Research Policy 40 (2011) 217–229

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

Evaluating the impact of R&D tax credits on innovation: A microeconometric study on Canadian firms☆

Dirk Czarnitzki[a,b,*], Petr Hanel[c,1], Julio Miguel Rosa[d,2]

[a] K.U. Leuven, Dept. of Managerial Economics, Strategy and Innovation, Naamsestraat 69, 3000 Leuven, Belgium
[b] Centre for European Economic Research (ZEW), Mannheim, Germany
[c] University of Sherbrooke, Dept. d'économique, Sherbrooke, Quebec J1K 2R1, Canada
[d] Industry Canada, Economic Research and Policy Analysis Branch, Ottawa, Ontario K1A 0H5, Canada

ARTICLE INFO

Article history:
Received 16 November 2008
Received in revised form 23 August 2010
Accepted 23 September 2010
Available online 29 October 2010

JEL classification:
C14
C25
H50
O38

Keywords:
R&D
Innovation
Public subsidies
Tax credit
Policy evaluation

ABSTRACT

This study examines the effect of R&D tax credits on innovation activities of Canadian manufacturing firms. Over the 1997–1999 period the Federal and Provincial R&D tax credit programs were used by more than one third of all manufacturing firms and by close to two thirds of firms in high-technology sectors. We investigate the average effect of R&D tax credits on a series of innovation indicators such as: number of new products, sales with new products, originality of innovation, etc. using a non-parametric matching approach. Compared to a hypothetical situation in the absence of R&D tax credits, recipients of tax credits show significantly better scores on most but not all performance indicators. We therefore conclude that tax credits lead to additional innovation output.

1. Introduction

Public support for innovation-related activities has been justified in several ways. First, governments are responsible for providing new or improved technology for public sector functions (security, health, and communications) and R&D for these tasks may be performed in public research laboratories or contracted out to private firms and funded by public revenues. This paper discusses the second justification for public subsidies which is to correct for market failures resulting from under-investment in innovation activities (cf. Nelson, 1959; Arrow, 1962). Owing to the difficulty that firms have in appropriating all the benefits associated with an innovation, it is argued that society benefits from innovation more than the innovators. Due to imperfect appropriation private firms invest less in innovation than is "socially desirable". Even if the imperfect appropriation problem did not exist or was remedied by government intervention, investment in R&D would still suffer from another market failure: the gap between the private return to the innovator and the cost of capital from external sources. Arrow (1962) associated this problem with high, uninsurable risk and large minimum scale required for introduction of major innovations. Hall (2002) approached it from the point of view of investment theory and argues that "[. . .] some innovations will fail to be provided purely because the cost of external capital is too high, even when they would pass the private-returns hurdle if funds were available at 'normal' interest rates". The theory of public policy based on these factors stresses the need for the government to provide incentives to private firms to compensate for the gap between the private and social returns to innovation expenditure (in particular to R&D) in order to ensure the socially optimal effort of research and development by the private sector.

☆ The views expressed in this article are those of the authors and do not necessarily reflect the views of Statistics Canada nor the view of Industry Canada.

* Corresponding author at: K.U. Leuven, Dept. of Managerial Economics, Strategy and Innovation, Naamsestraat 69, 3000 Leuven, Belgium. Tel.: +32 16 326 906; fax: +32 16 326 732.
E-mail addresses: dirk.czarnitzki@econ.kuleuven.be (D. Czarnitzki), Petr.Hanel@USherbrooke.ca (P. Hanel), JulioMiguel.Rosa@ic.gc.ca (J.M. Rosa).
[1] Tel.: +1 819 821 8000x62278; fax: +1 819 821 7934.
[2] Tel.: +1 613 948 1225; fax: +1 613 991 1261.

0048-7333/$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.respol.2010.09.017

Even though in theory grants[3] have the advantage of directly correcting market failures associated with innovation, in practice their administration by government agencies poses problems of its own. Ignorance, information asymmetries between the innovator and the government agency, as well as moral hazard on the part of inventor or the innovating firm,[4] may make it difficult if not impossible to distribute grants so as to reduce or eliminate the gap between the social and private return to R&D. Furthermore, the government agency administrating R&D grants may face influencing factors such as: political pressure, bureaucratic objectives, corruption, incompetence and the bureaucratic procedures are costly. The resulting "government failure" (Winston, 2006) may be even more important than the market failures the grants are supposed to correct.

The problems associated with direct grants to R&D and the disenchantment with government intervention in business led many countries to gradually replace or supplement direct grants by indirect fiscal measures such as tax credits for R&D expenditures. Tax credits are considered to be a neutral form of encouragement to R&D and all firms that incur eligible R&D expenditures, irrespective of the industry, size and the objective of innovation activity, can claim them. The most important attraction of tax credits to policy makers is that their administration does not involve arbitrary decisions regarding the distribution of R&D support among sectors, regions, industries or firms. They have, however, shortcomings of their own. They stimulate overall R&D activity but do not address the sources of market failures involved in innovation activities. They affect the composition of R&D, favouring activities promising the largest short term profits. Projects with high potential social rates of return and investment in exploratory projects and development of research infrastructure may be less stimulated by tax credits (Hall and van Reenen, 2000; David et al., 2000).

In addition to direct R&D grants, Canada has one of the most generous R&D tax-credit programs among major industrial countries. A comparison of the federal government funding of R&D made through the Scientific Research and Experimental Development Investment Tax Credit (SR&ED) program as opposed to direct grant programs indicates that the size of tax credits surpassed grants by 1983 and had reached about 18% of business enterprise intramural R&D expenditures (BERD) by 1989 (Hanel and Palda, 1992). The share of R&D and innovation related grants peaked at about 7% of BERD in 1982 and declined to 1.3% in 2000.[5]

According to the evaluation of the Scientific Research and Experimental Development Investment Tax Credit (SR&ED) program by Finance Canada (1998), the program was rated as the most important component in the system of government support of R&D followed by refundability of the federal credit, while government grants and contracts received the lowest rating.

In addition to the federal SR&ED tax credit program all provincial and territorial governments provide income tax deductions for research and development. The provinces of Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario and Quebec also offer various types of additional income tax incentives for research and development conducted within their borders. Therefore, the after tax cost of R&D is quite low in Canada. For example, in Ontario, the manufacturing base of Canada, the after-tax cost of $1 of R&D expenditure was 0.507$ in large firms and 0.431$ in small firms in 1996 (see Warda (1999), for the comparisons between Canadian provinces and Warda (2001), for an international comparison).

Owing to the administration of the program by fiscal authorities and the confidentiality that surrounds tax-related matters, there is little public information on the distribution of beneficiaries of tax credits. The report by Finance Canada (1998) breaks down recipients of tax credits by the sector of economic activity[6] only, and does not provide details on the use of tax credits by manufacturing industry sub-sectors or groups on a two-digit SIC level. Baldwin and Hanel (2003) provide a detailed description of the distribution and use of tax credits for R&D in the manufacturing sector based on the Canadian Survey of Innovation and Advanced Technology conducted in 1993.

According to the Statistics Canada Survey of Innovation 1999, more than one third of firms involved in manufacturing (35%) used R&D tax credits in the 1997–1999 period. The proportion of tax credit users is highest (65%) among firms in the high technology industries, followed by those in the medium technology sector (41%) and lowest in the low technology sector (26%). Among firms performing R&D, large companies use tax credits more frequently than the medium and small size firms (Hanel, 2003).[7] The tax credit program is also extensively used by R&D performing firms in the primary and service sectors.

In this paper, we evaluate the impact of R&D tax credits on innovation and economic performance of innovating firms in Canadian manufacturing.[8] The data from the Statistics Canada Survey of Innovation (1999) in manufacturing provides information on innovation activities, some indicators of their impact and the use of government support programs for R&D; this survey will be further analyzed throughout this paper. The survey provides a wealth of new information on innovation activities and it shows that R&D is but one, albeit very important, source of innovation. Unfortunately, the information on R&D from the survey is limited to questions asking if the firm carried out R&D activity, how it was organized and whether the firm outsourced R&D. No information on the amount of expenditures or employment in R&D was solicited. It is thus impossible to examine whether tax credits crowded out private investment in R&D or whether firms that claimed tax credits invested more in R&D than they would have without the public support. However, the survey data provide an opportunity to examine the effect of tax credits on innovation activity, its characteristics, and their economic impacts.

To assess the effect of R&D tax credits, it is important to correct for a possible selection bias in the empirical analysis. For example, estimates from a linear regression model considering the receipt of R&D tax credits as an exogenous variable are likely to be biased, because the recipients of tax credits could differ systematically in several characteristics from non-recipients. The actual recipients might, for example, show more absorptive capacity, be active in more technology-intensive industries, show more successful innovation activities in the past, etc. In this case, even in the hypothetical situation of the absence of a tax credit program, owing to their characteristics and past performance the actual recipients might

[3] For the sake of simplicity, we refer in the text to R&D grants because the paper looks at the alternative policy of R&D tax credits. In reality, government grants often support also other innovation-related activities than R&D.

[4] These problems also explain why innovating firms face higher cost of capital.

[5] The ratio of R&D grants to BERD declined from 7.1% in 1982 to 4.2% in 1990 and further to 1.3% in 2000 (see Statistics Canada, 2003: Appendix, Table 19).

[6] The value of claims by sector in 1992: primary 7%, manufacturing 48%, services 45% (Finance Canada, 1998).

[7] Small firms have between 20 and 49 employees, medium between 50 and 249 employees and large firms more than 250 employees.

[8] In addition to claiming R&D tax credits, firms may also apply for and receive R&D grants. In a recent study, Bérubé and Mohnen (2009) examine the effect of R&D grants on the performance of Canadian firms that received tax credits using the data from the 2005 Survey of Innovation from Statistics Canada. They found that firms that receive R&D grants in addition to R&D tax credits were significantly more innovative than firms that benefited only from R&D tax incentives. The R&D grants program stimulates in particular world-first innovations. Since world-first innovations are more likely to produce high externalities, the authors conclude that R&D grants stimulate innovation precisely where market failure is highest.