

Regional convergence in Europe: Theory and empirical evidence

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Agglomeration and regional imbalance: Why? And is it bad?



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1. Introduction

In a world of globalisation, it is tempting to foresee the “death of distance” and, once the impediments to mobility have declined sufficiently, to wait for the predictions of the neo-classical theory of factor mobility to materialise. According to this theory, production factors respond to market disequilibrium by moving from regions in which they are abundant toward regions in which they are scarce. In equilibrium the capital-labour ratio is equal across regions, thus implying that both factors receive the same return in each region. In other words, the mobility of production factors would guarantee the equalisation of their returns across regions. As a consequence, there would be no reasons anymore to worry about where activities locate.

Yet, in the *First Report on Economic and Social Cohesion*, the European Commission observes that “economic activity is strongly concentrated in the most urbanised areas of the Community. Regions with more than 500 inhabitants per square kilometres account for only 4% of the land area of the Union but for more than half the population. This implies that between two-thirds and three-quarters of the EU's total wealth creation occurs in urban areas” (p.24). For the European Commission (1996, p.13), this is clearly a very bad state of affairs: “Imbalances do not just imply a poorer quality of life for the most disadvantaged regions and the lack of life-chances open to their citizens, but indicate an under-utilisation of human potential and the failure to take advantage of economic opportunities which could benefit the Union as a whole.” And, indeed, most regional policy debates in industrialised countries implicitly assume that there is too much spatial concentration in economic activity. Regional planners and analysts point to the inability of the market to organise the space-economy in a rational way and forcefully argue that public intervention is needed, but they fail to explain the nature of this market failure. This is precisely what I want to investigate in Section 2.

Using a simple model of monopolistic competition, Section 3 then illustrates what seems to be the main spatial feature of modern economies, namely the emergence of a *putty-clay economic geography*. More precisely, the recent fall in trade costs seems to allow for a great deal of flexibility on where particular activities can locate, but once spatial differences develop, locations tend to become quite rigid. Hence, regions that were once similar may end up having very different production structures.

In the subsequent section, I discuss a fairly neglected fact: regions *per se* do not exist and their size and shape critically depend on the criteria used to determine their borders. When the drawing of regional borders endows some entities with large economic agglomerations (such as metropolises or urban networks), the corresponding regions are likely to grow faster than others, thus providing a possible explanation why contiguous regions may exhibit different patterns of development. In Section 5, I suggest a few guiding principles for what could be a better institutional regional system at the level of the European Union. Some remarks conclude in Section 6.

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2. Why is there a regional question?

2.1 The breakdown of the price mechanism in a spatial economy

As an economist, I find it natural to ask the question: *why would the market be unable to cope with location?* In order to answer this question, I must turn to general equilibrium analysis because this setting provides us with the benchmark that economists use to evaluate the market. The most elegant and general model of a market economy is the one developed by Kenneth Arrow and Gérard Debreu. It can be briefly described as follows. The economy is formed by agents (firms and households) and by commodities (goods and services). A firm is characterised by a set of production plans, each production plan describing a possible input-output relation. A household is identified by a relation of preference, by a bundle of initial resources and by shares in the firms' profits. Essentially, when both consumers' preferences and firms' technologies are convex, there exist a price system (one price per commodity), a production plan for each firm and a consumption bundle for each household that satisfy the following conditions: at the prevailing prices (i) supply equals demand for each commodity; (ii) each firm maximises its profit subject to its production set; and (iii) each household maximises her utility under her budget constraint defined by the value of her initial endowment and her shares in firms' profits. In other words, all markets clear while each agent chooses her most preferred action at the equilibrium prices.

In the Arrow-Debreu world, a commodity is defined not only by its physical characteristics, but also by the place where it is available. The same good traded at different places is treated, therefore, as a different commodity. Within this framework, choosing a location is part of choosing commodities. Hence, the Arrow-Debreu model integrates spatial interdependence of markets into general equilibrium in the same way as other forms of interdependence, thus suggesting that there is no regional question.

The inability of the competitive paradigm to deal with agglomeration, shown more than 20 years ago, seems to be ignored by a majority of the economics profession.

Unfortunately, however, things are not that simple. Although the inability of the competitive paradigm to deal with the process of agglomeration has been shown more than 20 years, it still seems to be ignored by a vast majority of the economics profession. Yet, Starrett (1978) has obtained a very general, although intriguing, result.

In order to illustrate his result, I consider the extreme case of a *homogeneous* space with a finite number of locations. By a homogeneous space, I mean the following: (i) the production set of a firm is the same in all locations; (ii) consumers' preferences are the same at all locations; and (iii) the natural resources are equally distributed across locations. Clearly, these assumptions are highly unrealistic. However, they are made in order to control for the impact that "nature" may have on the distribution of economic activity. Indeed, since our purpose is to understand why there exist large economic agglomerations, we are interested in finding socio-economic mechanisms that explain such agglomerations without appealing to physical attributes of locations. For the rest, Starrett describes the economy following the lines of the competitive framework as described in the foregoing.

Without making any convexity assumptions regarding preferences or technologies, Starrett shows the following result:

The Spatial Impossibility Theorem. *If space is homogeneous and transport is costly, then there is no competitive equilibrium involving transportation.*

What does it mean? At least two things. First, if economic activities are perfectly divisible, then a competitive equilibrium exists and it is such that each location operates as an autarchy. Typically, each local economy is identical to the others in that they have the same relative prices and the same production structure (backyard capitalism). This is hardly a surprising outcome since, by assumption, there is no reason for the economic agents to distinguish among locations and since each activity can operate at an arbitrarily small level. Agents thus succeed in reducing transport costs at their absolute minimum.

Second, if economic activities are not perfectly divisible, the transport of some goods between some places is unavoidable and, in this case, the above result tells us that no competitive equilibrium exists. One must then wonder about the reasons for such a market breakdown. In order to develop some insights, it is convenient to consider a 2-firm-2 location example in which (i) transportation is costly, (ii) firms must trade with one another, (iii) each firm can be set up in one place only, and (iv) firms' demand for land is somewhat but not perfectly elastic.

Let me now discuss the meaning of each of these assumptions for the non-existence of a competitive equilibrium that involves transportation. Clearly, such an equilibrium exists if firms can ship goods at zero transport costs or if firms can split their activities between the two locations and trade with each other within each location. In either of these cases, transportation vanishes from the economy, which becomes dimensionless. This is not what we are interested in so that the first three assumptions may be regarded as being rather undemanding for our purpose.

Consider now assumption (iv). If firms can substitute between land and other inputs such as capital, for example by building high-density structures, they can economise on the use of land while locating at the same place. In the realistic case where firms' demand for land has a positive and finite elasticity, both firms can locate together at location A. Hence, the land rent there is positive ($R_A > 0$) while the rent at the vacant location B is zero. If the land rent R_A is not too high relative to transport costs, this no-transportation configuration is an equilibrium. On the other hand, if R_A is very high, then at least one firm (say 2) can increase its profit by setting up at location B where $R_B = 0$ (recall that, at a competitive equilibrium, prices are given to economic agents and uninfluenced by their action), even though this entails some positive transportation cost between locations A and B. However, this new configuration cannot be an equilibrium. Since the price of a good is always lower at the place it is produced, firm 1 at location A finds the price of its output higher and the price of its input (excluding land) lower at location B, while firm 2 at location B finds the price of its output higher and the price of its input (neglecting land) lower at location A. Therefore, if land rents were the same at two locations, both firms would like to move, while a differential in the two land rents can at best prevent only one firm from moving. In other words, there exists no competitive rent system (1).

Thus, what creates problem in decentralising decisions across different locations is the fact that *economic agents may want to be separate because each one must choose to use a positive amount of land that cannot be made arbitrarily small*. When agents trade together, this physical separation implies that there is a tension between the incentive to reduce transport costs and the need to consume land. This tension cannot be solved at a competitive equilibrium because, space being homogeneous, *an agent's most preferred location depends only upon the locations chosen by the*

1) The reader may find the competitive assumption unrealistic in the case of two firms. As shown by the Spatial Impossibility Theorem, the number of firms can be made large without changing the conclusions.

others (2). Such a choice context has a “strategic” flavour that makes it difficult to be handled by the market.

Either space is heterogeneous (as in the neo-classical theory of international trade), or production and consumption externalities exist (as in urban economics) or markets are imperfect (as in economic geography).

Consequently, if we want to understand something about the spatial distribution of economic activities and, in particular, the formation of major economic agglomerations, the Spatial Impossibility Theorem tells us that we must assume either that *space is heterogeneous* (as in the neo-classical theory of international trade), or that production and consumption *externalities* exist and are many (as in urban economics) or that *markets are imperfectly competitive* (as in economic geography). The implications of the research strategy selected are important. For example, if we choose to rely on the heterogeneity of space, the market outcome is socially optimal. By contrast, if we choose one of the other two approaches, the market outcome is likely to be socially undesirable, thus pointing to the need for some public policy. Although it is obvious that space is heterogeneous, this seems weak as the main explanation for the existence of large metropolises as well as for the persistence of substantial regional income inequalities. When, then, should we distinguish between the other two possible solutions?

2.2 Externalities in the space-economy

For many years, the concept of externality has been used to describe a great deal of situations and it is important to have a clear perception of what they are. Following Scitovsky (1954), I consider two types of externalities: “technological externalities” (also called spillovers) and “pecuniary externalities”. The former deals with the effects of non-market interactions that are realised through processes directly affecting the utility of an individual or the production set of a firm. By contrast, the latter refers to the benefits of economic interactions that take place through usual market mechanisms via the mediation of prices. Technological externalities imply that prices do not reflect the social values of goods and services whereas, for the same reason, pecuniary externalities are relevant when markets are imperfectly competitive (even in the absence of technological externalities).

According to Anas *et al.*, (1998), cities are replete with technological externalities. The same would hold in local production systems (Pyke *et al.*, 1990). In particular, communication externalities remain very critical in various fields such as management, administration, research, and finance. Knowledge, ideas and, above all, tacit information, can be considered as impure public goods that generate spillover effects from one firm or institution to another. Consequently, if economic agents possess different pieces of information, pooling them through informal communication channels can benefit everyone, hence the importance of proximity (Glaeser, 1999). This may be explained by the fact that the transmission of ideas that are not yet formalised cannot take place in a totally standardised way. The initial steps in the development of a new technology, say, require repeated contacts between the agents involved in order to establish a common language, interpret individualised pieces of information, and bring them into the operational state. Such a process is facilitated by spatial proximity. Even in this age of telecommunications “knowledge crosses corridors and streets more easily than oceans and continents” (Feldman, 1994, p.2). Thus, at the local level, it seems reasonable to appeal to technological externalities to understand the formation of clusters.

However, at the interregional level, it makes sense to assume that market imperfections are more central to explain what is going on. This is not to deny the reality of spillovers and congestion effects,

2) It should be kept in mind that the essence of the theory of competitive markets is that agents make their production or consumption decisions on the basis of the price system alone. Thus, adding considerations such as firm 1 in A recognises that if it locates in B firm 2 will also change its decision, takes us away from that theory.

but I believe that they have little to do with the imbalance between large regions. At this spatial scale, the reasons for over- or under-concentration have more to do with linkages between firms and consumers-workers, through product and labour markets. In particular, pecuniary externalities become critical because firms and individuals do not account for the impact that their migration decisions have on the well-being of those who stay put as well as on those who live in the region of destination since prices do not reflect the exact impact of agents' decisions. Consequently, when migration flows are substantial, one may expect the spatial economy to be inefficiently organised.

According to the spatial scale retained, each type of externality may help understand the spatial agglomeration of economic activities. Both will be illustrated in Section 3.

2.3 Co-ordination failure in a spatial economy

Given the implications of the Spatial Impossibility Theorem, we discover another fundamental reason that could explain why there is a regional question: *the incompleteness of spatial markets*. Indeed, an underdeveloped region has typically a small number of markets, which deprives firms and workers of the opportunity to signal demand and supply for jobs and intermediate services (Matsuyama and Takahashi, 1998). For the first welfare theorem to hold, that is, for the market outcome to be efficient, firms and households must be able to make their production and consumption decisions on the basis of publicly posted prices not only for the active markets, but also for all potential markets. Since an economic good is differentiated by its location, this means that firms and households must know a very large number of prices, one price being associated with each good at each location (neglecting for simplicity land and transport prices). Stated differently, in order to figure out whether or not an agent wants to buy or sell a good in a given location, she must know the price of this good even though nobody chooses to exchange the good at this particular location. It seems hard to believe that something like that could happen since the price of a good is not quoted before a market is open.

Yet, we know from Samuelson (1952) that there exists a relationship between the equilibrium prices of the same good at different locations that allows one to obviate this difficulty. The equilibrium price at a location in which the good is not produced is equal to the minimum of the marginal production cost (over the places where the good is produced) plus the corresponding transport cost. Once firms and consumers know the matrix of transport costs between all location pairs, they are able to infer from the prices where the good is actually produced, the equilibrium prices at all the other places. It is precisely because these potential prices are either too high or too low that the corresponding good is not traded at such places.

On the other hand, once markets are imperfect, only the prices quoted at the active locations are available. Economic agents are no longer able to apply the procedure described above because prices now vary with the decisions they make. For an economic agent to be able to evaluate whether or not a void location is a desirable alternative, she must be able to anticipate what will be the actions taken there by other agents. This is already enough to make the informational requirements gigantic. This is not the end of the story, however. The price level of a good that prevails at a location varies with the agents transacting there. Hence, there are likely to exist different price levels that depend on the parties involved in opening a new marketplace. We thus encounter an additional difficulty: potentially acting agents must co-ordinate on a single profile of actions for these actions to

The underdevelopment of a region may result from a lack of co-ordination between the agents who could be potentially involved in the opening of new markets.

be consistent. To sum-up, when we account for the fact that markets are imperfectly competitive, it appears that the underdevelopment of a region may result from the lack of co-ordination between the agents who could be potentially involved in the opening of new markets in this region.

Such a co-ordination problem becomes especially acute once it is recognised that the activity level of a region in a developed economy depends, at least to a large extent, on the availability of a wide array of service-firms providing untradables. As the profitability of these firms depends, in turn, on the size of the final sector (Abdel-Rahman and Fujita, 1990), the lack of information regarding the prices of intermediate goods in a lagging region may well be sufficient to prevent firms operating in the final (exporting) sector from locating there.

If the agglomeration of economic activity within a few regions appears to be inefficient, then co-ordinating *all* the decisions needed to open the relevant new markets in some lagging regions is both profitable and socially desirable. However, the information that such an operation requires is tantamount, due to the very large number of agents involved, and seems out of reach from any decision maker.

3. Why is there agglomeration, and is it bad?

In this section, two processes of agglomeration are discussed. In the first, I focus on the formation of clusters of firms in an economy whose markets are supposed to be unaffected by clusters' size, presumably because they are small relative to the rest of the economy (Section 3.1). In the second, I will shift to general equilibrium and will assume that both workers and firms are mobile, thus generating market effects at the level of the whole economy (Section 3.2). In both settings, consumers and firms can locate in one region only, which stands for the fundamental indivisibility that appears at the level of the person or of the plant. Also common to both settings is the fact that the emerging locational configuration is the outcome of the interplay between centrifugal and centripetal forces.

The most typical feature of the analysis is that the two processes are self-reinforcing. In particular, we will see that, once transport costs (broadly defined in order to include all the impediments to trade) have sufficiently decreased, regions that were initially similar end up with very contrasted production patterns. Hence, divergence instead of convergence should be expected as integration develops. Yet, as will be discussed in the concluding section, further decreases in transport costs may well foster the dispersion of some activities due to factor price differentials.

3.1 The formation of clusters

In the urban economics literature, it is common to focus on what is called *localisation economies*, that is, externalities affecting all the firms belonging to the same sector and located in the area within which these externalities produce their effects (Henderson, 1988). As discussed in the foregoing, the key element in the transmission of knowledge and ideas is given by the various institutions that foster personal contacts. As observed by Saxenian (1994), the institutional and economic environment influencing the collective process of learning within a given area is probably as important as the microeconomic linkages between firms and other economic agents. They are probably the main local factors that are at the origin of localisation economies.

The formation and size of clusters depend on the relative strength of three distinct forces: the magnitude of localisation economies, the intensity of competition, and the level of transport costs.

It is well known from industrial organisation that geographical proximity renders competition on the product market fiercer, thus inducing firms to locate far apart (d'Aspremont *et al.*, 1979). This implies that firms' decisions to congregate or to separate depends on the trade-off between localisation economies and price competition. Furthermore, even though localisation economies lead to a reduction in a firm's cost, the same holds for its co-located competitors, thus intensifying the process of competition within the cluster and making the final outcome *a priori* unclear.

Even if price competition is relaxed through product differentiation, it is still true that firms want to be separate when transport costs are high. Since the emergence of industrial clusters is generally confined to small geographical areas, it is reasonable to assume that the spatial distribution of demand is unaffected by firms' locational behaviour. Therefore, the cost reduction associated with the agglomeration may be more than offset by the fall in exports. Consequently, transport costs have to be sufficiently low for firms to gather. Collecting all these arguments together, we may conclude that *firms supplying differentiated products must be able to serve almost equally well all markets (globalisation) in order to enjoy the local advantages associated with the formation of a cluster (localisation)*.

This argument can be made more precise, using the simple model discussed in Box 1 (3). This shows that the equilibrium states of the economy depend upon a factor, X , that combines into one variable the effects of transportation costs and the intensity of localisation economies. X also depends upon the total size of the market, the slope of the demand curve, and the substitutability between varieties.

Whether the economy has unique stable equilibrium that involves identical clusters, asymmetric clusters, or a single cluster in which all firms are agglomerated depends upon the value of this aggregate factor. The possible equilibrium patterns are displayed in Figure 1 where X is represented by the horizontal axis. The vertical axis shows the difference between the number of firms in each of two regions (N_A firms in region A, and N_B firms in region B). A dispersed equilibrium is unique (the solid line) when $X \leq 0$ so that there is "convergence". However, once X becomes positive, two more equilibria emerge (again the solid lines) and the story changes. These two equilibria involve a large and a small cluster (up to a permutation); they are stable while the dispersed equilibrium represented by the dotted line is now unstable. Once the value $X = 1$ is reached, all firms are concentrated within the large cluster whereas the small one vanishes: there is "divergence". Such a pattern provides a very neat example of what I meant by a putty-clay geography: the large cluster may equally arise in A or B but, once this has occurred, the corresponding region accommodates more and more firms.

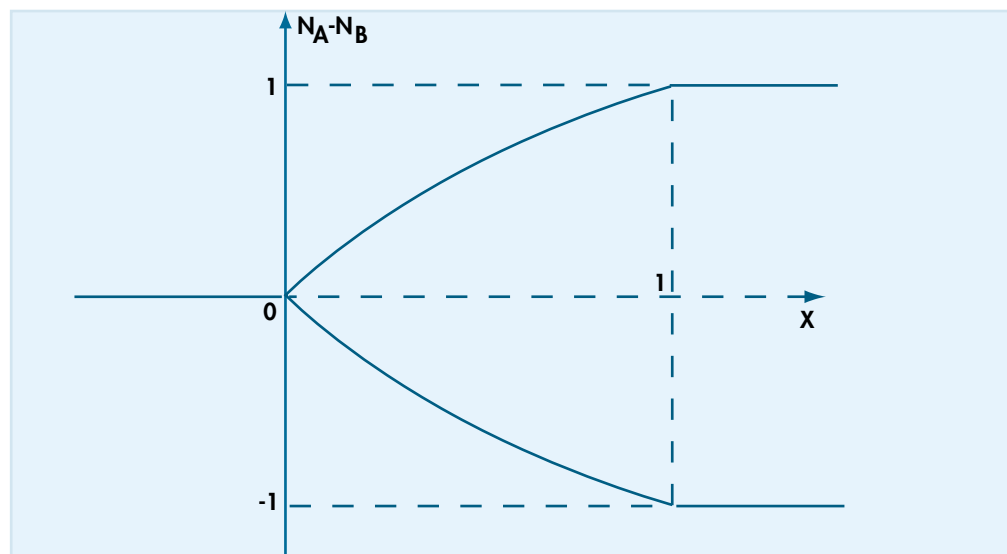
Low transport costs are likely to drive the economy towards more agglomeration because firms do not fear losing distant markets.

Despite the symmetry of the economy, *regions tend to nest clusters of different sizes* when there are localisation economies (4). Moreover, *a decrease in transport cost leads to more asymmetry between the clusters* (i.e. X increases). Low transport costs are likely to drive the economy towards more agglomeration in one region because firms do not fear the prospect of losing their business on distant markets. Second, we see that *more product differentiation induces more firms to locate within the large cluster* (again X increases). This is because product differentiation allows firms to relax price competition, thus leading them to exploit more the benefits associated with the presence of localisation economies. What makes these two properties relevant for us is the fact that transport costs keep decreasing whereas products become more and more differentiated. Therefore, we can safely conclude that these two effects combine to generate more agglomeration. In the limit, a single cluster may involve all firms.

3) For more details, see Belleflamme *et al.*, (2000).

4) Indeed, when $\theta = 0$ the equilibrium always involves two identical clusters since X is always negative.

Figure 1. The emergence of asymmetric clusters



Finally, as the desirability of the differentiated product rises, the degree of asymmetry between the two clusters grows. This occurs because the relative impact of localisation economies rises with the market size. Consequently, economic growth would go hand in hand with a more agglomerated pattern of production.

Is such a concentration a waste of resources? In order to answer this question, I assume that a benevolent planner is able to impose marginal cost pricing as well as to choose firms' locations that maximise social welfare. It can then be shown that the efficient solution displays a pattern similar to that arising when firms are free to choose prices and locations at the market equilibrium. More surprising, perhaps, is the fact that the *large cluster never involves too many firms in equilibrium*: the planner wants to set up more asymmetric clusters than what arises at the market solution. This result requires some explanation. At the efficient solution, prices are set at the lowest admissible level and locations are chosen so as to maximise the social benefits of agglomeration net of transport costs. By contrast, at the market equilibrium, firms maximise their own profits. In doing so, they take advantage of their spatial separation in order to relax competition, thus making higher profits. These two effects combine to generate the above-mentioned discrepancy between the market and efficient outcomes. More generally, economic agents worry only about their role as "receivers", neglecting the fact that they are also "transmitters" to the others, in the collective process leading to the upsurge of localisation economies. This provides a strong argument to support the idea that clusters are not too big from the efficiency point of view.

Unless dispersion corresponds to both the equilibrium and the optimum, the difference between regional surpluses generates a conflict between regions about firms' locations. Indeed, the region with the larger cluster benefits from larger localisation economies, and thus lower prices, as well as from lower transportation costs on its imports. This occurs because the planner focuses only upon global efficiency and not on interregional equity. This makes sense when lump sum transfers compensating the consumers of the less industrialised region are available. However, *when such redistributive instruments are not available, a trade-off between global efficiency and interregional equity arises.*

Box 1. The formation of clusters

Consider an economy with a large number of firms producing each a differentiated variety.* Firms decide, first, to locate in either of two possible regions (say A and B) in which clusters are nested and, then, compete in prices. In order to focus on the impact of localisation economies, it is assumed that both regions A and B are characterised by the same market conditions. In each region, firms' demand functions are generated by a representative consumer who has a utility function quadratic in the varieties of a differentiated product and linear in a homogeneous product. This utility function exhibits love for variety, a feature that seems to characterise consumers in modern economies.

The demand function for firm i is linear and given by:

$$(1) \quad q(i) = a - b p(i) + c \int_0^1 [p(j) - p(i)] dj$$

where the variables $p(j)$ stand for the competitors' prices, whereas a expresses the intensity of preferences for the differentiated product and c the substitutability between varieties (the higher c , the closer substitutes the varieties). This demand system has the intuitively appealing property that a firm pricing above (below) the average market price has less (more) outlets than many of its competitors. However, the impact of such a price gap decreases as varieties become more differentiated because each firm increases its market power.

When firm i produces in region $r = A, B$, its marginal cost $k_r(N_r)$ decreases with the number of firms N_r located in r :

$$(2) \quad k_r(N_r) \equiv k - \theta \cdot N_r$$

where k is a constant that stands for the marginal cost prevailing in the absence of agglomeration and θ is a parameter that measures the intensity of the localisation economies.

In selecting its price, each firm neglects its impact on the market but is aware that the market as a whole has a non-negligible impact on its behaviour through the average market price. This provides a setting in which individual firms are not competitive (in the classic economic sense of having infinite demand elasticity) but, at the same time, they have no strategic interactions with one another. In other words, there is monopolistic competition.

A spatial equilibrium is such that no firm can earn a higher profit by changing location. This arises at an interior point such as $0 < N_A < 1$ when the profit differential $\Delta\pi(N_A, N_B)$ between the two regions equals zero. However, an equilibrium may also arise when all firms agglomerate in region A (or in region B) provided that the profit differential evaluated at the corresponding agglomeration is nonpositive (nonnegative) so that no firm has an incentive to leave that cluster. Thus, we may observe two identical clusters (full dispersion), two asymmetric clusters, or a single cluster (agglomeration).

The profit differential can be shown to be given by:

$$(3) \quad \Delta\pi(N_A, N_B) = -C_1(N_A - N_B) [(N_A - N_B)^2 - X]$$

where C_1 is a positive constant whereas X depends on the basic parameters of the economy:

$$(4) \quad X \equiv \frac{[4a - 2b(2k + t - \theta)] - ct^2}{c\theta^2}$$

t being the unit transport cost between the two regions.

This implies that full dispersion, in which the number of firms is the same in the two clusters, is always an equilibrium, as suggested by the neo-classical approach. However, this equilibrium becomes unstable when other equilibria emerge as solutions to the quadratic equation $(N_A - N_B)^2 - X = 0$, that is, when the parameters of the economy are such that X is positive. More precisely, it can be shown that the economy has a unique stable equilibrium that involves: (i) identical clusters if and only if $X \leq 0$; (ii) asymmetric clusters if and only if $0 < X < 1$; (iii) a single cluster in which all firms are agglomerated if and only if $1 \leq X$.

*Formally, the set of firms is described by the interval $[0, 1]$.

3.2 The core-periphery structure

The interregional economy is replete with *pecuniary externalities*. For example, when some workers choose to move away from their region, they are likely to affect both the labour and product markets in various ways. The result will be a change in the well-being of those who stay put. Moreover, the moving workers do not account either for the impact of their decision on the workers and firms located in the region of destination. Still, their moves will increase the level of demand inside this region, thus making the place more attractive to firms. They will also depress the local labour market so that, everything else being equal, the local wage is affected negatively. In sum, these various changes may increase or decrease the attractiveness of the destination region for outside workers and firms. Such pecuniary externalities are especially relevant in the context of imperfectly competitive markets because prices do not perfectly reflect the social values of individual decisions. They are also better studied within a general equilibrium framework in order to account for the interactions between the product and labour markets.

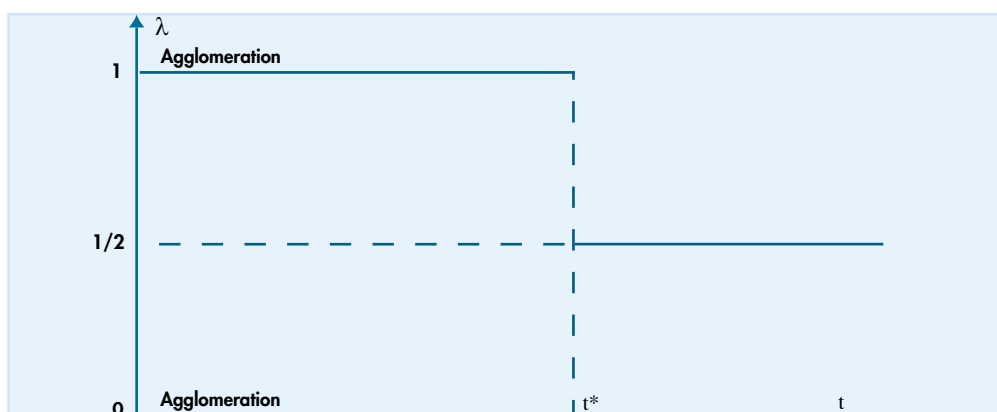
At first sight, this seems to be a formidable task. Yet, as shown by Krugman (1991), several of these various effects can be combined and studied within a simple enough general equilibrium model of monopolistic competition, which has come to be known as the *core-periphery model*. I present here some of the main conclusions of this model, using an alternative framework developed by Ottaviano *et al.*, (1999), which involves downward-sloping linear demands and a linear transport cost as in Section 3.1.

The intuition that underlies the agglomeration process is simple. The spatial immobility of a group of workers is a centrifugal force because they consume all types of goods. The centripetal force is less straightforward and finds its origin in a demand effect generated by love for variety. If a larger number of firms supplying a differentiated good are located in a region, the number of regional varieties is greater. In addition, the local price index is lower there than in the other region because local competition is fiercer. Everything else being equal, these two effects combine to make this region more attractive, thus inducing migration. The resulting increase in the number of consumers creates a larger local demand for the differentiated product, which in turn leads more firms to locate there. This implies the availability of even more varieties supplied at even lower prices in the region in question, so that the process keeps going on.

In order to figure out how this works, we add a new sector to the model developed before. This is shown in Box 2. This analysis shows that *agglomeration occurs when transport costs pass fall below some threshold level* (denoted by τ^* in the model). Agglomeration rises because agents (firms and workers)

belonging to the modern sector are able to benefit from the exploitation of increasing returns within a single region without losing much sales in the peripheral region. This is shown in Figure 2. The horizontal axis shows the value of t , while the vertical axis gives the fraction of firms in the modern sector that are located in one of the two regions. The solid lines in the figure depict the stable equilibria.

Figure 2. The transition toward a core-periphery structure



When increasing returns are stronger, the threshold transportation costs at which this occurs (t^*) rises because starting the production of a variety requires more workers. Hence, agglomeration is more likely, the stronger are the increasing returns at the firm's level. In addition, this threshold also increases with product differentiation. In other words, more product differentiation fosters agglomeration because firms fear less the negative impact of competition.

Interestingly, the market provides excessive agglomeration only for intermediate values of the transport costs.

To which extent is such an agglomeration efficient? Considering again a benevolent planner who maximises total welfare, it appears to be efficient to have agglomeration once (i) transport costs are low, (ii) increasing returns are strong and/or (iii) the output is sufficiently differentiated. Hence, the optimum displays a pattern similar to that of the market equilibrium. This implies that there is a threshold value t° below (above) which optimality entails agglomeration (dispersion).

Interestingly, it can be shown that t° is such that $t^\circ < t^*$. Such a discrepancy may be explained as follows. In the first place, the individual demand elasticity is much lower at the optimum (marginal cost pricing) than at the equilibrium (market equilibrium pricing), so that regional price indices are less sensitive to a decrease in t . The fall in transport costs must therefore be sufficiently large to make the agglomeration of workers socially desirable. In the second, workers do not internalise the negative external effects they impose on the workers who stay behind. However, the magnitude of these effects tends to decline as transport costs decrease by a sufficiently large amount. Hence, for agglomeration to be socially efficient, transport costs must be sufficiently low for the home market effect to be strong enough.

When transport costs are low ($t < t^\circ$) or high ($t > t^*$), no regional policy is required from the efficiency point of view, although equity considerations might justify such a policy when agglomeration arises. On the contrary, *for intermediate values of the transport costs ($t^\circ < t < t^*$), the market provides excessive agglomeration*, thus justifying the need for an active regional policy in order to foster dispersion on both the efficiency and equity grounds.

Box 2. The core-periphery in equilibrium

The model of Box 1 can be extended by having two factors (e.g., unskilled and skilled workers), denoted L and H . Factor L is evenly distributed between regions A and B and is spatially immobile. Factor H is mobile and λ denotes its share in region A .

There are two goods in the economy. The first good is homogeneous and is produced in the traditional sector, using factor L as the only input under constant returns to scale and perfect competition. In this sector, technology requires one unit of factor L in order to produce one unit of output. The good can be traded at zero cost between the two regions. In the traditional sector, equilibrium wages are therefore equal to one in both regions. The second good is a differentiated product supplied by a large number of firms belonging to the modern sector. These firms use H as the only input under increasing returns to scale and imperfect competition. In this sector, technology requires f units of factor H in order to produce any amount of a variety.

All consumers are endowed with preferences that are given by a utility identical to the one used in Box 1. Each variety can be traded at a positive cost of t units of the homogeneous good for each unit transported from one region to the other.

Labour market clearing implies that the number of workers in each region is just sufficient to allow the local firms in the modern sector to operate:

$$(1) \quad N_A = \lambda H/f \quad \text{and} \quad N_B = (1-\lambda)H/f$$

In this sector, the equilibrium wages corresponding to the above equation are determined by a bidding process between firms for labour, which ends when no firm can earn a strictly positive profit at the equilibrium market prices. In other words, all operating profits are absorbed by the wage bills. Firms and workers move together so that it is sufficient to focus on workers' migration. The distribution $(\lambda, 1-\lambda)$ is a spatial equilibrium when no worker may get a higher utility level by changing location. It arises at an interior solution $0 < \lambda < 1$ when the utility differential $\Delta V(\lambda)$ is zero, or at a corner $\lambda = 0$ ($\lambda = 1$) when the utility differential at the corresponding point is nonpositive (nonnegative).

Evaluating consumers' utility at the equilibrium prices and wages, we obtain the following regional utility differential:

$$(2) \quad \Delta V(\lambda) = C_2 (t^* - t) (\lambda - 1/2)$$

where C_2 is a positive constant and $t^* > 0$ when there are increasing returns ($f > 0$). It follows immediately from this expression that full dispersion ($\lambda = 1/2$) is always an equilibrium (as in Section 3.1). For $\lambda \neq 1/2$, C_2 being positive and the above equation linear in λ , the utility differential has always the same sign as $\lambda - 1/2$ if and only if $t < t^*$; otherwise it has the opposite sign. Hence, for large transport costs ($t > t^*$), it is readily verified that the symmetric configuration is the only stable equilibrium. In contrast, when $t < t^*$, this equilibrium becomes unstable and workers agglomerate in region A (B) if the initial fraction of workers residing in this region exceeds $1/2$.

The agglomeration processes exhibit a “chaotic” behaviour that explains why it is so hard to make predictions about regional development.

3.3 Some tentative conclusions

There are striking analogies between the general trends pushing toward agglomeration in the two settings discussed in 3.1 and 3.2. In both cases, the nature of the process of agglomeration is similar, even though the former model involves partial equilibrium and the latter general equilibrium. In addition, we have seen that agglomeration processes exhibit a “chaotic” behaviour that could well explain why it is so hard to make relevant predictions about regional development.

Among the critical parameters, it appears that the current fall in the various components defining transport costs is likely to play a significant role in shaping modern space-economies by fostering more agglomeration. Similarly, a higher degree of product differentiation favours more geographical concentration (5).

By contrast, the conclusions in terms of welfare are different. On the one hand, when the process of interaction generating technological externalities goes both ways (as in Section 3.1), the equilibrium distribution of agents turns out to be less concentrated than the optimal distribution. On the other, when pecuniary externalities are at work (as in Section 3.2), it is reasonable to believe that there exists a domain of transport cost values for which there is too much agglomeration. Hence, if clusters might well be too small, there might be too much agglomeration at the macro-spatial level. Among other things, this implies that *different agglomeration mechanisms acting at different spatial scales may lead to different conclusions in terms of efficiency*. This invites us to say that there is no general presumption regarding the direction in which governments should move in their regional policies; instead, any policy recommendation should rest on a detailed analysis of the main agglomeration forces at work.

Yet, we have seen that co-ordination failure leaves scope for an active regional policy. However, governments often lack the relevant information and are influenced by local lobbies with vested interests. What is needed is a combination involving private agents and the public sector at the local level. In this perspective, the rapid growth of a land development industry in the United States or in South East Asia is worth noting. It reveals that private/public developers may succeed in correcting inefficiencies through the co-ordination of residential location choices within small areas. Together with housing or offices, developers also provide different public goods (Henderson and Mitra, 1996). It is reasonable to believe that similar operations could be undertaken in the case of industrial parks supplying specific technological infrastructure.

Technological infrastructure generally takes the form of a local network of specialised providers of technological services, characterised by economies of scope (Justman and Teubal, 1995). These firms provide technological services to small and medium firms in low and mid-tech industries. These might include: product design services; identification, screening and testing of new production technologies; quality control and application of international standards; solution of ecological problems facing firms in a particular sector or region; and so on. Stated differently, the purpose is to create on a lower scale the diversified advantages that a large metropolis naturally offers to entering firms.

5) It is worth pointing out that the agglomeration forces discussed here are also encountered in many other models in which they generate similar trends (Fujita and Thisse, 1996).

Even though a case-by-case approach can barely be avoided, I am convinced that the design of sensible regional policies requires a deep understanding of the making of the various types of economic agglomerations that fashion the European economic space. In all cases, we come to the conclusion that relatively micro analysis is needed.

4. How to divide space into regions?

4.1 The indetermination of regions

When comparing the economic performance of regions, one should strive to compare the like. This is far from being the case.

In addition to the difficulties encountered in the foregoing discussion, there is a fundamental problem with regions. While nation-states seem to be admissible reference entities in that they clearly distinguish themselves from each other by the scale of their domestic trade and the instruments of national sovereignty (at least until recently), this is not the case for the regions. The systematic use of the region as a solution to the different questions raised in the discussion on decentralisation had the effect of concealing the vagueness of the concept. Even if the definitions often vary with the authors, they nonetheless share two important characteristics. On the one hand, the places that form a region are, in one way or another, considered as sufficiently similar to be grouped together within the same spatial entity. On the other hand, whatever definition is opted for, a look at the literature leaves one with a sense of frustration, a feeling shared, and often expressed, by the authors of the studies themselves.

The similarity of the places is judged in light of the principle of homogeneity or of functionality. The former emphasises the similarities between the places, while the latter concerns itself with certain relationships between the various places forming a region. The principle of homogeneity underlies the emergence of the concept of natural region, developed in the 19th century by geographers. The principle of functionality led to the concept of an economic region developed later by both geographers and economists. Nevertheless, much of this continues to be arbitrary.

It is, indeed, often forgotten that *the region is a relative concept*. It should be clear to the reader that the regions in a given territory are the outcome of a process of division of that territory into a finite number of sub-sets of places based on a particular binary relation defined over the corresponding territory. Some places will be taken as “equivalent” when considered from the point of view of this relation, even if they differ in other respects, and will be grouped together within the same spatial entity called a region. In other words, the places forming a region depend totally on the relation chosen in order to compare them. This relation is called an equivalence in set theory, that is, a binary relation that is reflexive, symmetric and transitive. As territorial divisions can be made on the basis of different relations of equivalence, *the regions change if the relation changes*. This difficulty has led several economists and geographers to doubt the existence of regions *per se* (Isard, 1956).

4.2 Do we compare the like or the unlike?

When comparing the economic performance of regions, one should strive to compare the like. This is far from being the case because not enough attention has been paid by economists to the drawing of regions. Indeed, one may wonder what can be the meaning of having Ile-de-France or Lombardia together with Ireland, on the one hand, and Hainaut (Belgium), on the other, in the NUTS2 classification of European regions. Let me just illustrate the nature of the difficulty we

encounter with such regional data. For example, the Ile-de-France is formed by several "départements" whose size is comparable to that of the Belgian "provinces" such as Hainaut. Seine-Saint-Denis and Hauts-de-Seine are two such districts that are included in the Ile-de-France. While the former district is likely to have an income per capita below the European average that makes it somewhat comparable to Hainaut, the latter could well become the leading area of the EU, especially if the Quartier de la Défense is included in it. So, at the very least, one should be very careful when making comparisons based on such a regional division. Economists should become aware that geographers are much more careful than they are when building their data banks, and should revise their work accordingly.

In the second place, one should not be fooled by the numbers. First, the per capita Gross Domestic Product of a region is a relevant indicator only if the resident population is more or less the population actually working in the region (this is true for Ile-de-France but not for the Hamburg and Brussels regions). A region, therefore, has a minimum possible size. Also, the differences between nominal per capita incomes are not of any great significance. Real incomes would need to be compared and, to do so, regional price indices would have to be available. This is especially important for strongly urbanised regions since we know that land rents are significantly higher in larger cities than in small cities, and that housing expenditures stand for a large fraction of individual consumption. Moreover, even the real per capita income does not take into account the many social and environmental variables that also influence the well being of people (after all, individuals are welfare-maximisers and not income-maximisers). In particular, living conditions and amenities are too often neglected in interregional economic comparisons, although they have a considerable influence on the well being of the inhabitants of a given area.

The work of geographers and regional scientists allows us to shed light on some interesting facts. First, given the existence of an urban hierarchy and the fact that big cities tend to be more productive than small cities, one should expect regional products per capita to be different and not to converge. For example, regions including major cities are likely to have a higher product per capita than the others. Not surprisingly, the leading European areas are precisely the large urban regions (Ile-de-France, Lombardia, Great London,...). Second, we also know that focussing on smaller spatial units is often associated with a widening of spatial inequalities. Therefore, the decentralisation of nations into regions makes regional disparities more transparent. This is likely to be accompanied by a higher demand for spatial equity than before. Third, one should keep in mind that the magnitude of spatial disparities is very sensitive to the design of the regional borders. This is true especially for small regions, such as those confined to the limits of a city. We encounter here what geographers call a *modifiable areal unit problem* (Goodchild, 1979; Openshaw and Taylor, 1979). By paying insufficient care to the design of regions, one runs a serious risk: arbitrary or partial indicators of regional discrepancies are likely to exacerbate the demand for spatial equity, thus threatening the political stability of the European construction.

Finally, I am not sure that all these interregional comparisons make any good economic sense. For example, by enlarging the European Union to some large and relatively poor countries (e.g., the Eastern European countries), most regions of the EU-15 would have a per capita regional product that would exceed the average product of the enlarged Union (6). Instead, it seems to me that the relevant

6) This poses again the question of the space to be used as a reference.

question is: *did a particular region succeed in improving upon its previous economic and social performances?* Although we all know the economic process is not a zero-sum game, by focussing too systematically on regional ranking we give ground to the idea that the growth of some regions takes place at the expense of others and that economic development resembles to a horse race.

5. The metropolitan region as a foundation for public policy

The arbitrary nature of administrative divisions is likely to cause a reduction in the advantages associated with the agglomeration of private activities and the decentralisation of public decision-making if they cannot be deployed within coherent political and economic entities. In defining regions, there should be (at least) two guiding principles. First, *a region should be organised around a major city* (or a network of smaller cities) because this offers a greater potential for a better management of the various agglomeration forces at work in a metropolitan area. Second, *a region should internalise most local public policy effects*, thus achieving a better balance between the public and private spheres. We call *metropolitan regions* spatial areas organised on the basis of these two principles (Thisse and van Ypersele, 1999). Let me explain the reasons that have motivated these choices.

A region should be organised around a major city or a network of smaller cities.

5.1 Agglomeration forces in cities

There is a great deal of evidence suggesting that cities or clusters play a growing role in modern economies. Besides the reasons mentioned in Sections 2.2 and 3.2, there are several others that explain this fact. In the first place, cities offer a very wide range of services and intermediate products that permit an increase in the productivity of private inputs (Hansen, 1990). This effect is particularly significant for the labour factor (Peri, 2000; Rauch, 1993). Moreover, firms find a wider range of skilled workers in cities; in the same way, workers face a large number of differentiated job opportunities, which enables them to enhance the value of their skills. The result is *a better matching between jobs and workers in urban labour markets* which, simultaneously, tend to fragment and diversify (Hamilton *et al.*, 2000). In short, the division of labour becomes finer in major cities as a result of the diversification and specialisation of tasks.

Contemporary forms of corporate organisation also contribute to the increasing role of cities in the process of economic development. Since the 1980s, one witnesses a drastic reduction in the internal share of production (7). The growth of outsourcing is the result of firms' policy to refocus their activities on their core competencies. At the same time, a policy of product customisation has developed, aimed at exploiting economies of scope by appealing to flexible production techniques. Such a sales policy, operated in conjunction with just-in-time management, results in the customer being supplied much faster than previously. All of this has resulted in a substantial growth in logistic services whose costs can be reduced by the formation of *clusters* (Porter, 1998). Clusters are very naturally nested in large cities (8), although they may also emerge outside of major cities as shown by many of the Italian industrial districts (see Pyke *et al.*, 1990).

7) For example, in Germany, the internal share has dropped from 67% in 1981 to less than 50% in 1990 (Conference Européenne des Ministres des Transports, 1997).

8) For the United States, Porter (1998) cites the examples of New York, Los Angeles, Boston, Detroit and Seattle. This list is not exhaustive.

5.2 Urban public goods

I now turn to local public policies. It is well known that a major difficulty in the supply of public goods lies in the incentive that each individual has not to reveal her true preferences with regard to the quantity of public goods she wishes to consume. Tiebout (1956) has pointed out that most public goods are local: their effect is only felt within service areas of a limited size. Therefore, the existence of communities supplying different quantities of public goods on the basis of different local taxes would lead households to reveal their preferences by their residential choice. The supply of public services would then also be carried out by a whole set of communities competing with each other on the political market. Although attractive and ingenious, Tiebout's suggestion is in many ways incomplete and its limits have been known for a long time.

It is possible to reconsider this approach from the territorial viewpoint. In this perspective, Hochman *et al.*, (1995) have proposed grouping the service areas of various local public goods within the same territory, while financing them by means of a tax on the land rent prevailing within this territory. These authors show that the constitution of such entities make it possible to achieve efficiency through competition between local governments. Geographical considerations would then seem to impose an institutional system having a territorial rather than a functional basis. In such a context, the relevant decision making entities should be consolidated and incorporated into areas sufficiently large to allow them to internalise as much as possible the effects of local public policies. This involves extending both the geographical base of local governments and their powers. Allowing for too fragmented territorial units fosters spatial/social segregation and runs, therefore, against the basic principles of redistribution.

Because it tries to incorporate both agglomeration economies and public policies within the same reference area, the concept of metropolitan region, while remaining arbitrary, seems to be less open to criticism. It must be emphasised, however, that the formation of regions must be endogenous. When arbitrary administrative boundaries are imposed without economic justifications, the expected benefits of agglomeration and decentralisation might be called into question. In addition, the regional boundaries should be revised regularly because of the continuous decrease in communication and transport costs. Such a proposal certainly goes against the customary habits that consider administrative boundaries permanent. Let me say that I am fully aware that this rigidity responds, at least partially, to the individual's need to belong to a lasting community whose geographic contours have to remain stable. Nevertheless, such a feeling should not deter an effective co-operation between neighbouring regions, especially when borders are considered (at least for the time being) as permanent.

6. Concluding remarks

There is a regional question whose origin lies in the inability of competitive markets to deal with the process of agglomeration of economic activities, due to the direct interdependence between locational decisions. But, apart from that, what have we learned? In what follows, I do not intend to be comprehensive but will restrict myself to summarise the main points.

1. Modern economies encapsulate a strong system of forces pushing toward more agglomeration in economic activities (see also Fujita *et al.*, 1999). What makes these forces so powerful is the

combination of a drastic fall in transport and trade costs, which combines with the cumulative nature of the agglomeration process. This gives rise to a new type of economic geography in which space is “slippery” while locations are “sticky”. Furthermore, technological progress brings about new types of innovative activities that benefit from being agglomerated and, therefore, tend to arise in developed areas (Audretsch and Feldman, 1996). Consequently, the wealth or poverty of people seems to be more and more related to the existence of prosperous and competitive clusters of specific industries, as well as to the presence of diversified and large metropolitan areas.

There is a risk of excessive agglomeration if the mobility of the skilled labour force keeps rising. Still, firms are likely to be attracted by cheaper areas offering a niche.

There is a risk of excessive agglomeration at the level of the EU if the mobility of the skilled labour force keeps rising. Yet, one would go too far in predicting that the European space will be much more polarised than what it is today. Urban systems are characterised by a strong inertia that favours dispersion. In addition, the growing concentration of activities in a few large regions is likely to be accompanied with higher urban costs (such as land rent, commuting costs, pollution) that will make these regions eventually less attractive (Ottaviano *et al.*, 1999). Finally, even though innovative activities often benefit from being agglomerated, firms are likely to be attracted by cheaper areas when technologies are well monitored, thus offering a *niche* to less diversified areas that can specialise in the production of specific goods (Commissariat Général du Plan, 1999). At the very least, this is a scenario suggested by the American example (Henderson, 1997). In this perspective, European cities would do well by improving their provision of public goods and services used directly by firms and by co-operating more with their hinterland.

2. Local clusters may emerge in very different places, thus opening the door to possible local development within depressed regions. However, one should resist to the temptation of planning and organising such clusters from above. Indeed, they often rest on informal processes such as discussions among workers within firms, inter-firm mobility of skilled workers, exchange of ideas within families or clubs, and bandwagon effects. The proliferation of externalities within cities leads Anas *et al.* (1998, p.1458) to conclude as follows: “only very comprehensive and detailed planning can overcome the resulting inefficiencies. Because the externalities are so poorly understood, however, attempted cures may well do more harm than the disease”. It is my contention that the situation is very similar when we come to the case of regional clusters, although the nature of externalities to take into account may be different (Soubeyran and Thisse, 1999).

Still, there is a lot to be learned from the many successful experiences undertaken. In particular, they concur in saying that the *efficiency and quality of local institutions* that facilitate communication and social co-ordination are critical in successful local development stories. This is a far too much neglected factor in development plans designed for lagging regions. The European Commission should be more active in detecting such inefficiencies and in making its regional aids conditional upon significant improvements in local (nonmarket) institutions.

3. Globalization of investment and decentralisation of public policy intensify fiscal competition between regions seeking to attract private investment. Offering subsidies is a common policy, but it raises the risk of a “race to the bottom”. Yet, the rapid rate of technological change, following on revolutionary developments in information technologies, life sciences, and new materials, has

introduced new dimensions of differentiation, which offer regions new opportunities to avoid the excesses of fiscal competition by developing *technological infrastructure*.

The European Commission should be more active in detecting institutional inefficiencies and in making its aid conditional upon improvements in local institutions.

Technological infrastructure is aimed at developing advanced scientific and engineering capabilities, often through generic research, that answer the needs of firms operating at the leading edge of technological innovation. Technological infrastructure introduces a dimension of quality that is far more pronounced than in conventional infrastructure, as firms differ widely in their ability to exploit it. *This offers regions an opportunity to avoid head-to-head competition by differentiating the characteristics of their infrastructure*, much as firms differentiate their products to relax price competition. The European Commission could launch an autonomous agency whose role would be to foster a better co-ordination among development plans established by regional governments.

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