

Scientific knowledge as a public good and the role of public policy

Abstract:

Why should governments support R&D – and under what circumstances? These are questions addressed by a growing body of economic research. This memorandum reviews selected findings, and suggests that, given the rising importance of intangibles in the modern economy, there is a case for spending substantially more on R&D than is the case within the European Union today.

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The role of the state

Innovation uses new knowledge. But much (although not all) knowledge is a public good. So a firm spending on new knowledge runs the risk that its spending can be appropriated by a rival. Thus firms have little motivation to spend on these forms of new knowledge. There is nothing wicked or immoral in this reluctance; the incentives are simply not there.

There are a number of ways that an undersupply of these public goods can be corrected.

1. *Directly:* The state sponsors research directly, e.g., offering a prize, or having a state-run innovation initiative like a space programme.
2. *Indirectly:*
 - a. The state pays universities to do research.
 - b. The state gives the private sector an incentive to do research, e.g., via an R&D tax credit or a 'Patent Box' (where patent holders are given a tax break).

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If the state is going to step in, it needs to do so as wisely as possible. Three principles of good public provision are to:

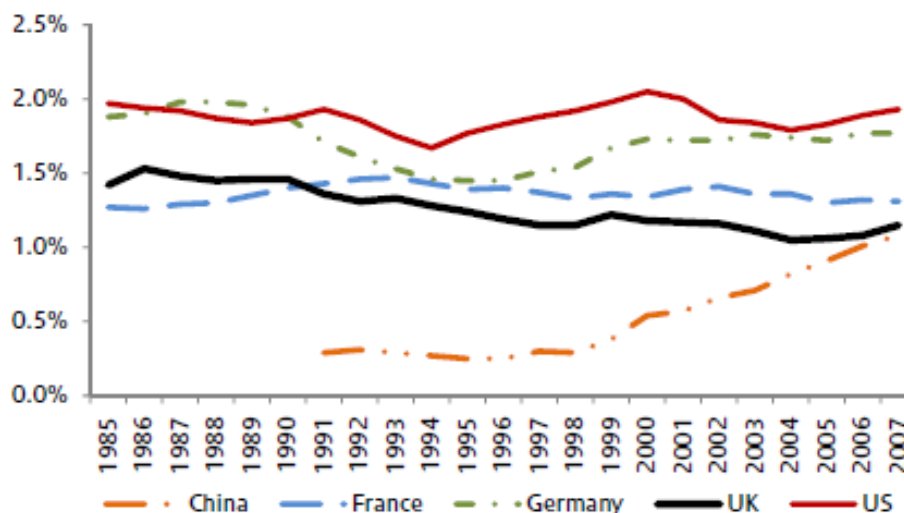
1. Avoid deadweight – that is, correct the under-provision of public goods as far as possible and not subsidise goods that would have been provided anyway.
2. Not “crowd out” private goods.
3. Provide state support efficiently, which typically would involve using competition.

Business innovation in intangible knowledge

How does this help us inform public policy towards innovation and knowledge creation? We have the following:

First, as a background fact, European countries spend less than the US on R&D (per unit of GDP) and are being caught up by China, see figure 1. This puts Europe below the 3% target in the Lisbon agenda. Note that this is not because Europe has a particular spread of industries: in the UK, R&D as a proportion of sales has fallen in all industries (as well as there being a shift away from R&D-intensive industries like manufacturing).

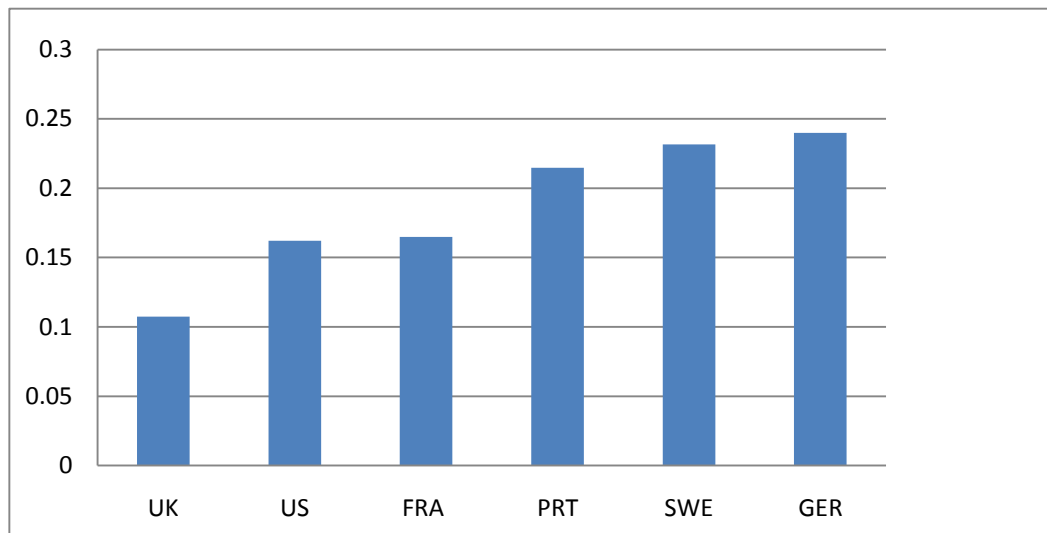
Figure 1: Business expenditure on R&D as a percentage of GDP



Source: OECD's 2009 Main Science and Technology Indicators (MSTI) dataset. Data elaborated by IFS (Election briefing note 2010)

Second, knowledge spending entails more than just R&D. Some of the new knowledge that goes into an iPhone is, indeed, from R&D – e.g., the scientific knowledge in the processor. But the innovation in the iPhone is also about clever software, cool design and brilliant marketing. As it turns out, these expenditures typically dwarf R&D budgets. The EU-funded COINVEST project (www.COINVEST.org.uk) shows that R&D is typically between 10% and 25% of all spending on intangibles, see figure 2 (where the intangibles are software, design, R&D, branding, training and business processes).

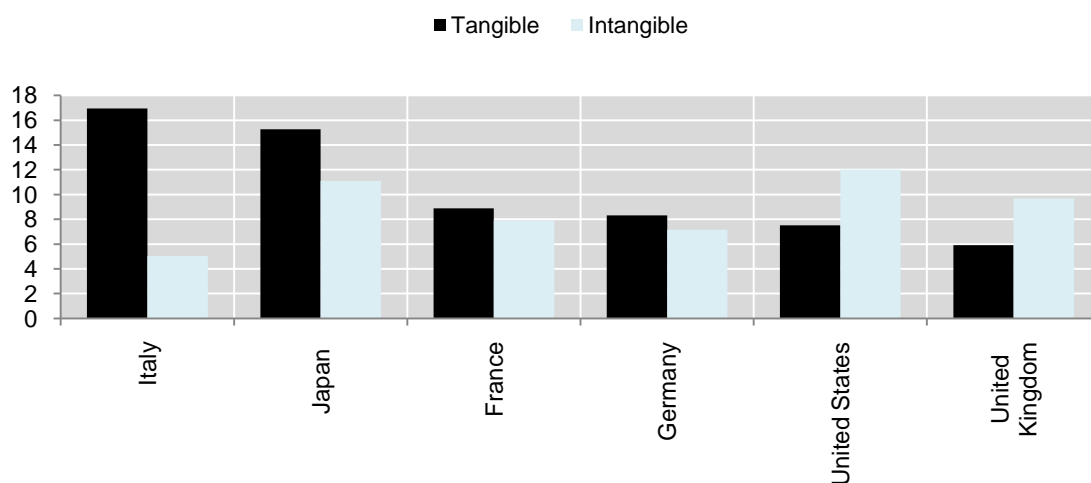
Figure 2: R&D spend as a fraction of total intangible investment, selected countries, 2006



Source: EU funded FP7 project, COINVEST, also reported in OECD Innovation Strategy (2010)

Third, spending on this broader range of intangibles is now, for some EU economies, greater than spend on tangibles. As figure 3 shows, in Germany and France investment in tangibles is about 8% of GDP. Investment in intangibles is a little bit less. In the US and UK by contrast, investment in tangibles exceeds that of tangibles. Now, the frequent talk of encouraging private and public investment is usually based on data on tangible investment. But in many advanced economies, such an approach seriously neglects the almost equally important intangible investment. In addition, the EU has set an R&D target of 3% of GDP. But if it wants to capture a wider set of intangibles, it might wish to set a target of 12% of GDP, around the US figure.

Figure 3: Tangible and Intangible Investment (% of GDP, 2006)



Source: OECD Measuring Innovation, based on data from FP7 COINVEST project.

The economic case for R&D

The bulk of evidence relating to public spending on basic R&D is that it “crowds in” private R&D – that is, stimulates the private sector to invest (Cohen et al. 2002; Box, 2009): for example Toole (1999) showed that a 1% increase in the stock of public basic research ultimately led to a 2.0% to 2.4% increase in the number of commercially available new chemical compounds. Thus public R&D spend on basic research fulfils one of the criteria of wise government spending, namely, that spending that it does not crowd out private spending.

Further, both public and private R&D investment raise overall growth: a 2004 OECD analysis estimated that a 1% increase in business R&D increases multifactor productivity by 0.13% and a 1% increase in public R&D increases multifactor productivity by 0.17%. However, more recent estimates from the UK (Haskel and Wallis, 2010) suggest that public R&D has its most potent impact when allocated to universities via open competition for research funding. That should come as no surprise, for such a system injects competition into the publicly funded research process.

The EU uses a range of market-based policies such as R&D tax credits and the Patent Box system. Many of these policies are poorly designed, however. The Patent Box, which rewards patent holders with a tax credit on the revenues derived from their patent, is badly targeted and wide open to abuse. In an interconnected innovation world, it is almost impossible to decide which particular revenue flow comes from which particular patent; and such patents might be developed abroad and then registered in the particular country giving the tax break. R&D tax credits, in many countries, are given on total spend on R&D and so are very expensive and prone to deadweight, since they subsidise R&D that would have been done anyway.

A priority is to measure these wider types of spending better. The above data use a mix of micro-economic surveys and macro-economic estimates. The UK Office of National Statistics, based on pioneering work by the Israeli Bureau of Statistics, has implemented a firm-level survey that goes beyond R&D and asks firms about their spending on software, design, training, branding and business processes. Wider knowledge spend can and must be measured; and this is a first step along the path to putting all innovation investment at centre stage on the statistical radar.