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Fiscal And Tax Competitiveness

Rewarding Innovation:

Improving Federal Tax Support for Business R&D in Canada

Mark Parsons

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In this issue...

Canada needs a tax system that not only lowers the cost of R&D through upfront subsidies, but also allows firms to reap the rewards of R&D success and innovation.

The Study in Brief

The Author of This Issue

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Business innovation is viewed by many as a solution to Canada's ailing productivity performance. One of the more troubling aspects of Canada's innovation track record is that businesses spend relatively little on research and development (R&D) despite having access to some of the world's most generous R&D tax incentives.

Canada's low levels of business R&D have called into question the effectiveness of Canada's generous R&D tax incentives, particularly the flagship federal Scientific Research and Experimental Development (SR&ED) program. A deeper analysis, however, reveals that tax incentives are effective in stimulating more R&D – that is, Canada would have lower levels of business R&D in the absence of these inducements. Instead, the root cause of Canada's business R&D deficit appears to stem from structural aspects of the economy and, more importantly, a lack of demand-related pressure to pursue innovation.

The rationale for R&D tax incentives rests on the notion that R&D undertaken by individual firms creates knowledge benefits that "spill over" to the Canadian economy. To determine whether tax incentives create value for the overall economy, one must establish whether the additional R&D generated produces large enough spillover benefits to offset the associated costs: tax administration, compliance and the costs of financing the incentive.

Weighing the costs and benefits, the available evidence suggests that the SR&ED tax incentive program has generated a narrow net benefit to Canada. But there are two important caveats. First, there is a great deal of uncertainty regarding the size of this net benefit, given the wide range in estimates from the literature, particularly those relating to spillovers. Second, the observation of a net benefit does not imply that the current SR&ED incentives are optimal, or that improvements cannot be made. If anything, the sensitivity of the results indicates that the SR&ED program is highly susceptible to falling into the "net loss" category in the absence of change.

So what should be done? Tax policy should be focused on creating a balanced and competitive tax environment across the entire innovation value chain, from initial R&D through commercialization to the development and production of new products and services. The current system of tax support is front-end loaded, pushing firms to undertake R&D through upfront subsidies. At the same time, the rewards generated by R&D and other innovative activities are taxed at rates above many countries, creating a disincentive to commercialize and develop new products and services in Canada. Indeed, among OECD countries, Canada offers the third-most generous subsidies for R&D investment, but is in the middle of the pack in terms of the overall competitiveness of its business tax regime, after accounting for recent and planned corporate tax cuts.

This *Commentary* introduces some federal tax policy considerations to spur innovation. The federal government should continue to focus its efforts on market "pull" factors by ensuring taxes on income derived from patents and subsequent production of new products and services (the fruits of R&D) are kept at internationally competitive levels. The federal tax regime should also not discourage the growth of small firms into larger, globally competitive companies.

Economists have good reason to obsess over Canada's productivity performance. As labour supply becomes more constrained, thanks to an aging population, Canadian workers will need to be more productive to support a higher standard of living for themselves and their older, retired peers.

Productivity's critical importance in wealth creation makes Canada's performance all the more worrisome. Between 2000 and 2010, labour productivity – output per hour worked – grew at a sluggish average pace of 0.9 percent a year, about half the growth rate registered by the Group of Seven (G7) industrialized countries and 40 percent of the US increase (OECD 2010b).[1] Drummond and Bentley (2010) call Canada's lack of productivity growth "Canada's #1 Economic Issue Today."

Identifying Canada's productivity problem is much easier than pinpointing the solution. The productivity challenge is multi-dimensional, and there is no magic bullet solution. But at the heart of the productivity puzzle is innovation. The logic is simple: if Canadian firms are to be more productive over time, they must be doing something better, or more innovatively, than before.

Canada's relative lack of innovation is likely one of the key culprits behind Canada's productivity struggles. Measuring the contribution of business innovation to productivity is challenging, though a measure called multi-factor productivity (MFP) provides some help. Growth in MFP measures the changes in labour productivity that is not accounted for by growth in physical capital (e.g., machinery and equipment) or from workforce skills. Much of MFP is believed to arise from business innovation – finding better ways to extract value from capital and labour resources.[2] Some view low MFP growth as being primarily responsible for Canada's weak labour productivity growth since 1980 and see this as a reflection of weak business innovation performance (CCA 2009).

Indeed, the weakness in MFP is pervasive across nearly all provinces. In a recent *Commentary*, Coulombe (2011) found that MFP growth in all provinces, with the exception of Newfoundland, was very low between 1985 and 2009 and blames poor innovation performance, namely the weak adoption of technologies.[3]

International benchmarking studies also point to relatively low levels of Canadian innovation. The Conference Board of Canada (2010) reported that Canada is a below-average performer in its capacity to innovate, ranking well behind its developed-country peers on a variety of innovation measures such as patents, trademarks and high-tech manufacturing.

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Fostering Innovation in Canada – The Role of Business R&D

One of innovation's key ingredients is R&D investment. Canadian business R&D has led to

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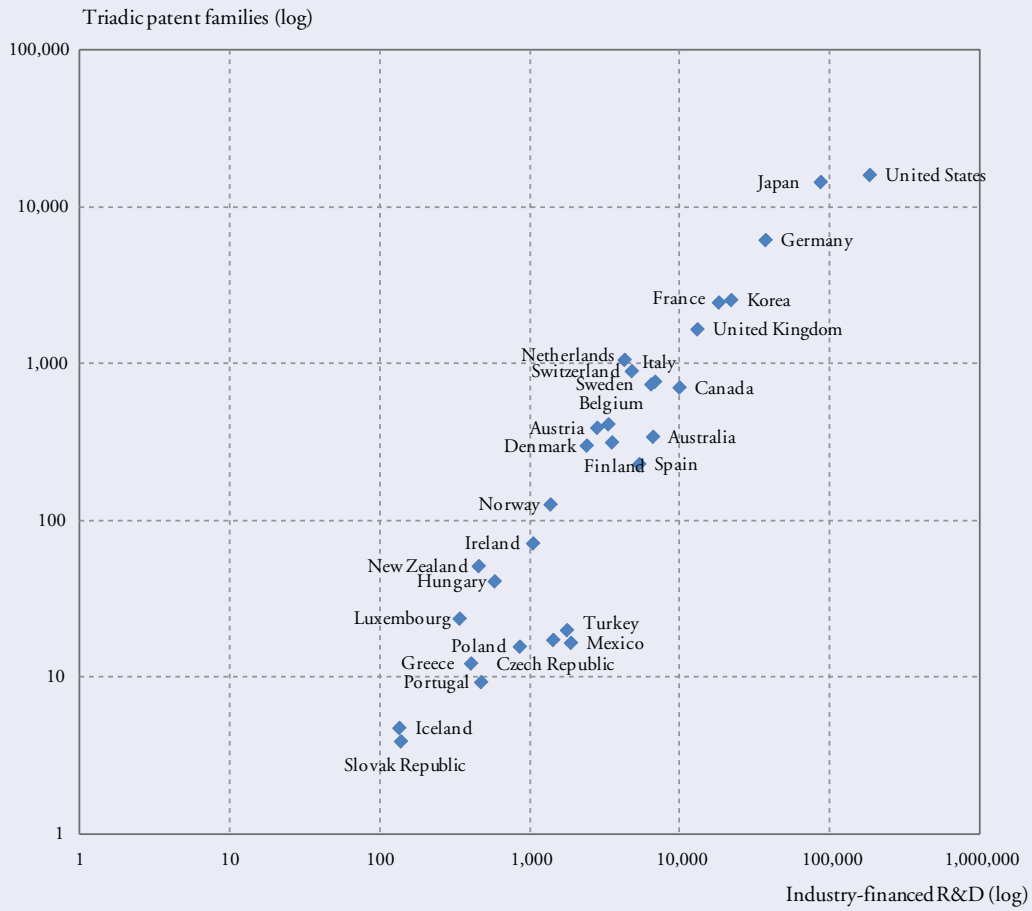
The views expressed in this *Commentary* are those of the author alone and do not necessarily reflect the views of PricewaterhouseCoopers LLP ("PwC").

1 For commentary on Canada's productivity record see, for example, Cooper (2010) and Sharpe (2010).

2 MFP can also arise from errors or omissions in the measurement of workforce skills and the capital stock.

3 Coulombe argues that his approach minimizes MFP measurement-error problems as, unlike many international studies, he used data from a common data source and applied the same methodology from all provinces. This implies that the weakness in MFP was coming mainly from technological or innovation issues rather than measurement problems.

Figure 1: Patents and Industry Financed R&D – 2005-07



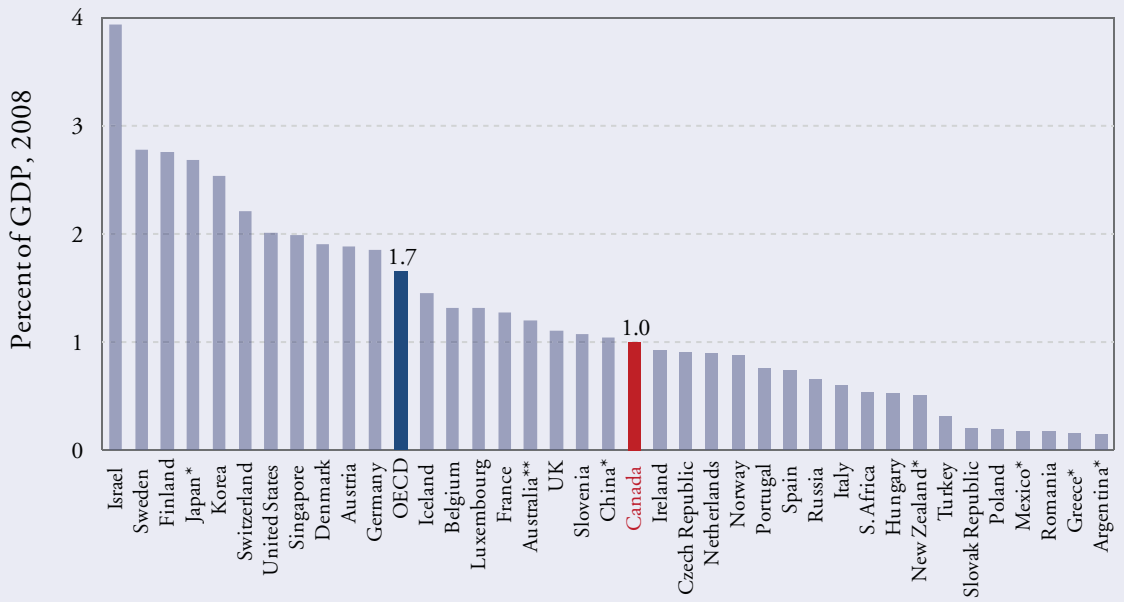
Note: "Triadic" patent families refer to patents filed at the European Patent Office, the US Patent and Trademark Office, and the Japan Patent Office, that protect the same invention. According to the OECD, triadic patent families are the most comparable national patent statistics, removing home advantage and the influence of geographical location.
Source: OECD (2009).

breakthroughs in medicine, information technology, biotechnology and many other fields. The BlackBerry, one of the world's leading smart phones developed by Research In Motion in Waterloo, Ont., is just one modern example of Canadian business R&D success.

Empirically, business R&D is strongly linked to measures of innovation output. The OECD has shown a strong positive relationship between a country's patent levels and its industry expenditures in R&D (Figure 1). A strong relationship also exists between business R&D intensity and the World Economic Forum's Innovation Index, which is a much broader measure of innovation performance (CCA 2009).

The real test, however, is whether business R&D ultimately translates into productivity improvements. Surveying the extensive literature in the area, the US Congressional Budget Office (2005) concludes that "results from econometric studies strongly suggest that R&D spending has a positive influence on productivity, with a rate of return that is likely to exceed that on conventional investments." An earlier OECD (2003) study showed that an increase in the business R&D to GDP ratio of just 0.1 percent is associated with an increase in real output per capita of 1.2 percent. In his assessment of the evidence, Macklem (2011), Senior Deputy Governor of the Bank of Canada,

Figure 2: Business Expenditures on R&D – 2008



Source: OECD(2010).
* 2007 , ** 2006

points to spending on R&D and innovation as key factors that make firms more productive.[4]

Despite the importance of business R&D, Canada simply does not measure up to its peers. As a share of economic output, Canada's business R&D investment comes in well behind the average for OECD countries, ranking 20th among 38 developed and developing countries (Figure 2). Moreover, Canada's performance has worsened in recent years, with the R&D to GDP ratio reaching its lowest point in more than a decade in 2008 (Figure 3). Canada's languishing business R&D performance has not gone unnoticed. The federal government in 2010 struck an Expert Panel to re-evaluate how the federal government supports business and public R&D in Canada.[5]

Government Support for Business R&D in Canada

There is little doubt that Canadian governments are committed to supporting R&D. The federal and provincial governments fund in excess of $7 billion a year through R&D grants, more than half of which flows to higher-education institutions.[6] Indeed, Canada's expenditures on higher-education R&D as a share of GDP ranks near the top of OECD countries, even coming ahead of the US (OECD 2010).[7]

Canada's commitment to R&D, however, is by no means confined to public sector grants. The federal and provincial governments also provide generous tax incentives to encourage business

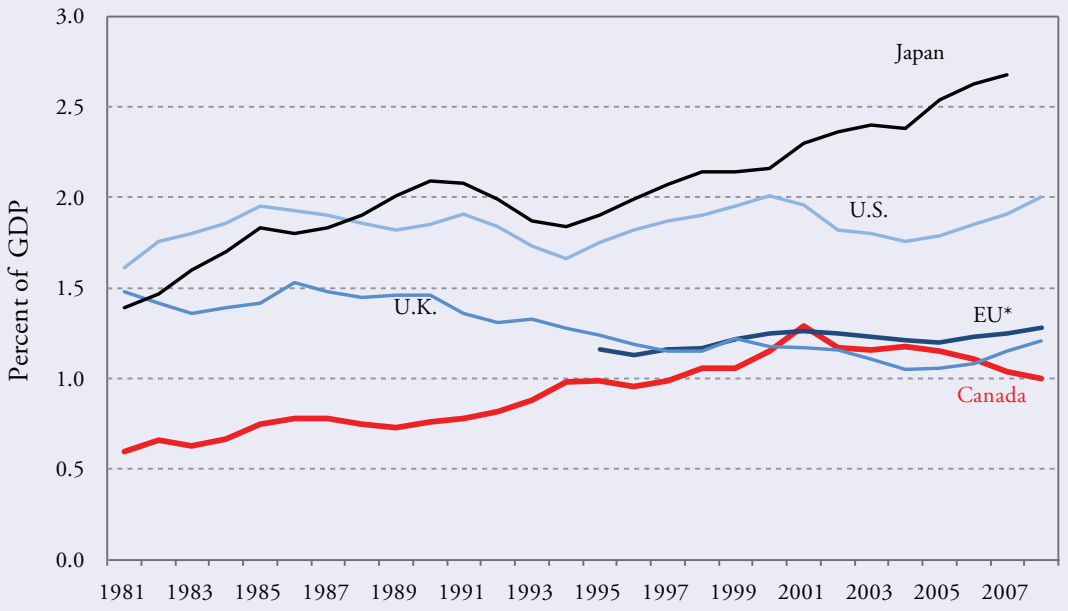
4 Other firm-level factors identified include investments in machinery and equipment, particularly in information and communications technology, employing workers with higher education attainment and competing in foreign markets.

5 On October 14, 2010, the Government of Canada launched the Expert Review Panel of Research and Development to study all federal programs that support business innovation. Recommendations to the government are expected in October 2011.

6 Preliminary estimate as of 2010. Source: Statistics Canada CANSIM table 358-0001: Gross Domestic Expenditures on Research and Development by Funding Sector (Provincial and Federal Government).

7 Higher education expenditures on R&D as a share of GDP were 0.6 percent of GDP in Canada compared to the OECD and US averages of 0.4 percent (OECD 2010).

Figure 3: Business Expenditures on R&D by Year



*European Union (15 Countries)
Source: Statistics Canada, Eurostat.

investments in R&D. By far the largest tax subsidy is the federal Scientific Research and Experimental Development (SR&ED) tax credit, which costs in excess of $3 billion per year.[8] The credit ranges from 20 percent for larger firms to 35 percent for small Canadian-controlled private corporations (CCPC) and applies to a broad range of eligible R&D spending such as wages, materials, equipment, R&D contracts and related overhead expenses (see Box 1). Unused credits can be carried forward for up to 20 years or back three years to reduce taxes payable. Another feature that makes SR&ED especially generous is that it applies to all eligible expenditures in Canada; in contrast, the US R&D tax credit applies only to incremental expenditures, or expenditures above a historic average.[9]

All provinces (with the exception of PEI) top up SR&ED with their own credits, ranging from 10 percent in BC and Alberta to 35 percent (wages only) in Quebec. As an added incentive, R&D investments also receive favourable tax deductibility rules – R&D spending (including equipment purchases) is fully tax deductible in the year it is incurred. This means that instead of amortizing R&D investment over several years, as with most types of physical investment, Canadian companies can claim all eligible R&D expenditures as an expense in the year it occurred to reduce taxable income.

Such generous incentives provide Canadian businesses access to one of the most heavily subsidized R&D tax regimes in the world. The overall subsidy rate on R&D in Canada – defined

8 The most recent estimate by the Department of Finance is $3.49 billion in 2008, with projections of $3.28 billion in 2009 and $3.47 billion in 2010. Source: Finance Canada (2010b).

9 The US R&D tax credit is applied to the excess of qualified research expenditures over a base amount (credit rate and definition of base amount varies depending on method used). From a policy perspective, the advantage of an incremental tax credit over a volume-based credit is that it reduces the subsidy on R&D that may have been performed in the absence of government support. The disadvantage, however, is that an incremental credit is more complicated and expensive to comply with and administer. It can also lead to large fluctuations and less predictable amount of R&D support.

Box 1: The Federal Scientific Research and Experimental Development (SR&ED) Tax Credit

The SR&ED tax credit program reduces taxes payable by an amount of 20 percent to 35 percent of eligible R&D spending.

Rates and Thresholds

The general federal SR&ED tax credit rate is 20 percent of eligible R&D performed in Canada. This rate increases to 35 percent for spending by Canadian-controlled private corporations (CCPCs) up to a maximum of $3 million in qualified expenditures. The expenditure limit becomes lower as taxable income and capital rise above certain thresholds. Specifically, the limit is phased out for every dollar of prior-year taxable income above $500,000 up to $800,000, and for every dollar of prior-year taxable capital above $10 million to $50 million. For example, a CCPC with eligible R&D expenditures of $5 million and below the taxable income and capital thresholds would receive a 35 percent credit on the first $3 million of spending and a 20 percent credit on the remaining $2 million. The federal SR&ED credit is applied to eligible spending net of any provincial investment tax credits.

Refundability

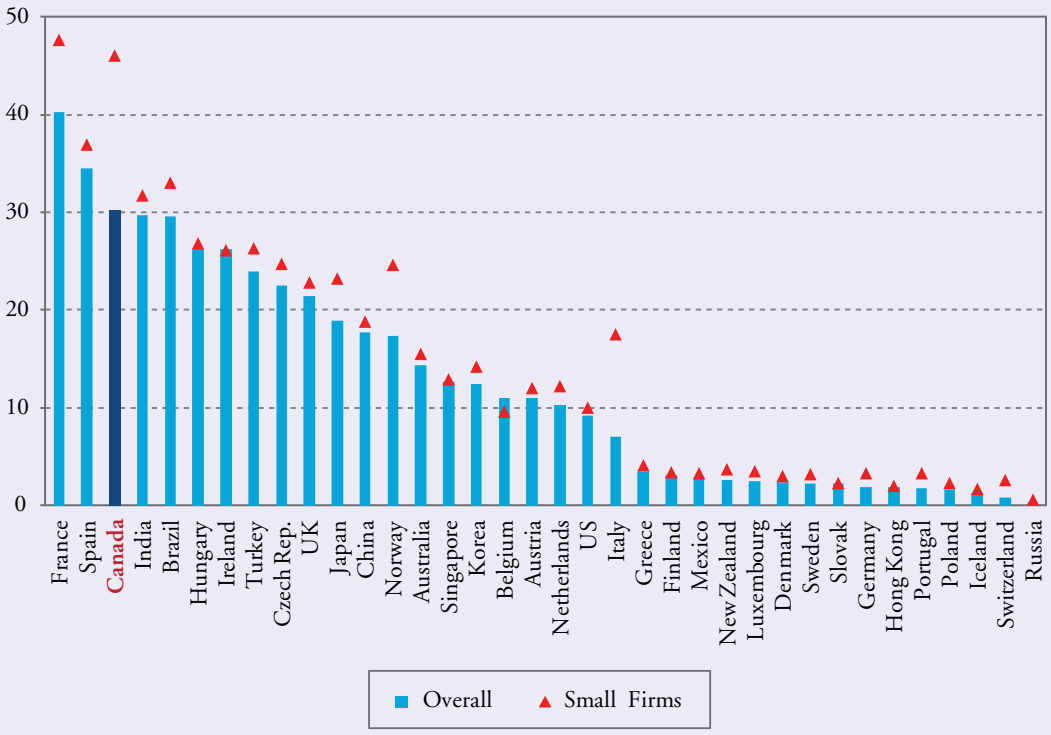
Tax credits earned at the 35 percent rate are fully refundable for current expenditures and 40 percent refundable for capital expenditures. Tax credits earned at the 20 percent rate are non-refundable, with the following exceptions: unincorporated businesses and small CCPCs with prior-year taxable income capital up to the $500,000 and $10 million thresholds, respectively, for qualified expenditures that exceed the $3 million expenditure limit. Such entities are eligible for 40 percent refundability on eligible current and capital expenditures. Unused credits can be carried forward up to 20 years or back three years to reduce taxes payable in those years.

Eligible Activities and Expenditures

To be eligible for the SR&ED program, firms must demonstrate that their activities meet Canada Revenue Agency criteria. First, the activity must generate information that results in scientific or technological advancement. Second, the outcome must be unknown in advance of undertaking the activity. Third, the activity must be carried out by qualified personnel and must involve systematic investigation through experiment and design.

Most expenditures associated with these activities in Canada, including salaries and wages, materials, equipment (if substantially used for R&D) and certain expenses from contract work performed by eligible organizations (e.g., universities) are eligible for the SR&ED tax credit. In addition, firms can claim a portion of overhead expenses that are tied to eligible R&D activities. In the 2008 federal budget, spending eligible for the credit was expanded to include certain salary and wages of Canadian-resident employees carrying out SR&ED work outside Canada.

Figure 4: Effective Subsidy Rate* on R&D Investments (percent)



* Percentage reduction in cost of R&D due to tax incentives.
Source: Finance Canada (2009).

as the percent reduction in the cost of R&D arising from tax incentives – is about 30 percent (Finance Canada 2009).[10] This gives Canada the third-most generous R&D tax regime among 36 countries studied, behind only France (40 percent) and Spain (35 percent). Other summary measures of tax support reach the same conclusion. The B-Index, or the after-tax cost of R&D due to tax credits and depreciation allowances, yields roughly the same rankings of tax assistance across the comparison group, with Canada again the third-most generous tax regime.

The overall R&D subsidy rate in Canada masks some important differences in the treatment of small versus large firms. As discussed, many small firms are eligible for a SR&ED credit of 35 percent, well above the 20 percent for larger corporations. Moreover, firms that are eligible for the 35 percent credit benefit from refundability provisions, meaning that a cash credit is provided even if taxable income is not generated. Canada's overall subsidy rate for small firms is the second most generous among OECD nations at 46 percent, behind only France (Finance Canada 2009). The

10 The subsidy rate is calculated from a straightforward transformation of the Marginal Effective Tax Rate (METR) on R&D investment. The METR measures the overall tax burden on new investment, factoring in a broad range of tax measures such as investment tax credits, corporate taxes, capital taxes, sales taxes, depreciation allowances and interest deductibility. More specifically, the METR measures the fraction of the return on new investment that goes toward paying corporate-level taxes (the "tax wedge"), expressed as a share of the return to investors. Because R&D is subsidized in most countries through investment tax credits and generous tax deductibility, the METR on new R&D is typically negative (i.e., the net of tax return is higher than the gross of tax return). METRs are the most widely accepted measure for comparing corporate tax regimes, as they capture all tax incentives relevant to firm investment decisions.

asymmetric treatment of small and large firms appears to stem from capital market challenges – the idea that small, start-up companies typically lack internal funds and find it more costly to raise financing than their larger counterparts.[11]

Canada's generosity towards business R&D holds true even if grant programs are factored into the international comparisons. The OECD (2010) looked at the total support that governments provide businesses to undertake R&D, directly through grants and indirectly through tax incentives. Among 30 member-countries studied, the OECD found that Canadian governments spend the second highest amount (as a share of GDP) on business R&D after Korea.[12] Canada's generosity stems almost exclusively from R&D tax incentives – the country spends relatively little, as a share of GDP, on direct R&D grants to business compared to the US or the average of OECD countries.[13]

Canada's SR&ED Tax Incentive: An Evaluation

As we have seen, Canada's sub-par business R&D spending arises despite the fact that the country offers one of the world's most generous R&D tax regimes. This observation has called into question the effectiveness of the R&D tax incentives. While it is tempting at first glance to conclude that Canada's R&D subsidies are not working, a deeper analysis is required.

First, Canada has witnessed a near doubling in its business R&D to GDP ratio since the early 1980s (Figure 3). The federal government has been offering tax credits for R&D activities since 1977, and introduced the present version of the program (notwithstanding incremental changes) with refundable credits for CCPCs in 1985. So while the level of R&D may be low, the growth in R&D has been significant since credits were introduced.

Second, and most important, there are reasons well beyond tax incentives why business spending on R&D may be low. R&D spending levels are dictated by both the demand and supply drivers of innovation. Tax incentives lower the cost of R&D and, therefore, impact the supply of R&D. The demand for R&D, on the other hand, is influenced primarily by pressures on individual firms to innovate – corporate cultures, exposure to foreign competition, characteristics of the industry and public policies (CCA 2009). Hence, tax incentives alone are not sufficient to drive high R&D levels. As the OECD (2011) notes: "Neither the supply-side nor demand-side policies are likely to be effective in isolation. Fostering innovation requires addressing the entire innovation chain."

Demand forces appear to be weighing on Canada's R&D performance. The CCA (2009) and the Science, Technology and Innovative Council (STIC 2011) have noted that, relative to their international peers, Canadian companies have failed to adopt innovation as a business strategy. The reasons are not entirely clear, but some Canadian companies do not seem to feel the same pressures to innovate as firms in other countries. A survey of business executives in Canada found that a "culture of complacency, rather than a drive to innovate" was cited as the

11 There is some empirical support for this argument. Reviewing the literature, Hall (2002) notes that "there is fairly clear evidence, based on theory, surveys, and empirical estimation, that small and startup firms in R&D-intensive industries face a higher cost of capital than their larger competitors and than firms in other industries." The issues associated with using an enhanced credit to address small firm financing problems is discussed later in this paper.

12 The OECD data does not capture the tax expenditures associated with sub-national (e.g., state, provincial) R&D tax credits.

13 The principal advantage of tax incentives is that businesses, as opposed to government officials reviewing grant applications, make decisions about R&D investments, resulting in market-driven innovations. On the other hand, proponents of government grants argue that greater focus can be placed on R&D projects perceived to offer the highest return to society. Reviewing the literature, Parsons and Phillips (2007) argue that the appropriate mix between grants and tax incentives depends on a country's policy priorities, making the comparisons difficult, and that there is no "evidence-based reason to choose among tax credits, grants and publicly performed R&D."

most important reason why Canadian productivity lags the US rate.[14]

Structural characteristics are also important. For example, a Finance Canada study (ab Iorwerth 2004) found that Canada, compared to the US, has a smaller concentration of industries that are known to have high R&D intensities, such as pharmaceuticals and telecommunications. But this only accounts for part of the Canadian R&D weakness. According to the consultation paper put forward by the Expert Review Panel on Research and Development (2010) even after accounting for differences in the sectoral mix, an even larger portion of the gap between US and Canadian R&D business investment stems from the "pervasive weakness in business R&D intensity across many sectors in Canada."

Another structural consideration is that a large number of foreign-owned multinational enterprises (MNEs) operate in Canada. While MNEs do undertake R&D in Canada through their subsidiaries, much of their R&D is performed from head-office locations outside of Canada, particularly in the US (Harris 2005).

As a result of these factors, there are good reasons to believe that Canada would have even *lower* levels of business R&D investment in the absence of R&D tax incentives. That is, R&D levels may be boosted by tax incentives, but weighed down by the above demand and structural forces, leading to Canada's current status as a sub-par performer. Later in this paper, I present evidence that shows this appears to be the case.

However, even if tax incentives spur more R&D, this does not necessarily prove their worth. It must also be demonstrated that the additional R&D creates knowledge "spillovers" to the rest of the economy that more than offset the cost of providing the tax credits.

In the following section, I introduce a framework to evaluate the SR&ED tax incentives based on some earlier work I conducted with colleague Nicholas Phillips at Finance Canada. The framework looked at the following evaluation variables:

- spillovers;
- sensitivity of R&D to tax incentives;
- costs of administration and compliance; and
- costs of financing the tax incentive.

The conclusion from this analysis is that, based on reasonable values of the key evaluation variables, the SR&ED tax credit appears to pass the cost-benefit test. But there are two important caveats. First, the results are highly sensitive to the underlying assumptions; in particular, the estimates of spillovers from the literature vary widely and are difficult to quantify. Second, the analysis does not imply that the current SR&ED incentives are optimal, or that improvements cannot be made.

In the final section, I will discuss potential tax policy opportunities that would improve taxation across the entire innovation value chain, allowing companies to reap the rewards of their R&D investments.

Spillovers – The Primary Rationale for R&D Subsidies

Economists who study public finance have long argued against targeted tax subsidies on most types of business inputs. The reason is that such subsidies can distort market prices, resulting in a misallocation of resources and a loss in economic welfare.[15]

14 Based on a survey of 152 executives from the *Globe and Mail's Report on Business Top 1000 Companies*, conducted between September 7 and September 22, 2010.The magazine asked the executives: "Canadian productivity lags behind the US. How important a factor is _____ in explaining weaker Canadian productivity? Is _____ a very important factor, a somewhat important factor, not very important or not at all important?" The highest percentage (32 percent) of respondents said that "culture of complacency, rather than a drive to innovate" was very important, ranking ahead of seven other factors (tax incentives, overall taxes, risk aversion, weak R&D culture, inadequate training, regulations, trade protection). Source: Gandalf Group (2010).

15 This is a well-known result of the Production-Efficiency Theorem by Diamond and Mirrlees (1971).

R&D, however, is not a standard input to production like labour and physical equipment. The main difference is that it is difficult, if not impossible, for firms to capture all the benefits from their R&D efforts, even using modern mechanisms that protect intellectual property (e.g., patents, copyright laws). Instead, the benefits of new knowledge or ideas created spillover to many firms, not just the performers of R&D.

When private companies cannot capture all of R&D's returns, economic theory indicates that they will invest in it below the level that is socially desirable. A popular method of correcting this so-called "market failure" is through R&D tax subsidies, compensating firms for the benefit their R&D investments provide to others.

The primary rationale for an R&D tax subsidy, therefore, rests on the idea that one firm's R&D creates a positive social benefit, or spillover, for the entire Canadian economy.[16] While true in theory, the existence and size of spillovers is an empirical question, and something researchers have wrestled with for years. While there are a number of data and measurement issues that make estimation difficult,[17] the general conclusion from these studies is that R&D spillovers are very significant – that is, that the social return far exceeds the private return.

Some of the earlier empirical work by Bernstein (1988, 1989) generated estimates showing relatively low domestic spillovers (i.e., the amount the domestic social return exceeds the private return) of 9 percent to 16 percent, while more recent studies have yielded spillovers in excess of 100 percent (e.g. Park 2004). Reviewing the empirical literature from eight Canadian studies, Parsons and Phillips (2007) calculated a median domestic spillover estimate of 56 percent, with individual estimates ranging widely from 9 percent to 138 percent.

Sensitivity of R&D to Tax Incentives

Large spillovers do not of themselves justify R&D tax incentives. Business R&D must also respond to these incentives. If tax credits subsidize firms that would have undertaken R&D in any event, they are not fulfilling their intended purpose of stimulating more R&D.

Isolating the impact of tax credits on business R&D requires careful statistical analysis that controls for other influences on R&D spending, such as changes in output, interest rates, industry composition, etc. The results of such studies are clear: R&D tax incentives do appear to stimulate R&D investment, by reducing the cost of R&D. Estimates of the incrementality ratio – the amount of R&D generated per $1 in subsidy – range from 28 cents to $1.38, but most estimates cluster around 90 cents, with the median Canadian estimate calculated by Parsons and Phillips (2007) at 86 cents.

The Cost of Tax Incentives

Another key consideration when evaluating any tax incentive is the public cost. The first element is the direct cost of compliance and administration. The SR&ED program involves complex, technical assessments and requires comprehensive documentation. While information is limited and somewhat dated, survey information suggests that the cost of compliance is significant. A survey by Finance Canada and Revenue Canada (1996) shows that that the cost of complying with the credit ranges from 15 cents per dollar of credit

16 Another rationale is capital market failures, caused by asymmetric information between the investor and the R&D performing firm. There is some evidence that R&D is subject to financing constraints, likely due to capital market problems (Hall and Lerner, 2009). By increasing the after-tax cash flow to financially constrained firms, tax credits help alleviate possible financing constraints. This effect is, in part, captured in the empirical estimates on the sensitivity of R&D to the tax incentives.

17 See Jones and Williams (1998) for a discussion of measurement issues surrounding spillovers and the social return to R&D, and the link to economic growth theory.

claimed for small claims (less than $100,000) to six cents per dollar of credit for large claims (more than $500,000). Weighting these values by actual credits granted, Parsons and Phillips (2007) estimate the cost of compliance is about eight cents per dollar of credit and that the costs of administering the program is approximately two cents per dollar of credit.

The second element of the public cost is indirect, but much more important. Taxes distort economic behaviour – decisions to save, invest and work – resulting in a reduction in economic efficiency and economic output. The marginal cost of funds (MCF) quantifies the cost associated with raising one dollar of taxes (or keeping them higher than otherwise required) to finance public expenditure or tax subsidies, such as R&D tax credits.[18] It is calculated as the $1 transfer of resources from the private to the public sector plus the marginal excess burden (MEB) or marginal efficiency loss from taxation.

The size of the efficiency loss, or MEB, from taxation depends on the tax used to generate revenue. Baylor and Beauséjour (2004) use a Canadian general equilibrium model to quantify the MEB for different taxes. Financing a tax subsidy by raising corporate income taxes is associated with a relatively high MEB of 0.4, or 40 cents for every dollar raised, due to the damaging effects of such taxes on investment and the tax base. Dahlby and Ferede (2011) generate an even higher MEB of about 0.7, or 70 cents, associated with the federal government levying a dollar of corporate income taxes.

Other taxes impose less harm to the economy. Baylor and Beauséjour (2004) show that a dollar raised through a value added sales tax (VAT) is associated with a relatively low MEB of about 0.1 since a VAT is broadly applied to most goods and services and helps minimize market distortions. To estimate the costs of financing the SR&ED tax credit, Parsons and Phillips (2007) calculated a weighted average MEB for the Canadian economy of 0.27, with weights reflecting federal government reliance on each type of tax. This means that $1 raised through the tax system to finance the SR&ED tax credit imposes an efficiency cost on the economy of about 27 cents.[19]

Weighing the Costs and Benefits

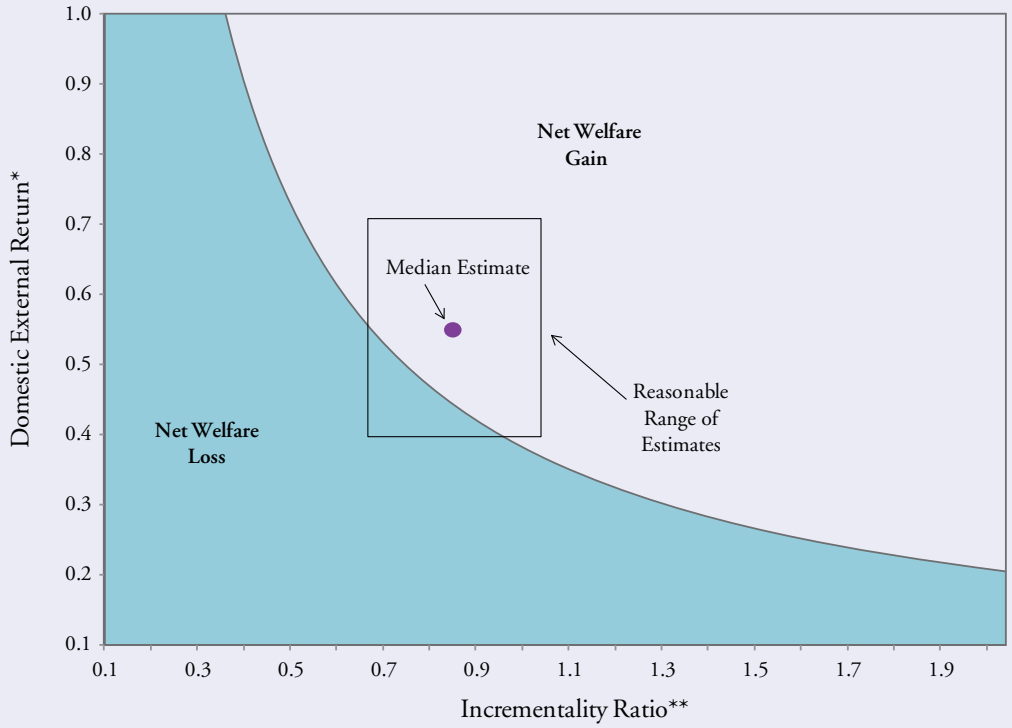
An evaluation of the SR&ED program must account for all the costs and benefits discussed above. Parsons and Phillips (2007) employ a simple welfare model of R&D investment that factors in each of the key evaluation variables – R&D spillovers, sensitivity of R&D investment to tax credits, the marginal cost of funds, as well as compliance and administrative costs. Using mid-point estimates from the literature discussed above, they find that the tax credit appears to generate a net welfare benefit of 11 cents per dollar of subsidy. In other words, the additional R&D stimulated by the credit appears to generate a high enough social return to more than offset the costs.

However, Parsons and Phillips caution that the results are highly sensitive to the underlying assumptions. A spillover return of only 13 percentage points lower than the median estimate tips the scale to a net welfare loss. In other words, for the SR&ED to record a net benefit it must generate spillovers in excess of 43 percent. Given the wide range of estimates and the difficulty in measuring these spillovers, it is not difficult to imagine a scenario where the spillovers could fall below this level. Similarly, the incrementality ratio would only need to fall by 0.2 points to yield a net welfare loss. Overall, based on the authors' reasonable range of estimates, the bulk of estimates would support a net benefit from the program, but with some chance of a welfare loss.

18 One can also interpret the MCF as an opportunity cost, namely the benefit that could have instead been realized by lowering other taxes instead of providing an SR&ED tax credit. For a more comprehensive discussion of the Marginal Cost of Funds see Dahlby (2008) and Dahlby and Ferede (2011).

19 This is remarkably close to Dahlby and Ferede's (2011) estimate of 0.26 (or in MCF terms 1.26) for the federal government.

Figure 5: Welfare Effect of the SR&ED Tax Credit



*Spillover benefits generated in Canada per dollar of R&D. Equals domestic return on R&D in Canada less the private return.
**Additional R&D per dollar of R&D subsidy.
Source: Parsons and Phillips (2007).

Table 1: How to Raise the Net Benefit of R&D Tax Incentives in Canada

↑ Benefits	↓ Costs
✓ Increase the amount of R&D generated for every dollar of tax incentive.	✓ Decrease the cost of financing the tax subsidy – rely on the least distortionary taxes to raise revenue.
✓ Increase the spillover benefits associated with business R&D in Canada	✓ Decrease compliance and administrative costs.

Source: Author based on evaluation framework used by Parsons and Phillips (2007).

From the perspective of a provincial government, provincial R&D tax credits are less likely to pass the cost-benefit test, according to Dahlby (2005). The reason is that a portion of the spillovers is likely to cross provincial boundaries, reducing the size of the benefit that each province receives on its R&D subsidies.

Federal Tax Policy Implications

While the previous section offers evidence that the SR&ED tax incentive appears to generate a net benefit for Canada, the analysis does not imply that the current program is optimal, or that there is no room for improvement.[20] Moreover, there is a great deal of uncertainty regarding this net benefit given the wide range in estimates from the literature, particularly those relating to spillover benefits.

The implication is that policymakers should keep a watchful eye on SR&ED and other related R&D tax incentives to make sure they add value. For the federal government in particular, proposed tax changes aimed at fostering R&D should be focused on improving either the benefit or the cost side of the cost-benefit equation, as shown in Table 1.

On the costs of financing SR&ED tax credits, some progress has been made to reduce Canada's reliance on the most harmful, or distortionary, taxes. The federal government's commitment to lowering the corporate income tax rate to 15 percent by 2013 will give Canada the lowest marginal tax rates on new investments among G7 countries (Department of Finance 2010). Harmonization of sales taxes in Ontario has also been positive for Canada's overall the tax mix, with the predicted impact of increasing investment and jobs through its elimination of taxes on business capital purchases (Smart and Bird 2008; Mintz 2010), benefits that could have been realized in BC before the cancellation of its HST. The benefits of harmonization should help offset some of the effects of the two-percentage-point-reduction in the federal Goods and Services Tax (GST), which increased the federal government's reliance on more harmful corporate and personal income taxes.

The Canada Revenue Agency (CRA) has also made some improvements to the SR&ED application forms over the past decade and announced administrative improvements in the 2008 federal budget. However, the program is still widely considered expensive to comply with, especially for small firms (Wensley 2010). In particular, a recent paper by the Canadian Chamber of Commerce (2011) argues that its members spend too much time on compliance activities. Some companies say they are experiencing a lack of predictability, as claims that were once approved are now being turned down.

However, any efforts to lower compliance and administration costs should be done carefully and weighed against the possible consequences. The SR&ED program, like other tax programs, necessarily involves a great deal of oversight and documentation to protect against potential abuses. A recent *Globe and Mail* article (McKenna 2011) highlights anecdotal cases of abuse, where improper or even fraudulent documentation is used to satisfy SR&ED claims. While a more comprehensive study is required to better understand potential program abuses, the key message is that a lack of enforcement and documentation could lead to the spread of routine business activities that do not meet the definition of qualifying expenditures (described in Box 1) as being incorrectly classified and reported as SR&ED. Therefore, in the context of the evaluation framework, the benefit of lower administration and compliance costs could be more than offset by a decline in social benefits as subsidies are channelled to non-R&D activities. One way to minimize compliance costs without raising the risk of illegitimate claims is to ensure tax rules are transparent, simple to understand and consistently applied.

20 The analysis is based on average parameters over a period of time and concludes that there has likely been a net welfare benefit from the program. Determining the optimal SR&ED tax subsidy would require equating the marginal benefits of the program with its marginal costs.

Perhaps the greatest opportunity for improvement is on the benefit side of the equation. Of course, there are a number of policies unrelated to tax that may increase the value of existing R&D tax incentives, such as potential changes to patent laws, grant programs, capital market rules, regulations and competition policy. There are also a number of more detailed SR&ED design considerations that may be improved. However, the next section is focused specifically on some broader tax policy options.

So what should be done? Canadian tax policy should be focused on creating a competitive tax environment across the entire innovation value chain, from initial R&D through commercialization to the development and production of new products and services in Canada. In the following section, I will show that the current system of tax support is front-end loaded, pushing firms to undertake R&D though upfront subsidies. Meanwhile, the rewards from R&D and other innovative activities are taxed, often at rates above many of Canada's international competitors, creating a disincentive to commercialize, develop and produce new products and services in Canada. This likely has a negative impact on the level of R&D and the amount of spillover benefits accruing to Canada. The following tax policy options are aimed at generating more value from Canada's existing incentives through a more balanced approach to R&D tax policy.

Addressing Market "Pull" Factors

As noted, the SR&ED provides one of the world's most generous upfront incentives to undertake R&D in Canada. However, once investments in R&D lead to commercial success in the form of new products, services and processes, the income is taxed like any other form of investment.

Recent evidence suggests that it is more likely that firms will undertake R&D in Canada if the returns, or fruits of R&D efforts, are taxed at a low rate. McKenzie and Sershun (2010) show that R&D investment is responsive to not only "push" tax factors (upfront subsidies such as the SR&ED tax credit) but also "pull" factors (the rate at which future production from R&D is taxed). Examining data in nine countries over a period of 19 years, they find that the pull effect of the production tax system is highly important and of similar magnitude to the push effect: a 10 percent decrease in the effective tax rate on marginal production costs leads to a 6 percent to 8 percent increase in R&D intensity (R&D to output) in the long run.

This finding should not be surprising. Innovative activity tends to cluster geographically, with R&D often linked with product development and production activities. A widely cited study by Audretsch and Feldman (1996) shows that in industries where industry R&D, university research and skilled labour are most important, there is a greater propensity for activity to cluster in a particular region than in other less knowledge-based industries. Reviewing the literature, Feldman (2000) notes that production is most geographically concentrated in industries where new knowledge is most important. This suggests that there may be limits to the extent R&D and subsequent production activities can be separated. In other words, R&D and production are, to some extent, complementary. The linkages of innovation activity – from R&D to subsequent production – within regions or countries may help explain why pull tax factors are empirically important drivers of R&D activity.

Also supporting the need to improve the "pull" forces of innovation is the link between R&D activity and investment in physical machinery and equipment (M&E). Firms that undertake R&D tend to be high growth and capital intensive. They are focused on developing new products and processes that use less labour (Harris 2005). Moreover, firms that undertake R&D may be more focused on adopting new technologies through the acquisition of M&E.

Analyzing investment data in Canada's manufacturing sector, Sourare (2009) found that M&E and R&D investments are positively linked in the long run, and the direction of causality runs in both directions – a finding supported by

previous studies.[21] The link between business investment in M&E and R&D suggests that tax policies should not be narrowly focused on providing upfront subsidies for R&D, but should also foster greater business investment.

Overall, these studies suggest that Canada needs to consider not only upfront subsidies like the SR&ED tax credit, but also the competitiveness of the overall corporate tax system. As McKenzie (2006) notes:

> "Failing to take account of both effects might result in government's giving with one hand and taking away with the other: encouraging R&D by offering direct subsidies...but discouraging R&D by imposing high production taxes on the new products and processes that are the fruits of R&D."

The good news is that there have been strides in the right direction to improve the competitiveness of Canada's corporate tax system, increasing the incentives to undertake R&D. The combined federal and provincial corporate income tax rate has dropped from 43 percent in 2000 to 29 percent in 2010 and is set to fall further to about 25 percent by 2012. These reductions, combined with sales tax harmonization efforts, will cause the marginal effective tax rate on new investment (METR) in Canada to fall from 28 percent in 2009 to about 18 percent in 2013 (Chen and Mintz, 2011).[22]

However, even with these changes, Chen and Mintz (2011) estimate that Canada will lag slightly behind the OECD average for business tax competitiveness in 2013, as other countries implement their planned or proposed corporate tax cuts. An ongoing concern is that the tax system continues to create an unlevel playing field, with companies in the service sector facing a tax disadvantage relative to manufacturers. Indeed, Chen and Mintz note that the gap between Canada's METR ranking in services relative to manufacturing is the largest of all OECD countries. The gap mainly arises from investment tax credits and other targeted incentives that primarily benefit manufacturers.

There may be other tax options for encouraging additional R&D through "pull" factors. Part of the solution may lie in re-examining how income on Canadian intellectual property (IP) is taxed in an international context. Under current tax rules, royalty and licensing income derived by Canadian companies from IP developed in Canada or developed or acquired by Canadian foreign affiliates and repatriated to Canada are subject to full Canadian tax. According to Mustard, Pantaleo and Wilkie (2009), the current tax system encourages companies to transfer IP outside of Canada, where licensing and royalty income is often taxed at lower rates. They also argue that the current system discourages Canadian companies with foreign operations from repatriating IP to Canada.

This argument is supported by the findings of Finance Minister Jim Flaherty's Advisory Panel on Canada's System of International Taxation. In its consultations, the panel noted that Canadian businesses often choose to move IP outside of Canada.[23] To increase commercialization of R&D in Canada, the panel suggested that the federal government monitor developments in other countries and consider the option of exempting IP-related income from Canadian tax, or taxing it at a preferential rate.[24]

Other countries have, or are considering, moving to a system where IP income is taxable at a significantly lower rate than regular business income, a tax arrangement known as a "patent box." The UK, for example, recently announced that profits attributed to patents after April 2013 will be taxed at a rate of only 10 percent, well below its 26 percent general corporate income tax

21 Evidence is also presented in Harris (2005).

22 These METR estimates were prepared in February 2011 assuming the HST in BC would proceed. Therefore, they somewhat overstate Canada's international corporate tax competitiveness in 2013. The METR is a summary measure of the competitiveness of a jurisdiction's corporate tax system. It includes all taxes that impact a businesses incentive to invest in a new project, including corporate income taxes, depreciation allowances, interest deductibility and provincial retail sales taxes.

23 Advisory Panel on Canada's System of International Taxation, p. 86, paragraph 7.31 (2008).

24 Advisory Panel on Canada's System of International Taxation, p. 98, paragraph 8.15 to 8.16 (2008).

rate.[25] According to the UK's HM Treasury and HM Revenue and Customs (2011):

> "The aim (of the patent box) is to provide an additional incentive for companies in the UK to retain and commercialise existing patents and to develop new innovative patented products. This will encourage companies to locate the high-value jobs associated with the development, manufacture and exploitation of patents in the UK and maintain the UK's position as a world leader in patented technologies."

Similar patent boxes were introduced in the Netherlands and Belgium as of 2007, and in Luxemburg and Spain in 2008. In the US, while no patent box exists, MNEs can often shelter foreign-source royalty and patent income earned by their subsidiaries by applying excess foreign tax credits from other income.[26] Moreover, many countries have generous tax depreciation deductions for newly acquired IP that are not available in Canada.

In principle, taxes on highly mobile forms of income should be kept relatively low (Mirrlees et. al. 2011). Patent related income is very mobile – it can easily be transferred from location to location. However, as patent boxes are relatively new, empirical evidence on their effectiveness remains sparse. In one of the few studies, Griffith, Miller and O'Connell (2010) of the London-based Institute for Fiscal Studies (IFS) have simulated the impacts of patent boxes, using previously estimated models of firm behaviour. They found that a country introducing a patent box can expect to attract more patents and patent income. At the same time, they found the rise in patent income is not enough to offset the lower tax rate, resulting in a decline in tax revenue from patent income.

The IFS study raises important questions about the direct tax revenue impacts of a patent box policy. But it does not provide evidence as to whether patent boxes result in a rise in R&D and commercialization activity – and the associated increase in tax revenues that may result. While R&D and patent activities can be separated, all else equal, a firm would likely prefer to license the technology in the same jurisdiction where the idea was developed in order to avoid the costs and administrative burden associated with establishing separate licensing companies or branches in other countries. In the UK, retaining IP is one of the motivations behind the proposed patent box. The HM Treasury and HM Revenue and Customs (2011) report claims that "The Patent Box will encourage investment and development of new patents and prevent movement of IP offshore by innovative business who otherwise might invest elsewhere."

There is also the possibility that patent boxes may increase the size of domestic spillover benefits from related R&D to the extent that IP is shared and further developed within the patent box country instead of abroad. While this possibility requires further analysis, a widely cited study by Jaffe, Trajtenberg and Henderson (1993) shows that there is indeed a local bias to patent citation activity in the US: patents are most likely to be cited (or used) in the same state, and in particular, the same metropolitan area, as where the patent was generated.

Overall, much still needs to be learned about patent boxes and their effect on innovation performance. One of the main challenges is the patent box's design, especially determining what types of patents and related income should be eligible for inclusion. Such eligibility requirements come with their own set of administrative and compliance issues.[27]

Still, Canadian governments should watch closely as other countries change the way in which they

25 The patent box deduction will be available to businesses that actively hold a qualifying patent or other qualifying IP and receive income related to that patent or IP. Eligible patents are proposed to include patents granted by UK's Intellectual Property Office and the European Patent Office.

26 US MNEs earn foreign tax credits for taxes paid on income earned by their foreign subsidiaries. FTCs reduce and often eliminate US taxes payable on foreign income that is repatriated to the US.

27 For example, as discussed by Griffith and Miller (2010), it may be easy to identify income from technology that a company licenses out, but it is more challenging to identify income from patented technology that a firm uses to generate income. Challenges may also arise if income is coming from a variety of patents, but where only some are eligible for the patent box.

promote R&D and commercialization activity through greater use of "pull" drivers as opposed to the more traditional reliance on R&D tax subsidies. Just as competition has driven down corporate income tax rates, it is also leading to competition in the IP area. While reductions in Canada's corporate tax rate have made the tax treatment of IP income more competitive, it is unclear whether the lower rate will be sufficient to prevent IP from being transferred out of Canada and developed in countries that are now aggressively pursuing patent boxes.

As suggested by the Advisory Panel on Canada's System of International Taxation, the federal government should monitor developments in other countries and study whether there may be opportunities to improve the tax treatment of IP income, with the goal of improving Canada's record at commercializing the results of R&D performed in Canada, as well as encouraging the acquisition of IP from outside Canada for further development and licensing.[28]

Encouraging Small Innovative Firms to Grow and Expand

The tax system should not discourage small Canadian start-ups or firms in early phases of technology development from growing into larger, globally competitive companies. As previously noted, small companies receive strong preferential tax treatment for R&D investment in Canada. In particular, current tax rules provide small CCPCs with an enhanced SR&ED credit of 35 percent for spending up to $3 million. This amount is fully refundable on current expenditures and 40 percent refundable on capital expenditures regardless of whether there is any taxable income. In contrast, medium to large companies receive a much-reduced 20 percent credit that is non-refundable.[29]

Such favourable tax treatment for small businesses is not limited to the SR&ED tax incentive. As of 2011, corporate income from CCPCs earning $500,000 or less is taxed at a federal rate of 11 percent compared to 16.5 percent for large firms. Moreover, there are a number of special tax measures, including the treatment of dividend income and lifetime capital gains, that favour small over large business (Chen and Mintz 2011).

This asymmetric tax treatment creates a large gap in the subsidy rate received by small and large firms on R&D investments (Figure 6). Indeed, in an international context, Canada offers the most preferential treatment to small firms: the difference between the small and large-firm R&D subsidy rate is higher in Canada than any other OECD country (Finance Canada 2009).[30]

The main argument for more favourable R&D tax support towards small business is that it compensates for their lack of access to financing. There are good reasons why small firms may find it especially difficult to finance R&D investments, including the lack of collateral in many technology start-ups, asymmetric information between financers and the firm (e.g., due to the technical nature of R&D and fears ideas will be leaked to competitors), and the uncertainty of future returns. The theoretical literature is inconclusive on whether information asymmetries lead to over or under investment.[31] However, the empirical

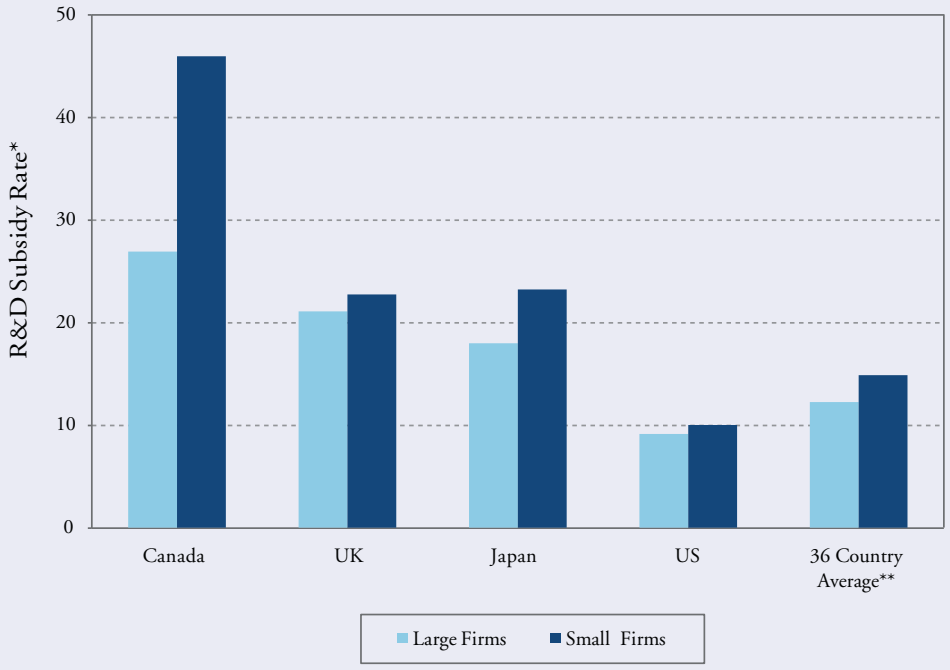
28 Further study should include any administrative issues and potential abuses that may arise from such a policy.

29 In contrast, most provinces with provincial R&D tax incentives do not discriminate between large and small firms, both in terms of the provincial credit rate and refundability. However, some provinces (e.g., Alberta) impose a R&D expenditure limit.

30 In addition to Canada, only five other OECD countries (out of 30) provide an enhanced federal R&D tax credit for small firms.

31 The theoretical literature does not always reach the conclusion that asymmetric information leads to underinvestment. Boadway and Keen (2006), for example, use a model of adverse selection to show that asymmetric information can lead to bad (or "lemons") projects being financed, resulting in overinvestment. However, this finding is based on the strong assumption that entrepreneurs are risk neutral, which is likely not the case if entrepreneurs are investing their own wealth in the project. Braido, da Costa and Dahlby (2011) extend the Boadway and Keen (2006) model to allow for risk aversion by entrepreneurs, and they find that the market may finance too many, too few, or the wrong kind of start-ups depending on the degree of risk aversion and other model parameters. In short, the theoretical models suggest that government should be cautious in how it attempts to address perceived capital market imperfections caused by asymmetric information.

Figure 6: Canada's Asymmetric R&D Tax Treatment Between Small and Large Firms



* Percentage reduction in cost of R&D due to tax incentives.
** Unweighted average of R&D subsidy rates from 30 OECD countries and 6 emerging and transition economies.
Source: Finance Canada (2009).

evidence suggests that small firms, particularly those in their early stages, face the greatest constraints to financing R&D due to imperfections in capital markets (Hall 2002, Hall and Lerner 2009). A more generous, refundable tax credit is intended to alleviate capital market problems faced by small firms, giving them financial resources to undertake R&D while in the pre-profit stage of development. Others argue that more favourable tax treatment is required to address the higher compliance and administration burden that small businesses face on SR&ED claims as described previously.

However, some commentators have voiced concerns over the extent of Canada's asymmetric tax treatment towards R&D. Wensley and Warda (2007) and Wensley (2010), for example, argue that the current tax rules significantly limit the benefits larger firms outside the CCPC definition, namely US multinationals, receive from SR&ED credits.

There is also the question of how well the enhanced subsidy targets the firms most in need of support. The size of a business may not be always be associated with capital market problems. For example, the age of the company, namely whether it is a start-up or a mature firm, may indicate more about its problems raising capital than its size. Examining the evidence, a paper by International Monetary Fund staff argues that "best response to market failures that may adversely affect SME (small and medium sized enterprises) is unlikely to be through size-related tax measures."[32] The IMF paper highlights the challenges of using tax policy to address problems faced by a target group of small firms, arguing that

32 Background paper prepared by IMF staff with input from participants from other organizations participating in the International Tax Dialogue Conference 2007 (OECD, World Bank and Inter-American Development Bank). See International Tax Dialogue (2007).

that such a system can create additional distortions (i.e., incentives to stay small or split up companies for tax purposes), and increase administrative and compliance costs.

Most importantly, the preferential treatment of small firms may have the unintended consequence of encouraging young, innovative firms to stay small and not grow into larger companies. As a firm grows, it may lose its favoured status as a small CCPC and face a significant increase in its tax burden. Indeed, simply moving from a qualifying small CCPC to a public or foreign-controlled company results in an immediate reduction in the eligible SR&ED credit rate from 35 percent mainly refundable to 20 percent non-refundable.

But even as a firm achieves initial R&D success and grows, the innovation process does not stop. It will likely need to undertake additional R&D to remain competitive, by continuously introducing new and improved products, services and processes. In fact, nearly three-quarters of Canadian business R&D is performed by firms with more than $50 million in revenues (STIC 2011). Subsequent rounds of R&D performed by a medium to large firm may produce similar knowledge spillover benefits as its R&D at the start-up stage, but carries much lower levels of tax support.

A recent study by Chen and Mintz (2011b) finds that Canada's tax system, through the claw back of tax incentives (including R&D tax credits), creates a "taxation wall" for small business that inhibits growth. In particular, they show that marginal effective tax rates on capital investments made by a Canadian entrepreneur rise sharply as the business grows. As an example, the effective tax rate roughly doubles when the business grows from $1 million in assets to more than $30 million. Based on these results, Chen and Mintz argue that Canada adopt more neutral tax policies to promote small business growth. Their findings follow a similar concern raised by the OECD (2008): "small Canadian owned firms are also unduly advantaged, which may discourage them from growing and becoming more productive."

More empirical evidence is required to examine the extent to which Canada's tax system impedes growth of small businesses. Leung, Meh and Terajima (2008) show that Canadian firms tend to be on average much smaller than US ones, and that the average size of Canadian firms has been falling over time. Moreover, they show that the predominance of small firms helps explain why Canada's productivity lags behind that of the US. Of course, as the authors argue, differences in tax codes represent only one of many possible explanations as to why Canadian firms are smaller.[33] Other factors that may help explain firm size distribution across countries include differences in small firm financing conditions, the protection of property for entrepreneurs, and the size of the market.

To help remove growth disincentives, the federal government should consider options to reduce the asymmetric treatment of small and large firm R&D and other related investments. In this respect, the planned reduction of the general federal corporate income tax rate to 15 percent by 2013 is a positive development, as it helps reduce the disparity between large and small firms in terms of how the profits stemming from R&D activities are taxed.[34]

But there are a number of other options the federal government could consider. The current system reduces the R&D expenditure limit eligible for the refundable 35 percent tax credit based on established thresholds for prior-year

33 The authors acknowledge that more research is required to determine the impact of tax differences. Chen, Lee and Mintz (2002) suggest that differences in tax codes provide small businesses with an incentive to keep income below certain thresholds to take advantage of preferential rates in Canada.

34 Chen and Mintz (2011b), however, note that many provinces have moved in the opposite direction, with the small business tax rate being cut more aggressively than the general corporate tax rate. Manitoba, for example, has announced that it will eliminate its provincial tax rate for small business entirely by 2012.

taxable income and capital. Thresholds for which the 35 percent rate applies have increased in recent years, but they still strongly favour small business, with the credit rate quickly falling to 20 percent after relatively small increases in income or capital. For example, a small CCPC would be eligible for a 35 percent refundable tax credit on the first $3 million of R&D spending if it had prior-year taxable income under $500,000 and taxable capital under $10 million. If the small CCPC instead had prior-year taxable income of $800,000 (but with the same amount of capital), it would be eligible only for a 20 percent non-refundable credit rate on all amounts of R&D spending.

In this hypothetical example, the financing constraints (if any) faced by the firm in the two scenarios are, in all likelihood, fundamentally the same, but the tax subsidy is dramatically different. These large swings in tax support could be reduced by closing the small-large SR&ED subsidy rate gap by having a more graduated or phased reduction in the tax credit as firms grow and expand, or a combination of both. The new system would need to be carefully designed so that it does not significantly increase the fiscal cost of the already generous SR&ED program or raise the tax system's complexity.

Conclusions

A commonly voiced concern is that Canadian businesses spend relatively little on R&D despite having access to some of the world's most generous R&D tax incentives. This observation has called into question the effectiveness of Canada's generous R&D tax incentives, particularly the flagship federal Scientific Research and Experimental Development (SR&ED) program. In this *Commentary*, I have shown that the SR&ED program appears to generate a narrow net benefit for Canada, based on reasonable estimates of key evaluation variables – the sensitivity of R&D to tax incentives, knowledge spillovers from R&D, compliance and administrative costs, and costs of financing the incentives.

But this finding should be interpreted with caution. First, there is a great deal of uncertainty regarding the net benefit given the wide range in estimates from the literature, particularly those relating to spillovers. Second, the mere observation of a net benefit does not imply that the current SR&ED incentives are optimal, or that improvements cannot be made. If anything, the sensitivity of the results to underlying assumptions indicate that the SR&ED program is highly susceptible to falling into the "net loss" category in the absence of change.

In this *Commentary*, I have explored options for generating more value from Canada's federal tax policies toward R&D, using the SR&ED evaluation framework as a guide. The main conclusion, supported by other studies, is that Canada would likely benefit from a more balanced approached, focused on creating a competitive tax environment across the entire innovation value chain, from initial R&D through commercialization to the development and production of new products and services. The current system of tax support is front-end loaded, pushing firms to undertake R&D through one of the world's most generous tax subsidies. At the same time, the rewards to R&D and other innovative activities are taxed, at a rate that still exceeds most OECD countries, creating a disincentive to commercialize and develop new products and services in Canada. This likely has a negative impact on the level R&D investment and the amount of spillover benefits accruing to Canada.

This analysis has some federal tax policy implications. Most importantly, the tax system must not discourage firms from turning R&D into commercially viable ideas and technologies as well as new products and services produced in Canada. This requires that Canadian taxes on the fruits of R&D – the returns on IP and new and improved products and services – are at internationally competitive levels. Past and planned corporate tax reductions are an important step in the right direction. But even with these tax cuts, research shows that Canada's overall business tax competitiveness will still lag behind the OECD average and that the tax system remains biased against the service sector.

Moreover, in recent years there has been a trend in Europe toward lowering the tax on income derived from intellectual property such as patents. As suggested by the Advisory Panel on Canada's System of International Taxation, the federal government should monitor these developments and study whether there may be opportunities to improve the tax treatment of IP income.

Another implication is that the tax system should not discourage small firms to grow from the start-up or early phases of technology development into larger, globally competitive companies. The current tax system creates a disincentive for growth through its strong preferential treatment of small business R&D. Indeed, Canada has the largest gap between small and large firm R&D tax subsidy rates of all OECD countries. Moving to a more neutral system that reduces the large swings in tax support between small and large firm R&D tax treatment would reduce this growth disincentive.

Overall, it seems that the federal government's best bet is to concentrate efforts on creating a competitive tax system across the entire innovation value chain. Innovation is a multi-stage, integrated process that encompasses more than R&D. It often starts with the discovery of new knowledge, spreads to the commercialization and adoption of ideas and progresses toward the development of new and improved products, services and processes. Each stage of the innovation chain is important, and this should be reflected in Canada's tax system.

In recent years, Canada has been moving in the right direction with general corporate tax reductions, helping create market pull drivers and reducing the disincentive for growth. But Canada cannot sit still, as other countries look to attract R&D activity and the skilled labour it brings. A tax system that allows firms to reap more of the rewards of their innovative activity is likely to improve Canada's overall innovation performance and economic competitiveness.

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