Annex 5

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Measuring the Value of R&D Tax Provisions

A Primer on the B-index Model for Analysis and Comparisons

Prepared for

The OMC Working Group on "Design and evaluation of fiscal measures to promote business research, development and innovation"

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Introduction

Innovation is the engine of a knowledge economy, and Research and Development (R&D) is the key ingredient of the innovation process. R&D ensures the generation of new knowledge and technologies. Organizations that perform R&D stay abreast of leading-edge technologies, make more informed decisions, and nurture a valuable knowledge base and absorptive capacity in their skilled personnel. New technologies resulting from R&D effort boost productivity. In turn, growth in productivity leads to economic growth. Economic research has long linked R&D expenditure with economic growth, showing that about 30-50% of economic growth in society comes from the introduction of new technologies[1].

A competitive and stable tax policy has the potential to be an effective tool for promoting R&D and innovation in the country or region. Government has a major supporting role in this area by providing a favourable business environment, including appropriate and competitive incentive programs for R&D. Tax incentives represent one of the pillars of such a policy in many countries.

Objective

The purpose of this note is the following:

- To introduce the tool – the B-index - for measuring the value of R&D tax treatment in various tax jurisdictions.
- To show how the B-index can help in the design of new tax incentives for R&D.
- To discuss the range of applications of the B-index.
- To demonstrate how the B-index can be used in assessing policies and identifying trends in the corporate R&D tax treatment.
- To show the relative position of European countries in R&D tax treatment.

About the B-index Model

The B-index model measures the relative attractiveness of R&D tax treatment in the country or region. It is based on well-founded economic theory and designed so that it is

[1] Michael J. Boskin and Laurence J. Lau, "Contributions of R&D to Economic Growth" in Smith & Barfield (Editors), *Technology, R&D, and the Economy*, The Brookings Institute, Washington D.C., 1996.

easy to apply and capable of including all tax parameters, and can be used as a policy analysis tool.

The model is based on the marginal effective tax rate approach. The marginal model is designed specifically to look at the tax burden on income generated by an "additional dollar" invested in R&D, and to construct an overall measure of the corporate tax burden on marginal R&D investments in different countries. The marginal model provides a useful summary of the main features of business taxation and is effective in making international comparisons.

Components of the Model

The model includes the following components of R&D cost structure and applicable tax provisions:

- Current expenditures: wages and salaries of R&D personnel and the cost of materials used in the R&D process.
- Capital expenditures incurred in R&D: the cost of machinery and equipment (ME) and facilities/buildings (B).
- Depreciation of capital assets used in R&D: these assets are typically depreciated over the useful life according to two methods: declining balance or straight line.[2]
- Additional allowances on R&D expenditures: these provisions allow firms conducting R&D to deduct more from their taxable income than they actually spend on R&D.
- Tax credits: credits are applied against income tax payable. The benefit of the credit can be non-taxable or taxable.
- Statutory corporate income tax rates.

Critical Assumptions

The B-index model measures total generosity (maximum full value) of the tax system. Thus it operates under the following additional assumptions:

- No tax exhaustion - the index makes any difference between non-refundability and refundability provisions of tax incentives. Firms have sufficient taxable income to claim a full amount of R&D tax incentives in the current year. Thus no caps/cut-offs on the use of tax credits is considered.

[2] The net-of-tax cost of R&D will be lower in those countries which allow an immediate or accelerated write-off of expenditures on R&D plant and equipment.

- No carry-forward/carry-back provisions - because of no tax exhaustion the carryovers do not apply. But they can be incorporated under specific assumptions regarding the distribution of tax credits over time.
- To comply with the assumption of no tax exhaustion, the model also assumes the income tax rate and the rate of the tax incentive to be available on top eligible income.
- Other things equal - in practice, the situation is very different in many countries. Interest rates are different. Limits are imposed and the process of compliance with the tax authorities' rules and regulations is costly and can take a slice out of the tax incentive. This is not, however, the problem dealt with in the model.

Technical Assumptions

For consistent comparisons, the model measures country B-indexes under constant and uniform technical assumptions. These assumptions include:

- R&D expenditures are split into current expenses and capital expenses, using an average proportion of 90 per cent and 10 per cent, respectively.
- Wages and salaries (a component of current costs) are assumed to represent 60 per cent of total R&D expenditures.
- Capital expenses are divided equally between machinery and equipment (5 per cent), and buildings (5 per cent).
- Time factor: the B-index model is expressed in present value terms (net return over time). It is assumed that for all the countries compared, the discount rate is constant and holds at 10 per cent.[3]

Elements Not Included in the Model

The model does not include taxes and related incentives that do not pertain to corporate income taxation. As such personal income taxes, value added taxes, commodity taxes, property taxes, payroll taxes, taxes on wealth and capital, and grants and subsidies (i.e. positive taxes) are not included.

It has to be noted, however, that some of these elements can be included in the index provided appropriate information is available – an example are direct measures such as grants and subsidies and procurement contracts.

[3] This is a standard discount rate used in other studies. The rate has been kept unchanged to ensure comparability over time of the B-index with previous B-index studies. See, Bronwyn Hall and John Van Reenen, "How Effective Are Fiscal Incentives for R&D? A Review of the Evidence", *Research Policy*, Vol. 29, 2000, p. 468.

B-index Summary

Definition
Minimum present value of before-tax income:

- necessary to pay for the cost of R&D, and
- to pay the corporate income taxes, so that
- it becomes profitable for a firm to perform R&D.

Generic Formula

$$\textbf{B-index} = (1-A)/(1-t)$$

Where:

A = the net present discounted value of depreciation allowances, tax credits and other R&D tax incentives available (i.e., after-tax cost)

t = corporate income tax rate

What the B-index Describes
In economic terms, the model represents a before tax rate of return on one euro (€ 1) of R&D investment – in present value. In accounting terms, the B-index formula represents a ratio of the after-tax cost (ATC) of € 1 of expenditure on R&D divided by 1 less the corporate income tax rate. The ATC enters the numerator of the B-index equation. It is defined as the net cost to the company of investing in R&D, taking account of all available tax incentives for R&D. Tax incentives lower the ATC of an R&D project.

Corporate income tax rates influence the level of ATC, as well. The higher the tax rate the lower the ATC of R&D, which gives an impression that having high corporate income tax rates is beneficial to the firm. To eliminate as much as possible the impact of tax incentives from the impact of the corporate income tax rate, the study applies the measure of the before-tax index.[4]

B-index vs. Tax-subsidy Ratio
The name "B-index" captures the fact that the model describes the minimum *benefit* to cost ratio at which an R&D investment becomes profitable given a jurisdiction's income tax treatment for firms performing R&D. The name is rather cryptic, however, for those using the index. Thus other transformations of the B-index have evolved that help to better understand the nature of the index. Among them is a *tax-subsidy ratio* (i.e. the value of the B-index subtracted from unity), which has been used extensively by the OECD.

[4] For details on the model, see Donald G. McFetridge and Jacek Warda, *Canadian R&D Tax Incentives: Their Impact and Adequacy, Canadian Tax Foundation*, Toronto, 1983 or Jacek Warda, "Measuring the Value of R&D Tax Treatments in OECD Countries," *STI Review*, No. 27, OECD, Paris, 2001.

Possible Extensions

The B-index methodology can be extended to cover government R&D grants and subsidies i.e., government direct support measures. Including direct measures will lower the B-index, thus making a subsidised R&D project relatively more attractive to the firm. The replacement of € 1 of private R&D expenditure with € 1 of subsidy reduces the after-tax cost of a one-euro R&D project to zero. Since the B-index is expressed as the before-tax income required to cover € 1 of R&D investment, a 100 per cent cost subsidy will reduce the B-index to zero. In the case of a 50 per cent subsidy, the R&D project's after-tax cost will be reduced by a half, thus allowing the B-index to fall by a half of its before-subsidy value.

Including Direct Subsidies

In general, subsidies can be included in the B-index in a relatively straightforward manner: The generic formula is: Bs = B(1-Ps).

Where Bs = the B-index adjusted for the subsidy component, B = the unadjusted B-index (incorporating only the impact of R&D tax treatment), and Ps = the proportion of industrial R&D in a country covered by subsidies.

On Measuring Fiscal/Direct Incentives Policy Mix

The B-index was applied in the OECD study discussing the impact of public R&D on business R&D.[5] The main findings of the study are:

- *Both types of incentives can be beneficial*: Tax incentives and direct government funding both have positive impact on business-funded R&D.
- *There is a threshold for direct government funding*: Countries that provide amount of direct government funding to business that is either too low or too high stimulate private R&D less than countries with an intermediate level of direct funding. A threshold for stimulating effect of direct government funding is estimated at 13 per cent of business R&D spending – beyond that the effect of government direct funding decreases.
- *Different tools stimulate different type of R&D*: Tax incentives stimulate mainly R&D projects that involve more applied or short-term research while direct incentives affect projects which research is more basic or long-run.
- *Direct incentives and tax incentives are substitutes*: increased use of one reduces the effect of the other on business R&D.

[5] Dominique Guellec and Bruno van Pottelsberghe, *The Impact of Public R&D Expenditure on Business R&D*, STI Working Papers 2000/4, OECD, Paris, 2000

An interesting finding of the study is that tax incentives and direct measures are *substitutes* rather than complements. That is despite the evidence that they stimulate different R&D projects - short-term and long-term, respectively. Thus the study calls for an integrated long-term policy framework that would provide more consistency in application of various types of incentives and coordination between the various institutions involved in their design and implementation.

It may be so that a suite of incentives, of both direct and indirect nature, may be required to effectively stimulate private sector R&D. Further research may examine such optimal allocation of R&D policy instruments. The B-index can help in generating various incentive mix scenarios and effectiveness simulations, as it helped in the study reported.

On Measuring Components of R&D Tax Treatment

The B-index is capable of measuring the contribution of individual components of the R&D tax treatment. To do that, however, selection of an appropriate reference base - defining a non-incentive (or pre-incentive) component - is required for such comparison.

The reference base is a benchmark against which we measure the impact of each incentive component on the B-index. Depending on the type of the incentive, a different benchmark has to be selected.

- Current R&D expense deduction is pretty easy, as it generally falls in most countries into the definition of the reference base, so no comparisons need to be performed. In countries that treat current R&D expenditures as investment that needs to be amortized (e.g., Norway), current expensing will certainly represent an incentive element. The size of the incentive component will be the difference between the present value of the current expense deduction and the present value of the depreciation allowed for R&D investment (i.e. that country's reference base).
- Comparing the impact of R&D tax credits or R&D allowances is straightforward. For tax credits, the benchmark is a zero-tax credit situation.
- The problem generally arises in measuring the contribution of incentive depreciation. Reference base can be objective – economic or book depreciation – or subjective – country-specific tax law defining the reference-base depreciation. In each case, the difference between the incentive depreciation and the reference base will measure the value of the depreciation incentive.

B-index at Work: Recent OECD Study

There have been major improvements in R&D tax credits with some countries offering new incentives and other countries increasing percentage rates of tax credit. Based on the

most recent OECD data (2004), an increasing number of OECD countries - now numbering 18 – are introducing special fiscal incentives to business R&D. This compares with 12 such OECD countries in 1996.[6] And most recent improvements in the R&D tax treatment took place in Europe. Countries such as Spain, Norway, Denmark, Hungary, France, Austria and the United Kingdom are leading the international comparison or have the strongest R&D tax treatment incentives in Europe.

The 2004 update of the tax treatment in the OECD countries has produced the following results:

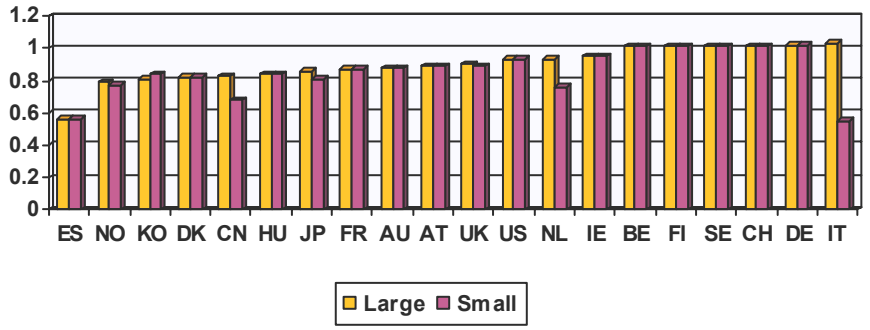
1. The use of R&D tax incentives in OECD countries continues to accelerate, particularly in Europe.
2. Eighteen of the 25 countries (72 per cent) surveyed have had an R&D tax incentive in place. This compares with only 12 countries (50 per cent) found to be using R&D tax treatment in 1996.
3. Five countries have boosted significantly their R&D tax treatment, compared with the 2001-2002 period - Denmark, France, Japan, Mexico and Norway.
4. Nine of the 18 users of R&D tax incentives have recorded no change to their system. Most of these countries' tax incentive programs are stable.
5. No country has abandoned or cut down on the generosity of the program unlike in the previous updates.

Chart 1 presents the international comparison of the R&D tax treatment for 20 OECD countries. Although the majority of countries provide R&D tax treatment regardless the size of the enterprise, seven countries – Canada, Italy, Japan, Korea, Netherlands, Norway and United Kingdom - provide R&D tax treatment for small companies. In most cases (marginal exception being Korea because of its low corporate income tax rate for small companies) small businesses are offered a preferential R&D tax treatment.

Chart 2 depicts changes in the R&D tax treatment over time for large companies. There has been a strong trend in the last five years to improve the R&D tax treatment – particularly in Europe and Asia. Of the 12 countries compared, nine recorded an improvement in the R&D tax treatment and three countries – Belgium, United States and Canada - found their R&D tax treatment at par over time.

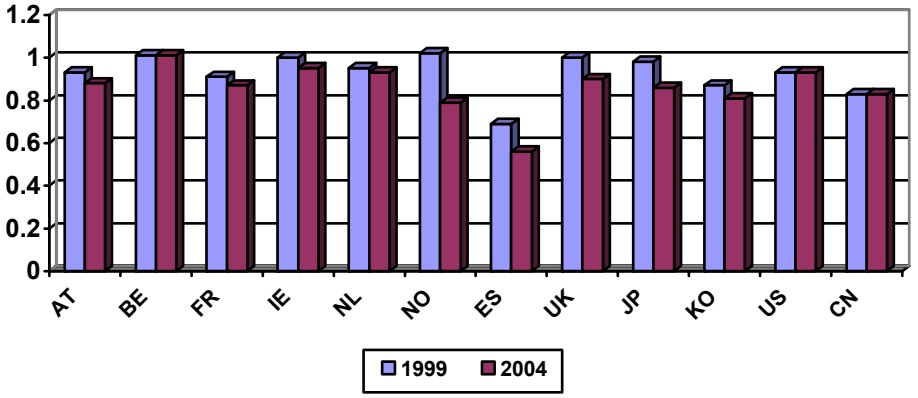
[6] *OECD Science, Technology and Industry Outlook*, OECD, Paris, 2004, and Jacek Warda, *R&D Tax Treatment in OECD Countries; A 2003-2004 Update*, Prepared for DSTI, OECD, September 2004

Chart 1: International Comparison of R&D Tax Treatment – 2004 (Large and Small Companies)



Source: *OECD Science, Technology and Industry Outlook*, OECD, Paris, 2004, Table 20, and JPW Innovation Associates Inc.

Chart 2: Changes in International R&D Tax Treatment, 1999 – 2004 (Large Companies)



Source: *OECD Science, Technology and Industry Outlook*, OECD, Paris, 2004, Table 20, and JPW Innovation Associates Inc.

Applications of the B-index

The B-index methodology has multiple uses. By measuring relative generosity of the R&D tax treatment, it makes international comparisons possible. It can be easily extended beyond the 25 OECD countries analyzed to cover the new and prospective members of the European Union. As such it can be used by these countries to inform and benchmark their R&D tax treatment position compared with other EU countries.

Moreover, as a synthetic measure, it allows tracking of tax trends and policy changes over time – thus it allows for monitoring progress. The B-index can also be used in the simulations of various tax incentive *designs* to estimate the relative value or attractiveness of such policy designs.

The index has been applied in econometric analysis to inform policy makers' decisions on the mix of indirect vs. direct support for R&D. It can also be used as a dependent variable in analysis of the effectiveness of tax incentives.

Finally, the index can be extended to include direct support instruments such as grants and contracts in order to produce a comprehensive picture of the overall level of generosity of government support to private sector R&D.

In sum, the benefits of the B-index include: measuring attractiveness of the tax system for R&D, making international comparisons possible, monitoring R&D tax policy changes, and allowing for tax and subsidy policy impact analysis.

B-index Discussion at the OMC Working Group Meeting

The B-index was found to be useful for comparisons and measurement of progress in implementing R&D tax incentives by EU member countries. Because of its quantification capabilities, charts, tables and regular updates can be produced through which the EU and individual countries can see where they stand in the ranking of attractiveness of the R&D tax treatment. This may generate interest among individual member countries to get apprised of their current comparative status and progress achieved. EU can also use the B-index model to involve individual countries in the design process for tax incentives to arrive at the optimal mix of incentives.

A question was raised whether countries that do not employ tax incentives and whose ranking is pretty low on the B-index scale (for example, Italy for large companies) should implement the tax incentives for R&D. The answer was that the B-index only shows how the country compares – it does not provide policy recommendations. It is for an individual country to decide on implementing tax incentives taking into account a multitude of other factors. Note R&D tax incentives do not operate in void – there are other factors and policy measures that might be also applicable to the country's situation.

In general, the B-index can help to promote the urgency for more R&D in the country or region, paving a way for better take-up of tax incentives as well as direct measures by the business sector.