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Why is Economic Geography not an Evolutionary Science? Towards an Evolutionary Economic Geography

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Abstract: The paper explains the commonalities and differences between neoclassical, institutional and evolutionary approaches that have been influential in economic geography during the last couple of decades. For all three approaches, we argue that they are in agreement in some respects and in conflict in other respects. While explaining to what extent and in what ways the Evolutionary Economic Geography approach differs from the New Economic Geography and the Institutional Economic Geography, we can specify the value-added of economic geography as an evolutionary science.

Key words: evolutionary economic geography, new economic geography, institutional economic geography

JEL-codes: A12; B20; B25; B52; R0; R1

1. Introduction

Since the 'Geographical Turn' in economics, a true *Methodenstreit* has been raging in the field of economic geography (Martin, 1999). From the 1980s onwards, economic geography moved away from traditional economic analysis and has transformed into a more interdisciplinary approach using insights from social, cultural and political sciences. This turn has been characterised by the 'Cultural Turn' (Amin and Thrift, 2000; Barnes, 2001) or the 'Institutional Turn' (Martin, 2000) in economic geography.[1] A decade later, following a seminal contribution by Krugman (1991a), neoclassical economists have re-entered the field of economic geography (Fujita et al., 1999; Brakman et al., 2001; Fujita and Thisse, 2002; Puga, 2002), yet met harsh resistance from the side of economic geographers. Neoclassical economists renewing their interest in geography while geographers moving away from economics, the debate between economists and geographers has been little fruitful, and is probably best characterised by a 'dialogue between the deaf' (Martin, 2003).

Evolutionary economics can be considered a third approach in economic geography, yet has hardly drawn serious attention. Although it is noticeable that, to an increasing extent, lip service is paid to evolutionary thinking and concepts (e.g., Storper, 1997; Cooke and Morgan, 1998; Martin, 1999; Sjöberg and Sjöholm, 2002; Cooke, 2002; Scott, 2004), there are few systematic attempts to apply evolutionary economics into the realm of economic geography (Boschma and Lambooy, 1999). According to Martin (2003), evolutionary economics has not (yet) developed into 'a coherent body of theory and empirics' in economic geography. It is even fair to say that evolutionary economists themselves have been somewhat more active in linking evolutionary economics with geographical issues (Arthur, 1987, 1990; Swann and Prevezer, 1996; Antonelli, 2000; Caniëls, 2000; Breschi and Lissoni, 2001, 2003; Bresnahan et al., 2001; Klepper, 2002a; McKelvey, 2004; Werker and Athreye, 2004). Perhaps one of the reasons of the relatively minor impact of evolutionary economics in economic geography so far, is that economic geographers tend to refer to evolutionary economics and institutional economics as being one and the same.

As reflected in the title, we propose an evolutionary approach in economic geography paraphrasing Veblen's (1898) seminal article *Why is economics not an evolutionary science?* Our main objective is to outline the basic elements of an Evolutionary Economic Geography. Before sketching the main contours of this new approach, we show that an Evolutionary Economic Geography is neither reducible to the neoclassical approach nor to the institutional approach in economic geography. In order to do so, we first sketch two theoretical developments in economic geography that have been taken place in the last couple of decades, that is, the New Economic Geography around the 1990s and the 'cultural or institutional turn' in economic geography around the 1980s. We explain in section 2 why the interface between these two strands of thought has shown to be a fertile ground for conflict rather than for exchange. In section 3, we present three key issues that represent dividing lines within economic geography (and economics): the assumption debate, the use of mathematics, and statics versus dynamics. This framework will allow us to discuss the main similarities and differences between neoclassical, institutional and evolutionary approaches, because we argue that each key issue unites two approaches and differentiates them from the third. We also show the value-added of the evolutionary approach and claim that an Evolutionary Economic Geography indeed puts 'new wine in new bottles'. With this purpose in mind, we compare the

[1] A similar institutional approach exists in economics, yet by far not gained the support within the community of economists as it did within the community of geographers.

Evolutionary Economic Geography approach with the Neoclassical Economic Geography and the Institutional Economic Geography in sections 4 and 5 respectively. The exchanges along the interfaces are shown to be fruitful and should be further encouraged, although synthesis between the evolutionary approach and the neoclassical or institutional approach is not expected. Rather, an Evolutionary Economic Geography approach is unique in its core assumptions, units of analysis, and type of explanations. To support this thesis, we briefly present, in a programmatic manner, the basic outlines of the Evolutionary Economic Geography in the final section.

Before introducing the three approaches in economic geography, it should be reminded that our objective is not to discuss and compare each approach in all its details (for this, see Nelson, 1995a; Hodgson, 1998; Marchionni, 2004). Consequently, we inevitably dispense with some of the nuances. We refer mainly to 'textbook versions' of the three theories, without claiming that modern writings would all perfectly fit into one of the three categories. On the contrary, it should be reminded throughout the text that our stylised differentiation into three approaches primarily serves a heuristic use, and ultimately aims to contribute to theorising at the interfaces between the approaches.

2. *Methodenstreit* in economic geography

Economic geography is subject to a lot of turmoil during the last two decades or so (Martin and Sunley, 1996; Amin and Thrift, 2000; Barnes, 2001; Meardon, 2001; Overman, 2004; Scott, 2004). If any 'revolution' has hit economic geography recently, it must be the application of neoclassical economics in economic geography by Krugman (1991a) and others. Below, we refer to this new research programme as New Economic Geography, a term proposed by Krugman, although we share Martin's view that Krugman's models are better characterised as economics than as geography (Martin, 1999).[2] We will also make use of the term Neoclassical Economic Geography, by which we refer to both the pre-Krugman contributions in regional science and the more recent New Economic Geography, as both start from the neoclassical assumptions of utility maximisation and the 'representative agent', and both derive model conclusions from equilibrium analysis, as in neoclassical economics.

Krugman's (1991a) approach can best be considered as a recent extension of neoclassical thinking to explain trade, specialisation and agglomeration, relaxing the frequently used assumptions of perfect competition and constant returns to scale. It basically is a micro-economic theory that explains the existence and persistence of agglomerations in terms of rational decisions of economic agents. Assuming increasing returns to scale at the firm-level and imperfect competition between firms, the contribution of Krugman has been to show that agglomeration can occur without having to assume regional differences or external economies. In particular, with transportation costs falling, a critical transition point is reached when both firms and workers find it more profitable to cluster in one region rather than to spread out over more regions. The transition point depends on the balance between internal scale economies for firms and economies of product variety for consumers related to clustering on the one hand, and inter-regional transportation costs on the other hand. What is more, the core model of Krugman has been shown to be

[2] Krugman's approach fits within the regional science tradition in geography, which is based on general-equilibrium-analysis from neoclassical economics. So one may better speak of the 'new regional science' or 'geographical economics' (Martin, 1999; Brakman et al., 2001).

extendable in many directions, including other factors such as congestion and unemployment (Fujita et al., 1999; Brakman et al., 2001; Puga, 2002).

Not long before Krugman and others set out their main ideas, the community of economic geographers itself had undergone an important reorientation. We refer to this change as the institutional turn in economic geography. One can view the institutional turn in economic geography as the successful development of the programme of institutionalism, which had little success within the boundaries of the economics profession.[3] Having said this, it is important to note that there is not (yet) a fully articulated 'institutional economic geography approach' (Martin, 2000). The same is true for institutional economics, which has never developed into a coherent, systematic paradigm (Hodgson, 1998). Both are better described as a collection of approaches that share common concepts and interests in explaining particular phenomena (Samuels, 1995). For most institutional scholars, the methodological and theoretical pluralism does not reflect incoherence. On the contrary, pluralism lies at the heart of methodology and is to be encouraged, at least if one accepts Institutional Economic Geography as an interdisciplinary and contextual science (Hodgson, 1988).

In its most stringent form, institutional approaches argue that differences in economic behaviour are primarily related to differences in institutions (Hodsgon, 1988, 1998; Whitley, 1992, 2003; Saxenian, 1994; Gertler, 1997). Institutional differences can be present among firms (in terms of organisational routines and business cultures) and among territories (in terms of legal frameworks, informal rules, policies, values and norms). Comparative analysis between these units with different institutions can then be related to differences in economic outcomes, like profit, growth, income distribution or conflicts. It should be noted that this definition of the institutional approach is only partial. One can distinguish between over and under-socialised accounts, related to putting primacy to institutions and social class regulating individual behaviour, or individuals whose rational actions result in institutions (Granovetter, 1985). In economics, for example, the 'old' institutional economics corresponds largely to the over-socialised account, while the 'new' institutional economics (Williamson, 1985) is in line with the under-socialised account (and, in this respect, is closer to neoclassical economics). Our characterisation of institutional approaches in economic geography deals primarily with the over-socialised account, because a large part of economic geography research can fairly be characterised as being closer to that account, putting primacy at institutions rather than individual action (Gertler, 1997).[4]

The New Economic Geography and the Institutional Economic Geography have developed independently from each other. There has been some debate between the two (e.g., Amin and Thrift, 2000;

[3] Except for transaction costs economics, which has become an important institutional theory in economics (Williamson, 1985), while it has been much less successful in economic geography (a notable exception being Scott, 1993). The success of transaction costs economics in economics is most probably related to the fact that both transaction costs economics and neoclassical theory share a micro-economic atomistic view on economic agents.

[4] Still, it must be recognised that the division between the two accounts is no longer as sharp as before. In many cases, institutional analyses do no longer explain economic behaviour from institutions alone. In fact, we will argue below that the interesting developments in economic geography take place exactly on the interfaces between different approaches, for example, on the institutional/evolutionary interface. Still, for heuristic reasons, we find it useful to characterise the institutional approach in economic geography as an over-socialised account. Central to this definition is the idea that institutions determine the larger part of economic behaviour, and, consequently, differences in economic behaviour and performance can be related more or less directly to differences in institutions. Accordingly, we define institutional approaches in economic geography as an archetype way of reasoning, rather than a coherent school of thought (which it is not).

Martin and Sunley, 2001), but we agree with Martin (2003) that it has led to little fruitful exchange of ideas so far. On the contrary, debates have been fierce and with little progress. This comes as no surprise, because the two strands of thoughts differ in fundamental ways. We understand the clash between the two approaches as reflecting at least two important incommensurabilities.

First, they differ in methodology and, related, they conceptualise space in very different ways. Institutional economic geographers dismiss *a priori* the use of formal modelling and econometric specifications derived from these. Instead, they apply an inductive, often, case-study research approach, signalling out the local specificity of 'real places'. One of the objectives of institutional analysis is to understand the effect of the local specificity of 'real places' on economic development, which is mainly attributed to place-specific institutions. Thus, an institutional approach takes differences between localities as the starting point of analysis and analyse how place-specific institutions affect local economic development. By contrast, the New Economic Geography approaches the matter deductively using formal models assuming utility maximisation and representative agents, and using equilibrium analysis to come to theoretical conclusions or predictions. Proponents of the latter approach do not value, or even reject altogether case-study research highlighting local specificity (e.g., Overman, 2004). The New Economic Geography does not even require differences between regions to exist, be it differences in factor prices or institutional set-ups. Rather, the models start from a 'neutral space' and aim to explain how agglomeration can *occur* from this. Their main goal is to show how uneven spatial patterns can emerge from an initially uniform world and, thus, they abstract from local specificity and different levels of spatial aggregation.

Second, the two approaches differ in their behavioural assumptions underlying explanations of economic phenomena. The New Economic Geography aims to explain geographical patterns in economic activity from utility-maximising actions of individual agents. Institutional scholars start from the premise that economic behaviour is not described accurately as utility-maximising but is better understood as being rule-guided. Agents are bounded rational and rely heavily on the institutional framework they operate in, guiding their decisions and actions. Institutions are embedded in geographically localised practices, which implies that localities ('real places') are the relevant unit of analysis. By doing so, Institutional Economic Geography analyses how institutional specificity affects economic behaviour and hereby local patterns of economic development. By contrast, institutions play no role in neoclassical models, or only in a loose and implicit sense (e.g., relating to particular parameters in the model) (Olsen, 2002). Local institutional and cultural factors are left out of the analysis, because these are not regarded as essential to an economic explanation, and should therefore be 'best left to the sociologists', as Krugman once put it (Martin, 1999).

Our argument holds that Evolutionary Economic Geography should be regarded as a third approach in economic geography that differs in turn from neoclassical and institutional approaches. Evolutionary Economic Geography applies core concepts and methodologies from evolutionary economics in the context of economic geography. It provides alternative explanations for the main *explananda* including agglomeration and regional growth differences. The starting point is to view organisations as competing on the basis of their routines that are built up over time. Evolutionary models of organisations' decision-making are based on the concept of bounded rationality and routine behaviour, rather than on utility maximisation (Simon, 1955a). Routines can be understood as organisational skills, which cannot be reduced to the sum of individual skills (Nelson and Winter, 1982). Routines are manifest at the firm level due to division-of-labour and hereby, division-of-skills between workers in a firm. Organisational routines, as for individual skills, consist for a large part of experience knowledge (learning-by-doing) and

tacit knowledge, which are hard to codify. Both aspects of routines render them difficult to imitate by other firms (Teece et al., 1997). Consequently, organisations are heterogeneous in their routines, and persistently so. Modelling organisations can thus no longer rely on assuming a 'representative agent'. It is this variety that fuels the selection process as an open-ended and out-of-equilibrium process of economic development (Hodgson, 1999). And, as organisations compete on the basis of their routines, competition is driven by Schumpeterian innovation based on new products and technologies requiring new routines, rather than on production costs alone as assumed in neoclassical models.

Basically, evolutionary economics explains the (changing) distribution of routines as the outcome of two processes (Alchian, 1950). First, firms learn from their own mistakes through trial-and-error. When routines do not work well, failure induces active search for other routines, for example, by investing in Research and Development. Evolutionary theory predicts most firms to innovate incrementally and to exploit their knowledge built up in the past. Empirical research tends to show that where incremental innovations typically increase the life chances of firms, major organisational transformations tend to decrease the survival rates of firms (Anderson and Tushman, 1990; Carroll and Hannan, 2000). Organisations can also learn by imitating, although imitation is failure-prone because the tacit components of routines are hard to copy (Teece et al., 1997). Second, 'intelligence' also exists at the level of an industry as a whole, analogous to the population level in biology (Nelson and Winter, 1982). As long as firms show routinised behaviour, market competition acts as a selection device causing 'smart' fit routines to diffuse and 'stupid' unfit routines to disappear. In particular, differential profits leading to differential growth rates render fitter routines to become more dominant in an industry. This selection logic is in line with evidence that firm growth is temporally autocorrelated, meaning that some firms persistently grow over time (Cefis and Orsenigo, 2001; Cefis, 2003).

Evolutionary Economic Geography aims to understand the spatial distribution of routines over time. It is especially interested in analysing the creation and diffusion of new routines in space, and the mechanisms through which the diffusion of 'fitter' routines occurs. Following this reasoning, the emergence of spatial agglomerations is not to be analysed in terms of rational location decisions, as in neoclassical theory, nor in terms of comparing institutional frameworks in different areas, as in institutional theory, but in terms of the historically grown spatial concentration of knowledge residing in organisational routines. There are several evolutionary mechanisms that may produce the spatial concentration of firms.

Agglomerations may be the result of a process, in which chance events become magnified by positive feedbacks at the firm level (Arthur, 1990). As success breeds success through learning, some firms will be lucky and grow out into industry leaders while other firms are unlucky and have to exit. The resulting industrial and spatial dynamics involve path dependence in firm and regional leadership, and once a spatial pattern has settled historically it becomes largely irreversible. In this case, evolutionary processes lead to spatial concentration in the absence of agglomeration economies (Klepper, 2002b). Spatial agglomeration may also be the result of increasing returns at the regional level. Knowledge is not only embodied in organisational routines in firms, but may also spill over from one firm to the other. As tacit knowledge is hard to exchange through contracts in global markets, knowledge spillovers occur more often among geographically proximate agents (Jaffe et al., 1993). Agglomeration economies act both as an incentive and as a selection mechanism, explaining why economic activity become more and more concentrated in leading regions, driving out firms in other regions. It must be recognised, however, that the tacit nature of knowledge and routines implies that spillovers do not occur automatically ('in the air')

but rely on transfer mechanisms, such as inter-firm collaborations, professional networks and labour mobility (Camagni, 1991; Capello, 1999; Breschi and Lissoni, 2003). These mechanisms are not tied to regional levels *per se*, and may even become increasingly detached from local contexts over time (Breschi and Lissoni, 2001).

In the following, we argue that an Evolutionary Economic Geography is linking the neoclassical and institutional approaches in that it agrees with the neoclassical approach methodologically (using formal modelling), and it agrees with the institutional approach in terms of behavioural foundations (as captured by the concept of bounded rationality). Given these similarities between the evolutionary approach on the one hand, and the neoclassical and institutional approaches on the other hand, one can expect the exchange of ideas along these two interfaces to be fruitful in economic geography. We will therefore explore in detail the interface between Evolutionary and Neoclassical Economic Geography (section 4) and the interface between Evolutionary and Institutional Economic Geography (section 5), respectively. In section 3, though, we first start with a brief description of three key issues in economic geography that are very helpful in understanding the nature of the interfaces between the three approaches in more depth.

3. Three key issues in economic geography

Since we plead for an Evolutionary Economic Geography approach that shares certain features but also differs in many ways from the Neoclassical and Institutional Economic Geography, we aim to clarify the similarities and differences with these two latter approaches. Though any attempt to describe and characterise the major theories in any discipline is inherently difficult and complex, we feel it is useful as a way to differentiate a new approach from existing ones, as well as to show the linkages between the proposed approach and more familiar lines of thought. We will do so by introducing three key issues, which are positioned within the triangle depicted in Figure 1. Each of the issues unites two of the three approaches and differentiates them from the third. The three issues recurrently show up both in the history of economics and in the history of economic geography.

The first issue concerns the usefulness of formal modelling, which unites evolutionary and neoclassical scholars, and differentiates them from institutional scholars. As mentioned before, most institutionalists reject the use of formal modelling because it does not capture the contextual nature of economic and social life (Martin, 2000). In economic geography, this key issue comes down to the basic question whether formal theorising is still acceptable when it requires using the concept of 'neutral space', and when one needs to abstract from local specificity. According to institutional scholars, formal models take an anti-realist stance almost as a rule, because they exclude place-specific qualitative factors (such as culture and institutions) that are hard to put into 'Greek letter economics', but which are considered essential to the explanation of regional differences (Gertler, 1997).[5] By contrast, neoclassical and evolutionary scholars use formal modelling as a tool in theorising albeit it in slightly different ways.

[5] Though institutional scholars often take a realist stance on scientific explanation in social science, it is important to recognise that realist explanations do not exclude the use of mathematics *per se* even though many mathematical models take an instrumentalist stance. Marchionni (2004) claims that Krugman is best regarded as a realist who uses models as a research strategy to come closer to unravelling the complex mechanisms underlying the economy, rather than an instrumentalist that judge mathematical models primarily on the basis of its predictive value. Mäki (1992) and Mäki and Oinas (2004) also argue at length that the use of abstract modelling does not imply an anti-realist stance *per se*.

The second issue centres on what might be called the assumption debate. Evolutionary and institutional approaches share a fundamental critique on the neoclassical assumption of utility-maximizing individuals. As Dosi (1984) once put it, "we must abandon the neoclassical framework because we cannot assume an exogenous and given context and many God-like actors who behave in accordance with a uniform rationality" (p. 107). By contrast, evolutionary and institutional scholars claim that economic agents are bounded rational and base their decisions on routines and institutions (Veblen, 1898; Simon, 1955a; Nelson and Winter, 1982). This is not to say that evolutionary and institutional approaches assume that agents do not strive to maximise utility, but that real-world agents are not able to do so due to bounded rationality. Instead, agents have to rely on routines (at the micro-level) and institutions (and the macro-level). Since routines and institutions are context-specific, with routines being specific to organisations, and institutions being specific to territories ('real places'), both approaches reject the atomistic view of neoclassical theory that ignores the contextuality of human action.

The third issue can be labelled 'statics versus dynamics'. Here evolutionary approaches take a critical stand toward static analysis in neoclassical and institutional approaches. Characteristic for evolutionary theory, be it as a theory of natural history in biology or as a theory of economic development in economics, is that it explains a current state of affairs from its history: "the explanation to why something exists intimately rests on how it became what it is" (Dosi, 1997: 1531). Thus, the current state of affairs cannot be derived from current conditions only, since the current state of affairs has emerged from and constrained by previous states of affairs. Evolutionary theory deals with *path dependent* processes, in which previous events affect the probability of future events to occur. In this view, small events can have large and long-lasting effects due to self-reinforcing processes (Arthur, 1989). In short, history matters (David, 1985).[6] In this respect, evolutionary approaches differ in a fundamental sense from the static approaches in neoclassical and institutional thinking that share an interest in comparative analysis. In economic geography, these two approaches attempt to explain regional growth differences using comparative analysis albeit in different ways (quantitative and qualitative, respectively).[7]

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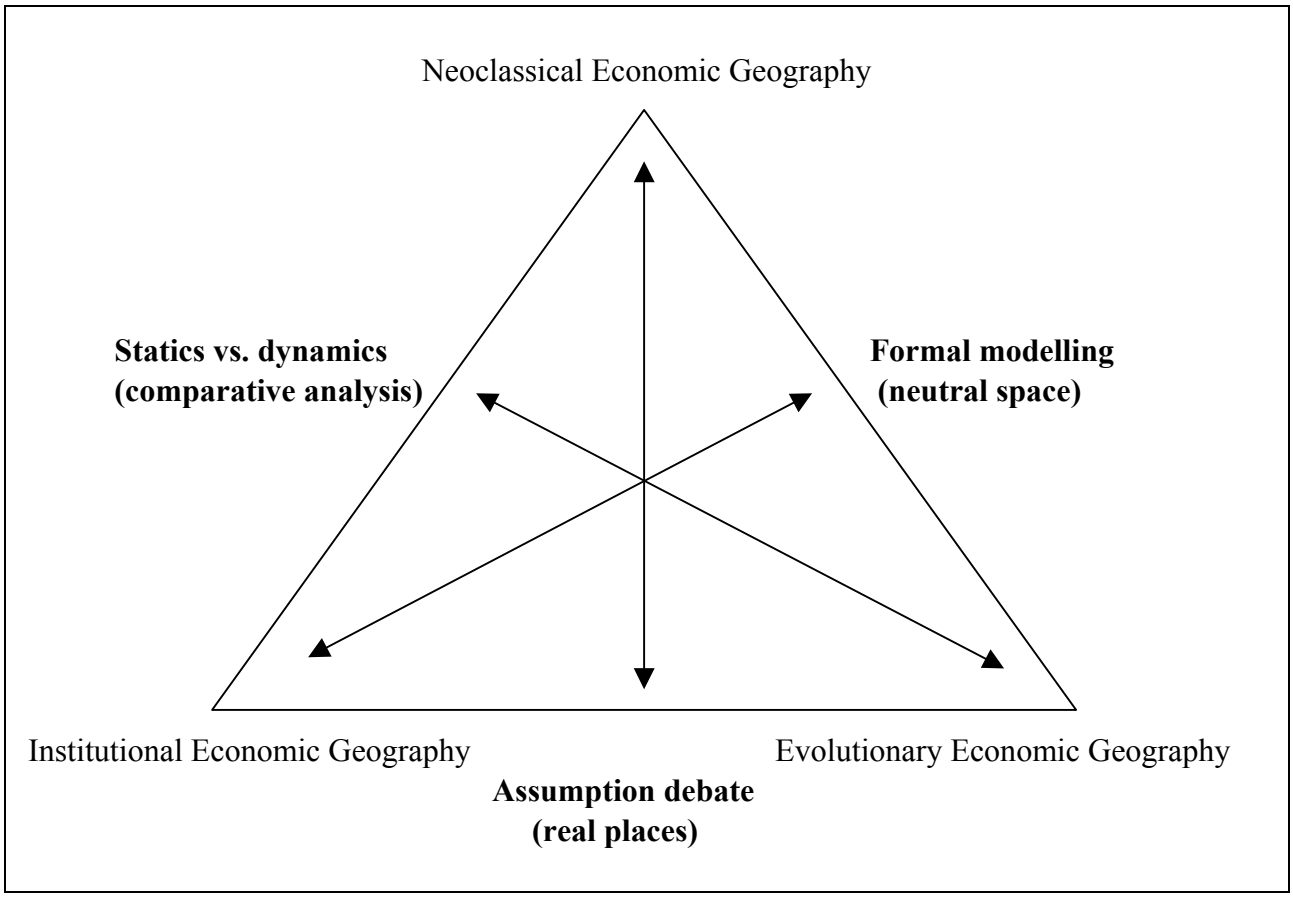
[6] See also the early critique by Atkinson and Stiglitz (1969) on neoclassical growth theory and the notion of production function. They argued that economic growth is essentially a historical process that cannot be understood without taking into account historical specificity.

[7] We do not, however, claim that all institutional approaches make use of static comparative analysis only. On the contrary, many people advocating institutional analysis have stressed the historical specificity of economic development, and the possibility that multiple trajectories of development exist rather than one ideal-type of economic growth (North, 1990). Hodgson (1998), for example, stresses that institutional economics does not only involve comparative studies on different institutional regimes with different economic performance, but also institutional *change*, and, very often, institutional change as an evolutionary process. Some, including Samuels (1995), even characterise institutionalism as an evolutionary approach, due to its emphasis on process and evolution: "Veblenian evolutionism is Darwinian in having neither cause of causes nor predetermined end state; it is non-teleological and open-ended" (p. 580). Still, institutions being explained and explanatory, it remains unclear what are the drivers of institutional change, unless one adopts a teleological approach after all.

Figure 1.
Three key issues within the triangle of neoclassical, institutional and evolutionary economic geography



Summarising, the clash between Neoclassical and Institutional Economic Geography can be understood as a result of two fundamental differences, related to methodology (use of formal modelling) and key behavioural assumptions (bounded rationality and routines/institutions guiding decision-making). Evolutionary Economic Geography takes an intermediate position: it agrees with the neoclassical approach in the usefulness of formal modelling that requires some degree of abstracting from local contexts, while it agrees with the institutional approach in its assumption of bounded rationality and its emphasis on the contextuality of human decision-making. This seemingly paradoxical position can be clarified as stemming from different levels of analysis: evolutionary economics views the organisational routines as the relevant context to explain decision-making under bounded rationality, while institutional approaches start from territorial institutions. Therefore, Evolutionary Economic Geography does not explain regional growth differences from macro-institutional differences, but from micro-histories of firms operating in territorial contexts.

4. The interface between Neoclassical Economic Geography and Evolutionary Economic Geography

As described earlier, the main contribution of neoclassical economics to economic geography in recent years has been the development of a new family of models based on Krugman's (1991a) core model. As these models are better understood as economic models treating only some aspects of geography (in particular transportation costs), the New Economic Geography has been attacked on various occasions by economic geographers and others for not dealing with 'true' geography (e.g., Martin and Sunley, 1996; David, 1999; Amin and Thrift, 2000; Nijkamp, 2001). Nevertheless, the New Economic Geography can be considered an important contribution to our theoretical understanding of possible mechanisms creating uneven spatial development. We argue that, despite fundamental differences, the New Economic Geography may come to similar conclusions as Evolutionary Economic Geography, and can thus be considered to be located at the interface between Neoclassical Economic Geography and Evolutionary Economic Geography. At the same time, we make clear it would be wrong to assume that convergence between the two approaches will necessarily occur. As argued earlier, evolutionary and neoclassical approaches share a common methodology of modelling, yet differ in key behavioural assumptions, units of analysis, treatment of time, and their conceptualisation of agglomeration economies.

The New Economic Geography can be considered as being part of a family of increasing-returns models in neoclassical economics, including growth theory, trade theory and economic geography. The new family of models has replaced the assumption of constant or decreasing returns to scale and perfect competition by the assumptions of increasing returns to scale and imperfect competition. These assumptions better capture the characteristics of most sectors in the modern economy being oligopolies with large firms realising increasing returns to scale internally. As for evolutionary approaches, the New Economic Geography differs in important respects from the traditional neoclassical approaches that typically involve models of a-historical and reversible processes with a unique optimal equilibrium. By contrast, both in evolutionary and New Economic Geography models, there is the possibility of multiple equilibria, path dependence in the process leading to one of the possible equilibria, irreversibility of outcomes leading the system to lock-in, and sub-optimal outcomes.

Another feature that both approaches share is that they are keen on explaining how uneven spatial patterns emerge from uniform or 'neutral space'. Even when assuming away regional differences, it is still possible to explain spatial concentration. In New Economic Geography models, agglomeration occurs when both consumers and firms foresee it is more advantageous to cluster in one location, thus minimising transport costs, and maximising profits (increasing returns to scale) and utility (higher variety of consumption goods). The precise location, then, does not matter as long as agents cluster somewhere in space.[8] A similar question preoccupies evolutionary thinking. For example, assuming that new firms can locate anywhere in space, and each firm has an equal probability to create a new firm by spin-off, the resulting locational dynamics can be modelled as a stochastic Polya urn process (Arthur, 1987), leading to skewed spatial distributions of firms. Similarly, Klepper (2002a) explains how Detroit became the capital of the U.S. car industry using a spin-off model assuming that routines are carried over from parent to spin-off, implying that survival rates of parents and spin-offs are correlated. From his 'industry lifecycle'

[8] This has been called 'putty-clay geography' by Fujita and Thisse (1996): "there is a priori considerable uncertainty and flexibility in where particular activities locate, but once spatial differences take shape they become quite rigid" (Martin, 1999, p. 70).

model, it can be derived that early entrants have a high survival probability because they have more time available to improve their organisational routines than firms entering later in time. Only spin-off firms that enter later, but stem from parent firms with fit routines are able to overcome the latecomer disadvantage, because these spin-offs inherit the fit routines of the parent firm. And as spin-offs locate in the same region as the parent firm, firms with fit routines will cluster in geographical space.

The stochastic logic underlying evolutionary models has also been applied to the spatial evolution of networks where new nodes can occur anywhere in space, and connections between nodes are made dependent on both geographical space (negatively) and 'preferential attachment' (positively). Preferential attachment means that a new node prefers to link with a node that is well-connected as to profit from its connectivity (Barabasi and Albert, 1999; Albert and Barabasi, 2002). The resulting topology and spatial organisation of a network can then be understood as a purely stochastic and myopic sequence (Andersson et al., 2003) that may generate hubs-and-spokes networks observed in infrastructure networks (e.g., Guimerà and Amaral, 2004). Equally, the historically grown network patterns between cities in urban systems can be conceptualised as stemming from preferential attachment (Castells, 1996).

Thus, although the precise modelling techniques and underlying theoretical assumptions greatly differ between evolutionary and neoclassical approaches, both use formal models assuming 'neutral space' to explain the emergence of uneven distributions in an initially even world. Despite these common features, the New Economic Geography and the Evolutionary Economic Geography differ fundamentally on at least four grounds.

First, the New Economic Geography remains firmly within the neoclassical framework using the core assumptions of utility maximisation of economic agents and homogeneity of agents ('the representative agent'). In this, it differs greatly from evolutionary theory that is based on a different set of assumptions including bounded rationality, routine behaviour and heterogeneity among agents. Furthermore, whereas neoclassical models assume a given market structure (monopolistic competition in the case of the New Economic Geography), evolutionary models take into account entry, exit and innovation, and let market structure to evolve endogenously.

Second, the economic levels of aggregation in the two approaches differ. Neoclassical models address the spatial economy as a whole in terms of location decisions of agents (firms and consumers) at the micro-level, but do not aim to explain the spatial evolution of particular industries or networks. In this context, Martin (1999) is right in stating that the New Economic Geography is "… unable to tell where it (industrial localization and specialization) occurs, or why in particular places and not in others" (p. 78). By contrast, evolutionary models explain geographical patterns at the level of industries and networks. The spatial evolution of the economic system as a whole can then be addressed in a multi-sector framework of structural change, in which catching-up and falling-behind of territorial units are analysed historically in terms of the rise and fall of sectors and infrastructure networks in space (Dosi and Soete, 1988; Hall and Preston, 1988; Pasinetti, 1993; Hohenberg and Lees, 1995).[9]

Third, the treatment of dynamics in both theories is different. Although the New Economic Geography models are often interpreted as reflecting the formation of agglomerations in time, its conclusions are based on static equilibrium analysis, as in other neoclassical models. Model predictions are derived by

[9] Note that analysing regional convergence and divergence in a multi-sector analysis also provides a straightforward theory of spatial leapfrogging (Martin and Sunley, 1998), in which regions specialising in new sectors take over regions locked in mature industries.

computing the one-off locational choice of all individual agents, such that their joint actions are in equilibrium.[10] In these models, a change in equilibrium is 'caused' by a change in the exogenous parameters, and not endogenously in time. For example, a fall in transportation costs may lead firms to cluster in one region rather than being uniformly distributed in space. It follows that true dynamics are only addressed in terms of comparative static analysis of different equilibrium states with different parameter settings.[11] This aspect of neoclassical models differs from evolutionary models, in which economic dynamics only show temporary convergence towards equilibrium to be 'upset' by endogenously determined, innovative firm behaviour (Nelson and Winter, 1982). The disequilibrium tendency caused by deviant firm behaviour is not regarded as 'noise' but as the fundamental driving force underlying economic development. Evolutionary economists view the search for supra-normal profits by innovation, called Schumpeterian competition, as the primary dynamic in the economy (moving away from equilibrium), while the erosion of profits due to price competition is only considered as a secondary dynamic (converging to equilibrium). In modelling terms, this implies that the growth and decline of firms, sectors and territories are modelled explicitly in time, assuming some underlying stochastic process to reflect innovation. In this vein, both simple stochastic models (Simon, 1955b; Arthur, 1987; Gabaix, 1999) and more elaborated models (Klepper, 1996; Andersson et al., 2003) have been developed in the field of Evolutionary Economic Geography.

A final difference between neoclassical and evolutionary approaches concerns the underlying theory of agglomeration economies. As described earlier, the New Economic Geography relies in their explanation of agglomerations on pecuniary rents (increasing returns to scale internal to the firm), while evolutionary approaches are more interested in agglomeration economies arising from knowledge externalities.[12] In an evolutionary perspective, knowledge spillovers contribute to the self-reinforcing nature of agglomeration in which firm locating in a region attract new firms to locate in the same region as knowledge spillovers rise with the number of firms (Arthur, 1990; cf. Myrdal, 1957). At the same time, knowledge spillovers may be responsible for sustained regional variety in technological trajectories as knowledge specific to each technology spills over primarily among proximate firms (Essletzbichler and

[10] As noted by proponents of the New Economic Geography (Krugman, 1996; Brakman and Garretsen, 2003), models outcomes are derived from Nash-equilibria, as in game theory. In this respect, one can consider the New Economic Geography as dealing with location games involving many players.

[11] According to Martin (1999), history is not regarded as 'real history' in the New Economic Geography: "there is no sense of the real and context-specific periods of time over which spatial agglomerations have evolved" (p. 76). It is relevant to distinguish between two different meanings of path dependence here. Path dependence may reflect a dynamic process in which small events, magnified by increasing returns, produce spatial outcomes. This meaning of path dependence has been adopted by New Economic Geography models and some evolutionary models, including Arthur (1989). Another notion of path dependence is employed by evolutionary (but also institutional) approaches, which interpret spatial outcomes as directed and channelled by structures (as embodied in routines and institutions) laid down in the past. Or, as Martin (1999) has put it, "path dependence does not just 'produce' geography as in the 'new economic geography' models; places produce path dependence" (p. 80). To be more precise, it is the dynamic interplay between agency and structure producing specific outcomes in particular places, and leading to real space that are put central in an evolutionary approach.

[12] Krugman (1991b) also criticised the notion of knowledge spillovers on empirical grounds when claiming that knowledge flows could hardly be measured: "knowledge flows are invisible, they leave no paper trail by which they may be measured and tracked" (p. 53). Since, a number of scholars have developed methodologies to indicate knowledge spillovers, in particular, by making use of patent citations as pioneered by Jaffe et al. (1993).

Rigby, 2005). A number of research questions follow from the concept of knowledge spillovers in an evolutionary perspective (Feldman, 1999; Breschi and Lissoni, 2003; Schamp, 2002). First, as knowledge can spill over in more than one way (imitation, spin-offs, social networks, labour mobility, collaborative networking), one question is which of the mechanisms of knowledge spillovers are most important. Second, for each of these mechanisms one can analyse whether geographically close or more distant relationships are driving knowledge creation and spillovers (Rallet and Torre, 1999; Malmberg and Maskell, 2002; Bathelt et al., 2004). Third, an unresolved issue remains whether variety (Jacobs, 1969) or specialisation is more favourable for knowledge spillovers (Glaeser et al., 1992; Van Oort, 2002). Theoretically, evolutionary theory would predict variety to be more important for knowledge spillovers to occur, at least with regard to knowledge supporting radical innovation, involving a recombination of knowledge. Lastly, given the multiple mechanisms of knowledge spillovers, the question holds which institutional arrangements are supportive for what kind of knowledge spillovers (and what type of subsequent innovations).

5. The interface between Institutional Economic Geography and Evolutionary Economic Geography

As stated in the introduction, it is quite common that institutional and evolutionary approaches are treated as being part of one and the same theory.[13] This association has largely been based on the aforementioned common critiques on neoclassical economics, rather than on the fundamental principles that evolutionary and institutional approaches would share *per se*. Both approaches reject utility maximisation and equilibrium analysis, and both stress the important role of institutions on economic development. However, we claim that it is not only confusing, but also misleading to equate institutional and evolutionary approaches in economic geography. Few people would agree that all studies gathered under the umbrella of institutional could equally be called evolutionary and *vice versa*. This is especially true for those *comparative* studies on alternative institutional arrangements and their comparative performance, which tend to ignore the role of dynamics central to evolutionary approaches. Conversely, quite some influential evolutionary studies do not include the role of institutions in their models (e.g., Arthur, 1987; Klepper, 2002a).

One issue of disagreement, which has been explained earlier, holds that Institutional Economic Geography takes a critical stand toward formal modelling. Evolutionary Economic Geography uses formal modelling as a theoretical tool to derive testable hypotheses, while Institutional Economic Geography tends to dismiss the use of formal models *a priori*. In regional studies, for example, institutionalists call for anti-reductionist qualitative methodologies, in particular in-depth case study research, to appreciate the complex and multi-faceted nature of regional development. The use of qualitative methodologies more or less follows from the nature of theorising. However, in some cases their core concepts turn out to be hard to operationalise also in qualitative research designs. For example, the notion of 'institutional thickness' (Amin and Thrift, 1994; Keeble et al., 1999) has been influential as a concept in economic geography, but has also been criticised for being a vague concept that can not be accurately measured, let alone that its impact on regional development can be determined and tested (Markusen, 1999). More generally,

[13] Illustrative is that followers of the 'old' institutional economics in the US have somewhat confusingly called themselves evolutionary economists (Hodgson, 1998).

according to some criticasters, institutional and cultural approaches in economic geography show 'a lack of rigour, lack of hypothesis testing and ill-defined concepts' (Martin, 2003, p. 36).[14] The contributions of institutional approaches in economic geography have thus been, most importantly, theoretical, by suggesting new explanations and mechanisms underlying regional development, and in terms of policy implications, by opening up new discourses on the cultural meaning and heritage of places and the limited transferability of locally rooted economic production (e.g., Gertler, 1997).

Even if research methods often follow from theoretical premises, the use of qualitative research methods does not automatically follow from theoretical premises in Institutional Economic Geography in all instances. For instance, recent network approaches in Institutional Economic Geography, including the embeddedness literature and relational economic geography (Bathelt and Gluckler, 2003), could make use of statistical techniques from social network analysis (Wasserman and Faust, 1994) and modelling techniques from graph theory (Barabasi and Albert, 1999; Watts, 2004). However, in their programmatic contribution on relational economic geography, Boggs and Rantisi (2003) argue that 'being relational in practice' implies, as a rule, a case study approach. Thus, some seem to have *a priori* objections to the use of quantitative tools, even if theoretical contributions allow for their fruitful application. The same observation has been made recently in Markusen's (2003) reply to institutional economic geographers, in which she pleas to go beyond the oppositional distinction between inductive or deductive research, and between qualitative or quantitative research. Her argument is in line with the methodological foundations of evolutionary economics that has combined what Nelson and Winter (1982) called 'appreciative theorising' and 'formal modelling' from its very start.

A second, more subtle issue in comparing evolutionary and institutional approaches is their treatment of context. Whereas evolutionary approaches start from organisational routines at the firm level, institutional approaches start from institutions at some territorial level(s). Thus, both acknowledge the importance of context in economic decision-making and reject the framework of utility maximisation central to the neoclassical paradigm, yet they differ in the precise context that is assumed to underlie economic behaviour. Organisational routines are specific to each firm providing a micro-context that results from the past experience and activities of the firm. Institutions, by contrast, are specific to communities and territories providing a macro context. From an evolutionary perspective, to take institutions as explanatory variables in economic analysis is illogical. While institutions may indeed constrain economic behaviour, their presence still allows for heterogeneity in the routines of firms. Accordingly, a territory as the unit of analysis is problematic, though not without meaning, as there is no strong reason to assume beforehand that routines are place-specific. Rather, some regions may be characterised by a strong degree of homogeneity in routines, while others may not. Thus, despite being a contextual approach, Evolutionary Economic Geography is mainly interested in determining whether, and if so, in what way, geography matters, rather than pre-assuming it matters in all cases.[15]

[14] Though cultural studies have become well developed and established in sociology, anthropology and geography, some suggest that these studies suffer from 'conceptual imprecision, theoretical ambiguity and empirical open-endedness' (Martin and Sunley, 2001, p. 10).

[15] This also requires a multi-level approach (e.g. using spatial autocorrelation techniques), in which data at various spatial scales determine whether, and if so, at which spatial levels behaviour and performance of firms are conditioned (Van Oort, 2002; Phelps, 2004).

Let us illustrate the previous remarks when dealing with the innovation system approach, which has its historical roots in evolutionary economics (Freeman, 1987; Nelson, 1993; Edquist, 1997; Cooke et al., 1998; Cooke, 2001; Asheim and Isaksen, 2002). Ironically, however, the innovation system approach has many characteristics of an Institutional Economic Geography approach. The initial concept of national systems of innovation, for example, aimed to uncover the institutional setting in a country affecting the interaction patterns between actors involved in the innovation process. As such, it takes the existence of institutions for granted and tries to link differential economic performances to different institutional settings. More recently, however, evolutionary scholars stress the specificity of sectoral innovation systems and their similarity across regions (Breschi and Malerba, 1997; Breschi, 2000). This sectoral approach suggests that the history of innovation systems, in specific places, should be understood from a *dynamic* perspective, by analysing how institutions have co-evolved with the emergence of a new sector.[16] In doing so, it acknowledges that the implementation and diffusion of novelty often requires the restructuring of old institutions and the establishment of new institutions (Freeman and Perez, 1988; Galli and Teubal, 1997). A well-known example is the rise of the synthetic dye industry in the second half of the nineteenth century, which required many institutional changes (such as new scientific and educational organisations, and new patent laws), which Germany succeeded to implement, but the UK and the US did not (Murmann, 2003). Consequently, in an evolutionary framework, the key issue is to analyse the extent to which institutions are flexible and responsive to changes in different places. Institutional differences between regions or nations, in this view, are part of the *explananda*, as institutions co-evolve with processes of technological innovation and industrial dynamics (Nelson, 1995b). As a result, Evolutionary Economic Geography claims that real places emerge from innovative actions of economic agents, rather than fully determining their actions.[17]

The question that is still to be answered is how an Evolutionary Economic Geography can reconcile the notion of neutral space in formal models (similar to neoclassical approaches) with the concept of real places in real-world cases (as in institutional approaches). In an evolutionary perspective, specific institutions present in real places can not provide a sufficient explanation for differences in regional

[16] While it may be true that institutions are primarily sector-specific, it may not be excluded that sector-specific institutional models may converge to some extent over time, due to evolutionary forces like competition, selection and imitation. For instance, a key sector in a country may become so dominant that its institutions (e.g., research system, or property rights) become part of a national system (Hollingsworth, 2000). However, in practice, the transfer of institutional models between sectors is expected be to subject to many problems, due to, among other things, the systemic nature of institutions. In that case, differences between sectoral systems of innovation are likely to co-exist and persist (Amable, 2000). What this example shows is that a dynamic perspective on institutions is highly relevant and exactly what an evolutionary approach is all about.

[17] Differences between territories can only be understood as the outcome of a long-term evolutionary process. Therefore, imitation of successful routines or institutions by other territories is inherently difficult and, more importantly, the effects are expected to be very different, depending on the set of routines and institutions in which it is introduced (Gertler, 2003). Consequently, comparative analysis, including benchmarking of regions, has its limitations, because a set of successful micro-routines and macro-institutions cannot simply be carried over to different historical contexts. Comparisons are useful to analyse which dimensions of an innovation system perform relatively poor and require adaptation, but they are less useful in providing solutions to fit the historical context of specific innovation systems. The core problem of policy by imitation concerns the high degree of tacitness and (often subtle) interdependencies that exist between the different factors contributing to a successful model. The historical trajectory of a territory sets serious limits on copying an external model that owed its success to its deep roots in an alien environment (Zysman, 1994; Rivkin, 2000).

growth, neither can traditional determinants (e.g. factor prices) from neoclassical growth theory. While these factors can certainly constrain the set of regions where growth may occur, they fail to explain why even regions with similar institutions and factor endowments can have different rates and patterns of growth. Consequently, factors related to institutions and factor endowments are to be supplemented by a dynamic analysis at the sector and network level, in which the path dependent and self-reinforcing nature of locational dynamics is at the core of a systematic explanation.

When dealing with the emergence of new sectors in particular regions, Evolutionary Economic Geography has theoretical reasons to assume that firms operate in neutral space (rather than for reasons of modelling simplicity, cf. Krugman, 1991a). Place-specific features do not determine the location of new sectors, because the selection pressure of existing spatial structures is still rather weak when new industries emerge. That is, the environment is considered to be of minor importance at the initial stage of development of a sector, because a gap is likely to exist between the requirements of the new firms (in terms of knowledge, skills, *et cetera*) and its environment. Utmost, regional institutions may play a generic and rather unimportant role at the start of a new sector, such as providing generic knowledge and skills, functions that are often equally well provided in many other regions. The crucial inputs, being sector-specific knowledge and skills, are developed by firms themselves as their organisational routines evolve over time. For this reason, one can expect firms in new sectors to emerge in many different locations. In this context, Storper and Walker (1989) have used the term open windows of locational opportunity to describe the locational dynamics of firms in new sectors, which comes close to the assumption of neutral space in evolutionary models.[18] Similarly, the spatial evolution of networks can be understood as a process that starts off in neutral space, where many locations are candidates to become new hubs. Yet, over time, only few locations will develop a central hub function with high connectivity, and consequently, the windows of locational opportunity close again (Castells, 1996).

Over time, the initial neutral space is transformed in real places as the new sectors and new infrastructure networks become spatially concentrated in some regions according to a path dependent process, and trigger the institutional base of these regions to transform. The renewal of institutions to become supportive of new economic activity is an outcome of a long process of co-evolution, rather than the initial determinant of new sectors locating in a region (recall the example of Germany's chemical industries at the end of the nineteenth century). Thus, regional development is more about path dependence than place dependence, although some places may be better in renewing their institutions than others. Institutions play only a generic role at the start of a new sector, and become more specific and better developed in those areas where a critical mass of firms locates. Thus, at one moment in time, the same institutional base of a region may be functioning well for mature industries and may be irrelevant, or even dysfunctional, for emerging sectors. Naturally, the paradox of regional policy holds that it can be effective in conserving economic activity, yet it has difficulties to trigger new economic activity necessary for long-term development (Pasinetti, 1993; Saviotti, 1996).

[18] Such an evolutionary approach should, however, not take the notion of neutral space for granted, but, instead, test it in empirical research.

6. Towards an Evolutionary Economic Geography

To sum up our discussion on neoclassical, institutional and evolutionary approaches in economic geography, we present in table 1 the similarities and differences between them. The three categories of methodology, key assumptions and statics versus dynamics correspond to the interfaces in the triangle presented in figure 1. For reasons of clarity, we have included geography as an additional category to underline the notions of neutral space and real place. We also listed in table 2 the key propositions of the evolutionary approach in economic geography as discussed throughout the paper.

Methodologically, we can conclude that Evolutionary Economic Geography disagrees with institutional approaches in their dismissal of formal modelling and their reluctance to test statistically theoretical propositions. However, different from neoclassical thinking, evolutionary scholars also acknowledge the value of case studies as tool in appreciative theorising. Thus, Evolutionary Economic Geography strongly supports 'methodological variety and openness' in economic geography, as recently advocated by Plummer and Sheppard (2000), Markusen (2003) and Scott (2004). Following Nelson and Winter (1982), an evolutionary approach employs formal modelling (being deductive) as well as 'appreciative' theorising (being more inductive). Evolutionary Economic Geography firmly grounds formal theorising in more realistic assumptions (like bounded rationality), while it makes use of case study approaches accounting for regional specificities, but no longer at the expense of analytical rigour.

Concerning key assumptions, Evolutionary Economic Geography is closer to the institutional approach in assuming economic action to be contextual rather than driven by maximisation calculus. However, whereas institutional scholars relate behaviour of agents to macro-institutions of territories, evolutionary scholars put primacy on micro-routines of organisations. In this view, price differentials (the neoclassical view) and place-specific institutions (the institutional view) only condition the range of possible behaviours and potential locations of firms, but the actual behaviour and location is determined by organisational routines acquired in the past. Having said this, firms are not only victims of history: routines can be changed by innovation and relocation. Innovative behaviour of firms thus plays a central role in any evolutionary explanation.

Table 1
A comparison of the three approaches in economic geography

Key issues	**Neoclassical**	**Institutional**	**Evolutionary**
Methodology	Deductive Formal modelling	Inductive Appreciative theorising	Both Both
Key assumptions	Optimising agent A-contextual	Rule-following agent Contextual (macro)	Satisficing agent Contextual (micro)
Statics versus dynamics	Equilibrium analysis Micro-to-macro	Comparative analysis Macro-to-micro	Out-of-equilibrium analysis Recursive
Geography	Neutral space Transport costs	Real place Place dependence	Neutral space $\rightarrow$ real place Path dependence

Table 2
Summary of Evolutionary Economic Geography (EEG)

- EEG combines appreciative theorising (inductive) and formal modelling (deductive)
- EEG takes firms, and their routines, as the unit of analysis
- EEG assumes the behaviour and success of firms to be dependent primarily on the routines a firm (or its founder) has built up in the past (path dependence)
- EEG views the traditional determinants of firm (location) behaviour being price signals (neoclassical) and place-specific institutions as conditioning the range of possible (location) behaviours, but not determining actual (location) behaviour
- EEG views institutions as primarily influencing innovation in a generic sense, and as co-evolving with technologies over time and differently so in different regions
- EEG explains regional economic development from the dynamics of structural change at the level of sectors, networks, and institutions at multiple territorial levels

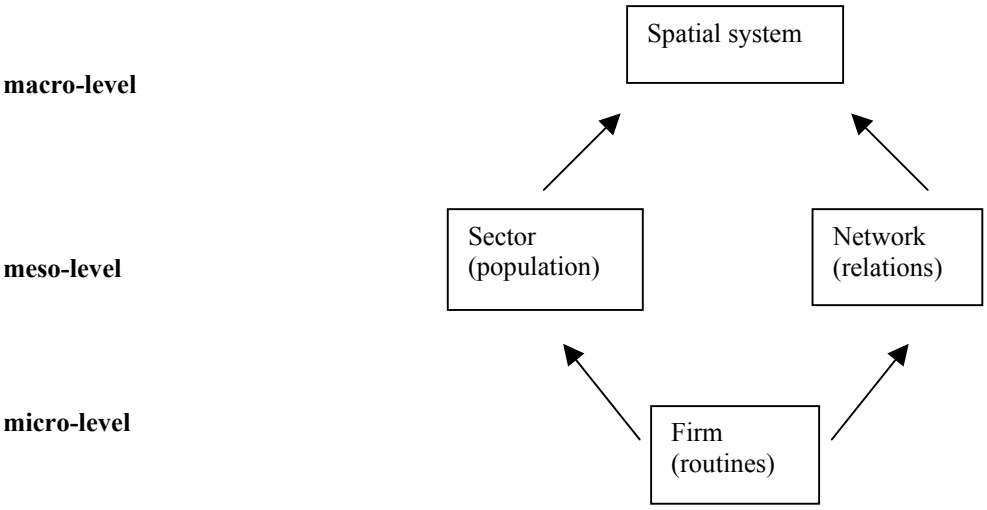
As far as the issue of static versus dynamic analysis is concerned, Evolutionary Economic Geography takes an explicit dynamic perspective, in which processes of birth and death of firms and sectors are put central, as well as the role of innovation and the co-evolution of firms/sectors with institutions. By contrast, the New Economic Geography is based on a static account of equilibrium analysis, while institutional approaches focus on static comparative analyses of institutions in different contexts. From this, it follows that the notions of neutral space (as assumed in neoclassical models for modelling simplicity) and the notion of real place (central to Institutional Economic Geography) can be reconciled in evolutionary thinking by viewing the spatial evolution of new sectors or new infrastructure networks as a dynamic process transforming neutral space into real places.

To further underline and support our claim that an Evolutionary Economic Geography potentially provides a comprehensive framework for theoretical and empirical research in economic geography, we propose a multi-layer scheme as depicted in figure 2. Starting from the evolutionary theory of the firm as developed by Nelson and Winter (1982), Teece et al. (1997) and others, the evolutionary approach in economic geography applies to two meso-levels, that is, the spatial evolution of sectors and of networks. Firms' relations at the sector level are mainly of a competitive nature, which renders entry-and-exit models and survival analysis obvious candidate techniques for analysis. The core models of the spatial evolution of industry are Arthur's (1987) models of spin-offs and agglomeration economies, and Klepper's (2002a) model of the industry lifecycle. Taking a dynamic perspective, the spatial evolution of a new industry in these models is analysed in terms of locations of entry, spin-offs and exits driving the distribution of organisational routines in a population of firms over time. With regard to the spatial evolution of networks, firms develop relationships over time that are less competitive and of a more complementary nature. Underlying the networks of firms is the supporting infrastructures networks including energy, transportation and information technologies. Network evolution, be it of firms or of infrastructures, can then be understood as an entry process of new nodes connecting with certain probability to existing nodes depending on the latter geographical distance and connectivity (Barabasi and

Albert, 1999; cf. Castells, 1996). Well-connected nodes become even better connected locations rendering the final distribution of connections skewed: networks automatically evolve towards a hierarchy with some locations becoming highly connected primary hubs, other secondary hubs, while most locations evolve into poorly connected spokes. The model equally applies to the spatial evolution of networks between individuals and firms (e.g., Breschi and Lissoni, 2003) as to the spatial evolution of infrastructures (e.g., Guimerà and Amaral, 2004).

Reasoning from the dynamics of sectors and networks, Evolutionary Economic Geography also applies to the macro-level of the spatial system as a whole. The economic development of cities and regions can be analysed as an aggregate of sectors and infrastructures in a region, and its geographical position and economic competitiveness in a global system of trade and commerce. Following from the meso-levels of sectors and networks, differential regional growth patterns, including convergence, divergence and leapfrogging, can be analysed by the long-term patterns of structural change. Only regions that consistently relocate resources to the development of new sectors and new infrastructure networks can sustain high levels of growth, while regions that remain locked-in in mature industries and established infrastructures will typically experience structural decline. At the same time, each era will see a limited number of new fast-growing localities due to the path dependent locational patterns of new industries and new networks, in line with recent empirical evidence on temporally auto-correlated growth rates of cities (Pumain, 1997). However, regional dynamics cannot be understood from the spatial evolution of industries and networks alone, because specific institutional structures tend to co-evolve (Nelson, 1995b). Thus, geographical analysis focused on the dynamics of industries and networks needs to be supplemented by institutional analysis.

Figure 2
Evolutionary Economic Geography applied at different levels of aggregation



Having said this, Evolutionary Economic Geography is still at an early stage of development. Some of its fundamental concepts, such as routines and path dependence, need more careful elaboration both theoretically and empirically (see, e.g., Martin, 2003; Becker, 2004). Furthermore, there are relatively few studies to date that can serve as 'Kuhnian exemplars' of this new approach. Notwithstanding these shortcomings, we believe that Evolutionary Economic Geography provides genuine new explanations for the main *explananda* in economic geography, such as location behaviour of the firm, the spatial evolution of sectors and networks, the co-evolution of firms, technologies and territorial institutions, and convergence/divergence in spatial systems. The comparison of the evolutionary approach with neoclassical and institutional approaches shows that Evolutionary Economic Geography indeed offers a value-added to the field of economic geography. What is more, an evolutionary approach offers interfaces with neoclassical and institutional approaches that are potentially much more fertile than the uneasy interactions we have witnessed between neoclassical and institutional scholars so far. We realise there is still a long way to go before Evolutionary Economic Geography will become an established field. Having said this, we are convinced that evolutionary theory constitutes a truly new and promising paradigm in economic geography. Time will tell whether it will live up our expectations: it is evolution as usual.

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