A Comparison Of The Effectiveness Of Tax Laws Between Countries For Firms Engaging In Research And Development

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ABSTRACT

The creation of new technology is seen as a driver for economic expansion and job growth worldwide. To encourage firms to innovate, many countries provide tax incentives. Two such tax incentives are the ability to carry back net operating losses and tax credits for research and development expenditures.

This paper attempts to answer the question: Do these tax incentives truly lower the average tax rates paid by high-technology firms? Firms from Canada, Germany, and Japan are examined for the years 1993 to 1997.

In general, this paper finds that the ability to carry back a loss, or to use the R&D tax credit, does not, in themselves, produce a lower average tax rate than a similar firm within the same country. However, the more tax options a country produces does lower average tax rates – a larger combination of tax incentives allows firms more leeway towards tax minimization.

INTRODUCTION

*T*his paper compares the effect of the research and development (R&D) tax credit incentives and the net operating loss (NOLs) carryback laws offered by three major industrialized nations: Canada, Germany and Japan. This paper answers the question of whether or not the availability of favorable laws surrounding NOLs and R&D credits result in relatively lower average tax rates paid by firms likely to be "start-ups" and investing in research and development.

Every level of government imposes some form of discriminatory taxes to support or protect commerce in countries, states and cities. Actions available to these governments include: 1) offering export incentives; 2) forming export cartels; 3) imposing import controls; 4) creating a favorable tax atmosphere (Auquier and Caves, 1979).

Many countries attempt to create a favorable tax atmosphere for high-technology ("high-tech") firms. These firms, and the technological innovations they produce, are important in two ways. First, information technology industries have been growing at twice the overall rate of the world economy. Second, R&D can create "spillover" effects – positive economic growth in other areas of the economy (Hines, 1994 and 1997). In fact, there is significant evidence that R&D spending acts a public good, and the social rate of return that high-tech firms generate exceeds their private rate of return (Cockburn and Griliches, 1988 and Hall, 1996).

One incentive that countries can offer high-tech firms is favorable tax treatment. This tax treatment can be made favorable in a number of ways, including offering research and development tax credits and NOL carryback treatment.

The R&D tax credit usually allows an immediate tax credit (of 10 to 20%) of the purchase price of an expenditure for an asset that will be used for research and development. The result is a lower after-tax cost of the expenditure, which means more firms will be like to engage in such transactions. In this paper, I examine the firms from one country, Canada, which allows an R&D tax credit, and two countries which do not – Japan and Germany.

Most countries allow losses incurred by firms to be carried forward. On the other hand, some countries allow losses to also be carried back, and tax refunds given to firms immediately after a loss year (instead of waiting for positive net income in a subsequent year). The ability to carry back helps firms two ways: first, they could apply immediately for a tax refund, and second, they have more options to minimize their expected tax liability in all firm years. In this paper, I examine firms from two countries which allow NOL carry backs – Canada and Germany, and one country which allows only NOL carry forwards, Japan.

The remainder of this paper is outlined as follows. Section two discusses prior research in this area. Section three describes the research design used, details the sample selection and analyzes the results. Section six concludes.

PRIOR RESEARCH

R&D Tax Credits

Prior research on tax incentives, like the R&D tax credit, has either determined its effectiveness (Altshuler 1988 and Billings and McGill 1992), measured R&D expenditures relative to forgone tax revenues (General Accounting Office 1995), or set an asset value on the expenditure (Lev and Souguannis 1996; Horowitz and Zhao 1997). In general, the evidence on the effectiveness of the R&D tax credit is mixed – some have argued that the credit has a limited ability to stimulate research. For example, Kamian and Schwartz (1978) investigate the early history of the R&D tax credit and find that eligible firms had a significantly higher increase than ineligible firms. Coopers and Lybrand (1998) studies the R&D tax credit using a macroeconomic model and also concludes that the tax credit positively stimulated U.S. investment, innovation, wage growth, consumption and exports.

On the other hand, Altshuler (1988) uses tax return data to investigate the R&D tax credit incentive effects. She concludes that the average effective tax rate of the incremental credit in 1981 was less than one-tenth of the statutory credit rate of 25 percent. Similarly, the GAO (1989) uses tax return data and finds that the credit stimulated between $1 billion and $2.5 billion in additional R&D at a cost of $7 billion in tax revenues.

Net Operating Loss Carryback

All major industrialized nations allow companies to carry the loss they might recognize in one year forward to some future year. Such an allowance prevents the possibility of providing companies with a significant incentive to manipulate earnings from year-to-year. On the other hand, a much smaller number of countries allow the net operating loss to be carried back.

Unlike R&D tax credits, I am unaware of any research that has been conducted on the inter-country differences of NOL tax rules.

RESEARCH DESIGN, SAMPLE SELECTION AND RESULTS

This paper incorporates a combination of paired t-test two sample means to test whether high-technology firms in countries which provide NOL carry backs and R&D tax credits are able to lessen their tax liability more than countries with only one or neither tax advantage. Data are collected from the firms in each of three countries (Canada, Germany and Japan) from the *Worldscope Global Researcher Database*. The sample is selected for the years 1994 to 1998. Firms must have complete data for all five of the sample years and have research and development expenditures reported in at least one year. Regulated industries are omitted from the sample.

The sample I selected yields 576 firms with sufficient data over the time period, as shown in Table 1.

I then segregate firms which have at least one NOL year, from those firms which have none during the five year period from 1994 to 1998. The average tax rate (as measured by federal tax liability/net income) for all firms with no NOL but who engaged in research and development during the period is computed. These average rates are shown for each sample year for each country in Table 2.

Table 1: Number Of Firms With R&D By Each Country

Country	Number Of Firms
Canada	137
Germany	65
Japan	374
Total	**576**

Table 2: No NOL In 1994 Through 1998 Average Tax Rates
For A Firm With No Nols Between 1994 And 1998

Japan	
1994	52.5%
1995	51.3%
1996	50.9%
1997	48.9%
1998	52.5%
Canada	
1994	31.0%
1995	32.5%
1996	27.2%
1997	30.3%
1998	31.0%
Germany	
1994	45.0%
1995	37.6%
1996	39.4%
1997	41.9%
1998	42.9%

Firms Going Into An NOL

From the sample of each country with firms having at least one NOL year and R&D expenditures, I select firms with income in 1994 and 1995 and NOLs in 1996, 1997 and 1998. I have made this selection since I consider this a realistic scenario for high-tech and particularly start-up firms. High-tech firms are cyclical by nature, which means they may experience consecutive years of NOLs, followed by income, followed by more years of NOLs. Start-up firms should experience NOLs in a sporadic nature for the first years of their operations, followed by consistent profits as their products become more popular.

Suppose a firm has income in years one and two, followed by NOLs in year three, four and five. Firms in countries with tax laws which allow NOL carry backs should have greater percentage decrease in their tax liability from the average tax rate of non-NOL firms in their country for years one and two (where the NOL is being carried back, resulting in a tax refund, and in fact should experience a negative tax) than non-NOL carry back firms. This result is intuitively simple, since most firms should elect to carry back, given time value of money. The hypothesis should be as follows:

H1:   Canadian firms should have a greater percentage decrease in its tax liability in the two years of net taxable income (1994 and 1995) before a three year period of NOLs (1996, 1997 and 1998) than Japanese firms.

H2:   German firms should have a greater percentage decrease in its tax liability in the two years net taxable income (1994 and 1995) before a three year period of NOLs (1996, 1997 and 1998) than Japanese firms.

Table 3: Firms Going Into An NOL

Average tax rates for a firm with income in 1994 and 1995 and NOLs in 1996, 1997 and 1998			
Japan (neither NOL carryback nor R&D tax credits)			
Year	Average Rate	Diff from non-NOL average	%-age diff from non-NOL*
1994	46.9%	(5.6%)	(10.6%)
1995	49.1%	(2.2%)	(4.3%)
1996	8.3%	(42.6%)	(83.7%)
1997	2.8%	(46.1%)	(94.2%)
1998	4.8%	(47.7%)	(90.3%)
Canada (NOL carryback and R&D tax credits)			
	Average Rate	Diff from non-NOL average	%-age diff from non-NOL*
1994	38.6%	7.6%	24.5%
1995	38.5%	6.0%	18.5%
1996	(3.3%)	(30.5%)	(112.1%)
1997	(0.1%)	(30.4%)	(100.3%)
1998	3.4%	(27.6%)	(89%)
Germany (NOL carryback but no R&D tax credits)			
	Average Rate	Diff from non-NOL average	%-age diff from non-NOL*
1994	32.7%	(12.3%)	(27.3%)(a)
1995	29.2%	(8.4%)	(22.3%)(a)
1996	(4.8%)	(44.2%)	(112.2%)
1997	(0.1%)	(42.0%)	(100.2%)
1998	1.8%	(41.1%)	(95.8%)

* This percentage is computed by dividing "diff from non-NOL average" by average tax rates of non-NOL firms for that year.
(a) Statistically significant at .05 level from Japan, using a two paired t-test.

As Table 3 shows, H1 is not proven, in fact, the opposite actually occurs – the difference in the percentage decrease in Canadian average tax rates for firms one and two years before the NOLs is actually an increase and higher than the average rate of Japanese firms who will not have an NOL to carry back. On the other hand, H2 is statistically significant. German firms, with the ability to carry back, have lower average tax rates than firms in Japan (who do not have the ability to carry back).

Firms Coming Out Of An NOL

In another test which may approximate the income and loss experience of a high-tech and/or start-up firm, suppose a firm had a NOL in year one and two, followed by net income in years three, four and five. Given the fact that all countries allow NOL carry forwards, the percentage decrease in tax liability should be relatively equal across countries. However, if a country provides other tax credits (like the R&D credit), as well as the option of carrying back or carrying forward a loss, a firm in that country could be much more "tax-optimizing" (similar to the way some firms manage net income for financial accounting purposes – for example, Dhalawal, et al. 1999) In other word, that firm could reduce its tax liability by a greater percentage in the years after an NOL than a firm in a country that does not provide as many options.

This leads to hypotheses three and four:

H3   Firms in Canada, which provides more tax options than Germany, should have a greater percentage reduction from non-NOL firms in its country in years three, four and five (1997, 1998 and 1999) than firms in Germany.

H4:   Firms in Germany, which provide more tax options than Japan, should have a greater percentage reduction in years three, four and five (1997, 1998 and 1999) than firms in Japan.

Table 4: Firms Coming Out Of An NOL

Average tax rates for a firm with NOLs in 1994 and 1995 and income in 1996, 1997 and 1998			
Japan (neither NOL carryback nor R&D tax credits)			
	Average Rate	Diff from non-NOL average	%-age diff from non-NOL*
1994	1.8%	(50.7%)	(96.6%)
1995	16.7%	(34.6%)	(67.4%)
1996	24.2%	(26.7%)	(52.5%)
1997	27.8%	(21.1%)	(43.1%)
1998	35.0%	(17.5%)	(33.3%)
Canada (both NOL carryback and R&D tax credits)			
	Average Rate	Diff from non-NOL average	%-age diff from non-NOL*
1994	9.4%	(21.6%)	(70.0)
1995	16.9%	(15.6%)	(48.0%)
1996	1.1%	(26.1%)	(96.0%)(a)(b)
1997	1.1%	(29.2%)	(96.4%)(a)(b)
1998	0.1%	(30.9%)	(99.7%)(a)(b)
Germany (NOL carryback but no R&D tax credits)			
	Average Rate	Diff from non-NOL average	%-age diff from non-NOL*
1994	1.0%	(44.0%)	(97.7%)
1995	1.0%	(36.6%)	(97.3%)
1996	1.2%	(38.2%)	(97.0%)
1997	18.4%	(23.5%)	(56.1%)
1998	12.3%	(30.6%)	(71.3%)

* This percentage is computed by dividing "diff from non-NOL average" by average tax rates of non-NOL firms for that year.
 (a) Statistically significant from Japan at the .01 level, using a two-paired t-test.
 (b) Statistically significant from Germany at the .10 level, using a two-paired t-test.

        As Table 4 shows, both hypotheses are statistically significant at the .01 level. The ability of Canadian firms, given multiple tax options, to continue to minimize the tax liability on three years of income after two years of NOL, is statistically significant compared with Germany. Germany firms, in addition, armed with the more tax options than Japan, are able to minimize their tax liability more than Japan.

CONCLUSIONS

        The creation of new technology is seen as a driver for economic expansion and job growth worldwide. To encourage firms to innovate, many countries provide tax incentives. Two such tax incentives are the ability to carry back net operating losses and tax credits for research and development expenditures.

This paper attempts to answer the question: Do these tax incentives truly lower the average tax rates paid by high-technology firms? Firms from Canada, Germany and Japan are examined for the years 1993 to 1997.

In general, the ability to carry back a loss, or to use the R&D tax credit, does not, by themselves, produce a lower average tax rate than what the firm could expect to incur. However, the more tax options a country provides does lower average tax rates of high-technology firms – a larger combination of tax incentives allows firms more leeway towards tax minimization.

While these results were true in two scenarios I select, future studies should examine the effect of various years of NOL and of taxable income, as well as other countries (like the United States) which allow for R&D tax credits.

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