10. Support for research and innovation

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Summary

- In the December 2009 Pre-Budget Report (PBR), the government announced its intention to introduce a 'patent box' – a new policy aimed at encouraging innovation in the UK by taxing income from patents granted after April 2013 at a reduced 10% rate of corporation tax.
- The proposed patent box would do little to address the market failures that typically justify government intervention in innovation markets. It is expensive even on the government's own costing (£1.3 billion a year), the bulk of the gains will accrue to a few large companies, and the money would be better spent supporting innovation by maintaining spending on the science base or other infrastructure investments.
- Spending cuts of £600 million have already been announced from the higher education and science and research budgets. This is likely to be followed by further cuts in these areas, as the government attempts to cut spending on public services.
- The PBR also announced minor reforms to the research and development tax credits to allow small and medium-sized companies to benefit from the scheme without the need to own the intellectual property resulting from the research. This is welcome.

10.1 Introduction

Many governments around the world subsidise investment in research and innovation. This support is delivered in a number of ways, including direct spending on science, research and universities, as well as market-based policies such as research and development (R&D) tax credits. The rationale for these policies is that markets fail to provide sufficient incentives for investment in research, because research activities generate benefits not only to the individuals and firms carrying them out but also to others. An additional source of market failure is the difficulty that exists in financing investments in research and innovation due to their risky and intangible nature (see Box 10.1).

In this chapter, we comment on:

- the proposed 'patent box' (Section 10.2);
- direct spending on science and universities (Section 10.3);
- the reforms to the R&D tax credits for small and medium-sized enterprises announced in the December 2009 Pre-Budget Report (PBR) (Section 10.4).

Section 10.5 concludes.

Box 10.1. Why governments support innovation

Research and innovation involve the creation of new ideas. These are intangible, and thus it is often difficult for the inventors to appropriate all the returns from their efforts. Some of the benefits from the inventions will 'spill over' to third parties (this is what economists call a positive externality). As a result, market incentives alone may provide too little incentive for research and innovation from society's point of view. This is one of the strongest justifications for government support of research and innovation: by lowering the private cost (or increasing the private gain), government can encourage the activities that generate spillovers.

In addition, firms and individuals may be restricted in the extent to which they can respond to market incentives due to failures in financial markets, which make it difficult to secure external sources of finance for risky and intangible projects. This can also lead research and innovative activities to be underprovided.

Other rationales for government intervention include coordination failures – where individuals and firms may face difficulty in acting collectively towards a common goal – and information failures, where firms are unaware of the existence of potential research partners or of a particular technology.

The extent to which these market failures provide a justification for government intervention will vary according to the type of activity. The largest externalities (spillovers) arise in the area of basic science. Fundamental discoveries and general technologies will find the widest application and have the broadest impact. This type of research would be hard to secure private financing for and tends to have more uncertain returns. Much of this type of activity is conducted in (government-supported) universities or research labs. While firms do sometimes also contribute to basic science, more often they carry out applied research that has a particular application to a specific market and a more certain return. This generates fewer externalities and is likely to be easier to finance. Research and innovation that benefit an individual firm, but do not spill over to other firms, are beneficial to growth. But in this case the market provides the appropriate incentives for the firms to balance costs against benefits and so carry out the socially optimal amount of innovation, and government support is not warranted.

10.2 The patent box

In the December 2009 PBR, the government announced its intention to introduce a 'patent box' in April 2013, which will tax income from patents at a reduced rate of corporation tax. The stated aim of this policy is 'to strengthen the incentives to invest in innovative industries and ensure the UK remains an attractive location for innovation'.[1]

The government has given few details on how the policy will work in practice, although the PBR did suggest that the lower rate will apply only to income from patents 'granted after the legislation is passed' in 2013 and gave an estimated costing of the patent box of

[1] See paragraph 4.40 of HM Treasury, *Pre-Budget Report 2009*, December 2009, http://www.hm-treasury.gov.uk/prebud_pbr09_repindex.htm.

£1.3 billion a year.[2] Consultation on how the scheme will work is due to happen before its introduction in the 2011 Finance Bill.

A patent is a legal document that grants an individual, institution or firm the exclusive rights to use (or license) a novel technology for a specified period of time. In exchange for these exclusive rights, the underlying technology describing how the innovation works must be disclosed so that, once the patent has expired, the information is freely available to others. The underlying technology can have been developed anywhere in the world; the inventors who created the invention are often distinct from the firm that holds the patent and can be located in a different country.

Patents are issued by national patent offices and provide monopoly rights to use a technology in that country.[3] For example, the UK Intellectual Property Office (UKIPO) issues patents in the UK. The patent office in which a patent is held indicates the country in which the intellectual property is protected, not the country in which the research was undertaken or the country in which the firm holding the patent is resident for tax purposes. Many foreign firms hold patents at the UKIPO, and many UK firms hold patents in foreign patent offices.

Patents that are granted usually represent the fruits of research that was undertaken many years prior to filing a patent application. In addition, the average length of time it takes to have a patent granted, after the initial filing, is five years.[4]

Is subsidising income from patents sensible?

A policy of subsidising income from patents is not well targeted at the market failures that typically justify government intervention in innovation markets. A patent box targets the *income* received from an innovation. However, the largest source of external benefit arises from the research activity itself – exploring new ideas allows others to learn from the experience – which may or may not result in large revenue streams. Although the commercial application of an idea (which generates revenue) can also lead to external benefits, the majority of benefits here are likely to be captured by the innovator.[5] In fact, the grant of a patent, by issuing monopoly rights over that technology, is designed to ensure that the owner can capture the returns to the invention. A policy targeted at patent income also only rewards successful research after the fact, but important external benefits may also arise from unsuccessful research: others can learn from mistakes.

In addition, there is a long lag between creating a patentable technology and generating a stream of income on which a reduced rate of corporation tax can be levied. A firm that has a new idea must carry out the research to create a patentable technology and then move through the processes of getting the patent granted and commercialising it. It is only once

[2] Quote from paragraph 4.40 and estimate from table 1.2 of HM Treasury, *Pre-Budget Report 2009*, December 2009, http://www.hm-treasury.gov.uk/prebud_pbr09_repindex.htm. The estimate is a steady-state figure.

[3] Holding a patent in one national office may also give some degree of protection in other countries. There is also a European Patent Office (EPO); however, there is no such thing as a European patent: applications filed to the EPO designate the countries in which protection is sought, and patents will be granted by the relevant national offices.

[4] Figures for European Patent Office; see section 4.2 of OECD, *OECD Patent Statistics Manual*, 2009. The grant lag varies across offices.

[5] See, for example, H. L. Williams, 'Intellectual property rights and innovation: evidence from the human genome', 2009, http://www.people.fas.harvard.edu/~hlwill/papers/Williams_jmp.pdf, which suggests that patented innovations are the ones that have the least spillovers.

the idea generates income that the policy provides a reward, long after the initial finance will have been secured. However, financial market failures mean that innovators may be unable to secure external sources of finance for the initial investment into risky and intangible projects. This policy does not address this market failure.

Two issues that are likely to have a major effect on the impact of the policy are 'Which patents are eligible under the scheme?' and 'How is patent income defined?'.

Which patents will be eligible?

Implementation of a patent box will require a definition of which patents are eligible – something that is not at all obvious.

One approach would make all patents granted by the UKIPO eligible. This would exclude patents held by UK firms (firms that are resident in the UK for tax purposes) that are filed at other national patent offices, such as the US Patent and Trademark Office (USPTO), the Japan Patent Office (JPO) and other European national offices, and would encompass patents filed by foreign firms, many of which will not be resident in the UK for tax purposes. This would increase the incentive for firms paying corporation tax in the UK to file patents at the UKIPO, but would not change firms' incentives to create technology in the UK.

An alternative approach would be to define the group of patents as those that arose from UK research. In the first instance, it would be difficult to define which patents were created in the UK. Often, the technology underlying a patent is created by multiple inventors located in different countries, making it difficult to select those that were truly created in the UK. In addition, a policy that specified that research must be conducted in the UK would likely meet resistance from the EU Commission, since favouring research conducted in the UK over that conducted elsewhere is incompatible with the free movement of services in the EU. Ireland introduced an exemption for patent royalties in 1973 that attempts to target R&D conducted in Ireland, but it is due to reconsider this policy following a formal request from the EU Commission.[6]

The definition that is closest to that adopted in other countries (see Box 10.2) is all patents held by firms that are tax-resident in the UK. As discussed above, there is an important distinction between where intellectual property is held and where innovative activity takes place: while the firm holding the patent may be resident in the UK, some or all of the inventors who created the underlying technology may be located in other countries.

As an example, Ericsson Ltd is a UK subsidiary of a Swedish firm. In 2005, it filed a patent application at the European Patent Office (EPO) relating to the splitting of optical signals, which was based on the work of two inventors located in Italy.[7] This issue is common; looking at patent applications filed at the EPO in 2005:

[6] For information about EU Commission actions and further references, see press release IP/07/408, available at http://europa.eu/press_room/index_en.htm. For information about the Irish exemption, see, for example, A&L Goodbody, 'The Irish patent exemption', http://www.hg.org/articles/article_1176.html.

[7] Publication number EP1762029, application title 'Wavelength division multiplex (WDM) optical demultiplexer'. This patent document can be viewed at https://data.epo.org/publication-server/search using the publication number and publication dates in 2007.

Box 10.2. Patent box systems in other countries

There are a number of European countries that have implemented some form of a patent box, including the Benelux countries (Belgium, the Netherlands and Luxembourg), Ireland and Spain. The systems in operation in these countries generally define eligible patents as those held by firms resident in the country for tax purposes, and include patents that have been created by offshore inventors. It seems unlikely that the UK would be able to operate a policy that restricts where research leading to the patent took place, given Ireland's current experience with the European Commission and other EU cases. See references in main text.

The relief comes in the form either of a reduced rate of corporation tax for the eligible income or an exemption from corporation tax for a percentage of the eligible income.

For example, in Belgium, a patent is eligible if it has been either developed by the firm or acquired or licensed and then further developed by the firm in Belgium. In the latter case, further development does not require additional patents. At no stage does the patent or further development have to take place in Belgium; the technology can be created in a foreign R&D centre. The basis for the tax deduction is the income that is derived directly from licensing the patents or from using the patents in the production process. In the latter case, the 'deemed income' is calculated as that which the company would have received had it licensed the patents to unrelated third parties. In both cases, the tax deduction is equal to 80% of the arm's-length income.

- one-fifth of those filed by UK applicants listed at least one inventor resident outside the UK;[8]
- one-quarter of those filed by subsidiaries of UK-headquartered firms were filed from an offshore applicant.[9]

This means that at least some of the activity subsidised would be conducted offshore.

Does it matter where innovative activity is conducted? In the case of patentable inventions, many of the external benefits are likely to arise from the inventors that create the new technologies; inventors hold tacit knowledge which is shared when they interact with others. There is some evidence to suggest that these benefits are largest to those who are geographically close.[10] Therefore, activities carried out offshore may have lower external benefits for the UK. On the other hand, if firms have chosen the optimal location for innovative activities, this may be in order to access the latest technologies or tap into specific skills. Some of the external benefits generated offshore may then be transmitted, through those firms, back to the UK.[11]

Under a definition that included all patents held by firms that are tax-resident in the UK, there would be additional issues to address – for example, would the patents that are held by a UK-headquartered firm in an offshore subsidiary be eligible? Also, would the

[8] 20% of the inventors listed on patents filed by UK applicants were located outside the UK, 10% elsewhere in Europe and 6% in the US.

[9] Of these offshore applicants, a third were located in the US and a quarter were in each of Germany and Sweden.

[10] A. B. Jaffe and M. Trajtenberg, *Patents, Citations and Innovation: A Window on the Knowledge Economy*, MIT Press, Cambridge, MA, 2002.

[11] R. Griffith, R. Harrison, and J. Van Reenen, 'How special is the special relationship? Using the impact of US R&D spillovers on UK firms as a test of technology sourcing', *American Economic Review*, 2006, 76, 1859–75.

patents be eligible if they were being licensed to a UK-resident firm from another company?

The definition of which group of patents would be eligible for the patent box will have a very important effect on the incentives created by the policy and the extent to which it makes the UK a more attractive location for innovative activity or patent holding.

How is income attributed to a patent?

A further difficulty arises in attributing income to specific patents, and so identifying which income qualifies for the reduced rate of corporation tax.

If a firm licenses out a patented technology, then the income received can be clearly identified. However, the income is much harder to identify when the patented technology is used within the firm to generate income. For example, say that Ericsson used the technology described above to produce a new radio access networking product and sold it at a profit. While part of the income received is due to the patented technology, some of it will be due to other factors – for example, the success of the marketing department. How much income did the patent generate? Since the patented technology is not sold in the market, there is no observable price, and so it is difficult to identify the income stream that it generates; instead, this must be imputed.

Similar problems arise in other parts of the tax system – for example, the transfer pricing problem that occurs when inputs are transferred within a firm or across borders. The solution applied in transfer pricing, and in patent box systems in other countries (see Box 10.2), is to require firms to use the arm's-length principles to define the income, i.e. to determine a measure of how much a third-party firm would pay to license the patent in order to use it in the creation of goods or services. This can be a difficult calculation, particularly if income is generated using multiple patents, only some of which are eligible for the patent box. This is likely to be the case when the policy is introduced, since it will only apply to those patents granted after April 2013. Difficulty may also arise if the firm is using technology from multiple patents held by subsidiaries in different locations. The rules to deal with this are likely to be complex and open to abuse.

Impact of the policy

How effective will a patent box be at increasing incentives to invest in innovation in the UK? The precise answer will depend on the final workings of the policy. As discussed above, one key issue will be which patents are included in terms of where the research that went into producing the patent was carried out. Whatever the design, the policy will largely increase incentives to locate *income from patents* in the UK, and so is not well targeted towards encouraging additional innovative *activity* to take place in the UK. The policy is clearly not targeted at attracting tax revenue, as the government estimates a revenue cost of £1.3 billion a year.

The policy might be most effective at increasing research incentives for domestic firms that conduct all of their activity in the UK; these firms have less scope for income shifting. However, these firms are on average smaller, and are more likely to be financially constrained; for these firms, the time lag between carrying out the research and earning the income from a patent will be likely to matter a lot. For large multinational firms, the policy is likely to create an incentive to shift income from patents into the UK without necessarily any accompanying real innovative activity.

Therefore, a reduced rate of corporation tax on patent income seems unlikely to encourage much additional innovative activity in the UK either from domestic firms or from encouraging multinationals to locate innovative *activities* here.

Who will benefit most from the patent box? The distribution of patent holdings is highly skewed; the majority of patent applications are filed by a small group of firms. For example, if we look at patent applications made by UK-headquartered firms at the EPO in 2005 (the most recent year for which complete information is available), we see that the four firms with the largest number of patent applications (GlaxoSmithKline, AstraZeneca, Unilever PLC and BT Group PLC) accounted for over a fifth of all patent applications filed by UK firms – see Table 10.1. The 10 largest firms together, which represent only 1% of UK firms applying for a patent in 2005, accounted for one-third of patent applications. The share of patent income received by the largest firms is likely to be even bigger.

Table 10.1. The number and location of patent applications made by UK firms

	Number of patent applications (% of all patent applications made by UK firms)	**Number of patent applications made by a UK subsidiary** *Inventors' location*		**Number of patent applications made by an offshore subsidiary** *Inventors' location*	
		UK	***Some or all offshore***	***UK***	***Some or all offshore***
GlaxoSmithKline	222 (6.7%)	72	53	12	85
AstraZeneca	211 (6.3%)	75	136	0	0
Unilever PLC	195 (5.9%)	1	5	60	129
BT Group PLC	103 (3.1%)	52	51	0	0
Total	3,329 (100%)	1,954	628	82	665

Notes: Patent applications are those made to the EPO with an application priority date in 2005. We include all patents filed by the firms' European and US subsidiaries. Patent applications with inventors located in the UK are those applications where the residential address of all inventors was in the UK, and those with some or all offshore are patent applications where at least one inventor had a residential address outside the UK.
Source: Authors' calculations using the EPO Worldwide Patent Statistical Database, PATSTAT.

Another feature of the pattern of patent application and inventor location that we see in Table 10.1 is that it is often the case that a patent held by a UK firm was created by offshore inventors. The location of the inventors provides a better indicator of where the research activity was conducted than the location of the firm making the patent application. This means that by targeting patents, the policy will be subsidising not only research activity in the UK but also research activity carried out offshore.

Assuming that the income stream generated by these patents is similar across firms, and abstracting from any behavioural changes, the bulk of the benefits from this policy will accrue to a few large companies. However, the policy is likely to also lead firms to change their behaviour – for example, by:

- increasing the amount of innovative activity that leads to eligible patents;
- increasing the patenting of intellectual property that would otherwise have been unpatented;
- moving patent income into the UK from other locations for tax purposes;

- shifting income that was not previously defined as coming from patents into the patent box.

The changes in behaviour that involve shifting or reassigning income, without any change in real activity, will represent a deadweight cost of the policy; they will allow companies to reduce their tax bills without any increase in innovative activities. In addition, the tax reduction will be available to all new patents, including those that would have taken place without the policy, and as a result it will entail a further and large deadweight cost from subsidising existing investments. In fact, the largest revenue cost will result from those patents that generate the largest revenue streams. These are the projects that are the most likely to have been undertaken anyway, since they are the most profitable.

One final point is that the pre-announcement of this policy, with the government saying that it will not apply to patents that come in between now and the implementation date, will encourage firms to delay patents being granted until after the legislation is passed. In practice, this is likely to have only a small impact. A patent takes an average of five years to be granted, so most of the patents applied for today will not be granted until after the policy is in force. Where the procedure is quicker, firms may have an incentive to delay. In addition, some of the firms that have already applied for a patent will want to try to delay the grant date until after legislation. However, delaying the grant date of a patent has no effect on real activity, since patents can be used while still in the application stage.

10.3 Direct spending on science and universities

Direct government spending can address many of the market failures present in the innovation market. All developed economies spend substantial sums on supporting science and research. For example, President Barack Obama's American Recovery and Reinvestment Act included large increases in spending on science in the US.

Basic science creates fundamental discoveries and general technologies which will have wide applications and broad impact. This type of research is hard to secure private financing for, partly because it tends to have highly uncertain returns and partly because it is difficult to appropriate the returns. Most basic research activity is therefore carried out with direct government support, and it is often conducted in government-run research labs or universities.

Government spending can also foster conditions that support private sector innovation. For example, infrastructure investment can help create conditions that are conducive to research. These include not only world-class universities and research facilities, but also good transport networks, high-speed internet services and a host of other facilities.

UK government direct spending on the science base has grown over the past decade, and stands at a relatively high level.[12] On many measures, the UK has a strong science base.

[12] The science budget more than doubled between 1997 and 2007. For more information, see Department for Innovation, Universities and Skills, *Innovation Nation – Background Analysis: Strengths and Weaknesses of the UK Innovation System*, 2008, http://www.dius.gov.uk/reports_and_publications%20HIDDEN/~/media/publications/I/innovation_nation_background_analysis and http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk//dius/science/science-funding/budget/page28923.html.

For example, with only 1% of the world's population, the UK produces 9% of all scientific papers and receives 12% of citations.[13]

But what are the prospects for government spending on science going forward? In the 2009 PBR, the government announced proposals for £600 million of cuts to come from higher education and science and research budgets before 2013. This was part of measures aimed at reducing government spending and is due to come from:

> a combination of changes to student support within existing arrangements; efficiency savings and prioritisation across universities, science and research; some switching of modes of study in higher education; and reductions in budgets that do not support student participation.[14]

It is likely that further cuts will follow in this area, as the government attempts to rein in public spending. Going forward, the government would, on the estimates produced in Chapter 8, need to make cuts totalling £42.0 billion, or 10.9%, to Whitehall spending on public services over the four years 2011–12 to 2014–15. For 2011–12 and 2012–13, the government has committed to protect some priority areas of spending, including the NHS and schools, and to continue to increase spending on overseas aid sharply. As a result, cuts will need to be made from the remaining unprotected departments, the largest of which are Transport, Defence, Housing and Higher Education. It seems likely that further cuts will be made to the higher education and research and science budgets, as well as to infrastructure more generally.

Cuts in spending on science and universities are likely to have important long-term consequences. They would lead not only to direct falls in innovative outputs, but also to indirect falls to the extent that the UK would become a less desirable place for firms to conduct research.[15] If the government's aim is 'to strengthen the incentives to invest in innovative industries and ensure the UK remains an attractive location for innovation', as was stated in the PBR, then the revenue loss expected from the patent box – £1.3 billion a year – would be better spent protecting the spending in this area. This would go a long way to shoring up the science budget, which for 2010–11 is £3.2 billion.[16]

10.4 R&D tax credits

The UK currently offers tax relief for R&D costs through two tax credits – one aimed at large firms and the other at small and medium-sized enterprises (SMEs)[17] – which

[13] See Department for Business, Innovation and Skills, *International Comparative Performance of the UK Research Base*, 2009, http://www.dius.gov.uk/science/science_funding/science_budget/~/media/publications/I/ICPRUK09v1_4.

[14] See paragraph 6.46 of HM Treasury, *Pre-Budget Report 2009*, December 2009, http://www.hm-treasury.gov.uk/prebud_pbr09_repindex.htm. At this stage, there are no further details about what this will actually mean in practice.

[15] For the benefits of public R&D spending, see, for example, J. Haskel and G. Wallis, 'Public support for innovation, intangible investment and productivity growth in the UK market sector', 2009, http://www.coinvest.org.uk/pub/CERIBA/PublicSupportCeriba/innovation_JHGW_09Dec09.pdf, and D. King, 'The scientific impact of nations: what different countries get for their research spending', *Nature*, 2004, 430, 311–16, http://www.berr.gov.uk/files/file11959.pdf.

[16] See http://www.rcuk.ac.uk/aboutrcs/funding/scibudget.

[17] SMEs are defined as those with fewer than 500 employees and either an annual turnover not exceeding €100 million or a balance sheet not exceeding €86 million.

together cost approximately £600 million per year.[18] Tax credits reduce firms' costs by allowing them to deduct an amount greater than actual R&D expenditure from taxable profits, and thereby reduce their corporation tax bill. Tax credits are market-based policies which aim to increase the private rate of return to R&D, to bring it closer to the social rate of return. By subsidising research activity directly, this policy is reasonably well targeted at externality-generating activities (see Box 10.1).

For large companies, tax relief is given at 130%; that is, for each £100 of qualifying costs, a company can reduce the income on which corporation tax is paid by £130. For SMEs, the tax relief is 175%.[19] In addition, for SMEs, part of the credit is 'repayable': firms with insufficient taxable profits can claim a cash payment equal to 24% of eligible R&D expenditure. This makes the SME tax credit effective for small R&D-intensive start-ups that have not yet generated any taxable profits. However, at present, SMEs can only claim relief on intellectual property that they own themselves.

In PBR 2009, the government restated its commitment to the R&D tax credit as a mechanism for promoting innovation. In addition, it announced the 'removal of the condition that any IP [intellectual property] deriving from the research and development must be owned by the company making the claim'.[20] This is a small but welcome adjustment. Small firms might organise their investments in such a way that the intellectual property is held by another firm – for example, if a number of small firms conduct a research project jointly, allowing them to share both the high costs and the benefits.

10.5 Conclusion

The government is proposing to introduce a patent box – an expensive and poorly targeted policy – while at the same time likely making large cuts to the science budget, jeopardising the UK's strength in this area.

The government's stated aim in introducing the patent box, which will tax income from patents at a reduced rate of corporation tax, is to 'ensure the UK remains an attractive location for innovation'. This seems to be at odds with the likely outcome, since this policy gives increased incentives to hold patent *income*, not necessarily to conduct innovative activity, in the UK.

Part of the effect will be to encourage eligible patent income to shift into the UK. Income is not a good target for the innovative activity that is associated with the highest external benefits, and thus the patent box lacks the justification usually attributable to government support for innovation.

The policy may encourage additional innovative activity, but there is nothing to ensure that this will be located in the UK. It seems likely that much of the cost will be

[18] See table 7 of HM Treasury and HM Revenue and Customs, *Tax Ready Reckoner and Tax Reliefs*, December 2009, http://www.hm-treasury.gov.uk/d/pbr09_taxreadyreckoner.pdf.

[19] In both cases, the relief is only available for companies spending at least £10,000 a year on qualifying R&D costs; for SMEs, there is also an upper limit of €7.5 million on the total amount of aid that can be received for any one R&D project. There are strict guidelines regarding what qualifies as an R&D project. Broadly, it must be a project that 'seeks to achieve an advance in overall knowledge or capability in a field of science or technology through the resolution of scientific or technological uncertainty' (http://www.hmrc.gov.uk/ct/forms-rates/claims/randd.htm).

[20] See paragraphs 4.41 and 4.42 of HM Treasury, *Pre-Budget Report 2009*, December 2009, http://www.hm-treasury.gov.uk/prebud_pbr09_repindex.htm.

deadweight, i.e. it will subsidise activity that would have taken place in the absence of the reduced corporate tax rate. For the policy to lead to increased innovation in the UK, there would need to be a strong link between where patents are held and where innovation takes place.

It is not clear that this policy will lead firms to increase the amount of innovation they undertake, since there is a long and uncertain lag between creating a patentable idea and earning the income on which the lower tax rate is levied.

If the patent box is unlikely to achieve its stated objectives, why might it have been introduced? Firms earning a lot of income from patents may have told the government that they would consider relocating if it failed to offer similar tax advantages to those available in countries that have already introduced patent boxes. By implementing the scheme, the government may reduce the likelihood of this happening, although it is hard to know how credible the threat of relocation would have been in the first place.

Unlike the patent box, there are clear rationales for spending on education, science, research and infrastructure. Government intervention in these areas can help to create an environment that is attractive for innovating firms. This government has a strong and welcome track record at increasing spending in these areas. It would be a shame to reverse this trend, especially at the cost of introducing a £1.3 billion a year patent box which provides tax relief for a few large companies.