

# Agenda

Advancing economics in business

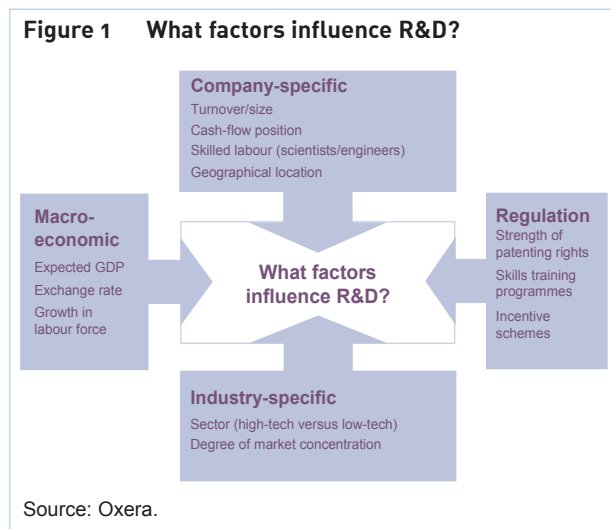
## Innovation through the tax system: what is the role of tax incentives?

**R&D encourages long-term economic growth through sustainable increases in productivity. Market incentives alone may not be sufficient to lead to an optimal level of R&D, so governments often encourage R&D activity through tax incentives. The design of these schemes varies throughout the EU, which has implications for both the effectiveness of the tax incentives and the complexity of any evaluation**

The European Commission aims to increase the amount of research in Europe, so that investment in R&D amounts to 3% of European GDP by 2010.<sup>1</sup> If successful, this could have a significant impact on long-term growth and employment throughout Europe. It is therefore critical to understand the drivers of investment in R&D, and how additional R&D activity can be encouraged. The overall strength of the economy, the regulatory regime, and various firm- and industry-specific factors can all influence spending on R&D (see Figure 1). For example, incentive schemes may encourage investment in R&D, including grants to attract scientists and engineers into the particular industry.

One way in which to incentivise R&D is through tax incentives. In 2006, the Commission introduced a series of recommendations to policy-makers involved in the design, implementation and evaluation of tax incentives for R&D.<sup>2</sup> These included encouraging collaboration across Member States when considering the tax treatment of cross-border R&D projects.<sup>3</sup>

The focus in this article is on the use of tax incentives. As part of the long-term evaluation of R&D tax incentives, Oxera has undertaken research for HM Revenue & Customs (HMRC), exploring the feasibility of robust empirical analysis of R&D tax incentives in the UK. Results were examined from empirical evaluations of tax incentives, looking at factors that influence spending on R&D, the impact of tax incentives on R&D, and the methodological approaches that could be adopted to evaluate these incentives.



In the recent UK Budget, changes were made to the corporate tax system in order to encourage greater R&D:

As innovation becomes increasingly important in maintaining the UK's globally competitive position, R&D tax credits play an even greater role in the UK's response to globalisation.<sup>4</sup>

### What schemes have been adopted in Europe?

Over half of the Member States have introduced tax incentives to encourage R&D.<sup>5</sup> The majority of schemes aim to make R&D less costly by reducing the amount of corporation tax paid by companies. Tax incentive schemes in the EU vary in terms of the type of fiscal

This article is based on the Oxera report 'Feasibility Study for Potential Econometric Assessment of the Impact of Tax Credits on R&D Expenditure', prepared for HM Revenue & Customs, September 2006. See [www.oxera.com](http://www.oxera.com). Details of incentive schemes in Member States are based on information gathered during the course of the research study for HMRC.

**Why do governments intervene to encourage R&D?**

Without intervention by governments, less R&D may be undertaken than is socially optimal.

As benefits accruing to companies that undertake R&D (private returns) may be substantially lower than the wider benefits that arise to society (social returns), this may deter investment in R&D. Empirical investigations have shown that the social rate of return to R&D may be up to five times higher than private rates of return.<sup>1</sup>

Economic theory suggests that companies are less inclined to invest in R&D if the information to replicate the research is available freely in the final product than if everyone had to pay for it. For example, once Mercedes-Benz invented the anti-lock braking system

(ABS), other manufacturers were able to copy the technology with relatively little cost, and ABS quickly became a standard feature on many cars from other manufacturers. The protection of such intellectual property rights through the patenting system may not be sufficiently strong to prevent companies that do not undertake R&D from free-riding on those that do.

R&D is also inherently risky because it may not ultimately lead to a successful innovation, which could be an additional disincentive for firms from investing in R&D. Even for those companies wishing to engage in R&D, uncertainty over the outcome of significant expenditure may make it difficult to obtain sufficient financing for the R&D programmes.

Note: <sup>1</sup> OECD (2002), 'Tax Incentives for Research and Development: Trends and Issues', Science Technology Industry, p. 6.

relief that is available, the expenditure qualifying for the relief, and the mechanics of the scheme.

There are two main types of tax relief.

- **Tax allowances**—companies' taxable income is reduced by the amount of R&D expenses. In some countries, the schemes enable taxable income to be reduced by more than the amount that is spent on R&D. The reduction in companies' taxable income is calculated from the tax allowance rate multiplied by the amount of eligible R&D expenditure.
- **Tax credits**—in contrast to tax allowances, which reduce companies' taxable income, tax credits directly reduce companies' payable income taxes. For tax credits, the reduction in the cost of R&D programmes for the company depends on the amount of eligible R&D and the applicable credit rate.

Firms without significant tax liabilities may benefit more from tax allowance schemes, while larger companies' total tax liability may be reduced through tax credits or tax allowances.

A number of countries, including the UK, have implemented schemes to encourage R&D in companies that do not pay tax, or in those companies that may not have sufficient income to benefit fully from the tax incentives. Typically, either the government refunds the unused proportion of the tax credits, or the unused credits are carried forward. In the latter case, the effectiveness of the policy could be reduced if the time value of money is not taken into account.

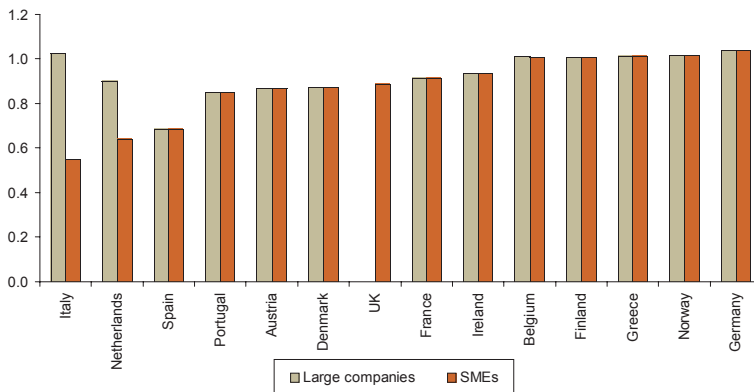
As well as the *form* of the tax incentives, schemes vary according to whether all expenditure on R&D is eligible (volume-based schemes), or whether only R&D over and above a specified base amount is eligible (incremental schemes).

Volume schemes (such as the system in the UK) may be simpler to administer, but as companies' total amount of R&D expenditure is eligible, this may be more costly for governments. Incremental schemes may be cheaper, as only that R&D that exceeds a specified base level is supported. According to theory, the R&D intensity of companies follows an S-shaped path (the Gompertz curve), and stabilises as the company matures. As such, incremental schemes may be effective in encouraging firms to undertake additional R&D, but may penalise companies that engage in a high stable level of R&D. This suggests that volume schemes may be more effective in encouraging R&D in industries with stable levels of R&D activity. However, such schemes might lead to the subsidising of research that would have taken place, even without government support.

The generosity of R&D tax incentive schemes varies considerably across the EU. As a result of the unique features of countries' tax systems, it can be difficult to compare schemes. However, a broad indication can be obtained by estimating the present value of before-tax income that is required to cover the initial cost of R&D investment and to pay corporate income tax.<sup>6</sup> Figure 2 below compares estimates for large companies and small and medium-sized enterprises (SMEs) throughout Europe: the lower the estimate, the more attractive a country's tax treatment of R&D. A value of 0.8 implies that companies need \$0.8 to finance \$1 of R&D.

According to this measure, at the time of this research, Italy and the Netherlands had the most attractive tax incentive schemes to encourage R&D by SMEs, while Spain and Portugal had the most generous tax incentives to encourage large firms to undertake R&D. In contrast, there were no tax incentives for R&D in Germany (as of 2002). Germany abolished its system of R&D tax credits in the 1990s as a result of concerns that the schemes led to tax evasion or avoidance by companies, with

**Figure 2 Generosity of R&D tax incentives across Europe**



Note: Pottelsberghe, Nysten and Megally (2003) do not report the estimate for large companies in the UK. This is due to the UK tax incentive scheme for large companies not being introduced until 2002.

Source: Pottelsberghe, B.V., Nysten, S. and Megally, S. (2003), 'Evaluation of Current Fiscal Incentives for Business R&D in Belgium', June, p. 17.

corporate income tax in their first three profitable years, with a subsequent tax exemption of 50% for the following two years.<sup>10</sup>

### What is the impact of tax incentives for R&D?

It is generally acknowledged that R&D tax incentive schemes increase companies' expenditure on R&D by at least the cost in forgone tax revenue, with the benefits increasing with time.<sup>11</sup> Empirical studies show that, in the short term, a 1% increase in R&D tax incentives may lead to a 1% increase in R&D expenditure by reducing the cost to the company of undertaking research. Over the long term, the increase in R&D expenditure could be double this level.<sup>12</sup>

non-R&D spending being incorrectly recorded under the tax credits.<sup>7</sup>

Among EU countries, France, the Netherlands and Belgium have the longest history of tax incentives for R&D. Together with France, the Netherlands is one of the few countries where tax incentive schemes apply to the wages of workers undertaking R&D.<sup>8</sup>

Not only does France have a similar scheme to the Netherlands, but it was also the first country to introduce tax incentives supporting young innovative companies that undertake levels of R&D that amount to at least 15% of the company's total revenue.<sup>9</sup> The 2004 Finance Act introduced the 'young innovative company' status for SMEs, which exempted these companies from all

In practice, it is often challenging to evaluate R&D tax incentives. According to the European Commission, relatively few tax incentive schemes have been evaluated as a result of their relative 'newness' and the lack of adequate data.<sup>13</sup> Oxera's research for HMRC found that there is unlikely to be sufficient data in the UK from which robust estimates of the impact of R&D tax incentives could be obtained. However, as more data becomes available with time, this would enable a robust econometric assessment of R&D tax incentives to be undertaken. That said, the available data was found to be more limited for smaller companies, which means that a more restricted range of statistical techniques would need to be used to assess the policy effects for these companies.

#### Tax incentives in the Netherlands

The Dutch tax incentive scheme (WBSO) reduces wage taxes and national insurance contributions for companies employing workers that engage in R&D (as of 2003).<sup>1</sup> The scheme enables companies to obtain rebates, which can amount to around 40% of a stipulated percentage of the company's total bill for R&D labour wages.

Eligible R&D must be undertaken in the Netherlands, and orientated towards technological and scientific research or the development of products, processes or software. In contrast to other schemes in Europe, the company applying for the rebate must show that the R&D is technically new.

Companies can choose whether to obtain the rebate on a monthly or annual basis. If they opt for the monthly

scheme, the rebate is estimated from the amount the company expects to spend on R&D-related wages over that month. At the end of the year, a correction is applied to adjust for any differences between expected and actual R&D expenditure. If actual expenditure is lower than expected, the tax credit that was obtained on the difference has to be reimbursed. However, if actual expenditure is higher than expected, the company cannot obtain additional tax credit. Such a scheme may benefit financially constrained companies. In contrast, larger companies may prefer receiving the rebate on an annual basis, as this means that no correction is required to adjust for any difference between expected and actual R&D expenditure, since such expenditure is not forecast.

Note: <sup>1</sup> Pottelsberghe, B.V., Nysten, S. and Megally, S. (2003), 'Evaluation of Current Fiscal Incentives for Business R&D in Belgium', June, pp. 26–32.

## R&D tax allowances in the UK

The Finance Bill in 2000 introduced the first tax credit scheme in the UK for SMEs, and was supplemented in 2002 with a scheme targeted at larger companies.<sup>1</sup> These schemes enable companies to deduct R&D expenditure at above the standard 100% when calculating corporate income tax liabilities.

Companies must spend at least £10,000 in an accounting period on qualifying R&D before claiming tax relief. Qualifying R&D is broadly the cost of staff actively engaged in R&D as well as materials and equipment used. A unique feature of the UK scheme is that companies undertaking R&D have six years in which to submit claims for tax relief.

The recent Budget enhanced the tax credit scheme for SMEs and large companies. This will raise the rate at which large companies can deduct R&D expenditure

(undertaken on their own behalf or for another non-SME) from the current rate of 125% to 130% from April 2008. The rate at which SMEs can deduct R&D expenditure (undertaken on their own behalf) will increase from 150% to 175% from April 2008, subject to state aid clearance.<sup>2</sup>

SMEs can also claim a 125% deduction on R&D that is sub-contracted to the SME by a non-SME. The sub-contractor cannot claim the R&D tax relief.

In addition to the sub-contractor scheme, any SME that makes losses, and thus does not pay tax, may under certain circumstances receive cash from HMRC, known as 'payable credits'.<sup>3</sup>

Any company (whether a large company or an SME) undertaking R&D into certain specified diseases can claim an additional deduction of 50% of qualifying expenditure on R&D (as part of the Vaccines Research Relief scheme).

Notes: <sup>1</sup> The definition of an SME follows the approach adopted by the European Commission for state aid purposes. An SME has less than 25% of its capital or voting rights owned by an enterprise that is not an SME, and has fewer than 250 employees, with either an annual turnover that does not exceed €40m, or an annual balance sheet total that does not exceed €27m in the current or previous year.

<sup>2</sup> HM Treasury (2007), 'Budget 2007: Building Britain's Long-term Future—Prosperity and Fairness for Families', Economic and Fiscal Strategy Report and Financial Statement and Budget Report, March, p. 51.

<sup>3</sup> The payable tax credit could amount to £24 for every £100 of actual R&D expenditure; it applies only to the SME scheme, and not the large company scheme.

To assess the impact of incentive schemes on R&D expenditure, data is required for those companies that claim R&D tax incentives over a sufficiently long period for the incentives to have affected spending on R&D.<sup>14</sup> Ideally, companies claiming R&D tax incentives would be compared with a representative control group of companies that do not claim tax incentives. Econometric (statistical) analysis of R&D tax incentives could then be conducted to evaluate whether companies claiming these tax incentives spend more on R&D than companies that do not.

It is crucial to ensure that the evaluation is robust, which raises some challenging methodological issues—not least of which is the difficulty in identifying a comparable group of companies that undertake R&D, but that do not claim tax credits. In addition, to isolate the impact of tax incentives on R&D, controls need to be made for other factors that could influence R&D expenditure, such as company turnover and size. Furthermore, modelling R&D expenditure becomes more complex since the direction in which the causality flows is not always clear—eg, whether turnover affects the level of R&D expenditure, or whether the level of R&D expenditure influences a company's turnover.<sup>15</sup>

## Conclusion

The wider benefits of additional investment in R&D are well known, and it is recognised that tax incentives generally lead to an increase in R&D expenditure over the longer term. However, evaluating the direct impact of tax incentive schemes is challenging, particularly as these schemes are continually evolving.

In 2006, the European Commission recommended that evaluations should focus on the extent to which tax incentives lead to an increase in R&D over and above the level that would have occurred without such schemes.<sup>16</sup> It was also recommended that the broader benefits of tax incentives should be evaluated in the context of the overall state of the economy.

As a result of the divergence in tax incentive schemes across Europe, there is no single solution to these challenges. It will be interesting to see how Member States face up to the complexities involved when evaluating the impact of such schemes, as the results of empirical studies will provide additional insights into the optimal design of tax incentive schemes for R&D.

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- <sup>1</sup> European Commission (2003), 'Investing in Research: An Action Plan for Europe', Communication from the Commission.
- <sup>2</sup> European Commission (2006), 'Communication from the Commission to the Council, the European Parliament and the European Economic and Social Committee: Towards a More Effective Use of tax Incentives in Favour of R&D', Commission staff working document, p. 12.
- <sup>3</sup> European Commission (2006), 'Tax Incentives: Commission Promotes an Effective Use of Tax Incentives for R&D', press release IP/06/1598, November 22nd.
- <sup>4</sup> HM Treasury (2007), 'Budget 2007: Building Britain's Long-term Future—Prosperity and Fairness for Families', Economic and Fiscal Strategy Report and Financial Statement and Budget Report, March, p. 49.
- <sup>5</sup> European Commission (2006), 'Communication from the Commission to the Council, the European Parliament and the European Economic and Social Committee: Towards a More Effective Use of Tax Incentives in Favour of R&D', Commission staff working document, p. 5.
- <sup>6</sup> Algebraically, estimates are calculated as the after-tax cost of an expenditure of \$1 on R&D, divided by  $1 - \text{the corporate income tax rate}$ .
- <sup>7</sup> OECD (2002), 'Tax Incentives for Research and Development: Trends and Issues', Science Technology Industry, p. 30.
- <sup>8</sup> In France, employers are exempt from social security for an eight-year period for highly skilled personnel engaged in R&D.
- <sup>9</sup> Expert Group on Fiscal Measures for Research (2004), 'Report Submitted to CREST in the Context of the Open Method of Co-ordination', The Hague, June 15th, p. 50.
- <sup>10</sup> In order to benefit from the scheme, SMEs must be established for less than eight years, comprise fewer than 250 persons, with sales turnover of less than €40m. Belgium introduced a similar scheme in 2006.
- <sup>11</sup> European Commission (2006), 'Communication from the Commission to the Council, the European Parliament and the European Economic and Social Committee: Towards a More Effective Use of Tax Incentives in Favour of R&D', Commission staff working document.
- <sup>12</sup> Hall, B. (1992), 'R&D Tax Policy during the Eighties: Success or Failure?', National Bureau of Economic Research Working Paper, No. 4240.
- <sup>13</sup> European Commission (2006), 'Communication from the Commission to the Council, the European Parliament and the European Economic and Social Committee: Towards a More Effective Use of Tax Incentives in Favour of R&D', Commission staff working document, p. 11.
- <sup>14</sup> It may take up to five years before tax incentive schemes have an impact on R&D, and even longer for these schemes to have an impact on the wider macroeconomy.
- <sup>15</sup> Oxera's report for HMRC provides further detail on the issues that need to be considered before undertaking a robust econometric evaluation of R&D tax incentive schemes.
- <sup>16</sup> European Commission (2006), 'Communication from the Commission to the Council, the European Parliament and the European Economic and Social Committee: Towards a More Effective Use of Tax Incentives in Favour of R&D', Commission staff working document.

If you have any questions regarding the issues raised in this article, please contact the editor, Derek Holt: tel +44 (0) 1865 253 000 or email [d\\_holt@oxera.com](mailto:d_holt@oxera.com)

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