

Scientific Unification in Economics. The case of the New Economic Geography

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ABSTRACT

Scientific unification – the application of the same principles and tools to the study of phenomena from different domains – is a powerful ideal in economics that significantly shapes its internal dynamics and how it relates to neighbouring fields. In this paper I discuss aspects of scientific unification in the case of the New Economic Geography, an approach to spatial issues recently developed within economics. The analysis shows that the drive to unify affects a range of inter-theoretic, inter-field and inter-disciplinary relations, and that it meets with disunities of various sorts, which affect the kind of products unification ultimately delivers.

1. INTRODUCTION

Scientific unification – the application of the same principles, explanatory schemata, models and tools to the study of phenomena in different domains – has been and still is a powerful scientific ideal. Celebrated examples include Newton's theory of universal gravitation, which unified celestial and terrestrial phenomena, Einstein's theory of special relativity, which unified electric and magnetic phenomena, and Darwin's theory of natural selection, which unified phenomena in fields such as comparative anatomy, biogeography, and palaeontology. In economics too scientific unification is a powerful force that significantly affects its own internal dynamics as well as its relationship to neighbouring fields. Consider for example the widespread adoption of economics-style models and explanations in neighbouring social sciences like sociology and political science. The search for unity partly lies behind the emergence of new fields such as neuroeconomics, which integrates economics, psychology and neuroscience to study how the brain makes economic choices; network theory, which studies the properties of networks throughout the social and the natural sciences, and in its economics application it is used to explain phenomena as diverse as scientific collaborations, variations in crime, and differences in social cooperation; or the New Economic Geography, whose unificationist achievements have been celebrated in the awarding of the 2008 Nobel Prize in economics to its founding father, Paul Krugman.

The general intuition behind the ideal of scientific unification is that all sciences are after all concerned with one and the same world. The unification of the entire scientific domain either by means of a grand single theory, or of a small set of fundamental laws is probably unattainable. Nevertheless, dealing with complex interrelations between phenomena seems to require at least some degree of unity and integration of scientific knowledge. Take social phenomena for example. These are closely interconnected through a complex thicket of causal relations. In order to understand them, social scientists might often be forced to transcend disciplinary boundaries. And at least *prima facie*, it seems plausible that biological theories

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should also somehow bear on social scientific theories, for the individuals that constitute the social world are after all also biological systems.

In the philosophy of science unification has traditionally been a hot topic of debate (see Bechtel and Hamilton 2008 and Cat 2007 for overviews). Modern discussion began with the classic paper by Oppenheim and Putnam (1958), which envisaged the unity of science in the form of a reduction of all the sciences to physics. More recent accounts have suggested that scientific understanding itself is a product of the unification of disparate phenomena, and accordingly take science to progress by reducing the number of types of facts that we have to accept as ultimate (Friedman 1974; Kitcher 1981). Today many philosophers of science have dismissed these and similar proposals as inadequate both descriptively and normatively.

In spite of the dissatisfaction among philosophers however, scientists continue to pursue unification in some form, and when successful these achievements are widely acclaimed. The philosophical project of finding a one-size-fits-all model has failed not because unification is unimportant, but because it is a local, varied and context-dependent phenomenon. The real challenge for philosophers of science now is to understand how and why scientists engage in various kinds of unifying research strategies; strategies that might prove fruitful in some contexts and not in others, and only for some purposes (e.g., explanation, confirmation, and discovery). Some have already begun to analyze reductionist and unifying strategies from this perspective (e.g., Grantham 2004, Wimsatt 2006, Wylie 1999), but thus far very little attention has been paid to unification in economics. If, as it seems increasingly clear, it assumes different features in different scientific contexts, in economics it is likely to be somehow different from unification in say, biology. We might discover that the unifying strategies deployed within and around economics are misguided. It's more likely, however, that we'll find that they work only sometimes and only for some purposes, and we might be able to understand why they work when they do.

My focus here is on the features of scientific unification in the case of the New Economic Geography. What emerges is that unification drives theoretical development and shapes a variety of inter-theoretic, inter-field and inter-disciplinary relations. At the same time, it co-exists with disunities of various sorts that affect the kind of products that are ultimately delivered. Similar ideas, I believe, could be applied beyond the case under scrutiny. At the end of the paper I briefly speculate on how the pursuit of scientific unification and the sorts of friction it faces play out in the case of neuroeconomics. The objective is to make a case supporting the claim that unification is a powerful driving force in economics and that it takes place often enough to deserve philosophical attention.

2. VARIETIES OF SCIENTIFIC UNIFICATION

Scientific unification encompasses a set of activities that yield the unification or integration of scientific knowledge. I propose to distinguish four levels at which unification can take place, which correspond to items that either enter in the process of unification or are affected by it: phenomena, theories, fields and disciplines. Although differentiating these levels in practice involves some degree of arbitrariness, I believe that each level brings to light important features of scientific unification (though obviously not all four levels will be involved in every case). My case study also shows that, at each level, distinctive frictions influence and constrain the kind and degree of unification established at that level.

First, *explanatory unification* concerns phenomena. It is a matter of explaining several classes of explanandum phenomena with the same, or fewer, explanantia. According to Friedman (1974) and Kitcher (1981), scientific explanation amounts to unification, and hence it



is a matter of deriving many explananda from a small set of premises, or argument patterns. On this view, the explanatory power of a theory is a function of its unifying power and science progresses by reducing the number of types of facts we have to accept as ultimate. In order to appreciate the value of unified explanations however we don't need to endorse Friedman's and Kitcher's proposals in their entirety. It's indeed possible to view unifying power and explanatory power as distinct and still appreciate explanatory unification. For instance, we can hold that unified explanations are to be pursued when and only insofar as they reflect a deep ontological unity among apparently different kinds of phenomena (Mäki 2001): when two phenomena, say optical processes and electromagnetic processes, are identified as being of the same kind. More modestly, unified explanations sometimes make salient commonalities and general patterns, which would be concealed by disunified explanations that focus on the details specific to particular occurrences (e.g. Sober 1999).¹

Second, *theoretical unification* is a matter of unifying previously separate theories by means of one that possesses all (or most of) their explanatory content.² The paradigmatic cases of unification in the history of science have often accomplished unification of both phenomena and theories. For instance, Maxwell's theory unified electromagnetism and optics in showing that electromagnetic waves and light waves were one and the same thing. Similarly, Newton's theory unified Galileo's laws of terrestrial mechanics and Kepler's laws of celestial bodies by showing that the motions of celestial and terrestrial bodies could be explained through the law of universal gravitation. What counts as a class of phenomena is defined by a theory, so that a theory that successfully unifies two classes of phenomena (henceforth the unifying theory) also unifies the respective theories (henceforth the unified theories).

When it is a question of more mundane cases the distinction between the unification of phenomena and of theories nonetheless still proves useful. The reason is that a unifying theory might account for only a subset of the phenomena that the unified ones, taken together, explain. In many cases, a unifying theory includes a set of idealizations and abstractions that differ from that of the unified theories. Each theory, whether unifying or unified, may because of its distinctive idealizations and abstractions be useful for different explanatory purposes. In such cases, explanatory unification may not produce a complete theoretical unification. Theoretical unification turns out to be a matter of degree.

Third, scientific unification can also occur at the level of fields. Let's call this *inter-field integration*. Focusing on the interconnections between fields rather than exclusively on those between theories will produce a more general framework for examining scientific unification. Fields typically include several theories and much more besides:

A central problem, a domain consisting of items taken to be facts related to that problem, general explanatory facts and goals providing expectations as to how the problem is to be solved, techniques and methods, and sometimes, but not always, laws and theories which are related to the problem and which attempt to realize the explanatory goals (Darden and Maull 1977: 4)

¹ Consider an explanation of an increase in crime rate, which appeals to a higher level of unemployment and abstracts away from the changes of opportunities and motivations of the individuals involved. To see why this is a unified explanation, suppose we have two regions both experiencing a rise in the crime rate as the consequence of an increase in the level of unemployment. The unemployment explanation provides a unified explanation of the two occurrences, whereas the explanation that invokes the changes of opportunities and motivations of the individuals involved would be different in the two cases.

² According to Whewell (1847), theories that unify phenomena are also more likely to be true (see also Thagard 2007).



The unification of fields occurs via a number of routes, of which the unification of theories is just one. For instance, it may happen through the development of an ‘inter-field theory’, in other words a theory that identifies and explains the relations between fields (Darden and Maull 1977), or through the development of a theory that explains the presuppositions of another without replacing it (Kitcher 1984). Fields could also become progressively integrated through the establishment of non-theoretical connections, which Grantham (2004) calls ‘practical’ unification. This takes place when “one field comes to rely on the methods, heuristics, or data of a neighboring field” (Grantham 2004: 143), such as when the theories or methods developed in one field generate new hypotheses in another, or when data from one field are used to confirm hypotheses developed in a neighbouring field. For the data, methods or heuristics that are distinctive of one field to bear on a neighbouring field there needs to be at least some theoretical understanding of how the two domains are related, but practical unification can occur also with a relatively low degree of theoretical unification. Various practices can therefore contribute to the unification of fields (and thereby of science), although they can hardly, if ever, effect a complete inter-field unification, that is, one in which the new field supplants previously existing ones.

Finally, the pursuit of unification may also affect inter-disciplinary relationships: a theory may enter a domain of phenomena that fall within the purview of a discipline distinct from that in which it was originally developed. This phenomenon is known as *scientific imperialism*. Talk of disciplines rather than fields allows us to emphasize the sociological and institutional aspects that contribute to define disciplinary identities and boundaries, and which are absent from the definition of a field. Although the term ‘scientific imperialism’ has negative connotations, following an idea advanced by Uskali Mäki (2009), we can distinguish forms of scientific imperialism, some of which can be positively evaluated. If we think of scientists as seeking to increase a theory’s degree of unification by way of applying it to new types of phenomena, it is largely a matter of social and historical contingency whether these phenomena are studied within other disciplines. If we endorse the idea that the scope of theories should be determined by the real order of things and not by pre-existing disciplinary boundaries, then it follows that in principle there is nothing wrong with that kind of imperialism that follows from the expansion of a theory’s scope. But this is not all there is to scientific imperialism. Scientific imperialism can also affect other aspects of the scientific endeavour such as the standing of one discipline and/or conceptions about the scientific status of one style of research vis-à-vis another. Whereas expanding the scope of a theory in search of real unity among phenomena is potentially progressive, entering another discipline in the attempt to change its theoretical convictions and style of inquiry is a more suspicious form of scientific imperialism. The latter can create or reinforce positions of dominance that have little or nothing to do with recognized scientific merits. Whether breaking disciplinary boundaries turn into suspicious forms of imperialism can only be ascertained on a case-by-case basis.

3. UNIFICATION IN THE NEW ECONOMIC GEOGRAPHY

The New Economic Geography (NEG henceforth) is an approach developed within economics at the beginning of the 1990s that seeks to explain spatial agglomeration (and spatial dispersion) within a unified framework (Krugman 1991, Fujita et al. 1999, Fujita and Thisse 2002, Brakman et al. 2001, Baldwin et al. 2003). The concept of agglomeration refers to seemingly very distinct empirical phenomena: the existence of the core-periphery structure



corresponding to North-South dualism; regional disparities within countries; the existence of cities and systems of cities, which are sometimes specialized in a small number of industries; industry clusters such as Silicon Valley; and finally the presence of commercial districts within cities, such as Soho in London. Although each type of agglomeration could be the result of different types of mechanisms, NEG hypothesizes that these apparently distinct phenomena are at least partly the result of similar mechanisms, viz. 'economic mechanisms yielding agglomeration by relying on the trade-off between various forms of increasing returns and different types of mobility costs' (Fujita and Thisse 2002: 1).

The approach rests on two building blocks: the presence of increasing returns at the firm level and transportation costs.³ Increasing returns at the firm level requires dropping the standard economic assumption of perfect competition and replacing it with that of imperfect competition.⁴ On the aggregate level, increasing returns and transportation costs give rise to pecuniary externalities, which are transmitted through the market via effects on prices. In essence, their presence implies that the more firms and workers there are in a locality, the larger the market, the more attractive it becomes as a location for further firms and workers.⁵ This generates a cumulative process that may result in the concentration of all economic activity in one location. While pecuniary externalities push towards such concentration, immobile factors, congestion and the like, push towards dispersion. The relative strength of the two sets of forces determines whether spatial agglomeration occurs.

NEG is now a well-established field in economics. In 2008 Paul Krugman was awarded the Nobel Prize in Economics. The Nobel Prize press release mentioned the integration of the fields of trade and geography as one of the remarkable achievements of Krugman's theory:

Patterns of trade and location have always been key issues in the economic debate. What are the effects of free trade and globalization? What are the driving forces behind worldwide urbanization? Paul Krugman has formulated a new theory to answer these questions. He has thereby *integrated the previously disparate research fields of international trade and economic geography*. (My emphasis)⁶

For NEG theorists too, unification is one of its main accomplishments: it shows that similar kinds of economic mechanisms are at work in bringing about a host of phenomena that have been separately studied, thereby achieving explanatory unification. In doing so, it answers Ohlin's call (1933) for the unification of trade theory and location theory (Brakman et al. 2001). And yet this enthusiasm for the NEG's achievements is not shared by all. Economic geographers, who have been traditionally concerned with spatial issues, received the NEG's

³ The presence of space implies that the cost of exchanging goods and services across locations increases as (both physical and cultural) distance increases due to physical transport, tariffs, cultural barriers and so on. These costs are generically treated as *transportation costs*.

⁴ *Increasing returns* are defined as a decrease in the average costs per unit of output for the individual firm as the level of output increases. In the imperfect competition setting NEG assumes, firms take the price-setting behavior of other firms as given, and do not take into account the effects of changing their own price onto the price index. The products are symmetric, which means that consumers do not prefer one variety to another. However, they prefer variety for its own sake, which means that they always prefer to consume a unit of a new variety than an additional unit of a product they have already consumed. This is one of the reasons why firm agglomeration is beneficial for workers.

⁵ *Externalities* are defined as a decrease in average costs as a result of an increase at the level of output of the whole industry. *Pecuniary externalities* are transmitted through the market via price effects for each firm, which, as a consequence, may decide to change its output decisions.

⁶ The Nobel Prize press release can be found at http://nobelprize.org/nobel_prizes/economics/laureates/2008/press.html.



appearance with suspicion, if not with outright hostility. Among the accusations economic geographers have levelled against NEG is that it represents yet another instance of imperialism on the part of economics. We can already begin to see that the NEG's pursuit of explanatory unification has affected a range of inter-theoretic, inter-field and inter-disciplinary relations. It is to these issues that the remainder of this section is devoted.

3.1. EXPLANATORY UNIFICATION

NEG seeks to explain a host of spatial phenomena previously studied by separate theories in different fields by showing how these are brought about by the same kind of economic mechanisms. The account of explanatory unification advanced by Philip Kitcher (1981, 1989) largely captures the structure of explanatory unification in NEG (Mäki and Marchionni 2009). According to Kitcher, to explain is to unify, and unification (and hence explanation) is a matter of inference and derivation. Explanatory unification proceeds by reducing the number of argument patterns while maximizing the number of explanandum sentences that can be derived.⁷ In economics, argument patterns are typically embodied in *model types*, so that unification therein proceeds via the application of a small number of similar model types to an increasing number of economic as well as non-economic phenomena.

In the case of NEG two similar model types have effected the unification: the core-periphery model (henceforth the CP model) and the vertical-linkages model (henceforth the VL model). Both of these adopt the monopolistic competition framework set out in the Dixit and Stiglitz (1977) model with transportation costs, and derive the agglomeration of economic activity between two a priori identical locations. The difference between them lies in the specific foundations for the agglomeration mechanism they postulate; in other words, each type specifies more specific versions of the generic mechanism described in the previous section. In the CP model, the size of the market in each location is determined by the migration decisions of workers: a larger market is a more attractive location to firms and hence to workers via a reduction in the price of the goods. In the VL model, on the other hand, the workers do not move, and the size of the market is made endogenous by the presence of input-output linkages between firms: the more firms there are in a location the larger is the market for upstream firms and the lower are the costs for downstream firms. These model types are then filled in with specific variables in order to derive diverse types of agglomeration phenomena.

Two features of NEG however diverge from Kitcher's account of explanatory unification. First, in Kitcher's, unification is a matter of deriving large classes of explanandum sentences from a parsimonious set of inferential patterns. But explanatory unification can also be seen as a matter of redescribing a large number of apparently independent phenomena as manifestations of a common set of mechanisms, thereby revealing an underlying ontic unity between the phenomena (Mäki 2001). In NEG the two kinds of unification go together. The kind of unity NEG pursues has to do with different phenomena being governed by similar kinds of economic mechanisms. The CP and the VL model types are not merely similar patterns of

⁷ Argument patterns include three components: 1) a schematic argument: a sequence of schematic sentences, which are expressions in which most if not all non-logical expressions are replaced with dummy letters; 2) a set of filling instructions that indicate how dummy letters are to be replaced in specific applications; 3) a classification for the schematic argument that provides the inferential characteristics of the argument, dividing the schematic sentences between premises, conclusions, and rules of inference (Kitcher 1981).



derivation, but they embody stylized causal mechanisms, which are fleshed out according to the specifics of each explanandum phenomenon.

The second, related feature is that in contrast to Kitcher, NEG theorists endorse the view, widespread among economists, that a phenomenon is genuinely explained only if it is derived from well-defined microeconomic parameters (Mäki and Marchionni 2009, Marchionni 2009). NEG's contribution vis-à-vis existing theories is held to be twofold. First, it unifies phenomena that were previously treated separately: the *unificationist* contribution. Second, it is the only field within economics that provides a micro-foundation in a general equilibrium framework for the spatial distribution of economic activity: the *explanatory* contribution. If genuine explanation in NEG has to do with the presence of micro-foundations, the derivation of diverse phenomena from a small number of model types is not what the theorists take to do the explanatory work. This is so even though it is the search for micro-foundations (the explanatory contribution) that has revealed that different classes of agglomeration phenomena are governed by the same kind of economic mechanisms (the unificationist contribution).

In the case of NEG, explanation and unification of phenomena have proceeded in parallel, but they trace back to distinct components of the theory. Furthermore, for certain kinds of explananda, they may go in opposite directions: the unification of phenomena demands that explanatory information be abstracted away. As the theorists admit, explanatory unification could not be achieved without neglecting the details that are specific to different kinds of agglomeration phenomena:

By using highly stylized models, which no doubt neglect a lot of specifics about urban/regional/international phenomena, geographical economics is able to show that the same mechanisms are at work at different levels of spatial aggregation. [...]
In order to lay the foundations for a unified approach, there is a price to be paid in terms of a neglect of institutional and geographical details. (Brakman et al. 2001: 323)

As this quote suggests, unification required that a host of institutional and geographical details specific to the phenomenon be left out. But these specific details are needed to fully account for the spatial phenomena that NEG unifies. It follows that when the theory is used to explain particular aspects of specific phenomena (cities for instance), the NEG unifying mechanism alone cannot do all the explanatory work. It needs to be complemented with information specific to the kind of phenomenon to be explained (such as the presence of land developers or the presence of knowledge spillovers).⁸ As we will see in the next section, some of the specific information is provided by other economic theories.

3.2. THEORETICAL UNIFICATION

Back in 1933, Bertil Ohlin, a well-known international trade theorist, claimed that the separation between international trade theory and location theory was artificial: "International trade theory cannot be understood except in relation to and as part of the general location theory, to which the lack of mobility of goods and factors has equal relevance" (p. 142). Later on he complained that no serious attempt to "build a general location theory and introduce national borders" had been made (Ohlin 1979: 6). Only twelve years later, Paul Krugman (1991) published the seminal NEG model. NEG promises finally to realize Ohlin's dream of a

⁸ Mäki and Marchionni (2009) examine this issue in detail by distinguishing kinds of information and kinds of explananda.



general theory of the location of economic activity, as the scientific background report of the Nobel Prize committee notes:

Traditionally, trade theory and economic geography evolved as separate subfields of economics. More recently, however, they have ... *become more and more united through new theoretical insights*, which emphasize that the same basic forces simultaneously determine specialization across countries for a given international distribution of factors of production (trade theory) and the long-run location of those factors across countries (economic geography) (p. 1, my emphasis).⁹

Furthermore, efforts have recently been made to integrate economic growth in the spatial models of NEG. Thus NEG holds out the promise to unify theories of location, international trade and growth.

According to the standard view of theoretical unification, NEG, the unifying theory, will eventually replace international and location theory, and possibly also growth theory. If NEG had all the explanatory content of the unified theories, then they could be dispensed with. But unification in scientific practice does not always look like this. If the explanatory content of the unifying theory only overlaps with and does not fully cover that of the unified theories, then dispensing with the latter amounts to leaving some explananda unexplained. And at least so far NEG cannot account for a number of stylized facts about location, trade and growth. This is mainly because it focuses exclusively on a kind of economic mechanism (pecuniary externalities) that is believed to operate in bringing about diverse classes of phenomena. In reality there are other mechanisms and forces specific to each class of phenomena that NEG does not encompass. The importance of the alternative mechanisms and forces will vary from case to case, so that whereas for certain stylized facts the NEG mechanism will be more important than the specific ones, in other cases the reverse will be the case. Economists, in effect, generally perceive growth theory, trade theory, location theory and NEG as complementary.¹⁰ Within each field different theories in fact postulate different kinds of economic mechanisms to account for their respective phenomena. Dispensing with one theory basically means dispensing with one kind of mechanism and one possible explanation. Depending on the phenomenon we want to explain, a different mechanism or a different combination of mechanisms acting together will be relevant. In principle further developments within NEG and neighbouring fields could produce a grand theory that tells us when, how and which combinations of mechanisms operate in bringing about certain phenomena. As things stand now, however, there is little reason to believe so. What we now have is a plurality of overlapping, interlocking theories in different subfields, which NEG has helped to render more integrated. Here there is clear tension between the opposing forces for and against unity: on

⁹ The report can be found at http://nobelprize.org/nobel_prizes/economics/laureates/2008/sci.html. Note that the report talks of economic geography as one of the fields that NEG unifies. But this is misleading because as I'll explain below the field of economic geography distantiates itself quite considerably from both economics and NEG. It is more appropriate to talk of location theory, an interdisciplinary field, involving regional science, urban and regional economics, concerned with modeling the determinants and consequences of the locational decisions of economic agents (see Marchionni 2009).

¹⁰ Growth theory, trade theory, and location theory include a variety of theories and explanatory models. They are more like fields than theories. In this section for simplicity I use these labels to stand for theories. The point I make about theoretical unification however applies to the theories that within each field seek to account for the phenomena NEG unifies (see Brakman et al. 2001 and Marchionni 2009). Section 3.3 shifts the focus from theories to fields.



the one hand the unifying ambitions of NEG push towards the unification of phenomena and theories, and on the other the presence of theories whose domains only partially overlap with that of NEG maintains a certain degree of disunity.

3.3. INTER-FIELD INTEGRATION

Looking at inter-field connections offers additional insights into NEG unification. Trade theory, location theory and growth theory are perhaps more appropriately treated as fields rather than theories because they include several explanatory models that aim to account for a number of stylized facts about, respectively, international trade, location and economic growth. From this broader perspective, NEG can be looked upon as an inter-field theory that examines the relations between the phenomena studied by different fields and thereby contributes to render these fields more integrated.

The development of NEG, in fact, is closely tied to that of contemporary theories of trade and growth in the context of what is known as the ‘increasing returns revolution’ in economics. NEG is said to be the “fourth wave of the increasing returns revolution in economics” (Fujita et al. 1999: 3). The revolution consists in shifting away from the constant returns to scale-perfect competition paradigm that dominated the discipline of economics until the 1970s and 1980s, and adopt in its stead an increasing returns-imperfect competition framework. Economists have been aware of the crucial importance of increasing returns and imperfect competition for long, and yet they lacked the tools to adequately incorporate them in the formal and rigorous models economists favour. The Dixit-Stiglitz model of monopolistic competition offered precisely that tool. Thanks to its workability and analytical flexibility, the model could be applied to different areas of inquiry. It was originally conceived as a contribution to the literature on product differentiation, but it was later applied to the phenomena of international trade, growth, and geography, all of which are thought to be the result of the presence of increasing returns.

The application of the Dixit-Stiglitz model to phenomena of growth and trade follows a similar path. In both cases, the then dominant neoclassical variant (based on constant returns and perfect competition) was unable to address some stylized facts and the existence of increasing returns was thought to be necessary to explain them. In commenting the situation of trade theory around the 1970s, Paul Krugman (1995: 1244) describes it as “a collection of highly disparate and messy approaches, standing both in contrast and in opposition to the impressive unity and clarity of the constant-returns, perfect competition theory.” Thanks to the Dixit-Stiglitz model, theories of growth and trade based on increasing returns (‘new trade theory’ and ‘new growth theory’ respectively) became serious complements to the neoclassical ones. Then, a sequence of extensions to Krugman’s new trade theory models led to the formulation of the first NEG’s model, that is, Krugman 1991 (Brakman et al. 2001).

The role of the Dixit-Stiglitz model of monopolistic competition becomes apparent once we shift the focus from theories to fields and therein to what Grantham calls practical unification. The model functioned as a vehicle towards the integration of several fields in economics: the same analytical tool was employed with the appropriate modifications in various fields, and for precisely the same purpose, namely to deal with increasing returns at the firm level and imperfect competition. Its application to the domain of spatial phenomena finally led to the development of NEG, which in turn significantly contributed to the integration of these fields at the theoretical level. NEG can then be thought as an inter-field theory that is both a product of this process of integration as well as a vehicle of further integration. Both practical and theoretical connections have simultaneously worked towards the integration of several related fields. Even so, the fields continue to proceed largely independently from each other. The drive



towards unification continues to play a prominent role within each field and across them,¹¹ but as mentioned earlier, so far NEG is unable (and does not aim) to account for a number of stylized facts that theories belonging to these fields seek to explain.

3.4. *ECONOMICS IMPERIALISM*

The development of NEG has also had effects on fields outside economics: economic geography, a subfield of human geography, lays claim to substantial parts of its domain. Economic geography is diverse in both scope and methods. At its core, however, is an emphasis on the complexity of empirical reality, on place rather than space, on concepts such as contingency and specificity and, on the level of method, on the extensive use of case studies and a discursive style of theorizing. Given that the mainstream of the economics discipline has traditionally neglected spatial and geographical issues, it is not surprising that economic geographers perceived NEG as an attempt to invade their own territory.¹²

Mäki and Marchionni (2007) deal with this aspect of the relationship between NEG and economic geography. We propose to consider NEG's foray into the field of economic geography a consequence of its pursuit of unification and suggest that there is nothing inherently problematic in this pursuit. Disciplinary boundaries are not sacred, and it just so happens that the phenomena NEG unifies also fall within the purview of another discipline. On the other hand, we also warn against the danger of unconditionally celebrating unification and the ensuing imperialism. It is indeed possible that the spatial phenomena NEG unifies are not in reality so unified, and/or that the range and significance of the spatial questions NEG can address is very limited (as economic geographers have not failed to point out). All this needs to be established empirically, however. More importantly, as mentioned above, scientific imperialism also affects sociological and institutional aspects of interdisciplinary relations. When what is exported is not only a theory, but a purportedly superior research style and/or the higher standing of a discipline, the mechanisms sustaining these non-epistemic aspects of imperialism may tip the balance in favour of theories for which empirical support is poor at best.

A significant component of the concern expressed by economic geographers indeed has to do with these aspects of imperialism. The danger, as they perceive it, is that NEG might end up enjoying increasing policy influence just because of the higher standing of economics. Similarly, the alleged 'scientificity' of economics could give NEG an extra edge in the academic competition and end up colonizing economic geography at the cost of the latter's theoretical and methodological commitment. As things stand now, it is not at all clear that NEG warrants a superior position vis-à-vis the theories of economic geographers in the domain of spatial phenomena. In sum, the NEG pursuit of unification generates pressures on disciplinary boundaries but in spite of attempts at promoting cross-fertilization, which if successful could promote integration, the two fields largely proceed in mutual disregard for each other's work.

¹¹ For example trade theory models built to include both neoclassical and new trade theory determinants of international trade, or recent efforts in NEG aimed at the construction of more general models from which specific models can be derived as special cases.

¹² The choice of calling it 'new economic geography' has probably contributed to reinforce the geographers' perception of imperialism. Some NEG theorists proposed to adopt 'geographical economics' instead to underscore the disciplinary origin of the approach, but the original name still remains prevalent.



4. CONCLUSIONS

Philosophical interest in the practice of scientific unification in economics has been scarce. A perspective acknowledging the potential benefits of economists' unifying practices as well as the limitations has largely been missing. This is a gap that needs to be filled because the quest for unity constitutes a powerful driver of theoretical development in economics that significantly affects its internal development as well as its relationship with neighbouring fields and disciplines. We have seen that the NEG's efforts to provide a unified explanation of agglomeration phenomena by showing how they are brought about by the same kind of economic mechanisms has influenced its relationship to other theories, fields and disciplines. From this case, it also emerges quite clearly that unification encounters resistances that ultimately influence the kind and degree of unification that is established at each level. First, unification of phenomena turns out to be a distinct achievement from explanation and for certain explanatory purposes, unification and explanation pull against each other. Second, the stylized mechanism that NEG postulates and on which the unification is based upon does not suffice to do all the explanatory job of existing theories dealing with the phenomena NEG unifies. Third, as an inter-field theory NEG has further advanced the integration of a number of related subfields in economics, but for the most part these continue to proceed autonomously. Finally, insofar as inter-disciplinary relations are concerned, in spite of a few attempts at cross-fertilization, NEG and economic geography continue to proceed in mutual ignorance of each other's work.

I believe that other cases of unification in economics can be usefully examined by paying attention to the levels at which unification occurs and the frictions it faces at each of these levels. Consider for example neuroeconomics. It is often seen as an attempt to reduce economic theories to theories about the brain, and neuroeconomists themselves have sometimes expressed unifying ambitions.¹³ The following quote from two major representatives is telling in this respect:

Economics, psychology, and neuroscience are converging today into a single, unified discipline with the ultimate aim of providing a single, general theory of human behaviour. This is the emerging field of neuroeconomics in which consilience, the accordance of two or more inductions drawn from different groups of phenomena, seems to be operating. Economists and psychologists are providing rich conceptual tools for understanding and modelling behaviour, while neurobiologists provide tools for the study of mechanism. (Glimcher and Rustichini 2004: 447)

Unlike NEG, however, the main vehicles of unification are the new technologies (PET and fMRI for example), which make it possible to generate data on the brain level, and a batch of methods, including experimental templates (e.g., the Ultimatum Game), which have become stable enough to travel across disciplinary boundaries (cf. Guala 2009). These have made available a plethora of new data in a situation in which empirical evidence has been chronically lacking. Neuroeconomics potentially increases the degree of integration among economics, psychology and neuroscience, which in turn could lead to improved knowledge about decision-making. For instance, neuroscientific knowledge may generate new behavioural hypotheses and introduce (mechanistic) constraints on models of individual choice (Clithero et al. 2008).

From the disunity side, many have claimed that economics is and should remain unaffected by neuroscientific findings (e.g., Gul and Pesendorfer 2008). I suspect that this dismissive reaction is, to some extent, due to worries concerning aspects of neuroscience imperialism

¹³ The reduction of higher-level theories to theories at the lower level also contributes to the unification of science. This is in fact Oppenheim and Putnam (1958)'s model of scientific unity mentioned above.



that could threaten economists' own disciplinary identity. The idea that economics should be insulated from whatever is going on in neuroscience is perhaps too extreme. Nevertheless, although neuroeconomics is still in its infancy and it is too soon to tell how it will develop, there are good reasons to doubt that it will ever replace standard ways of doing economics. For one thing, the contribution of neuroscience to economics has to pass through psychology (e.g., Padoa-Schioppa 2008), and a wealth of arguments, which I won't go into here, has made it clear that the global reduction of psychology to neuroscience is unfeasible and possibly detrimental¹⁴ – even though successful local reductions occur. As in the NEG case, here, too the quest for unity plays an important role, but the frictions exerted by disunities of various sorts crucially influence the kind of products that are delivered in practice.

In fact the products that the pursuit of scientific unification delivers are often a far cry from the splendid achievements that standard philosophical models presuppose. Still, I believe, economists' unifying practices, and their effects within and around economics, are worth philosophical attention. If we think of unification as a set of activities good for some purposes and only in some contexts, analyzing the way in which economists actually practice them will help us to identify their strengths and their limitations, and possibly to "calibrate them as tools" (Wimsatt 2006: 446). Some features may well remain stable across contexts and locales even though the specific activities and the frictions they face are different from case to case. The analysis of the NEG unification should be seen as a contribution to this more ambitious project.

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¹⁴ The standard defence against the reducibility of psychology to neuroscience is the 'multiple realizability' argument (Fodor 1974). How exactly mental states and brain states are related and what consequences this relation has for the sciences involved is still a hotly debated issue.



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