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Does Europe perform too little corporate R&D? A comparison of EU and non-EU corporate R&D performance

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ABSTRACT

This paper examines whether there are significant differences in private R&D investment performance between the EU and the US and, if so, why. The study is based on data from the 2008 EU Industrial R&D Investment Scoreboard. The investigation assesses the effects of three very distinct factors that can determine the relative size of the overall R&D intensities of the two economies: these are the influence of sector composition (*structural effect*) vis-à-vis the intensity of R&D in each sector (*intrinsic effect*) and company demographics. The paper finds that the lower overall corporate R&D intensity for the EU is the result of sector specialisation (*structural effect*) – the US has a stronger sectoral specialisation in the high R&D intensity (especially ICT-related) sectors than the EU does, and also has a much larger population of R&D investing firms within these sectors. Since aggregate R&D indicators are so closely dependent on industrial structures, many of the debates and claims about differences in comparative R&D performance are in effect about industrial structure rather than sectoral R&D performance. These have complex policy implications that are discussed in the closing section.

1. Introduction

1.1. Comparative R&D expenditure performance: a policy issue?

Research and Development (R&D) expenditures have long been an important concern for innovation analysts, who have used them as a proxy for innovation inputs and as a determinant of productivity growth. Perhaps, as a consequence, governments have increasingly seen R&D policy as an instrument for achieving their wider objectives related to growth, productivity and competitiveness. One effect of this is that many governments, as well as the EU as a whole, have established R&D intensity targets (for a comprehensive overview, see: Sheehan and Wyckoff (2003)). Some governments have brought in R&D tax credit schemes to encourage additional R&D investment and some of these schemes give tax relief based on an R&D intensity measure.

In the Lisbon strategy – which seeks to make the EU 'the most competitive knowledge-based economy' – the EU formulated a commitment to higher levels of R&D intensity as well as to changes in R&D organisation and framework conditions. Such objectives rest partly on proposals to increase publicly-funded R&D, but also emphasise the need for significant increases in business-funded R&D. The EU's aim in doing this is to approach and possibly surpass the effort made by competing economies (particularly the US). In fact, as Soete (2006) put it in an interesting paper, while Europe has kept up with the US in investing public resources in knowledge, both in higher education and research, the EU has dramatically failed to convince the private sector and its citizens to invest in knowledge, the key to its own long-term future.

Building on the Lisbon objective, the 2002 Barcelona European Council set a target for EU R&D of 3% of EU GDP, of which 2/3 should be financed by the private sector (European Commission, 2003).

These targets are appealing and enticingly easy to grasp. However, they are even more easily misunderstood because aggre-

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gate R&D numbers for countries or regions are not simply an effect of R&D 'effort': they are a combined outcome of company strategies, company demographics, industrial structures, and macro-economic dynamics (Soete, 2005).

A complete model of these determinants of R&D expenditure would probably be very complex indeed (see for example Jaumotte and Pain (2005) and Falk (2004) for relevant modelling efforts). It is important to keep these underlying issues in mind when thinking about the appropriateness of particular policy strategies, and about whether and how specific targets for R&D expenditure or R&D intensity might be reached. A common approach is to distinguish between 'intrinsic' and 'structural' factors in shaping R&D intensity: intrinsic factors reflect within-sector effort, while structural factors reflect the size of R&D-intensive sectors in relation to other sectors within an economy. Low aggregate R&D intensity can simply reflect the absence or small size of R&D-intensive sectors (or the very large relative size of sectors with high sales but relatively low R&D such as oil & gas), rather than any general failure of R&D performance (Griffith and Harrison, 2003, for example, have recently shown that the UK's low aggregate R&D intensity largely reflects structural factors).

1.2. Aim and research questions

This article aims to investigate the differences in private-sector R&D investment between EU companies and their competitors in other major economies. It utilises recent company data to identify structural and specialisation characteristics that explain the sizeable differences in aggregate R&D intensity observed between two populations of companies (EU and non-EU ones).[1] The specific research question guiding our investigation is whether the explanation for the lower overall corporate R&D intensity of the EU vis-à-vis the US and Japan is mainly because of lower EU R&D intensities across a wide range of sectors or because the structure of the EU economy has a larger relative share of low R&D intensity sectors and hence a smaller share of high intensity sectors. In other words, does the explanation lie mainly in an "intrinsic" vs. a "structural" effect? This study also investigates the distributions of R&D and R&D intensity for the three main world regions as well as the demographics of R&D-intensive firms to investigate whether these effects play a role in determining the differences in overall R&D intensity between these different world regions. Finally, the study analyses the possible consequences of these findings for policy-making.

1.3. Structure of the paper

The paper is organised as follows:

After the above introduction, Section 2 briefly reviews the main findings and relevance of benchmarking private R&D investment performance within the literature on "Economics of Research and Innovation".

Section 3 provides an overview of the tools used to benchmark R&D investment as well as presenting the data used in this study, namely the R&D investment of a large set of firms derived from the information listed in their annual accounts.

Section 4 investigates the distribution of R&D by comparing R&D across different sector groups using R&D intensity levels (following a widely-used approach to characterise industrial sectors according to their technological activity as measured by their level of R&D intensity).

This is followed by Section 5 which introduces the methodology to decompose R&D intensity into 'structural' and 'intrinsic' effects, within the major economies under study. This method of decomposition is then applied to an extensive set of company R&D data; key features are discussed and the results for the main economies compared.

Following this, Section 6 analyses the distribution of R&D across top R&D investing firms to examine R&D intensity by company size to see if differences in this contribute to differences between world regions.

Finally, Section 7 sums up the main findings and offers some concluding remarks relevant to policy-making.

2. Industrial R&D investment performance in the EU

This section sets out the conceptual framework reliably anchored to the published economic literature and highlights why the nature and causes of the EU private R&D investment performance profile matter and why they are important for policy-making. It also briefly reviews the relevance of benchmarking private R&D investment performance within the literature on the "Economics of Research and Innovation".

2.1. Why private R&D investment performance matters

Economic theory (Solow, 1957) points to technical change as the major source of productivity growth in the long run. R&D is a major source of technical change (Romer, 1990; Guellec and van Pottelsberghe de la Potterie, 2001) and this is recognised as a key element for increasing the knowledge base and, with it, the growth, productivity and competitiveness of an economy (Coccia, 2008; Mowery and Rosenberg, 1989).

As a matter of fact, most of the arguments that provide justification for policies targeted at raising the level and efficiency of R&D rely on the assumption of close links between R&D spending and micro- and macro-economic performance (Kafouros, 2008; Bilbao-Osorio and Rodríguez-Pose, 2004; Griffith et al., 2004; Mitchell, 1999).

It follows that, given the role played by competitive innovation-led enterprises in the economy (i.e. the return in terms of economic and social benefits), policy initiatives do not aim at raising the level of private R&D *per se*, but aim at making R&D investment more effective and at overcoming possible barriers to innovation and hence to economic and social prosperity (Pessoa, 2007; Soete, 2007; Jones and Williams, 1998).

It is not our intention to debate here whether, in order to address the EU R&D investment deficit to achieve a knowledge-intensive economy and society, the EU needs a long-term, structured industrial policy or simply short-term policy actions that address one-by-one the different market failures which impede the scale, effectiveness and impact of R&D investment.

We are however convinced that, within this context, it is important to understand and describe the nature and characteristics of the EU's deficit in R&D intensity and performance since this would guide the shape and effectiveness of whatever R&D-related policies and means might be employed.

2.2. The EU R&D intensity deficit: nature and reasons

There is extensive literature that deals with the deficit in the EU's overall company R&D intensity compared to that of competing economies and the various factors that could determine it. For instance, there are many scientific papers that consider firms'

[1] The study relies on data on industrial R&D performance: the "EU Industrial R&D Investment Scoreboard". Its most updated version contains R&D investment and company performance data of the 1000 largest R&D performing enterprises in the EU and 1000 in the non-EU (European Commission, 2008b).