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Book review

Zoltan J. Acs (2002): Innovation and the growth of cities. Edward Elgar, Cheltenham, UK, Northampton, MA, USA, 247pp., £ 59.00, ISBN 1-84064-936-4

Though ample evidence is available that shows that innovative industries are geographically highly concentrated, few people have analysed systematically the relationship between innovation and geography. An exception is Zoltan Acs, who has spent over a decade researching how and why space matters in innovative activity through various collaborative projects with Audretsch, Anselin and Varga. This book collects a number of empirical studies on knowledge, innovation and geography previously published in various journals, which form (apart from Chapters 5 and 6 that do not deal with geography) a coherent whole.

The issue tackled by Acs and colleagues is important. By now, consensus has grown that innovation and knowledge production are the prime sources of job creation and economic growth. The relationship between geography and knowledge production, however, is a complex one, which is hard to tackle with standard theories in economics. Knowledge does not conform to the standards properties of economics (excludability and rivalry). Moreover, knowledge flows and knowledge stocks are difficult to measure empirically.

Even though Acs recognises the challenges mentioned, he prefers to use standard economic theory and tools wherever possible. His point of departure is the Jaffe (1989) conceptualisation of 'geographically mediated spillovers' within a knowledge production function approach (unfortunately, Acs explains this model three times in three different chapters). Jaffe's main concern was to analyse whether patent activity as a knowledge output benefited from geographic coincidence of university and corporate research, and he found (weak) supporting evidence that spillovers are facilitated by the co-location of university research and corporate labs within a state.

In Chapter 2, Acs repeats Jaffe's study using innovation counts instead of patents. Innovation counts can be considered superior to patents as a proxy for R&D output, because patents do not always lead to innovation. Substituting patents by innovation counts yields more convincing evidence supporting the hypothesis that spillovers are facilitated by the coincidence in location of university research and corporate labs within a state. It was further found that larger firms rely more

on in-house R&D, while smaller firms benefit relatively more from spillovers from university research. This result provides an answer to the question as to where small firms get their innovation producing inputs, given that they invest little in R&D themselves. In so far as small firms are entrepreneurial, one can argue that entrepreneurship is facilitated by local knowledge spillovers.

In Chapter 3 and Chapter 4, the basic framework laid down in Chapter 2 is extended in various directions. First, Acs and his colleagues refine the analysis by using data on 125 metropolitan statistical areas (MSAs) rather than relying on data at the state level. MSA data are to be preferred over state-level data because these better reflect the appropriate geographical scale of knowledge spillovers. Second, they repeat their analysis for different sectors separately to understand the specificities of sectors regarding local knowledge spillovers. Thirdly, they introduce spatially lagged variables that capture the effect of inputs in counties surrounding an MSA. In doing so, they were the first scholars to specify an explicit geographical structure within the knowledge production approach. The analyses all tend to confirm the basic message of the book: university spillovers are important, they are to a large extent geographically localised, they are more important for smaller firms than for larger firms, and they are sector-specific (most pronounced for the electronics sector and instrument sector, while no effects were found for chemicals and the machinery sector).

Chapters 5 and 6 deal with issues unrelated to knowledge spillovers, but concentrate on more classical issues of the way in which firm size, innovative activities and capital structure are interrelated. Though the studies are interesting in their own right, I feel that the exclusion of these chapters would not have lowered the quality of the book and probably would have increased its coherence and focus. Suffice it to say that the reader can, in principle, read these chapters independently from the other chapters.

The effect of knowledge spillovers on employment is analysed in Chapters 7 and 8. Though less elaborated upon theoretically, the analysis is of great importance for economic policy, which has devoted increasing effort on the stimulation of (local) high-tech sectors, implicitly assuming that it will enhance employment growth. The central outcome of their analysis holds that, at the level of MSAs, academic research has indeed an employment spillover. The question remains, however, as to the way in which employment in medium- and low-sectors is affected by knowledge spillovers, considering the fact that the large majority of cities and regions in the world are specialised in medium and low-tech industries.

The last empirical study reported in Chapter 9 addresses urbanisation economies, a very recent and hot topic in economic geography. Urbanisation economies are agglomeration economies that stem from a large variety of different industries co-located in a particular urban area or region. These externalities, also termed Jacobs externalities (after Jane Jacobs who suggested this effect in the sixties), are different from localisation economies that stem from the concentration of activity in one particular industry. Using data on university research and corporate R&D, and a matching between disciplines and sectors so as to distinguish between localisation effects (between a discipline and a related sector) and urbanisation effects (between a discipline and an unrelated sector), Acs' analysis did not produce

evidence for urbanisation economies. The contribution of this chapter, however, lies more in addressing the issue and proposing an econometric technique rather than in the actual results, because the data used are limited and the matching procedure between disciplines and sector is to some extent ad-hoc.

The book ends with a chapter on innovation systems and an epilogue on regional policy. Acs is careful not to argue that, because knowledge spillovers appear substantial and geographically localised, policies should be aimed at increasing university research and R&D expenditures. Such a conclusion, though in line with the 'production function thinking', would call for a linear, technology push approach to science policy. By contrast, Acs highlights the role of various types of institutions supporting entrepreneurship and knowledge-based industries. This is in itself not surprising given the large literature on the role of institutions in high-tech regional development, but it is surprising given that institutions play no role in Acs' empirical work reported in the previous chapters.

The main contribution of Acs' book clearly lies in the empirical analysis of knowledge spillovers and their effect on innovation and employment, as well as in the use of original spatial econometric techniques. Future research in this area should try to verify whether the patterns found by Acs and his colleagues can be found in other countries using more recent data. As it is, the book spans an agenda for empirical research and, implicitly, urges us (or better, our national statistical agencies) systematically to collect data on knowledge inputs and outputs at relevant spatial levels.

However, the limits of this approach should be recognised as well, and these are, in my personal opinion, twofold. First, the knowledge production function approach is essentially a static cross-sectional analysis designed to explain knowledge output by knowledge inputs and a geographical coincidence structure. This is clearly sufficient in the short-run, yet it fails to explain the way in which centres of knowledge production shift over time, simply because it is not designed to do so. For example, as Acs (p. 2) himself mentions as one of the fascinating phenomena of recent history, why the *manufacturing belt* lost its position to *sun belt* states in the last couple of decades.

A second limitation of Acs' approach is that he measures the extent to which knowledge spillovers play a role in explaining innovative activity or employment, but does not go into the precise mechanisms through which these spillover effects come about. This may also explain why his discussion of economic policy is only loosely connected to the empirical results reported in the book. Without insight in the precise mechanisms of knowledge spillovers, policy-making remains difficult.

These limitations are clearly not inherent to Acs' theoretical ideas on localised knowledge spillovers, but rather to the research designs that have been chosen. Therefore, his book can be considered as a landmark of the first generation of empirical studies on knowledge spillovers, and should be read by anyone even remotely interested in the field. A second generation, however, is currently underway and typically tries to go beyond the production function approach, focusing on the exact mechanisms through which knowledge is produced and diffused. For example, one recent study (Breschi and Lissoni, 2002) suggests that social networks rather than geographical proximity *per se* enable knowledge spillovers. Another recent

study (Klepper, 2002) explains the geographical concentration of innovation and production in the automobile industry by an explicit evolutionary model, in which spin-off firms inherit knowledge and competencies from the parent firm rather than from proximate firms. Given that spin-offs locate close to the parent firm, regional concentration emerges as a dynamic result. These studies are only two examples of new approaches showing that evolutionary economics develops new insights in economic geography that go beyond earlier approaches without giving up formal rigor.

References

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