R&D tax credits

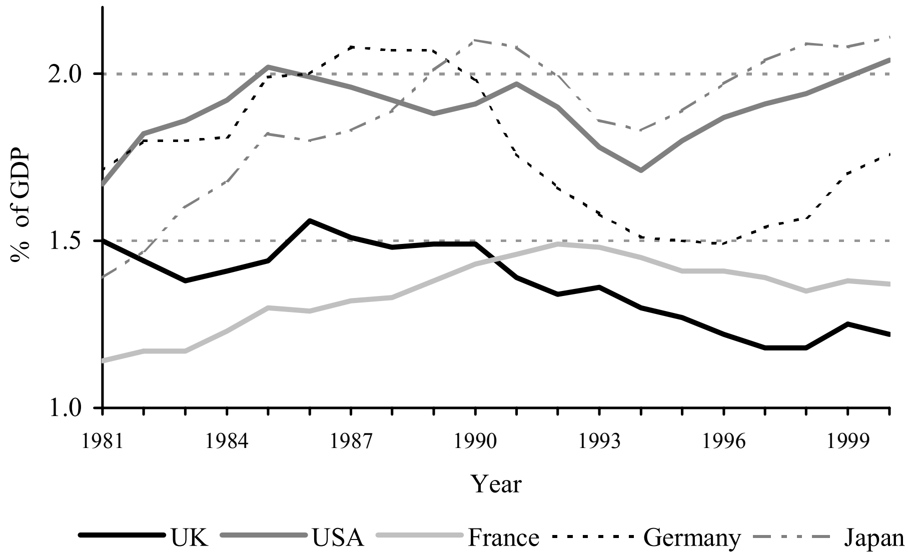
Our current understanding of economic growth emphasises the role of new knowledge created by profit-seeking firms as a primary source of long-run growth in GDP and living standards. Firms engage in research and development (R&D) in order to develop new products or to reduce the cost of producing their existing products. They may also need to do R&D in order to understand and absorb new knowledge created elsewhere. This emphasis on the role of R&D is supported by a range of empirical evidence suggesting that R&D expenditure is important for explaining productivity growth at the firm, industry and country level.

Governments in many countries, including the UK, are concerned that firms are not doing enough R&D, and have designed policies that aim to encourage more of it. In the UK the Government has recently introduced two separate R&D tax credits for small and large firms. These tax credits work like a negative tax that reduces firms' costs of doing R&D. In this article we will discuss what economic arguments lie behind concerns that R&D is under-provided, what the tax credits look like, and whether there is any evidence that they work.

What is R&D, and why might firms not do enough of it?

In practice firms undertake a whole spectrum of innovative activities that range from small modifications to existing products or processes at one end, to general scientific research with no specific commercial application at the other. A lot of scientific research is also done in universities and government laboratories. The Organisation for Economic Cooperation and Development (OECD) has developed a definition of R&D that sets required standards of novelty for an activity to be called R&D. Based on their definition, the OECD publish statistics on how much R&D is performed in different countries. The vast majority of formal R&D is done in a small number of rich and technologically advanced countries, often referred to as the 'G5': the USA, Japan, Germany, France and the UK. Figure 1 shows business spending on R&D as a percentage of GDP for the G5 countries over the period from 1981 to 2000. This measure of R&D intensity has declined in the UK relative to the other G5 countries, especially over the 1990s. This is one of the reasons why the Government has been concerned about the level of business R&D in the UK.

Figure 1. Business R&D as a % of GDP: G5 countries



Note: Data for Germany cover West Germany until 1990 and unified Germany from 1991.

Source: OECD, Main Science and Technology Indicators, 2002.

However, the fact that the level of R&D in the UK has been declining relative to that in other similar countries does not automatically imply that the Government should intervene in order to encourage higher levels of R&D spending. In reducing their R&D intensity, UK firms may be reacting optimally to changes in their market environment. In the face of limited information on firms' R&D requirements, it is always possible that government intervention will simply result in a wasteful use of scarce resources, or even make matters worse by diverting existing resources into less productive activities.

Economic justification for government intervention in firms' R&D activities should rely on two conditions: that the market does not provide firms with sufficient incentives to invest in the optimum level of R&D, and that government intervention can efficiently and effectively provide the appropriate incentives. The first of these conditions requires that there are externalities to R&D – in other words, when a firm generates new knowledge, some of the benefits accrue to other firms and individuals in ways that they do not pay for. The reason we might expect this to be the case is that knowledge is unlike most other goods, such as steel or computers, for example. A firm might have difficulty preventing somebody else from legally using a piece of knowledge that it has created, but this is unlikely to be the case with other goods, where the firm's property rights are more easily enforced.

There is a considerable amount of empirical evidence that there are indeed externalities to R&D. Many studies have found that firms benefit from the R&D expenditure of other firms in their industry. These "spillovers" can occur in several ways, for example through imitation or "reverse engineering" of new products introduced by other firms. The presence of spillovers means that a firm's private return (i.e. its profit) from investing in R&D will be lower than the return to society as a whole. Taking the middle range of existing estimates, the social return to R&D may be more than twice the private return. Because each firm does not take these wider benefits into account when making its R&D investment decisions, the total amount of R&D undertaken by all firms will be lower than the socially optimal level. This is the primary economic justification for government support for R&D.

Policies to increase the level of R&D

In practice, government policy in most countries already promotes R&D in many ways. About one third of all R&D performed in the UK is funded by government, most of it performed in universities. The patent system is a way of providing incentives for firms to innovate, because they know that their inventions cannot be imitated by others for the lifetime of the patent. The UK Government also directly funds about 10% of R&D that is performed by businesses. Much of this relates to defence R&D, but there exist several schemes through which firms, and particularly smaller firms, can apply for government grants to perform R&D.

However, in recent years there has been a general move in several OECD countries away from direct funding for R&D and towards indirect support through the tax system. Tax incentives seem a natural policy for a market-oriented government that wants to increase R&D expenditure. The key advantage compared with direct support is that decisions on where and how to spend R&D budgets are made by firms themselves, who are likely to have better information than any bureaucratic central authority on which projects are most likely to be successful. By reducing firms' costs of R&D, tax credits directly target the externality that provides the justification for intervention in the first place.

The UK Government has recently implemented two new R&D tax credits, one for small and medium sized enterprises (SMEs), introduced in 2000, and one for larger firms, introduced in 2002. The credits work by allowing firms to deduct more than 100% of the cost of their current expenditure on R&D from their taxable profits, thus reducing their corporation tax bill. The rate for SMEs is 50% and for large firms 25%, so for every £1m spent on R&D a SME can deduct £1.5m from its taxable profits and a large firm can deduct £1.25m. In the case of a large firm paying corporation tax at 30%, this provides a 7.5% benefit, or £75,000 for every £1m spent on R&D. A tax credit of this form is only valuable to firms if they are making positive profits on which they pay tax. Since this may not always be the case, especially for SMEs, the small firms' credit has an additional provision so that a SME that is not making any taxable profits can claim a cash repayment at a rate of 24%, or £240,000 for every £1m spent on R&D.

Several important questions arise in the design of an R&D tax credit. One big choice is whether to subsidise all of a firm's R&D (a volume-based credit) or just the additional amount of R&D expenditure over some base (an incremental credit). A disadvantage of volume-based credits is that they not only reduce the cost of new R&D, but also subsidise the R&D that a firm would have done anyway. This means that a large part of the cost to the government does not have any impact on firms' incentives to do more R&D. In comparison, an incremental credit increases firms' incentives to do R&D in the same way as a volume-based credit, but at a much lower cost to the exchequer. However, a key problem with incremental credits is that it may be difficult to define incremental R&D without creating perverse incentives. For example, one option is to define incremental R&D as any expenditure over a rolling average of the previous two or three years, but this may discourage firms from raising their R&D spending too much in any one year since this raises the base for the calculation of incremental R&D in future years. Partly for this reason, as well as reasons of administrative simplicity, the UK Government has decided on volume-based tax credits.

Do R&D tax credits work?

So is there any evidence that R&D tax credits work, and what effects can we expect the new UK tax credits to have on R&D and productivity growth in the UK? Economists have traditionally been sceptical about the efficacy of fiscal incentives for R&D, partly because the responsiveness of R&D to its tax price was believed to be low. However, several studies using evidence from countries that have introduced tax credits in the past have suggested that tax changes do significantly affect the level of R&D. A consensus estimate is that a 10% reduction in the price of R&D would lead to a 1% increase in the amount of R&D in the short-run (i.e. within two or three years) and a 10% increase in the longer run.

A remaining concern is whether observed increases in R&D expenditure represent genuine increases in the production of new knowledge, or whether firms are re-labelling other activities as R&D in order to receive the credit. It is also possible that the main impact of subsidies to R&D in the short-run is to increase the salaries of scientists and engineers, which account for up to 50% of all R&D expenditure. There is some evidence that R&D tax credits have had this effect in the USA.

Overall, it is likely that the new R&D tax credits in the UK will increase the level of R&D spending by UK firms, and will contribute to productivity growth. However, we should not expect them to bring about a miraculous recovery in R&D expenditure towards the levels seen in the other G5 countries, and the R&D tax credits alone are unlikely to raise UK productivity levels up to those in the USA. These policies should be seen as part of a broad innovation strategy that includes investment in skills, infrastructure and improved networks for the diffusion of new technologies from universities to firms. This last area in particular is a focus of the current policy debate.