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Why is economic geography not an evolutionary science?

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1. Introduction

In this paper, we want to address the question why economic geography is not an evolutionary science. This question paraphrases Thorstein Veblen (1898) who asked the question why economics wasn't an economic science in 1898. Over eighty years later, Nelson and Winter (1982) were the first to provide a comprehensive evolutionary theory of economic change, which, though disputed and criticised at many occasions, still stands out as the major reference. And, importantly, after the publication of Nelson's and Winter's seminal book, a new discipline was born called "evolutionary economics" (Nelson, 1995).

Boschma and Lambooy (1999) have tried to link the field of evolutionary economics to questions and theories in economic geography, and in particular questions related to regional development. They were able to show that the two fields of investigation share a lot of common themes, yet may also benefit from one another.

In this paper, we will not go into the differences and similarities of evolutionary and geographical approaches to economic change and development. Instead, we will outline the basic theoretical contours of what may become an "evolutionary economic geography", which can be simply defined as an branch

of economic geography that explains and describes phenomena using evolutionary theory. The basic starting points of an evolutionary economic geography will be firm behaviour as captured in the term 'routines'. These routines are spatially distributed and co-occur in specific combinations in specific organisations.

The spatial and economic determinants of routines, and the changes herein resulting from 'innovation', are basically what an evolutionary economic geographer would like to understand. We will show that an evolutionary approach allows us to disentangle spatial outcomes of economic change processes from spatial determinants, and by doing so, open a way to empirically disentangle agglomeration economies from agglomeration outcomes of economic change.

2. Routines, competition and innovation

Quite to the contrary of mainstream economic science (neoclassical economics), decision-making theory underlying evolutionary economics is based on routine behaviour. Instead of describing the behaviour of individuals or firms as if they optimise some objective function given budgetary and other constraints, evolutionary economists start from the premise that the larger part of human behaviour including organisational behaviour is routinised. In this, they follow a by now quite old school in organisation theory that was started by Herbert Simon who introduced the central concept of "bounded rationality". It was he who stressed that cognitive constraints of the human brain and human organisations render them incapable of optimisation in most real-world relevant situations.

The cognitive incapacity, however, does not imply that their behaviour should therefore be best described as random or chaotic. Already long ago, Armen Alchian (1950) argued that intelligence in market economies stems from two sources. First firms can learn from their mistakes and from competitors. Firms act intelligently because they remember what type of routines (technologies, products, decision-rules, procedures, accounting methods, marketing, human resources management, *et cetera*) did not work and they typically hold on to routines that are successful. Furthermore, individuals and organisations are able to observe successful behaviour of others and try to imitate their successful routines (though imitation of a routine is not always successful because it needs to be complementary to the existing set of routines, Rivkin, 2000).

Apart from the intelligent behaviour of firms as evidenced by their ability to get rid of unsuccessful routines and to exploit the opportunity of imitation, 'intelligence' also exist at the level of an industry as a whole. As long as firms show routinised behaviour, which only sporadically changes, market competition acts as a selection device which benefits the lucky 'smart' ones and punishes the unlucky 'stupid' ones. This asymmetrical benefits provided by the market results from price competition that enables the more efficient firms to sell more, make more profit, and hereby expand the production capacity at the expense of less efficient firms.

If one accepts the premise of organisations consisting of a large number of routines, each of which will change only sporadically, sometimes coincidentally, sometimes through purposeful research, sometimes through imitation, one can accept an evolutionary economic geography that described economic development by the time-spatial distribution of routines. We will give two examples of the research questions such a perspective leads us to.

3. Spin-offs, shakeouts and industry evolution

In a book entitled *Increasing Returns and Path Dependence in the Economy* Arthur (1994) attempted to summarise the implications of an evolutionary approach to the economy. Most interestingly, he was one of the few who were able to relate evolutionary mechanisms to spatial outcomes (and vice versa). In fact he introduced two models, a spin-off model of industry evolution and an agglomeration model of industry evolution.

In the first model an industry comes into being as a consequence of a spin-off process of firms giving birth to firms giving birth to firms et cetera. This process is known to have played an important role in the rapid growth and spatial concentration of several industries including ICT in Silicon Valley (De Jong, 1987) and the automobile industry in the Detroit area (Klepper, 2002).

Arthur's models assumes a number of regions that all start off with one company. Each company has a fixed probability to give birth to a spin-off, which is assumed to locate in the same region as the parent company (a stylised fact in empirical research, which however is not explained by the model itself). A snowball-like process starts off in which some regions starts to have spinoffs early on (due to pure chance), and the same regions will then also produce more spinoffs hereafter because the probability of a *region* to produce spinoffs is dependent on the number of firms that located there before. This process will never end, yet it will tend to produce a stable distribution in the long-run as each new spinoff will have less an impact on the total distribution. This model thus explains spatial concentration of some industrial activity purely from a chance process of firms giving birth to spinoffs. The spin-off process is therefore characterised by *multiple possible outcomes*: the spatial distribution of industrial activity that historically emerged could as well has been completely opposite. Figure 1 illustrates this by showing four end results of simulations with equal initial conditions (for three regions).

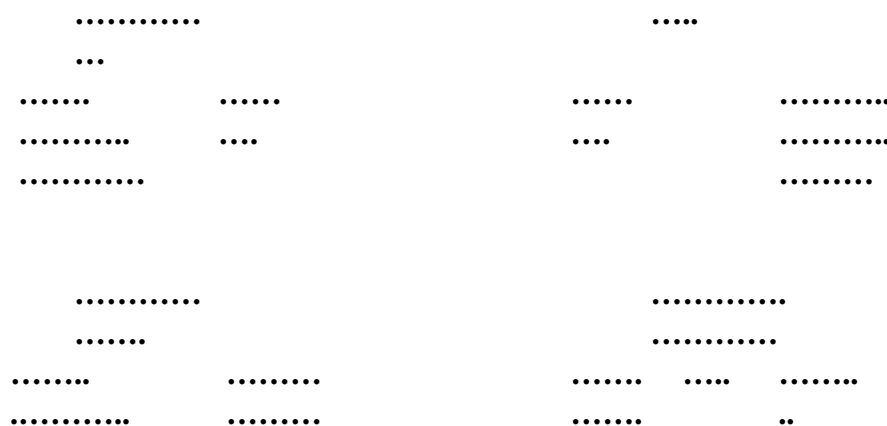


Figure 1.

End results of four simulations of the location pattern caused by a *spin-off* process (source Arthur, 1994, p. 104)

The spin-off process giving rise to spatial concentration can be enhanced by three additional

mechanisms (Klepper, 2002): more successful firms produce more successful spinoffs, more successful firms produce more spinoffs, and after some point, firms are forced to exit due to cost competition producing a shake-out (in line with the product life-cycle hypothesis). The first two mechanisms will lead a region that harvest an early successful firm to produce more and more successful spinoffs. This reasoning behind these mechanisms are explicitly evolutionary: spin-off of successful firms inherit a large part of the successful routines ('DNA') of their parents, while spin-off of less successful firms inherit a large part of the less successful routines ('DNA') of their parents. And, since successful firms grow faster, and the probability of spinoffs can be expected to be dependent on size, successful firms will produce more spinoffs. The third mechanism makes that once cost competition becomes fierce (also for firms in different regions), a shake-out occurs that will asymmetrically hit the regions that harvested the less successful firms and their spinoffs (Klepper and Graddy, 1990).

The statistical significance of all three mechanisms have been confirmed econometrically for the U.S. history of automobile firms using survival rates of different cohorts and types of firms (Klepper, 2002) yet still needs to be assessed in other industries. Note that in the original spin-off model by Arthur (1994) as well as in the additional mechanisms proposed by Klepper agglomeration economies do not play any role.

4. Location, agglomeration and spillovers

A second model assumes firms do not emerge out of existing firms but are started independently. The location choice of a new firm can therefore not be 'automatically' determined by the location of the parent company: the location of the firm becomes a choice decision. Arthur (1994) assumes each firm has a locational preferences for one particular region, and that this preference is uniformly distributed (meaning that each region is preferred by the same number of firms). In this model, however, and contrary to the former model, agglomeration economies are assumed to play a role. Put another way, there are increasing returns to a location. These increasing returns can be caused by all kinds of agglomeration economies including spillovers, specialised labour market, and a specialised supplier industries. Already long ago, this cumulative and self-reinforcing process had been described, though modelled in a different way, by Myrdal (1957).

This model implies that initially, concerning the first firms that enter an industry, location does matter a lot. New firms do not yet have very specific locational demands let alone regions being able to meet specific demands lacking competences as well as being risk-averse (Boschma, 1997). Only after a critical mass of firms has established in one region, and slightly more than in other regions, new firms become attracted to this one region because of agglomeration effects. Remember that agglomeration effects occur between any number of firms in a region, but that the size of these effects for each individual firms is expected to be positively dependent on the number of other firms present in the region.

If we simulate this second model, a typical set up is to assume three regions and a population of firms that enter sequentially the economy. Each region is initially naturally preferred by one third of all firms, and when a firm is drawn from the population it is put back in the 'urn'. This is another way of saying that the probability that a firm at time t has a natural preference for region i is the same for all i ($i=1,2,3$).

Apart from the natural preference of a firm for a region, the location decision is determined by the number of firms already present in a population. This means that once one region has slightly more firms (due to chance the process of random drawings earlier on), all firms suddenly choose for one and the same region. This self-reinforcing and irreversible process is what Arthur called a lock-in.

Again we have a situation of *multiple possible outcomes*: each region could have been the ‘winner’ yet once one region gets a lead in will attract all other new firms. In figure 2 this is simulated as follows: the sequential time pattern (1)-(2)-(3) shows a lock-in process in the southwest region. However, the process that ended as (3) could as well have ended as in (4) in which case the eastern regions becomes dominant.

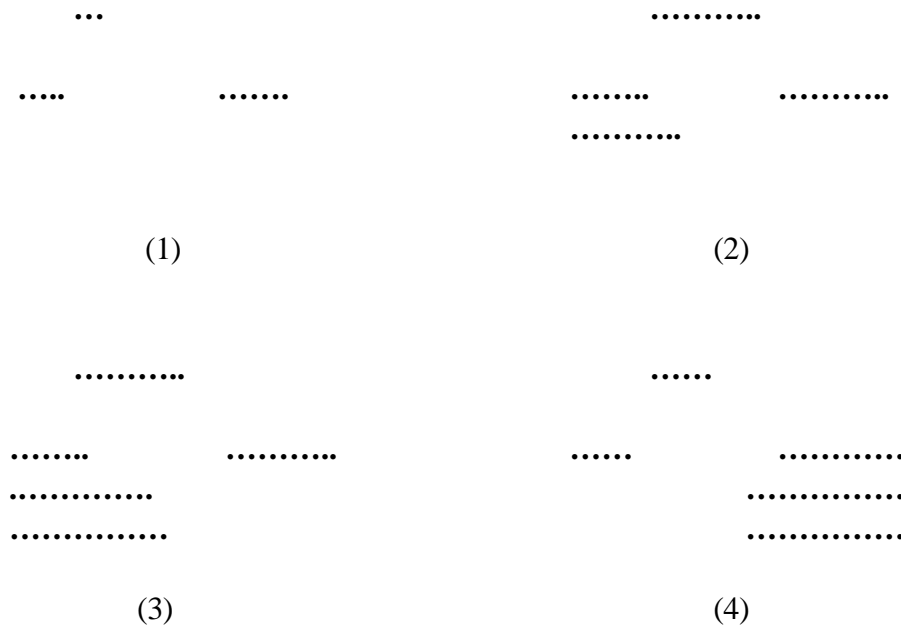


Figure 2.

Two simulations of the locational pattern of firms in a sector emerging from firm location decisions under increasing returns to a location (source: Arthur, 1994, p. 105)

5. Towards an evolutionary research program in economic geography

The two models serve to show that different evolutionary mechanisms can be responsible for the spatial clustering of a sector in time. In both cases, we invoke a mechanism that ‘organises’ the initial chaos of location decisions into a spatial concentration. In the first cause, we look at the inheritance dynamics of successful routines from parent companies to offspring while in the second case we focus on the inter-firm economies that are created either consciously or unconsciously.

Clearly, the first explanation is explicitly evolutionary as it adds a time dimension to knowledge creation, replication and distribution. More precisely, knowledge creation occurs and remains within the boundaries of firms (tacit knowledge and routines) and is reproduced through its own growth and through its giving birth to spinoffs. The second explanation is more common in economics and has become a central element in what has been called new growth theory (Van Oort, 2002). This explanation stresses the possibility of successful knowledge and routines to spillover. This can occur for example through job hopping that leads to a replication process similar to that of spinoffs, but it can also

occur through non-evolutionary mechanisms as common investments in local public goods or club goods, or through an ever finer division-of-labour of supplying or buying industries.

What this short example aimed to show is very different mechanisms can come into play which can cause the same type of phenomena to occur. It is therefore of crucial importance that empirical research focuses on these rival explanations and aims to understand why in some sectors and regions some mechanisms tend to be more dominant. Obviously, this provides a huge agenda for future empirical research, but recent progress in empirical techniques addressing these issues has been made (Acs *et al.*, 2002; Klepper, 2002; Van Oort, 2002; Frenken, 2002).

We barely understand how this dynamic spatial formation of new industries is influenced by the environment from which it emerges. We need more understanding how the dynamic interplay between firms and the surrounding environment evolves during the growth process, and why some regions are more capable of doing so than others. This is a complex issue in which many environmental features (including institutions) are likely to play a role. Evolutionary thinking offers us promising concepts to describe these processes in terms of co-evolution, localised change and lock-in.

We also aimed to show in this short paper that processes of spatial and economic change can be effectively addressed in evolutionary models. The rich arsenal of analytical tools, econometric techniques and simulation models available from natural and social evolutionary science provide us with great opportunities (Anderson *et al.*, 1988; Arthur *et al.*, 1997; Batten, 2002), to advance the analytical rigor in economic geography without necessarily giving up the intellectual openness and historical/contextual premises of the approach.

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