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THE EFFECTS OF COMPLIANCE COSTS ON GLOBAL R&D TAX INCENTIVES

STEFAN J. RICHTER

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Reviewed and approved\* by the following:

Rick Laux  
Assistant Professor of Accounting  
Thesis Supervisor

Orie Barron  
Professor of Accounting  
Honors Adviser

\* Signatures are on file in the Schreyer Honors College.

## ABSTRACT

In this study, tax compliance costs are incorporated into previous research that analyzed and compared 28 countries' tax incentives for encouraging private investment in research and development (R&D). R&D has proven to provide substantial economic benefits to the country in which it takes place, but R&D creates positive externalities in that the firm conducting the research does not fully receive all of the benefits. Therefore, firms may invest below the optimal amount of R&D. Because of this potential underinvestment and given the benefits to a country's economy, governments provide incentives to encourage firms to conduct greater amounts of R&D. Tax benefits are a common incentive that governments use to do this. The substantial differences between each country's tax incentive systems make it difficult to compare the relative benefits among countries. Consequently, previous researchers have developed the B-Index, which provides a quantitative measure of how beneficial each country's R&D tax incentives are in relation to one another. Even though the B-Index incorporates many elements of R&D tax incentives, compliance costs that firms incur to obtain R&D tax benefits are not included in the formula. Firms often cite complex tax regulations and high compliance costs as barriers to obtaining these R&D tax benefits. In this study, previous research and data are combined to develop estimates for compliance costs on a country by country basis. These compliance costs are then incorporated into the B-Index. Despite the fact that firms often cite high compliance costs, I find the costs affect the ranking of countries' R&D tax incentives in a negligible amount.

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## **Chapter 1**

### **Introduction**

Research and development (R&D) is a driving force behind the growth and success of many firms and many countries' economies. Prior research has shown the positive effects of R&D in helping companies increase earnings and market value (Sougiannis, 1994) and with the overall growth of countries' economies (Corrado, 2012). In 2011, the Federal Reserve Chairman, Ben Bernanke gave a speech highlighting the central role that R&D plays in economic growth. Bernanke stated, "Innovation and technological change are undoubtedly central to the growth process; over the past 200 years or so, innovation, technical advances, and investment in capital goods embodying new technologies have transformed economies around the world."

Even though there is strong evidence that R&D is beneficial to a country's economy, Arrow (1959) argues that private businesses may underinvest in R&D activities; given this potential underinvestment, Arrow further argues that governments should provide incentives for firms to increase R&D. Arrow explains that R&D provides positive externalities because the firm conducting the research does not fully receive all of the benefits of their work, and R&D is an inherently risky activity with unknown outcomes. Given this nature of R&D, there is concern that firms may not invest in R&D at the optimal amount. Therefore, Arrow argues the government should help finance R&D activities. In the speech given by Bernanke discussed above, Bernanke agrees with Arrow's theory of firm underinvestment in R&D. Arrow's theory provides the basis for Bernanke's speech in which he discusses the government's role in promoting R&D in the United States.

Governments have created a myriad of policies and programs to encourage R&D. Tax incentives are an important method used by dozens of countries to encourage companies to undertake more R&D. Tax incentives reduce the cost for companies to conduct R&D by providing a subsidy that reduces companies' tax liabilities. Examples of tax incentives include tax credits, tax deductions, tax super deductions, and accelerated capital depreciation (Stewart, Warda, and Atkinson, 2012).

R&D tax incentives are common among developed countries, but the exact form of the tax incentive can vary substantially from country to country. Consequently, McFetridge and Warda (1983) developed the B-Index to provide a quantitative ranking of how beneficial R&D tax incentives compare among countries. The B-Index equals the amount of pre-tax income that a firm needs to earn to cover the cost of spending one additional United States' dollar (USD) on R&D. A lower B-Index value indicates a country provides more beneficial R&D tax incentives (Warda, 2006). Since the development of the B-Index in 1983, it has been updated, most recently in July 2012, to reflect the current structure of countries' R&D tax incentives (Stewart, Warda, and Atkinson, 2012).

The B-Index incorporates many aspects of R&D tax incentives, but the B-Index fails to incorporate compliance costs and the complexity of tax codes. Compliance costs and the complexity of tax codes have been cited as hindering businesses from taking advantage of tax incentives (McKinnon). Governments require companies to meet certain R&D standards and comply with tax regulations to obtain these tax benefits (Warda, 1998). Governmental "red tape" and compliance measures vary by country, but they add barriers for businesses to obtain these tax breaks. Given what appear to be high compliance costs and complex tax codes, it seems they may have a significant impact on the ranking of countries' R&D tax incentives. However, compliance costs have not been incorporated into the B-Index or any other research that compared countries' R&D tax incentives.

Therefore, I hypothesize that when including a measure of compliance costs and the complexity of tax codes into the B-Index, the impact on countries' R&D tax incentives' rankings will be significantly impacted. To test this hypothesis, this paper estimates compliance costs per USD of R&D tax expense because the B-Index is stated in terms of the tax benefits associated with one additional USD spent on R&D. I find the average compliance cost per USD of R&D expense equals \$0.06 for the 28 countries considered in the model. These compliance costs are then incorporated into the B-Index and the new B-Index values and rankings are calculated. When these compliance costs are incorporated into the B-Index, I find the average absolute change in a country's ranking equals 1.857. When an outlier is excluded, the average absolute change in a country's ranking drops to 1.278. Given this analysis, I find compliance costs have essentially no effect on the quantitative ranking of countries' tax incentives that encourage R&D.



## Chapter 2

### R&D's Importance in Economic Growth

R&D plays a central role in fostering economic growth. Previous research analyzing the economic impact of R&D finds that it has a positive effect on the growth of countries' economies. For example, Corrado, Haskel, Iommi, and Jona-Lasinio (2012) study the economic impact of intangible capital on the economies of the United States and the European Union (EU). Intangible capital includes R&D, design, and branding. They find that investment in intangible capital plays a major role in economic growth as intangible capital accounted for 65% of the economic growth in the United States and 50% of the economic growth in the EU between 1995 and 2007. While R&D is only one part of intangible capital, this study shows the importance of R&D in the growth of countries' economies.

There is also indirect evidence to further demonstrate the importance of R&D in economic growth. Many countries have set forth policy measures and goals to increase their R&D expenditures as a means to economic development. For example, Canada's Department of Finance in 2006 issued a long term economic plan known as *Advantage Canada: Building a Strong Economy for Canadians*. One of the four main principles of the plan emphasized investing in sustainable growth. The plan called for the Canadian government to "invest and seek partnerships with the provinces and the private sector in strategic areas that contribute to strong economies-including primary scientific research."

The EU's 2000 Lisbon Agenda and Europe 2020 strategies provide more examples of countries setting forth policy measures to increase R&D expenditures. The overall objective of the Lisbon Agenda aimed at making the EU "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable growth with more and better jobs and greater

social cohesion” (The EU at a Glance - Towards a Knowledge-Based Society). In order to meet this objective, one of the main goals of the plan called for devoting three percent of Gross Domestic Product (GDP) towards R&D. Despite failing to reach this goal by 2010, overall R&D in the EU increased during the decade. The Europe 2020 strategy renewed this goal of devoting three percent of GDP towards R&D as one of the five main points of this new plan (R&D Expenditure). The EU has included increasing R&D as one of its main goals to increase the EU’s economic competitiveness because of the economic benefits associated with R&D.

Further indirect evidence indicating the importance of R&D can be found in the recommendations given in the Organisation for Economic Co-operation and Development’s (OECD) report titled *Economic Policy Reforms 2013: Going for Growth*. This report recommends areas where each country should focus to grow its economy. When reviewing this report, a common recommendation for many countries such as Australia, Canada, the Czech Republic, Ireland, New Zealand, and Slovakia is for the country to increase R&D expenditures. For example, one of the four main recommendations for Canada calls for enhancing its R&D expenditures, while one of the four main recommendations for the Czech Republic and New Zealand call for both countries to increase their policy and public support for R&D. This report shows how the OECD stresses the importance of investment in R&D as a way for countries to grow their economies.

R&D plays a vital role in the economic growth of countries. Corrado, Haskel, Iommi, and Jona-Lasinio’s (2012) research shows the importance of R&D in the economic growth of the United States and EU, while countries’ policies encouraging R&D show the emphasis that countries place on R&D as a means to economic growth.

## Chapter 3

### Overview of R&D Tax Incentives

Given the previous discussion regarding the economic importance of R&D and considering Arrow's (1959) argument that companies may underinvest in R&D activities, many countries have enacted tax incentives to encourage R&D. The types of tax incentives and requirements to attain these benefits vary by country, but most of the tax incentives can be broken down into two main categories: tax credits and tax deductions (Stewart, Warda, and Atkinson, 2012).

#### **Tax Credits:**

Currently, 19 countries have some form of R&D tax credit in place. Tax credits offer a direct, dollar for dollar reduction in a company's tax liability (*Research Incentives in the New Tax Landscape*). R&D tax credits are generally offered in three forms: a volume tax credit, an incremental tax credit, and a hybrid of the two.

Volume tax credits, also known as a flat tax credit, are equal to a percentage of the total amount of R&D expenses incurred during the year (Stewart, Warda, and Atkinson, 2012). Canada's tax credit, known as the Scientific Research and Experimental Development Tax Credit (SR&ED credit), is an example of a volume credit. The SR&ED credit amount is equal to 20% of qualified R&D expenditures for large companies and 35% of qualified R&D expenditures for small and medium enterprises (SMEs) (Eberle, King, and Nowak, 2012). Austria also offers a volume based credit with it being equal to 10% of qualified R&D expenditures (*2012 Global Survey of R&D Tax Incentives*).

In contrast to the volume tax credit, an incremental tax credit requires firms to increase R&D expenditures over time. The firm then receives a credit as a percentage of the R&D expenses incurred that exceed a calculated base amount (Stewart, Warda, and Atkinson, 2012). For example, Ireland's incremental tax credit is calculated as 25% of the R&D expenses incurred in the current year that exceed expenses incurred in 2003 (Eberle, King, and Nowak, 2012). Italy's incremental tax credit is equal to 90% of expenses incurred in the current year that exceed the base amount, which is equal to the average expenses incurred during the years 2008-2010 (*2012 Global Survey of R&D Tax Incentives*). Governments tend to prefer this type of credit as it has more of a stimulating effect in increasing R&D expenditures year after year, but this credit is less desired by firms because it is harder to forecast the amount of the credit (Stewart, Warda, and Atkinson, 2012).

The last type of credit is a hybrid of the volume and incremental tax credits. For example, Japan's tax credit is equal to a volume tax credit of 8% to 12% of R&D expenses, depending on the size of the company, plus a 5% incremental tax credit for current year expenses that exceed the preceding three years' average R&D expenses (*2012 Global Survey of R&D Tax Incentives*). Portugal also offers a hybrid credit. The volume credit is equal to 32.5% of current year R&D expenses while the incremental credit is equal to 50% of current year expenses that exceed the average of the two preceding years' R&D expenses with a limit of €1.5 million (Eberle, King, and Nowak, 2012).

The United States' R&D tax credit, known as the Research & Experimentation Tax Credit (Research Credit), is one of the most discussed and analyzed credits in the world. The United States originally enacted the Research Credit in 1981; since then it has gone through substantial changes and variations (Eberle, King, and Nowak, 2012). Unlike most other countries' R&D tax incentives, the Research Credit is not permanent and must be reenacted by Congress every few years (Stewart, Warda, and Atkinson, 2012). Since 1981, the credit has been

extended 14 times, often retroactively (*The Research Tax Credit's Design and Administration Can Be Improved*).

Over the past three decades, Congress has enacted various methods in calculating the credit, and currently two different methods are offered. The regular credit, also known as the “traditional credit,” became effective in 1990. It is equal to 20% of qualified R&D expenditures that exceed the base amount. The base amount is equal to the greater of (1) the average sales during the previous four years multiplied by the minimum of (a) 16% or (b) the ratio of qualified R&D expenditures divided by sales during the years 1984 to 1988, or (2) 50% of the current year’s qualified R&D expenditures. For start-up companies that did not exist during the years 1984 through 1988, the base amount is equal to a “three percent fixed-base percentage for the first five years and then applying a formula approach for years thereafter, taking into account recent qualifying expenditures and recent gross receipts” (Eberle, King, and Nowak, 2012). As it can be seen, the regular credit’s calculation is very complex. Consequently, Congress enacted legislation, effective at the beginning of 2007 that created the alternative simplified credit (ASC). As the name implies, the calculation is less complex to calculate than the regular credit. The ASC is equal to 14% of current year qualified R&D expenditures that exceed 50% of the three preceding tax years’ average qualified R&D expenditures (*2012 Global Survey of R&D Tax Incentives*).

### **Tax Deductions:**

Tax deductions are another common form of tax incentives offered to encourage R&D. There are three main types of tax deductions: standard/special deductions, super deductions, and accelerated capital depreciation. All three types of deductions reduce a firm’s taxable income which consequently reduces the overall tax liability of a firm.

Standard/special deductions allow firms to deduct up to 100% of R&D expenses in the current year (Stewart, Warda, and Atkinson, 2012). Belgium’s special deduction, known as the

investment deduction, allows large firms to deduct 13.5% and SMEs to deduct 20.5% of the value of R&D investments in the current year. This deduction is in addition to the regular tax depreciation that is allowed for the investments (Cops, 2008).

Super deductions, the most widespread form of R&D tax deductions, permit firms to deduct more than 100% of R&D expenses in the current year. For example, India's super deduction rate is 200%. Therefore, a company in India could take a deduction of two USD for every one USD of R&D expenses incurred (Stewart, Warda, and Atkinson, 2012). Hungary and the Czech Republic also have a 200% super deduction, while the Russia and China use a 150% super deduction and the United Kingdom allows a 130% super deduction for large companies and a 175% super deduction for SMEs (*2012 Global Survey of R&D Tax Incentives*).

Lastly, some countries use accelerated capital depreciation as another form of a tax deduction. With accelerated depreciation, a firm can depreciate a R&D capital asset more quickly than if the asset was employed in some area in the firm other than for R&D. In Canada, if a capital asset is used 90% or more in a R&D capacity, the asset can be depreciated 100% in the first year. Capital assets used specifically for R&D purposes in South Africa are provided with the accelerated depreciation schedule of 50%, 30%, and 20% for years one, two, and three, respectively (*Research Incentives in the New Tax Landscape*).

The following table provides a summary on a country by country basis as to whether the country offers tax credits and/or tax super deductions, the two most common forms of R&D tax incentives offered:

Table 3-1: R&amp;D Tax Incentives Offered By Country

Country	Tax Credit	Super Deduction
Australia	X	X
Austria	X	X
Belgium	X	X
Brazil	X	X
Canada	X	
Chile		
China		X
Czech Republic		X
Denmark		
Finland		
France	X	
Germany		
Hungary	X	X
Iceland		
India		X
Indonesia		
Ireland	X	
Israel		
Italy	X	
Japan	X	
Luxembourg		
Malaysia		X
Mexico		
Netherlands		
New Zealand		
Norway	X	
Poland		
Portugal	X	
Russia		X
Singapore		X
Slovak Republic		
Slovenia		X
South Africa		X
South Korea	X	
Spain	X	
Sweden		
Switzerland		
Taiwan	X	
Turkey		X
United Kingdom		X
United States	X	

Adapted from: *Research Incentives In the New Tax Landscape*. Rep. Ernst & Young, July 2010. Web. 14 Mar. 2013.

Stewart, Luke A., Jacek Warda, and Robert D. Atkinson. *We're #27!: The United States Lags Far Behind in R&D Tax Incentive Generosity*. Rep. The Information Technology & Innovation Foundation, July 2012. Web. Jan.-Feb. 2013.

Governments from around the world have devised many forms of R&D tax incentives which use different formulas and rates to calculate the reduction in tax liabilities. Each country has developed a unique system as each government has different objectives and varying methodologies as to what works best in a particular country.



## Chapter 4

### The B-Index: Comparing Countries' R&D Tax Incentives

Given the varying types and methods of calculating countries' R&D tax incentives, researchers have developed ways of comparing the incentives among countries. The B-Index, a common method of doing this, was originally developed by McFetridge and Warda (1983). From 1996 until 2009, the OECD used it as the official metric to compare countries' R&D tax incentives (Warda, 2006 and Stewart, 2012). Since 2009, the Information Technology & Innovation Foundation (ITIF), with the help of Warda, has continued to update the B-Index to track the relative benefits of countries' tax incentives. The ITIF most recently updated the B-Index in July 2012 (Stewart, Warda, and Atkinson, 2012).

The B-Index is defined as “the present value of before tax income necessary to cover the initial cost of R&D investment and to pay corporate income tax, so that it is profitable to perform research activities” (Warda, 2009). In other words, if a firm was to spend one additional USD on R&D, the B-Index equals the amount of pre-tax income that a firm needs to earn to cover this cost (Warda, 2006). The value of the B-Index ranges between zero and one if R&D tax incentives are offered in the country, with lower values indicating more beneficial tax treatment; values above one indicate the country does not offer any specific R&D tax incentive (Stewart, Warda, and Atkinson, 2012). The formula for the B-Index is:

$$B - Index = \frac{(1 - A)}{(1 - t)}. \quad (4-1)$$

The  $A$  is equal to the net present discounted value of all R&D tax incentives offered in the country such as credits, deductions, and depreciation allowances, and the  $t$  is equal to the corporate income tax rate in the country (Warda, 2009).  $A$ 's value takes into account the tax

treatment associated with current and capital R&D expenditures. Current expenditures consist of wages paid to researchers and materials used in the R&D process while capital expenditures include the cost of equipment and buildings used for R&D purposes (Stewart, Warda, and Atkinson, 2012). The B-Index includes the corporate income tax rate as a factor in the calculation of the index because it incorporates the degree of symmetry between the tax relief offered for R&D expenditures and the corporate income tax rate (Clark). Because some countries differentiate between SMEs and large companies in terms of tax treatment for R&D expenditures and tax rates, the B-Index is calculated separately for SMEs and large companies (Stewart, Warda, and Atkinson, 2012).

The B-Index is a common approach to compare the relative generosity of countries' tax incentives because of its relative simplicity and its ability to incorporate the tax treatment of current and capital R&D expenditures (Clark). To achieve the relative simplicity of the B-Index, certain assumptions are made. A major assumption that the model operates under is that a firm has enough income to obtain the maximum benefit of all tax incentives offered (Stewart, Warda, and Atkinson, 2012). Given no income exhaustion of the tax benefits, this also implies that the model does not take into consideration any carryforward or carryback provisions offered in a country. In addition, some countries, such as the United Kingdom, have caps or limits as to how much of a credit or deduction that can be claimed, but the B-Index does not take these items into consideration (Warda, 2005). The corporate income tax rate used to calculate the index is the top corporate income tax rate applicable for either SMEs or large companies (Stewart, Warda, and Atkinson, 2012). Regarding R&D expenditures, the model assumes that 90% of expenditures are current and 10% are capital. Because the B-Index is defined in present value terms, the discount rate is assumed to be 10% (Warda, 2005). Lastly, even though definitions as to what qualifies as a R&D expenditure differ by country, the model assumes the definition of eligible R&D expenditures for special tax treatment is homogeneous across all countries (Stewart, Warda, and

Atkinson, 2012). All of these assumptions are necessary because it is not feasible to incorporate every unique facet of a country's tax treatment for R&D expenditures into the B-Index.

The following table summarizes alphabetically by country the 2012 B-Indices for SMEs and large firms and the country's rank as calculated by the ITIF for the 41 countries studied (Stewart, Warda, and Atkinson, 2012):

**Table 4-1: 2012 B-Index Results by Country**

Country	SMEs		Large Firms	
	B-Index	Rank	B-Index	Rank
Australia	0.83	17	0.89	22
Austria	0.88	23	0.88	20
Belgium	0.86	20	0.86	15
Brazil	0.74	10	0.74	7
Canada	0.67	5	0.82	13
Chile	1.01	29	1.01	29
China	0.86	20	0.86	15
Czech Republic	0.80	16	0.80	12
Denmark	0.71	7	0.71	5
Finland	1.01	29	1.01	29
France	0.57	2	0.66	4
Germany	1.02	40	1.02	40
Hungary	0.78	13	0.78	8
Iceland	1.01	29	1.01	29
India	0.56	1	0.56	1
Indonesia	1.01	29	1.01	29
Ireland	0.87	22	0.87	18
Israel	1.01	29	1.01	29
Italy	0.88	23	0.88	20
Japan	0.84	18	0.87	18
Luxembourg	1.01	29	1.01	29
Malaysia	0.71	7	0.71	5
Mexico	1.01	29	1.01	29
Netherlands	0.67	5	0.86	15
New Zealand	1.02	40	1.02	40
Norway	0.75	12	0.78	8
Poland	1.01	29	1.01	29
Portugal	0.59	3	0.59	2
Russia	0.90	25	0.90	23
Singapore	0.91	26	0.91	26
Slovak Republic	1.01	29	1.01	29
Slovenia	0.95	28	0.95	28
South Africa	0.78	13	0.78	8

Country	SMEs		Large Firms	
	B-Index	Rank	B-Index	Rank
South Korea	0.74	10	0.90	23
Spain	0.65	4	0.65	3
Sweden	1.01	29	1.01	29
Switzerland	1.01	29	1.01	29
Taiwan	0.85	19	0.85	14
Turkey	0.78	13	0.78	8
United Kingdom	0.72	9	0.90	23
United States	0.94	27	0.94	27

Source: Stewart, Luke A., Jacek Warda, and Robert D. Atkinson. *We're #27!: The United States Lags Far Behind in R&D Tax Incentive Generosity*. Rep. The Information Technology & Innovation Foundation, July 2012. Web. Jan.-Feb. 2013.

\*Please refer to Appendices A and B in which the B-Index is summarized by country rank.

Based on the table above, it can be seen that India, France, Portugal, Spain, and Canada offer the most beneficial R&D tax incentives for SMEs. For large firms, India, Portugal, Spain, France, and Denmark offer the most beneficial tax incentives. Despite the popularity of the United States' Research Credit, it ranks at number 27 for both SMEs and large firms. As seen below in Table 4-2, when comparing the B-Index values listed in Table 4-1 with the types of R&D tax incentives listed in Table 3-1, on average, credits, super deductions, or a combination of the two do not appear to provide more favorable tax benefits. This is because the structure of the tax incentive rather than the type of tax incentive offered is what truly affects the B-Index, and countries can provide similar tax benefits by using different types of tax incentives.

**Table 4-2: Average B-Index Based on Type of R&D Tax Incentive Offered**

Average B-Index Based on Type of R&D Tax Incentive		
R&D Tax Incentive Offered:	SMEs	Large Firms
Tax Credits	0.798	0.833
Tax Super Deductions	0.789	0.811
Both	0.818	0.830

The B-Index equals the amount of pre-tax income that a firm needs to earn to cover the cost of spending one additional USD on R&D (Warda, 2006). The definition of the B-Index, with its simplifying assumptions, makes it a useful tool for comparing countries' R&D tax incentives that are normally difficult to compare given their complexity and varying nature among countries.

## Chapter 5

### Compliance Costs Associated with R&D Tax Incentives

Compliance costs and complex tax codes can increase the time and money spent to obtain R&D tax breaks. An article in the Wall Street Journal from July 2012 reported that tax consultants estimate only 5% of the available tax deductions and credits are being taken by businesses in the United States. The article cites high compliance costs and a complex tax code as a hindrance from businesses taking advantage of tax deductions and credits (McKinnon, 2012). This chapter discusses compliance costs that firms face when trying to obtain R&D tax benefits.

The United States' Research Credit is often referred to as being burdensome and complex. Many tax professionals, such as Walter Brickman, a Senior Manager at Ernst & Young with 12.5 years of experience in working with the Research Credit, cite the complexity and uncertainty of it. The determination as to whether a research activity is a qualified R&D expense requires significant analysis. A company must be able to demonstrate a nexus between its qualifying activities and the associated qualifying expenses as well as substantiate adequately the qualifying nature of the research activities conducted. Many companies maintain their books and records on a cost center basis which does not provide a means to associate the company's qualified research activities directly to the corresponding qualified expenses. The documentation required to sustain the Research Credit in some instances increases a company's compliance costs. The Research Credit is often a contentious issue between taxpayers and the Internal Revenue Service (IRS). IRS examinations of the research credit can often be protracted and require a significant investment of time and money to resolve. The complexity of the definition of qualified research as well as the requirement to maintain adequate documentation to

substantiate research expenses are some of the issues that Brickman cites with respect to the Research Credit which can increase compliance costs to obtain the tax benefits.

Because of the complexity of the Research Credit, companies often require the services of accounting and tax firms. These consultants provide services to help companies document their R&D activities and calculate the amount of the credit. An article titled “Hidden Cash: Tap Into R&D Tax Credits” in *Business on Main* discusses how specialized consulting firms often have to provide services to help smaller businesses take advantage of the credit because smaller companies and their accountants often do not have the required knowledge to claim the credit (Myers). These consulting services can add significant costs in order to obtain the credit.

In addition to the issues and compliance costs surrounding the United States’ Research Credit, Canada’s SR&ED credit is also cited as being complicated and burdensome. In a briefing written by Warda (1998) to The Conference Board of Canada titled *Improving Canada’s SR&ED Tax Incentive Program*, he comments on the complexities and uncertainties surrounding the credit. Warda begins the briefing by stating, “Businesses believe that SR&ED tax incentives come at a significant cost that limits their attractiveness and impact. The business community—especially small, knowledge-intensive companies—claims that the system’s administration and delivery process is the source of this cost.” He goes on to comment on particular difficulties that companies encounter when claiming the credit and the resulting compliance costs. The Canada Revenue Agency (CRA) is cited as changing the requirements for what constitutes as qualified research expenditures, often doing it retroactively. This creates confusion and can increase compliance costs for companies. Warda states that the type of documentation required by the CRA is different than that required by standard business practices. This causes firms to spend more time and money collecting extra documentation. The claims and auditing process also creates more problems for companies and can further increase costs. The claims and auditing process is typically resolved within 18 to 24 months. This long delay creates uncertainty as to the

amount of the credit that the company will ultimately receive, and it can have adverse effects on smaller companies that rely heavily on the credit. The auditing process also results in more compliance costs as the process is typically time consuming and involves negotiating the amount of credit with a CRA agent. Smaller firms are at a disadvantage as they do not have the resources needed to negotiate. Even though Canada's SR&ED credit is one of the more favorable tax incentives offered in the world, it is cited as complicated and uncertain which adds compliance costs for companies claiming the credit.

The United States and Canada are not the only countries cited as having complex tax codes and high compliance costs. The following is a list of other countries and descriptions of issues cited with regards to R&D tax incentives:

- Australia: Excessive documentation requirements may prevent companies from filing applications for R&D credits. Paul Brindle, managing director of the tax and accounting business at Thomson Reuters, stated that the costs of providing documentation may outweigh the benefits of the credit (Kitney).
- Belgium: Smaller companies may have difficulty obtaining the tax breaks because of government regulations restricting access to the tax incentives (Eberle, King, and Nowak, 2012).
- China: Companies face conflicting and overlapping government jurisdiction by different branches of the government which make it hard to obtain the tax benefits (Eberle, King, and Nowak, 2012).
- France: The R&D tax incentive system can be complicated at times. This may hinder some companies from taking advantage of the tax benefits (Eberle, King, and Nowak, 2012).
- Taiwan: Government restrictions prevent certain companies from attaining favorable tax treatment for R&D activities (Eberle, King, and Nowak, 2012).



- Turkey: Complex legislation is cited as being a deterrent to claiming the tax benefits (Eberle, King, and Nowak, 2012).
- United Kingdom: Detailed documentation of the R&D activities including project definitions, scientific research being conducted, timesheets, and personnel records must be tracked and maintained (Eberle, King, and Nowak, 2012).

As it can be seen, many countries are cited as having complex tax laws surrounding their R&D tax incentives. These complexities can add substantial compliance costs to firms attempting to obtain the tax breaks and could be a factor in determining where a company conducts its R&D.

## Chapter 6

### Estimate of Compliance Costs

As discussed in the previous chapter, the complexity and administrative requirements of R&D tax incentives can increase compliance costs. However, there has been little research analyzing the costs incurred to obtain these benefits. Given this void in research, I estimate compliance costs in the 28 countries that offer R&D tax benefits. With these estimates, I incorporate them into the B-Index to determine the effect on the rankings of countries' R&D tax incentives. The B-Index, as discussed above in Chapter 4, equals the present value of pre-tax income that a firm needs to earn to cover the after-tax cost of expending one additional USD on R&D activities (Warda, 2006). Because the B-Index is stated per USD of R&D expense, I estimate the amount of compliance costs that a firm incurs to secure the corresponding R&D tax benefit per USD of R&D expense.

Given the lack of data surrounding compliance costs, I was only able to obtain estimates for the United States and Canada. As I show below, I convert these estimates into the cost per USD of R&D expense. These estimates are then extrapolated to calculate the compliance costs in the other countries using the average number of hours it takes to prepare, file, and pay taxes in each country.

Through discussions with a tax consultant at a Big Four accounting firm, I was provided with an estimate of consulting fees that companies incur to have a United States' Research Credit study completed. The average estimated consulting fees that a company incurs equal \$0.20 of consulting fees per \$1.00 of credit. A credit study includes interviewing research personnel, analyzing R&D expense data, determining the amount of qualified research expenditures, and

calculating the credit. I assume that these consulting fees will represent compliance costs. In order to convert this figure into costs per USD of R&D expense, I calculate the average amount of expenses that a firm would incur to obtain one USD of credit. Then using a system of equations, I derive the cost per USD of R&D expense.

Using the formulas for calculating the regular credit and ASC, the average amount of expenses that a firm would incur to obtain one USD of credit can be calculated. Given the complex methods of calculating the credit, it is assumed that the firm can maximize its credit amount because its current year R&D expenses exceed the base amount as described above in Chapter 3. This assumption is applicable because the B-Index is calculated in a similar manner in that it assumes that the firm can take full advantage of all R&D tax incentives, indicating that it has enough taxable income, and its current year expenses exceed the base amount (Stewart, Warda, and Atkinson, 2012).

For the regular credit, the maximum value of the credit is equal to 20% of current year qualified expenditures that exceed the base amount. For simplicity, I assume the base amount equals 50% of current year expenses. This essentially limits the credit to 10% (50% multiplied by 20%) of current year R&D expenses. The credit amount is then further reduced by one minus the tax rate because the firm takes a regular deduction for the R&D expenses, and double counting the R&D expense for both a tax deduction and tax credit is not permissible by the IRS (*Federal Register*). Using the tax rate of 35% for the United States, the same tax rate used by the B-Index, the effective amount of the credit per USD of R&D expense is equal to 6.5% or \$0.065 as shown below:

$$(20\% \times 50\%) \times (1 - 0.35) = 6.5\% \quad (6-1)$$

To calculate the effective amount of credit per USD of R&D expense for the ASC, a similar technique is used. The ASC is equal to 14% of qualified research expenditures that exceed 50% of the three preceding tax years' average qualified R&D expenditures. Assuming

that the maximum rate of 14% can be claimed given no prior expenses, and then reducing the credit by one minus the tax rate for reasons described above, the effective amount of credit per USD of R&D expense is equal to 9.1% or \$0.091:

$$14\% \times (1 - 0.35) = 9.1\% \quad (6-2)$$

Next, a weighted average of these two rates is calculated based on the number of tax returns filed by corporations between 2007 and 2009. This is a similar methodology that the B-Index incorporates into calculating the United States' B-Index (Stewart, Warda, and Atkinson, 2012). As seen below in Figure 6-1, the number of returns filed and the corresponding percentages using the two methods are shown:

**Table 6-1: Number of Returns Filed Using Regular Credit and ASC (2007-2009)**

	Credit Type	
	Regular	ASC
2009	7,279	4,252
2008	8,227	3,528
2007	9,179	2,321
Sub-Total	24,685	10,101
Total		34,786
Percent of Total	71%	29%

Source: "SOI Tax Stats - Corporation Research Credit." *SOI Tax Stats*. Internal Revenue Service, 15 Aug. 2012. Web. 20 Mar. 2013.

The weighted average of the two rates is calculated as seen below:

$$71\% \times 6.5\% + 29\% \times 9.1\% = 7.25\% \quad (6-3)$$

Thus far, it has been shown that for every USD of credit that a firm receives, a firm pays \$0.20 in consulting fees/compliance costs and the effective rate of the credit per USD of R&D expense is 7.25%. Next, these numbers are converted into compliance costs per USD of R&D expense using a system of equations, as shown below:

$$\text{\$1 credit} = \text{\$0.20 costs} \quad (6-4)$$

$$\text{\$1 R\&D expense} = \text{\$0.0725 credit} \quad (6-5)$$

By substituting the \$0.20 costs into the second equation for the credit variable, the amount of costs per USD of R&D expense is calculated to be \$0.0145:

$$\$1 \text{ R\&D expense} = \$0.0725 \times \$0.20 \text{ costs} \quad (6-6)$$

$$\$1 \text{ R\&D expense} = \$0.0145 \text{ costs} \quad (6-7)$$

For the United States, I estimate that per USD of R&D expense, a firm will incur \$0.0145 in compliance costs to receive the tax benefit.

Throughout my research, I discovered that Canadian SMEs reported incurring compliance costs equal to 20% of the total credit amount they received, and large Canadian firms reported incurring compliance costs equal to 5% of the total credit amount they received (Warda, 1998). Using the SMEs' and large firms' credit rates of the Canadian SR&ED credit, the amount of compliance costs per USD of R&D expense can be calculated. Given that the credit rate for SMEs equals 35% (Eberle, King, and Nowak, 2012), the amount of compliance costs per USD of R&D expense can be calculated in a similar manner as described above using a system of equations:

$$\$1 \text{ credit} = \$0.20 \text{ costs} \quad (6-8)$$

$$\$1 \text{ R\&D expense} = \$0.35 \text{ credit} \quad (6-9)$$

By substituting the \$0.20 costs into the second equation for the credit variable, the amount of costs per USD of R&D expense is calculated to be \$0.07:

$$\$1 \text{ R\&D expense} = \$0.35 \times \$0.20 \text{ costs} \quad (6-10)$$

$$\$1 \text{ R\&D expense} = \$0.07 \text{ costs} \quad (6-11)$$

Large Canadian firms receive a 20% flat tax credit for each USD of R&D expense (Eberle, King, and Nowak, 2012). Using this rate, the amount of compliance costs per USD of R&D expense can be calculated by using a system of equations:

$$\$1 \text{ credit} = \$0.05 \text{ costs} \quad (6-12)$$

$$\$1 \text{ R\&D expense} = \$0.20 \text{ credit} \quad (6-13)$$

By substituting the \$0.05 costs into the second equation for the credit variable, the amount of costs per USD of R&D expense is calculated to be \$0.01:

$$\$1 \text{ R\&D expense} = \$0.35 \times \$0.20 \text{ costs} \quad (6-14)$$

$$\$1 \text{ R\&D expense} = \$0.01 \text{ costs} \quad (6-15)$$

For Canada, I estimate that per USD of R&D expense, SMEs will incur \$0.07 in compliance costs to receive the tax benefit and large firms will incur \$0.01 in compliance costs to receive the tax benefit. As stated above, I estimate the compliance cost per USD of R&D expense in the United States to be \$0.0145.

Given these estimates, I will extrapolate the values to determine compliance costs for other countries by using data presented in the World Bank's report titled *Doing Business 2013: Smarter Regulations for Small and Medium-Size Enterprises*. The Doing Business Report analyzes and assesses 10 areas of business regulations on a country by country basis. One of the areas of business regulations that the report assesses are tax systems. A metric used to determine the relative administration burden of a tax system is the average number of hours per year that it takes a firm to prepare, file, and pay taxes in a country. Even though these values do not directly indicate the administration burden of R&D tax incentives, they provide a relative ranking of the complexity and compliance burden of countries' tax systems. Therefore, I argue these values also reflect the relative complexity and compliance costs of countries' R&D tax incentives. As seen below in Table 6-1, the average number of hours per year that it takes a firm to prepare, file, and pay taxes as reported by the Doing Business Report is shown:

Table 6-2: The Average Time Spent per Year by a Firm to Prepare, File, and Pay Taxes by Country

Country	Hours/Year	Rank
Australia	109	4
Austria	170	14
Belgium	156	11
Brazil	2600	28
Canada	131	8
China	338	26
Czech Republic	413	27
Denmark	130	7
France	132	9
Hungary	277	24
India	243	19
Ireland	80	1
Italy	269	21
Japan	330	25
Malaysia	133	10
Netherlands	127	6
Norway	87	3
Portugal	275	23
Russia	177	16
Singapore	82	2
Slovenia	260	20
South Africa	200	17
South Korea	164	12
Spain	167	13
Taiwan	271	22
Turkey	223	18
United Kingdom	110	5
United States	175	15

Source: World Bank. 2013. *Doing Business 2013: Smarter Regulations for Small and Medium-Size Enterprises*.

Washington, DC: World Bank Group. DOI: 10.1596/978-0-8213-9615-5.

\*Please refer to Appendix C in which the table is summarized by country rank.

Please note that compared to Tables 3-1 and 4-1, Table 6-1 only includes the 28 countries that currently provide some form of a R&D tax incentive. I provided the other countries in previous tables to show which countries had been included in the B-Index studies. However, from this point forward in the analysis, only countries that provide R&D tax incentives will be considered.

At this point, I have calculated estimates of compliance costs in the United States and Canada and have obtained data that provides a quantitative ranking of countries' tax systems. To determine compliance costs in other countries that offer R&D tax benefits, I will use the United States and Canadian values as base figures. Given that I have developed estimates of compliance costs for United States' firms, Canadian SMEs, and Canadian large firms, I calculate three different sets of compliance measures for all countries.

Using the United States' compliance cost value of \$0.0145 and 175 hours needed to comply with tax regulations, I extrapolate compliance costs for other countries. To do this, I use the ratio of hours needed to comply with tax regulations in Country X divided by the United States' hours, and multiply this ratio by the United States' compliance costs:

$$\text{Country X Compliance Cost} = \frac{\text{Hours for Country X}}{175 \text{ hours}} * \$0.0145 \quad (6-16)$$

Using this formula, Table 6-3 shows the estimated compliance cost per USD of R&D expense for the 28 countries:



**Table 6-3: Estimated Compliance Cost per USD of R&D Expense Based on the United States' Estimated Compliance Costs**

<b>Country</b>	<b>Compliance Cost</b>
Australia	\$ 0.0090
Austria	\$ 0.0141
Belgium	\$ 0.0129
Brazil	\$ 0.2154
Canada	\$ 0.0109
China	\$ 0.0280
Czech Republic	\$ 0.0342
Denmark	\$ 0.0108
France	\$ 0.0109
Hungary	\$ 0.0230
India	\$ 0.0201
Ireland	\$ 0.0066
Italy	\$ 0.0223
Japan	\$ 0.0273
Malaysia	\$ 0.0110
Netherlands	\$ 0.0105
Norway	\$ 0.0072
Portugal	\$ 0.0228
Russia	\$ 0.0147
Singapore	\$ 0.0068
Slovenia	\$ 0.0215
South Africa	\$ 0.0166
South Korea	\$ 0.0136
Spain	\$ 0.0138
Taiwan	\$ 0.0225
Turkey	\$ 0.0185
United Kingdom	\$ 0.0091
<b>United States</b>	<b>\$ 0.0145</b>

A similar method is used to extrapolate compliance costs for other countries using the Canadian SMEs' compliance cost value of \$0.07 and 131 hours needed to comply with tax regulations:

$$\text{Country X Compliance Cost} = \frac{\text{Hours for Country X}}{131 \text{ hours}} * \$0.07 \quad (6-17)$$

Using this formula, Table 6-4 shows the estimated compliance cost per USD of R&D expense using the Canadian SMEs' values for the 28 countries:

**Table 6-4: Estimated Compliance Cost per USD of R&D Expense Based on Canadian SMEs' Estimated Compliance Costs**

Country	Compliance Cost
Australia	\$ 0.0582
Austria	\$ 0.0908
Belgium	\$ 0.0834
Brazil	\$ 1.3893
<b>Canada</b>	<b>\$ 0.0700</b>
China	\$ 0.1806
Czech Republic	\$ 0.2207
Denmark	\$ 0.0695
France	\$ 0.0705
Hungary	\$ 0.1480
India	\$ 0.1298
Ireland	\$ 0.0427
Italy	\$ 0.1437
Japan	\$ 0.1763
Malaysia	\$ 0.0711
Netherlands	\$ 0.0679
Norway	\$ 0.0465
Portugal	\$ 0.1469
Russia	\$ 0.0946
Singapore	\$ 0.0438
Slovenia	\$ 0.1389
South Africa	\$ 0.1069
South Korea	\$ 0.0876
Spain	\$ 0.0892
Taiwan	\$ 0.1448
Turkey	\$ 0.1192
United Kingdom	\$ 0.0588
United States	\$ 0.0935

The third set of compliance costs are extrapolated using the Canadian large firms' costs of \$0.01 and 131 hours needed to comply with tax regulations:

$$\text{Country } X \text{ Compliance Cost} = \frac{\text{Hours for Country } X}{131 \text{ hours}} * \$0.01 \quad (6-18)$$

Using this formula, Table 6-5 shows the estimated compliance cost per USD of R&D expense using the Canadian large firms' values for the 28 countries:

**Table 6-5: Estimated Compliance Cost per USD of R&D Expense Based on Canadian Large Firms' Estimated Compliance Costs**

Country	Compliance Costs
Australia	\$ 0.0083
Austria	\$ 0.0130
Belgium	\$ 0.0119
Brazil	\$ 0.1985
<b>Canada</b>	<b>\$ 0.0100</b>
China	\$ 0.0258
Czech Republic	\$ 0.0315
Denmark	\$ 0.0099
France	\$ 0.0101
Hungary	\$ 0.0211
India	\$ 0.0185
Ireland	\$ 0.0061
Italy	\$ 0.0205
Japan	\$ 0.0252
Malaysia	\$ 0.0102
Netherlands	\$ 0.0097
Norway	\$ 0.0066
Portugal	\$ 0.0210
Russia	\$ 0.0135
Singapore	\$ 0.0063
Slovenia	\$ 0.0198
South Africa	\$ 0.0153
South Korea	\$ 0.0125
Spain	\$ 0.0127
Taiwan	\$ 0.0207
Turkey	\$ 0.0170
United Kingdom	\$ 0.0084
United States	\$ 0.0134

As shown in the previous discussion, I derived three sets of compliance costs per USD of R&D expense for the 28 countries that provide R&D tax incentives. I did this by using estimated values of compliance costs incurred in the United States and Canada, and then these values were extrapolated based on the quantitative rankings of countries' tax systems as provided in the Doing Business Report to arrive at costs incurred per USD of R&D expense for each country.

## Chapter 7

### **Incorporating Compliance Costs into the B-Index, Calculating the New B-Index, and Analyzing the Results**

Finally, compliance costs can now be incorporated into the B-Index to determine their effects on the ranking of countries' R&D tax incentives. As a reminder, I hypothesized that when including compliance costs in the B-Index, they would significantly impact the ranking of countries' R&D tax incentives. As shown in Chapter 6, compliance costs were converted into costs per USD of R&D expense, the same units the B-Index is stated in. This allows the compliance costs to be easily incorporated into the B-Index. Once these values are incorporated, the B-Index will be recalculated for each country, and the new values of the B-Index and rankings will be analyzed.

As discussed in Chapter 4, the B-Index equals the present value of pre-tax income that a firm needs to earn to cover the after-tax cost of expending one additional USD on R&D activities (Warda, 2006). Given this definition, the compliance costs are added to the B-Index because the costs increase the value of pre-tax income that a firm needs to earn to cover the after-tax cost of expending one additional USD on R&D. Because the B-Index is measured in pre-tax income, the compliance costs are added to the B-Index before tax. Using  $CC$  to represent compliance costs, the formula for the new B-Index is:

$$B - Index = \frac{(1 - A)}{(1 - t)} + CC . \quad (7-1)$$

Using this formula, the following four tables show the results when incorporating the compliance costs into the B-Index. The first table shows the results when using the United States' base compliance costs of \$0.0145 and incorporating the values into the B-Index for SMEs.

The second table shows the results using the United States' base compliance cost of \$0.0145 and incorporating the values into the B-Index for large firms. The third table shows the results when using the Canadian base compliance cost of \$0.07 for SMEs and incorporating the values into the B-Index for SMEs. The fourth table shows the results when using the Canadian base compliance cost of \$0.01 for large firms and incorporating the values into the B-Index for large firms. The following tables are arranged by the new B-Index value, going from the most beneficial R&D tax incentives to the least beneficial R&D tax incentives. Please refer to Appendices D-G where the tables are arranged alphabetically by country. Following the tables, I discuss the results of the new B-Index.

Table 7-1: New SMEs' B-Index Using United States' Compliance Cost Estimate by Country

Country	Original B-Index	Original Ranking	Compliance Costs	New B-Index	New Ranking	Change in Ranking	Absolute Change in Ranking
India	0.56	1	0.0201	0.5801	1	0	0
France	0.57	2	0.0109	0.5809	2	0	0
Portugal	0.59	3	0.0228	0.6128	3	0	0
Spain	0.65	4	0.0138	0.6638	4	0	0
Netherlands	0.67	5	0.0105	0.6805	5	0	0
Canada	0.67	5	0.0109	0.6809	6	-1	1
Denmark	0.71	7	0.0108	0.7208	7	0	0
Malaysia	0.71	7	0.0110	0.7210	8	-1	1
United Kingdom	0.72	9	0.0091	0.7291	9	0	0
South Korea	0.74	10	0.0136	0.7536	10	0	0
Norway	0.75	12	0.0072	0.7572	11	1	1
South Africa	0.78	13	0.0166	0.7966	12	1	1
Turkey	0.78	13	0.0185	0.7985	13	0	0
Hungary	0.78	13	0.0230	0.8030	14	-1	1
Czech Republic	0.80	16	0.0342	0.8342	15	1	1
Australia	0.83	17	0.0090	0.8390	16	1	1
Japan	0.84	18	0.0273	0.8673	17	1	1
Taiwan	0.85	19	0.0225	0.8725	18	1	1
Belgium	0.86	20	0.0129	0.8729	19	1	1
Ireland	0.87	22	0.0066	0.8766	20	2	2
China	0.86	20	0.0280	0.8880	21	-1	1
Austria	0.88	23	0.0141	0.8941	22	1	1
Italy	0.88	23	0.0223	0.9023	23	0	0
Russia	0.90	25	0.0147	0.9147	24	1	1
Singapore	0.91	26	0.0068	0.9168	25	1	1
United States	0.94	27	0.0145	0.9545	26	1	1
Brazil	0.74	10	0.2154	0.9554	27	-17	17
Slovenia	0.95	28	0.0215	0.9715	28	0	0

Table 7-2: New Large Firms' B-Index Using United States' Compliance Cost Estimate by Country

Country	Original B-Index	Original Ranking	Compliance Costs	New B-Index	New Ranking	Change in Ranking	Absolute Change in Ranking
India	0.56	1	0.0201	0.5801	1	0	0
Portugal	0.59	2	0.0228	0.6128	2	0	0
Spain	0.65	3	0.0138	0.6638	3	0	0
France	0.66	4	0.0109	0.6709	4	0	0
Denmark	0.71	5	0.0108	0.7208	5	0	0
Malaysia	0.71	5	0.0110	0.7210	6	-1	1
Norway	0.78	8	0.0072	0.7872	7	1	1
South Africa	0.78	8	0.0166	0.7966	8	0	0
Turkey	0.78	8	0.0185	0.7985	9	-1	1
Hungary	0.78	8	0.0230	0.8030	10	-2	2
Canada	0.82	13	0.0109	0.8309	11	2	2
Czech Republic	0.80	12	0.0342	0.8342	12	0	0
Netherlands	0.86	15	0.0105	0.8705	13	2	2
Taiwan	0.85	14	0.0225	0.8725	14	0	0
Belgium	0.86	15	0.0129	0.8729	15	0	0
Ireland	0.87	18	0.0066	0.8766	16	2	2
China	0.86	15	0.0280	0.8880	17	-2	2
Austria	0.88	20	0.0141	0.8941	18	2	2
Japan	0.87	18	0.0273	0.8973	19	-1	1
Australia	0.89	22	0.0090	0.8990	20	2	2
Italy	0.88	20	0.0223	0.9023	21	-1	1
United Kingdom	0.90	23	0.0091	0.9091	22	1	1
South Korea	0.90	23	0.0136	0.9136	23	0	0
Russia	0.90	23	0.0147	0.9147	24	-1	1
Singapore	0.91	26	0.0068	0.9168	25	1	1
United States	0.94	27	0.0145	0.9545	26	1	1
Brazil	0.74	7	0.2154	0.9554	27	-20	20
Slovenia	0.95	28	0.0215	0.9715	28	0	0



Table 7-3: New SMEs' B-Index Using Canadian SMEs' Compliance Cost Estimate by Country

Country	Original B-Index	Original Ranking	Compliance Costs	New B-Index	New Ranking	Change in Ranking	Absolute Change in Ranking
France	0.57	2	0.0705	0.6405	1	1	1
India	0.56	1	0.1298	0.6898	2	-1	1
Portugal	0.59	3	0.1469	0.7369	3	0	0
Netherlands	0.67	5	0.0679	0.7379	4	1	1
Spain	0.65	4	0.0892	0.7392	5	-1	1
Canada	0.67	5	0.0700	0.7400	6	-1	1
United Kingdom	0.72	9	0.0588	0.7788	7	2	2
Denmark	0.71	7	0.0695	0.7795	8	-1	1
Malaysia	0.71	7	0.0711	0.7811	9	-2	2
Norway	0.75	12	0.0465	0.7965	10	2	2
South Korea	0.74	10	0.0876	0.8276	11	-1	1
South Africa	0.78	13	0.1069	0.8869	12	1	1
Australia	0.83	17	0.0582	0.8882	13	4	4
Turkey	0.78	13	0.1192	0.8992	14	-1	1
Ireland	0.87	22	0.0427	0.9127	15	7	7
Hungary	0.78	13	0.1480	0.9280	16	-3	3
Belgium	0.86	20	0.0834	0.9434	17	3	3
Singapore	0.91	26	0.0438	0.9538	18	8	8
Austria	0.88	23	0.0908	0.9708	19	4	4
Russia	0.90	25	0.0946	0.9946	20	5	5
Taiwan	0.85	19	0.1448	0.9948	21	-2	2
Japan	0.84	18	0.1763	1.0163	22	-4	4
Czech Republic	0.80	16	0.2207	1.0207	23	-7	7
Italy	0.88	23	0.1437	1.0237	24	-1	1
United States	0.94	27	0.0935	1.0335	25	2	2
China	0.86	20	0.1806	1.0406	26	-6	6
Slovenia	0.95	28	0.1389	1.0889	27	1	1
Brazil	0.74	10	1.3893	2.1293	28	-18	18

Table 7-4: New Large Firms' B-Index Using Canadian Large Firms' Compliance Cost Estimate by Country

Country	Original B-Index	Original Ranking	Compliance Costs	New B-Index	New Ranking	Change in Ranking	Absolute Change in Ranking
India	0.56	1	0.0185	0.5785	1	0	0
Portugal	0.59	2	0.0210	0.6110	2	0	0
Spain	0.65	3	0.0127	0.6627	3	0	0
France	0.66	4	0.0101	0.6701	4	0	0
Denmark	0.71	5	0.0099	0.7199	5	0	0
Malaysia	0.71	5	0.0102	0.7202	6	-1	1
Norway	0.78	8	0.0066	0.7866	7	1	1
South Africa	0.78	8	0.0153	0.7953	8	0	0
Turkey	0.78	8	0.0170	0.7970	9	-1	1
Hungary	0.78	8	0.0211	0.8011	10	-2	2
Canada	0.82	13	0.0100	0.8300	11	2	2
Czech Republic	0.80	12	0.0315	0.8315	12	0	0
Netherlands	0.86	15	0.0097	0.8697	13	2	2
Taiwan	0.85	14	0.0207	0.8707	14	0	0
Belgium	0.86	15	0.0119	0.8719	15	0	0
Ireland	0.87	18	0.0061	0.8761	16	2	2
China	0.86	15	0.0258	0.8858	17	-2	2
Austria	0.88	20	0.0130	0.8930	18	2	2
Japan	0.87	18	0.0252	0.8952	19	-1	1
Australia	0.89	22	0.0083	0.8983	20	2	2
Italy	0.88	20	0.0205	0.9005	21	-1	1
United Kingdom	0.90	23	0.0084	0.9084	22	1	1
South Korea	0.90	23	0.0125	0.9125	23	0	0
Russia	0.90	23	0.0135	0.9135	24	-1	1
Singapore	0.91	26	0.0063	0.9163	25	1	1
Brazil	0.74	7	0.1985	0.9385	26	-19	19
United States	0.94	27	0.0134	0.9534	27	0	0
Slovenia	0.95	28	0.0198	0.9698	28	0	0

**Analysis:**

With these new B-Index values, I can determine whether or not my hypothesis is correct. As seen in the preceding four tables, the far right column shows the absolute change in ranking per country. Using these values, I calculate the average absolute change in ranking per country to determine the overall effects of compliance costs. It should be noted that Brazil was an outlier in the data because the average time spent to prepare, file, and pay taxes was 2,600 hours per the Doing Business Report, where as the average for all other countries was 193 hours. Therefore, I provide the average absolute change in rankings for each of the four tables, with and without Brazil, as seen in Table 7-5:

**Table 7-5: Average Absolute Change in Ranking per Country**

Average Absolute Change in Ranking per Country			
Compliance Cost Estimate		With Brazil	Without Brazil
Table 7-1	U.S. - SMEs	1.214	0.667
Table 7-2	U.S. - Large Firms	1.536	0.889
Table 7-3	Canada - SMEs	3.214	2.667
Table 7-4	Canada - Large Firms	1.464	0.889

Table 7-5 shows there was extremely little change in the ranking of countries' R&D tax incentives as the average absolute change equals 1.857 and 1.278 with and without Brazil, respectively. Given this small change in rankings, I conclude that my hypothesis is incorrect. Based on this analysis, compliance costs do not affect the relative rankings of countries' R&D tax incentives.

To determine why there was so little change in the new B-Index rankings, the amount of compliance costs per USD of R&D expense can give some insight. The average estimated compliance cost was calculated to be \$0.06 for the three methods (United States, Canadian SMEs, and Canadian large firms). The deviation between each country's compliance costs is extremely small. Because of this, there is little change in the values of the B-Index and the relative ranking

of countries when compliance costs are added. Next, I will provide a few comments and observations on the four sets of the new B-Index values.

When analyzing the results for Table 7-1 in which the United States' compliance costs for SMEs were incorporated into the B-Index for SMEs, the average absolute change in ranking per country was 1.214 and 0.667 with and without Brazil, respectively. India, France, and Portugal are ranked number 1, 2, and 3 as is the case in the original B-Index. The United States moves up one spot, but Brazil is the country replacing the United States as number 27. The results based on Table 7-1 indicate that compliance costs do not have an impact on the relative ranking of countries' R&D tax incentives.

Tables 7-2 and 7-4 paint similar pictures as Table 7-1. The average absolute change in ranking per country using the United States' compliance cost estimate is 1.536 and 0.889 with and without Brazil, respectively. The average absolute change in ranking per country using Canadian large firm compliance cost estimates is 1.464 and 0.889 with and without Brazil, respectively. These results are only slightly higher than the results from Table 7-1. It should be noted that these results are less precise as the compliance costs were calculated using the average time spent to prepare, file, and pay taxes for SMEs, not large firms. There is no equivalent Doing Business Report for large businesses. Even though the Doing Business Report's average time figures only provided a relative ranking, these results cannot be relied upon as being highly accurate. Nonetheless, the change in ranking is extremely small, and once again, it appears compliance costs do not affect the ranking of countries' tax incentives.

As seen in Table 7-3, when using the Canadian SMEs' compliance costs to calculate the new B-Index, there is a larger effect on the change in countries' rankings than there is for the other three calculations. The average absolute change in ranking per country is 3.214 and 2.667 with and without Brazil, respectively. These results show that compliance costs affect the rankings of countries to some extent, although it is not a major difference. Warda (1998)

discussed that SMEs might incur higher relative compliance costs than larger firms in relation to the total tax benefit. He explains the reason for this difference could be due to SMEs' inexperience in dealing with the requirements for obtaining the tax benefits. This infers there are economies of scale in terms of the amount of R&D conducted and compliance costs incurred. Therefore, it makes sense that the change in rankings of SMEs may be slightly higher than the change in rankings of large firms. It should be noted that the B-Index increases to above one for Japan, the Czech Republic, Italy, the United States, China, Slovenia, and Brazil, while the B-Index increases to values just below one for Russia and Taiwan. These high B-Index values indicate that when considering compliance costs, firms need about one USD of pre-tax income to cover the after-tax cost of expending one additional USD on R&D activities. Therefore, there seems to be essentially no benefit provided by tax incentives for these nine countries when considering compliance costs.

Based on these results, it appears that compliance costs do not affect large firms' B-Index rankings as to which country provides more beneficial tax treatment for R&D activities. For SMEs, the United States' estimate of compliance costs and its effects on the SMEs' B-Index is extremely small, while there is a larger change for SMEs' B-Index using the Canadian compliance cost estimate. Overall, I conclude compliance costs do not affect the relative rankings of countries' R&D tax incentives.

## **Chapter 8**

### **Conclusion**

R&D tax incentives are a common method used by governments to encourage private firms to invest in additional R&D. In order to compare the relative R&D tax benefits of each government's tax system, the B-Index provides a simple method of doing so. An aspect that the B-Index fails to consider is compliance costs associated with obtaining the tax benefits. When considering the administrative burden born by firms to obtain the often complex tax incentives, it would seem that compliance costs may play a role in determining the relative attractiveness of each country's R&D tax benefits. However, as I have demonstrated in this paper, when compliance costs are incorporated into the B-Index, the relative ranking of R&D tax benefits among countries changes by an insignificant amount. Therefore, I conclude that compliance costs do not affect the relative rankings of countries' R&D tax incentives.

It should be noted that my analysis had a few limitations which required certain assumptions to be made, and the results of my analysis may have been different had better data been available. Given that compliance cost estimates were only available for the United States and Canada, it was necessary to extrapolate these values to other countries by using data in the Doing Business Report. This report only provided the average time spent per year to prepare, file, and pay taxes for SMEs. I assumed these amounts represented the relative ranking of countries' R&D tax incentives' compliance costs, which most likely is not true. The requirements to obtain the R&D tax benefits vary by country and most likely do not correlate with the time spent to prepare income tax forms. In addition, the United States' compliance cost estimate is most likely understated as it was based on consulting fees that a firm would pay an

external professional services firm. It did not include the internal compliance fees that a firm incurs such as data documentation and time spent working with the external professional services firm. Further research is needed to provide more precise compliance cost estimates on a country by country basis to determine with more certainty whether or not compliance costs affect the relative rankings of countries' R&D tax incentives.

## Appendix A

### 2012 B-Index Results for SMEs by Rank

Country	B-Index	Rank
India	0.56	1
France	0.57	2
Portugal	0.59	3
Spain	0.65	4
Canada	0.67	5
Netherlands	0.67	5
Denmark	0.71	7
Malaysia	0.71	7
United Kingdom	0.72	9
Brazil	0.74	10
South Korea	0.74	10
Norway	0.75	12
Hungary	0.78	13
South Africa	0.78	13
Turkey	0.78	13
Czech Republic	0.80	16
Australia	0.83	17
Japan	0.84	18
Taiwan	0.85	19
Belgium	0.86	20

Country	B-Index	Rank
China	0.86	20
Ireland	0.87	22
Austria	0.88	23
Italy	0.88	23
Russia	0.90	25
Singapore	0.91	26
United States	0.94	27
Slovenia	0.95	28
Chile	1.01	29
Finland	1.01	29
Iceland	1.01	29
Indonesia	1.01	29
Israel	1.01	29
Luxembourg	1.01	29
Mexico	1.01	29
Poland	1.01	29
Slovak Republic	1.01	29
Sweden	1.01	29
Switzerland	1.01	29
Germany	1.02	40
New Zealand	1.02	40

Source: Stewart, Luke A., Jacek Warda, and Robert D. Atkinson. *We're #27!: The United States Lags Far Behind in*

*R&D Tax Incentive Generosity*. Rep. The Information Technology & Innovation Foundation, July 2012.

Web. Jan.-Feb. 2013.



## Appendix B

### 2012 B-Index Results for Large Firms by Rank

Country	B-Index	Rank
India	0.56	1
Portugal	0.59	2
Spain	0.65	3
France	0.66	4
Denmark	0.71	5
Malaysia	0.71	5
Brazil	0.74	7
Hungary	0.78	8
Norway	0.78	8
South Africa	0.78	8
Turkey	0.78	8
Czech Republic	0.80	12
Canada	0.82	13
Taiwan	0.85	14
Belgium	0.86	15
China	0.86	15
Netherlands	0.86	15
Ireland	0.87	18
Japan	0.87	18
Austria	0.88	20
Italy	0.88	20

Country	B-Index	Rank
Australia	0.89	22
Russia	0.90	23
South Korea	0.90	23
United Kingdom	0.90	23
Singapore	0.91	26
United States	0.94	27
Slovenia	0.95	28
Chile	1.01	29
Finland	1.01	29
Iceland	1.01	29
Indonesia	1.01	29
Israel	1.01	29
Luxembourg	1.01	29
Mexico	1.01	29
Poland	1.01	29
Slovak Republic	1.01	29
Sweden	1.01	29
Switzerland	1.01	29
Germany	1.02	40
New Zealand	1.02	40

Source: Stewart, Luke A., Jacek Warda, and Robert D. Atkinson. *We're #27!: The United States Lags Far Behind in R&D Tax Incentive Generosity*. Rep. The Information Technology & Innovation Foundation, July 2012. Web. Jan.-Feb. 2013.

### Appendix C

#### The Average Time Spent per Year by a Firm to Prepare, File, and Pay Taxes by Rank

Country	Hours/Year	Rank
Ireland	80	1
Singapore	82	2
Norway	87	3
Australia	109	4
United Kingdom	110	5
Netherlands	127	6
Denmark	130	7
Canada	131	8
France	132	9
Malaysia	133	10
Belgium	156	11
South Korea	164	12
Spain	167	13
Austria	170	14
United States	175	15
Russia	177	16
South Africa	200	17
Turkey	223	18
India	243	19
Slovenia	260	20
Italy	269	21
Taiwan	271	22
Portugal	275	23
Hungary	277	24
Japan	330	25
China	338	26
Czech Republic	413	27
Brazil	2600	28

Source: World Bank. 2013. *Doing Business 2013: Smarter Regulations for Small and Medium-Size Enterprises*.

Washington, DC: World Bank Group. DOI: 10.1596/978-0-8213-9615-5.

## Appendix D

### New SMEs' B-Index Using United States' Compliance Cost Estimate by Country

Country	Original B-Index	Original Ranking	Compliance Costs	New B-Index	New Ranking	Change in Ranking	Absolute Change in Ranking
Australia	0.83	17	0.0090	0.8390	16	1	1
Austria	0.88	23	0.0141	0.8941	22	1	1
Belgium	0.86	20	0.0129	0.8729	19	1	1
Brazil	0.74	10	0.2154	0.9554	27	-17	17
Canada	0.67	5	0.0109	0.6809	6	-1	1
China	0.86	20	0.0280	0.8880	21	-1	1
Czech Republic	0.80	16	0.0342	0.8342	15	1	1
Denmark	0.71	7	0.0108	0.7208	7	0	0
France	0.57	2	0.0109	0.5809	2	0	0
Hungary	0.78	13	0.0230	0.8030	14	-1	1
India	0.56	1	0.0201	0.5801	1	0	0
Ireland	0.87	22	0.0066	0.8766	20	2	2
Italy	0.88	23	0.0223	0.9023	23	0	0
Japan	0.84	18	0.0273	0.8673	17	1	1
Malaysia	0.71	7	0.0110	0.7210	8	-1	1
Netherlands	0.67	5	0.0105	0.6805	5	0	0
Norway	0.75	12	0.0072	0.7572	11	1	1
Portugal	0.59	3	0.0228	0.6128	3	0	0
Russia	0.90	25	0.0147	0.9147	24	1	1
Singapore	0.91	26	0.0068	0.9168	25	1	1
Slovenia	0.95	28	0.0215	0.9715	28	0	0
South Africa	0.78	13	0.0166	0.7966	12	1	1
South Korea	0.74	10	0.0136	0.7536	10	0	0
Spain	0.65	4	0.0138	0.6638	4	0	0
Taiwan	0.85	19	0.0225	0.8725	18	1	1
Turkey	0.78	13	0.0185	0.7985	13	0	0
United Kingdom	0.72	9	0.0091	0.7291	9	0	0
United States	0.94	27	0.0145	0.9545	26	1	1

## Appendix E

## New Large Firms' B-Index Using United States' Compliance Cost Estimate by Country

Country	Original B-Index	Original Ranking	Compliance Costs	New B-Index	New Ranking	Change in Ranking	Absolute Change in Ranking
Australia	0.89	22	0.0090	0.8990	20	2	2
Austria	0.88	20	0.0141	0.8941	18	2	2
Belgium	0.86	15	0.0129	0.8729	15	0	0
Brazil	0.74	7	0.2154	0.9554	27	-20	20
Canada	0.82	13	0.0109	0.8309	11	2	2
China	0.86	15	0.0280	0.8880	17	-2	2
Czech Republic	0.80	12	0.0342	0.8342	12	0	0
Denmark	0.71	5	0.0108	0.7208	5	0	0
France	0.66	4	0.0109	0.6709	4	0	0
Hungary	0.78	8	0.0230	0.8030	10	-2	2
India	0.56	1	0.0201	0.5801	1	0	0
Ireland	0.87	18	0.0066	0.8766	16	2	2
Italy	0.88	20	0.0223	0.9023	21	-1	1
Japan	0.87	18	0.0273	0.8973	19	-1	1
Malaysia	0.71	5	0.0110	0.7210	6	-1	1
Netherlands	0.86	15	0.0105	0.8705	13	2	2
Norway	0.78	8	0.0072	0.7872	7	1	1
Portugal	0.59	2	0.0228	0.6128	2	0	0
Russia	0.90	23	0.0147	0.9147	24	-1	1
Singapore	0.91	26	0.0068	0.9168	25	1	1
Slovenia	0.95	28	0.0215	0.9715	28	0	0
South Africa	0.78	8	0.0166	0.7966	8	0	0
South Korea	0.90	23	0.0136	0.9136	23	0	0
Spain	0.65	3	0.0138	0.6638	3	0	0
Taiwan	0.85	14	0.0225	0.8725	14	0	0
Turkey	0.78	8	0.0185	0.7985	9	-1	1
United Kingdom	0.90	23	0.0091	0.9091	22	1	1
United States	0.94	27	0.0145	0.9545	26	1	1

## Appendix F

### New SMEs' B-Index Using Canadian SMEs' Compliance Cost Estimate by Country

Country	Original B-Index	Original Ranking	Compliance Costs	New B-Index	New Ranking	Change in Ranking	Absolute Change in Ranking
Australia	0.83	17	0.0582	0.8882	13	4	4
Austria	0.88	23	0.0908	0.9708	19	4	4
Belgium	0.86	20	0.0834	0.9434	17	3	3
Brazil	0.74	10	1.3893	2.1293	28	-18	18
Canada	0.67	5	0.0700	0.7400	6	-1	1
China	0.86	20	0.1806	1.0406	26	-6	6
Czech Republic	0.80	16	0.2207	1.0207	23	-7	7
Denmark	0.71	7	0.0695	0.7795	8	-1	1
France	0.57	2	0.0705	0.6405	1	1	1
Hungary	0.78	13	0.1480	0.9280	16	-3	3
India	0.56	1	0.1298	0.6898	2	-1	1
Ireland	0.87	22	0.0427	0.9127	15	7	7
Italy	0.88	23	0.1437	1.0237	24	-1	1
Japan	0.84	18	0.1763	1.0163	22	-4	4
Malaysia	0.71	7	0.0711	0.7811	9	-2	2
Netherlands	0.67	5	0.0679	0.7379	4	1	1
Norway	0.75	12	0.0465	0.7965	10	2	2
Portugal	0.59	3	0.1469	0.7369	3	0	0
Russia	0.90	25	0.0946	0.9946	20	5	5
Singapore	0.91	26	0.0438	0.9538	18	8	8
Slovenia	0.95	28	0.1389	1.0889	27	1	1
South Africa	0.78	13	0.1069	0.8869	12	1	1
South Korea	0.74	10	0.0876	0.8276	11	-1	1
Spain	0.65	4	0.0892	0.7392	5	-1	1
Taiwan	0.85	19	0.1448	0.9948	21	-2	2
Turkey	0.78	13	0.1192	0.8992	14	-1	1
United Kingdom	0.72	9	0.0588	0.7788	7	2	2
United States	0.94	27	0.0935	1.0335	25	2	2

## Appendix G

## New Large Firms' B-Index Using Canadian Large Firms' Compliance Cost Estimate by Country

Country	Original B-Index	Original Ranking	Compliance Costs	New B-Index	New Ranking	Change in Ranking	Absolute Change in Ranking
Australia	0.89	22	0.0083	0.8983	20	2	2
Austria	0.88	20	0.0130	0.8930	18	2	2
Belgium	0.86	15	0.0119	0.8719	15	0	0
Brazil	0.74	7	0.1985	0.9385	26	-19	19
Canada	0.82	13	0.0100	0.8300	11	2	2
China	0.86	15	0.0258	0.8858	17	-2	2
Czech Republic	0.80	12	0.0315	0.8315	12	0	0
Denmark	0.71	5	0.0099	0.7199	5	0	0
France	0.66	4	0.0101	0.6701	4	0	0
Hungary	0.78	8	0.0211	0.8011	10	-2	2
India	0.56	1	0.0185	0.5785	1	0	0
Ireland	0.87	18	0.0061	0.8761	16	2	2
Italy	0.88	20	0.0205	0.9005	21	-1	1
Japan	0.87	18	0.0252	0.8952	19	-1	1
Malaysia	0.71	5	0.0102	0.7202	6	-1	1
Netherlands	0.86	15	0.0097	0.8697	13	2	2
Norway	0.78	8	0.0066	0.7866	7	1	1
Portugal	0.59	2	0.0210	0.6110	2	0	0
Russia	0.90	23	0.0135	0.9135	24	-1	1
Singapore	0.91	26	0.0063	0.9163	25	1	1
Slovenia	0.95	28	0.0198	0.9698	28	0	0
South Africa	0.78	8	0.0153	0.7953	8	0	0
South Korea	0.90	23	0.0125	0.9125	23	0	0
Spain	0.65	3	0.0127	0.6627	3	0	0
Taiwan	0.85	14	0.0207	0.8707	14	0	0
Turkey	0.78	8	0.0170	0.7970	9	-1	1
United Kingdom	0.90	23	0.0084	0.9084	22	1	1
United States	0.94	27	0.0134	0.9534	27	0	0

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# ACADEMIC VITA OF STEFAN J. RICHTER

Stefan J. Richter  
1230 Twelve Oaks Ct.  
Murrysville, PA 15668  
stefanjrichter@gmail.com

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## Education

B.S., Accounting, Spring 2014, The Pennsylvania State University, University Park, PA  
M.S., Accounting, Spring 2014, The Pennsylvania State University, University Park, PA  
Minors in International Business and Economics

## Honors and Awards

- The Schreyer Honors College Academic Excellence Scholarship, The Pennsylvania State University, 2008-2012
- Dean's List, The Pennsylvania State University, 2008-Present
- The President's Freshman Award, The Pennsylvania State University, Fall 2008
- The Evan Pugh Scholar Award (Senior), The Pennsylvania State University, Spring 2011
- The Robert W. Koehler Excellence in Accounting Scholarship, The Pennsylvania State University, 2012

## Work Experience

Ernst & Young LLP, Tysons Corner, VA  
Tax Intern  
January 2012 – April 2012, June 2012 – August 2012

ParenteBeard LLC, Pittsburgh, PA  
Audit Intern  
June 2011 – August 2011

## Association Memberships/Activities

Accounting Society (2008-2011)  
Theta Delta Chi Fraternity (2009-2013)