

in brief...

Location, location, location: why geography matters for R&D

A key insight of economic geography is that proximity is good for productivity. Research by **John Van Reenen** and colleagues explores this relationship in the context of corporate research labs, revealing a strong link between R&D and growth driven by 'knowledge spillovers' between firms located close to each other.

President Obama recently proposed increasing the generosity of the US tax credit system for corporate spending on research and development (R&D) and making it a permanent feature of the US tax code. This was justified by the idea that more R&D would lead to growth, not just worldwide but particularly in the United States.

But such a bold claim raises some fundamental questions: does the location of R&D matter? Will a firm be more productive if it locates in one region rather than another? And do R&D 'spillovers' – the benefits to firms other than the company spending its money on R&D – decline with distance and, if so, how quickly?

The answers are important for several reasons, most notably for understanding regional growth. If geographical spillovers are confined to narrow geographical markets, growth rates will diverge, poor regions will get poorer and rich ones will get richer.

Few doubt that, in the long run, new and better products and processes are stronger determinants of firm growth than growth in demand for existing products. Given the importance of this issue, it is not surprising that economists have studied the link between a firm's R&D and its productivity.

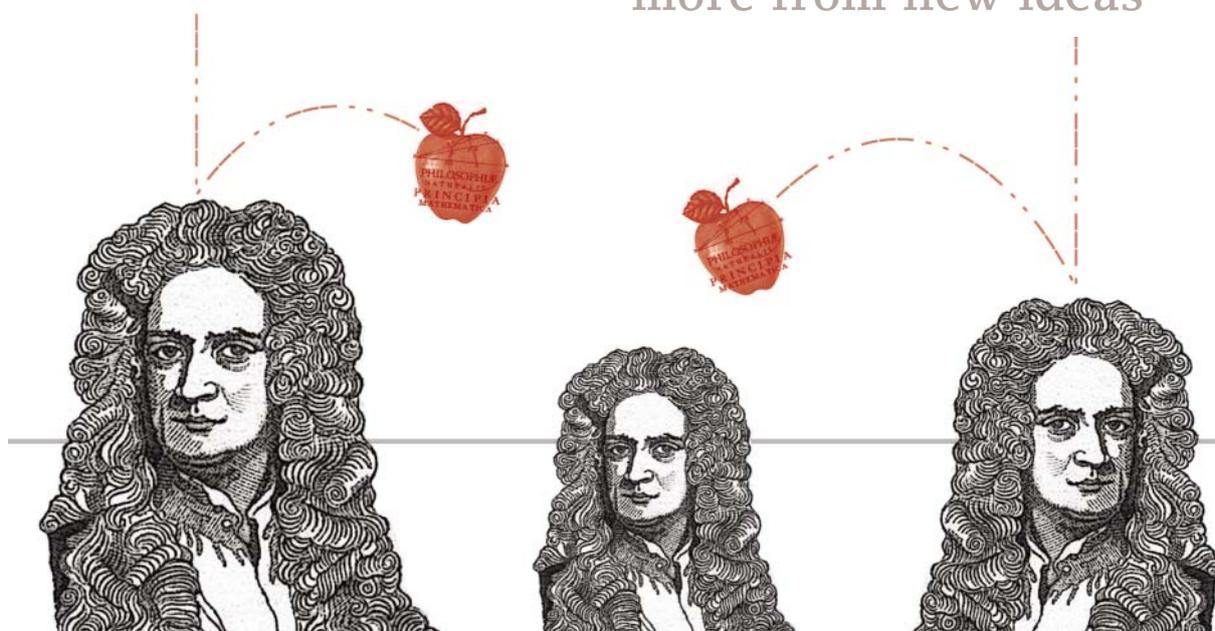
Equally if not more important is the fact that not only

does a firm's research affect its own productivity, but there are also significant spillovers from the R&D efforts of other firms. This idea, which is at the heart of modern growth theory, dates back to the 1960s and attempts were first made to quantify the impact in the 1970s. Our research puts a new twist on the hunt for R&D spillovers, focusing on geography.

In the analytical framework we use, a firm's productivity is a function of its own knowledge and the 'spillover pool', a weighted average of other firms' knowledge. To work out which firms benefit from R&D spillovers, we have to figure out which ones are close 'neighbours'. This boils down to working out some distance 'weights' – the bigger the weight, the closer you are, and thus the more likely you are to benefit from a neighbouring firm's research. So for firms in California, it matters whether you are located in Silicon Valley or near Yosemite National Park!

These weights thus play two roles: they determine both the set of firms that contribute to the spillover pool and the relative importance of the firms within that set. For

**A firm whose inventors
are close to other firms'
R&D will benefit a lot
more from new ideas**



Geographical growth spillovers explain why local policy-makers compete to attract corporate R&D labs to their regions

example, in the geographical context of the United States, we might limit attention to firms that are in the same state and weight those firms by their geographical distance from the firm doing the R&D.

But there are channels other than geography that affect R&D spillovers. For example, firms that perform R&D in similar technology classes might benefit from each other's efforts ('technological spillovers'). On the other hand, firms that produce similar products might actually be hurt by the R&D efforts of product market rivals as these competitors will steal business from them if they innovate successfully.

Moreover, these spillover links are not independent. For example, firms in the same geographical region might perform R&D in similar technology classes, as in Silicon Valley. Our research assesses all three channels simultaneously. Although we focus on geographical spillovers, we control for technological spillovers and business-stealing effects.

We postulate that inventors are more likely to be sources of spillovers than top management. Although for many small firms the locations of corporate headquarters and research labs are highly correlated, many large firms have several labs in different locations so taking account only of headquarters could severely underestimate the importance of inventors learning from neighbouring inventors.

Our research indicates that the locations of researchers are indeed more important than the locations of headquarters, but both have explanatory power. Furthermore, the effects of R&D fall with distance, and geographical R&D markets are very local.

We conclude that location does matter. There is a strong link between R&D and growth through knowledge 'spilling over' between firms. Among other things, this means that research will generally be under-provided by the market.

But the process of R&D spillovers driving growth has an important geographical element: having your inventors close to where the R&D is occurring means that you benefit a lot more from new ideas. This is why local policy-makers like to attract R&D facilities into their areas, but it is also why regional economic convergence, if it occurs, is often so slow.

Our findings are complementary to those of Michael Greenstone and colleagues (2010), who find that locating a large new plant in a region increases the productivity of other plants in that region. Moreover, our research provides an explanation for the findings of Daniel Wilson (2008), who documents that local policy-makers invest substantial sums in the form of tax incentives to attract R&D labs to their regions.

This article summarises 'Spillovers in Space: Does Geography Matter?'; by Sergey Lychagin, Joris Pinkse, Margaret Slade and John Van Reenen, CEP Discussion Paper No. 991 (<http://cep.lse.ac.uk/pubs/download/dp0991.pdf>).

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Further reading

Michael Greenstone, Richard Hornbeck and Enrico Moretti (2010) 'Identifying Agglomeration Spillovers: Evidence from Winners and Losers of Large Plant Openings', *Journal of Political Economy* 118(3): 536-98

Daniel Wilson (2009) 'Beggars thy Neighbor? The In-state, Out-of-state and Aggregate Effects of R&D Tax Credits', *Review of Economics and Statistics* 91(2): 431-6

