From New Trade Theory to New Economic geography: A Space Odyssey

De la Nouvelle Théorie du commerce international à la Nouvelle Géographie économique : une odyssée de l'espace

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This paper examines the evolution of New Economic Geography (NEG) as a sequel to New Trade Theory. The focus is on the contributions and methodological self-reflections of Paul Krugman, who started both the NTT and the NEG. His approach is characterized as “MIT programme”, a combination of Samuelson’s imperative of modelling economic problems in minimalistic frameworks of constrained optimization with Krugman’s own rules for building pathbreaking models. This paper compares the actual achievements of the NEG with the demands of the MIT programme. It is argued that the extension of trade theory to geographical economics has widened the scope of analysis of economic interaction between different countries (or regions), but that the NEG still has some way to go in exploring the role of space. Transport costs have mostly been introduced in an ad-hoc fashion, but there are first attempts to endogenize them in terms of market prices for trade services.

Keywords : new trade theory, new economic geography, Paul Krugman, international trade, spatial economics, transport costs

De la Nouvelle Théorie du commerce international à la Nouvelle Géographie économique : une odyssée de l’espace

L’article étudie la Nouvelle Géographie économique (NEG) comme un développement de la Nouvelle Théorie du commerce international (NTCI). L’accent est mis sur les contributions et réflexions de Paul Krugman qui est l’initiateur à la fois de la NTCI et de la NEG. Son approche, connue sous l’expression de « Programme du MIT », combine l’impératif de Samuelson d’un modèle minimaliste d’optimisation sous contrainte avec les propres contraintes.
règles de Krugman de construction de modèles très novateurs. L’article met en regard les réalisations de la NEG et les exigences du programme du MIT. Nous soutenons l’idée que le développement de la théorie du commerce vers l’économie géographique a élargi le spectre d’analyse de l’interaction économique entre différents pays (ou régions), mais que la NEG doit encore progresser dans l’exploration du rôle de l’espace. Jusqu’à maintenant, les coûts de transport ont été introduits de façon ad hoc, mais il existe des tentatives pour les endogénéiser en termes de prix de services commerciaux.

Mots clés : nouvelle théorie du commerce international, nouvelle géographie économique, théorie du commerce international, Paul Krugman, économie spatiale, coûts de transport

JEL : B41, F12, R1

“[T]he general theory of interregional exchange ... is presented as a direct extension of the general theory of price formation ... The location of production ... is dependent on the local distribution of factors of production as well as the mobility and the divisibility of these and the goods ... [D]ue to the limited divisibility of factors of production, the scale of production becomes an important factor in determining the production costs. The producing unit with the lowest costs requires production at a large scale and distribution of the products of a corresponding area. For these two reasons, division of labour will take place between different areas, since different industries are concentrated in different areas. The costs of transporting the goods tend to counteract this division of labour and, thus, also the ensuing exchange, but they cannot completely prevent it.” (Ohlin, [1922] 2002, 140-41)

“[T]he theory of international trade is only a part of a general localization theory.” (Ohlin, 1933, vii)

1. Introduction: Paul’s act

The story often told about the emergence of the now middle-aged “New Economic Geography” (NEG) reads like a saga about the homecoming of a lost people: “Once upon a time there was the tribe of Economic Geography. Its people, also known as Egees, lived out in the periphery of the lands of Economics, far away from its centre, which was known as the domain of GET (imposingly short for General Equilibrium Theory). In the distant past, many of the forefathers of the Egees and the Getters had shared common grounds. Yet, when the citadel of GET expanded its rule of marginalism over the lands of Economics, it created an urban sprawl of departments, journals and research clusters. The Egees, used to a more pastoral life-style, became increasingly marginalized and excluded. It did not help that some of their more formal members, who called themselves...
Spatial Economists, ran their research in terms of marginal analysis. In the dialects of GET, ‘spatial’ was easily confused with ‘special’, as opposed to ‘general’. And the Egees themselves preferred to draw a borderline between their territory and the domain of GET by insisting that geography needs to be both spatial and special. They pointed out that geography deals, after all, with the specific features of economic activities that are dispersed and connected in space.

Then came a young man whose name was Paul. He had wandered in from NTT, an upstart region whose name was pronounced as ‘Entity’, boldly referring to a (then) New Trade Theory that he himself had helped to set up. Paul began to preach a novel sort of spatial economics that his friends called New Economic Geography. He quickly attracted many followers among the young people. Despite fierce protests from older Egee chiefs, he managed to bring the people of Economic Geography back into closer contact with GET. The people of GET praised him for this feat and gave him the highest award in Economics, the Nobel prize. Yet, as practitioners of the dismal science they did not find it easy to live happily ever after. In some way or other, they are still looking for space.”

The second part of this story (i.e., Paul’s Act) may serve as an abstract of our paper, but it characterizes also more elaborate accounts of how New Economic Geography developed out of New Trade Theory; (see, e.g., Behrens and Robert-Nicoud 2009, Brakman and Garretsen 2009, and Neary 2009). A peculiar feature of the best among those accounts is the personal union of the hero and the storyteller. Paul Krugman, the Nobel Prize winner of 2008, not only pioneered research in both fields; he is also a gifted writer who has provided various authoritative reviews of their development—one of them, of course, in his Nobel lecture (Krugman 2008). His numerous reflections on the evolution from NTT to NEG pay tribute to Johann Heinrich von Thünen, Bertil Ohlin and other precursors who had contributed to the developments of both spatial economics and general equilibrium theory. However, Krugman’s reviews are a history of his own making, describing a research strategy that we name (for want of better) “the MIT programme”. In this paper, we compare the actual achievements of the NEG with the demands of that programme. We do not provide a comprehensive survey of the NEG and its links with NTT. Instead, we set the focus largely on the theoretical contributions and the methodological self-reflections.

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1 Members of other tribes often point out that the Economists’ trophy is just the “Sveriges Riksbank Prize . . . in Memory of Alfred Nobel”, and not a true Nobel Prize, let alone the Nobel Peace Prize. Yet it should be noted that, going by the standards of Nordic sagas, there is very little murder and crime in the story of Paul.

2 Other reviews by Krugman are discussed under way and listed in the references at the end of this paper.
of Paul Krugman, as they constitute the core ideas and representative mode of thinking that started the NEG. We argue that the extension of the NTT to geographical economics has widened the scope of analysis of economic interaction in space, but that the NEG still has some way to go before space can be considered as a well-explored dimension of economic analysis.

In the following sections, we describe the history of the transition from NTT to NEG in four steps. In section 2 we outline the New Trade Theory as a route to general explanations of intrasectoral trade across national borders. The core elements of NTT are increasing returns to scale and imperfect competition. In the context of this paper, an important extension of the NTT is the home market effect, based on the existence of trade costs. In section 3 we examine the evolution of the New Economic Geography as a sequel to the NTT. The NEG introduces partial factor mobility into a basic NTT framework and puts even greater emphasis on trade costs and the home market effect. External economies of scale now determine the pattern of location, which may evolve dynamically into equilibria with centres and peripheries. In section 4 we take a look at Krugman’s research style and related notions of scientific progress in “the MIT programme”. Finally, in section 5, we raise the question of how far the NEG deals with space “seriously”, i.e., by the standards of the MIT programme. We point out that, in a sort of space odyssey, various ad-hoc approaches (in terms of iceberg costs and other parameters) have been developed in order to integrate spatial considerations into the general equilibrium models. Yet, to date very little work has been done to endogenize trade costs in terms of market prices for trade services.

2. The New Trade Theory

The New Trade Theory, or NTT, is a label that summarizes a range of attempts to explain international trade in terms of inherent advantages of specialization that arise from increasing returns to scale and concomitant forms of imperfect competition. Seminal contributions were made by Krugman (1979; 1980; 1981a) as well as Lancaster (1980), Helpman (1981) and Helpman and Krugman (1985).

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3 Our focus on Krugman is also justified by the Nobel Prize: “If it were not for the combination of the disciplines of trade and geography into a single consistent framework, Krugman might have had to share his prize with, for example, Elhanan Helpman or Avinash Dixit, if it had been based purely on his work on trade theory, or maybe with Masahisa Fujita, Tony Venables or Jacques Thisse, if only geography or spatial economics had counted. It is indeed the combination of his contribution to both trade and geography that makes Krugman’s work special.” (Brakman and Garretsen, 2009, 3)
Like any theory that carries the attribute “New” in its name, the NTT label is likely to provoke at least three questions: What is considered as “old theory”? Is the “New... Theory” really new (as compared to the old)? If so, is it still new, at least in terms of not being made obsolete by newer theories? Since the NTT is now well into its thirties, there are good reasons to ask all of these questions.

“Old trade theory” is defined as the set of classical and neoclassical theories that are based on the principle of comparative advantage. According to this principle, all countries (or regions) can make gains from trading with each other, if there are differences between their relative costs of producing the same range of goods. In the classical version à la Ricardo the discrepancies in relative costs arise from given differences in technology. In the neoclassical version à la Heckscher-Ohlin they arise from given differences in the endowments of factors of production (land, capital and labour, high-skilled and low-skilled). Comparative cost advantages determine the pattern of specialization in terms of intersectoral trade. Old trade theory is based on the assumptions of constant returns to scale and perfect competition. Hence, firms do not matter, and general equilibrium under free trade is superior to autarky in terms of consumption possibilities at country-levels.4

By contrast, the New Trade Theory does not base its explanations of trade patterns and gains from trade on given comparative advantages. It sets the focus on intraindustry trade, i.e. simultaneous exports and imports of similar goods, and attempts to explain observable specializations and patterns of trade between countries that do not a priori differ in terms of technology and endowments. As Krugman (1990, 1-7; 2008, 337-40) remembers, this was a response to a partly theoretical and partly empirical challenge. Already by the 1970s, there was clear evidence that intrasectoral trade between countries with similar characteristics was growing faster than intersectoral trade between them (Grubel and Lloyd, 1975). This could not be explained in terms of comparative advantage, and there were hints that theories of intrasectoral trade should be based on the presence of increasing returns to scale.

In his first NTT paper, Krugman cites Balassa (1967) and others for that insight, and he even mentions that “the role of economies of large-scale production is a major subtheme in the work of Ohlin (1933)” (Krugman, 1979, 469). Ohlin is nowadays mostly known for having combined Heckscher’s theory of international trade, based on the relative scarcity of factors of production, with Cassel’s general

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4 In the neoclassical version, however, Pareto improvement at the national level requires that the winners from trade (the owners of the abundant factor) compensate the losers (the owners of the scarce factor).
equilibrium framework to yield the theorems of factor proportions and factor price equalization. Through the lens of Stolper’s and Samuelson’s formalizations, Ohlin’s contribution to trade theory has been narrowed down to the 2x2x2 framework (two goods, two factors, two countries) with constant returns to scale (Stolper and Samuelson 1941; Samuelson 1948 and 1949). However, starting with his licentiate thesis of 1922, Ohlin had repeatedly argued that economies of scale (internal and external) lead to a concentration of production in a smaller number of firms and locations. Summing up his “theory of interregional exchange” of 1922, he emphasized that increasing returns are not just a “subtheme” of the unequal distribution of production factors across different regions, but an independent and complementary cause of interregional (or international) trade:

The studies have shown that there might be two reasons for exchange: the relative scarcity of factors of production, on the one hand, and increasing returns, on the other, which in turn are connected to the limited divisibility of factors of production. The exchange that then takes place tends to equalize the relative scarcity of factors of production and make a more complete utilization of the indivisible factors of production possible. (Ohlin, [1922] 1999, 171; see also the first lead quote of the present paper)

So, in a first answer to the second question one might argue that the NTT is not really new, since the young Ohlin (at age 23) and other old trade theorists had developed early notions of its core idea.5

However, in his explicit response to the question Was It All in Ohlin?, Krugman (2002a, 397-98), points out that internal economies of scale imply imperfect competition. In Ohlin’s times, Krugman (2008, 338) argues, “there were no general equilibrium models of imperfect competition readily to hand—and trade theory, perhaps more than any other applied field of economics, is built around general equilibrium analysis.” This changed only in the late 1970s, with the advent of the Dixit-Stiglitz (1977) model of monopolistic competition, which introduced “an elegant, parsimonious and tractable formalisation of the Chamberlinian model” (Neary, 2004, 159). On the consumer side, the Dixit-Stiglitz model posits a taste for diversity, or “love for variety”, expressed in preferences for differentiated products, which could be considered as varieties of the same good. Hence, consumers’ welfare increases with the number of varieties available. This is easily seen from the following CES specification of the Dixit-Stiglitz utility function, typically used in NEG models as sub-utility function for the consumption of manufactured goods:

5 Some economists even trace them back to Adam Smith; see, for example, Maneschi (2000).
where utility $U$ is a symmetric and additively separable function of the consumption levels $c_i$ of a large, variable number $N$ of varieties of the same good, with $\rho$ as the “love for variety” in terms of a constant elasticity of substitution (CES). Under the assumption of equal consumption of every variety, the right-hand side can be rewritten as:

$$(Nc^\rho)^{1/\rho} = N^{1/\rho} = N^{1/\rho - 1}[Nc]$$

(cf. Brakman et al., 2009, 92). An increase in variety (rise in $N$) leads to an increase in utility because of the love for variety ($N^{1/\rho - 1}$, where $1/\rho - 1 > 0$, such that $N^{1/\rho - 1} > N$).

On the producer side, the Dixit-Stiglitz model assumes monopolistic competition in which each of the varieties is produced by a separate firm. The firms are small enough to take the market price level and consumers’ income as given, when setting the price for their variety. Increasing returns are simply modelled by the combination of a fixed cost $\alpha$ and a constant marginal cost $\beta$. In the basic versions of NTT and NEG models, labour is the only factor of production. The production function of the typical firm $i$ can thus be written as:

$$l_i = \alpha + \beta y_i,$$

where $l_i$ is the labour input required to produce the firm output $y_i$ of variety $i$.

In his first NTT paper, Krugman (1979) used the Dixit-Stiglitz framework for two symmetric economies. He showed that both consumers and producers would make gains from international trade, as the exploitation of scale economies goes hand in hand with an increase in the number of available varieties:

"Trade needs not be a result of international differences in technology or factor endowments. Instead, trade may simply be a way of extending the market and allowing the exploitation of scale economies, with the effects of trade being similar to those of labor force growth and regional agglomeration. (Krugman 1979, 479)"

In its core, the NTT thus explains the patterns of trade as outcomes of profitable specialization in a cost structure that may be completely independent of the attributes of the countries (technology, endowments) that were assumed as given in old trade theory.
However, the new and the old trade theories are not mutually exclusive, but can be seen as complementary explanations of trade patterns. The Grubel-Lloyd index of intraindustry trade shares does not normally take the extreme values of 0 and 1 over a large number of sectors, since the trade of most countries in this world is partly intersectoral, partly intrasectoral. In the third of his NTT papers, Krugman (1981a) takes the Grubel-Lloyd argument to a different corner by grouping the countries in terms of their similarities in technology and factor endowments. A higher Grubel-Lloyd index value indicates greater similarity and the exploitation of increasing returns. Krugman also points out that the two-way trade in similar goods does not pose the “serious income-distribution problems” that are connected with Heckscher-Ohlin theory in its Stolper-Samuelson corollaries.

Krugman (1981a) suggested a trend towards greater similarity and, hence, more intrasectoral trade in the world economy. Three decades later, the picture has changed. In his Nobel lecture and in addresses to “old” trade theorists and “old” economic geographers, Krugman (2008; 2011a and 2011b) observes that, in the course of globalization, the “world [is] becoming more classical”. In the early 1990s the opening-up of China and Eastern Europe led to an enormous increase in the supply of (cheap) labour to global companies and markets. Trade between high-income countries and emerging markets has grown very fast since then, but it has become less intrasectoral.  

Heckscher-Ohlin and perhaps also Ricardo seem to have made a comeback.

Since Krugman, in most of his NTT writings, draws a strict dividing line between comparative advantage on the one hand, and increasing returns on the other, he does not (to our knowledge) make any conjectures about the endogeneity of this return of reality to the domains of old trade theory. Yet, one might expect that economies of scale develop together with the size of capital stocks, and that the industries of capital-abundant countries, in the course of trade-driven processes of economic growth, develop an interest in access to the markets of labour-abundant countries with large populations. On the laters’ demand side, the taste for diversity (or “love for variety”) appears to be a strong motive for liberalization, as demonstrated by Eastern consumer behaviour after the fall of the Berlin wall and by the high-speed growth of the Chinese economy. The intermittent decline in the share of intrasectoral trade could thus be explained

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6 This is demonstrated by the Grubel-Lloyd index values (5-digit level) for trade between high-income countries and their trade with medium-income and low-income countries after 1998, as reported in Brülhart (2009, 433) and World Bank (2009, 183).

7 As the Heckscher-Ohlin arguments predominate, the statement that “the world [is] becoming more classical” should actually be taken to imply “more neoclassical”.
by a combination of the attractions of the “varieties of the West” and economies of scale that can be exploited through comparative advantages (in terms of factor proportions) in both horizontal and vertical trade.

Such an endogenization of comparative advantage (in terms of factor proportions) would require a dynamic theory with cumulative processes of asymmetric capital accumulation and circular causation of increasing returns to scale—and Krugman’s contributions to the NTT were not quite that. It should be noted, though, that Krugman (1981b) had developed a model of “trade, accumulation, and uneven development”, which does the job for an earlier era of global trade, in which capital stocks diverged in the course of “first-world industrialization”. Stimulated by discussions with Lance Taylor (the well-known author of Structuralist Macroeconomics), Krugman (1981b) demonstrates that an “inherent tendency for international inequality to increase” can be deduced from a 2x2x2-NTT model, in which external economies in the industrial sector lead to capital accumulation in one country, and to a subsequent divergence of factor endowments. The result is a theory of uneven development that, somewhat surprisingly, “fits in very well with the Heckscher-Ohlin theory of trade” (Krugman 1981b—here quoted after Krugman 1990, 93-94). A full decade before Krugman’s core-periphery model of vintage 1991 paved the way for the NEG, the same author had thus developed an NTT core-periphery model that went largely unnoticed.

In retrospect, Krugman and other writers normally make the link from NTT to NEG through his second contribution to New Trade Theory. While the 1979 paper emphasized supply-side arguments for intrasectoral trade in terms of increasing returns, Krugman (1980) makes an extension to the demand side in terms of the “home market effect”. In his Nobel lecture, Krugman (2008, 335) remembers that, in the old days when old trade theory dominated the scene, “Staffan Burenstam Linder’s An Essay on Trade and Transformation (1961), with its argument that exports tend to reflect the characteristics of the home market, was passed hand to hand by graduate students as if it were a samizdat pamphlet.” Linder, whose dissertational Essay was supervised by Ohlin, had actually attempted to solve the Leontief paradox by arguing that the development of differentiated industrial goods requires proximity to consumers with preferences for such varieties. This would lead to a trade pattern, in which countries tend to export exactly those goods for which they have a large domestic market. Adding transport costs to a slightly different version of his basic NTT model of 1979, Krugman (1980) replicated this result:

Increasing returns provide an incentive to concentrate production of any one product in a single location; given this incentive to concentrate, transport costs are minimized by choosing a location close to the largest market, and this location then exports to other markets. (Krugman, 2008, 339)
To sum up the response to the second question, one might thus confidently state that the combination of increasing returns to scale (both internal and external) and product differentiation was novel enough to justify the attribute “new” for the NTT in the 1980s. But what about the third question: Is the NTT still new, at least in terms of not being made obsolete by newer theories?

In recent years a “New New Trade Theory” (NNTT) has been developed, essentially originating from Melitz (2003). The NNTT takes Krugman’s 1980 model to the firm level and describes trade as an intrasectoral selection process among heterogeneous firms. It starts from the observation that firms within the same industry react differently towards the challenges of globalization: some disappear (exit), some produce for the domestic market (local players), and some produce for domestic and export markets (global players). Empirical findings point to a close correlation of the selection process with productivity differences between the firms. This raises the question of whether productivity growth causes trade, or vice versa.

Melitz (2003) uses a specific version of Krugman’s 1980 model to show that trade causes growth. As indicated above, the Krugmanite NTT models are basically characterized by symmetric CES preferences, identical technologies and identical factor endowments, such that the classical or neoclassical rationales for trade become irrelevant. The symmetry assumptions imply that firms are identical with regard to technology and the fixed costs of production. Hence, there cannot be any selection effects or aggregate scale effects, when the economies switch from autarky to international trade. There is no exit of firms from the market, nor do they increase their aggregate output; trade leads exclusively to greater product differentiation, which increases utility and welfare. The Melitz 2003 model, too, uses the assumption of symmetric CES preferences, identical technologies and identical endowments. Yet it makes a distinction between firms with regard to their productivity in terms of (stochastically distributed) differences in their marginal costs. More productive firms charge lower prices, and they produce and sell more. The fixed costs are subdivided into fixed costs of production (essentially R&D) and fixed costs of market entry, applying to both domestic and foreign markets. This allows for a selection of global players, local players and exits in terms of “productivity cut-offs”, as only the most productive firms will cover their costs (and get their mark-ups) in domestic and export markets. As Melitz (2003, 1717) argues, home market effects also play a role, because “size difference across countries will induce differences in equilibrium wage levels. These wage differences then generate further firm selection effects and aggregate productivity differences across countries”. Melitz (2003) and others demonstrate that, under relatively general assumptions, the positive scale effect of international trade on growth dominates the negative selection effect.

Be that as it may, what matters in the context of this paper are the following observations. The first is that, in the spirit of NTT and NNTT, the different approaches to explaining trade—based on comparative advantage, or on increasing returns to scale—are not seen as incompatible or mutually exclusive theories. On the contrary, it is emphasized (e.g. by Krugman (1981a), Helpman and Krugman (1985), and Krugman (1994), ch. 5) that the NTT can be embedded into the standard 2x2x2-framework of neoclassical trade theory, and that this combination helps to explain the observable coexistence of inter- and intrasectoral trade. Neary’s belief that “revolutions, especially intellectual ones, are more successful when they encompass the old view rather than totally supplanting it” (Neary, 2009, 225) may not be shared by all of those who think of themselves as revolutionary thinkers. But the strive for all-encompassing combinations of old and new views is clearly perceptible in Krugman’s work on trade theory, even though (apart from Krugman, 1981b) it does not systematically explore the causal links from increasing returns to comparative advantage.

The second observation is that Krugman’s earliest contributions to the New Trade Theory contain all the elements of his core contribution to the New Economic Geography. Exploring the differentiating effects of transport costs on goods prices and real wages in different countries, Krugman (1980) formalizes the home market effect, but takes incomes as given. Krugman (1979, 20), on the other hand, makes income endogenous and displays a systematic understanding of the forces of agglomeration in the presence of increasing returns:

If there are impediments to trade, there will be an incentive for workers to move to the region that already has the larger labor force. This is clearest, if we consider the extreme case where no trade in goods is possible, but labor is perfectly mobile. Then the more populous region will offer both a greater real wage w/p and a greater variety of goods, inducing immigration. In equilibrium all workers will have concentrated in one region or the other. Which region ends up with the population depends on initial conditions; in the presence of increasing returns history matters.

3. The New Economic Geography
The starting point of the NEG is Krugman’s 1991 article on Increasing Returns and Economic Geography, and a second key contribution is The Spatial Economy (1999), a comprehensive treatise that he wrote together with Masahisa Fujita and Anthony Venables. Several
strands of literature have emerged since then, where practically all contributions refer to these two works as sources of a new thinking about economic geography. As in the case of the New Trade Theory, those three questions might be posed again: What is considered as “old economic geography”? Is the NEG really new? And is it still new? In this case, the questions are harder to answer, because the developments of economic geography prior to the NEG as well as the recent extensions and variations of the latter are more diverse than the traditions and fashions in trade theory. In much of the literature, the NEG is also set in stronger contrast with older traditions of economic geography. While (as observed above) the NTT is considered as a complementary component of a larger set of trade theories, the NEG is frequently presented as a general theory and mode of analysis that supplants rather than encompasses “old economic geography”, or it is described as a distinct subdiscipline of economics, not of geography.8

In his second Ohlin lecture of 1992, entitled Geography Lost and Found, Krugman (1995, 37-59) provides his own history of economic geography and argues in a rather encompassing style. In order to show what he considers to be the crucial novelty of NEG, he refers to five traditions of spatial economics:9

1. **Germanic Geometry**, with the location and central-place theories of Alfred Weber, Walter Christaller and August Lösch;
2. **Social Physics** in the tradition of American geographers (only Chauncy Harris is mentioned in passing), with applications of Zipf’s law to the distribution of city sizes, gravity analysis to the prediction of trade patterns, and the concept of market potential for the choice of location;
3. **Cumulative Causation**, or self-reinforcing regional growth and decline, an idea taken from the development theories of Gunnar Myrdal and Albert Hirschman, and transferred to regional science by the geographer Alan Pred;
4. **Local External Economies** in the tradition of Alfred Marshall’s concept of “industrial districts” and other notions of agglomeration effects that are essentially based on technological (rather than pecuniary) externalities; Vernon Henderson is the only name mentioned in this context;

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8 Brakman et al. (2009, xxii) thus prefer the label Geographical Economics to New Economic Geography: “Not only does the label ‘new’ inevitably wear off after some time, but the latter term also has the disadvantage that it suggests that the theory was developed by economic geographers. This is not the case. Instead, geographical economics has its roots firmly in international economics, and modern international trade and economic growth theory. It adds the location of economic activity to these theories.” Mäki and Marchionni (2010) even ask “Is geographical economics imperializing economic geography?” and analyze a number of corresponding complaints from the side of economic geographers.

9 These traditions are also discussed in Krugman (1998a and 1998b), though in a less systematic classification.
5. **Land Rent and Land Use Analysis**, based on von Thünen’s “pioneering Isolated State” and revived both in the “new urban economics” of the 1960s and 1970s, and in Walter Isard’s *Location and Space-Economy* (1956), which Krugman (1995, 55-56) describes as an attempt “to get space into economics” by “assembling von Thünen and Weber, Christaller and Lösch into a manageable package”.

Krugman’s selection of traditions is certainly closer to current-style economic theorizing than other traditions of economic geography (such as commercial geography, or world-system theories). Yet, he deems all these approaches to be crucially deficient, either because they do not describe their ideas in terms of optimizing behaviour and market structure (1, 2 and 3), or because they neglect the role of increasing returns and pecuniary externalities in the formation of central markets (4 and 5). In conclusion of his Ohlin lecture, Krugman (1995, 59-65 and 89-108) makes a suggestion about how the insights of the varying traditions in spatial economics can be integrated and validated in the NEG framework:

If one had to define the philosophical difference between the ‘new’ economic geography and the location theory that preceded it, it would be this: the new literature insists on models that are general equilibrium, and in which spatial structure emerges from invisible-hand processes. (Krugman, 1998a, 9)

Moreover, Krugman elevates the NEG to the status of a general theory in which older theories of spatial economics can be nested. ¹⁰

What, more specifically, was new about that framework in the early 1990s, when Krugman published his seminal NEG paper and gave the Ohlin lectures in short sequence? In a rather loose fashion, Krugman (1998b, 164) describes the NEG “as a ‘genre’: a style of economic analysis which tries to explain the spatial structure of the economy using certain technical tricks to produce models in which there are increasing returns and markets are characterized by imperfect competition.” As pointed out at the end of the previous section, Krugman had already developed the key concepts in his early NTT papers. Yet, even though the connection through the home-market effect was “obvious in retrospect”, it took Krugman ten years to take the step from the NTT to the NEG: “The only good news was that nobody else picked up that $100 bill lying on the sidewalk in the interim” (Krugman, 2002a, 399).

The key to the application of NTT technology to geography was the combination of the home-market effect with partial factor-mobility. This produces “simple models of regional divergence” that—in the

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¹⁰ Here is another difference between the NEG and the NTT, as the trade-theory synthesis consists of embedding NTT models of increasing returns into old-style 2x2x2 frameworks (see section 2).
A perfect competition, constant returns
M monopolistic competition, increasing returns

W wage payments (income)
C consumer spending

Figure 1: Structure of the core model of the New Economic Geography

structure of Krugman’s pathbreaking works (1991a and 1991b)—tend to develop into the extreme spatial disparities of an industrialized core and an agricultural periphery. This can be illustrated by Figure 1, which presents the structure of Krugman’s core-periphery model (1991a) in a way that brings out the standard features of NEG modelling.¹¹

The Krugmanite core-periphery version of the core model has two sectors, A (for agriculture) and M (for manufactures, or industry), located in regions 1 and 2. Each of these sectors employs a single

¹¹ Brakman et al. (2009, 87) present a similar graph as the “core model of Geographical Economics” and refer explicitly to the core-periphery model in Krugman (1991a). For other, more detailed discussions of the key characteristics of the NEG core model see also Fujita et al. (1999, ch. 5) and Baldwin et al. (2003, ch. 2).
and specific factor, which is in fixed supply. Thus there are farm workers in A and firm workers in B, and there is no labour mobility between the sectors. Work generates incomes for both groups, and the aggregate income of the consumers in each country is spent on manufactures \( (\delta C_n) \) and the agricultural produce \( [(1-\delta)C_n] \), from domestic production and/or from imports. The agricultural sector produces a single, homogenous good in perfect competition, with constant returns to scale, whereas the manufacturing sector produces \( N_1 \) varieties of the industrial good in country 1 and \( N_2 \) varieties in country 2. Each variety is produced by one firm (so that there are \( N_1 \) firms in 1 and \( N_2 \) firms in 2), with increasing returns to scale at the firm level. This conforms to the Dixit-Stiglitz model of monopolistic competition. Two further characteristics are the presence of significant transport costs for manufactures, expressed in terms of Samuelsonian “iceberg meltaways”, and partial factor-mobility, as manufacturing workers can move between regions 1 and 2, whereas farm workers are immobile. Fujita et al. (1999, 6-9) describe the characteristics of the core-periphery model as the “modelling tricks: Dixit-Stiglitz, Icebergs, Evolution, and the Computer”. The last two tricks refer to the “simple, evolutionary dynamic stories” that can be told in this framework, supported by numerical examples and simulations that require the assistance of computers.

A crucial step from NTT to NEG was, as mentioned above, the introduction of partial factor-mobility in the manufacturing sector (Krugman, 1991a). Allowing workers to move from one region to the other implies that demand is no longer fixed. Starting from a symmetric interregional distribution of industry, the migration of workers shifts demand and creates the so-called core, the emerging “central place” in the economy. Firms that locate their production in the core save transport costs, but face also a greater number of competitors. The more firms locate in the region, the lower is the price index and the higher the real wage. In the periphery, we observe the

12 “Of course, the label ‘agriculture’ need not always be interpreted literally; the sector’s defining characteristic is that it is the ‘residual’, perfectly competitive sector that is the counterpart to the action taking place in the increasing-returns, imperfectly competitive manufacturing sector.” (Fujita et al. 1999, 45)

13 “Iceberg transport costs [are] an assumption first introduced by Paul Samuelson (1952) in international trade theory: that a fraction of any good shipped simply ‘melts away’ in transit, so that transport costs are in effect incurred in the good shipped.” (Krugman 1999b, 165). The idea goes back to von Thünen (1826: ch. 4) who expressed the cost of grain transportation in terms of the grain consumed by the pulling horses on the way. The standard NEG model assumes, however, zero transport costs for agricultural goods (such as grain), since the A sector must balance any spatial distribution of activities in the M sector. The assumption of positive transport costs is accordingly made for manufactures exports only.

14 This applies only if transport costs are low, on which more below.
opposite effect. As workers move away, more and more goods have to be imported. The real wage falls, as an increasing fraction of the purchasing power is spent on transport costs.

In the NEG core model, market structure is important for the following reason: Monopolistic competition is necessary to preserve the possibility of intrasectoral trade between the regions. It prevents that all demand falls on a single good, which would leave no room for other varieties and lead to agglomeration of all industry in one region. Internal economies of scale ensure that each variety is produced by one firm only. External economies of scale in the form of forward and backward linkages create the tendency of a rising number of local firms to attract more firms to this region. In case the resulting circular causation leads to full agglomeration, the assumption of a competitive agricultural sector preserves the spatial dimension by keeping some economic activity in the periphery. The metaphorical introduction of this sector, with its constant returns to scale, serves to guarantee balanced interregional trade. As a modelling trick it comes fairly close to the famous quip that “space is a device to prevent it all happening in Cambridge.”

In the core-periphery model, the introduction of space creates distance that can be overcome only by paying transport costs. These counteract the increasing returns to scale at the firm level. At zero transport costs, location becomes irrelevant, since all markets are optimally served from one single location. At prohibitive transport costs, no markets outside the home market can be served. In between these extremes, transport costs determine the spatial distribution of industry. In Krugman’s words, the choice of location is presented as follows:

Because of economies of scale, producers have an incentive to concentrate production of each good or service in a limited number of locations. Because of the costs of transacting across distance, the preferred locations for each individual producer are those where demand is large or supply of inputs is particularly convenient—which in general are the locations chosen by other producers. (Krugman, 1991b, 98)

The core-periphery model of the NEG features thus only three stable equilibria, the symmetric mix and complete agglomeration of manufacturing in one region or the other. If transport costs are high (but not prohibitive), both regions produce a similarly large range of varieties of manufactures plus the agricultural good. Trade occurs in manufactures only and is intrasectoral, as in the models

15 “As Dharma Kumar paraphrased Joan Robinson, ‘time is a device to prevent everything happening at once, space is a device to prevent it all happening in Cambridge’.” (Maddison, 1994, 126)
of the NTT. If transport costs fall (in some cases even if the change is minimal), the symmetric equilibrium becomes unstable, as any market entry of an additional firm (moving in from the other region) adds a variety to the market of the respective region and induces immigration. The ensuing process of agglomeration leads eventually to a core-periphery structure, in which the latter region is inhabited by farmers only. It trades agricultural products against manufactures from the core, and we are back in a world of comparative advantage!

Not all NEG models display such catastrophic bang-bang behaviour. Krugman’s core-periphery model serves nevertheless as benchmark for a wide variety of models with more gradual outcomes, because it makes drastically clear how the message that “space matters” can be formulated in a general equilibrium framework (see, for example, Baldwin et al., 2003). In all NEG models, transport costs play an essential role for the dynamics of geographical change, as they are a key determinant of the relative strength of centrifugal and centripetal forces. The basic forces are the price-index effect on the one hand, and the pecuniary externalities in the form of backward and forward linkages on the other (see also Neary, 2001, 542-43). In the case of relatively low transport costs, the arrival of a new firm in region $1$ (which has moved from region $2$) triggers a fall in the price index. This happens because of the concomitant decrease in transport costs, but also due to lower proportional demand for all firms in region $1$. Moreover, the firms face a rise in nominal wage costs as they compete for workers. All this increases, however, the real wage in the region and induces the immigration of workers from region $2$, leading to a countervailing effect in terms of increased demand, also described as backward linkage. Immigration stops only when the real wage rate is equalized between the regions. This implies a fall in the nominal wage in region $1$, as transport costs and the price index are now lower than in region $2$. The ensuing fall in the average and marginal costs in region $1$ creates a forward linkage and works in favour of agglomeration.

Further centripetal and centrifugal forces are added in more sophisticated NEG models, in which, for example, congestion costs counteract agglomeration. As Krugman (1999a, 11) points out, “models of economic geography will typically exhibit a pattern in which the qualitative behaviour of the model changes abruptly when the quantitative balance of forces passes some critical level.” The main parameter that triggers such bifurcations is transport costs. Their conceptualization in core-periphery and other models merits further examination, in order to provide a fuller understanding of what is

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16 Local technology spillovers and labour market pooling, as suggested by Marshall (1890), are two additional agglomeration forces; see, e.g., Fujita and Thisse (2002, ch. 8), Baldwin et al. (2003, ch. 7) and Ehnts (2008).
“really new” and “still new” in the NEG. For this, it is necessary to assess the benefits and costs of the style of analysis propagated by Krugman. Before we return to space, we have to take a closer look at that style.

4. The MIT Programme

In October 1990, just before his leading paper on Increasing Returns and Economic Geography was published, Krugman presented its core ideas in the Gaston Eyskens Lectures at the University of Leuven. He ended the lectures on the following programmatic note:

The geographers themselves probably won’t like this: the economics profession’s simultaneous love for rigor and contempt for realism will surely prove infuriating. I do not come here, however, to fight against the sociology of my profession, but to exploit it: by demonstrating that models of economic geography can be cute and fun, I hope to attract other people into tilling this nearly virgin soil. (Krugman, 1991b, 99)

The signal words are “love for rigor”, “contempt for realism”, “cute models” and “virgin soil”. They characterize much of Krugman’s research philosophy, which he has made more explicit in numerous other places (in particular in 1993a, 1995, part 3, and 2011b). Krugman has a great talent of cutting right to the chase of the matter, in witty prose, often with self-irony. By economists’ standards, he is omnipresent in the media, and not just on matters of NTT and NEG. He shows “love for provocation”, often directed at groups far larger and powerful than the old-style economic geographers. So he is certainly justified to claim that he has “a fairly distinctive intellectual style” (Krugman, 1993a, 25). Yet, we prefer to name Krugman’s research philosophy the MIT Programme. The master himself is to blame for that, since he repeatedly refers to the training and inspiration that he has received from doing his PhD studies at the MIT, from being mentored by Rudi Dornbusch, from sharing an office suite with Paul Samuelson and Robert Solow, and from being impregnated by Samuelson’s witty style, political views and, above all, by his “modelling ethos” (Krugman, 2011b, 3).

Samuelson’s “signature method of economic theory”, expounded and demonstrated in his Foundations of Economic Analysis (1947), can

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17 See, for example, the obituaries for Dornbusch and Samuelson (Krugman, 2002b, 2010), and the following confession, made at the Ohlin Centennial: “[L]et me… admit that reading Ohlin in the original is still not much fun: the MIT-trained economist in me keeps fidgeting impatiently, wondering when he will get to the point—that is, to the kernel of insight that ended up being grist for the mills of later modelers… [A] modern economics student might be forgiven for preferring to get his Ohlin via Samuelson, and indeed via Krugman-Obstfeld.” (Krugman, 2002a: 389)
be described in terms of two rules that have set standards for research at the MIT, and more generally for mainstream economics, ever since:

[W]ith every economic problem 1. reduce the number of variables and keep only a minimum set of simple economic relations; 2. if possible, rewrite it as a constrained optimization problem. (quoted after Fonseca, undated)

These rules are also at the base of Krugman’s research that has driven the developments of the NTT and the NEG. Yet, his version of the MIT programme is more comprehensive, essentially characterized by two overlapping sets of prescriptions. In Krugman’s own words (1993a, 27-29), the first set contains his general rules for research: “1. Listen to the Gentiles; 2. question the question; 3. dare to be silly; and 4. simplify, simplify.” The second set describes the properties that Krugman (2011b, 4) thinks to be essential for pathbreaking models, such as his 1991 core-periphery paper. These “main characteristics” are: (a) full microfoundations, (b) no dormitive properties, (c) distance between assumptions and conclusions, and (d) more than one possible outcome.

What is meant by all these prescriptions? Paraphrasing Krugman’s *How I work* (1993a) and other self-reflections, “listen to the gentiles” essentially means to pay attention to what intelligent non-economists have to say about economic phenomena that mainstream economists seem incapable to deal with properly. “Question the question” is the advice to switch from nails to screws, when using a screwdriver instead of a hammer. In other words, those who employ new analytical tools should adapt the objects of research accordingly, instead of sticking to the research questions handled with the old standard toolbox. “Dare to be silly” is an encouragement to be aggressively unrealistic and unconventional in the choice of assumptions, when looking at the gentiles’ observations from the angle of the new tool of analysis, and to build the model accordingly. What assumption is justifiably silly and what just silly, depends on the usefulness of the models for explaining and predicting real phenomena. For this the assumptions need neither be realistic nor conventionally accepted. Finally, “simplify, simplify” is simply necessary to distil the essential causalities from the analysis, and to convey the message as clearly to others in- and outside the field. Krugman’s “minimum necessary model” approach is clearly reminiscent of Samuelson’s rule n° 1.

Samuelson’s rule n° 2—constrained optimization—is contained in Krugman’s set of model characteristics. Element (a), “full microfoundations”, does not imply the “Chicago programme” of rigorously sticking to models of perfect competition and efficient markets. The Dixit-Stiglitz model is an obvious deviation. In the spirit of Samuelson
Krugman interprets “full microfoundations” more broadly as building models

in which economic outcomes can be represented as the equilibrium that results when maximizing individuals interact. You do not have to believe that this is a literal description of the economy—I certainly do not—to recognize that it is an approach that has shown a lot of power to make sense of the world, and my goal was to exploit that power, not challenge it. (2011b, 4)

For Krugman, equilibrium is not necessarily an optimum, and the existence of multiple equilibria is of the essence in dealing with trade and geography, as stated by characteristic (d): “more than one outcome”. Element (b), “no dormitive properties”, is the categorical imperative of avoiding tautologies, or black boxes that leave the explanandum unexplained.18 Krugman’s favourite example of the tautologies to avoid in the NEG is the practice of asserting that “production clumps together because of agglomeration economies” in terms of invisible externalities, such as information and knowledge spillovers. Element (c), “distance between assumptions and conclusions” is the objective to construct models, in which counterintuitive or other unexpected things can happen in the transmission of impulses, or interaction of variables in general.

All of this should amount to enabling the economist “to answer ‘what if’ questions: if something were different, how would that change the economic outcomes?” With reference to Samuelson’s modelling ethos, Krugman (2011b, 3) contrasts this approach with pre-Samuelsonian institutionalism in American economics, as well as with the current mainstream in economic geography (proper). ‘What if’ “is a kind of question that is almost by definition impossible to answer if your approach emphasizes the uniqueness of each individual case and the specifics of history” (ibidem).

Naturally, the examples that Krugman gives for the application of his modelling rules are all taken from his history of applying the Dixit-Stiglitz model to trade and geography. His methodological reflections are part of a Methodenstreit with the economic geographers (proper), where the NEG’s focus on mathematical tractability is pitched against the emphasis on empirical diversity and particularity. The heat of the controversy can be felt from the following summary of NEG critique by Krugman’s main adversary in the geographers’ camp:

18 “Dormitive properties” refers to the mock examination scene in the final act of Molière’s Imaginary Invalid, where Argan, the candidate, is asked about “the cause and reason why opium makes one sleep” and answers: “The reason is that in opium resides a dormitive virtue, of which it is the nature to stupefy the senses.” To which the chorus responds: “Well, well, well, well has he answered! Worthy, worthy is he to enter into our learned body.”
To geographers, the ‘new economic geography’ being promoted by economists has very little resonance with the theoretical or empirical concerns of contemporary economic geography proper. Rather, it represents a reworking of regional science and urban economics models, precisely the sort of approaches that geographers discarded years ago. The mathematics on which the ‘new geographical economics’ is being built may be sophisticated, but most geographers would view the results as not particularly novel and the empirical applications trivial. (Martin, 1999, 67)

For Martin, the NEG’s “myopic view of ‘theory’” leads to a neglect of geography, by which economic geographers mean “real places”. He concludes that the NEG “represents a case of mistaken identity: it is not that new, and it most certainly is not geography” (ibidem). The keyword here is “realism”, and Krugman’s latest response is a sarcastic observation of the relative success of aggressively unrealistic economists over realistic geographers in the real world of politics:

In a crude sense, mainstream economics is not going away: like it or not, the White House has a council of Economic Advisers, not a Council of Geographical Advisers, the World Bank hires lots of economists and not many geographers, and so on. So if insights from geography are going to have the influence they should, there has to be some kind of rapprochement. (Krugman, 2011b, 2)

In our view, one of the steps required for a rapprochement may actually be a closer adherence to the MIT Programme—paradoxical as that may sound to geographers. As the next section will show, a combination of Krugman’s rule of “listening to the gentiles”, who insist on the diversity and particularity of spatial economies, with a little more of the model-building imperatives (b) and (c) might help to put more space into economics.

5. Elusive Space

The spatial economy is the title of the landmark contribution of Fujita, Krugman and Venables (1999) to the field of New Economic Geography. Krugman and Fujita (2004, 150) claim that they view their work “to an important degree as a continuation, perhaps even a validation, of Isard’s dream of returning space to the core of economics.”

Not surprisingly, Krugman’s core-periphery model resembles the results of von Thünen’s (1826) model of a monocentric economy. However, there is a fundamental difference in the treatment of space. While von Thünen uses a continuous two-dimensional space to set up his concentric rings, Krugman’s model features a

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19 For Isard’s dream see also Fujita (1999).
discrete two-region space. Even though one dimension has been dropped on the way, Krugman’s model yields two additional insights. First, agglomeration is caused not by considerations to locate close to the market alone; it is also influenced by increasing returns to scale. Second, the location of the agglomeration is determined endogenously. While von Thünen takes the market at the centre as exogenously given, the development of the core in Krugman’s model is endogenous. Depending on the level of transport costs, stability of the spatial structure can become an issue. The typical thought experiment is that of falling transport costs, which makes the system move from a stable symmetric equilibrium toward agglomeration in either of the two regions.

This example of integrating an older tradition demonstrates that the interaction among economies of scale, transport costs and market size in the NEG is highly interesting by the standards of mainstream economics. The core model uses the Dixit-Stiglitz approach, which has become conventional in industrial economics, trade theory, growth theory and monetary macroeconomics, in order to produce dynamics of cumulative and circular causation with multiple equilibria. In terms of reducing real-world complexity to few essential variables and economic relations, the NEG core model corresponds to the requirement of a minimalist framework. In a very large literature, it has thus achieved the status of a general theory of the spatial economy. In terms of providing a framework for answering ‘what if’ questions it is increasingly regarded as empirically relevant (cf. Brakman et al., 2009, part II).

However, the claims to analytical generality and empirical relevance of the NEG approach to space can be contested, not only by the standards of “economic geographers proper”, but also by those of the MIT programme. Krugman himself points out repeatedly that new models do not only have benefits, they also have a cost. They always come with blind spots; the challenge is to do away with them by extending the scope or changing the shape of the models. This is how Krugman generally describes his own approach to the exploration of intrasectoral trade and regional divergence, which previously had been restricted by the conventional assumption of constant returns to scale. Yet, the NEG core model too has its blind spots in focal areas. They result from restrictions that may be justified in terms of mathematical tractability, which is the main reason for the prescriptions “dare to be silly” and “simplify, simplify”, but makes the treatment of space rather arbitrary and limited.

It has been pointed out by Neary (2001; 2004, and 2009) that the general validity of the NEG core model is impaired by the use of CES preferences in the (sub-)utility function for manufactured goods (see section 2). This deemphasizes, among other things, the implications of increasing returns to scale, as there is no barrier to market entry and no strategic behaviour. In addition, to make the core-periphery model
and other NEG structures work, Krugman (1991a) and followers have taken recourse to a number of what Fujita and Krugman (2004, 150) proudly name “intellectual cheap tricks”. In the context of dealing with a spatial economy the following are most prominent:

- the Samuelsonian concept of “iceberg meltaways” as expression of transport costs in the manufacturing sector, and trade costs in general (see section 3);
- the assumption of zero transport costs for agricultural goods;
- the ad-hoc migration equation determining the amount of factor mobility taking place in otherwise unspecified periods of time;\(^\text{20}\)
- the “no black hole” condition, by which the “love for variety” parameter must be smaller than spending on manufactures; otherwise, “the forces working toward agglomeration would always prevail, and the economy would tend to collapse into a point”, independently of the level of transport costs (Fujita et al., 1999, 58).

Some of these tricks (such as the migration equation and the “no black hole” condition) carry a flavour of Molière’s “dormitive properties”, and the whole assortment may remind the reader of Voltaire’s quip that incantations will destroy a flock of sheep, if administered with a certain dose of arsenic. The distance between the assumptions and the conclusions derived from the NEG core model is thus considerably shortened, contrary to rule (c). Such tricks may be necessary for the tractability of a model structure that helps to bring light into dark space, like Marshall’s “engine for the discovery of truth”. Moreover, it should be noted that the nature of their subject makes NEG models complex—much more complex than Krugman’s skilful simplifications and metaphors may look to the uninitiated reader. But the tricks should be permissible only for the innovations, i.e. the pioneering models that serve to attract attention to new avenues for research. The follower models should try to do without them, one by one. To some extent, they have done so: positive transport costs for agricultural goods have been integrated (Picard and Zeng, 2005); and the migration equation has been extended to include explicit optimization of forward-looking agents (Baldwin et al., 2003, 54-62). However, there is an increasing dissatisfaction with the “straightjacket” of the NEG core model, still defined by “Dixit-Stiglitz, icebergs, evolution and the computer”, as its results hinge critically on its peculiar assumptions (Behrens and Robert-Nicoud, 2011).

How far has the NEG travelled in exploring market interaction for the determination of trade costs? In dealing with space, the iceberg metaphor for transport costs is unsatisfactory. In the words of

\(^{20}\) Fujita et al. (1999, 62 fn. 2) argue that “these dynamics are equivalent to the ‘replicator dynamics’ routinely used in evolutionary game theory”, and that the core-periphery model “can, if one likes, be regarded as an evolutionary game”. See Matsuyama (1991) for a more critical discussion of the migration equation.
Krugman (1991a, 489), the fraction of each unit of manufactures that arrives in the other region is “an inverse index of the transportation costs . . . the final parameter determining whether regions converge or diverge”. The iceberg trick looks ingenious because it defines transport costs without the complications of an explicit treatment of the transport sector. This is permissible, if transport costs are used only as a parameter for first-hand examinations of stability and other properties of the basic structure. In this sense, Krugman’s original plan was “to let reality fill in the transport cost parameter, and then let the computers do the rest.” In early attempts at getting empirical, simple measures of physical distance (e.g., distances between capitals) or price indices (e.g., differences between CIF and FOB) were considered as sufficient for the parametric exercises. Following rule (c), space was otherwise considered as a neutral entity, since agglomerations were not to be taken as given by comparative advantages that arise from “first nature” geography (see Krugman, 1993b).

Yet, even though Krugman and co-authors asserted eight years later that “[w]e are really interested in all of the costs of doing business over space” (Fujita et al., 1999, 98), NEG modelling stuck for a long time to a peculiar stylization of “reality”, in which space was reduced to the distance between two points, and trade costs were assumed to be symmetric and entirely determined by some measure of physical distance in exponential form. The symmetry assumption may serve to “neutralize” physical geography in the analysis of location decisions. However, it implies that the price of shipping one unit of manufactures to the other region is the same in both regions, even if and when nearly all industry has moved to one region. In a framework that emphasizes the importance of increasing returns to scale for agglomeration, such an assumption looks not only “aggressively unrealistic”, conforming to Krugman’s maxim of “daring to be silly”,21 it looks oddly inconsequent, and shortens the distance between assumptions and conclusions (violating rule c).22

There are further indications of economies of scale in the determination of transport costs. These become more obvious if the notion of “trade costs” is widened to include all costs that are specific to bridging distances between industry locations and markets.23

21 See Jonkeren et al. (2011) for empirical evidence on asymmetric trade costs.
22 Takahashi (2011) introduces asymmetric transport costs. Contrary to his claims, his framework is not a general equilibrium analysis, since he uses a footloose entrepreneur model, where income effects are excluded.
23 Hummels (2007) shows that transport costs have been both falling and rising in the second half of the 20th century. Rietveld and Vickerman (2004) relate price movements in the transport sector to changes in transportation technologies and to an increasing importance of transport-related transaction costs.
The properties of the Krugman iceberg model ... imply that the delivered prices of goods increase exponentially with the distance shipped. On the other hand, all of the available evidence suggests that delivered prices tend to be concave rather than convex with distance. As such, the treatment of geography and space in these types of new economic geography models is very particular, and is based on assumptions which would be regarded as untenable in most other spatial models. (McCann, 2005, 315-16)

Apart from the different ways, in which reality may get in the way of iceberg cost concepts, the arguments above point to further, more immanent objections. The first is a problem of dealing with more than two regions, the second relates to feedbacks from trade and agglomeration to transport costs and trade costs in a wider sense.

So far, most NEG models are confined to the typical two-region setting. As space is more than a line between two discrete points, and the question is whether the results from the two-region case also hold for many regions. This is generally answered in the affirmative by taking recourse to the metaphor of a “racetrack economy” (cf. Fujita et al., 1999, ch.6; Brakman et al., 2009, 171-75). In that economy all regions are lined up like pearls on a string, sequentially located around the circumference of a circle with equal distances between adjacent regions. The distance to all other regions is the shortest route along the circuit, or “the racetrack”. Numerical analysis by simulation helps to identify the number and location of agglomerations in the \( n \)-region setting. There is an interesting contrast with the older location theories of Christaller and Lösch, where equidistance is an outcome of optimization, whereas it is taken as given in multi-regional NEG models. The assumption may help to preserve the neutrality of space and to yield insights about the number and positions of agglomerations. But it sets a symmetry restriction that ignores potential feedbacks from economies of scale on trade costs which may emerge once equidistance is abandoned.

The basic problem underlying these varieties of dealing with space is causality. It cannot be excluded that there is a two-way relationship between the spatial distribution of economic activity and trade costs. The latter should not just be treated as an exogenous parameter for location decisions; they are most likely to have components that vary endogenously with the size and direction of the manufactures exports. Keeping space exogenous by a “transport technology parameter” is as unsatisfactory as exogenous technical progress used to be in growth theory, where the standard model à la Solow yielded many interesting insights, but had a big blind spot concerning the driving mechanism of growth.

A widely used approach to integrating trade flows into the determination of trade costs is the “phi-ness of trade” concept, developed by Head and Ries (2001). It is essentially a trade-to-production ratio...
that indicates the trade intensity between two regions. Its name is derived from the usual specification:

$$\Phi_{ij} = \sqrt{\frac{z_{ij}z_{ji}}{z_{ii}z_{jj}}}$$

where $z_{ij}$ denotes a trade flow, in this case from region $i$ to $j$. Trade flows within the region, such as $z_{ii}$, indicate domestic absorption. The higher the value of $\Phi$ (phi), the lower the trade costs. While the phi-ness of trade may be a useful method to indicate economic integration, it is less useful for the integration of trade costs into the NEG framework. An empirical problem, related to extending the two-region framework of the NEG to multi-region settings, is that the phi-ness indicator will take low values (near autarky) for trade with and among small regions in a big world, even if trade costs are low. There is no significant and stable correlation of phi-ness with trade costs. While this deficiency might be overcome by more sophisticated constructions of the phi-ness indicator, it is harder to eliminate the fundamental problem of excessive endogeneity. Trade costs are derived from trade flows and then inserted into the model in order to determine exactly those trade flows. This could reasonably be done in recursive models with time lags, but we know of no phi-ness-based NEG models that have these properties. Using the phi-ness concept comes thus close to breaking Krugman’s rules of “no dormitive properties” and “distance between assumptions and conclusions”.

In recent years a number of papers have been produced with claims to have endogenized trade costs in models of geographical economics. One example is Duranton and Storper (2008), who show under which conditions a decline in transport costs could lead to a rise in trade costs. However, their framework differs from the standard NEG analysis in that product differentiation is not the base but a possible outcome of the model in terms of different levels of quality. Furthermore, transport costs remain exogenous. As the authors note, the quality production function for “exports is formally equivalent to the standard assumption of iceberg transport costs in NEG” (Duranton and Storper, 2008, 301 fn. 10). A different approach is chosen by Gruber and Marattin (2010). They introduce taxation into a standard NEG model. This makes funds available for investment in infrastructure, which lowers transport costs. These become endogenous to political decisions about the spending of

24 In Christiansen et al. (2010) we discuss this problem in greater detail in an empirical application of the footloose capital model (a specific linearized version of the NEG framework) to the trade between the Baltic and the Nordic countries.
tax revenues, but they are not derived from maximizing behaviour of private agents. Lang (2010) introduces heterogenous transport costs for manufactures to a linear footloose entrepreneur model and describes a regional sorting of firms by transport costs. Again, transport costs are exogenously given and not microfounded.

Yet it may be argued that the NEG has finally, after a long and roundabout passage through different concepts, made a breakthrough towards a proper endogenization of transport costs in terms of Krugman’s rule (a), i.e. “full microfoundations”. Behrens, Gaigné and Thisse (2009) provide a general-equilibrium framework, in which freight rates are not just taken as parametric, but determined by market mechanisms. They model the transport sector explicitly and analyse the interaction of carriers’ pricing strategies with manufacturing firms’ location decisions. An interesting result is that rising degrees of agglomeration lead to increased market power of carriers, which introduces a force of dispersion, or “spreading force”. If (or when) such models can be extended to include other relevant trade costs, and if they succeed in merging with further models that consider endogenous changes in congestion costs, trade costs for agricultural goods etc., the space odyssey of the NEG may come to an end—at least in terms of the model-building rules of the MIT Programme.

6. Conclusion

Returning space to the core of economics is an old dream, as Fujita and Krugman (2004, 150) point out with reference to Isard’s Location and Space Economy (1956). Prior to Isard, Ohlin (1933, vii) described his Interregional and International Trade as an endeavour to contribute toward solving the following problems:

« 1. To build a theory of international trade in harmony with the mutual-interdependence theory of pricing,—the universally accepted price theory of today,—, and thus independent of the classical labor theory of value . . .

2. To demonstrate that the theory of international trade is only a part of a general localization theory, wherein the space aspects of pricing are taken into full account, and to frame certain fundamentals of such a theory as a background for a theory of international trade, wherein the influence of local differences in the supply of factors of production and transportation costs within each country is duly considered. In this field collaboration between economists and economic geographers is urgently needed. The fact that the latter have received so little help and stimulus from the former seems chiefly due to the scanty attention economic theory has given to localization problems.

3. To analyse the domestic and international movements of the factors of production, particularly in their relation to commodity movements. »
With the advent of the New Economic Geography, Ohlin’s dream appears to have come true in all three of its parts.25 Chronologically, the development has run the other way: Following Krugman’s research history (as we have done in this paper), localization theory (à la NEG) uses the theory of international trade (à la NTT) as a conceptual background, rather than vice versa. Yet, Ohlin’s objectives, which in the 1930s could not be fully met for a lack of modelling techniques to combine increasing returns to scale with general equilibrium analysis, seem now to be fulfilled by the New Economic Geography, pioneered by Krugman (1991a). It provides a general-equilibrium analysis of trade, space aspects are taken into account, and movements of factors of production are considered, particularly in their relation to goods trade. Finally, mainstream economic theory gives fuller attention to localization problems, and NTT, NNTT and NEG have become acronyms for top-growth areas in terms of research efforts and literature output.

But are the “space aspects of pricing” really “taken into full account”? Many economic geographers (proper) still beg to disagree (see Martin (1999), Mäki and Marchionni (2011)). Even by the research standards of the NEG itself, here taken as identical with the MIT Programme, there is still a lot of work to be done (see also Behrens and Robert-Nicoud, 2011). With a view to the rigidities of the current structure of the NEG core model, the question is whether it can be done.

References


25 Ohlin (1933, vii) actually had a fourth objective: “4. To describe the mechanism of international trade variations and international capital movements under conditions of fixed foreign exchanges [...] This analysis will demonstrate that, among other things, (a) changes in the total buying power of each country are an essential part of such a mechanism, and (b) the fundamental problems of foreign exchange are integral parts of a theory of international trade.” As the prevailing dichotomy of the fields of “International Trade” and “International Macro and Finance” shows, this objective has not yet been met. For the record, it should be noted, though, that Krugman has done a lot of research on the International Macro side as well.


