

IDEAS ROUNDABOUT



Only

Home Bias



(A2 (A20) A13)

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Innovative Activity
A201

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Economists have long been sceptical of claims about the 'death of distance' – the idea that new technology has diminished the significance of geography for economic outcomes. Research by **Rachel Griffith**, **Sokbae Lee** and **John Van Reenen** on patent citations over time finds the first hard evidence that distance is indeed becoming less important.

Is distance dying at last?

Commentators have for years been claiming that economic activity no longer respects international frontiers. But while cheap communication, falling shipping costs and the internet make things easier, face-to-face interaction remains as important as ever, even in high-tech sectors like software and biotechnology – just think of Silicon Valley or Bangalore. And if one looks at trade patterns between countries, international boundaries still matter a lot.

Our new research finds the first evidence that distance really is dying – at least in the world of ideas. Having looked at over two million patent citations over a quarter of a century and broken them down by the country of the inventors (covering just about every nation in the world), we find that national barriers are crumbling when it comes to the flow of innovations, as measured by the relative speed of patent citations across countries.

We find that there was a great deal of 'home bias' between 1975 and 1990: for example, German inventors cited other Germans 14% faster than American inventors cited German patents. But the

really interesting thing is how these citations have changed over time: since 1990, the Americans have been only 5% slower at citing Germans than the Germans themselves; and the French only 1% slower. So even though information is spreading faster within countries, it has also started to flow really quickly between countries.

The importance of geography

Economists dating back to Alfred Marshall in the late nineteenth century have emphasised the importance of geographical proximity for the flow of ideas and the diffusion of technologies. Inventors find it hard to capture knowledge: like water, it 'spills over' to other people. Geographical proximity facilitates this process if face-to-face interaction is important, for example,

where knowledge is 'tacit' so that it is not codified in writing or in standard industry practices. Workers and managers meeting at formal and informal meetings and moving between firms will help to transmit new ideas between organisations.

The idea that closeness matters for the diffusion of knowledge also lies behind a number of government policies. Subsidies for research and development (R&D) generally target activities that are geographically located within the home country. These typically seek to attract shiny high-tech firms to locate in specific areas, based on the premise that their activities will have the highest 'positive externalities' – benefits not only for the investors but also for firms and workers nearby. Other policies aim to encourage clusters of high-tech firms, based on the belief that the sum of benefits from

When it comes to the flow of new ideas, distance is now dying

clusters of firms is greater than the constituent parts.

In contrast to the idea that geographical proximity is important for technology transfer, the notion of the 'death of distance' has recently flourished in the popular imagination (for example, Friedman, 2005; Cairncross, 1997; Coyle, 1997). Messiahs of globalisation claim that information travels around the globe at rapid speed from California to Calcutta through the internet, conferences, telephone and other communication devices. Under this view, geography plays little role.

There are plenty of anecdotes, but what is the hard evidence that distance matters? And to what extent have they changed over time?

Existing research: distance matters

Answering these questions turns out to be difficult for a number of reasons. First, how do we trace knowledge flows? And second, how can we distinguish the importance of geographical proximity for knowledge flows from other factors that may be associated with geography?

Patent citations have become an important source of information on the way that knowledge flows between firms and countries. When an inventor takes out a patent, they have to provide citations to the prior technology from which their ideas are drawn. This is a pretty direct measure of knowledge flows.

One prominent study that uses patent citations in this way is by Adam Jaffe and colleagues (1993). They show that inventors are far more likely to cite other inventors living close by than inventors in more distant locations.

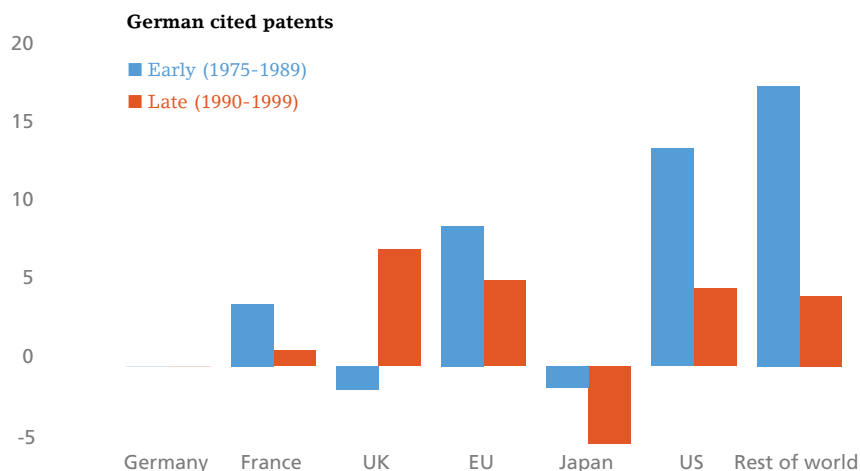
Several studies have followed this approach, and the consensus that has emerged is that knowledge really is subject to a significant degree of home bias. Our earlier study (Griffith et al, 2006) also shows that British firms who locate R&D labs in the United States are better able to tap into American knowledge than those that do not.

New research: distance starting to die

But much of this research uses older data. Our latest study aims to establish whether things have changed recently with

Figure 1: Distance matters less for the flow of ideas

Speed of citation: Example of inventions from Germany



Notes: This graph shows the relative percentage time (in mean number of days) from the date that a German inventor was granted a patent until the first citation of that patent (by the location of the inventor that made the citation). For example, the first bar (blue) for France in the early period indicates that the French inventor took 4% longer to cite a German invention than a German inventor took to cite another German inventor. This fell to 1% in the 1990s (red bar).

Innovations are flowing more quickly between countries, as measured by the relative speed of patent citations over time

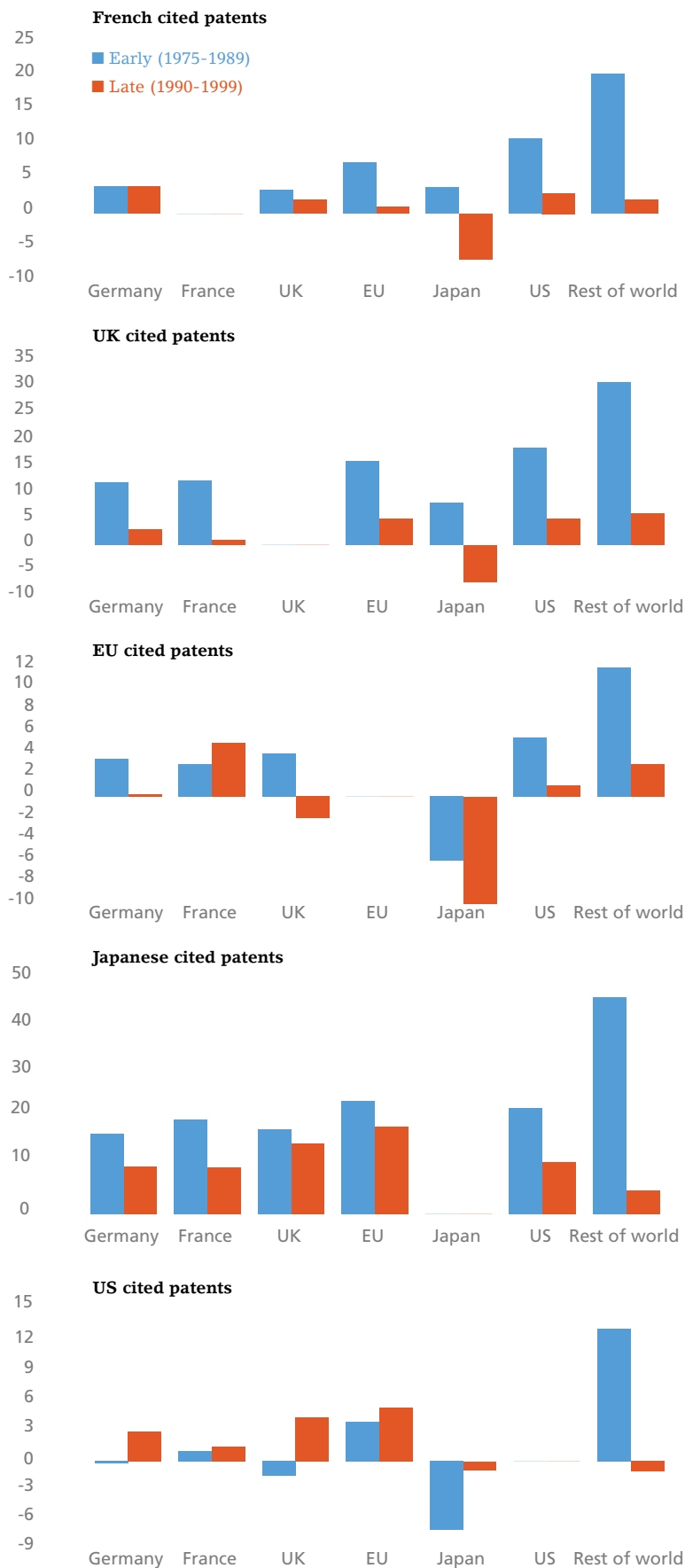
innovations such as the internet. We use patent citations to address whether the rumours of the death of distance have been somewhat exaggerated. In particular, we look at the speed of knowledge flows between countries.

A simple look at the raw data suggests substantial evidence of home bias in the way that knowledge is transmitted: being geographically close does make knowledge transfer easier. But we also see evidence that distance has become less important over time for the international transmission of ideas.

Figure 1 plots the relative speed of patent citations across countries and over

Figure 2:
Distance matters less for the flow of ideas

Speed of citation: All other countries



time for the example of inventions discovered in Germany. These are all successful applications to the US Patent Office for inventors living in Germany in an 'early' period (1975-89) on the left and then in a 'later' period (1990-99) on the right.

Looking first at the early period, the height of each bar indicates how much slower foreign inventors were in being first to cite Germans relative to other German inventors. In the 1970s and 1980s, American inventors were about 14% slower in citing Germans than the Germans themselves.

Figure 2 looks at inventions cited in the other OECD countries. The fact that the bars in both Figures 1 and 2 are almost all positive suggests that the phenomenon of home bias in ideas is alive and well – Germans are quicker at citing other Germans, British quicker at citing other British, and so on. What is more interesting is how home bias has changed over time – on average the bars in the later period are lower than the bars in the earlier period. This suggests that home bias in ideas has fallen. After 1990 in Figure 1, the French are only about 1% slower in citing Germans, and the Americans only about 5% slower in citing German inventors, than the Germans themselves (only the British seem to be slower off the block in citing Germans in the 1990s!).

This looks promising and suggests distance is dying. But there are many reasons why the simple patterns in the raw data might be misleading. In particular, knowledge may spread more or less quickly due to many patent characteristics that may be poorly captured by observable characteristics, and may be associated with geography. For example, if high quality patents are cited more quickly than lower quality patents, and if high quality patents are

Notes: As in Figure 1. Height of bar indicates how much slower a country is in citing another country.

geographically clustered for some other reason, then this could give the impression of home bias whereas in fact it is to do with the higher average quality of inventors in one location.

The traditional way to deal with this sort of problem in econometric research is to control for unobserved and correlated 'fixed effects' (things which we don't measure but are pretty much fixed over time). Lee (2007) develops an econometric estimator that allows us to do this by taking 'quasi-differences' over time between multiple citations on the same patent.

Our research suggests that controlling for these unobserved characteristics makes an important difference to estimates of the importance of home bias in innovative activity:

- First, the evidence for home bias is much weaker once we control for fixed effects. The non-fixed effects models (which are standard in the research literature) suggest home bias in a majority of cases, whereas our preferred models indicate home bias in only a minority of cases.
- Second, home bias is much stronger in the 'traditional' sectors of the economy (such as chemicals and mechanical engineering) than in more 'modern' sectors (such as computing). This is consistent with the idea that information diffuses faster internationally in the modern sectors.
- Finally, and most interestingly, we find evidence that home bias has declined over time, being much stronger in the pre-1990 period than the post-1990 period. We interpret this as suggesting that information flows more easily across national boundaries as the cost of international communication and travel has fallen.

Don't bury economic geography just yet

So the bottom line is that when it comes to the flow of new ideas, we find hard evidence that distance has become less



For traditional sectors with mature technologies, distance is not yet dead

important over time. But for many sectors, especially in the more traditional and mature technologies, it is not yet dead.

One policy implication of this research is that it makes less sense to subsidise corporate R&D if the ideas generated benefit other countries very quickly. Similarly, firms may worry more that their innovations may earn them profits for less time than in the past, as foreign firms learn to imitate and leapfrog them.

If new ideas benefit other countries more quickly nowadays, it may make less sense to subsidise corporate R&D

This article summarises 'Is Distance Dying at Last? Falling Home Bias in Fixed Effects Models of Patent Citations' by Rachel Griffith, Sokbae Lee and John Van Reenen, CEP Discussion Paper No. 818 (<http://cep.lse.ac.uk/pubs/download/dp0818.pdf>).

Rachel Griffith and Sokbae Lee are at University College London.

John Van Reenen is director of CEP.

Further reading

Frances Cairncross (1997), *The Death of Distance: How the Communications Revolution Will Change Our Lives*, Harvard Business School Press.

Diane Coyle (1997), *The Weightless World: Strategies for Managing the Digital Economy*, Capstone/MIT Press.

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Rachel Griffith, Rupert Harrison and John Van Reenen (2006), 'How Special is the Special Relationship: Using the Impact of R&D Spillovers on British Firms as a Test of Technology Sourcing', *American Economic Review* 96(5): 1859-75.

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Sokbae Lee (2007), 'Estimating Panel Data Duration Models with Censored Data', *Econometric Theory*, forthcoming.

Alfred Marshall (1890), *Principles of Economics*, Macmillan.