Is the UK doing enough innovative activity? International comparative evidence

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Policy makers in the UK[1] and the EU have been concerned that not enough resources are being devoted to innovative activities. The Barcelona European Council recently set a target to raise European research and development (R&D) expenditure to 3% of GDP. Recent figures for the UK show that Gross Expenditure on R&D was 1.9% of GDP in 2000, falling behind Germany, France and the US.[2] This low R&D intensity is cited as a potential reason underlying the UK's productivity gap vis-à-vis those countries.

Economic theory stresses that innovative activities are a key factor in generating productivity growth. Firms may innovate by developing new products, entering new markets or developing new production processes, which lower the cost of producing existing products. To become a successful innovator, firms may engage in R&D to create new ideas or to capitalise on the innovations of other firms.

In this article, we will consider the economic reasons that might lead firms to under-invest in innovative activity and the economic rationale for government intervention. We will then discuss some cross-country evidence on innovative activity from the 3rd Community Innovations Survey. Whilst such comparative evidence does not definitively answer the question of whether or not the UK is doing enough innovative activity, it can serve as a useful indicator.

Economic theory: what is innovative activity and why don't firms do enough?

Firms engage in a range of different types of innovative activities, from commercially orientated development projects to basic, generic R&D to support future commercial applications. Firms may also engage in collaborative projects with other firms or with organisations specialised in research and development such as universities and public sector laboratories.

A firm's decision to invest in R&D is motivated by the level of expected future profits. These profits depend on the costs of the investment and its expected revenues. The expected revenues depend on the likelihood of the investment being successful and on the ability of the firm to appropriate the

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[1] Recent UK government initiatives include the "Science & innovation investment framework 2004-2014" (July 2004 HM Treasury, http://www.hm-treasury.gov.uk/spending_review/spend_sr04/associated_documents/spending_sr04_science.cfm), the Lambert Review into business-university collaboration (December 2003 DTI and HM Treasury, http://www.hm-treasury.gov.uk/media//EA556/ lambert_review_final_450.pdf) that suggested an increased role for Government in supporting collaborative activity between universities and businesses, and the "DTI Innovation Report, Competing in the global economy: the innovation challenge" (December 2003, http://www.dti.gov.uk/innovationreport/) . The current Government has also introduced two R&D tax credits aimed at stimulating R&D expenditure by firms.

[2] See Griffith, R. and R. Harrison, "Understanding the UK's poor technological performance", IFS Briefing Note No.37, June 2003. http://www.ifs.org.uk/corpact/bn37.pdf

returns to its innovative activity. For example, suppose a firm invests in R&D in order to introduce a better quality product at the same price as the existing one. A first risk is that the firm might be unsuccessful in developing a better quality product. A second is that consumers do not value the better quality product. A third risk is that the firm cannot appropriate the full returns to its innovation. This might arise because other competitors can costlessly use the new knowledge created, and also introduce the better quality product, thus reducing the returns to the firm that originally introduced the innovation.

Why might firms under-invest in innovative activity from the point of view of the economy as a whole? Economic theory suggests that the innovation process is likely to be characterised by market failures that lead to under-investment in R&D. One of the main reasons is the one mentioned above that firms may be unable to appropriate all of the returns from their innovations. This can happen because knowledge has some of the characteristics of a **public good** and is a **semi-public good**. These characteristics include that knowledge is **non-rivalrous** because, unlike for a private good, one person can use knowledge without diminishing the ability of other people to use it. In addition, knowledge may be **non-excludable** in that once it has been created it is not always possible to prevent other people from gaining access to it. In the example above the innovator could not prevent competitors from benefiting from knowledge that it created. Such benefits that accrue to parties other than those who undertake an economic activity are **spillover benefits** or **positive externalities**. From the point of view of society it would be optimal to take such externalities into account when deciding whether or not to invest in the R&D project. However, a private firm will only consider its own expected revenues and so will end up investing less than the socially optimal level. There exists a body of empirical literature that supports the argument that the social returns to R&D are higher than the private returns to the firms making the investments.

There are other reasons why firms might under-invest in innovative activity. First, capital market failures increase the cost of borrowing and may prevent firms from undertaking investments. These failures arise due to information asymmetries between lenders and borrowers, for example if a firm has more information about the quality and the probability that the project will be successful than the lender, or if during the course of the project the borrower has incentives to carry out a riskier project taking into account that the lender cannot monitor it fully. Second, coordination or information failures might mean that firms do not optimally co-invest in innovative projects. Third, a lack of appropriate skills may limit innovative activity. Finally, the structure of market competition can also affect the amount of investment in R&D. For example, firms that face a lot of competitors may have greater incentives to innovate in order to survive than other firms in less competitive markets.

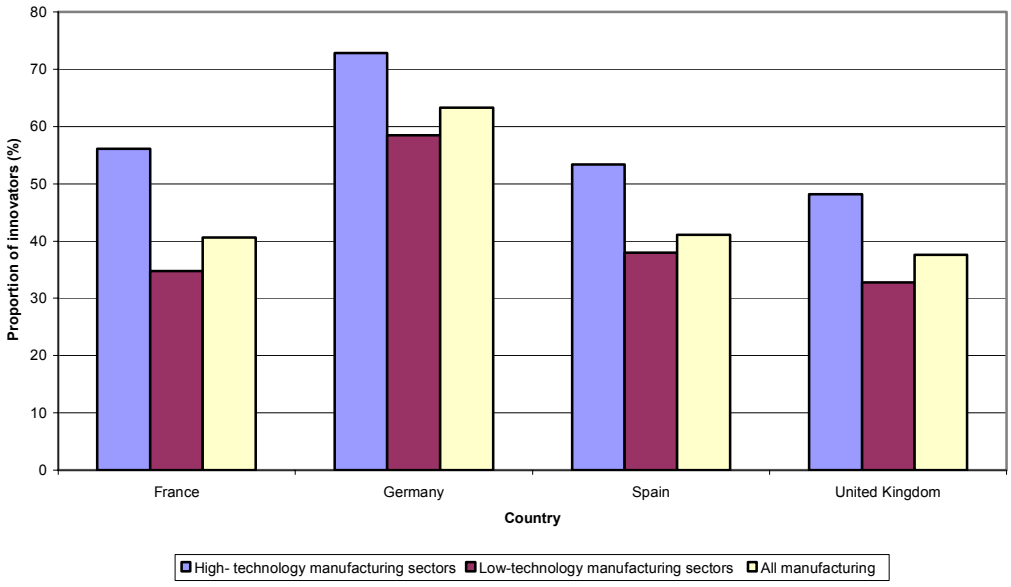
Why should government intervene? If firms have insufficient incentives to invest in R&D from a social point of view and government can efficiently and effectively intervene to correct the incentives then there is a rationale for

intervention. Policy instruments such as patents and R&D tax credits[3] or direct subsidies aim to tackle these failures, giving incentives to firms to increase their investment in innovative activity towards the optimal social level. The patent system can reinforce firms' ability to prevent other firms costlessly using the knowledge they have created. Subsidies and R&D tax credits can lower the cost of the investment. R&D tax credits might have advantages over direct subsidies since they are market-mediated instruments, in the sense that private firms still decide which R&D projects are carried out. Other methods of government support for R&D investment include the provision of information to tackle coordination and information failures and the direct involvement of government in basic R&D through public laboratories and universities that contribute to the science base.[4] Note, however, that government does not always have the full set of information in order to intervene effectively and efficiently and could introduce distorting incentives.

Cross-country comparison: are UK firms not doing enough?

Researchers at the IFS, in collaboration with researchers in France, Germany and Spain, are undertaking international comparisons of innovative activity.[5]

Chart 1: Proportion of innovators (product and/or process)



Source: IEEF based on the Third Community Innovation Survey (CIS3). Data corresponds to 1998-2000 period.

The analysis is based on the 3rd Community Innovation Survey (CIS3), which provides detailed information on innovation activity at the enterprise level and which is comparable across countries. In general, our findings are in line with

[3] An article by Rupert Harrison on "R&D tax credits" was included in volume 21, issue 4 of *Economic Review*.

[4] Some activities generate very basic knowledge that is non-excludable and might be optimally disseminated widely which gives a rationale for public good provision.

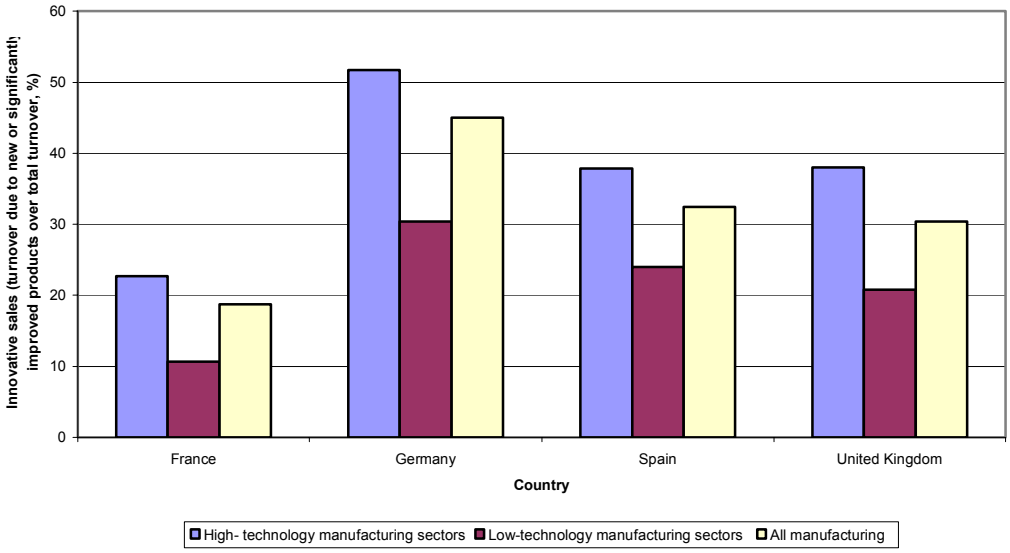
[5] See research project "Innovation and Employment in European Firms: Microeconometric evidence" outcomes at http://www.eco.uc3m.es/IEEF/index.html.

other comparative studies of innovative activity that support the idea that UK firms under-perform compared to their counterparts in other European countries.

The survey defines innovative firms (innovators) as those that introduced any new or significantly improved products and/or processes for the enterprise between 1998 and 2000. Chart 1 shows the proportion of innovators in manufacturing industries. Firms operating in high-technology manufacturing industries (such as chemicals, transport equipment machinery and electrical industries) are more likely to be innovators than those in low-technology industries (such as food, textile and wood industries). The proportion of innovators both in low and high technology manufacturing industries in the UK is lower than in the other three countries.

For firms that introduced product innovations, an interesting indicator is the proportion of total sales that are due to these products or services.[6] This indicates how the market values the innovative activity, which gives some idea of the quality of the innovation. Chart 2 illustrates that the UK compares more favourably on this indicator in manufacturing industries, although it still lags behind Germany.

Chart 2: Innovative sales for those firms that are product innvoators



Source: IEEF based on the Third Community Innovation Survey (CIS3). Data corresponds to year 2000.

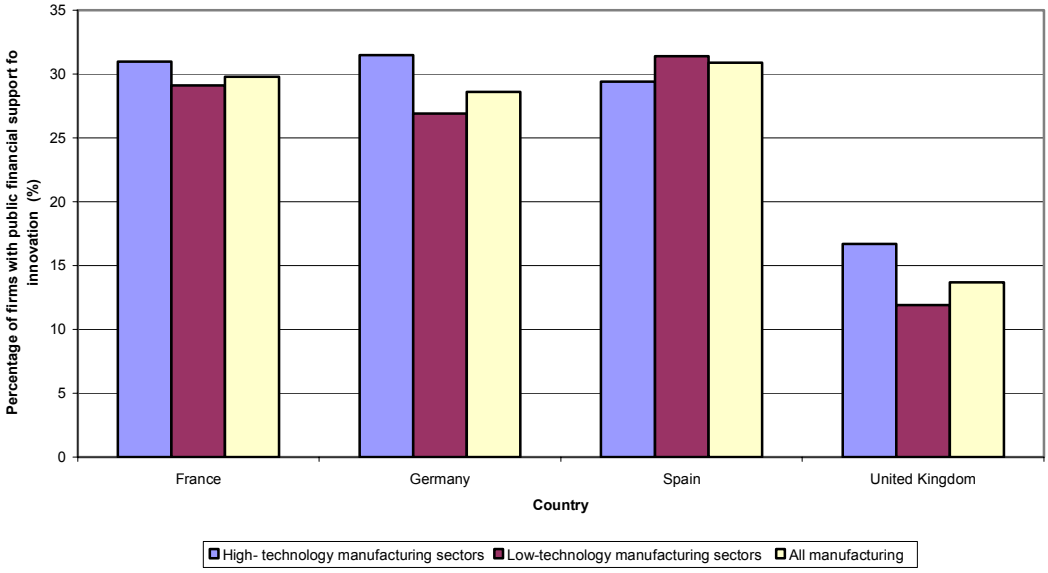
The survey also asks about firms' R&D expenditure and the use of specialist R&D employees. In terms of R&D effort (measured by R&D expenditure as a proportion of total sales), the UK compares more favourably to the other three countries. This measure varies across industries, and the UK compares particularly well in the chemicals sector, which is among the most R&D

[6] A recent HM Treasury and DTI consultation benchmarking the UK's productivity performance suggested using this indicator as an outcome measure for innovation. DTI and HM-Treasury (2004), "Benchmarking UK productivity performance" http://www.hm-treasury.gov.uk/media/97626/productivitychs.pdf.

intensive. The intensity with which firms employ scientists and technicians (measured by R&D employees as a proportion of total employees) shows the same pattern as R&D effort. Indeed, a large proportion of firms' expenditure on R&D goes to pay the wages of scientists.

One reason for different levels of innovative activity across countries might be the extent and the effectiveness of government intervention. Chart 3 shows the proportion of innovators that have used any public financial support, e.g. R&D tax credits or direct subsidies. Compared to the other three countries, the UK has a significantly lower proportion of innovators who are accessing public financial support in all manufacturing industries. But this may not be unique to the area of innovation, in that government intervention may be less prevalent in other areas of the economy in the UK, compared to other European countries.

Chart 3: Percentage of innovative firms with public financial support for innovation



Source: IEEF based on the Third Community Innovation Survey (CIS3). Data corresponds to year 2000.

To conclude, UK firms show lower levels of innovation activity than firms in Spain, France and Germany. International differences in innovative activity might be caused by differences in the prevalence of market failures or variation in public policy design. In addition, they might be caused by differences in the institutional settings, such as differences in the extent of product market competition or differences in the environment in which university research is conducted, that lead to different incentives for firms and scientists to carry out R&D or commercialise their research. International comparisons of economic environments relevant to innovative activity, policy and policy effectiveness may shed light on these issues and is a focus of the current policy debate.