

6. Company taxation and innovation policy

This chapter begins with a discussion of four issues in company taxation. First, we assess the recent government consultation document on reform to corporation tax, which looks at possible changes to the rules for calculating taxable income. (This follows a series of reforms to the taxation of corporate profits since 1997, which are discussed in Chapter 9.) In Section 6.2, we look at the taxation of dividends, in the light of the changes to the UK tax system since 1997 and recent proposals for reform in the USA. In Section 6.3, we assess the structure of North Sea taxation following the changes announced in Budget 2002 and in the 2002 Pre-Budget Report. Then, in Section 6.4, we consider an issue that is not on the government's immediate agenda, but one where there might be a case for reform – stamp duty on share transactions.

The chapter also looks at innovation policy, following the 2002 Pre-Budget Report announcement of a review into the interaction between universities and business, which will report at the same time as a separate review of the UK's innovation performance. In the final section of the chapter, we examine trends in UK research and development (R&D) activity and consider current policy towards innovation, including the two new R&D tax credits.

6.1 The August 2002 consultation

In August 2002, the government issued a consultation document on further reform to the corporation tax system.¹ This considered possible reforms in three main areas relating to the calculation of taxable income: the treatment of depreciation and gains and losses on capital assets; the schedular system, which distinguishes between income from different sources; and the distinction between trading companies and investment companies.

The objective of the proposed reforms in each area is to align the calculation of taxable income more closely with the measurement of profits in company accounts. This follows the approach taken in recent changes to the taxation of intangible assets (Finance Act 2000), loan relationships (Finance Act 1996) and foreign exchange gains and losses (Finance Act 1993). In many areas, such alignment with accounting practice can achieve useful simplification of the tax system. However, some of the proposals considered in the consultation document could have radical impacts on tax reliefs for depreciation and on the tax treatment of losses, as we discuss in this section.² As the trading/

¹ HM Treasury and Inland Revenue, *Reform of Corporation Tax*, London, 2002 (www.inlandrevenue.gov.uk/consult_new/taxreform_final.pdf).

² A more detailed response to this consultation is provided by A. Klemm and J. McCrae, *Reform of Corporation Tax: A Response to the Government's Consultation Document*, Briefing Note no. 30, IFS, London, 2002 (www.ifs.org.uk/corptax/bn30.pdf). A wider discussion of the issues involved in aligning tax and commercial accounts is provided by G.

investment company distinction affects only a limited number of firms, our discussion here focuses on the first two issues.

Capital allowances

Capital equipment that is used in producing goods or supplying services typically falls in value as it is used, and may become worthless at the end of its useful life. This fall in the value of capital assets, known as economic depreciation, represents a cost to the owner, which is reflected in depreciation charges against profits in company accounts, and in capital allowances against taxable income in the corporation tax. Capital allowances claimed in 1999–2000 amounted to £65 billion, or about half of total income chargeable to corporation tax (net of these and all other allowances).³ About 90% of these capital allowances were for plant and machinery. Any reform to the system of capital allowances could therefore have large effects on the tax bills facing individual companies, even if it were revenue-neutral overall. Capital-intensive industries such as energy, engineering and other manufacturing could be particularly affected.

Under the current rules, most types of plant and machinery qualify for a 25% per annum writing-down allowance, on a declining-balance basis.⁴ There are more generous provisions for favoured forms of investment, such as some energy-saving technologies and investment by smaller companies, and a lower rate for some ‘long-lived’ assets used mainly by utility companies. Industrial buildings benefit from a 4% per annum writing-down allowance on a straight-line basis,⁵ whilst there is no writing-down allowance for commercial buildings.

At present, there is no connection between these writing-down allowances prescribed for tax purposes and the depreciation charges that are used in firms’ published accounts. In reporting their profits, firms may use higher or lower depreciation rates, depending on the nature of the capital assets they own. For example, expenditure on computers with very short useful lives may be written off more quickly, whilst expenditure on pipelines with very long useful lives may be written off more slowly. The treatment of these assets in company accounts has no implications for the firm’s corporation tax liability.

Replacing the current system of capital allowances by a deduction for the depreciation charge reported in company accounts would have major implications for firms that account for depreciation at substantially different rates from the current schedules of capital allowances. Retailers who depreciate their commercial property would benefit, gaining a deduction for depreciation where none is currently provided under capital allowances.

Macdonald, *The Taxation of Business Income: Aligning Taxable Income with Accounting Income*, Tax Law Review Committee Discussion Paper no. 2, IFS, London, 2002.

³ *Inland Revenue Statistics* (www.inlandrevenue.gov.uk/stats/index.htm).

⁴ For a £100 investment, the capital allowance is £25 in the first year, £18.75 in the second year (i.e. 25% of the remaining £75 balance), and so on. These allowances are treated as costs in the calculation of taxable income for each period.

⁵ For a £100 investment, the capital allowance is £4 per year for a period of 25 years.

Engineering firms that write off their plant and machinery more slowly than the 25% capital allowance rate would tend to lose out, receiving less generous depreciation deductions than under the current tax rules.

The consultation document omits any detailed analysis of which sectors would gain and lose from this change, whether the tax relief for depreciation would become more or less generous overall as a result, and what the consequent effects on corporation tax revenues would be. We estimate that, on average, depreciation rates used in company accounts tend to be lower than those specified by capital allowances. If so, tax relief for depreciation would become less generous, on average, if this reform were to be implemented, and corporation tax payments would tend to be higher, unless there were an offsetting reduction in the corporation tax rate. There would also be substantial redistribution of corporation tax payments, with plant-and-machinery-intensive sectors such as manufacturing tending to lose and other sectors, such as services, tending to gain.⁶

Such a change in the tax treatment of depreciation would have a substantial impact on the cost of capital and the incentive to undertake investment in the UK. Existing capital allowances do not provide particularly generous tax relief for depreciation when compared with corporate income taxes in other major economies.⁷ Whilst there may be a case for linking tax depreciation schedules more closely to economic depreciation rates for assets used by different sectors, or for cutting tax allowances for depreciation overall, such radical reforms should clearly be evaluated with regard to their effects on business investment and corporation tax payments, and not slipped in under the banner of simplifying the calculation of taxable income.

A problem with aligning tax and accounting depreciation deductions is that, by choosing to increase the rate at which capital expenditures are written off against profits, firms would be able to defer their corporation tax payments. Not only would this be a potential threat to corporation tax revenues in the longer term, but it would also reduce the quality of the information provided in published accounts. Especially after recent accounting scandals, it would seem risky to introduce tax incentives for companies to produce accounts that may not provide an appropriate measure of profits. To avoid too much abuse, the likely outcome would be prescribed maximum rates of depreciation for different types of assets, similar to the present capital allowances, with accounting depreciation provisions tending to converge on these prescribed rates. So rather than aligning tax allowances with company accounts, the result may be the opposite, i.e. to align accounts with tax rules.

⁶ A. Klemm and J. McCrae, *Reform of Corporation Tax: A Response to the Government's Consultation Document*, Briefing Note no. 30, IFS, London, 2002 (www.ifs.org.uk/corptax/bn30.pdf), discuss the available empirical evidence in more detail.

⁷ A. Klemm and J. McCrae, *Reform of Corporation Tax: A Response to the Government's Consultation Document*, Briefing Note no. 30, IFS, London, 2002 (www.ifs.org.uk/corptax/bn30.pdf), compare the tax treatments of depreciation in 16 OECD countries.

The schedular system

The consultation document also considers changes to the schedular system currently used to compute taxable income, which would have implications for the tax treatment of losses. Like most corporate income taxes, corporation tax is charged when taxable income is positive, but there is not a symmetric treatment when taxable income is negative. A symmetric treatment would require a negative tax payment, or a payment from the Inland Revenue to the firm, equal to the tax rate times the loss. Instead, the loss can, at best, be set against taxable profits from a limited number of earlier years. When this carry-back provision is exhausted, losses can only be carried forward to set against taxable profits in subsequent years, with no compensation for the delay before losses can actually be used.

These limitations on loss relief discriminate against large, risky investments, which, in the event that they turn out to be unsuccessful, could push the firm into a loss-making position. High tax payments expected if returns turn out to be high are not balanced by tax rebates expected if profits turn out to be negative, an effect that can be avoided if the firm chooses a safer investment with less chance of returning a loss. This effect is particularly important in the case of new, start-up firms, which do not have past profits against which losses can be carried back, and which may not expect to generate positive taxable profits for some considerable time. The tax treatment of the same investment project undertaken by an established firm with profits generated by existing operations is also more generous, which runs counter to the government's objective of stimulating enterprise and business start-ups.

The schedular system in the UK corporation tax introduces further limitations on relief for losses. Profits and losses from different sources are not aggregated at the level of the firm, but are calculated separately under different 'schedules', and 'cases' within schedules (for example, Schedule A Property Income and Schedule D Case I Trading Income), and for trading income, separately for different trades. In the current year, any losses can generally be offset against current profits from any schedule or trade. Losses carried back or forward, however, can generally only be offset against profits from the same schedule or trade.⁸ The result is that a loss generated on one activity may not even be offset against a profit generated by the same firm but from a different source and in a different time period. Such losses in an otherwise profitable firm are often called trapped losses, particularly if they stem from a scaled-down or abandoned activity that is not expected ever to produce profits high enough to relieve past losses. The effect of the schedular system is that integrated companies are currently taxed similarly to groups, as group relief also only allows losses to be offset against profits of other subsidiaries in the same accounting period. The origins of the schedules, however, date back to the development of the personal income tax in the nineteenth century, and have no parallel in the calculation of profits in company accounts.

⁸ The exact limitations on the set-off of losses vary somewhat across different schedules and cases.

The Inland Revenue estimates that, of the £80 billion losses generated by UK companies in 2000–01, around £15 billion were unrelieved and left to be carried forward to later years. Providing full relief for these losses would therefore be expensive: using the standard corporation tax rate of 30% suggests a cost of around £4.5 billion, compared with total corporation tax receipts in 2000–01 of around £32 billion. Such expensive measures are unlikely to be on the government's agenda at the present time.

The consultation document does not estimate what fraction of these losses would be relieved under various proposed relaxations of the schedular system, but it is likely to be rather small. Of much greater quantitative significance would be changes to the current system of group relief. If the schedular system were to be significantly relaxed or abolished, then there would be a strong case for relaxing the limits on group relief as well, allowing group-wide carry-forward of losses. Otherwise, there would be a tax incentive for groups with large stocks of losses carried forward to integrate their subsidiaries, so as to be able to offset these losses against profits from other activities. Another argument for relaxing the limits on group relief would be the logic of aligning taxable income more closely with accounting profit, which would suggest taxing groups of companies on the same consolidated basis as reported in their consolidated accounts. However, the cost of the additional loss relief that this implies may make such changes prohibitively expensive for the foreseeable future.

The extent to which changes to the schedular system would deal with the concern over start-up companies is unclear, since relatively few new firms are likely to have income from more than one source. A more targeted approach to this issue would be to allow at least some tax reliefs to be paid immediately to loss-making firms in their start-up phase, along the lines of the R&D tax credit for small and medium-sized companies introduced in April 2000.

6.2 Dividend taxes

Since 1997, there have been important changes to the taxation of dividends in the UK – namely, the abolition of repayable tax credits to tax-exempt shareholders in 1997 and the abolition of advance corporation tax (ACT) in 1999. While no new reforms have been announced since the abolition of ACT, this topic remains interesting, especially as the USA has just announced a possible change to its system of dividend taxation.

Background

Across the world, many different approaches to dividend taxation are taken. This is because different views can be held about the extent to which double taxation of dividends should be avoided. Double taxation can arise because dividends are paid out of taxed profits but may then be subject to income taxes levied on the recipient of the dividend.

In a classical system of dividend taxation, corporate taxes and taxes paid by recipients of dividends are completely separate, and dividends therefore face

taxation both at the firm and at the individual level. Theoretically, there are two ways this double taxation can be completely avoided. One possibility is to tax dividends only at the shareholder level. This can be achieved by a full imputation tax system, in which a tax credit accompanies dividends paid out of taxed profits, reflecting the full amount of corporate tax paid on the underlying profits. The individual can then set this tax credit against his or her own tax liability. If the personal tax rate is higher than the corporation tax rate, additional tax payments are required; if it is lower, some of the tax credit will be paid out to the shareholder. The other possibility is to tax dividends at the company level only. This can be achieved by exempting dividends from income taxation, which is in fact the US proposal. Whilst full imputation ensures that dividends are taxed only once at the recipient's marginal income tax rate, the latter approach imposes a single flat-rate charge at the corporate income tax rate.

In practice, few countries employ any of these systems in a pure form. Instead, most countries operate systems that relieve some, but not all, of the possible double taxation of dividends. Systems practised include: applying a lower personal tax rate on dividends than on other personal income; using partial imputation (i.e. dividends come with a tax credit, but the tax credit does not reflect the full tax paid at the corporate level); or applying a lower corporation tax rate on distributed earnings. The systems of some countries incorporate more than one of these features.

The system in the UK

From 1973 to 1997, the UK used a partial imputation system, in which dividends were accompanied by a tax credit that was set at the standard personal income tax rate, so that basic-rate taxpayers did not face any additional tax liability on dividend income. Higher-rate taxpayers had to pay additional tax on dividends, and tax-exempt shareholders could claim back the tax credit. The latter point was especially important for pension funds, as a high proportion of shares are held indirectly through such institutions. The reason for calling this system a *partial* imputation system is that the rate of the tax credit was generally lower than the corporation tax rate.

Since the July 1997 Budget, these tax credits are no longer repayable to tax-exempt institutional shareholders. For other domestic shareholders, nothing of substance changed,⁹ so that the UK now has a hybrid system, with partial imputation for taxpaying shareholders and a classical treatment of tax-exempt shareholders. The reform could therefore be seen as a move towards a more classical system of dividend taxation. In effect, the current UK system could also be described as having no income tax on dividends for most domestic shareholders and a preferential tax rate on dividends for higher-rate taxpayers.

⁹ The tax credit was cut from 20% to 10%, but this did not affect domestic shareholders, because their tax rates on dividend income were reduced correspondingly (currently 10% for basic-rate taxpayers and 32.5% for higher-rate taxpayers).

The system in the USA

The situation in the USA is rather different. As yet, the USA is one of only four OECD countries applying a pure classical system of dividend taxation.¹⁰ The recent proposal to abolish dividend taxation at the shareholder level would therefore move the US system more in line with those of other countries, which give some relief for double taxation, even if in very diverse ways. The direction of change in the proposed US reform, away from a classical system, is opposite to the direction of the recent changes in the UK. The final system achieved is, however, rather similar. The only substantial difference in its effect is that the tax liability in the UK is still to some extent determined by the tax rate of the shareholder, as higher-rate taxpayers face an additional tax charge on dividends. The US proposals would abandon progressive taxation of dividends, as dividend income would be subject to a flat-rate charge at the corporate tax rate. The US announcement also contained a proposal to exempt retained profits from capital gains taxation at the personal level. As the practicality of this proposal is somewhat unclear, we do not discuss it further in this section.

Effects of reforms

The reforms in the UK and those proposed in the USA have both been accompanied by claims that they would have beneficial effects on investment. In the USA, the further claim was made that they would be beneficial for the stock market. Interestingly, even though the reforms go in opposite directions, it has been claimed in both cases that they will lead to higher investment.

The argument in the UK was that pension funds were thought to prefer a large share of profits to be paid out rather than reinvested, because only dividends paid out benefited from the tax credit. It was then argued that removing the repayability of the tax credit would diminish the pressure that pension funds were thought to exert on companies to pay out dividends rather than reinvest earnings, possibly to the detriment of investment. If this were right, the US proposals would seem unlikely to lead to higher investment, as they reduce taxes on dividends and therefore make dividend payouts more attractive from the point of view of shareholders.

There is another less speculative effect that operates through the cost of capital. Lower taxes on dividend income may reduce the cost of capital for investment financed by issuing new shares, since the anticipated return in the form of future dividend payments is subject to lower taxation. In aggregate, however, most investment is financed not by new equity but by either retained earnings or borrowing.¹¹ The cost of capital using these sources of finance will not change. In particular, since financing investment by retained earnings

¹⁰ The other three countries are Switzerland, Luxembourg and the Netherlands. There are other countries that do not have imputation systems; however, as they have reduced income tax rates on dividends, they have in effect relieved some of the double taxation and are therefore not classified here as pure classical systems. These countries include Austria, Belgium, Hungary, Japan, Poland and Sweden.

¹¹ Some firms depend more heavily on new equity finance – for example, small start-up firms.

exchanges dividends now for the expectation of higher dividends in the future, a permanently lower tax rate on dividends has no effect on the required rate of return. Even for firms using new equity finance, the cost of capital will only fall if their key shareholders are taxpaying individuals, affected by the proposed reform. A large proportion of company equity is owned indirectly through pension funds or plans, which are already exempt from income tax on dividends. The cost-of-capital effect could therefore lead to higher investment for some firms as a result of the proposed US tax change, but it is doubtful that the aggregate effect will be large.

The proposed US reform may have other effects. Some stimulus to the stock market is possible, but again not likely to be large, as domestic taxpaying individuals are the only shareholders for whom taxation will change as a result of the reform. More likely effects are changes in the way companies pay out cash to shareholders. The current US tax system taxes dividends more highly than share buy-backs, and arguably this has led to high levels of buy-backs in the USA. Removing the tax disadvantage of dividends may well lead to firms switching from buy-backs to dividend payments. But it should be stressed that this is a change to the form in which cash is paid from firms to their shareholders, not to the level of cash distributed by firms, and consequently it is unlikely to have any substantive effects.

To sum up, while many countries have recently changed their dividend tax systems, it is unlikely that the effects on business investment or the stock market have been large. Specifically in the case of the USA, it is difficult to avoid the conclusion that the main effect of the proposed US reform would be to raise the post-tax incomes of individuals who own equities directly rather than through tax-exempt pension plans, with the largest beneficiaries likely to be among the wealthiest stockholders. Whilst such a measure is unlikely to appeal to Gordon Brown, further changes to dividend taxation in the UK should not be ruled out. Whether the UK can keep its current system, which still uses tax credits, will also depend on international developments, such as rulings by the European Court of Justice and the possible drafting of further European Union directives.

6.3 North Sea taxation

Changes to North Sea taxation announced in Budget 2002 have some merits, but policy in this area still seems to be driven too much by short-term revenue needs or changes in the oil price. More consideration should be given to creating a stable tax regime that would facilitate long-term investment decisions.

The changes announced in the April 2002 Budget include the introduction of a new supplementary charge in addition to corporation tax and new 100% capital investment allowances, plus the abolition of licence royalties. The first two changes applied with immediate effect, but the abolition of licence royalties was subject to consultation on its timing. In the November 2002 Pre-Budget Report, it was announced that they would be abolished from 1 January 2003.

Box 6.1. North Sea taxation

The following taxes and charges are levied on North Sea production. Most remaining taxes are charged on a measure of profits, but the exact definition of taxable profits varies across taxes. The taxes charged vary with the date of approval of a field. A summary is given in Table 6.1.

Petroleum revenue tax (PRT): Charged on profits at a rate of 50% on fields approved prior to 15 March 1993.

Corporation tax (CT): Charged on profits at a rate of 30% on all fields. This is the same tax as charged on the UK mainland, except that it is ring-fenced, i.e. losses from other activities cannot be set against profits from oil and gas production.

Supplementary charge: Charged on profits at a rate of 10% on all fields. Unlike for corporation tax purposes, financing expenses (mainly interest) are not deductible.

Prior to 1 January 2003, there were also:

Licence royalties: Charged on gross value of output, less some limited expenditure, at a rate of 12.5% on fields approved prior to 31 March 1982.

Table 6.1. Applicable taxes and marginal tax rates by date of approval of field

Date of approval of oilfield	Taxes that apply:	Marginal tax rate
Up to 31/3/82	CT, supplementary charge, PRT, licence royalties (until 31/12/02)	73.8% until 31/12/02 70% from 1/1/03
1/4/82–15/3/93	CT, supplementary charge, PRT	70%
Since 16/3/93	CT, supplementary charge	40%

Economic effects of the reforms

The new 10% supplementary charge and the 100% capital allowances are in line with the economic theory of resource taxation. Many economists have argued that taxes levied on profits from the exploitation of natural resources should be neutral with respect to investment. In other words, they should not discourage investment in projects that would be profitable in the absence of taxation. This can be achieved by taxing economic rents rather than total profits. Economic rents are any profits in excess of the minimum level that makes a project commercially viable. Extracting natural resources typically generates a high level of economic rents, as the underlying resources are intrinsically scarce. The level of rents an oilfield generates also depends strongly on the price of crude oil and therefore varies if prices are volatile. Capital allowances of 100% ensure that a large share of the minimum required

return to a project remains untaxed,¹² while the supplementary charge increases the tax rate on rents. These two changes together can thus be seen as a step towards economically efficient rent taxation for new investment activity in the North Sea.

The remaining change is the abolition of licence royalties. This only affects oilfields approved prior to 31 March 1982, as only those fields were liable to royalties. Royalties were levied on the gross value of output, less some limited expenditure. Being revenue-based, royalties can have extremely harmful effects on incentives to invest. Not only are they charged on fields earning less than the minimum required return, but they can even apply to loss-making fields, as most costs are not deductible in the calculation of their base. The use of royalties also meant that there were three different tax regimes coexisting in the North Sea, depending on the date of approval of a field. Their abolition reduces this number to two. (See Box 6.1 for a summary of North Sea taxation.)

Effects on revenues

The combined effect of the 10% supplementary charge and the new 100% investment allowances is to increase tax revenues by about £600 million yearly by 2004–05.¹³ Licence royalties raised £558 million in 2001–02,¹⁴ just under 11% of total tax revenues from the North Sea. However, as royalties were deductible as an expense for all other North Sea taxes, the revenue cost of their abolition is estimated to average £143 million per year.¹⁵ The net effect of all the new changes to North Sea taxes will therefore be to raise annual revenues by nearly half a billion pounds.

Conclusion

Although the recent changes have merit in themselves, it is important to view North Sea taxation in historical perspective. Too often in the past, North Sea tax rules have changed in response to short-term revenue needs or changes in the oil price. Investment in the North Sea needs to be planned over a long time horizon, and stability is needed to allow firms to make informed decisions. This implies the need for a stable tax regime that is able to cope automatically with the volatility of oil prices.

The current reforms arguably did not go far enough as there are still two different tax regimes, depending on the date of approval of a field. While opinions on the optimal level of taxation may differ, it is hard to see how

¹² Some normal profits will still be taxed, because the 100% allowance does not apply to all capital investment and because the value of any unused allowances diminishes in present-value terms.

¹³ Table A.1 of HM Treasury, *Financial Statement and Budget Report*, London, 2002 (www.hm-treasury.gov.uk/Budget/bud_bud02/budget_report/bud_bud02_repchapa.cfm?).

¹⁴ Table 11.11 of *Inland Revenue Statistics* (www.inlandrevenue.gov.uk/stats/corporate_tax/ct_t11_1.htm).

¹⁵ Table B.4 of HM Treasury, *Pre-Budget Report 2002*, Cm. 5664, London, 2002 (www.hm-treasury.gov.uk/Pre_Budget_Report/prebud_pbr02/report/prebud_pbr02_repannxb1.cfm?).

different rates on fields approved at different times form part of a well-designed tax system. The argument that high taxes on old fields do not cause any harm because investment is a sunk cost does not completely hold. As older fields reach the end of their lifetimes, incremental investment is often needed. Premature abandonment of fields would be undesirable, as the cost of reopening fields later is likely to be prohibitive and any unused resources would potentially be lost.

6.4 Stamp duty on shares

In 2001–02, stamp duty on share transactions raised £2.9 billion, down from £4.5 billion in 2000–01. This represents about $\frac{3}{4}\%$ of total public sector net receipts, a small but not insignificant sum.¹⁶ The Chancellor's fiscal room for manoeuvre is clearly limited in the forthcoming Budget, but given his oft-stated goal of increasing productivity, there is no reason why, in principle, he could not consider policy change involving a reduction in the rate of stamp duty on shares.

Stamp duty is levied at $\frac{1}{2}\%$ of the purchase price on all share transactions in UK incorporated companies. Reducing stamp duty on shares – perhaps instead of a reduction in a less distorting tax such as corporation tax – would be likely to boost productivity for three main reasons. First, stamp duty lacks any investment allowances and is therefore likely to discourage investment more than other kinds of capital taxes. Secondly, it reduces the efficiency of the stock market for UK listed companies by raising transactions costs and possibly increasing share price volatility. Finally, it distorts merger and acquisition activity, producing a bias towards overseas rather than UK ownership of companies. Each of these effects is discussed in turn below.

Stamp duty is levied on the purchase price of a share. Unlike corporation tax, which taxes profits after allowing at least partially for the cost of investment, stamp duty in effect taxes both the full amount invested and the subsequent profits. Thus, for a given revenue yield, stamp duty imposes a heavier tax burden on investments that just break even, making it more likely that the tax will prevent them taking place. Stamp duty on shares is therefore likely to be a less efficient way of raising revenue than corporation tax.

Because stamp duty is levied on transactions, it directly reduces share turnover and market liquidity, thereby reducing the efficiency of the market in UK company shares wherever they are traded. The limited empirical evidence available suggests that reducing the rate of stamp duty on shares may increase share turnover substantially.¹⁷ Transactions taxes such as the 'Tobin tax' on foreign exchange transactions have been proposed as a way of reducing price volatility and therefore risk in financial markets by discouraging short-term speculative behaviour. However, stamp duty may actually increase volatility

¹⁶ *Inland Revenue Statistics* (www.inlandrevenue.gov.uk/stats/index.htm).

¹⁷ See table 3.1 of M. Hawkins and J. McCrae, *Stamp Duty on Share Transactions: Is There a Case for Change?*, Commentary no. 89, IFS, London, 2002 (www.ifs.org.uk/corptax/comm89.pdf).

by reducing the liquidity of the market and increasing the price impact of a given size of share transaction. The empirical evidence is mixed, but on balance it does not support the idea that stamp duty on share transactions is likely to reduce price volatility.¹⁸

Stamp duty may also distort the market for corporate control. A UK company planning a foreign takeover will be willing to pay less than an otherwise identical overseas competitor for the target company, due to the stamp duty that its shareholders will have to pay on future share transactions in the foreign subsidiary. On the other hand, a foreign company considering a takeover of a UK company will be willing to pay more for it than otherwise identical UK companies, since it will take the shares in the company outside the stamp duty base. The resulting distortion to merger and acquisition activity means that companies may end up not being run by the set of managers that would deliver the best performance.

In the last Budget, which raised taxes overall, the Chancellor still found room to spend £900 million on measures designed to raise productivity.¹⁹ If he wishes to focus on this goal again, then taking together the effects described above, there may be a case for reducing stamp duty on shares to alleviate these distortions.

6.5 R&D and policy towards innovation

Following the introduction of a research and development (R&D) tax credit for larger firms in Budget 2002, the 2002 Pre-Budget Report went on to announce an independent review into collaboration between business and universities. The review will report by Summer 2003, around the same time as the Department of Trade and Industry (DTI) Innovation Review, which is to examine business innovation and its contribution to UK productivity growth.

This section documents trends in UK R&D over the last two decades and discusses the role of government in supporting R&D and innovation. It summarises recent changes to the tax treatment of R&D, and discusses the current direction of government policy towards innovation.

Trends in UK R&D

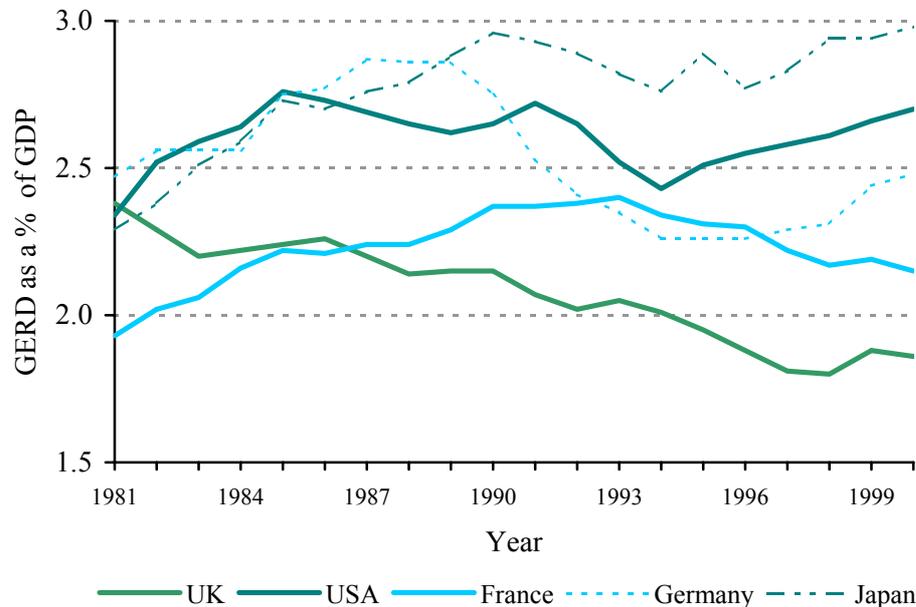
Gross expenditure on R&D as a percentage of GDP or national income (GERD intensity) has declined steadily in the UK over the last two decades, while in other G5 countries it has either increased or shown little overall change. In particular, while all of the G5 experienced stagnant or falling GERD intensity between 1990 and 1994, the USA, Japan and Germany all showed strong increases over the second half of the 1990s. In contrast, the UK

¹⁸ See section A.3 of M. Hawkins and J. McCrae, *Stamp Duty on Share Transactions: Is There a Case for Change?*, Commentary no. 89, IFS, London, 2002 (www.ifs.org.uk/corptax/comm89.pdf).

¹⁹ HM Treasury, *Budget 2002: The Strength to Make Long-Term Decisions*, London, 2002 (www.hm-treasury.gov.uk/Budget/bud_bud02/bud_bud02_index.cfm?).

continued to decline after 1994, with signs of a small pick-up only emerging after 1998. The result is that the UK now has levels of GERD intensity up to 1 percentage point of national income lower than other G5 countries. (See Figure 6.1.)

Figure 6.1. GERD as a percentage 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*, Paris, 2002 (www.sourceoecd.org).

GERD is composed of three main constituent parts according to who performs the R&D. By far the largest component is business enterprise expenditure on R&D (BERD), followed by higher education expenditure on R&D (HERD) and government expenditure on R&D (GOVERD). GERD can also be broken down according to who funds the R&D, which may not be the same as who performs it. The main sources of funding are government (including Research Councils and Higher Education Funding Councils), domestic business enterprise, abroad, and other national sources (mainly private non-profit organisations). Breakdowns of GERD both by who performs the R&D and by who funds it are shown in Table 6.2.

The shares of GERD funded and carried out by government fell sharply between 1981 and 1990, with a smaller decline between 1990 and 2000.²⁰ The share funded from abroad has been rising steadily over the period. Within BERD, there has also been a shift in funding away from government and towards domestic business and overseas sources, as Table 6.3 shows.

²⁰ The Atomic Energy Authority was transferred from the government sector to the business enterprise sector after 1986. While the effect of this transfer and later privatisations is to overstate slightly the extent of the trend away from government activity, the overall picture is not significantly affected.

Table 6.2. Breakdown of R&D by who performs it and who funds it

	1981	1990	2000
GERD as a % of GDP	2.38%	2.15%	1.86%
GERD, £m^a	13,720	16,381	17,532
% of GERD by who performs it:			
BERD	63%	71%	66%
HERD	14%	16%	21%
GOVERD	21%	13%	12%
<i>Of which: defence</i>	–	6%	8%
<i>civil</i>	–	7%	4%
% of GERD by who funds it:			
Government	50%	34%	29%
<i>Of which: defence</i>	–	14%	8%
<i>civil</i>	–	20%	21%
Domestic business	41%	50%	49%
<i>Of which: defence</i>	–	3%	3%
<i>civil</i>	–	47%	46%
Abroad	7%	12%	16%
Other national sources	2%	4%	6%

^a In millions of 2001 pounds sterling, deflated by the GDP deflator.

Note: Figures do not sum to 100 as the private non-profit sector has been omitted from the table.

Sources: OECD, *Main Science and Technology Indicators*, Paris, 2002

(www.sourceoecd.org); ONS, *Gross Expenditure on Research and Development*, London, 2002 (www.statistics.gov.uk).

Table 6.3. Percentages of BERD by who funds it

% of BERD by source of funding	1981	1990	2000
Government	30%	16%	9%
Domestic business	61%	68%	70%
Abroad	9%	16%	21%
Other national sources	–	–	–

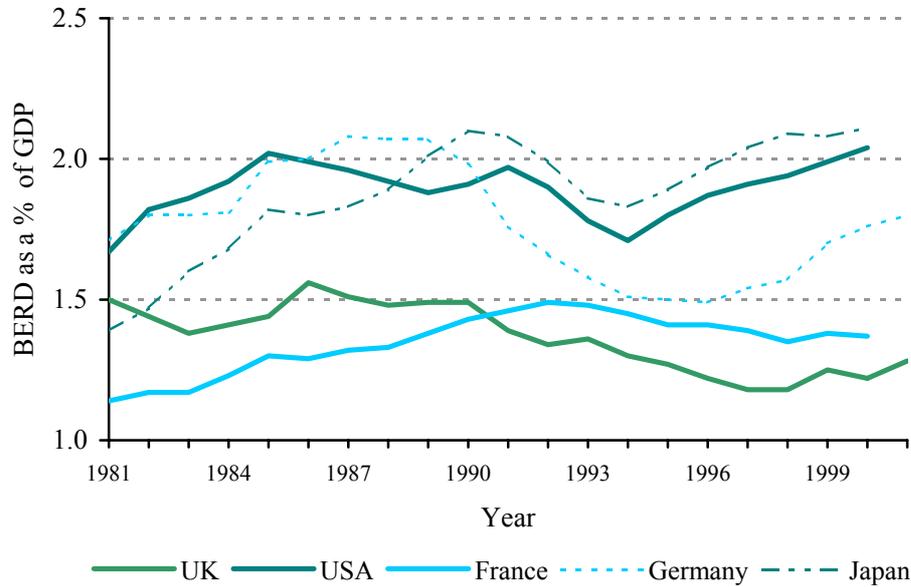
Source: OECD, *Main Science and Technology Indicators*, Paris, 2002 (www.sourceoecd.org).

Almost all of the fall in GERD intensity over the 1990s is due to a fall in BERD intensity, its largest component. In particular, Figure 6.2 shows that BERD intensity continued to fall from 1994 to 1998 in the UK, while it was rising in the USA, Japan and Germany, and only began to recover after 1998. In fact, the level of UK spending on BERD was only very slightly higher in real terms in 2000 than in 1990. BERD is particularly significant because it is the most commercially relevant component of GERD, and it is also the component that should be affected by the new R&D tax credits.

A key feature of UK R&D performance over the 1990s has been the rapidly increasing amount of R&D done by UK firms abroad, especially in the USA. Figure 6.3 shows total levels of UK R&D from two different sources over the period 1992–2000. The first is BERD as discussed above, which includes all R&D that is performed in the UK, while the second comes from the DTI's R&D Scoreboard. This lists all R&D done by UK firms including their

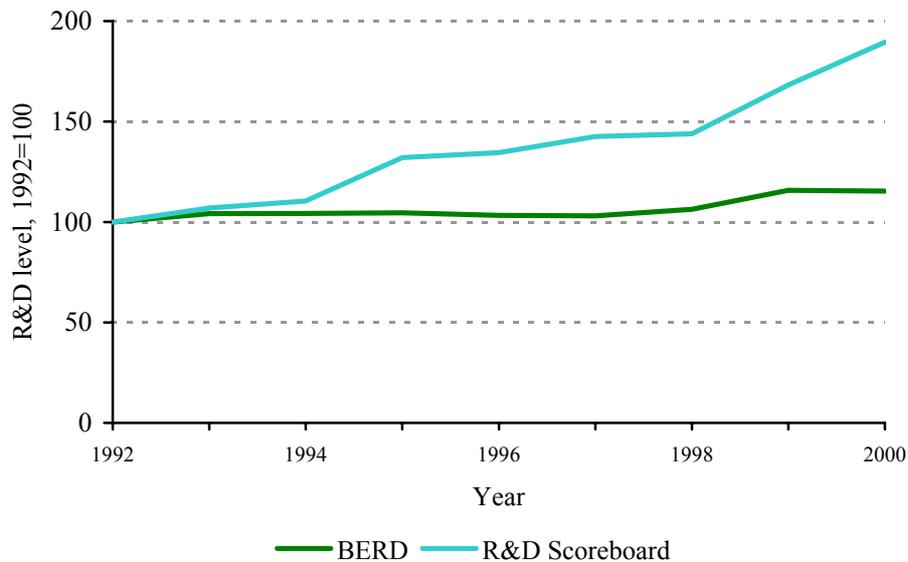
subsidiaries abroad, plus R&D done by UK subsidiaries of foreign firms, as reported in company accounts. The R&D Scoreboard figure thus corresponds

Figure 6.2. BERD as a percentage of GDP: G5 countries



Notes: Data for the UK and Germany extend up to 2001. Data for Germany cover West Germany until 1990 and unified Germany from 1991.
Source: OECD, *Main Science and Technology Indicators*, Paris, 2002 (www.sourceoecd.org).

Figure 6.3. UK R&D levels: BERD and R&D Scoreboard

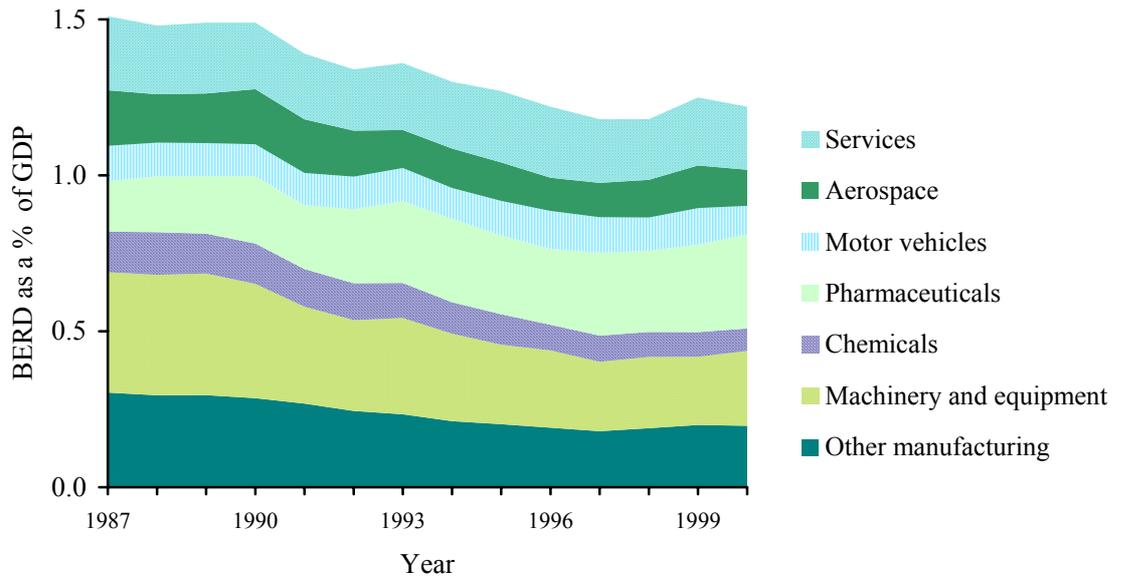


Note: Nominal levels have been deflated by the GDP deflator and rebased to equal 100 in 1992.

Sources: OECD, *Main Science and Technology Indicators*, Paris, 2002 (www.sourceoecd.org); Department of Trade and Industry, R&D Scoreboard, 1993–2001.

roughly to the BERD figure plus the R&D done by UK firms abroad.²¹ The graph shows that R&D spending by UK firms has grown much faster over the 1990s than R&D performed in the UK. This discrepancy raises the question of whether we should be concerned from a policy point of view with R&D that is located in the UK or R&D that is done by UK firms. The latter may be more important if firms are locating R&D abroad in order to source new technologies from the cutting edge of innovation.²²

Figure 6.4. UK BERD as a percentage of GDP: industry breakdown



Source: OECD, *Analytical Business Enterprise Research and Development*, Paris, 2002 (www.sourceoecd.org).

The industry composition of UK BERD has changed over the last two decades. Figure 6.4 shows UK BERD intensity between 1987 and 2000 broken down into broad industrial sectors. Most R&D is done in manufacturing industries, with ‘pharmaceuticals’ now the largest single contributor to aggregate BERD. Most of the decline in overall intensity during the 1990s can be explained by the ‘chemicals’, ‘machinery and equipment’ and ‘other manufacturing’ sectors. ‘Pharmaceuticals’ is the only sector to have increased its contribution to BERD intensity over the period, replacing ‘machinery and equipment’ as the largest contributor in about 1996.

A fall in aggregate BERD intensity over time can be decomposed into two contributing factors: a fall in intensity within industries, and a shift in the

²¹ There are some differences in the definition of eligible R&D between the two. For example, the R&D Scoreboard does not include R&D done under contract for government or other firms. These differences should not seriously affect the comparison of overall trends.

²² See M. Serapio and D. Dalton, ‘Globalization of industrial R&D: an examination of foreign direct investments in R&D in the United States’, *Research Policy*, 1999, vol. 28, pp. 303–16. The authors suggest that this ‘technology-sourcing’ behaviour is increasingly common amongst foreign firms that locate R&D activity in the USA.

composition of output away from high-intensity towards low-intensity industries. Figure 6.4 does not distinguish between declines in intensity *within* industries and shifts in activity *between* industries. Almost all OECD countries have seen their service sectors grow faster than manufacturing over the last twenty years, and this would automatically tend to reduce aggregate BERD intensity due to the second, between-industry factor. However, almost all of the decline in aggregate BERD intensity in the UK relative to other G5 countries during the mid-1990s is due to a fall in R&D intensity within manufacturing industries, rather than to a particularly rapid decline in the share of manufacturing activity in the UK over this period.²³

Government policy towards innovation

The government intervenes in innovation markets in a number of ways. As shown above, a significant part of R&D expenditure is financed directly by government. Other forms of intervention include R&D tax credits, support for technology transfer between universities and business, and measures designed to overcome failures in financial markets. In addition, government funds education and other aspects of national infrastructure that are essential inputs into R&D and innovation, and provides patent protection and regulation. In this section, we briefly describe some of these measures and discuss the rationales behind them.

Direct support

Direct government support for innovation largely consists of funding for R&D. This funding comes through one of three channels: directly from central government departments (about 50%), from the Research Councils (about 25%) and from the Higher Education Funding Councils (about 25%).²⁴ Where the R&D is actually carried out varies between the different channels. For example, in 2000, about 45% of R&D funded directly by government departments was performed in government laboratories and about 40% was performed by businesses, with the majority of the rest performed in higher education institutions. In contrast, almost all of the R&D funded through the other two channels was carried out in higher education institutions.

There are several reasons why government may want to fund or carry out R&D. In the case of defence R&D, the government is a provider of a service – namely, national defence – to the country. The government has considerable information advantages over the private sector as regards its defence needs, suggesting a role for government in funding defence-related R&D. Whether the government carries out this type of R&D itself or funds the private sector to carry it out should be decided on grounds of cost-efficiency and perhaps also the need for secrecy. In 2000, just under a third of all R&D funded by government was for defence purposes. This contrasts with only 6% of R&D

²³ See R. Griffith and R. Harrison, IFS Working Paper, forthcoming.

²⁴ ONS, *R&D Performed in the UK in Each Sector According to Source of Finance*, London, 2002 (www.statistics.gov.uk/STATBASE/tsdataset.asp?vlnk=584).

funded by businesses, although over half of the defence R&D funded by government was actually carried out by businesses.²⁵

Another reason why the government may want to fund R&D is that it would not otherwise be funded by the private sector because it would not be profitable for any particular firm to fund it. R&D covers a spectrum, with general scientific research that does not have a specific commercial use in mind at one end, and R&D designed around the introduction of a specific commercial product or process at the other. The market will provide weaker incentives to undertake the former kind of R&D because it is more difficult for an individual firm to appropriate the benefits of this type of research. In this context, new knowledge can be thought of as a public good, in that once it is generated it can be used by everyone. Thus, in the absence of government intervention, if all R&D were funded by businesses, there would be too little of this type of research from society's point of view.²⁶

These kinds of concerns apply particularly to fundamental scientific research. This is the main economic argument behind government funding for research in the higher education sector, via the Research Councils and Higher Education Funding Councils. These institutions should ideally act as agents of government to commission and deliver research that fulfils the needs of society as a whole and that would not be provided by the private sector.

As mentioned above, government also directly funds R&D performed by businesses. This direct funding in the UK has declined in real terms over the last twenty years. Over the last decade, about 75% of it has been for defence purposes, with the remainder for civil R&D. Again, the idea that businesses cannot completely capture all the benefits of their research forms the main justification for this kind of funding.

R&D tax credits

Direct funding is not the only way that the government can support R&D performed by the private sector. In recent years, there has been a general trend in many OECD countries away from direct grants and towards indirect assistance via the favourable tax treatment of R&D expenditure. One reason is that businesses may, in many cases, have better information than government as regards which programmes of research are likely to be successful. Tax credits attempt to stimulate private sector R&D by reducing its cost while keeping control over the nature and direction of research in the hands of businesses. With the introduction of the R&D tax credit for small and medium-sized enterprises (SMEs) in April 2000 and for larger firms in April 2002, the UK has now joined several other OECD countries in supporting private sector R&D by this method.

The SMEs tax credit rate is 50% and the rate for larger firms is 25%. Both credits operate as an extra deduction, which in practice means that qualifying

²⁵ ONS, *Sources of Funds for Civil and Defence R&D in UK Businesses*, London, 2002, www.statistics.gov.uk/STATBASE/tsdataset.asp?vlnk=571.

²⁶ More generally, the patent system is one way in which government intervenes to overcome this appropriation problem: ensuring that inventors are able to profit from their inventions protects their incentives to innovate.

SMEs are able to deduct 150%, and larger firms 125%, of eligible current R&D expenditure from their taxable profits in the year it is incurred.²⁷ The SMEs credit also has a refundable component. Qualifying SMEs with insufficient taxable profits to claim the full deduction can claim a cash payment equal to 24% of eligible expenditure, instead of carrying forward eligible R&D losses to offset against future profits. The amount payable is limited to the company's PAYE and National Insurance contributions for the period.

The SMEs credit was projected to cost the exchequer around £100 million in lost revenue in 2001–02 and £150 million per year from 2002–03, potentially benefiting around 4,500 firms.²⁸ The actual cost in 2001–02 is estimated in the 2002 Pre-Budget Report to have been only £80 million,²⁹ although it is as yet unclear whether this was due to lower-than-expected take-up or lower R&D per SME. The equivalent cost of the tax credit for large firms was forecast to be £200 million in the first year, rising to £400 million by 2004–05.³⁰ Estimates of actual costs will not be available until after the end of the current tax year. These figures compare with £1.5 billion of direct government funding for private sector R&D in 2001, of which only £190 million was for non-defence purposes.³¹

The 2002 Pre-Budget Report states that one of the areas to be covered by the forthcoming review into business–university collaboration will be the effectiveness of the R&D tax credits in stimulating business demand for research and skills. While evaluation is extremely important for the design of successful policy, it should be stressed that the effects of these policies are only likely to be fully realised over a longer time period. Evidence from the USA and other countries suggests that firms' responses to the introduction of R&D tax credits are characterised by long lags while investment and research plans respond to the new incentives, with the full response only realised after as long as 10 years.³² This suggests that the government should resist the temptation to alter policies significantly in the short term, so that the policy regime has a chance to 'bed down'.

The interaction between the R&D tax credits and other forms of government support for innovation differs between the two tax credits. The R&D tax credit

²⁷ The R&D allowance allows firms to deduct 100% of capital expenditure on R&D from their taxable profits. This is already more generous than standard capital allowances.

²⁸ HM Treasury, *Financial Statement and Budget Report*, London, 1999 (<http://archive.treasury.gov.uk/budget/1999/fsbr/29807.htm>).

²⁹ HM Treasury, *Pre-Budget Report 2002*, Cm. 5664, London, 2002 (www.hm-treasury.gov.uk/pre_budget_report/prebud_pbr02/prebud_pbr02_index.cfm).

³⁰ Table A.1 of HM Treasury, *Pre-Budget Report 2002*, Cm. 5664, London, 2002 (www.hm-treasury.gov.uk/budget/bud_bud02/budget_report/bud_bud02_repchapa.cfm).

³¹ ONS, *Sources of Funds for Civil and Defence R&D in UK Businesses*, London, 2002 (www.statistics.gov.uk/STATBASE/tsdataset.asp?vlnk=571).

³² See, for example, N. Bloom, R. Griffith and J. Van Reenen, 'Do R&D tax credits work? Evidence from an international panel of countries, 1979–1994', *Journal of Public Economics*, 2002, vol. 85, pp. 1–31.

for SMEs is unavailable on projects that have benefited from notified State Aids such as DTI Smart or Link awards, and is restricted to the unsubsidised portion of R&D expenditure for projects benefiting from non-State Aids.³³ Larger firms, on the other hand, can claim the R&D tax credit even on R&D that has been partly or fully subsidised directly. They also receive the full credit on R&D subcontracted to universities and other non-profit bodies such as scientific research organisations or NHS bodies, but not on other subcontracted R&D. SMEs receive a credit on 65% of all subcontracted R&D expenditure provided they retain intellectual property rights.

Other policies

Government policy towards science and innovation has also focused on the science base and on the efficient use of research – for example, through knowledge transfer from universities to businesses. In July 2002, the government published its science strategy, *Investing in Innovation*,³⁴ and the November Pre-Budget Report announced an independent review into business–university collaboration. The review will report by Summer 2003, around the same time as the DTI Innovation Review, which is to examine business innovation and its contribution to UK productivity growth.

There are currently a large number of relatively small-scale policies aimed at enhancing knowledge transfer, especially between universities and businesses. These include the Higher Education Innovation Fund, with funding projected to be £90 million by 2005–06, and other DTI knowledge-transfer activities, projected to cost £300 million by 2005–06. Together with the Wellcome Trust and the Gatsby Foundation, the government has funded the University Challenge scheme. This is aimed at encouraging commercial spin-offs from university research, with a total £30 million of initial investment capital so far combined with £40 million from private sector sources.³⁵

The forthcoming reviews might provide a good opportunity to examine the economic rationales for such schemes, the incentives each scheme provides for innovation and commercialisation of research, and the interactions between different policies. Economic justification of such policies should identify specific market failures – for example, those leading to insufficient uptake by businesses of new technologies developed in universities; in the case of the University Challenge scheme, a case might be made that private investors do not have sufficient information to determine whether to invest in new technologies. A further issue is whether any of the schemes distort firms' decisions about how to implement and organise new innovations. For example, the University Challenge scheme only funds the commercialisation

³³ The legal definition of State Aids is set out in Article 87(1) of the Treaty of Rome. A subsidy is considered a State Aid when the effect of aid: distorts competition; is selective in its effects (e.g. only affects subgroups of firms, or only affects businesses in a specific region or locality); or affects trade, or could potentially affect trade, between EU member states.

³⁴ HM Treasury, Department of Trade and Industry and Department for Education and Skills, *Investing in Innovation: A Strategy for Science, Engineering and Technology*, London, 2002 (www.hm-treasury.gov.uk/spending_review/spend_sr02/spend_sr02_science.cfm).

³⁵ HM Treasury, *Pre-Budget Report 2002*, Cm. 5664, London, 2002 (www.hm-treasury.gov.uk/pre_budget_report/prebud_pbr02/prebud_pbr02_index.cfm).

of research through start-ups and not through licensing agreements, which may be more suitable in some cases.

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