

Papers in Evolutionary Economic Geography

11.01

The emerging empirics of evolutionary economic geography

Ron Boschma and Koen Frenken



Utrecht University
Urban & Regional research centre Utrecht

The emerging empirics of evolutionary economic geography

Ron Boschma

(Department of Economic Geography, Utrecht University, r.boschma@geo.uu.nl)

Koen Frenken

(School of Innovation Sciences, Eindhoven University of Technology, k.frenken@tue.nl)

*paper prepared for special issue of Journal of Economic Geography
(guest editors: Harry Garretsen and Ron Martin)*

Key words: evolutionary economic geography, clusters, related variety, institutions, regional branching

JEL codes: B25, B52, D85, L25, 018, R0, R1

Abstract

Following last decade's programmatic papers on Evolutionary Economic Geography, we report on recent empirical advances and how this empirical work can be positioned vis-à-vis other strands of research in economic geography. First, we review studies on the path dependent nature of clustering, and how the evolutionary perspective relates to that of New Economic Geography. Second, we discuss research on agglomeration externalities in Regional Science, and how Evolutionary Economic Geography contributed to this literature with the concepts of cognitive proximity and related variety. Third, we go into the role of institutions in Evolutionary Economic Geography, and we relate this to the way Institutional Economic Geography tends to view institutions. From this discussion, a number of new research challenges are derived.

1. Introduction

In recent years, economic geography has been subject to new and promising developments. In the first ten years of its existence, the Journal of Economic Geography has played a key role in promoting these developments, by providing an interdisciplinary platform through which new research programmes have been disseminated. One such programme has been Evolutionary Economic Geography (Storper, 1997; Boschma and Lambooy, 1999; Boschma and Frenken, 2006; Martin and Sunley, 2006; Frenken, 2007; Journal of Economic Geography *special issue*, 2007, Economic Geography *special issue*, 2009; Boschma and Martin, 2010; Coe, 2010).

Evolutionary Economic Geography (EEG) explains the spatial evolution of firms, industries, networks, cities and regions from elementary processes of the entry, growth, decline and exit of firms, and their locational behaviour. What renders evolutionary theory attractive in economic geography, is that it may develop into a general theory in economic geography while being applicable empirically to specific processes in space and time. This feature "... makes evolutionary theory compatible with a contextual view as advocated in economic geography, without giving up the ideal of developing a theoretical framework that goes beyond the specific and the unique" (Frenken and Boschma, 2007, pp. 635-636).

Here, we report on recent research that has explicitly been motivated by the evolutionary programme. Due to lack of space, we cannot provide a comprehensive account.¹ Rather, we focus on three main areas that have attracted most attention: (1) clustering of economic activity; (2) the nature of agglomeration externalities; and (3) the role of institutions in regional development. For each of the three areas, we discuss how this empirical work in EEG can be positioned vis-à-vis other strands of research in economic geography. Regarding clustering, we link EEG to New Economic Geography, regarding agglomeration externalities to Regional Science, and regarding institutions to Institutional Economic Geography.

2. A short recapitulation

In our evolutionary approach to economic geography, we start from the definition of economic geography as dealing with the uneven distribution of economic activity across space. An evolutionary approach specifically focuses on the historical processes that produce these patterns. The current distribution of economic activity across space is thus understood as an outcome of largely contingent, yet path dependent, historical processes, or as Dosi (1997) has it: “the explanation to why something exists intimately rests on how it became what it is” (p. 1531).

We follow the seminal work by Nelson and Winter (1982) in taking organizational routines as the unit of analysis. Firm-specific routines are underlying a firm’s organizational capabilities on the basis of which it competes (Teece et al., 1997). Economic evolution can then be understood as the selective transmission of routines among organizational entities, particularly, firms. As the replication of routines among firms is imperfect, variety in routines persists over time as routines are passed on with small modifications. Nevertheless, variety is constantly reduced due to competition and constraining institutions. At the same time, radically new routines can be introduced through innovations, even if not many of them will survive the selection process.

With spinoff firms and labour mobility being its prime vehicles, routine replication is mostly a local affair (Maskell, 2001; Essletzbichler and Rigby, 2007; Klepper, 2007). What follows is that the spatial evolution of firm-specific routines develops along a geographically localised lineage structure, in which successful routines have a higher chance not only to survive, but also to be transferred to other local firms. This process results in regional branching in which new routines develop out of technologically related routines (Frenken and Boschma, 2007; Boschma and Frenken, 2011), underlining the importance of ‘related variety’ for regional development (Frenken et al., 2007). The process of evolutionary branching that underlies economic development is not only a path dependent process, but also a place-dependent process (Martin and Sunley, 2006). That is, spatial conditions for the creation, transmission and influx of new routines are expected to differ at various spatial scales, for example, depending on the set of institutions, the structure of networks and patterns of migration.

¹ For example, we will not pay attention to the study of knowledge networks from an EEG perspective, despite the fact that progress has been made in recent years (see Boschma and Frenken, 2010 for an overview). In particular, some have integrated the evolutionary analysis of networks into a proximity perspective, in which the different proximities (geographical proximity being one of those) may act as drivers of network formation (Balland, 2009; Ter Wal, 2009; Vinciguerra et al., 2010).

3. Clustering as an evolutionary process

From an evolutionary perspective, clusters are analysed by tracing regional entry and exit patterns over time. Following a demographic logic, the number of firms in a region at a particular moment in time equals the cumulative number of entries (possibly including inward migration) minus the cumulative number of exits (possibly including outward migration). Entry rates are highly dependent on the number of incumbent firms in a region, as each firm constitutes a potential source for spinoffs (Arthur, 1994; Sorenson and Audia, 2000; Stuart and Sorenson, 2003) as well as a signal to (re)locating firms (Suire and Vincente 2009). This explains why clusters, once established, tend to persist over time. That is, clusters are self-reproducing even if localisation economies are absent (Klepper, 2007; Wenting, 2008) or negative (Sorenson and Audia, 2000; Stuart and Sorenson, 2003; Boschma and Wenting, 2007).²

The central question, though, is how one explains the emergence of clusters in certain places rather than others. Klepper's (2007) industry lifecycle study on the U.S. car industry has provided a comprehensive explanation for the emergence of clusters, which has subsequently been replicated for the British car industry by Boschma and Wenting (2007) as well as for a series of other industries as diverse as the global fashion design industry (Wenting 2008), the U.S. tire industry (Buenstorf and Klepper, 2009), the U.S. semiconductor industry (Klepper, 2010), the Dutch banking industry (Boschma and Wenting, 2010), the Dutch publishing industry (Heebels and Boschma, 2010) and the global video game industry (De Vaan et al., 2010). In short, Klepper explains clusters as a snowball process where clusters emerge through a spinoff process. In this framework, firms are assumed to be heterogeneous in their capabilities, partly because of different pre-entry experience and partly because of idiosyncratic factors. Spinoffs inherit a large part of their capabilities from their parent, which explains why successful firms tend to give birth to successful spinoffs. Thus, following a Darwinian genealogy reasoning (Boschma and Frenken, 2003, 2006), more successful firms produce more, and more successful, spinoffs. Since spinoffs tend to locate in the same region as the parent firm, a cluster emerges once a single firm or a few successful firms start to create many successful spinoffs, which, in turn, create successful spinoffs themselves. Once exit rates start to increase due to rising competition levels stemming from economies of R&D at the firm level (Klepper 1996), these firms will survive while firms with less fit capabilities will have to exit. As a result, a cluster emerges in the region(s) where the initial successful parents happen to have located in the past.

This evolutionary theory to spatial clustering has two important implications. First, there is regional path dependence (Iammarino, 2005; Martin and Sunley 2006). Since the first generation of firms is not composed of spinoffs, but mostly by entrepreneurs coming from related industries, regions that host industries that are related to the new industry, have a higher probability to create this new industry (Boschma and Wenting, 2007; Buenstorf et al., 2010). So, a more dynamic perspective on industry relatedness would claim that regional diversification requires the local presence of technologically related industries, out of which new industries will develop

² See Fritsch and Mueller (2007) and Andersson and Koster (2011) for analysis of persistence in regional startup rates. Also note that this finding is in line with Rigby and Essletzbichler (2006) who found that technological heterogeneity across regions tends to persist over long periods of time.

through recombination, a process which can be defined as ‘branching’ (Frenken and Boschma, 2007; Boschma and Frenken, 2011).³ However, regional success in one industry is not automatically reproduced in the next industry, as the success of firms is only partly determined by pre-entry experience. As new industries also rely on newly created knowledge and institutions, the windows of opportunity are open for regions at least to some extent, although this differs strongly from industry to industry (Storper and Walker, 1989; Boschma and Lambooy, 1999). Yet, regions hosting related industries clearly enjoy an advantage, because related industries provide a large pool of potential experienced entrepreneurs, among other regional assets.

The second implication of this line of research holds that clusters are expected to emerge even in the absence of localisation economies. In all aforementioned industry studies on cars, fashion design, tires, semiconductors, banking and publishing, it has been shown that the sheer presence of a firm in a cluster does not affect its survival rate. Rather, the emergence of a cluster could be explained by interacting the spinoff and cluster variables, indicating that the cluster emerged due to well-performing spinoffs coming from a selected number of successful parents in the region (Klepper, 2007; Boschma and Wenting 2010; Heebels and Boschma, 2010). Yet, one recent study on the evolution of the global video game industry did find cluster advantages to exist (De Vaan et al. 2010). Concluding, clusters emerge as an evolutionary process of spinoff formation, while the role of localisation economies in this process is limited, at best.

An important question that remains concerns the precise nature of inheritance. It is apparent from the high correlation in performance between parent and spinoff that ‘something’ is being transmitted from the parent firm to spinoff. However, whether the spinoff inherits knowledge, or organizational capabilities, or network relations, or reputation remains unclear. One can also ask the question under what conditions transmission is more or less noisy, leading to higher or lower correlation in performance. Both what has been transmitted, and how noisy the transmission process has been, is likely to depend on industry characteristics (e.g. the nature of knowledge, appropriability conditions), the motivation to start a spinoff (whether a disagreement is underlying the spinoff), and the geographical distance between parent and spinoff (with the performance correlation between parent and spinoff declining with geographical distance).

Another question holds whether the theory equally applies to services and creative industries as to manufacturing. Even though the mechanism of spinoff creation and clustering has been found to operate in the same way in service and creative industries as in manufacturing industries (Wenting, 2008; Boschma and Wenting, 2010; Heebels and Boschma, 2010; De Vaan et al., 2010), the *location* of clusters seems to differ. Industries like banking, publishing and design tend to cluster in the largest cities while manufacturing clusters typically emerge in smaller cities. This suggests that some form of agglomeration economies may play a role in the largest cities attracting service/creative industries – possibly the presence of related industries – that is

³ For example, Neffke et al. (2009) found in a recent study on Swedish regions that industries had a higher probability to enter a region when these were technologically related to other pre-existing industries in that region. Interestingly, as expected, industries that were not technologically related to existing industries in a region were also more likely to exit the region, as compared to related industries. See also Hildago et al. (2007) for similar findings at the level of countries. See also case studies evidence (e.g., Staber, 2001; Bathelt and Boggs, 2003).

yet to be explored in industry lifecycle studies. We continue the discussion of related industries as a source of agglomeration externalities in the next section.

Interestingly, the evolutionary economic geography (EEG) approach to clustering has quite a lot in common with the core model in New Economic Geography (NEG) (Krugman, 1991; Brakman et al., 2001): (i) spatial distributions are derived from location choices and market competition rather than from regional differences in factor prices; (ii) competition is driven by scale economies at the firm level, (iii) clustering results from a self-reinforcing and irreversible dynamic process, and (iv) the location of a cluster is path dependent on early decisions in its formative stage. Yes, despite these common features, we have argued before that the evolutionary perspective is different from NEG in a number of important respects (Boschma and Frenken 2006, pp. 283-286). Most fundamentally, EEG explains the spatial distribution of economic activity as a historical process, where path dependence in the location of economic activity results from the local spinoff creation. Even if the location of a cluster is historically contingent upon the location of a few well-performing entrepreneurs, the reason why a cluster emerged in a certain region can be explained *ex post* from the genealogy of entrepreneurs. By contrast, NEG explains spatial distribution of economic activity as resulting from optimising behaviour by workers and firms leading to an instant (a-historical) equilibrium. Path dependence, then, means in NEG that once a parameter is changed resulting from an exogenous event (e.g., a fall in transport costs due to advances in transport technology), the system can change from having a single equilibrium to having multiple equilibria, without the ambition to explain ‘where it (industrial localization and specialization) occurs, or why in particular places and not in others’ (Martin, 1999, p. 78). Thus, NEG describes clustering as a general phenomenon underlying the historical formation of cities and shifts in the urban system that can be expected from changes in transportation costs or trade barriers (Krugman, 2011).

4. Agglomeration externalities in an evolutionary framework: beyond ‘MAR versus Jacobs’

Since the seminal paper of Glaeser et al. (1992), the agglomeration externalities literature investigates whether a specific composition of sectors in a region enhances agglomeration externalities and, hereby, regional growth. A central question holds whether firms benefit primarily from other local firms in the same industry, or from local firms that are active in other industries. As Marshall (1920) once argued, agglomeration externalities based on regional specialization may arise from thick, specialized labour markets, local access to specialized suppliers and markets, and the presence of local knowledge spillovers. These externalities are now better known as localisation economies or MAR externalities (referring to Marshall-Arrow-Romer). Others followed the work of Jacobs (1969) in emphasizing the blessings of diversified cities, which would induce cross-industry knowledge spillovers and recombinant innovations. Jacobs was among the first to acknowledge that a deep division of labour in a city could contribute to urban growth, not only because of efficiency reasons, as Adam Smith once argued, but also because it gives rise to opportunities for innovation.

Recently, a comprehensive review (Beaudry and Schiffauerova, 2009) and meta-analysis (De Groot et al., 2009) of this literature concluded that the empirical evidence is indecisive. There are almost as many studies that found no evidence for either type of externalities, evidence for one

type of externalities, or evidence for both types of externalities. Clearly, the specification of agglomeration externalities in regional growth models needs to be improved as to advance our understanding of agglomeration externalities. From an evolutionary perspective, four strategies are currently being explored.

First, studies have gone beyond the dichotomy of variety versus specialization underlying the ‘MAR versus Jacobs’ debate. Regarding knowledge spillovers, it has been argued that knowledge is more likely to spill over between agents when their cognitive distance is neither too large, as some degree of cognitive proximity is required to ensure effective learning, nor too small, as agents with the same knowledge will have little to learn from each other (Nooteboom, 2000; Boschma 2005). Accordingly, the higher the number of related industries in a region, the more opportunities exist for effective knowledge transfers between sectors.⁴ That is, related variety, rather than variety or specialisation *per se*, is expected to enhance regional growth (Frenken et al., 2007). In a study on regional growth in The Netherlands, Frenken et al. (2007) have addressed the effects of related variety. As expected, regions with a high degree of related variety showed the highest employment growth rates. Such an effect has also been found in studies on regional growth in Italy (Boschma and Iammarino, 2009) and Spain (Boschma et al., 2010) using export data. Another study looking at regional growth in specific industries in the UK only found evidence for related variety as a source of agglomeration economies for ICT-related industries (Bishop and Gripiaios 2010).

Second, following product lifecycle theory, it has been suggested that the type of agglomeration externalities varies according to the stage of the product lifecycle in an industry (Potter and Watts, 2010. Henderson et al. (1995) found that new industries benefit from Jacobs’ externalities supportive of product innovation through recombination of technologies available from other industries, while more mature industries benefit more from MAR externalities in more specialized cities supportive of process innovation and supply chain optimization. Neffke et al. (2011) found similar results in a study on Swedish industries. Whereas the importance of MAR externalities increased with the maturity of industries, the significance of Jacobs’ externalities declined when industries matured. Product lifecycle theory also predicts that the dominant flow of relocation will be from the diversified core to a specialist location in the periphery once firms start to mass-produce a standardized product. Such relocation patterns have indeed been found for French (Duranton and Puga, 2001), Dutch (Pellenbarg and Van Steen, 2003) and Portuguese manufacturing firms (Holl, 2004).

Third, an increasing number of studies on agglomeration externalities move down from the regional level to the firm level. As firms are heterogeneous in their routines and capabilities, it is likely that the costs and benefits that firms enjoy from co-location differ. In particular, more knowledge-intensive firms have more to lose and less to gain from local knowledge spillovers than firms that are less knowledge intensive. Indeed, there is evidence that the extent to which firms profit from MAR externalities falls when their level of knowledge increases (Shaver and Flyer 2000; Cantwell and Santangelo 2002; Alcacer 2006; Alcacer and Chung 2007). A recent study by Brown and Rigby (2010) has tested whether MAR externalities assist newer plants to

⁴ Industry relatedness can thus be defined as to the extent to which the knowledge and skill base of two industries overlap (Neffke and Henning, 2009).

compensate for their lack of internal capabilities, while distinguishing between knowledge spillovers, labour market pooling and buyer-supplier relationships as three different sources of MAR externalities. They found that, indeed, relatively new plants benefit the most from two of the three types of MAR externalities: knowledge spillovers and labour market pooling.

Fourth, studies have attempted to ‘open the black box’ of knowledge spillovers as a source of agglomeration externalities by specifically examining the channels through which such spillovers are expected to occur (Almeida and Kogut, 1999; Breschi and Lissoni, 2001; Giuliani, 2007; Desrochers and Leppälä, 2010). Labour mobility is one such channel through which knowledge is being transferred between companies, and there is some evidence that especially labour flows between related industries are of particular relevance for firms’ performance (Boschma et al., 2009). What is more, the social network ties between moving individuals and their former colleagues or between previous collaborators may well remain a channel for knowledge exchange. Evidence of knowledge spillovers of this sort has been found by Agrawal et al. (2006) and Breschi and Lissoni (2009) by examining patent citations in social networks, and by Maggioni et al. (2007) and Ponds et al. (2010) using inter-regional collaboration networks. Concerning the specific nature of the knowledge, Sorenson et al. (2006) found that the advantages of being geographically proximate to some knowledge source depend crucially on the nature of the knowledge at hand. Simple knowledge flows equally to actors near and far, while complex knowledge is unlikely to diffuse, no matter how proximate actors are. With knowledge of moderate complexity, however, they show that more close actors are in a better position to benefit from knowledge diffusion, in contrast to more distant recipients.

In sum, an evolutionary approach on agglomeration externalities opens up a series of new perspectives. It argues that the nature and extent of agglomeration externalities depend on the relatedness among industries present in the region and the stage of the product lifecycle an industry is in. And, highlighting firm heterogeneity, evolutionary studies have begun to examine what type of firms are most likely to benefit from clusters and through what kind of interaction mechanisms. All these perspectives have been addressed in empirical research designs using rich datasets that tend to produce consistent results. As such, these evolutionary approaches to agglomeration externalities provide a useful complement to Regional Science approaches that make use of (knowledge) production approaches and related models.

5. Institutions in evolutionary economic geography

In our programmatic paper (Boschma and Frenken 2006), we argued that institutions play a important role in evolutionary economic geography. Yet, to explain regional differences in economic development first and foremost from differences in institutions plays down the central roles played by creative entrepreneurs and global firms as drivers of economic change. Thus, as further elaborated in a later contribution (Boschma and Frenken 2009), we argued that institutions can be integrated in evolutionary economic geography if institutions are treated as conditioning, rather than determining firm behaviour and regional development.

First, in our view, an evolutionary approach perceives the behaviour of firms mainly as stemming from their routines, rather than from territorial institutions. Firms develop routines in a

path-dependent and idiosyncratic manner, which makes that routines of firms vary greatly, even under the same institutions. One should therefore avoid reading off the behaviour and performance of firms from territorial institutions in a deterministic manner (Gertler, 2010). There is little evidence showing that agents act and perform the same when subject to the same institutions. For instance, Giuliani and Bell (2005) have demonstrated that agents in clusters differ widely in terms of economic power, absorptive capacity and network positions, despite the fact that they are all part of the same institutional setting, such as a local culture. This is not to say that institutions do not have an impact on firms. On the contrary, major ruptures, like the collapse of Communist regimes, may transform the selection environment of firms in such a manner that it will lead to firm dynamics and induce institutional change. Yet, we expect their routines will still have an effect on how responsive firms and organizations are to such dramatic changes (Spicer et al., 2000).

Second, to link evolutionary economic geography more firmly to Institutional Economic Geography and political economy approaches (McKinnon et al., 2009), we suggested (Boschma and Frenken 2009) to explore more fully the political dimension of routines, as advocated by Nelson and Winter (1977, 1982). Research in this area could focus on how firms regulate internally potential conflicts of interests between stakeholders like labour and capital, and how firms develop different routines in that respect. A geographical approach would extend such an analysis to the creation and diffusion of such routines among firms within and across regions, and determine under what conditions such a diffusion process leads to the institutionalization of these routines at various spatial scales. This is an area of research that is still largely unexplored.

Third, EEG avoids treating institutions as pre-given and fixed, but as co-evolving with technologies and markets (Nelson, 1995, Schamp, 2010). Murmann (2003), for example, analysed the entry and exit rates of synthetic dye industries in various countries and attributed the success of Germany primarily to institutional innovations in patent law and university-industry collaboration. And, in her study of the German software sector, Strambach (2010) found that an institutional system is not necessarily coherent, but subject to institutional plasticity, meaning that a range of options for new paths are open within the overarching institutional system. Creative agents can deliberately deviate from the established path, creating new institutions but not necessarily breaking with the institutional system. As Strambach showed, plasticity explains how the customized business software sector in Germany could develop in an unfavourable institutional setting at the national level. These studies show how a dynamic approach to institutions can be fruitfully linked to the study of industrial dynamics at the regional level, by investigating how regions are more likely to adapt their institutions to seize opportunities provided by new industries, or to enable the revival of mature industries, and under what conditions institutional adaptation fails to occur (Maskell and Malmberg, 2007; Hassink, 2010; Martin, 2010). An important question that remains to be studied is the degree to which related industries have overlapping institutional frameworks, and whether regional branching in related industries smoothen the process of institutional adaptation.

Taking up institutions in such a dynamic evolutionary framework, as outlined above, may throw new light on how institutions may matter in economic geography. Such an approach would (1) take the micro-scale of the firm (and its routines) as point of departure; (2) highlight the variety of routines existing in the same institutional setting; (3) argue that, as institutions condition

rather than determine behaviour, actors may respond differently to the same institutional change; (4) throw light on how firms, individually or collectively, can change institutions; and (5) analyse co-evolution of technologies, market structure and institutions at various spatial scales.

6. Concluding remarks

Following our programmatic papers on Evolutionary Economic Geography, we have outlined a number of recent empirical advances. We have tried to demonstrate that evolutionary economic geography has provided new insights on clustering, agglomeration externalities, and the role of institutions in regional development. Having said that, we believe that evolutionary economic geography is still under construction. Some of these empirical applications need to be developed further, and more advanced methodologies that can cope with longitudinal data are required to accomplish this task. And, much can be learnt from the contributions by our fellows in New Economic Geography, Regional Science, and Institutional Economic Geography. We sincerely hope that the Journal of Economic Geography will continue to provide a platform to support plurality and advance scholarship in our field.

References

- Agrawal, A., Cockburn, I., McHale, J. (2006) Gone but not forgotten: knowledge flows, labor mobility, and enduring social relationships. *Journal of Economic Geography*, 6: 571–591.
- Alcacer, J. (2006) Location choices across the value chain: How activity and capability influence collocation. *Management Science*, 52(10): 1457–1471.
- Alcacer, J., Chung, W. (2007) Location strategies and knowledge spillovers. *Management Science*, 53(5): 760–776.
- Almeida, P., Kogut, B. (1999) Localisation of knowledge and the mobility of engineers in regional networks. *Management Science*, 45(7): 905–917.
- Andersson, M., Koster, S. (2011) Sources of persistence in regional start-up rates. Evidence from Sweden, *Journal of Economic Geography*, 11 (1): 179-201
- Arthur, W.B. (1994) *Increasing Returns and Path Dependence in the Economy*. Ann Arbor: University of Michigan Press.
- Balland, P.A. (2009) Proximity and the evolution of collaboration networks: Evidences from R&D projects within the GNSS industry. *Papers in Evolutionary Economic Geography* 09.14, Utrecht University.
- Bathelt, H., Boggs, J.S. (2003) Towards a reconceptualization of regional development paths: Is Leipzig's media cluster a continuation of or a rupture with the past? *Economic Geography*, 79: 265-293.

- Beaudry, C., Schiffauerova, A. (2009) Who's right, Marshall or Jacobs? The localization versus urbanization debate. *Research Policy* 38(2): 318–337.
- Bishop, P., Gripiaios, P. (2010) Spatial externalities, relatedness and sector employment growth in Great Britain. *Regional Studies*, in press, doi:10.1080/00343400802508810.
- Boschma, R.A. (2005) Proximity and innovation. A critical assessment. *Regional Studies*, 39(1): 61–74.
- Boschma, R., Eriksson, R., Lindgren, U. (2009) How does labour mobility affect the performance of plants? The importance of relatedness and geographical proximity. *Journal of Economic Geography*, 9(2): 169–190.
- Boschma R.A., Frenken, K. (2003) Evolutionary economics and industry location. *Review for Regional Research*, 23: 183–200.
- Boschma, R.A., Frenken, K. (2006) Why is economic geography not an evolutionary science? Towards an evolutionary economic geography. *Journal of Economic Geography*, 6(3): 273–302.
- Boschma, R.A., Frenken, K. (2009) Some notes on institutions in evolutionary economic geography. *Economic Geography*, 85(2): 151–158.
- Boschma, R.A., Frenken, K. (2010) The spatial evolution of innovation networks. A proximity perspective, in R.A. Boschma, R. Martin (eds.), *Handbook on Evolutionary Economic Geography*, Cheltenham: Edward Elgar, pp. 120–135.
- Boschma, R.A., Frenken, K. (2011) Technological relatedness and regional branching, in H. Bathelt, M.P. Feldman, D.F. Kogler (eds.), *Dynamic Geographies of Knowledge Creation and Innovation*, London: Routledge, Taylor and Francis, in press.
- Boschma, R.A., Iammarino, S. (2009) Related variety, trade linkages and regional growth, *Economic Geography*, 85(3): 289–311.
- Boschma, R.A., Lambooy, J.G. (1999) Evolutionary economics and economic geography. *Journal of Evolutionary Economics*, 9: 411–429.
- Boschma, R.A., Martin, R. (eds.) (2010) *The Handbook of Evolutionary Economic Geography*. Cheltenham: Edward Elgar.
- Boschma, R.A., Minondo, A., Navarro, M. (2010) Related variety and regional growth in Spain. *Papers in Evolutionary Economic Geography* 10.12, Utrecht University.
- Boschma, R.A., Wenting, R. (2007) The spatial evolution of the British automobile industry. Does location matter? *Industrial and Corporate Change*, 16(2): 213–238.

- Boschma, R.A., Wenting, R. (2010) Spinoffs and M&A as drivers of spatial clustering: the evolution of the Dutch banking sector in the Amsterdam region in the period 1850-1993, working paper, Utrecht University.
- Brakman, S., Garretsen, H., van Marrewijk, C. (2001) *An Introduction to Geographical Economics: Trade, Location and Growth*. Cambridge: Cambridge University Press.
- Breschi, S., Lissoni, F. (2001) Localised knowledge spillovers vs. innovative milieux: Knowledge "tacitness" reconsidered. *Papers in Regional Science*, 80(3): 255–273.
- Breschi, S., Lissoni, F. (2009) Mobility of skilled workers and co-invention networks: an anatomy of localized knowledge flows. *Journal of Economic Geography*, 9(4): 439–468.
- Brown, W.M., Rigby, D.L. (2010) Marshallian localization economies: where do they come from and to whom do they flow? *Paper presented at the DIME workshop 'Industrial Dynamics and Economic Geography'*, Utrecht, September.
- Buenstorf, G., Klepper, S. (2009) Heritage and agglomeration. The Akron tyre cluster revisited. *The Economic Journal*, 119: 705–733.
- Buenstorf, G., Fritsch, M., Medrano, L. (2010) Regional knowledge and the emergence of an industry. Laser systems production in West Germany, 1975-2005. *Papers in Evolutionary Economic Geography* 10.16, Utrecht University.
- Cantwell, J.A., Santangelo, G.D. (2002) The new geography of corporate research in information and communications technology (ICT). *Journal of Evolutionary Economics*, 12: 163–197.
- Coe, M.N. (2010), Geographies of production 1: An evolutionary revolution?, *Progress in Human Geography*, DOI: 10.1177/0309132510364281, online version 21 June
- De Groot, H.L.F., Poot, J., Smit, M.J. (2009) Agglomeration, innovation and regional development: Theoretical perspectives and meta-analysis, in R. Capello, P. Nijkamp (eds.), *Handbook of Regional Growth and Development Theories*. Cheltenham: Edward Elgar, pp. 256–281.
- Desrochers, P., Leppälä, S. (2010) Opening up the 'Jacobs Spillovers' black box: local diversity, creativity and the processes underlying new combinations. *Journal of Economic Geography*, in press, doi:10.1093/jeg/lbq028, online version October 8, 2010
- De Vaan, M., Boschma, R.A., Frenken, K. (2010) Pre-entry experience, agglomeration externalities and modes of exit: the case of the global video game industry (1972-2007). Utrecht University, *mimeo*.
- Dosi, G. (1997) Opportunities, incentives and the collective patterns of technological change. *The Economic Journal*, 107(444): 1530–1547.

Duranton, G., Puga, D. (2001) Nursery cities: Urban diversity, process innovation, and the life cycle of products. *American Economic Review*, 91(5): 1454–1477.

Economic Geography (2009) Special Issue on the Role of Institutions in Evolutionary Economic Geography (Ed G. Grabher). *Economic Geography*, 85 (2): 119–182.

Essletzbichler, J., Rigby, D.L. (2007) Exploring evolutionary economic geographies. *Journal of Economic Geography*, 7: 549–571.

Frenken, K. (ed.) (2007) *Applied Evolutionary Economics and Economic Geography*. Cheltenham UK: Edward Elgar.

Frenken, K., Boschma, R.A. (2007) A theoretical framework for evolutionary economic geography: industrial dynamics and urban growth as a branching process. *Journal of Economic Geography* 7(5): 635–649.

Frenken, K., Van Oort, F.G., Verburg, T. (2007) Related variety, unrelated variety and regional economic growth. *Regional Studies*, 41(5): 685–697.

Fritsch, M., Mueller, P. (2007) The persistence of regional new business formation activity over time. Assessing the potential of policy promotion programs. *Journal of Evolutionary Economics*, 17: 299–315.

Gertler, M. (2010) Rules of the game: The place of institutions in regional economic change. *Regional Studies*, 44(1): 1–15.

Giuliani, E. (2007) The selective nature of knowledge networks in clusters: evidence from the wine industry. *Journal of Economic Geography*, 7(2): 139–168.

Giuliani, E., Bell, M. (2005) The micro-determinants of meso-level learning and innovation: evidence from a Chilean wine cluster. *Research Policy*, 34(1): 47–68.

Glaeser, E.L., Kallal, H.D., Schinkmann, J.A., Shleifer, A. (1992) Growth in cities. *Journal of Political Economy* 100: 1126–1152.

Hassink, R. (2010) Locked in decline? On the role of regional lock-ins in old industrial areas. In: R.A. Boschma, R. Martin (eds.), *Handbook of Evolutionary Economic Geography*. Cheltenham: Edward Elgar, pp. 450-468.

Heebels, B., R. Boschma (2011), Performing in Dutch book publishing 1880-2008. The importance of entrepreneurial experience and the Amsterdam cluster, *Journal of Economic Geography*, doi:10.1093/jeg/lbq048, in print.

Henderson, J.V., A. Kuncoro, M. Turner (1995), Industrial development in cities, *Journal of Political Economy*, 103: 1067-1085.

Hidalgo, C.A., Klinger, B., Barabasi, A-L , Hausmann, R. (2007) The product space and its consequences for economic growth. *Science*, 317: 482–487.

Holl, A. (2004) Start-ups and relocations: Manufacturing plant location in Portugal. *Papers in Regional Science*, 83(4): 649–668.

Iammarino, S. (2005), An evolutionary integrated view of regional systems of innovation. Concepts, measures and historical perspectives, *European Planning Studies*, 13 (4): 497-519.

Journal of Economic Geography (2007) Special Issue on Evolutionary Economic Geography (Eds. R.A Boschma, R. Martin), *Journal of Economic Geography*, 7: 537–672.

Klepper, S. (1996) Entry, exit, growth, and innovation over the product life cycle. *American Economic Review*, 86(3): 562–583.

Klepper, S. (2007) Disagreements, spinoffs, and the evolution of Detroit as the capital of the U.S. automobile industry, *Management Science*, 53: 616–631.

Klepper, S. (2010). The origin and growth of industry clusters: The making of Silicon Valley and Detroit. *Journal of Urban Economics*, 67(1): 15–32.

Krugman, P.R. (1991) Increasing returns and economic geography. *Journal of Political Economy*, 99(3): 483–499.

Krugman, P. (2011) The New Economic Geography, now middle-aged. *Regional Studies* 45 (1): 1-7.

MacKinnon, D., Cumbers, A. Pyke, A., Birch, K., McMaster, R. (2009) Evolution in economic geography. Institutions, political economy and adaptation, *Economic Geography*, 85(2): 129–150.

Maggioni, M.A., Nosvelli, M., Uberti, T.E. (2007) Space versus networks in the geography of innovation: A European analysis. *Papers in Regional Science*, 86(3): 471-93.

Marshall, A. (1920), *Principles of Economics*. 8th ed. London: Macmillan

Martin, R. (1999) The new ‘geographical turn’ in economics: some critical reflections. *Cambridge Journal of Economics*, 23(1): 65–91.

Martin, R. (2010) Roepke lecture in economic geography. Rethinking regional path dependence. Beyond lock-in to evolution, *Economic Geography* 86 (1): 1–27.

Martin, R., Sunley, P. (2006) Path dependence and regional economic evolution. *Journal of Economic Geography*, 6(4): 395–437.

Maskell, P. (2001) The firm in economic geography. *Economic Geography*, 77(4): 329–344.

- Maskell, P. Malmberg, A. (2007) Myopia, knowledge development and cluster evolution. *Journal of Economic Geography*, 7 (5): 603–618.
- Murmann, J.P. (2003) *Knowledge and Competitive Advantage. The Co-evolution of Firms, Technology, and National Institutions*. Cambridge: Cambridge University Press.
- Neffke, F., Henning, M. (2009) Skill-relatedness and firm diversification. *Papers on Economics and Evolution* 09.06, Max Planck Institute, Jena.
- Neffke, F., Henning, M., Boschma, R.A. (2009) How do regions diversify over time? Industry relatedness and the development of new growth paths in regions. *Papers in Evolutionary Economic Geography* 09.16, Utrecht University.
- Neffke, F., Svensson Henning, M., Boschma, R.A., Lundquist, K.-J., Olander, L.-O. (2011) The dynamics of agglomeration externalities along the life cycle of industries. *Regional Studies*, 45 (1): 49-65.
- Nelson, R.R. (1995) Co-evolution of industry structure, technology and supporting institutions, and the making of comparative advantage. *International Journal of the Economics of Business*, 2(2): 171–184.
- Nelson, R.R., Winter, S.G. (1977) In search of a useful theory of innovation. *Research Policy*, 6: 36–76.
- Nelson, R.R., Winter, S.G. (1982) *An Evolutionary Theory of Economic Change*. Cambridge MA and London: The Belknap Press.
- Nooteboom, B. (2000) *Learning and Innovation in Organizations and Economies*. Oxford: Oxford University Press.
- Pellenbarg, P.H., Van Steen, P.J.M. (2003) Spatial perspectives on firm dynamics in the Netherlands. *Tijdschrift voor Economische en Sociale Geografie*, 94(5): 620–630.
- Ponds, R., van Oort, F., Frenken, K. (2010) Innovation, spillovers and university-industry collaboration: An extended knowledge production function approach. *Journal of Economic Geography*, 10 (2): 231-55.
- Potter, A., Watts, H.D. (2010) Evolutionary agglomeration theory: increasing returns, diminishing returns, and the industry life cycle, *Journal of Economic Geography*, doi:10.1093/jeg/lbq004, online version March 24, 2010.
- Rigby, D.L., Essletzbichler, J. (2006) Technological variety, technological change and a geography of production techniques. *Journal of Economic Geography*, 6: 45–70.

- Schamp, E.W. (2010) On the notion of co-evolution in economic geography, in R.A. Boschma, R. Martin (eds.), *Handbook on Evolutionary Economic Geography*. Cheltenham: Edward Elgar, pp. 432–449.
- Shaver, M., Flyer, F. (2000) Agglomeration economies, firm heterogeneity, and foreign direct investment in the United States. *Strategic Management Journal*, 21(12): 1175–1193.
- Sorenson, O. Audia, P.G. (2000) The social structure of entrepreneurial activity: Geographic concentration of footwear production in the United States, 1940–1989. *American Journal of Sociology*, 106: 424–462.
- Sorenson, O. Rivkin, J.W., Fleming, L. (2006) Complexity, networks and knowledge flow. *Research Policy*, 35(7): 994–1017.
- Spicer, A., McDermott, G., Kogut, B. (2000) Entrepreneurship and privatization in Central Europe: The tenuous balance between creation and destruction. *Academy of Management Review*, 25: 630–649.
- Staber, U. (2001) Spatial proximity and firm survival in a declining industrial district: The case of knitwear firms in Baden-Wurtemberg. *Regional Studies*, 35: 329–341.
- Storper, M. (1997) *The Regional World*. New York: The Guilford Press.
- Storper, M., Walker, R. (1989) *The Capitalist Imperative. Territory, Technology and Industrial Growth*. New York: Basil Blackwell.
- Strambach, S. (2010) Path dependency and path plasticity. The co-evolution of institutions and innovation - the German customized business software industry, in: R.A. Boschma, R. Martin (eds.), *Handbook of Evolutionary Economic Geography*. Cheltenham: Edward Elgar, 406–431.
- Stuart, T., Sorenson, O. (2003) The geography of opportunity: spatial heterogeneity in founding rates and the performance of biotechnology firms. *Research Policy*, 32(2): 229–253.
- Suire, R., Vicente, J. (2009) Why do some places succeed when others decline? A social interaction model of cluster viability *Journal of Economic Geography*, 9(3): 381–404.
- Teece, D., Pisano, G., Shuen, A. (1997) Dynamic capabilities and strategic management. *Strategic Management Journal*, 18 (7): 509–533.
- Ter Wal, A. (2009) The spatial dynamics of the inventor network in German biotechnology: Geographical proximity versus triadic closure. *Economic Geography Research Group Working Paper Series 02.09*, Royal Geographical Society, UK.
- Vinciguerra, S., Frenken, K., Valente, M. (2010). The geography of internet infrastructure: an evolutionary simulation approach based on preferential attachment. *Urban Studies*, 47(9): 1969-84.

Wenting, R. (2008) Spinoff dynamics and the spatial formation of the fashion design industry, 1858-2005. *Journal of Economic Geography*, 8: 593–614.