

Variable	Definition
SEEKDEBT	Sought debt financing in 2007
DENYDEBT	Partly or fully denied debt financing requested in 2007
R&D intensity	Percentage of total investment expenditure devoted to R&D
Mean ROA	Mean of net earnings after tax/total assets in 2005 and 2006
Mean growth in net hirings	Mean of net hirings$_t$/employment level$_{t-1}$ in 2005 and 2006
Mean natural log of total sales	Mean of the natural log of total sales of goods and services in 2005 and 2006
Equity	Equity financing received in 2007
Government	Financing assistance received from government in 2007
Trade credit	Trade credit (accounts payable) received in 2007
Exporter	Exported goods or services in 2007
Immigrant	Majority owner resided in Canada for less than five years (recent immigrant) in 2007
Minority	Majority owner was a member of a visible minority group
Age of firm	Years since business first started to sell goods and services
Age of majority owner	Age of majority owner
Intended use of debt: Fixed assets	Part or all of debt financing requested in 2007 intended to acquire fixed assets
Intended use of debt: Working capital	Part or all of debt financing requested in 2007 intended to be used as working capital
Intended use of debt: R&D	Part or all of debt financing requested in 2007 intended to be used for R&D activities

Initial examination of the data revealed outliers in average ROA and average growth in net hirings. In response, observations below the first percentile or above the 99th percentile in average ROA, along with observations above the 99th percentile in average growth in net hirings, were screened out from the data sample. Among R&D-performing SMEs in the screened sample, the R&D intensity at the 80th percentile was 20 percent.[10] Here, R&D-intensive firms will be denoted "RDI" SMEs, whereas firms in the bottom four quintiles will be denoted "LowRDI."

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[9] See the 2007 *Survey on Financing of Small and Medium Enterprises* questionnaire for more information on what constitutes a visible minority group.

[10] Thus, the group of "R&D-intensive SMEs" here is slightly different from the group identified in the previous section, which included only SMEs with R&D intensities *above* 20 percent.

Univariate comparisons between pertinent SME groups are presented in Table 10. Column I lists means for the entire sample, whereas columns II to IV present comparisons by R&D intensity. Comparisons by financing activities and outcome are presented in columns V to VIII. Interestingly, the findings in Table 10 reveal that differences in request rates and rejection rates are not statistically significant at the five-percent level among R&D groups. It is important to remember, however, that only incorporated firms are considered in this section,

in contrast to the previous section where request and approval rates considered both incorporated and unincorporated firms.

The results in Table 10 indicate that firm and owner characteristics of SMEs that sought debt financing in 2007 differed considerably from those of SMEs that did not seek debt financing. Significant differences in characteristics were also found between approved firms and rejected firms, highlighting the prudency of utilizing a multivariate framework for analysis.

Table 10:
Comparison of Means by SME Group

Variable	(I) All SMEs n = 5,208	(II) No R&D n = 3,717	(III) Low RDI n = 1,278	(IV) RDI n = 213	(V) Did Not Seek Debt n = 3,971	(VI) Sought Debt n = 1,237	(VII) Debt Denied n = 1,149	(VIII) Debt Approved n = 88
SEEKDEBT (binary)	23.8%	22.8%	26.0%	26.3%	–	–	–	–
R&D intensity	3.6%	–	6.2%	51.7%	3.5%	4.0%	3.7%	7.5%
R&D intensity (bottom four quintiles)[1]	–	–	–	–	1.5%	1.6%	1.6%	1.7%
R&D intensity (top quintile)[2]	–	–	–	–	2.0%	2.3%	2.1%	5.9%
Mean ROA (2005 and 2006)	7.5%	7.9%	6.5%	5.9%	7.5%	7.6%	7.6%	8.3%
Mean growth in net hirings (2005 and 2006)	8.3%	7.8%	9.1%	12.1%	6.7%	13.5%	13.2%	17.2%
Mean natural log of total sales (2005 and 2006)	14.1	14.1	14.3	14.0	14.0	14.6	14.6	13.9
Equity (binary)	1.6%	1.5%	1.8%	2.8%	0.8%	4.2%	4.2%	4.5%
Government (binary)	4.5%	2.6%	8.1%	16.9%	2.5%	11.2%	11.3%	9.1%
Trade credit (binary)	20.9%	19.6%	24.0%	24.9%	13.9%	43.3%	44.1%	33.0%
Exporter (binary)	21.5%	14.4%	36.8%	53.5%	20.5%	24.6%	25.0%	19.3%
Immigrant (binary)	1.9%	1.8%	2.0%	2.3%	1.9%	1.8%	1.7%	2.3%
Minority (binary)	7.5%	6.9%	8.8%	9.9%	8.6%	4.0%	3.5%	11.4%
Age of firm (years)	20.1	20.5	19.5	17.5	20.0	20.6	20.9	16.4
Age of majority owner (years)	52.5	52.8	51.9	51.4	53.0	51.0	51.2	48.1
	n = 1,237	n = 849	n = 332	n = 56				
DENYDEBT (binary)	7.1%	6.4%	7.8%	14.3%	–	–	–	–
Intended use of debt: Fixed assets (binary)	64.1%	66.2%	60.2%	55.4%	–	–	63.7%	69.3%
Intended use of debt: Working capital (binary)	45.5%	42.2%	52.7%	53.6%	–	–	45.0%	52.3%
Intended use of debt: R&D (binary)	4.8%	1.8%	9.9%	19.6%	–	–	4.8%	4.5%

[1] Observations that are not in the bottom four quintiles are given a value of zero in the calculations.
[2] Observations that are not in the top quintile are given a value of zero in the calculations.

　　　Significant difference at the 5-percent level when compared with RDI firms.
　　　Significant difference at the 5-percent level when compared with firms that sought debt financing.
　　　Significant difference at the 5-percent level when compared with firms that were approved debt financing.

2.2 Results

2.2.1 Probit Single-Equation Approach

The probability of seeking debt financing and the probability of being denied debt financing were each estimated independently using the probit model. To better understand the relationship between R&D intensity and financing activities, two types of probit models were developed. Following Piga and Atzeni (2007), Model 1 considers R&D intensity without differentiating between levels of R&D investment, whereas Model 2 singles out RDI firms from the rest of the SMEs. In other words, there is only one R&D-related regressor in Model 1, but in Model 2 there are two such regressors. Note that the variables associated with intended uses were excluded from the SEEKDEBT equations because such information is not available for firms that did not request debt financing.

The results of the estimations[11] using the probit single-equation approach are presented in Table 11. When estimating SEEKDEBT, the results in Models 1 and 2 indicate that R&D intensity does not have a significant impact on the likelihood that a SME will demand debt financing. In particular, the results provide further evidence that RDI SMEs are no more likely to request debt financing than other firms. As for DENYDEBT, the results indicate that both age of firm and age of owner become statistically insignificant in a multivariate setting, but the estimates still suggest that smaller firms and firms with a visible minority owner were more likely to be denied financing in 2007. The latter finding is likely due to the fact that visible minority-owned SMEs were concentrated primarily in the accommodation and food sector and in knowledge-based industries, which had two of the lowest approval rates among major industries (Industry Canada, 2009).

Table 11:
Probit Single-Equation Results

Variable	Model 1 DENYDEBT n = 1,237	Model 1 SEEKDEBT n = 5,208	Model 2 DENYDEBT n = 1,237	Model 2 SEEKDEBT n = 5,208
R&D intensity	0.01*** (0.003)	9.3E-06 (0.002)	– –	– –
R&D intensity (bottom four quintiles)	– –	– –	4.0E-03 (0.01)	2.0E-03 (0.005)
R&D intensity (top quintile)	– –	– –	0.01*** (0.004)	-1.4E-04 (0.002)
Mean ROA	0.05 (0.31)	0.11 (0.11)	0.05 (0.31)	0.11 (0.11)
Mean growth in net hirings	0.15 (0.14)	0.22*** (0.06)	0.15 (0.14)	0.22*** (0.06)
Mean natural log of total sales	-0.11*** (0.04)	0.07*** (0.01)	-0.11*** (0.04)	0.07*** (0.01)
Equity	0.10 (0.28)	0.67*** (0.15)	0.10 (0.28)	0.67*** (0.15)
Government	-0.23 (0.20)	0.77*** (0.09)	-0.23 (0.20)	0.77*** (0.09)
Trade credit	-0.13 (0.12)	0.81*** (0.05)	-0.13 (0.12)	0.81*** (0.05)
Exporter	-0.08 (0.15)	-0.07 (0.05)	-0.07 (0.15)	-0.08 (0.05)
Immigrant	0.04 (0.40)	-4.7E-03 (0.15)	0.04 (0.40)	-3.3E-03 (0.15)
Minority	0.68*** (0.22)	-0.35*** (0.09)	0.68*** (0.22)	-0.35*** (0.09)
Age of firm	-3.0E-03 (0.004)	1.5E-03 (0.001)	-3.0E-03 (0.004)	1.5E-03 (0.001)
Age of majority owner	-0.01 (0.006)	-0.01*** (0.002)	-0.01 (0.006)	-0.01*** (0.002)
Intended use of debt: Fixed assets	0.19 (0.13)	– –	0.19 (0.13)	– –
Intended use of debt: Working capital	0.25** (0.12)	– –	0.25** (0.12)	– –
Intended use of debt: R&D	-0.22 (0.28)	– –	-0.20 (0.29)	– –
Intercept	0.26 (0.61)	-1.26*** (0.20)	0.28 (0.61)	-1.26*** (0.20)
Log-likelihood	-295.9	-2,522	-295.8	-2,522

Standard error in parentheses.
Significance: *** $\rho = 1$ percent, ** $\rho = 5$ percent, * $\rho = 10$ percent.

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[11] Average marginal effects for both the probit single-equation and bivariate probit approaches can be found in the Supplementary Tables.

Importantly, the DENYDEBT estimates in Table 11 show that in a multivariate setting two characteristics become statistically significant: working capital and R&D intensity. Intentions to use debt financing as working capital had a positive effect on DENYDEBT (i.e., higher probability of being denied debt financing), but such a finding is not surprising given that such intentions could be a sign of illiquidity in the firm. A more interesting finding was that R&D intensity had a positive and highly significant impact on DENYDEBT. In other words, the results in Model 1 imply that the probability of being denied financing increases with R&D intensity. However, the results in Model 2 indicate that such a relationship only applies to RDI SMEs as the coefficients associated with R&D intensity were highly statistically significant only for firms in the top quintile. This finding is in sharp contrast to Piga and Atzeni (2007), who found that firms in the bottom four quintiles were the most credit-constrained, while firms in the top quintile were the least constrained.

2.2.2 Bivariate Probit Approach

Out of concern that selection bias may be present in the data, this analysis re-estimates DENYDEBT and SEEKDEBT via the bivariate probit framework.[12] As shown in Table 12, the results for SEEKDEBT estimations in both Models 1 and 2 were almost identical to the results presented in Table 11. However, estimations of DENYDEBT under the bivariate probit framework produced noticeable differences from the single-equation results concerning statistical significance. In particular, no independent variable was found to be significant in Model 1, including R&D intensity. On the other hand, the results in Model 2 confirm that RDI SMEs were more likely to be denied debt financing as the effect of R&D intensity on DENYDEBT in the top quintile was positive and statistically significant, although mildly.

Table 12:
Bivariate Probit Results

Variable	Model 1 DENYDEBT n = 1,237	Model 1 SEEKDEBT n = 5,208	Model 2 DENYDEBT n = 1,237	Model 2 SEEKDEBT n = 5,208
R&D intensity	0.01 (0.005)	-1.1E-05 (0.002)	– –	– –
R&D intensity (bottom four quintiles)	– –	– –	2.7E-03 (0.01)	2.0E-03 (0.005)
R&D intensity (top quintile)	– –	– –	0.01* (0.005)	-1.6E-04 (0.002)
Mean ROA	-0.01 (0.39)	0.11 (0.11)	-0.01 (0.35)	0.10 (0.11)
Mean growth in net hirings	0.16 (0.43)	0.22*** -0.07	0.17 (0.34)	0.22*** (0.06)
Mean natural log of total sales	-0.10 (0.22)	0.07*** (0.01)	-0.10 (0.17)	0.07*** (0.01)
Equity	0.17 (1.33)	0.67*** (0.15)	0.18 (1.0)	0.67*** (0.15)
Government	-0.16 (1.80)	0.77*** (0.09)	-0.16 (1.4)	0.77*** (0.09)
Trade credit	-0.02 (1.96)	0.81*** (0.05)	-0.01 (1.5)	0.81*** (0.05)
Exporter	-0.08 (0.21)	-0.07 (0.05)	-0.07 (0.19)	-0.08 (0.05)
Immigrant	-0.03 (0.39)	-8.5E-03 (0.15)	-0.04 (0.39)	-6.9E-03 (0.15)
Minority	0.64 (1.23)	-0.35*** (0.09)	0.64 (0.97)	-0.35*** (0.09)
Age of firm	-2.7E-03 (0.006)	1.5E-03 (0.001)	-3.0E-03 (0.005)	1.5E-03 (0.001)
Age of majority owner	-0.01 (0.03)	-0.01*** (0.002)	-0.01 (0.02)	-0.01*** (0.002)
Intercept	0.28 (6.3)	-1.26*** (0.20)	0.27 (4.9)	-1.26*** (0.20)
ρ (rho)	0.16 (3.6)		0.18 (2.7)	
Log-likelihood	-2,821		-2,820	

Standard error in parentheses.
Significance: *** ρ = 1 percent, ** ρ = 5 percent, * ρ = 10 percent.

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[12] As data for intended use variables were available only for firms that sought debt financing, these variables were excluded altogether from the bivariate probit models.

Estimates of ρ (rho) in both Models 1 and 2 were found to be highly insignificant, meaning there is little evidence here to suggest that selection bias is present. Moreover, results of a likelihood ratio (LR) test found very little evidence that the bivariate probit approach provided a better fit for the data than the probit single-equation approach.[13] As a result, the estimates calculated in Table 11 do not appear to be affected by selection bias; thus, the conclusions based on the single-equation approach remain valid, assuming that the equations are correct.

In spite of some differences in the results between the two probit approaches, one consistent finding worth noting is the positive and statistically significant (albeit weakly in the bivariate probit case) effect of high levels of R&D intensity on the probability of being denied debt financing. Unlike LowRDI firms, which appear to have the same level of access to debt financing as firms without any R&D investment, there is some evidence to suggest that RDI SMEs are more likely to be rejected for debt financing.

It is important to remember, however, that this finding is based on only one year's worth of financing activity data. In 2007, credit markets were very active in Canada; thus, the debt approval rate was considerably higher compared with prior years. Therefore, the relatively small number of rejected firms (only 88 out of 1,237 firms in the sample were denied debt financing), plus any idiosyncratic characteristic associated with 2007 not captured in the models, could have had a non-trivial effect on the results. To provide more robustness to the above results, it is suggested that a similar investigation be conducted using more recent data.

Conclusions

Given the importance of the role R&D investments play in firm competitiveness and job creation, this study assesses the financing conditions faced by R&D-intensive SMEs. Financing R&D activities is frequently a challenge not only because of the often non-trivial costs but also because such activities are inherently risky as the payoff is not guaranteed. To achieve its objective, this report attempts to address the following questions:

- How do the characteristics of R&D-intensive SMEs differ from those of non-R&D-intensive SMEs?
- How do the experiences of R&D-intensive SMEs differ from those of non-R&D-intensive SMEs when seeking financing?
- Do R&D-intensive SMEs have less access to financing than non-R&D-intensive SMEs?

To address the first question and partially the second, a general comparison across firm and owner characteristics—including financing activities—by R&D intensity was conducted in Section 1. Without controlling for various firm and owner attributes, the univariate comparison revealed that R&D-intensive SMEs were, on average, younger and smaller than non-R&D-intensive firms. They were also significantly more likely to request external financing, including debt financing, but were also more likely to be denied financing due to a poor credit history and other factors.

To fully address the second and third questions, an effort was made to disentangle the effect R&D intensity has on credit conditions from other attributes, such as age of firm and majority owner and firm size (number of employees). In Section 2, a multivariate approach was utilized to estimate the demand for debt financing and debt financing rejection. The standard probit technique was applied for the estimations before the results were re-estimated using the bivariate

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[13] To validate the comparison, the single-equation models for DENYDEBT were re-estimated to exclude the intended use of debt variables. The resulting joint log-likelihood (simply the sum of the log-likelihoods associated with the selection and outcome equations) was found to be almost identical to the corresponding joint log-likelihood for the bivariate probit model for both Models 1 and 2. In effect, the LR statistic calculated was close to zero in both cases.

probit framework to account for possible selection bias as the decision to request debt financing is not random. Results in Section 2 revealed that in contrast to the finding in Section 1, R&D-intensive SMEs were not more likely to request debt financing in 2007. It is important to remember, however, that the samples in the two sections are not perfectly comparable as the sample in Section 2 excluded unincorporated SMEs, as well as some outliers.

Notwithstanding the differences in the two samples, the analyses in the two sections revealed one noteworthy finding: R&D-intensive SMEs were more likely to be denied financing than non-R&D-intensive SMEs. In other words, for high levels of R&D intensity only, the higher the R&D intensity, the greater the probability that the firm will be denied debt financing.

Supplementary Tables

Table A1:
Average Marginal Effects on Probability that Response = 1 (probit single-equation approach)

	Model 1		Model 2	
	DENYDEBT	**SEEKDEBT**	**DENYDEBT**	**SEEKDEBT**
Variable	**n = 1,237**	**n = 5,208**	**n = 1,237**	**n = 5,208**
R&D intensity	1.2E-03	2.5E-06	–	–
R&D intensity (bottom four quintiles)	–	–	4.9E-04	5.7E-04
R&D intensity (top quintile)	–	–	1.2E-03	-3.7E-05
Mean ROA	0.01	0.03	5.3E-03	0.03
Mean growth in net hirings	0.02	0.06	0.02	0.06
Mean natural log of total sales	-0.01	0.02	-0.01	0.02
Age of firm	-4.1E-04	3.9E-04	-4.2E-04	4.0E-04
Age of majority owner	-9.9E-04	-0.004	-0.001	-0.004

Note: Marginal effects for binary variables were not calculated.

Table A2:
Average Marginal Effects on Probability that Response = 1 (bivariate probit approach)

	Model 1		Model 2	
	DENYDEBT	**SEEKDEBT**	**DENYDEBT**	**SEEKDEBT**
Variable	**n = 1,237**	**n = 5,208**	**n = 1,237**	**n = 5,208**
R&D intensity	9.1E-04	-3.0E-06	-	-
R&D intensity (bottom four quintiles)	–	–	2.9E-04	5.5E-04
R&D intensity (top quintile)	–	–	9.1E-03	-4.3E-05
Mean ROA	-1.3E-03	0.03	-0.001	0.03
Mean growth in net hirings	0.02	0.06	0.02	0.06
Mean natural log of total sales	-0.01	0.02	-0.01	0.02
Age of firm	-2.9E-04	4.0E-04	-3.0E-04	4.0E-04
Age of majority owner	-0.001	-0.004	-0.001	-0.004

Note: Marginal effects for binary variables were not calculated.

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