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# Paul Krugman and the New Economic Geography - assesment in the light of the dynamics of a "real world" local system of firms

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# PAUL KRUGMAN AND THE NEG: AN ASSESSMENT IN THE LIGHT OF THE DYNAMICS OF A "REAL WORLD" LOCAL SYSTEM OF FIRMS

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**Key words: New Economic Geography, Etna Valley, Non-stationary economies, Networks.**

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**Abstract**

Since the publication of Krugman's paper on "Geography and Trade" in 1991, a burgeoning literature has developed under the heading New Economic Geography.

In the following we shall survey the NEG literature and critically evaluate its contribution relative to earlier work on similar topics. More specifically, we will focus our attention on a model that seems to have given new impulses to the introduction of spatial factors into the economic analysis: Krugman's model.

We will proceed with our assesment analysing if and to which extent the features of the model are effective in investigating a real local system of firms: the Etna Valley, an industrial agglomeration specialized in the production of microelectronic components in the area around the Sicilian town of Catania.

What emerged from the critical analysis is that the above model results to be extremely simplified. If, on one hand this may be true for every economic model, on the other, we feel that, in our specific case study, the formalization of the processes of local development does not result to be entirely useful. Indeed, great part of the analysis of the industrial district based on the "industrial atmosphere" (Marshall, 1890) remains out of the picture. Therefore, we find more useful the positions of those authors that not drawing on the deductive methods of theorising and analysing employed by Krugman, nonetheless have managed to enlighten mechanisms that seem to be more apt to investigate dynamics taking place in developing areas. More specifically, they seem to offer more useful insights in the context of non stationary economies where markets are not yet stabilized and therefore are not entirely capable of adequately transmitting incentives and information to the actors in the economy.

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## 1. Introduction

The relationship between economic geography and economics has for a long time been an uneven one. In constructing their theories and explanations of regional development, economic geographers have drawn on concepts and perspectives of different schools of economics; but, for their part economists have tended to accord little if any attention to the role of geography within the economic process (Martin and Sunley, 1996).

Recently however there have been developments within economics theory that may mark the beginning of a closer relationship with economic geography, and regional development theory more specifically. Since the publication of Krugman's paper on "Geography and Trade" in 1991, a burgeoning literature has developed under the heading New Economic Geography. In the following we shall survey the NEG literature and critically evaluate its contribution relative to earlier work on similar topics. More specifically, we will focus our attention on a model that seems to have given new impulses to the introduction of spatial factors into the economic analysis: Krugman's model. We will conclude analysing if and to which extent the features of the model are effective in investigating a real local system of firms: the Etna Valley.

As well as earlier works in location theory[1], NEG deals with variants of one basic question, namely, which factors have influenced and continue to influence the geographical distribution of economic activity. For instance: why did European manufacturing concentrate in such regions as the Midlands, the Ruhr Valley and Northern Italy in the early stages of the industrial revolution? What have been the causes of recent changes in the pattern of manufacturing activity (like those, for example, that have determined the exploits of the Asian Tigers)? Corresponding questions can be asked about the United States, where for a long time, manufacturing activity was concentrated in a comparatively small part of the country, in the manufacturing belt between the great lakes and New England, before it gradually shifted to the South and West (Krugman, 1991b).

An intuitive argument in the explanation of geographical concentration is that certain regions enjoy "first nature" advantages over others, such as superior endowment with natural resources and transportation facilities e.g. like harbours and rivers. Otherwise, in a broader sense, advantage can be explained in terms of governmental policies e.g. with respect to taxes, subsidies

[1] We refer to a tradition dating back to Von Thunen's (1826) analysis of land rent and use; the location analysis of Weber (1909), the central place theory of Christaller (1933) and Losch (1940), the regional science of Isard (1956);and the uban system theory of Henderson (1974).

etc. However there are many cases where regions without obvious natural advantages develop into economic centres (for example, the Italian North Eastern regions). In these cases additional arguments need to be invoked to understand concentrations.

The scope of agglomerations can vary from the urban level, to the broadest, international level. In an international framework, the existence of a limited amount of these clusters draws a line between developed and developing countries, with the former specialised in production processes characterized by large economies of scale and the latter being specialised in more traditional, less sophisticated industries. Even though references will be made to agglomerations on a national level, the issues raised in this thesis will be mostly regional in their scope.

The paper is organized as follows: in section 2 I trace the intellectual roots of the NEG literature, in section 3 I analyse and critically asses the distinctive aspects of the NEG models and the sub-national empirical literature, in section 4 I investigate the dynamics of a real local system of firm and finally section 5 gives some concluding remarks.

## 2. The intellectual background of the NEG

An interest in theorizing the advantages of spatial agglomeration can be traced back to the late 19$^{th}$ century and Alfred Marshall's observation about specialist industrial districts in the UK (Marshall, 1890). According to the traditional Marshallian conception, the advantages of agglomeration are rooted in the reduced costs that arise form the operation of three sets of "localisation economies": 1) a thick local labour market, especially for specialized skills, so that employers find it easier to find employees and vice versa 2) the availability of specialized input services, and 3) the existence of technological knowledge spillovers ("the mysteries of the trade become no mysteries, but are, as it were, in the air",Marshall 1890).

The Marshallian arguments do not rely on general equilibrium interactions. They are apt to explain small-scale concentrations of firms within specific industries but they cannot explain the existence of vast agglomerations with firms from different industries (Schmutzler, 1999).

However the subject matter remains marginal to mainstream economic for a long time despite scholars such Ohlin (1933, p.203) who pointed to "the economies of concentration of industries in general". Within the same route Hoover (1948, p.3/4) maintained that "economic interrelations between different industries and firms play an important part in shaping the pattern of location as a whole" and consequently "even in the absence of any initial differentiation,(...), patterns of specialization and concentration of activities would inevitably appear", the reason being not only

advantages from concentrating certain kinds of business in relatively few locations", but also form "proximity of related processes" and from the closeness of consumers and producers.

Geographical economics owes a tribute also to new theories of local development. The "localised" nature of growth is a fact that had already been recognized by early development theorists. The older (mainly qualitative) literature stressed the importance of circular causation mechanisms in shaping international and inter-regional inequalities. Hirschman (1963, p. 100) emphasized that there are "backward linkages effects, i.e. every no primary activity will induce attempts to supply through domestic production the inputs needed in that activity" and "forward linkages effects, i.e. every activity that does not cater exclusively to final demands, will induce attempts to utilize its outputs as inputs in some new activity". Hirschman focus is on how to exploit these linkages to trigger development processes.

Myrdal (1970, ch.3) used similar argument and explain that "by circular causation and cumulative effects, a country superior in productivity and income will become more superior while a country on an inferior level will tend to be held down at that level or even to deteriorate further". "Backwash effects" promote inequality and consists of "internal and external economies": economies of scale and the growth of knowledge through innovation, which tend to raise agricultural productivity, allow manufacturers to economize in the use of raw materials. The same mechanism, claimed Myrdal, operates on an interregional level.

The idea that tendencies towards concentration are reduced by various centrifugal forces is not exactly new either. Ohlin (1933) stated that "deglomerating" forces such as transportation costs, land rents and high labour prices limit the extent of agglomeration. Similarly, in his central place theory which attempts to explain regularities in the distribution of urban centres in Southern Germany, Christaller (1933) highlighted the trade off between scale economies as sources of agglomeration and high rents and as opposing forces and asks which geographical patterns are likely to arise from the interplay. Myrdal's backwash effects were partly offset by "spread effects" that mitigate inequalities. Growth in centres may induce growth in peripheral regions if these regions are needed to supply domestic inputs, for instance because they have a good resources basis. More recently, formal models in urban economics have addressed the interaction of centripetal and centrifugal forces; for example the urban system theory of Henderson (1974) considers urban land rents as centrifugal forces.

Even though neither centripetal and centrifugal forces nor general equilibrium considerations and micro-foundations are unknown to regional economists, the simple model developed in

Krugman (1991) is widely regarded as having given birth to something "new", and has certainly stimulated the emergence of a new wave of theorizing and, to a lesser extent, empirical work. The first aspect that sets a distance between Krugman and his predecessors is a purely technical one: until recently there was no single approach that employed the above elements in a coherent framework. The most likely reason for that is that underlying all the past explanations of agglomeration patterns is the assumption that there are substantial economies of scale at the level of the plant. But un-exhausted economies of scale at the level of the firm inevitably undermine perfect competition[2]. Therefore, traditional Arrow-Debreu competitive frameworks are unsuitable for explaining agglomeration.

The key to understand the new interest of economists in geography is mainly due to the fact that imperfect competition is no longer regarded as impossible to model. The NEG uses the model of monopolistic competition developed by Dixit and Stiglitz (1977) and applied to models of international trade in the presence of increasing returns within "new trade theory" (Krugman,1979). The assumption on market structure characterized by monopolistic competition conveniently avoids the problem associated with price taking behaviour when there are increasing returns to scale (Schmutzler, 1999).

Therefore, thanks to some modelling tricks, the NEG provides a comprehensive framework for the investigation of macro level spatial economics which has been missing so far.

Second, with its emphasis on the fact that "countries both occupy and exist in space" (Krugman, 1991), the NEG has certainly contributed to a better understanding of international trade theory. The new literature has opened the door for analytical discussion of recent tendencies in the world economy like increases in regional integration, changes in the distribution of manufacturing activity, and the rapid increase in foreign direct investment, issues that were previously pretty much ignored by economists (Krugman, 1998).

To sum up, many of the ideas from NEG are familiar from regional economics and from qualitative approaches to trade and development theory. The modelling strategy used in the analysis however, has some new elements.

## 3. The basic model

[2] In the absence of such scale economies, there would b no incentive for producers to concentrate their activity at all: they would simply supply consumers from many local plants. And the expansion of a regional market would not necessarily lead to an increase in the variety of goods produced within the region.

Krugman (1991) present a model to show how large scale agglomerations can emerge from the interaction of increasing returns and transportation costs. On a general level the model allows to investigate what effects different factors have on the robustness of agglomerations.

3. a. The assumptions

The model envisages an economy consisting of two sectors: perfectly competitive agriculture and imperfectly competitive (Dixit-Stigliz) manufacturing. A large number of potential firms can each produce differentiated products i = 1,…*N*. These products are symmetric in the sense that consumers do not prefer one product to another one. However, consumers have preference for variety: starting from any consumption vector a unit of a product that is not yet consumed is always preferred to an additional unit of a product that is already consumed.

A functional form that captures symmetry and preference for variety is given as follows. The usual welfare CES utility function:

$$U = C_M^{\mu} C_A^{1-\mu} \qquad [1]$$

Where μ ϵ (0,1). Checking through the first order conditions of the household's maximization problem shows that with this specification of utility, the share of consumer expenditure in manufacturing goods in household equilibrium is μ / 1-μ. Because the concentration will depend on the strength of the demand in this sector, this is one of the key parameters of the model. $C_M$ is the aggregate manifactures and, following the Dixit-Stiglitz procedure of aggregation we have:

$$C_M = \left[ \sum_{i=1}^{N} c_i^{(\sigma-1)/\sigma} \right]^{\sigma/\sigma-1} \qquad [2]$$

Here *N* is a (large) number of potential products and $\sigma$ is the elasticity of substitution among the products. As we will explain more in detail later on, an interesting thing to be noted is that, even if $\sigma$ is a tastes parameter, in equilibrium it is related to the economies of scale[3]; so it is

[3] Because firms set prices as usual, the real wage must equal the productivity of labour but, because the elasticity of demand is not infinity, we need to make a correction in it:

assumed to be more than one and, from this way to put the things, this (the degree of the economy of scale) is the second crucial parameter for determining (and reasoning about) the long run equilibrium.

A further simplification of the model is that the only production factor in the economy is labour. However there are two types of labour, workers who produce manufactured goods and farmers who produce the agricultural goods. The supply of labour is given exogenously as $L_m$ and $L_a$ respectively. The share of manufacturing workers in the population is assumed to equal μ, the share of manufacturing in consumer expenditure. Every firm takes advantage of economies of scale; precisely, constant marginal costs are assumed:

$$L_{Mi} = \alpha + \beta x_i \qquad [3]$$

where $L_{Mi}$ is the requirement of labour to produce $i$ and $x$ is the output of the $i_{th}$ good, $\alpha$ represent the fixed cost and $\beta$, the inverse of productivity, is the fixed marginal cost.

Geography enters the model in the form of the economy consisting of two symmetric regions. Suppose for the moment that both types of labour are immobile, so that the distribution of workers and farmers across regions is fixed. The transportation of manufactured goods between regions is costly. Hereby enters the third key parameter: transportation costs. To model transportation costs, Krugman uses a technical trick first introduced by Samuelson (1954) in international trade theory: that a fraction of any good shipped simply "melts away" in transit (Krugman, 1992). In this guise, not only can one avoid the need to model an additional industry, but because the transport cost between any two locations is always a constant fraction of the free on board price[4], the constant elasticity of demand (a key feature of the model), is preserved.

As usual, consumers maximize their utility function U ($C_m$, $C_a$) given their budget constraints;

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$$\frac{\partial c}{\partial l} = \frac{w_i}{p_i} = \frac{1}{\beta}\frac{\sigma}{\sigma - 1}$$

where $\sigma/(\sigma-1)$ is a sort of correction factor (Note that as $\sigma \to \infty$, this factor tends to the unity). So, in equilibrium we have:

$$\beta \frac{\partial c}{\partial l} = \frac{\sigma}{\sigma - 1}$$

That means the ratio of the marginal product of labour to its average product, an index of the degree of economies of scale, can be directly measured using $\sigma$, the taste parameter.

[4] In the new geography models, melting are usually assumed to take place at a costant rate per distance covered e.g. 1 per cent of the cargo melts away per mile (Krugman, 1998).

there is free entry for firms and firms maximize their profits.

3.b. Dynamics of agglomeration

Given this set up Krugman investigates under which circumstances agglomerations arise, that is, under which circumstances the entire manufacturing population will concentrate in one region.

Several intermediate results arise:

- For a large number of manufacturing products, the demand elasticity is approximately constant and the same as the elasticity of substitution. As a result, profit maximizing firms set a constant mark-up over marginal cost.
- Because of increasing returns to scale, each firm produces only one product.
- With free entry profits are zero.
- Because of the symmetry of the problem each firm produces at the same output level in equilibrium.

The equilibrium output of each firm is a positive function of the fixed costs and the elasticity of substitution and a negative function of marginal costs[5]. The number of firms in a region is a positive function of its manufacturing labour supply, and a negative function of both fixed and marginal costs. These results are intuitive: with a high elasticity of substitution, consumers do not value variety much, so there will be a small number of large firms in equilibrium, and this effect will be stronger when fixed costs are high. High marginal costs obviously reduce the output society can produce with a given labour supply, which implies a small number of firms will be producing low output.

Using these intermediate results, Krugman goes on to analyze the centrifugal and centripetal forces in its model. While agricultural labour is assumed to be immobile, manufacturing workers

[5] From note 4 we find the level of the prices for our two sectors: because profits must be zero we have:

$$P_i x_i = L_{Mi} w_i$$

and rearranging we find, at the end of the day:

$$P_i x_i = (\alpha + \beta x_i) w_i$$

and

$$x_i = \alpha(\sigma - 1) / \beta$$

Note that the above result is valid for every sector (in this model we have *i=1,2*), and so we have the same amount of production in both regions.

are now assumed to move towards the region that offers the higher present real wage.

Under which conditions can a concentration of the entire manufacturing activity in one location arise (centre) in equilibrium?

There are two reasons why a deviation from the centre might be unprofitable and they are both related to transportation costs. First, the firms must induce workers from the centre to work in the periphery. As the workers will have to import most consumption goods from the centre, the costs of living are higher in the periphery. As a consequence, the firm must pay higher wages, which drive up output price. Second, the majority of the firm's customers live in the centre. Serving them from the periphery involves transportation costs, which represent another reason to stay in the centre. On the other hand the immobile farmers can be served cheaper if the firm produces in the periphery. Agglomeration equilibrium arises when the last centrifugal force is small relative to the two centripetal effects.

It remains to be shown what determines whether centrifugal or centripetal forces dominate. If transportation costs are high, agglomeration becomes unlikely: it is prohibitively costly to serve the periphery from the centre and deviating from the centre may be a profitable strategy. Agglomeration arises only if transportation costs are positive, but so small that serving the periphery from the centre is a feasible alternative to local production.

Another factor that influences the robustness of agglomerations is the size of the manufacturing sector as measured by the share of consumer expenditure in manufacturing or the share of manufacturing workers in the population. For a high share of manufacturing in consumer expenditure, the extra wage necessary to compensate workers for living in the periphery is high: a large quantity of manufacturing goods has to be imported. Moreover, centrifugal forces are weak: the agricultural population and hence the size of the market will be small.

Another influent element is the elasticity of substitution. As mentioned earlier, in equilibrium $\sigma$-1/ $\sigma$ equals the ratio of average cost to marginal cost, a common measure of economies of scale. Hence a low elasticity of substitution tends to go along with high economies of scale, which make it less attractive to serve the smaller market locally. To sum up: with higher transportation costs, a large manufacturing sector and significant economies of scale agglomerations become more robust.

Agglomeration is not the only possible equilibrium in this set up. Krugman (1992) uses numerical simulations to show which constellation of equilibria arise as a function of various exogenous factors. For example, he investigates how transportation costs affect the equilibrium distribution of manufacturing over regions. Suppose region 1 has a slightly higher share of

agricultural population and the other parameters are suitably chosen. Then for relatively high transportation costs, there is an equilibrium such that both regions have some manufacturing, but region 1 has a higher share. This reflects the fact that the larger market is more attractive for manufacturing firms. As transportation costs fall, it becomes more attractive to serve region two from the larger market. The share of region 1 grows. For lower values a new equilibrium arises where all manufacturing is concentrated in region 1. Finally for very low values of transportation costs, this equilibrium is unique: the advantages of concentrating production dominate over the advantage of being close to the peripheral market; because of the asymmetry in the agricultural population, region 1 is the better location for production.
Krugman argues that this is consistent with the empirical observation that the development of railroads to Southern Italy in the nineteenth century which exposed the local industry to competition from the North eventually led to its collapse.

Manufacturing patterns also depend on the distribution of the agricultural population. If region's 1 share of agricultural population is sufficiently high, and the other parameters have suitable values (for example, transportation costs should not be too high), all manufacturing will be concentrated there in the unique equilibrium, because centrifugal forces coming from the desire to serve location 2 are too small. As the share decreases, the system goes through a sequence of bifurcations, that is, continuous changes in the equilibrium structure. First an additional equilibrium emerges with some manufacturing in region 2. As region 1's share of the agricultural population decreases, this is the only equilibrium. Next, a new equilibrium emerges without any production in region 1. Finally, for a sufficiently low agriculture share, this becomes the only equilibrium.

Both stories are, of course, only illustrative. Nonetheless it gives a sense of the typical dynamics of NEG models: multiple equilibria; self organisation of the economy into a spatial structure, often one with very uneven distribution of activity among locations with more or less identical natural endowments; and qualitative, often discontinuous change as a result of quantitative changes in underlying parameters.

One specific feature that it is interesting to stress is the way history matters in the model. Suppose two regions start out almost identically by nature, in the sense that no region has a superior resource base or technology or a large consumer market. Then an agglomeration can develop endogenously in one of the region. Due to minor historical events, small initial differences may lead to a core periphery structure.

3. c. Evolutions of the basic model

The most natural interpretation of the above model is that of a model of the spontaneous organisation of a single country into a manufacturing core and an agricultural periphery. It can be applied to the division of the Unitd States into a manufacturing belt and a farm belt in the middle of the 19th century or to the emergence of Italy's industrial north and agricultural Mezzogiorno some decades later (Krugman, 1998).

Since its first statement in Krugman (1991), this core-periphery model has been used more like an exemplification of the main principles of the "genre" than like a truthful representation of processes happening in reality. This, however, does not imply that core-periphery patterns within nations are unimportant phenomena. But as Krugman himself tends to stress, it remains that "much, perhaps most, of the usefulness of the core-periphery models is that it opens the door for the study of a much wider range of issues"(Krugman, 1998).

Broadly speaking, the core-periphery theoretical work has evolved in two directions. One direction has been an effort to link the new "genre" to old questions of location theory. The other has been an effort to use the "genre" as the basis for a new "spatial" view on international trade.

In a series of papers of Fujita has in essence tried to take German tradition of urban modelling that began with Von Thunen (1826) and giving it a true microeconomic foundation. In Fujita and Krugman (1995) a version of the original Von Thunen model is offered in which the existence of a central city is no longer simply assumed: instead manufacturing concentrates in the city because of the forward and backward linkages generated by that concentration. Agriculture is then spread around that centre, with land rents declining to zero at the agricultural frontier. Such "monocentric" equilibrium, however, results to be sustainable only if the population is sufficiently small. Fujita and Mori (1996a) take the same basic model but consider a gradually raising population which leads to the periodic emergence of new cities in a "long narrow" economy that gradually spreads along a line, the resulting multi city spatial economy may be regarded as a (one dimensional) version of Losch's central place theory. Fujita et al.(1997) consider an economy with multiple manufacturing industries, differing in transport costs and/or scale economies; such an economy spontaneously develops a system of central places that finally provides a justification (again in only one dimension) for Christaller's (1933) hierarchical model of central places.

Moving from the local to the global Venables (1996) has tried to use NEG tools as the basis of

a new style of international trade model. While it shares with the original Krugman approach the emphasis on transportation costs, it does not rely on labour mobility. As a result it becomes relevant to issues where the relevant regions are parts of different countries. Venables (1996) shows that even without labour mobility, concentration of the manufacturing industry sales in one of the two identical regions may occur: upstream firms benefit from being located close to many downstream firms, because thus they can serve customers more cheaply. Conversely downstream firms benefit form being in a location with many upstream firms, because this decreases input costs (Schmutzler, 1999).

In Krugman and Venables (1995) a similar model is used to form the basis for a geographical "history of the world". First, gradually declining transport costs lead to a spontaneous differentiation of the world economy into a high wage core and a low wage agricultural periphery. Further fall of trade costs, as experienced more recently, means that proximity is regarded as less important and production costs matter more, which leads to convergence of wages as the periphery industrializes.

Puga and Venables (1996) offer an alternative version of the story in which the driving force is the growing size of the market rather than growing economic integration.

Another interesting application results in the possible mix of trade and urban economics. Krugman and Livas (1996), for example, develop a model suggested by the relative decline of Mexico City as Mexico has opened itself to trade. The idea is that the importance of access to domestic consumers and suppliers, crucial as long as Mexico adopted trade barriers, has become much less relevant once its economy has become more dependent on the international market[6].

### 3.d Empirical relevance of the model and policy recommendations

Krugman does not make any attempt to draw policy implications from NEG models. Nor, he presents any empirical work of his own. However, the definitive validation of the "genre" must certainly derive from further work in the above areas.

[6] This result has been widely criticized. The critics claim that it crucially depends on a number of rather simplifying assumptions. For example real world centres are not only manufacturing centres but also government centres. Taking this into account, centres could certainly benefit from the liberalization of trade. Also, the model assumes the non-tradability of agricultural goods. If this assumption were relaxed, peripheral areas might suffer from imports of agricultural goods, and trade liberalization may weaken these areas (Henderson, 1996).

It has been argued, for example by Neary (2001), that NEG models are too stylized to be taken literally and therefore policy speculations should be deferred until more realistic models appear. Recently, however, other authors have taken a rather different position and argued that, for policy analysis to proceed, the first step is to take NEG models literally (Baldwin *et al.,* 2003).

The first key policy implication of NEG models is that all sorts of non-regional policies can have regional "side effects", that is, a potentially large impact on the location of economic activities and thus on the geographical distribution of wealth. As pointed out by Baldwin *et al* (2003), policy analyst tend to be rather focused, with tax experts looking at tax policies, competition experts looking at trade policies and so forth. In the wake of NEG models, such mono-minded approaches are likely to be incomplete at best. For example, we referred above to the interactions between trade policy and the regional structure of an economy.

A second key policy implication of NEG models is "threshold effects". Policy measures will only have an effect on the spatial distribution of economic activities if these measures reach a certain critical mass. An increase in transport costs can have either no or a huge impact, depending on the initial economic situation. The reason for the threshold-effect is that, even though a priori exists a high degree of flexibility of choice of location and the resultant spatial distribution of economic activities, once these choices have been made, the spatial pattern turns out to be highly rigid. The advantages of a chosen location have a tendency of reinforcing themselves, and the choice of location will only be reconsidered if policy interventions acquire enough mass to outdo the accumulated benefits (Ottaviano, 2003).

The third policy implication is "selection effects", which materialize when there is a multiplicity of long-run outcomes. This is the case when transport costs are low enough. In this situation of indeterminacy, policy intervention can play an important role in selecting which distribution of firms will be reached in the long run. For instance, even small subsidies that benefit only very few firms can be enough to attract the entire cluster. The reason is again self reinforcing agglomeration: once some firms move, agglomeration rents start growing so that all other firms have an incentive to follow. Thus, in the presence of a multiplicity of long-run outcomes, policy intervention can act as a selective device (Ottaviano, 2003).

The fourth and last policy implication of NEG models is "coordination effects". These arise when complexities of forward looking behaviour become relevant. A firm's rational choice is to locate where other firms will locate. Thus, shocks to expectations can have a strong impact on the economic landscape even without any actual change in environmental parameters.

Self-fulfilling expectations add a new dimension to the selection of policy interventions. Specifically public authorities can shape the economic landscape by coordinating the expectations of firms. In principle, this can happen even in the absence of any policy implementation. Thus, credible announcements are sufficient to make policies reach their stated aims without ever being implemented. Vice versa, perfectly plausible policies might have no or even perverse effects because of lack of communication (Ottaviano, 2003).

On an empirical level a number of studies exists that focussing on sub-national agglomerations, address the issues of the existence and of the determinants of agglomerations.

Ellison and Glaser (1997), use a location model where industries may be localised because: 1) the overall activity is localized; 2) activity within the industry is concentrated in randomly located plants; 3) activity within the industry is concentrated in non-randomly located plants.
To isolate the third explanation from the other two, they elaborate a measure of localisation that control for the effect of plant size.
First, they define a measure of sector relative to overall localisation as:

$$\boldsymbol{G^k}_{\boldsymbol{EG}} = \sum_i \left(l_i^k - l_i\right)^2 / \left(1 - \sum_i l_i^2\right) \qquad [4]$$

where $l^k_i$ is location $i$'s share of industry $k$ and $l_i$ is location $i$'s share of overall activity. $G^k{}_{EG}$ measures the extent of localisation for industry $k$ over and above localisation of activity as a whole.
To control for the effect of plant size, they construct the standard Herfindal index of industrial concentration for industry $k$:

$$\boldsymbol{H^k} = \sum_j (z_j^k)^2 \qquad [5]$$

where $z^k_j$ is the share of plant $j$ in the total industry output $k$.
Finally, they use the above measures to construct an index of localisation:

$$\boldsymbol{\Gamma}_{\boldsymbol{EG}} = (G_{EG} - H^k)/(1 - H_k) \quad [6]$$

They show that the expected value of this measure is zero if the plants are randomly located, therefore,

a positive $\Gamma_{EG}$ indicates excess localisation relative to activity as a whole and to random location.

Ellison and Glaser (1997) calculate this measure for the location of employment in 459 US industries across 50 States. They found 446 industries departed from randomness and showed excess localization.

However, no clear classification of industries emerges by extent of localisation, as the least and the most localized industries do not show relevant common characteristics.

Duranton and Overman (2001) suggest a further development of Ellison and Glaeser which allows for the fact the location decisions are made over a continuous rather than discrete space and that also enables them to assess whether departures from randomness are statistically significant or not (Overman, Reading and Venables, 2001).

An attempt to explain this excess localisation sees urban and regional economists particularly keen to accept that both factor endowment and economic geography factors play a role. This reflects the fact that the assumption of exogenous factors endowments appears too strong on a sub-national level characterized by a relatively high mobility of the factors of production.

Ellison and Glaser (1999), focus on how much localisation can be explained by natural advantage. Their estimation takes the form of regressing state- industry employment shares on a non linear function of state characteristics. They find that 20 per cent of these shares is explained by the chosen state characteristics, and suggests that this could reach the 50 per cent if other characteristics are included. Overman, Reading and Venables (2001) notice that it is not clear whether some of the characteristics Ellison and Glaser included in the model are first nature: for example, they refer to wage, skill composition and population density measures. If these are not first nature they are endogenous and the problem is not corrected for.

However, even ignoring the problem, an important implication arises from the latter study: from 50 per cent to 80 per cent of localisation at the state level is not explained by first nature advantage. Therefore, some sort of “agglomeration economy” needs to be taken into account to explain the residual excess localisation.

There are three main strands of research on agglomeration economies.

The first strand assesses the importance of localisation versus urbanisation economies. The latter arises when there is a positive externality due to the presence of firms in different sectors; the former when the positive externality arises from firms of the same sector. Henderson (1998) finds

that localisation increases firm productivity. Henderson et al. (1995) considers that localisation increases also growth.

This is in contrast with the result reached by Glaeser *et al.* (1997) according to which it is diversity that increases growth. Finally, the issue remains unsolved and Combes (2001) criticizes the empirical approach of this literature.

A related literature focuses on the effect of scale or density of economic activity on productivity levels. Ciccone and Hall (1996) construct an index of the density of economic activity in the US at the state level. They find that doubling employment density in a county increases state labour productivity by 6 per cent and total factor productivity by 4 per cent.

Finally, few papers, attempt to investigate the role of Marshall's three agglomeration forces. Dumas, Ellison and Glaeser (1997) use data on plant births and deaths in the US for selected years and construct three different measures. They use input-output tables to construct measures of supplier presence and customer presence. To capture for labour market agglomeration they construct a measure based on the risk of closure and a comparison of the plant's labour market mix to average labour mix in the area. A proxy for information flows is constructed using weights based on co-ownership across diverse industries.

They find that inputs help explaining where existing firms locate new plants while output matters more for plants created by new firms. However, neither effect was relevant compared to the importance of labour mix, especially in the case of new firms. Although, as suggested by Overman, Venables and Reading (2001), knowledge spillovers were poorly proxied, their measure suggests they have an important role in shaping agglomerations.

Additional evidence on technological spillovers emerges from a study of Jaffe *et al*. (1993). They compare location of patent citations with the location of cited patents. At the US level they find that citations are likely to be from domestic patents. The same pattern arises at the State and at the urban level (Overman, Reading and Venables, 2001). We will come back to the importance and the limits of the actual evidence on knowledge spillovers during the analysis of the case study.

Although our task was limited to a brief presentation of a much wider body of literature, we can say that nearly all the evidence we have at a sub-national level suggests that both endowments and geography matters in determining location. However, if on the one hand, the fact that geography matters is increasingly supported by the empirical literature, on the other, much more work need to be done to understand why it matters. Further evidence is needed to define the role of the possible determinants of agglomeration as demand and supply linkages,

pools of skilled labour and technological spillovers and to clarify the mechanisms through which economic activities benefit from them (Overman, Reading and Venables, 2001).

### 3.e. Critical aspects

In our opinion, two lines of criticism may arise from the analysis of Krugman's model: one is strictly technical, the other more general and related to what the model is trying to capture.

On a technical level, a number of questions remain obscure in the analysis. Firstly, how do we can be sure that whether a new firm moves to the agricultural area, its workers will make a demand large enough for another firm? In theory, they can buy all the goods they need from the firm in which their work. More realistically speaking, there can be the possibility to have industrial concentration in the "north" with few firms in the "south". To attract new firms, their demand must be larger than the market effect, and so their salary has to be very high (not only to compensate transportation costs, but much more) in order to compensate other firms for moving there.

Moreover, the hypothesis of positive externalities from living is only postulated, but there is no particular motivation (or microeconomic theory) for it: for example, in the U.S. a lot of cities are overcrowded and an increasing number of people prefer to live in the countryside. This hypothesis states that externalities are linked to distance, so it does not seems to be true that "distance enters naturally via transportation costs and in no other way" (Krugman, 1991). It plays, instead, a very important role.

From the point of view of the results, the role of transportation costs it is not clear. Even if the story of the transportation costs appears analytically clear, it seems to be logically unrealistic that high transportation cost plays against regional divergence. In the neoclassical framework, for example, one of the friction that prevent the market from equalize per capita income are external diseconomies (such as high transportation costs) [7] and also in other non neoclassical model, such as the Hotelling one, the possibilities of choosing location and the presence of transports cost can induce (if the market works and the prices are always the same for each firm) concentration of firms in a certain area. Empirically speaking, many authors have pointed out that one of the most severe problems in the activation of industrialization processes in peasant areas is due to the

[7.] In such a case the transportation costs, proportional to the production, will raise the marginal costs and the average costs of the firm operating in the underdeveloped area, and some firms have to leave the market, if the price is the same for every firm.

presence of high costs to achieve developed markets.

If transportation costs are so important in the determination of the equilibrium (if there are no transportation costs the location does not matters), the assumption of zero transportation costs for agricultural goods becomes very strong. Agricultural workers, the distribution of which is given by the land, should tend to go and sell their product in the larger market, but they can do this with no costs. It may be that the presence of these costs can change the equilibrium configuration (modifying the probabilities of divergence). My impression is that the author need of some kind of externalities to have concentration, and this role is played by the transportation costs in that strange way (what happens, instead, if we choose pollution?) (Brakman *et al*., 1994).

By assuming full employment, Krugman seems to neglect the fact that industrialization is not a problem in itself; it is a problems because where there is not industrialization, areas became (or remain) unable to employ the population. From this point of view the model loose part of its appeal: if there is unemployment in the agricultural area (people that wants to work with the same salary or less than the industrialized area) why should not some firms move there?

On a more general level, we certainly agree with the view that sees the main achievements of the literature not in the specific results of Krugman's analysis but rather in the popularization of ideas that deserved more attention than they got in the past. However, for these ideas to have a long lasting impact, it will be important that economists approach these issues in other terms than the very special framework discussed here. Theoretical work on regional issue relies almost exclusively on variants of the Dixit-Stiglitz model. If, on one hand, having a dominant framework of analysis encourages the exchange of ideas, on the other hand, it imposes severe limits to he analysis. One of the most important limitations to the new geographical economics is its stubborn concentration only on those externalities that can be modelled through the Dixit Stiglitz framework. To approach issues such as the geographical impact of technological and knowledge spillovers, for instance, partial equilibrium approaches may be more tractable (Martin and Sunley, 1996). With one dominant framework these issues may well end up being under-theorised.

Another issue related to the above observations regards Krugman's interpretation of economic development as an historical path dependent process. In Krugman's view the role played by geography in determining "lock in" is strictly an increasing returns phenomenon that takes the form of the externalities associated with industrial agglomeration. What he fails to consider is the importance of local institutional, social, and cultural structures in shaping the geography of local development. Krugman dismiss these factors on the premises that non –economic or

"social" factors are not easily modelled and that they should therefore be left to sociologists. However, recent studies in economic geography have begun to show the relevance and to explain the nature of "socio-institutional" externalities for the initial emergence and adaptability of industrial districts (Martin and Sunley, 1996).

Finally, as emphasized by Neary, 2001, we believe the policy implications of the basic NEG model are simply just too stark to be true: "faced with multiple equilibria which have a clear welfare ranking, it is tempting to suggest a new sub-field of "strategic location policy" through the exploitation of selection effects, perhaps drawing on fifteen years' work on strategic trade policy. All these are temptations to be resisted, since they take literally the neat structure of the model, and ignore the econometric difficulties in estimating the non-linear, non-monotonic relations it predicts" (Neary, 2000).

## 4. The case for an Etna Valley

In this section we will analyse if and to which extent the features of Krugman's model are effective in investigating a real local system of firms: the Etna Valley. In the present context, this case, is particularly interesting since it seems to find its origins in the variety of multiform relations or, more specifically, in the network of interactions taking place among the manufacturing sector, the University and the Public Administration. It is seems therefore appropriate to critically investigate the role of public institutions and organisations in shaping the trajectory of regional-industrial evolution in the light of the NEG.

In particular, our empirical analysis will focus on one of the most interesting and representative phenomenon that has characterized the Southern Italian economic landscape in the last ten years, namely the emergence of an industrial agglomeration specialized in the production of microelectronic components in the area around the Sicilian town of Catania. Indeed, in the last decade a great number of high- tech industries has established in the area. The presence of these activities ranging from the productive as well as the service and research sector has generated the expression "Etna Valley" to define the geographical area where these firms are situated.

The "Etna Valley" includes 200 local firms, 1.000 new SME operating in the high-tech sector (semiconductors, bio-technologies, chip, software, and telecommunication services) and 23 multinationals like Nokia, Arch. Chemicals Inc., IBM, Alcatel, Vodafone, T.net, ISSRF, Accent,

Csc. The agglomeration employs about 8.000 workers[8], 27 per cent in manufacturing and 10 per cent in the New Economy (www.distretti.org).

Three elements are considered to have triggered the cumulative circular causation process that has shaped the geography of development of the "Etna valley":

- the presence of the multinational industrial colossus STMicroelectronics (ST hereafter) fuelling the diffusion of complex high-tech knowledge and information;
- the synergic contribute of the University and other research centres;
- the policies of public authorities that have contributed to the creation of a favourable "economic atmosphere".

4.a. The contribute of ST

The Italian-French multinational ST, controls the 4 per cent of the world market of semi-conductors with a global labour force of 33.000 workers whom over 4.000 are occupied in the area of Catania (www.distretti.org).

ST until the end of the 80's had remained estranged from the local economic environment, limiting its interventions to the exploitation of a pool of highly qualified low cost workers. During the 90's however, ST has progressively adopted a new strategy. This has resulted in:

- new investments directed to the research sector in the field of microelectronics
- the employment of local engineers and
- an active collaboration with the University of Catania directed at the investigation of the use of new materials.

Beside its industrial activities ST has recently developed advanced research projects with the collaboration of various departments of the University. Moreover a growth of the human capital both from a qualitative and a quantitative point of view has been taking place, contributing to the creation of a highly qualified and specialized pool of labour. This new approach to the local resources has caused also a modification in the relationship with other firms in the territory. The

[8] This must be considered in the light of the fact that the total workforce in Sicily amounts to 1.350.000 (www.distretti.org).

complete vertical integration of the production processes has been replaced by a strategy of decentralization of some small but significant functions in favour of local external actors. A number of entrepreneurs have used the know-how acquired working for ST to identify opportunities related to activities to support the production of microelectronic components (spin off) and have now become part of ST's supply chain[9]. It can certainly be related to the presence of ST the localisation in the area of 23 international manufacturers that are part of its supply chain. However recent estimates have estimated an overall chain of local supplier of about 200 firms.

4.b The contribute of the University

The collaboration between the University and ST can be traced back to the 60's. The main result of that collaboration was the creation of one of the most advanced research institution in the field of basic and applied research in microelectronics in Europe (*Co.Ri.M.Me*.). The consortium aimed at the development of new microelectronic technologies, processes and products. Its activities stopped in 1996 to be moved within the industrial partner. At that time it counted 201 employers, one third occupied in research activities.

The positive influence exerted by the experience of the consortium has recently motivated a closer collaboration between academic institutions and the ST. Specifically, the National Research Council (*CNR*) in 1993 has created the National Institute of Methodologies and Technologies for Microelectronics (*IMETEM*), to guarantee a closer and continuous interaction between the Department of Physics of the University and the structures for applied research within ST.

In 1990 a collaboration among the Department of Chemistry of the University and ST developed in the creation of a laboratory specialized in research on new materials (*Superlab*).

Other important research institutions have established in the area including, one the most advanced research institute in the field of nuclear physics in Europe (*Laboratorio del Sud*) and *Conphoebus* a no- profit institution researching renewable energy sources.

Besides the above initiatives the University takes part in an experimental project aimed at forming young researchers with entrepreneurial skills. The Scientific and Technological Park of Sicily aims at the creation of new high tech firms as a research spin-off. With a budget of about

[9] Examples include S.A.T, Hitech, Ion Beam, Dintel.

30 billions of Euros, founded by the Department of Research and University and by the Found for Regional Development of the EU, this initiative will possibly play a prominent role in the promotion of innovation and in overcoming the limits imposed by the inadequacies of the actual financial structure.

4.c The contribute of the Public Administration

On an institutional level diverse incentives have been promoted to create workplaces and motivate investments in the area. A striking feature that emerges from the analysis of these measures is the great number of actors and institutional levels involved: the local Council, the Regional Assembly, the Province council, the National Government and the EU. Each actor plans, develops and implements its own project following its own criteria. These initiatives lack a general framework of reference, a unique criteria that would give coherence to the kaleidoscope of actions. We will present them now in some detail.

1) The exemption from the payment of Italian Social Welfare charges for a period of six years, compared with three years with the rest of the Mezzogiorno[10].These contributes are now covered by the Region[11].

2) The inclusion of Catania among the "EU Zone 1"**.** It means it has been recognized as one of those low income regions that have a priority in the assignment of EU structural funds aimed at regional convergence. These funds have been assigned for the period 2000-2006 to Regions that will found projects on the basis of criteria defined by the EU and, in more detail by the Region itself.

3) The presence of a *contratto d' area*. These kinds of contracts are applied to specific affected by industrial crisis and are financed with national funds. They guarantee favourable conditions for the financing of productive activities choosing to establish in the area.

4) The application of the incentives for the establishment of industrial activities in the South of Italy (national law):

- contributes up to the 40 per cent for new or renewed plants;

[10] This incentive has helped reduce labour costs for ST in Catania by 30-40 per cent (FT, 17 October 2000).

[11] This provision is the result of the powers attributed to the Regional Assembly because of its status of "autonomous Region" of Sicily.

- contributes up to the 40 per cent for the creation of research centres;
- contributes up to 75 per cenț for R&D projects in industrial or pre-competitive area;
- contributes up to the 80 per cent for training projects.

5) The Scientific and Technological Park of Sicily described in the latter section.

6) An example of good local policy rooted in the specificities of the territory is exemplified by the "*Patto per il Lavoro "Città di Catania"*, an agreement subscribed by local institutions, unions and entrepreneurs with the aim of triggering a virtuous circuit founded on new investments, the valorisation of human capital and employment. The "pact" was agreed in 1991 addressing specifically: the promotion of permanent training; the elimination of the large black market; the strengthening of "social" economy; the establishment of clear rules to be adopted in local industrial consultations and of all the other instruments needed for a) the creation of new b) facilitate the entrance of the young in the labour market and of all those who meet difficulties to integrate or re-integrate in it c) stabilize the situation of those workers occupied in irregular areas of the labour market or involved in processes of exclusion from it.

Free support is offered to investors that intend to start, enlarge, or convert economic activities for the production of goods or the provision of services according to the objective established by the above agreement. A "Single Beaureu" (*Sportello Unico)* based on Singapore's model (FT, Oct 17, 2000) has been establish to accelerate bureaucratic processes and guarantee investors the release of all the permits necessary for the start up of the initiative within 90 days.

7) In the 80's, in the context of the establishment of new policies in favour of SME, the EC created a range of tools aimed at the optimization in the use of the resources available through the Structural Funds. Specifically, in 1984, the EC developed a model of centre (European Business and Innovation Centre or EC-BIC) drawing from the experiences of both the French Pepinieres d'Enterprises for the supply of services and the American "incubators" for new enterprises.

Learning from the innovative experiences taking place in countries at a mature stage of industrialization the EC conceived EC-BIC like regional development policy instruments oriented towards the valorisation of the local resources, both human and financial. Being those instruments for regional development their intervention is limited to innovative activities in the manufacturing or service sector, while they do not operate towards commercial, tourist, or professional activities.

To ensure stability in the management of these centres the European Commission committed to guarantee the involvement of  a great number of local actors in the form of a system of balanced participation (with no majority shareholders).

The incubator BIC Sicily has been active since 1996 in the industrial area of Catania. Among the service offered, the most relevant ones regard training activities, through programmes financed with European structural funds. Examples include the *C.N.I.T.A* project (Creation of New advanced Technology Enterprises) that aims at enabling young people to acquire a range of technical skills to be used in the implementation of entrepreneurial ideas. Moreover BIC Sicily is deeply involved in the support of local SME through programmes aimed at creating incentives for exchange and collaborations with foreign firms.

4. d. The Etna Valley: what model of district?

To explain the emergence of our district, we argue, the analysis must abandon the formal elegance of NEG modelling and enter the space of complex social historical processes. Together with external economies another large set of dynamic forces support local development. Therefore, the adoption of a unique theoretical paradigm proves inadequate and such forces are borrowed from different theoretical approaches. Some come from industrial studies: the importance of a leader firm in shaping district organisational structure; others from within the economic geography**'s** tradition **(**specifically, the new industrial geography literature) such as the importance attributed to public institutions and socio-economic conditions in hindering or fostering local development.

Our case study emphasizes the function of ST, the leader firm (*impresa motrice*), as the engine of the local system's internal dynamism. This actor also accomplishes the role of channelling external technologies and market information towards subcontractors. NEG instead, disregards the role of individual firms in shaping districts' opportunities as autonomous economic actors.

There is another factor, specifically the cost of labor that we consider as crucial in activating the local process of agglomeration. Sicily has this abundant pool of intellectual labor thanks partly to unemployment of 26 per cent. In the absence of a thriving job market, young people are motivated to study. Moreover thanks also to the incentives created by the EU, the Italian Government and local bodies, brainpower costs less than elsewhere in Europe (FT, 17 October

2000).[12] In Krugman's model wage differentials are based on transport costs, in the Sicilian district instead, it is the surplus of qualified workers and the system of job-creating incentives that determines the low cost of local engineers.

In NEG local clusters of industry are associated with market size effects (labor pooling and specialist suppliers) and with internal economies. In the analysis, however, due to the specific character of the industries involved, the role of these elements seems rather marginal.

Indeed, the agglomeration is based on IT industries, operating in what Rullani (2000) refers to as the New/net/knowledge economy (microchips but also, software and telecommunications services). Within these industries a new, post-Fordist paradigm arises that is based either on high value products with a low impact on transport costs or on an organizational revolution that draws on the gains from being part of networks of firms. Networks are not only the product of the new technologies that facilitate a more flexible organizational behavior, but, also, the expressions of new economic needs. Variance and uncertainty in those industries become like actual resources to use in the competitive process as they allow answering in a flexible way to mutable and differentiated situations. Within this context, the role of transport costs, as predicted in NEG models, is rather marginal; what really matters for firms' location choices is to gain access to efficient networks of distance interactions. In our case study, in contrast to Krugman's market size-effects, the main emphasis is on the intermingling of firms and global (in the case of newly established multinationals) and local networks. Networks have usually been defined by the economic geography literature as type of organizational relation that are neither market transactions nor hierarchies, and the term has been used to refer to cooperative and mutually beneficial relationships among producers. If on the one hand Krugman's emphasis on pecuniary relations is a reminder to geographers not to lose sight of market effects, on the other, "his neglect of externalities that are intangible and leave no paper trail, appear too restrictive" (Martin and Sunley p. 273, 1998). As pointed out by the paper by Jaffe *et al.* (1993) cited above, and by the dynamics of our high-tech district, knowledge flows do sometimes leave a paper trail, in the form of citation patents.

But what is then, if any, the role played by geography within this framework?

[12] The full annual cost of employing an electronic engineer in Catania is about Dollars 22,000. This compares with Dollars 45,000 in Milan, Dollars 60,000 in France and as much as Dollars 100,000 in California. Even Singapore is more expensive, at Dollars 28,000 (FT, 17 October 2000).

Naturally, the valorization of network relations does not imply that the territory and direct forms of interactions become now irrelevant. On the contrary, face to face relations remain the most effective way to manage knowledge that is becoming more and more related to the specific local context and, therefore not easy to standardize and to transfer even in the presence of networks.

Knowledge spill over to local firms through localized labor turn over, spin off and horizontal cooperation (mostly with the University) are the main channels through which specific knowledge is localised and embedded in the local community (Breschi and Lissoni, 2001a). This interest in embedeness has been the distinctive contribution of the recent geographical literature on industrial districts and is applied with particular force to high technology districts[13]. This stands in complete contrast to Krugman's rejection of invisible externalities. His rejection seems to be made on the grounds that if externalities cannot be modelled than they have to be assumed a priori and so the analyst could say anything about types of spill over. If this on the one hand, rules out more sociological approaches, on the other is a reminder that further efforts need to be made to open the black box of knowledge flows.

In our opinion Krugman's stylised facts seem insufficient in providing an exhaustive account of the development experience analyzed through our case study. To a certain extent districts theories in the tradition of economic geography integrate those missing elements; they 'provide the rationale of an observed development process (…). They reported these facts and made them understandable' (Rullani, 2000: authors' translation). These approaches increasingly pointed to the ways in which economic activities are "embedded" in, and made possible by social and cultural activities and the related notions of knowledge flows and spill over, transmission mechanisms, learning process.

It seems natural then for us then, to interpret in the light of the above observations the finding that State direct intervention failed to be effective when uniformly distributed among different actors (Becattini, 2000). That is: when projects were financed without considering local entrepreneurial capacity, growth potential and firms' linkages with the local economic area. Indeed, in the 60's and 70's national and local policy makers relied on classical Keynesian policies, namely the power of heavy financial incentives to move capitals from the North and the rest of Europe. Even though external economic incentives have certainly played a key role in creating the initial conditions for the first establishment of ST in the 60's, they did failed in

[13] Belussi (1998); Rullani (2000); Becattini (2000).

activating endogenous processes of cumulative growth and for more than a decade ST was a "cathedral in the desert" with a marginal role in the local economy. The change of strategy that has involved ST and that has led to functions decentralization has been supported by a new set of measures that are product of a wider political change. Examples include the synergic partnership with the University, the new investments in research and development activities through the creation of the Science Park, the creation of the Single Bureau and of the BIC incubator, all these policy are the product of industrialisation policies rooted in local resources[14].

But, while we attempted an assessment of existing policies, we realized that part of the local potential for development, had been dissipated because the public institutions involved in shaping the trajectory of regional industrial evolution have lacked a common framework of reference. As mentioned earlier, a number of institutional actors and levels (the local Council, the Region, the Province, the National Government, the EU) have intervened, each with its on objectives and its own tools. In our opinion, each of the measures described above has been able to activate local potential for development but at the same time has not been able to intervene on some structural limits with roots in the specificities of the territory.

Our policy proposal arises exactly from the latter observations: to overcome the limits of the fragmented implementation of this kaleidoscope of measures, a unique development plan firmly rooted on the territory of must be created. It should coordinate the actions of the BIC incubator, of the Science Park and of National incentives. Each of these should perform a specific role within the overall framework defined by the plan. The Science Park, for example is apt to specifically target high tech initiatives, the BIC incubator should focus on newly established small firms and so forth. Two actors can be involved in the coordination of the plan: the University and the local public administration. However, we feel that it would be more effective to specifically differentiate the roles of the two in the following way: the University should limit its intervention to a scientific consultancy one, while the management of the plan should be entirely in the hands of the local public authority. The reason for this is in the key role reserved to local actors and resources; we believe that just the local public authority can manage a complex plan that involves services, infrastructures and negotiations with unions and entrepreneurs. Moreover, for the same reason, the need for a very specific model of governance arises: a

[14] Some authors see the origin of this new policy attitude towards local resources in the new electoral law introduced in the mid 90's and has led the major and the presidents of the Regional and Provincial Assembly to be elected directly by the citizens.

participatory democratic model of policy making that would involve diverse representative of public administrations, entrepreneurs, unions, banks and financial institution, and other social actors (for example, environmental associations).

The obstacles that still need to be specifically addressed by policy maker in order to establish a local system that can be considered a high tech district in the same guise as, for example, the examples of the Silicon Valley, Route 128, Orange County (USA), Sophia Antiopolis (France), Tsukuba (Japan) are the following:

- The presence of very few catalyst forces able of generating attraction effects.
- The weakness of the local entrepreneurial environment. Local enterprises are still too small both in size and number of employers.
- Outflows of knowledge follow rigid hierarchical channels: from the large enterprise to the small and very rarely different directions are experienced. Multi-directional information flows, are a distinctive character of the most evolved agglomerations (as the ones cited above).
- The level of development reached by the most advanced services is still not satisfactory.
- There is a lack of adequate financial services and structures to support new initiatives. Risk capital for small and medium high tech enterprises is still very limited.
- The scarce relevance of the academic spin off.
- Relational *networks* are still prominently subjective in their and institutional ones are scarce.

## 5. Conclusions

In this paper we have briefly reviewed the NEG literature. Specifically we have focused our attention on a model that seems to have given a new impulse to the introduction of spatial factors into economic analysis: Krugman's model.

What emerged from the critical analysis is that the above model results to be extremely simplified. If, on one hand this may be true for every economic model, on the other, we feel that, in our specific case study, the formalization of the processes of local development does not result to be entirely useful. Indeed, great part of the analysis of the industrial district based on the "industrial atmosphere" (Marshall, 1890) remains out of the picture. Therefore, we find more

useful the positions of those authors that not drawing on the deductive methods of theorising and analysing employed by Krugman, nonetheless have managed to enlighten mechanisms that seem to be more apt to investigate dynamics taking place in developing areas. More specifically, they seem to offer more useful insights in the context of non stationary economies where markets are not yet stabilized and therefore are not entirely capable of adequately transmitting incentives and information to the actors in the economy.

Development exists also as 'local stories, exceptional entrepreneurs and their pioneering firms; different capabilities to import ideas, men, technologies; the local culture and firms' imitative capacity (…). Geography matters, but it also matters cultural proximity, openness to external ideas, attitude to imitate (…).' (Viesti, 2000: 164, author's translation). To a certain extent districts theories in the tradition of the new industrial geography, integrate those missing elements, increasingly pointing out the importance for local development of knowledge and the related notions of knowledge flows and spill over, transmission mechanisms, learning process, etc. Recent criticism by innovation economists, however, highlighted how these studies hardly provide a detailed description of firms' network linkages; they do not show how workers disclose knowledge, and whether this knowledge is effectively valuable for the receiver that they attempted only timidly to open the black box of knowledge flows (Breschi, Lissoni, 2001).

To conclude, we maintain that the temptation to employ ideal type models needs to be rejected in favour of a more dynamic approach. A further step would be to draw an interpretative framework that contains elements from different theoretical traditions.

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