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Is a higher rate of R&D tax credit a panacea for low levels of R&D in disadvantaged regions?

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ABSTRACT

This paper studies the impact of R&D spending on output as well as forecasting the impact of a regionally enhanced R&D tax credit on the 'user cost' (or price) of R&D expenditure and subsequently the demand for R&D. The example we use of a 'disadvantaged' region is Northern Ireland (partly because it has the lowest levels of R&D spending in the UK, and partly because the necessary data is available for this region). We find that in the long run, R&D spending has a mostly positive impact on output across various manufacturing industries. In addition, plants with a zero R&D stock experience significant one-off negative productivity effects. As to the adjustment of R&D in response to changes in the 'user cost', our results suggest a rather slow adjustment over time, and a long-run own-price elasticity of around −1.4 for Northern Ireland. We also find that to have a major impact on R&D spending in the Province, the R&D tax credit would need to be increased substantially; this would be expensive in terms of the net exchequer cost.

1. Introduction

The expansion of the global economy and the role of technology as a key driver of globalisation have meant that the promotion of science and innovation is now a central tenant of UK industrial strategy (HM Treasury, 2004). Although the importance of R&D investment for innovation and subsequent economic growth has long been acknowledged (see below), there is concern in policy circles about the low levels of business investment by firms in R&D activities particularly at the regional level. Compared with other OECD and EU countries the UK has failed to improve its relative position as regards such investment. Business expenditure on R&D as a proportion of GDP remains below the OECD average and has been declining relative to other OECD countries—in 2003 the UK was ranked 12th whereas in 1993 it was ranked in 8th position (OECD, 2005). An alternative source of information on investment in R&D is provided by the 2005 EU Scoreboard data (EU, 2006). These data show investment in R&D by the top 1000 EU companies and places the UK 11th out of 15 countries in terms of R&D intensity (investment as a proportion of net sales) and 8th out of 15 when measured as investment per employee. When the analysis is extended to incorporate the top 1000 non-EU firms in 26 OECD countries[1] these rankings drop to 19th and 15th, respectively.

There are a number of benefits from increasing R&D in local, regional and national economies. These include the likely increased level of innovation (both product and process) that would accompany such an increase in the R&D stock, plus an overall increase in firm-level capabilities and absorptive capacity, which will have additional positive impacts on productivity through firms being better placed to internalise knowledge from outside the company (e.g. foreign technology transfers). This would increase the ability of firms to benefit more from globalisation as the literature generally shows that increased R&D, linked to greater absorptive capacity, is also associated with greater exposure to internationalisation (as R&D/absorptive capacity reduce entry barriers into international markets)—see Harris and Li (2008) for a review of the literature and empirical evidence of nexus between firm's internationalisation, R&D/innovation activities, and absorptive capacity. Increased R&D by plants in disadvantaged regions, leading to greater innovation, absorptive capacity, and internationalisation, is likely to create a virtuous circle of further positive impacts on R&D, and therefore a movement upward in the growth path of the region's economy.

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[1] Data on Iceland, Mexico, New Zealand and Turkey was either missing or applied to one firm only.

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The decline in international rankings has occurred despite the efforts of government to provide incentives for firms either to initiate R&D activities or to expand the range of developmental activities that they undertake. If one takes the view that increasing R&D activities at the regional level is directly linked with national interests and certain regions lag behind in terms of R&D investment, then supporting these regions to become more involved in R&D will be to the benefit of the national interest. Following on from this, the question as to the type of policy instrument that is appropriate to support R&D at the regional level has to be addressed. There are two main ways in which government can directly influence the level of R&D spending within firms—by directly subsidising such expenditures through grants (and/or loans) or by offering fiscal incentives. Historically in the UK, government has resorted to grant-based schemes, such as national schemes like SMART and SPUR,[2] or regional schemes like R&D grants in Northern Ireland (since 1977) through the operation of Selective Financial Assistance (see Harris et al., 2002). However, in 2000, government introduced a fiscal incentive in the form of a R&D tax credit for SMEs and extended the scheme in 2002 to include large companies. The tax credit is additional to traditional monetary-based inducements, and the rates are uniform across the UK.

The literature that considers the effectiveness of government grants to increase private sector R&D reaches very mixed conclusions. Partly this reflects a concern that direct subsidisation of R&D may have a high deadweight component (as firms free-ride on such subsidies); it also reflects the fact that many government schemes are aimed at longer-term outcomes (including pre-commercialisation R&D spending), rather than projects that generate near-term profits (which are more receptive to fiscal incentives, as discussed below). Thus Busom (2000) for Spain, Lach (2002) for Israel, Czarnitzki and Fier (2002) for Germany, and Kaiser (2004) for Denmark, all report negative (or insignificant) links between R&D subsidies and private R&D expenditures at the firm level. Moreover, surveys by David et al. (2000), Klette et al. (2000) and Harhoff and Fier (2002) also report a wide array of evaluations results.

In contrast, fiscal incentives allow government to finance a portion of the R&D undertaken by firms that qualify automatically through the tax system; and it is argued that they are more likely to favour projects that generate near-term profits. The use of fiscal incentives, such as tax allowances, deferrals or most preferably, tax credits, has become increasingly popular in a number of countries (OECD, 2003), although it has a relatively long history in Canada (back to the early 1960s) and at both the federal and state level in the US.[3] There is a broad agreement that tax incentives stimulate R&D (see Hall, 1993; Hines, 1994; Mamuneas and Nadiri, 1996, for the US; and Bloom et al., 2002, for 9 OECD countries; and also Hall and van Reenen, 2000, for a review of the evidence). For example, Wu (2005) has considered the effect of state R&D tax credits as well as public sector R&D subsidies in the US, finding that tax credits have stimulated private R&D spending but public sector R&D subsidies seem to have had no significant effect. Many of the studies covered find long-run R&D price elasticities of around unity, implying that a 10% decrease in the cost of R&D through tax incentives stimulated a 10% increase in the level of R&D in the long-run; however, short-run effects are much lower, implying that the demand for R&D responds very slowly over time to changes in its price.

The literature suggests that a tax credit policy will bring benefits at the national level but if it is applied at a uniform rate then there will be different effects across regions. In relation to R&D tax credit as a policy tool, Howells (2005) noted that "...it will be the successful core regions with high concentrations of R&D activity that will benefit most ...By contrast, disadvantaged regions will benefit least from such a measure." (p. 1225).

This paper investigates the use of tax credits to raise the level of R&D investment in a disadvantaged region (Northern Ireland[4]) and models the impact of applying differential rates. Given that panel micro-data is required to consider the relationships between R&D and productivity, as well as R&D and fiscal incentives, few (if any) studies have been undertaken at the sub-national level in the UK (or elsewhere). Moreover, Northern Ireland is an instructive case study in that business spending on R&D is relatively low compared to average spending in the UK as a whole. Data from the 2005 Community Innovation Survey shows that in terms of the amount spent on R&D per employee, the Northern Ireland figure was £766 per employee (or 39.4% of the UK level of expenditure per employee) for manufacturing and £140 per employee (or 21.6% of the UK level) for services.[5] Across all sectors, the CIS data shows that Northern Ireland spent £236 per employee on R&D compared to £921 per employee in the UK, or 25.6% of the UK level of expenditure. The next lowest spending region in the UK was the North East with spending of 51.5% of the average UK figure. Northern Ireland also has a long history of generous publicly funded support for industry which has produced mixed results (Harris, 1991a; Harris and Trainor, 1995) and the agencies responsible for allocating support have a certain degree of autonomy that do not exist in the national agencies. In addition, the use of the fiscal system to stimulate investment is currently under discussion in policy circles as politicians negotiate with the Treasury to agree a financial settlement to accompany an acceptable political agreement.

The next section describes the model that is estimated to determine the relationship between R&D and productivity. Section 3 discusses the dataset that was constructed for the estimation. Section 4 discusses the impact of R&D on productivity before considering (in Section 5) the impact of an enhanced R&D tax credit on productivity. The paper concludes with a discussion on the implications for policy and related issues.

2. The model

The model that is used to estimate the impact of business R&D on firm-level productivity is based on the notion of the 'knowledge production function' as developed by Griliches (1980), whereby usually a simple Cobb-Douglas production function is extended to include the R&D capital stock (the firm's stock, and in some studies

[2] That is the Small Firm Merit Awards for Research and Technology programme and Support for Products Under Research programme. See Harris and Robinson (2001, Chapter 3) for a detailed discussion of these schemes.

[3] R&D tax credits were first introduced at the federal level in 1981, followed closely by Minnesota and by 1996, 17 states offered R&D tax credits. It is argued in the US that the state schemes are put into place to capture spillovers that only feature locally, based around clusters of R&D intensive industries which can then be encouraged to further grow through R&D tax credits that might induce inward investment of firms in these industries (see Hall and Wosinska, 1999, with respect to the Californian R&D tax credit scheme).

[4] Gross value added per head in Northern Ireland was only 80% of the UK average during the 1991–2003 period (with a standard deviation of 1.3% suggesting that there was little evidence of convergence).

[5] The other major source of information on R&D spending (the Business Enterprise R&D – or BERD – survey carried out annually in the UK) shows that in 2004 business R&D divided by gross value-added was 0.5% in Northern Ireland, compared to 1.2% for the UK (with both of these percentages well below the 3% of GDP target set by the Lisbon Agenda for the EU by 2010).