EUROPEAN CENTRAL BANK

EUROSYSTEM

ECB FORUM
ON CENTRAL BANKING

26-28 June 2017 • Sintra Portugal

Investment and growth in advanced economies

Conference proceedings

An innovation deficit behind Europe's overall productivity slowdown?

By Reinhilde Veugelers[106]

Abstract

Europe maintains lofty ambitions for building its future prosperity and safeguarding its social model through innovation. An ambitious target of devoting 3% of GDP to R&D was already set in 2002. The same 3% was again targeted in the EU2020 strategy. Despite attention to innovation as a driver of growth and despite R&D targeting, Europe's performance on innovation remains weak to date. At the same time, Europe's TFP growth continues to display a lacklustre performance. Rather than looking at productivity growth through the residual TFP construction, this contribution looks directly into the evidence on innovation as a potential source of productivity growth. We look at the evidence on an innovation deficit behind Europe's overall productivity slowdown in Sections 1 and 2. Sections 3 and 4 try to get at why it is so hard to improve Europe's innovative performance and identify some policy implications.

1 The power of innovation as a growth machine

Before we look at the direct evidence on innovation in Europe, this section first looks at specifics of innovation investment.

1. Like capital investment, investments in innovation can create private welfare for the innovator, generating a private rate of return and motivating him to invest in the first place. But innovation's full creative potential benefits not only directly the initial innovator. As new knowledge diffuses, it can be used by others who can apply the new knowledge into new, often unrelated, applications. This is the well-known public good character of ideas.

It is this diffusion power from innovation that makes innovation such a powerful growth machine. Estimates for social rates of return can easily become multiples of the private rate of return[107]. But this diffusion cannot be taken for granted. It requires codification and transferability of knowledge together with the capacity and incentives to adopt and adapt knowledge at the receiver side. The patent system has as its mission, not only to provide incentives to the original innovator, but also in return, to disclose the invention, such that it can be more easily used by others

[106] Full Professor at KULeuven/MSI and Senior Fellow at Bruegel.

[107] For more on private and social rates of return, see eg Veugelers (2016).

(when the patent expires). But perhaps the most potent mechanism for the transfer of new know-how is when researchers who embody the new knowledge move from the innovating entity to other sectors or other firms.

Recent evidence from OECD (Andrews et al. (2017)) shows there may be a problem of diffusion/adoption, suggesting a problem in the diffusion section of the innovation-growth machine rather than innovation at the frontier, which is causing an increasingly larger divide between innovators at the frontier and laggards failing to use the opportunities from new, typically digital, technologies to catch up.

2. Innovation's full economic returns typically require a long time lag before full diffusion takes place. A longer term horizon is therefore needed to evaluate the full social returns to innovation, much longer than for other types of investments.

3. Innovation is a creative power, but it also destructs old technologies/products/skills. These are the two faces of the creative destruction power of innovation. Creative ideas, particularly those that are of the more radical, disruptive type, typically do not come from incumbent firms, who do not want to cannibalize their existing positions, but often come from new firms challenging incumbents, or when they come from incumbents, because they are challenged by new firms. If these radical innovations will come to be, they therefore require absence of entry barriers for new challengers and framework conditions for smooth transitions.

2 Assessing Europe's innovation-based growth deficit

As we care about innovation because of its power to generate growth, what we should measure are the effects of innovation on overall welfare. But unfortunately, we don't have good measures of the effects of innovation, particularly on the social value of innovative investments, which is what we ultimately care about[108].

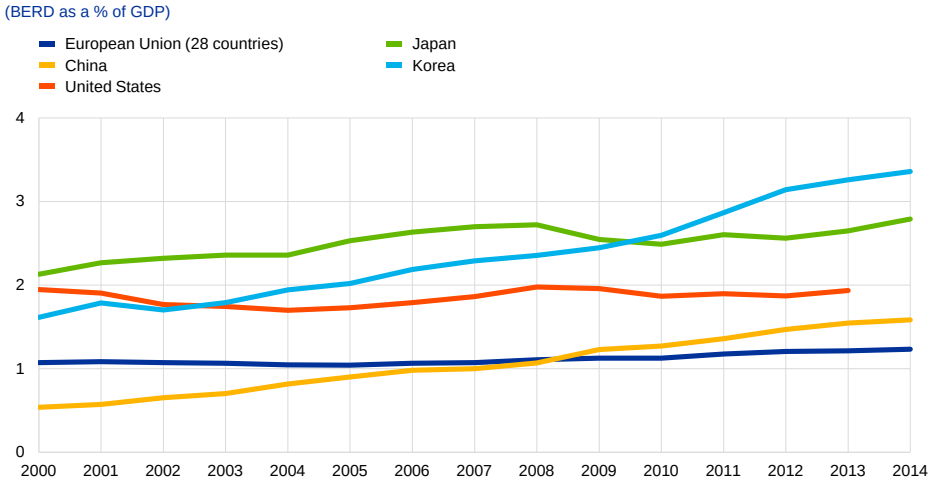
What is commonly measured are innovation inputs, with perhaps the most focal indicator the business sector expenditures on Research and Development (the so called BERD series, regularly published by the OECD/Eurostat). These expenditures reflect at the same time the capacity as well as the incentives of the private sector to use scientific and technological opportunities to launch innovations that will improve their profitability and competitiveness. Low scores on this indicator may identify deficits in innovative capabilities by the business sector, together with deficits in the framework conditions for innovation. It is therefore a major indicator for EU innovation policy to monitor. It is targeted as part of an overall 3% target for a country's R&D-to-GDP ratio to be around 2%. Chart 1 shows that the EU Business R&D share of GDP, although not declining over time, is not increasing fast enough to catch up. It continues to hover around 1%, which is consistently below other

[108] See eg Veugelers (2016).

countries like the US, Japan and Korea and since 2008, also below the score for China.

Chart 1

Trends in Business R&D in the world



Source: Own calculation on basis of EC, Innovation Union Scoreboard, 2016, based on OECD.

Broader than R&D are the expenditures for innovation, which also include expenses for introducing innovations not new to the market, but new to the firm, and therefore also measure diffusion through the adoption of innovations from others. The Eurostat-CIS data for Germany provide a panel comparable over time, allowing to assess both the trends in number of firms which are innovation active and the trend in expenditures by innovation active firms. These data show that the share of German firms that are innovation active has dropped over time (EFI 2015 and Rammer & Hünermund (2017)). Particularly, many small and medium-sized firms have discontinued their investments in innovation. This is consistent with the supra reported OECD evidence on the diffusion deficit (Andrews et al. (2017)). As a consequence, the inequality of innovation activities (as measured through the Gini-coefficient for innovation expenditures) has become larger over time in Germany. At the same time, they find a high stability in the group of firms with the largest R&D budgets in Germany. Overall, the total expenditures by the corporate sector on R&D are not decreasing in Germany, even slightly increasing, but the innovation landscape is becoming increasingly more unequal and concentrated in a few firms.

Ongoing work at Bruegel (Veugelers & Kalcik (2017)) tries to examine for Europe the trend in corporate R&D expenditures to become more concentrated in a few “superstars”. We use the information on European firms from the 2005 to 2015 editions of the EC-JRC Scoreboard of largest R&D spenders worldwide. The total investments of R&D by these firms remained stable during the crisis and continued to go up after the crisis (at least nominally). First preliminary results show that the distribution of R&D expenditures by European Scoreboard firms in the latest year available (2015) is highly unevenly distributed, much more than their sales and employment. Most of the inequality in R&D expenditures is due to the difference between the Top 10% and the rest. Inequality in the Bottom 90% only accounts for

7% of total inequality. The Top 10% of European Scoreboard firms represent 77% of all European Scoreboard R&D expenditures. The Top 1% of R&D spenders account for almost one third of all European R&D scoreboard expenditures.

When looking at the trend in inequality and concentration over time, from 2005 to 2015, the European Scoreboard data do not signal increasing inequality in R&D; on the contrary, the trend is downward and so is the trend in inequality in sales and employment of the European Scoreboard firms. This contrasts with the work of Autor et al. (2017) for the US corporate sector, who find an increasing trend of more concentration of sales and employment. It is in line with Philippon et al. (2017), who found that unlike for the US, concentration of sales has not increased, even decreased in Europe. Nevertheless, the downward trend in concentration of European R&D expenditures still leaves high levels of inequality. Furthermore, the decline in R&D concentration among European Scoreboard firms seems to have stopped since 2011. Since 2012, particularly the Top 1% R&D spenders have forged ahead. This more recent trend in increasing inequality of the R&D landscape and the increasing concentration in fewer firms, holds even more outspokenly for the US and in the digital sectors.

Should we worry about high and possibly increasing concentration of R&D expenditures? This depends on what is driving the high concentration. High concentration of corporate R&D in a few firms can arise from higher efficiency of larger firms. The speed, depth and breadth of technological change, large sunk investments for building R&D capacity, the need to access networks and alliance partners for innovation are all characteristics that would predict R&D races increasingly characterized as “winner take most”, where large firms are the most likely winners (Schumpeter Mark I) (Acemoglu & Hildenband (2017)). However, the speed with which the latest technological innovations get diffused or spill over voluntarily or involuntarily should lead to catching up and dissipating of previous leadership positions. If the diffusion process happens sufficiently fast, differences between leaders and laggards should shrink over time. A persistent concentration could thus suggest a diffusion deficit. At the same time, the fluidity of the R&D environment needs to be recognized where competences, network positions and technology leaderships of incumbents can be quickly overturned by radically new technology avenues. This will disrupt the incumbent leaders, creating room for new winners (Schumpeter Mark II). Even if the R&D landscape will still be concentrated, new tenants may inhabit the top.

An important issue for any potential policy concern on concentration of the R&D landscape is therefore to examine whether the “superstar R&D firms” are incumbent market leaders exploiting their market power or incumbent R&D superstars exploiting their superior innovative capacities and experience, or new superstar firms introducing radically new innovations. High or increasing concentration may be welfare enhancing if it follows from higher efficiency of leading firms, but it becomes a policy concern if it is a reflection of failing diffusion of innovations between leaders and laggards or from incumbents raising entry barriers for new potentially more efficient leaders. First results from the ongoing Bruegel work (Veugelers & Kalcik (2017)) shows a high incumbency among leading firms in Pharma/Biotech,

consistent with high economies of scale, scope and experience in this sector. This sector does show a trend towards decreasing concentration, suggesting diffusion and entry of new firms among European Scoreboard firms, notably from biotech, be it that the decreasing trend is very modest.

In the digital sectors, the incumbency effect is smaller than in Pharma. While almost 90% of the R&D expenditures of the largest 20 R&D spenders in the Health sector came from firms that were already the largest 20 R&D spenders in 2005, this share is below two thirds for ICT sectors. Nevertheless, in view of the rapid changes in technology in this sector, one would have perhaps expected a smaller incumbency effect.

3 Uncovering Europe's innovation deficit

The continued business R&D deficit, the lack of diffusion and the high, relatively, stable, concentration of R&D expenditures in a few leading firms, is central for understanding Europe's continued deficit in innovation based growth. It is a symptom of its low capacity for structural change and shifting towards new growth areas. But what explains this business R&D deficit? And why is this deficit so persistent? In line with Aghion et al. (2007) and others, Europe's persistent business innovation gap can be correlated with its industrial structure. New firms fail to play a significant role in the innovation dynamics of European industry, especially in the high-tech sectors. This is illustrated by their inability to enter, and more importantly, for the most efficient innovative entrants, to grow to world leadership. The churning that characterizes the creative destruction process in a knowledge based economy encounters significant obstacles in Europe, suggesting barriers to entry and growth for new innovating firms that ultimately weaken Europe's growth potential. Bartelsman et al. (2004) found that post entry performance differs markedly between Europe and the US, which suggests the importance of barriers to company growth. This inability for new European firms to grow large seems to manifest itself particularly in the high-tech, high-growth sectors, most notably in the digital sectors. This correlates with a lower specialization of the European economy in R&D intensive, high growth sectors of the nineties, again most notably the digital sectors.

This structural European innovation deficit story, related to company age and sectoral make-up of its economy, has been investigated in more detail in a Bruegel Policy Brief and Contribution (Veugelers and Cincera (2010)), confirming that the major source of Europe's lagging business innovation deficit relative to the US is the lack of young companies that have grown into world-leading innovators ("Yollies") in new innovation based growth sectors, most notably in digital and health sectors.

Why are there fewer companies starting up and growing into world leading innovators in Europe? The most frequently cited explanation for the differences in dynamic structure between Europe and the US is a greater willingness on the part of US financial markets to fund the growth of new companies in new sectors. Although the evidence clearly supports the importance of access to finance for highly innovative growth projects, the evidence also shows nevertheless that one cannot

ignore the importance of other impediments to innovation, reducing the expected rates of return on R&D investments. These other barriers include insufficient demand for innovations, regulatory burdens and access to skills (Schneider and Veugelers (2010)). Cincera and Veugelers (2014) examine econometrically the rates of return to R&D investments for world leading R&D investors. They find that, while in the US, young firms succeed in realizing significantly higher rates of return to R&D as compared to their older counterparts, European innovating firms fail to generate significant rates of return, even if they are young and even if they are in high-tech sectors.

All this is a strong reminder that the innovation deficit in Europe is systemic. Access to finance cannot be tackled in isolation, but should be embedded in an innovation environment that also addresses other barriers to innovation. As these other barriers reduce the expected rates of return on highly innovative projects, they affect the appetite of financers to provide funds for these projects.

4 Some policy suggestions for addressing Europe's innovation deficit

What types of policy interventions are needed in Europe to address these specific barriers? And how targeted do they need to be? A first important remark is that a general innovation policy aimed at improving the environment for innovation remains necessary. This overall innovation policy is also needed to power the diffusion engine. Such an overall innovation policy should further the integration of European capital, labour, product and services markets, make it easier for players in the innovation system to interact and, at the same time, ensure healthy competition and an innovation friendly regulatory framework.

Such an overall innovation policy will be necessary, but it will not be sufficient. Policy measures are also needed to tackle the specific barriers faced in new sectors by new companies. This includes inter alia access to external finance for fast growing highly innovative projects, by public funding and/or by leveraging private risk funding.

As there are still too many unknowns about whether and which interventions are effective for which countries, policymakers are advised to engage in close monitoring of emerging innovative markets. Monitoring should include a strong prospective angle, able to identify new emerging markets well in advance so that a pro-active policy mix can be identified for the very earliest phases of development, when the risk of market failure is at its highest.

References

Acemoglu, Daron and Nikolaus Hildebrand (2017), "Increasing Concentration and Persistence of Innovation: Facts and Theory", mimeo.

Aghion P., E. Bartelsman, E. Perotti and S. Scarpetta (2008), “Barriers to exit, experimentation and comparative advantage”, RICAFE2 WP 056, London School of Economics.

Andrews, D., Criscuolo, C., and Gal, P. (2015), *Frontier firms, technology diffusion and public policy: micro evidence from OECD countries* (No 2), OECD Publishing.

Autor, David, David Dorn, Lawrence F. Katz, Christina Patterson, and John Van Reenen (2016), “The Fall of the Labor Share and the Rise of Superstar Firms”, *Working Paper*, Massachusetts Institute of Technology.

Bartelsman E., J. Haltiwanger and S. Scarpetta (2004), “Microeconomic evidence of creative destruction in industrial and developing countries”, *Tinbergen Institute Discussion Papers* 04-114/3, Tinbergen Institute.

Cincera, M. and R. Veugelers (2014), “Differences in the rates of return to R&D for European and US Young Leading R&D firms”, *Research Policy*, 43, 1413-142.

Philippon, T. and G. Gutiérrez (2017), “Is there an investment gap in advanced economies? If so, why?”, in ECB, *Investment and growth in advanced economies*, Frankfurt am Main.

Rammer, C. and P. Hünermund (2016), Innovation activity in Germany is becoming more concentrated.

Schneider, C. and R. Veugelers (2010), “On Young Highly Innovative Companies: why they matter and how (not) to policy support them”, *Industry and Corporate Change*, 19, 4, 969-1007.

Veugelers, R. and M. Cincera (2010), “Europe’s Missing Yollies”, *Bruegel Policy Brief* 2010/06, Bruegel Brussels.

Veugelers, R. and M. Cincera (2010), “Young Leading Innovators and EU’s R&D intensity gap”, *Bruegel Policy Contribution* 2010/09, Bruegel Brussels.

Veugelers, R. (2016), “Getting the most from public R&D spending in times of budgetary austerity: some insights from SIMPATIC analysis”, *Bruegel Working Paper* 2016/01.

Veugelers, R. and R. Kalcik (2017), “Does the European corporate R&D landscape become increasingly more concentrated in a happy few ‘superstars’?”, *Bruegel Working Paper*, forthcoming.