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Institutional Framework and Decentralisation in Rural Development

(First draft)

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Abstract

The paper analyses the institutional arrangements emerging in the rural local systems and the current enforcement and effect of rural and agricultural EU policies at the local level. The various kinds of policy implement a complex system of incentives, constraints and opportunities, which interact with the specific territorial context. The interaction between policies and the strategies of farmers and other local actors explains the spontaneous formation of emerging institutions. These institutions constitute the present governance of the territory, whose outcome may be unpredictable and at odds with policy objectives. An Artificial Neural Network (ANN) model can be used to represent and depict the functioning of this complex local system and its final result.

1. Introduction: a research agenda

In the last decade a new relevant concept in the literature on rural development has emerged: the local rural system. It has emerged as a specific subject in the general analysis of the local economic systems, whose study has a great tradition especially in those countries where very strong local industrial development experiences have taken place in the last decades. The Italian case can be considered one of the most relevant example (Saraceno, 1994; Cecchi and Basile, 1995; Esposti and Sotte, 1999).

The literature on the local economic systems mainly interests rural development for the emphasis it pays to the local economy as a self-organising system, that is a set of formal or informal institutional arrangements between local actors resulting from the interaction between their strategies and expectations. This institutional interpretation of

[*] Although the paper is a joint effort by the authors, sections 1,3, 5 can be attributed to Esposti, sections 2, 4, 6 to Sotte. The paper is a preliminary result of research of "relevant national interest" on the subject "Employment in rural areas" co-financed by the Italian Ministry for the University and Scientific Research (MURST).

the functioning of the local economy has been strongly stressed in the analysis of the industrial districts leading to a deep and rich reinterpretation of the Marshallian principles in an institutionalist and evolutionary perspective (Becattini, 1990; Foster, 1993). Along this tradition, many European researchers have focused on regional processes of technological innovation adopting the term of "innovative milieu" to describe the local clustering of highly innovative producers (Keeble and Wilkinson, 1999). This also progressively shifts the attention to what is considered the crucial aspect of the formation and evolution of the local economic systems: the *collective learning* (Camagni, 1991).

In the recent years, this stream of literature has found many contacts with the application of the principles of artificial intelligence to the modelling of artificial societies and social simulation (Castro Caldas and Cohelo, 1999, Dosi, 1993; Terna, 1998). These contacts are mainly due to the emergence of some shared theoretical foundations in the analysis of the functioning of local economic systems: agents are heterogeneous; heterogeneous agents dynamically interact spontaneously generating institutional arrangements; agents are not fully rational but they behave according to some procedural rule; complex interaction of such agents makes the local system highly capable of adaptation and learning.

The need of a rural version of the study of local economic system has arisen due to the inadequacy of that Marshallian foundation widely acknowledged in the analysis of the industrial local systems. In rural areas, the Marshallian local external economies are not necessarily the only and prevalent economies of localisation. Moreover, in the rural context the strength of the localisation economies is not necessarily the crucial topic of the local development pattern. In other words, strong theoretical foundations about the specificity of rural local systems are needed. These foundations should focus on those local scope economies that can represent the "rural analogy" to the traditional Marshallian local scale economies on which the analysis of the industrial local systems is founded.

A theoretical analysis of the prevailing institutional framework in the rural local context has not only a speculative interest; it is also of great interest in policy design. In particular, the issue of the territorial dimension of EU agricultural and rural policies is of especial importance in rural areas, where numerous new policies and institutions

have recently been implemented to foster rural development. In these cases, the local consistency of EU policy in its entirety is extremely relevant, and the outcome may prove to be particularly surprising and diversified. Indeed, the subject of the regional dimension of EU policies is not a new topic in the literature. On the one hand, much research has been devoted to assessing the regional distribution of these policies across the EU and, in some cases, to evaluating disparities and biases (Sotte, 1995). On the other hand, attention has focused on how regional lobbies, interest groups and policy makers are able to shape overall EU agricultural and rural policy formation (Nuppenau and Thiele, 1997; Rausser, 1992).

However, this literature does not address the reverse side of the problem: given the policy, how does the local context react? This question is crucial because if we are interested in the effects and outcome of policies, we have to know what the local context is, who really decides on local resource use, and to what extent the policy actually affects this use according to its alleged objectives. The question is not a trivial one, given the large body of literature on local economies as self-organising systems, that is complex systems whose actors and strategies dynamically interact to determine the so called local governance (Danson and Wittham, 1999). This perspective also changes our view about the topic of decentralisation in rural development policies. The local governance is always decentralised, by definition; the issue is then how can we decentralise government in rural areas according to the existent and operating decentralised local governance.

This paper focuses on the effects of the EU policies when considered at the local level; how they interact with the local context to create new institutions, behaviours and strategies. In the second section, we introduce the crucial idea of territorial governance, or in other words, the complex systems of actors and strategies that effectively decides on the local use of resources. In the third, section we deal with EU agriculture policies when viewed from the local perspective, and their interaction with local institutions to constitute a specific territorial governance; this system of interactions described in details for the farming family in section 4. The fifth section introduces the analytical framework to derive the governance outcome from the interaction between policies provision and delivery and agents and institutions at the local level. This can viewed as a neural network model which may be of help in defining the complex mechanism

generating the emerging local territorial governance. The model presented in fifth section can seem quite abstract. However, it has the main objective to illustrate, through a simple simulation in sixth section, how the main theoretical foundations about the functioning of local systems, their institutional framework and the set of heterogeneous and interacting agents, can be studied on the ground of artificial societies and their capacity of adaptation and learning.

2. The Territorial Dimension of Anything

The main difference between the generic terms 'region' and 'territory' is that the latter defines the genetic properties of the former. The territory is the entire set of the geographical, natural, cultural and socio-economic features of a region. This set is unique and generates the complex systems of individual and group strategies, objectives and interactions which finally define the genetic development perspectives of the region (Esposti and Sotte, 1999). It is genetic because it also depends on the environment: that is, the external (to the region) market and political conditions which also affect its development.

This interaction between the territory and the external conditions is, however, unique as well. If policies can be considered as external conditions, then they act differently at each local level; we may expect heterogeneous local outcomes from homogenous policies. Moreover, the social actor operates locally at a different interdependent level; therefore, different political and institutional levels cannot be represented in a hierarchical framework, because horizontal and cross-wise interactions predominate (interlocking directorates). As a consequence, external policies are unable to control for territorial specificity, which is highly complex, and continuously and often chaotically changing; they can only affect agent behaviour and strategy, but in a way that is highly unpredictable. An appropriate mix of EU-wide and local (specific) policies may significantly narrow the range of possible outcomes and may avert unexpected effects. However, if this mix requires the addition of many policies and institutions, the effect may be an increase, rather than a reduction, in the range of possible outcomes and the expectation that undesirable results will ensue.

Institutional economics and the sociological literature have dealt with the local rules that apply within a territory as a result of the interaction between local systems and external

conditions and policies (Ercoli, 1999). The term *governance* synthesises this concept. It substantially differs from the term *government*: that is, the political will to control and manage a territory by wielding consistent and exclusive political power. Governance, by contrast, is the actual capacity to control and manage local resources through formal and informal social norms, institutions and through the consensus and cooperation of local agents; government and its policies are only a part, and not necessarily the most important one, of local governance.

The problem of actual territorial governance is of particular interest in the case of rural areas for two main reasons:

- many new EU policies and related institutions have been implemented in rural areas since the mid-eighties. These policies have been often developed in parallel with traditional agricultural policy, at both the EU and national level. However, this parallelism does not exist locally: each policy is territorial and local when viewed from the beneficiary's standpoint. Therefore, the "new" rural polices and the "old" agricultural policies potentially define a new, unexpected and specific territorial policy;
- rural areas frequently display very strong endogenous territorial governance regardless of the formal institutions and policies implemented therein. The creation of close-knit informal networks is often the typical and successful reaction of these areas to their alleged disadvantages with respect to urban ones. The spontaneous and quite complex governance now emerging in rural areas has been studied in the literature, usually with reference to industrial districts (Foster, 1993; Danson and Whittam, 1999) and, in particular, to the Italian situation (Becattini, 1990; Esposti and Sotte, 1999).

The combined effects of many rural and agricultural policies and of dense local networks make it particularly hard to analyse the interaction among all the components that shape the so-called *rural regime* – that is, the system of emerging institutions which controls and manages the set of local resources. What, we may ask, is is the actual impact of rural policies in rural areas when they are considered jointly with the local action of EU agricultural policies and with the existing formal and informal governance? Is this impact consistent with the alleged objective of EU policies themselves? To provide an answer we need an appropriate theoretical framework.

Our aim in this paper is to outline the main features of this theoretical framework. Our approach is to link the capacity to learn and adapt of local actors and the delivery of agricultural-rural policies with the organisational design of the territory.

3. The EU Rural-Agricultural Policy seen from below

As said in the previous sections, the question of the complex interaction between policies and institutions within a territory is particularly important in those rural regions with substantial industrial development, and which display a "high density" of formal and informal strategies, institutions and actors (the so-called industrial districts). Accordingly, the following analysis will focus mainly on these cases. The intention is not to examine the interaction between the territory and EU policy in terms of the policy formation process – that is, in terms of the extent to which lobbying by local interests is able to affect EU policy decisions. This side of the problem has already been studied, and probably overemphasised (Rausser, 1992). Assuming that lobbying at the local rural level has low impact on the EU level, the problem is the other way round: how do local actors react to EU policies? How are these policies actually delivered, and what form does governance of the territory take? From this perspective, local action is the output from, and policies are the input to, the system, rather than the reverse.

Policies does not provide governance directly. Locally, governance is only determined by the actual behaviour of the actors and institutions affected by policies, as well by many other aspects. Moreover, all policies at each political level provide incentives, constraints, and bureaucracies, and their mixture is usually specific and largely unknown. Policies (either EU and national and local) do not interact directly with the alleged beneficiaries, whether farmers or other actors (for instance entrepreneurs in other sectors). Instead, they interact with some local formal institution or/and bureaucracy which is actually responsible for the local delivery of the policy. Furthermore, farmers and actors interact locally according to their strategies, and this interaction usually takes the form of some kind of organisation. The shape and nature of this organisation is linked to the policies and formal institutions/bureaucracies in order to derive the maximum advantage from them for the organised actors.

On this basis, what are the relevant rural and agricultural EU policies? Firstly, when viewed from below – that is, from the rural areas – any policy is a rural policy inasmuch

as it impacts on the rural area in some way. Therefore, EU agricultural policy in its entirety (the CAP) is the sum of an implicit rural policy and an explicit one. The difference lies in the kind of governance that they involve in delivery at local level. Thus, the EU agricultural and rural policy according to Agenda 2000 provides for three levels of governance:

- *Implicit rural governance (or simply CAP)*: by which is meant the so-called traditional sectoral policy directly targeted by the Commission on farmers, with no intervention by other institutions or national/local policies. Obviously still working on it is a bureaucracy managing the whole Common Market Organisation according to Agenda 2000. Although Agenda 2000 provides for a stabilisation of the CAP budget (including accompanying measures) under 40 billion ECUs, this is the main action provided by the EU policies at the local level, and it involves about 90% of the budget for the entire reform period (2000-2006) (Sotte, 1999). It mainly concerns cereals, oil and protein crops, dairy production and livestock. These represent only a marginal part of regional agricultural GDP (under 15% on average in Italian Southern regions), but they involve a large area of land (about 80% on average in Italian regions). Implicitly, this policy provides an incentive for production through price support, but much more than this it provides rents to land or livestock ownership in the form of direct payments, premiums and quotas.
- *Multi-level governance*: about 10% of the CAP budget according to Agenda 2000 is devoted to rural development: in the form of either traditional accompanying measures directly oriented to farmers, or modernisation and diversification measures which may involve other actors as well as farmers. However, the main difference from the previous case is that here policies are not directly delivered by the EU to the farmers: there are other political and institutional levels involved. Regardless of whether the region is under new objectives 1 and 2 or not, all rural development measures are managed at the regional level. The regions are committed to drawing up a 7-year Rural Development Program, and they may also arrange individual contracts with farmers (Territorial Contracts) (Hervieu, 1999). Moreover, also the nation level is involved; Agenda 2000 allows each member state to define rural areas under Objective 2 and to extend less favoured areas status to natural parks and protected areas. Finally, under a fixed ceiling, any member state may adjust direct

payments to the overall employment and economic situation of farms, and they must arrange cross-compliance measures with which to modulate payments according to the environmental impact of the farm activity. The point here is that delivery of these measures to farmers involves many existing and new institutions, procedures and actors whose main task is to manage the incentives in the form of direct payments. This clearly creates a new conditioning power in the territory. However, an even more important aspect is that regions and member states already have an (implicit or explicit) territorial policy regarding public services location in particular (hospitals, schools and so on), public investments (infrastructure, education, etc.) and other sectoral policies (in particular industrial). All these policies involve other institutions and actors and closely affect the multi-level governance of the territory.

- *Agencies governance:* this is the least explicit and poorest of the EU rural policies; its philosophy is neither to deliver incentives in the form of direct payments through regional/national institutions nor to pay farmers directly for some production. The intention is to create new institutions whose main aim is to foster local development. The typical example, although it is not an agency *strictu-sensu*, is the LEADER-PLUS Community initiative (although three others are provided for in Agenda 2000: INTERREG, URBAN and EQUAL). Although LEADER-PLUS is apparently unable to compete with the other levels of governance in terms of the resources managed,[1] it may have a strong impact locally. It is able to organise wide and non-sectoral interests and actors (the Local Action Groups) without appealing to existing institutions and without the intermediation of the multi-level governance. Indeed, LEADER-PLUS can also manage projects and resources in the context of rural development measures; for this reason, it often either conflicts with existing institutions and bureaucracies of the previous level of governance or it is absorbed by this level itself (Farrell).

Territorial governance is always a self-organising process: the different levels of governance create such a complex and locally specific system of incentives, institutions and bureaucracies that the final outcome is difficult to predict. Needed, therefore, is a framework within which to describe this system and determine its output.

[1] 1.7 billion ECUs have been allocated to the LEADER II initiative (1994-1999).

4. Policies and the Actual Territorial Governance

The complex interaction between local economies and EU policy delivery involves so many aspects, actors and interests that it is impossible to include all of them in a theoretical framework. Here we shall consider the relevant policies, interest groups and strategies and the institutions and adjustment mechanisms that emerge as a consequence. Figure 1 is an attempt to represent this process by focusing on the strategies of the family farm.

In a context of intense industrial development, the original family farm has two alternative strategies. The first is to remove as many resources as can be devoted to the other emerging sectors where higher productivity with respect to agriculture can be achieved. If emerging sectors take the form of industrial districts, they imply the physical shift of resources from the most rural areas to new urban and concentrated areas in the same region. Therefore, the strategy is to remove labour and capital from the rural areas and save land if it cannot be devoted to industrial settlement, which implies a rent-seeking behaviour which endeavours to obtain the maximum rent from land with the minimum use of capital and labour. This strategy is implicitly fostered by the direct payments envisaged by recent CAP reforms, and it also reinforces industrial development itself, allowing embryonic industrial clusters to find relatively cheap crucial resources locally, and to achieve the critical mass necessary for a real industrial district to come about (Esposti and Sotte, 1999).

The other strategy is to become a professional farm, which requires higher capitalisation, and continue to devote at least a part of family labour to the farm's activities. This strategy is clearly promoted by the CAP price support, although it biases these farms towards growing the crops which receive most support. The increasing substitution of price support with direct payments, however, only apparently negatively affects this latter strategy in favour of the former. Indeed, the combination of price support and direct payments under the present CAP enables both rent-seekers and professional farmers to obtain, respectively, rent and profit. This can be accomplished by means of specific institutional arrangements between the two actors where professional farms provide labour and capital while rent-seekers provide abundant land;

external service contracting, especially for machinery services provision (*contoterzismo* in Italian), is one of the most widespread of these institutional arrangements.[2]

Under the present CAP, these institutional arrangements are able to fit both strategies and therefore tend to reinforce each other. At the same time, however, these arrangements tend to inhibit the pursuit of alternative strategies by professional farmers. Indeed, and especially in most rural areas, farmers could invest capital, labour and land in alternative activities: non-supported, high quality and environmental friendly crops, agro-tourism and landscape conservation, or even other sectors such as traditional artisan products, cultural initiatives, and so on. All these activities are in fact supported by agencies governance, and also by multi-level governance, but with much lower resources than those devoted to traditional CAP.

Furthermore, multi-level governance is locally a complex system of policies. If we consider policy delivery as a whole – industrial settlement incentives infrastructures, public services and so on – they are usually greatly biased toward the most industrialised areas, the industrial districts, since these are deemed more crucial for the region's economy and for the local political competition (for building local political consensus). Therefore, this level of governance usually fosters territorial competition between the urban and industrial concentration and rural areas within the same rural region, implicitly creating negative feed-back on alternative strategies for professional farms.

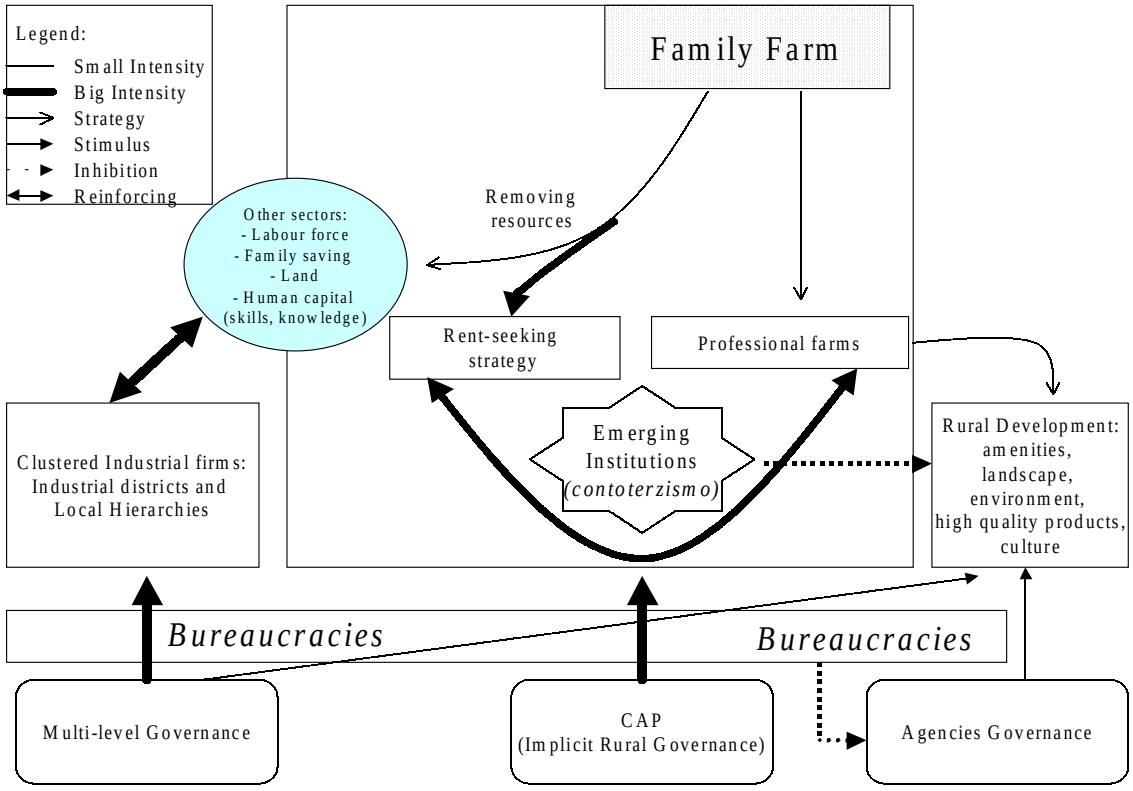
Finally, different levels of governance imply bureaucracies with different powers. Multi-level governance and traditional CAP usually exercise a complex bureaucratic power which has been established locally, but also at the national and EU levels, for at least two decades. By contrast, agency governance is quite recent and by definition seeks to create a direct partnership between local actors with a low level of bureaucratic control. Consequently, strong and consolidated bureaucracies counteract agency governance or try to take part in it, thereby hampering its operation. Moreover, the defence of the *status quo* and of control over the territory explains why coalitions

[2] In any case, other forms can be observed for example forming societies between professional farmers and landowners.

between bureaucracies and farmers interest groups are often formed to counter new policy delivery arrangements and new beneficiaries.[3]

We shall now seek to fit figure 1 and its complex interactions into a formal model. This model should be able to demonstrate how, given the external conditions and policy provision, some strategies and institutional arrangements locally generate the so-called *Dominant Design* (Luna, 1996). In the literature, Neural Networks (NN) models are frequently used to deal with the problem of giving adequate representation to how institutions emerge endogenously from interacting heterogeneous agents and how they interact locally with exogenous policies.

Figure 1 – Strategies, policies and actual governance



5. A Neural-Network Framework

Although it considers only some relevant aspects, the system depicted in figure 1 is still quite complex. The complexity is due to several factors. Firstly, actors and strategies are heterogeneous; moreover, they have expectations, and they shape their strategies

[3] One typical example is the negative reaction to the Cork Conference proposals, the so-called 'Cork fears' (Saraceno, 1999)

according to them, but they cannot be considered as fully rational because only incomplete information is available on other actors' strategies and on ongoing processes. In any case, even if they knew the other actors' strategies, they could not pursue an autonomous strategy because of the dialectical relationship that binds them to the evolutionary path of the system as a whole.

Secondly, the system is dynamic in the sense that it changes over time according to strategies and policies; self-reinforcing mechanisms and negative feedback continuously reshape the system itself. But not only does the system behave dynamically and not linearly; it also learns from the past and adapts to it through emerging institutions (the dominant design). All this can explain why the same policies produce very different outcomes and governance according to the real territorial context.

How can this system be formalised to yield a model to explain and predict the actual territorial governance observed locally? Although still not widely used in the literature on agricultural policy impacts (Nuppenau and Thiele, 1997), artificial Neural Networks (NN) are an appropriate tool. They are often employed in economic applications for empirical analysis, both for classifying and forecasting (Kohzadi *et al.*, 1995). Here we are interested in their ability to represent complex systems theoretically and simulate them. In this section, we propose a neural network representation of the interaction between policies and local actors depicted in previous sections.[4]

According to the discussion thus far, the topology of this NN model may be described as follows (figure 2). Policies represent signals and stimuli (the input layer) directed towards heterogeneous actors. The latter react to these stimuli by formulating an expectation and a consequent strategy. This is the so-called 'actors layer' comprising rent-seekers, professional farms, industrial entrepreneurs or, more generally, entrepreneurs seeking external (i..e district) scale economies (we may call them Marshallian entrepreneurs), and bureaucracies implied by policies.[5] These actors elaborate strategies as signals to the next layer, the institutional layer; here different strategies interact in order to reach arrangements among themselves. We define four components of these layers: the industry clustering; service contracting; the bureaucratic coalition created between bureaucracies and rent-seekers; the local diversification system in which economies of scope induce entrepreneurs to set up a local net of

[4] For wide-ranging analysis of the subject see White (1992).

diversified activities in order to meet the needs of the rural community.[6] The final outcomes of these arrangements are rents, profits, bureaucratic power and the localisation of activities: this is the actual governance of the territory.

The NN model should account for all the qualitative information provided by the figure: the intensity of a stimulus (or its inhibition), the activation of a strategy and reinforcing mechanisms. All these aspects should eventually explain the emergence of institutional arrangements within the specific territory, and why they may differ across the same territory.

We can conceive this model as a MultiLayer Perceptrons (MLP) network comprising different layers in which several nodes (neurons) receive stimuli and process them to produce an output; the nodes of the same layer do not interact directly. Each node receives numerous stimulating inputs, which it weighs and sums to obtain the output. However, the output is not a linear function of this weighted sum of inputs. More frequently, the relation is discrete: that is to say, the weighted sum may or may not activate the node, so that the output may be 0 o 1 according to the intensity of inputs and to the weights. If an inhibiting relation also operates, then output may range between –1 and 1.

Taking account of uncertainty and a stochastic environment (in particular markets), the output can be more realistically represented by the following functions (Gallant, 1993):

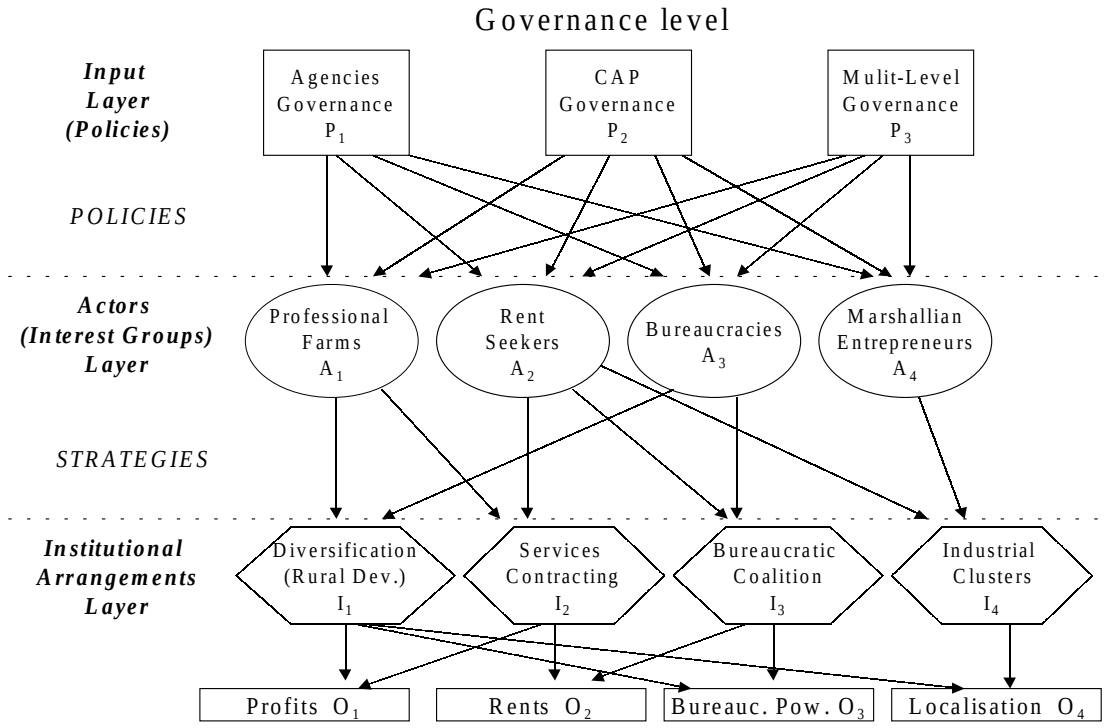
$$(1) \qquad u_i = \begin{cases} \dfrac{1}{1+e^{-I_i}} & \text{if activations is in } [0,1] \\ -1+\dfrac{2}{1+e^{-I_i}} & \text{if activations is in } [-1,1] \end{cases}$$

where u_i is the output of the *i-th* node, $I_i = \sum_j w_{i,j}\, u_j$, $\forall\, j \neq i$, that is, the weighted sum of the *i-th* node inputs which are the weighted *j-th* nodes outputs. The two forms in (1) allow both for simple activation (yes or no) and for a more complex relation (yes, no or inhibition). In our model, a weighted sum of policies activates actors' strategies whose weighted sum in turn activates institutional arrangements which eventually generate the overall network output. In this context and according to the previous analysis, a strategy means allocating the resources of the family farm: land, labour and capital. Rent seekers can allocate labour and capital to the embryonic industrial districts

[5] In our context each actor node is not a single actor but a group of homogenous actors.

and land to professional farm contractors. The latter have two competitive alternatives: allocating labour and capital to service contracting or investing them in diversifying activities (also non-agricultural). Marshallian entrepreneurs tend to concentrate labour and capital in industrial districts, the purpose being to take advantage of the implied localised scale economies. Finally, in delivering policies, bureaucracies act to conserve their local power by counteracting policy and institutional arrangements which may reduce their control or remove power from them.

Figure 2 – Topology of the "Territorial Governance" NN



None of these strategies is the result of any rational expectation maximisation process; here we adopt a far less restrictive idea of rationality as reasoned behaviour, or the directed, intentional behaviour of agents seeking advantages by committing resources to activities. This is a version of rationality which entails nothing more than decision making, and therefore choices which seek to make the most of the resources at the command of the agent (Metcalfe and Calderini, 1997). According to this idea, actors react to changing external conditions merely by adapting their strategies.

[6] This is also the prevailing idea of Rural Development.

This adaptation makes the institutional arrangements either emerge or vanish. How does this adaptation process work? In a context of NN models, we can talk about network' learning; in fact, agents change and adapt their strategies according to the final network outputs, or in other words, according to the resulting rents, profit and localisation of activities. The most popular model of learning is the *backpropagation network*; the essential feature of which is that each node corrects weights according to the differences between the expected outputs and the outputs provided by the net. Therefore, learning and adaptation involves the correction of weights by any node. In the present model, however, we have no particular expected output for the nodes; they adapt weights according to the net output just to improve the output itself. According to this argument, an alternative learning device is so-called *reinforcement learning* (Beltratti *et al*., 1996). This process is strictly adaptive because the only information that the node receives from the environment through the net output is an evaluation of the goodness of its strategy; it receives no information as to what the correct strategy should be. However, each agent still has aspiration levels according to which it directs its choices: the most rewarding actions are discovered by a trial-and-error search process in a dynamic environment (Kaebling *et al*., 1996).

One simple way to take account of this idea is the Temporal Difference algorithm, which simply assumes that each actor's strategy is reinforced or weakened according to the temporal sequence of the relevant net output;[7] the weights correction is the following:

$$(2) \qquad \Delta \mathbf{w}_t = \alpha \left(U_t - U_{t-1}\right) \sum_{k=0}^{t} r^{t-k} \nabla_w U_k$$

where α is the learning rate, r is the discount rate, U is the relevant network output and $\nabla_w U_k$ is the gradient of this output with respect to the vector of weights. The content of (2) is quite clear: each actor adjust its inputs' weights according to three components: how quickly it learns; how much and in which direction the output has changed in the last period; how the output reacted in the past to weight changes. The network achieves its steady state when $\left(U_t - U_{t-1}\right) = \Delta \mathbf{w}_t = 0$: that is, when the output does not change given the input; only changes in the input, i.e. policies delivery, are able to move the

[7] Relevant with respect to the strategy put in place by the actor. Indeed, actors have aspiration levels whereby they act as if they had an unknown and unlimited output target.

network from the steady state. However, according to the starting values, a network can achieve either different steady states or none (Gallant, 1993).

Learning through this correction of weights has a clear economic interpretation; in fact, weights in NN represent the strength of the connection. Therefore, if an actor increases the weight attributed to a policy, this means that it gives a more important role to this policy in defining its strategy; the reverse happens if the weight is reduced. In the case of the institutional layer, a weight increase means that a greater role is played by a given strategy in forming arrangements. Table 1 shows how the described general principle of this network actually works in the territorial governance model.

Table 1 - Functioning details of the NN model

Nodes	*Weights Restrictions*	*Activation Function*	*Aspiration Output*	*Nodes*	*Weights Restrictions*	*Activation Function*	*Aspiration Output*
Actors				**Institutions**			
Rent-Seekers	$w_{P_1}=0$ $w_{P_2}>0$ $w_{P_3}=0$	[0,1]	Rent	*Service Contracting*	$w_{A_1}>0$ $w_{A_2}>0$ $w_{A_3}=0$	[0,1]	Rents, Profits
Professional Farms	$w_{P_1}<0$ $w_{P_2}>0$ $w_{P_3}<0$	[-1,1]	Profit	*Diversification*	$w_{A_1}<0$ $w_{A_2}=0$ $w_{A_3}<0$	[0,1]	Profits
Bureaucracies	$w_{P_1}=0$ $w_{P_2}>0$ $w_{P_3}>0$	[0,1]	Bureaucratic Power	*Industrial Clusters*	$w_{A_1}=0$ $w_{A_2}>0$ $w_{A_3}=0$	[0,1]	Localisation
Marshallian Entrepreneurs	$w_{P_1}=0$ $w_{P_2}>0$ $w_{P_3}=0$	[0,1]	Localisation	*Bureaucratic Coalition*	$w_{A_1}=0$ $w_{A_2}>0$ $w_{A_3}>0$	[0,1]	Bureaucratic Power

6. A Simulation

A simple simulation can show the potentials of the NN model in Figure 2 in explaining the actual policies effect at the local level. The aim is to support the concepts of learning

and emerging dominant strategies and institutional arrangements with some computational evidence.

In the case of the current CAP, 90% of resources are devoted to P_2 while only 10% to P_1 and P_3 (European Commission, 1997); let's assume that P_1 and P_3 have the same share of 5%. Moreover, in a rural region with strong industrial districts, more non-agricultural policies from the national and regional level concentrate on the industrial areas increasing the intensity of the P_3. Therefore, for the simulation we assume that the intensity of policies is 0.05, 0.90 and 0.55 respectively.

Figure 3, 4 and 5 describe the outputs of the nodes of actor, institutional, output layers respectively[8]. The simulation runs for 200 iterations of the learning process with an assumed learning rate of 0.1[9]. Figure 3 shows how the professional farm strategy is the less stable; according to the described NN model professional farm can choose between diversification (maximum output = - 1) and service contracting (maximum output = + 1). However, after an unstable learning process, the professional farm strategy results clearly oriented toward service contracting. The emerging strategy also explains why in figure 4 diversification does not appear as a dominant design with respect to service contracting. The latter is also reinforced by bureaucratic coalition and industrial district formation and this interaction between these institutional arrangments also explains outputs in figure 5. In this NN model, localisation is assumed to vary between [-1,1], where –1 means minimum concentration and it is induced by the prevalence of the diversification institutional arrangement and +1 means maximum concentration and it is caused by prevalence of industrial districts. Therefore, the NN tends to find a steady state which implies a significant concentration as effect of the insufficient emergence of diversification strategies. However, this does not prevent professional farms from high profit that can be achieved choosing the service contracting strategy; profits are still achieved under different strategies and institutional arrangements.

Figure 6 shows a further example of the potential of the NN in explaining local policies effect. Let's assume an alternative policy scenario (European Commission, 1997); assume that the main bulk of resources is devoted to P_1 and P_3, while P_2 is marginal and assume that there is no additive national or regional non-agricultural policy in P_3.

[8] With respect to the (2), we assumed that actors during the network learning evaluate only outputs and weights of the last period.

[9] The starting values of outputs are forced to the middle of the potential output range, i.e. [0,1] or [-1,1].

Therefore, the intensity of policies is now 0.45, 0.1 and 0.45 respectively. Figure 6 shows how, under this scenario, professional farms choose diversification as dominant strategy over service contracting although it still takes advantage of the positive feedback given by the presence of the strategies of the other actors, which indeed have no alternative. However, in this case other actor' strategies are less intense and this is a further evidence provided by the model about how different policy designs can also imply different equilibria at local level[10].

7. Concluding Remarks

The paper has focused on the regional impact of EU rural and agricultural policies. The intention, however, has not been to study how policies differ across regions, but rather how, at the territorial level, actors react and adapt to the given delivery of policies. This aspect is not widely considered in the literature, the main reason being that it requires a quite complex representation of the territorial context.

First, an effort in the direction of some theoretical foundations about the institutional functioning of rural local systems is needed; all relevant actors, their aspirations, strategic options and interactions must be considered and modelled. Second, policies themselves should be rethought and classified in terms of the local governance they activate rather then in terms of the government level supplying them or their target sectors.

The paper has carried out an analytic effort in this direction. Firstly, the overall delivery of policies at the local level has been considered, with the stress on the different kinds of governance that they engender on the territory. According to them, local actors are able to make different choices among alternative strategic sets; each actor's choice interacts positively or negatively with another, according to the actors' aspirations. This interaction spontaneously gives rise to local institutional arrangements which finally become dominant over alternative settings.

This complex system of dynamically interacting agents can be effectively viewed as a Neural Network (NN). A realistic and complete topology of this network is far from being achieved here, and it evidently warrants further study. Nevertheless, the paper has presented a highly stylised version of the functioning of the local system in reaction to

[10] Due to limited space, we do not report more results of this alternative scenario. However, they can be requested to the authors.

policies as a NN. The aim has been to show, through a simple simulation, that this tool has the potential to highlight how dominant strategies and institutional designs emerge locally, and how they are affected by the actual intensity and delivery of policies.

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Figure 3 – Output of the Actors Layer nodes

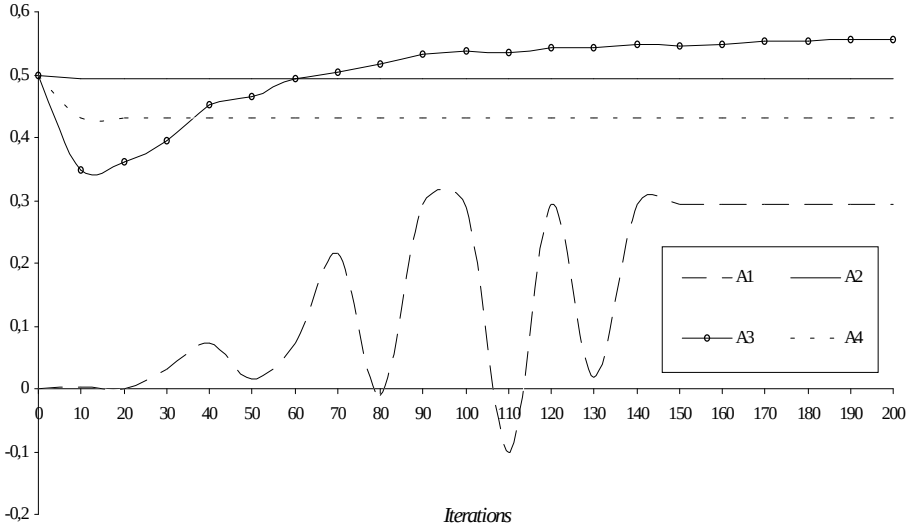

Figure 4 - Output of the Institutional Layer nodes

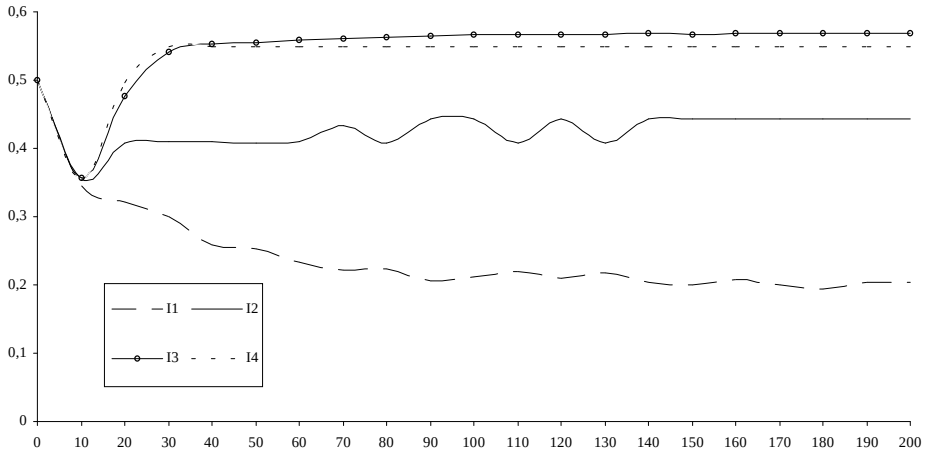

Figure 5 - Output of the Output Layer nodes

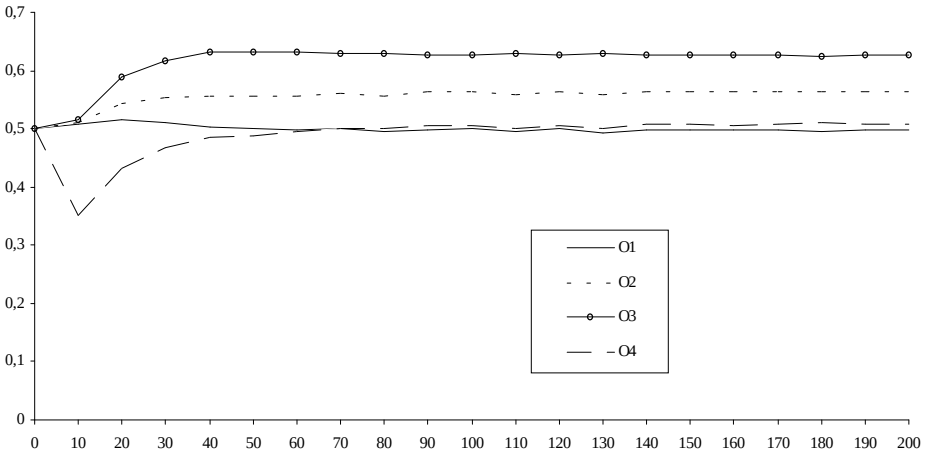

Figure 6 - Output of the Actors Layer nodes (alternative scenario)