Agricultural convergence and competitiveness in the EU-15 regions

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1. INTRODUCTION

Over the recent years, the concept of regional convergence has been more and more associated to that of competitiveness, understood as high and rising standards of living with the lowest possible level of involuntary unemployment in an economic and social sustainable environment (European Commission, 1999; 2001; 2002a, b; 2005a, b, c). Thus, productivity growth, for its closely relationship with competitiveness and the standards of living, and the promotion of its domestic determinants have become key objectives for sustaining the cohesion process (European Commission, 2002c, 2003; Krugman, 1994).

The issue is of specific importance in the EU agricultural sector where wealth and competitiveness conditions differ substantially across regions and might increase under the action of the recent policy, economic and social changes, induced primarily by the radical overhaul of the Common Agricultural Policy (CAP), the Lisbon strategy, the enlargement to 25 Member States, the high domestic production costs, the food demand saturation in quantity terms, and the new public priorities. The scenario makes agricultural competitiveness an unavoidable choice for farmers and policies. Particularly for the latter, it remains a critical challenge due to the slow process of convergence that has characterised the sector in the recent years (Bernini Carri, Sassi, 2002) and the important role given by the CAP reform not only to the Community but also to Member States and regions in promoting competitiveness (European Commission, 2005c).

In this context, the aim of the study is to verify the existence, within a sample of 170 EU-15 regions at NUTS2 level, of groups of regions with an initial agricultural competitiveness profile near enough to converge towards the same long-term equilibrium.

More precisely, the analysis, based on the EUROSTAT data, has first tested the convergence process from 1994-2003 in the whole sample that is taken as reference scenario. Than, by the means of a clustering technique, it has determined subgroups of regions characterised by maximum internal homogeneity and maximum inter-cluster heterogeneity in terms of a set of indicators expressing the level of competitiveness and its main determinants in the initial year. Finally, for each cluster, the convergence process has been estimated.

The results are presented after the description of the methodology adopted that makes reference to:

- The Kohonen Self-Organizing Maps for the cluster analysis; and
- The description of the shape of the distributions and of the intra-distributions dynamics along the line of the stochastic kernel technique for the convergence process estimation.

Finally, the conclusions critically examine the results achieved and their policy implications.

2. SAMPLE AND METHODOLOGY

The EUROSTAT data constraints have limited the number of regions in the sample that consists of the 170 NUTS2 regions representative of the EU-15 Member States[1].

[1] The regions in the sample are: AT11 - Burgenland; AT12 – Niederosterreich; AT13 – Wien; AT21 – Karnten; AT22 – Steiermark; AT31 – Oberosterreich; AT32 – Salzburg; AT33 – Tirol; AT34 – Vorarlberg; DE11 – Stuttgart; DE12 – Karlsruhe; DE13 – Freiburg; DE14 – Tubingen; DE21 – Oberbayern; DE22 – Niederbayern; DE23 – Oberpfalz; DE24 – Oberfranken; DE25 – Mittelfranken; DE26 – Unterfranken; DE27 – Schwaben; DE71 – Darmstadt; DE72 – Gieben; DE73 – Kassel; DE80 - Mecklenburg-Vorpommern; DE91 – Braunschweig; DE92 – Hannover; DE93 – Luneburg; DE94 - Weser-Ems; DEA1 – Dusseldorf; DEA2 – Koln; DEA3 – Munster; DEA4 – Detmold; DEA5 – Arnsberg; DEB1 – Koblenz; DEB2 – Trier; DEB3 - Rheinhessen-Pfalz; DEC0 – Saarland; DEE1 – Dessau; DEE2 – Halle; DEE3 – Magdeburg; DEF0 - Schleswig-Holstein; DEG0 – Thuringen; DK00 – Danmark; ES11 – Galicia; ES12 - Principado de Asturias; ES13 – Cantabria; ES21 - Pais Vasco; ES22 - Comunidad Foral de Navarra; ES23 - La Rioja; ES24 – Aragon; ES30 - Comunidad de Madrid; ES41 - Castilla y Leon; ES42 - Castilla-La Mancha; ES43 – Extremadura; ES51 – Cataluna; ES52 - Comunidad Valenciana; ES53 - Illes Balears; ES61 – Andalucia; ES62 - Region de Murcia; ES70 – Canarias; FI13 - Ita-Suomi; FI20 – Aland; FR10 - Ile-de-France; FR21 - Champagne-Ardenne; FR22 – Picardie; FR23 - Haute-Normandie; FR24 – Centre; FR25 - Basse-Normandie; FR26 – Bourgogne; FR30 - Nord - Pas-de-Calais; FR41 – Lorraine; FR42 – Alsace; FR43 - Franche-Comté; FR51 - Pays-de-la-Loire; FR52 – Bretagne; FR53 - Poitou-Charentes; FR61 – Aquitaine; FR62 - Midi-Pyrénées; FR63 – Limousin; FR71 - Rhone-Alpes; FR72 – Auvergne; FR81 - Languedoc-Roussillon; FR82 - Provence-Alpes-Cote d'Azur; FR83 – Corse; GR11 - Anatoliki Makedonia, Thraki; GR12 - Kentriki Makedonia; GR13 - Dytiky Macedonia; GR14 – Thessalia; GR21 – Ipeiros; GR22 - Ionia Nisia; GR23 - Dytiki Ellada; GR24 - Sterea Ellada; GR25 – Peloponnisos; GR30 – Attiki; GR41 - Voreio Ai gaio; GR42 - Notio Ai gaio; GR43 – Kriti; IE01 - Border, midland and western; IE02 - Southern and eastern; ITC1 – Piemonte; ITC2 - Valle d'Aosta; ITC3 – Liguria; ITC4 – Lombardia; ITD3 – Veneto; ITD4 - Friuli-Venezia Giulia; ITD5 - Emilia Romagna; ITE1 – Toscana; ITE2 – Umbria; ITE3 – Marche; ITE4 – Lazio; ITF1 – Abruzzo; ITF2 – Molise; ITF3 – Campania; ITF4 – Puglia; ITF5 – Basilicata; ITF6 – Calabria; ITG1- Sicilia; ITG2 – Sardegna; LU00 – Luxembourg; NL11 – Groningen; NL12 – Friesland; NL13 – Drenthe; NL21 – Overijssel; NL22 – Gelderland; NL23 – Flevoland; NL31 – Utrecht; NL32 - Noord-Holland; NL33 - Zuid-Holland; NL34 – Zeeland; NL41 - Noord-Brabant; NL42 – Limburg; PT11 – Norte; PT15 – Algarve; PT20 - Regiao Autonoma dos Acores; PT30 - Regiao Autonoma da Madeira; SE01 – Stockholm; SE02 - Ostra Mellansverige; SE04 – Sydsverige; SE06 - Norra Mellansverige; SE07 - Mellersta Norrland; SE08 - Ovre Norrland; SE09 - Smaland med oarna; SE0A – Vastsverige; UKD1 – Cumbria; UKD2 – Cheshire;UKD4 – Lancashire; UKE1 - East Riding and North Lincolnshire; UKE2 - North Yorkshire; UKE4 - West Yorkshire; UKF1 - Derbyshire and Nottinghamshire; UKF2 - Leicestershire, Rutland and Northamptonshire; UKF3 – Lincolnshire; UKG1 - Herefordshire, Worcestershire and Warwickshire; UKG2 - Shropshire and Staffordshire; UKH1 - East Anglia; UKH2 - Bedfordshire and Hertfordshire; UKH3 – Essex; UKJ1 - Berkshire, Buckingamshire and Oxfordshire; UKJ2 - Surrey, East and West Sussex; UKJ3 - Hampshire and Isle of Wight; UKJ4 – Kent; UKK1 - Gloucestershire, Wiltshire and North Somerset; UKK2 - Dorset and Somerset; UKK3 - Cornwall and Isles of Scilly; UKK4 – Devon; UKL1 - West Wales and The Valleys; UKL2 - East Wales; UKM1 - North Eastern Scotland; UKM2 - Eastern Scotland; UKM3 - South Western Scotland.

The Kohonen Self-Organizing Maps (Kohonen, 1981a, b, c, d; 1982a, b) has provided a multi-dimension selection criterion of segmentation of the territorial units (Ultsch, Vetter, 1994; Giudici, 2003).

As a convergence club is a group of economies whose initial conditions are near enough to converge toward the same long-term equilibrium, the competitiveness indicators have been referred to 1994, the initial year of the time period analysed. Also in this case, data constraints in the reference year have limited the number of the indicators. However, those quantified are suitable to measure regional agricultural competitiveness at the macroeconomic level and its main domestic determinants[2]. They have been selected keeping into account the fact that according to the recent policy, economic and social changes in the EU, technical efficiency is not any more the only key objective for a competitive agriculture. The sector should be more focused on price signals and at the same time on diversification, innovation, social needs and environmental protection.

Thus, the indicators selected[3] are:

- *Index of Competitiveness*, expressed by the labour productivity estimated as the ratio between the gross agricultural value added at basic and constant prices on the total agricultural labour force in annual work unit[4];
- *Index of Diversification*, obtained as ratio between the value of the inseparable non-agricultural secondary activities[5] and the value of the agricultural output;
- *Index of Innovation*, represented by the number of patent applications per worker and understood as a measure of R&D results (EUROSTAT, 2004b);

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[2] For a definition of regional competitiveness at the macroeconomic level see Aiginger (1998) and Martin (2003b).

[3] For a deeper analysis of these aspects and a possible interpretation of the explanatory variables adopted see Brooksbank, Pickernell (1999) and DEFPRA (2002).

[4] The indicator has been selected keeping into account the recent competitiveness reports of the EC where regional competitiveness is understood as strong productivity performance and, for the whole economy, is measured by the regional GDP per hours (European Commission, 2003).

[5] Inseparable non-agricultural activities are defined as "activities closely linked to the agricultural production for which information on any of production, intermediate consumption, compensation of employees, labour input or gross fixed capital formation cannot be separable from information on the main agricultural activity during the period of statistical observation" (EUROSTAT, 2004a).

- *Index of Dependence on the CAP Direct Support*, estimated as ratio between the value of cereals on total agricultural value added. It is a proxy of direct subsidies as data at regional level for the variable is not available. Cereals are one of the “strong” sector of the Community agriculture not only in terms of output but also of direct support. It absorbs more than 30% of total Guarantee section of EAGGF. In a context of general removing of direct support any productivity performance of regions that rely heavily on it should have problems of competitiveness (DEFPRA, 2002);
- *Index of Production Sustainability*, given by the share of the annual work unit of young farmers, those with less than 35 years, and a proxy of the innovation propensity as in the literature the indicator is interpreted as expression of changes in the structural organisation of the sector and the application of modern technologies and farming practices (OECD, 2002).

Other explanatory variables have been quantified but they have been excluded in the analysis due to their correlation with others that makes them not important in defining the cluster profile.

The indicators have been standardised so that their value does not affect the results through a greater weight of the greater distances.

The optimal number of clusters has been selected on the basis of the Ward method and the R2 statistics.

2.1. The shape of the distribution and the intra-distribution dynamics

The natural logarithm of the gross agricultural value added at basic and constant prices on the total agricultural labour force in annual work unit (AVA/AWU) divided by the average of the sample has been adopted as explanatory variable of the convergence process[6].

[6] It is assumed that, as in the economy as a whole, productivity growth and the growth in the standards of living are closely related: in the long-term an increase in real wages equals that in labour productivity (European Commission, 2002b).

The shape of the distributions has been analysed through the Kernel density estimate[7] (Bowman, Azzalini,1997) implemented by the density plot that gives an indication of the median, the inter-quartile range, and the outliers.

Finally, a Kernel Surface Plot for 5-years transitions in the data, averaging over 1994 through 2003, has allowed representing the intra-distribution dynamics. The methodology refers to the non-parametric approach introduced by Quah (1996a, b, c, d; 1997). It considers simultaneously agricultural growth and distribution across regions in order to understand the specific interaction among economies that cannot be predicted by a "representative economy" (Bernard, Durlauf, 1996) parametric model (Durlauf, Quah, 1999; Friedman, 1992; Quah, 1996a, b, c, d). The stochastic kernel has been preferred to the transition probability technique, the other commonly used non parametric approach, to overcome the possible distortions introduced by the latter in the choice of the cells size[8]. This graphic representation has been completed by the Contour Plot, the three dimensional data in a flat, two-dimensional plane with the contour lines representing the height in the z direction from the corresponding three-dimensional surface.

The two Plots provide information not only on the peaks of the distribution, but also on its mobility in the sense that there is:

- Persistence when most of the mass is concentrated along the 45-degree diagonal;
- Convergence if most of the graph is located parallel to the initial period axis;
- Overtaking[9] when most of the mass is rotated 90 degrees counter-clockwise from the 45-degree diagonal (Quah, 1997).

Also in this case, as with the density function, the choice of the bandwidth is key and it has been evaluated by the Normal Optimal Smoothing method (Bowman, Azzalini, 1997).

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[7] The choice of the bandwidth that sets the degree of smoothness of the plot has been selected through the Normal Optimal Smoothing method (Bowman, Azzalini, 1997).

[8] The transition probability matrix discretizes the space of the explanatory variable values and count the transitions out and into these cells. When variables are continuous, as it is our case, the matrix should distort their dynamics according to the choice of the extreme values of the cells. The problem is overcome reducing the cells size up to they tend to infinity and obtaining a stochastic Kernel surface that represents a transition probability matrix into the continuum (Quah, 1997).

[9] Overtaking means that the poor regions become rich and the rich become poor.

3. RESULTS

3.1. Agricultural Convergence across EU-15 Regions

Figure 1.a shows the smooth Kernel functions for the whole sample in 1994, 1998 and 2003. The principal modes of the distributions are seen to occur virtually at the identical position very closed to the average value of the sample. By 2003 the peak has become more pronounced. The number of regions in the middle agricultural income class is increasing particularly from 1994 to 1998. The data shows no reversal in the dynamics described, thus the tendencies appear monotone.

In the Box Plots in Figure 1.b, the dynamics of the extreme values of the sample (the broken line) underlines a barely noticeable convergence process. Within these borders, the median of the data[10] remains almost the same over the time period analysed and closed to the EU-15 average. The inter-quartile range has reduced marginally in the first five years to stabilize in the second half of the time period.

Also the whiskers show a convergence tendency that is determined particularly by the poorest regions dynamics in the first half of the decade. The lower adjacent value underlines some outliers. However, part of the outstanding performers has catch-up with the initially poor economy[11].

The Figure 2 shows the Stochastic Kernel for 5-years transitions in the relative *ln AVA/AWU* data in a three-dimensional representation in both a three dimensional plane and in a flat, two-dimensional plane. The most of the graph is concentrated along the 45-degree diagonal, indicating that the majority of the regions after 5 years have the probability to remain where they began.

3.2. Cluster Analysis

The Ward method and the R^2 statistics have suggested to segment the 170 regions of the sample in four optimal clusters[12] whose profile is explained by all the indicators adopted even if with a different importance[13]. The clusters profile is summarized in Figure 3.

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[10] The median of the data in Figure 2 is represented by the thin horizontal line in the interior of the boxes.
[11] This explains the negative asymmetry of the density functions and its reduction over time.
[12] The regions in each cluster are 65 for Cluster 1 (ES11, ES12, ES13, ES21, ES22, ES23, ES24, ES30, ES41, ES42, ES43, ES51, ES52, ES53, ES61, ES62, ES70, FR81, GR11, GR12, GR13, GR14, GR21, GR22, GR23, GR24, GR25, GR30, GR41, GR42, GR43, IE01, ITC1, ITC2, ITC3, ITC4, ITD4, ITD5, ITE1, ITE2, ITE3, ITE4, ITF1, ITF2, ITF3,

Cluster 1 shows only the Index of diversification on the average. The values of the other explanatory variables are below the average and the lowest compared with the other clusters. Thus, the subgroup includes regions, mainly concentrated in the Mediterranean area, that with respect to those in other clusters are *not competitive*.

Cluster 2 is characterised by the highest index of competitiveness and innovation, a relatively low index of sustainability and diversification and an index of dependence on direct support a little higher than the average. The regions in this group can be defined as *strongly competitive and innovative*.

Cluster 3 has the highest index of diversification and that of competitiveness and sustainability above the average, while below the average are the index of innovation and of dependency on direct support; in this class the regions are *competitive,* a character associated with *diversification and production sustainability.*

Cluster 4 includes regions mostly concentrated in the central part of the UE-15 that on average distinguish themselves for the highest production sustainability and dependency on direct support, the diversification is the lowest while the index of innovation and competitiveness are marginally higher than the average. The regions in the group have a "young" agriculture *strongly dependent on direct support*.

3.3. Convergence and Competitiveness

ITF4, ITF5, ITF6, ITG1, ITG2, PT11, PT15, PT20, PT30, SE06, SE07, SE09, SE0A, UKD1, UKD4, UKE4, UKJ2, UKK4, UKL1, UKL2); 45 for Cluster 2 (AT13, DE71, DEA1, DEA2, DEB3, DK00, FR10, FR42, FR61, FR82, ITD3, NL11, NL12, NL13, NL21, NL22, NL23, NL31, NL32, NL33, NL34, NL41, NL42, SE02, SE04, SE08, UKD2, UKE1, UKE2, UKF1, UKF2, UKF3, UKG1, UKG2, UKH1, UKH2, UKH3, UKJ1, UKJ3, UKJ4, UKK1, UKK2, UKK3, UKM1, UKM2); 10 for Cluster 3 (AT11, AT21, AT32, AT33, AT34, FR21, FR53, FR83, SE01, UKM3); and 50 for Cluster 4 (AT12, AT22, AT31, DE11, DE12, DE13, DE14, DE21, DE22, DE23, DE24, DE25, DE26, DE27, DE72, DE73, DE80, DE91, DE92, DE93, DE94, DEA3, DEA4, DEA5, DEB1, DEB2, DEC0, DEE1, DEE2, DEE3, DEF0, DEG0, FI13, FI20, FR22, FR23, FR24, FR25, FR26, FR30, FR41, FR43, FR51, FR52, FR62, FR63, FR71, FR72, IE02, LU00).

[13] The importance values are:

- 1.0000 for the Index of Production Sustainability
- 0.7685 for the Index of Competitiveness
- 0.5028 for the Index of Diversification
- 0.4252 for the index of dependence on the CAP Direct Support
- 0.3237 for the Index of Innovation.

In the three reference years, the dynamic of the shape of the distributions of the regions of *Cluster 1* is monotone (Figure 4.a). Over time, the principal mode has shift a little towards the right side closed to the EU average value of the explanatory variable with a larger proportion of the distribution around it.

In the box plots, a part from the 1994, the changes in the distance between the richest and the poorest regions, in the median and in the top and bottom edges are marginal. (Figure 4.b).

After 1994, the upper and lower adjacent values improve showing a hypothesis of equivalent growth. The dynamics of the borders of the distribution is affected by the outliers, as suggested by the shape of the density function.

Figure 5 shows that most of the graph is concentrated along the 45-degree diagonal, thus there is persistence in the intra-distribution dynamics.

The shape of the densities of the subgroup of regions in *Cluster 2* differs significantly from that of the whole sample (Figure 6.a). In fact, it is far from to be monotone showing a reversal from 1994 and 1998, passing form a left-skewed distribution to a right-skewed one and even the secondary mode shifts from the low to the upper tail. Furthermore, the second peak disappears in 2003.

As the principal mode, it changes position moving towards the lower value of EU's average and increasing its high. With respect to 1994, in 2003, there is a smaller proportion of the distribution in the low and particularly in the upper tail. If the former tendency represents a good signal, it means that the poorest regions are becoming richer, the second is negative: for the majority of the richest regions the relative income indicator is deteriorating.

The Box Plots in Figure 6.b gives some more information on these tendencies. The borders of the distribution and the upper and lower adjacent values show a fluctuating performance even if the trend support a hypothesis of decreasing convergence. As expected, the inter-quartile range and its vertical location have decreased over time. Thus, the distribution of the middle agricultural income regions has reduced its spread and, both in the upper and the lower quartile, have deteriorated their position even if at a lower intensity in the last four years.

The intra-distribution dynamics depicted in Figure 7 shows a convergence process towards an AVA/AWU value above the UE-15 average.

The shape of density functions for the regions of *Cluster 3* underlines a process of separating (Figure 8.a). Some of the regions originally close together in the middle class have subsequently separated around two “basins of attraction” characterised by lower relative AVA/AWU.

This hypothesis of divergence is confirmed in the box plots (Figure 8.b).

The analysis of the intra-distribution dynamics, provided by Figure 9, adds some important element to this scenario. It confirms a separating process with the poorest regions in the second pick that deteriorate their position over a 5-year horizon. More generally, the observations are rotating clockwise toward the parallel the to final year axis assuming the typical shape determined by a divergence process. In the long term, there is the probability for the regions to reduce and differentiate their income.

Even if the distributions are monotone, in *Cluster 4* a twinpeakedness becomes evident in 2003 when the sample separates around the average value (Figure 10.a).

In the box plots there is no significant changes a part on the lower adjacent value that deteriorate a little over time supporting an hypothesis of a slight divergence in the shape of the distribution (Figure 10.b). The extraordinarily poorly-performing regions in the first half of the time period have caught up with the poor economy.

Finally, the stochastic Kernel displays a situation of persistence in the intra-distribution dynamics (Figure 11).

4. CONCLUSIONS

The analysis of the convergence process across the 170 NUTS2 regions of the EU-15 has underlined a state of persistence in the intra-distribution dynamics. The only changes, describing a slight convergence, are in the extremities of the sample and mainly in the first part of the time period considered.

Within this context, the classification of the regions in subgroups has shown that the complexity of the competitive scenario across the territorial units in the initial year has affected the process of convergence differently. Roughly speaking, mobility is associated with a competitive profile and persistence with a non-competitive profile and a high dependence on the CAP support.

As the two clusters characterised by agricultural competitiveness, there is a club of convergence where competitiveness goes with innovation (*Cluster 2*) while the agricultural productivity diverge and regions are interested by a separation process when the competitive profile is combined with a relative "younger" agriculture and higher diversification (*Cluster 3*).

This supports the evidence the literature suggests in terms of association between high innovation and high productivity also in the agricultural sector (European Commission, 2001) and reinforce the need to put the Lisbon Council prescriptions in operation into the sector and to direct to agriculture part of the resources the Barcelona Council has endorsed as a target for public and private spending in R&D: 3% of GDP by the end of the decade (Barcelona European Council, 2002).

The results concerning *Cluster 3* are in line with the importance addressed by the recent CAP reform to diversification and sustainability: they are key pillars in building an open and competitive agriculture (European Commission, 2004a). However, these factors alone seem not to be able to promote a process of convergence and their impact on agricultural income disparities should be carefully evaluated: as previously underlined, separation and divergence seem to prevail in the intra-distribution dynamics.

This means that the state of competitiveness in itself is not the condition that carries out convergence: the process seems to be determined by the specific factors at the basis of competitiveness.

The results referred to *Cluster 4* underline that the relative high dependence on subsidies has not activated a process of both competitiveness and convergence in the sector across these regions. This opens to an important issue concerning the role of the CAP and, particularly, of the direct aid provided to the European farmers.

The analysis suggests that what the agricultural sector mostly needs to face convergence and competitiveness is not an increase in the Community aid but an enterprise policy aimed at establishing an environment conductive to farms growth and innovation and able to support the specific strategies the farmers carry out. These measures should keep in to account the different territorial characters and thus far form to be centralised and concentrated. This is where the interventions at regional levels come in. In this context, Regions and Member States have to undertake a key and dynamic role offering to the sector well structured and complementary policies for the development of a market-oriented agricultural sector whit technological development and innovation the main drivers of increased productivity.

The measures at territorial level are even more important in the regions of *Cluster 1*, those with a non competitive agriculture in relative terms, where they assume a specific meaning. The spatial representation shows that these regions are mainly located in the Mediterranean area where the quality competitiveness is, at least, as important as the price competition. The former should find a clear definition and support at institutional level in the territorial units and should find support above all in the international arena. However, these areas belong to Member States with a relatively low institutional power, at list at Community level, in this field.

This strengthens the need for reinforcing competitive capacity of national and local institutions. It becomes a pre-condition and an indispensable component of a comprehensive strategy aimed at developing agricultural competitiveness and convergence in the EU regions.

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Figure 1 – The shape of the distribution of the 170 NUTS 2 regions

a. Densities of relative *ln AVA/AWU* b. Box plots

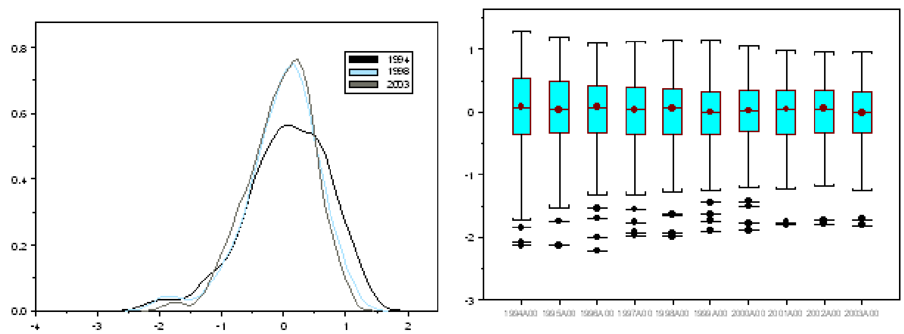


Figure 2 – Relative *ln AVA/AWU* dynamics across 170 NUTS 2 regions – 5 year horizon

a. Stochastic kernel b. Counter plot

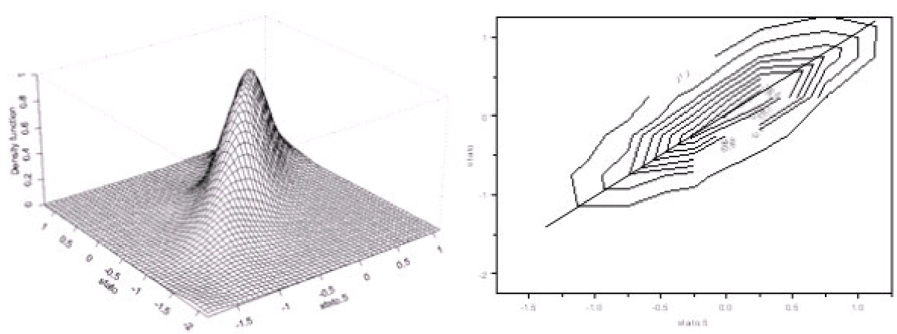
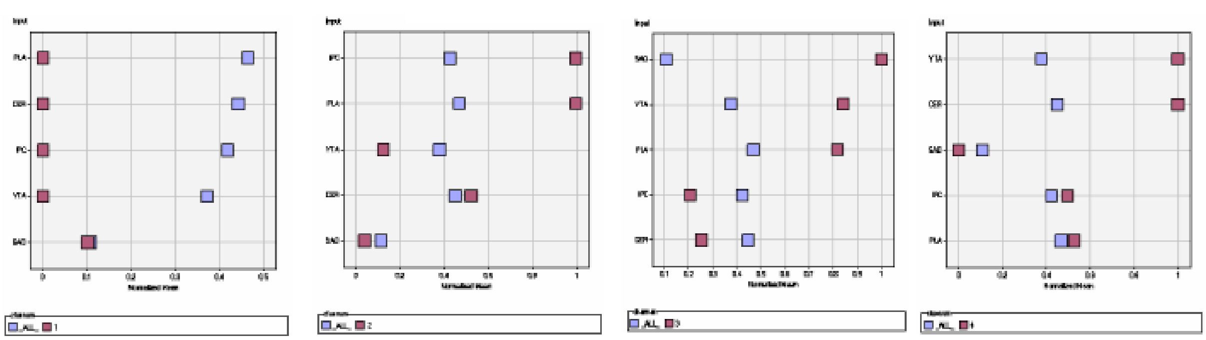


Figure 3 - Clusters profile



YTA = Index of Production Sustainability; PLA = Index of Competitiveness;
SAO = Index of Diversification; CER = Index of Dependence on the CAP Direct Support;
IPC = Index of Innovation

Figure 4 The shape of the distribution of the regions of Cluster 1

a. Densities of relative *ln AVA/AWU* b. Box plots

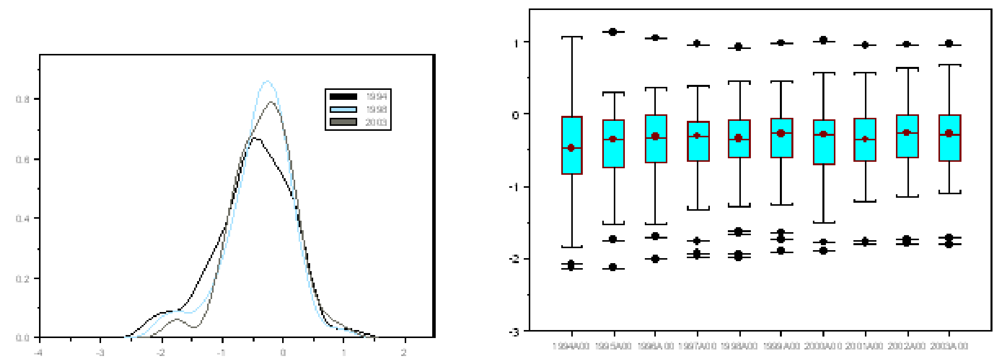


Figure 5 – Relative *ln AVA/AWU* dynamics across the regions of Cluster 1 – 5 year horizon

a. Stochastic kernel b. Counter plot

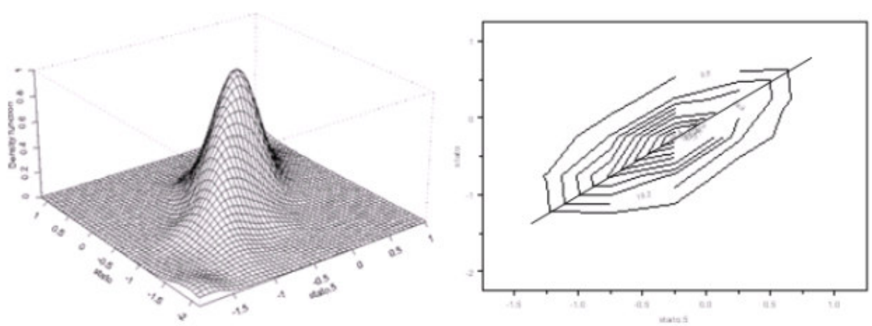


Figure 6 - The shape of the distribution of regions of Cluster 2

a. Densities of relative *ln AVA/AWU* b. Box plots - Densities of relative *ln AVA/AWU*

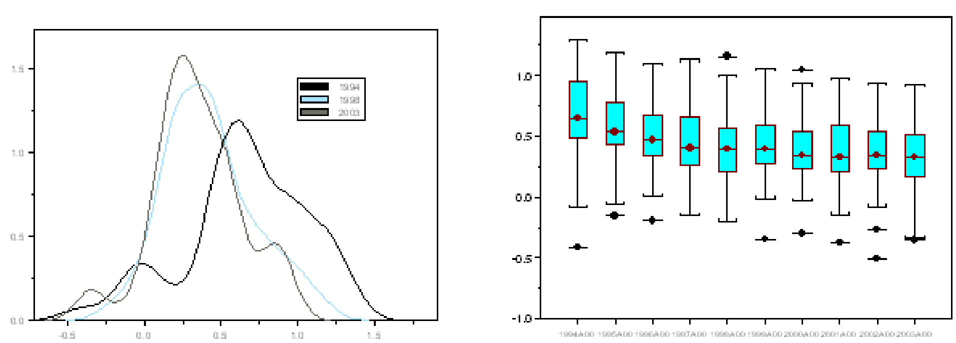


Figure 7 – Relative *ln AVA/AWU* dynamics across the regions of Cluster 2 – 5 year horizon

a. Stochastic kernel b. Counter plot

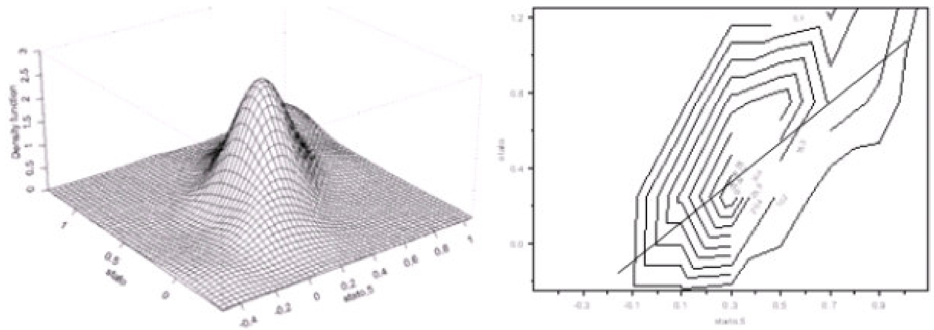


Figure 8 - Figure 6 - The shape of the distribution of regions of Cluster 2

a. Densities of relative *ln AVA/AWU* b. Box plots - Densities of relative *ln AVA/AWU*

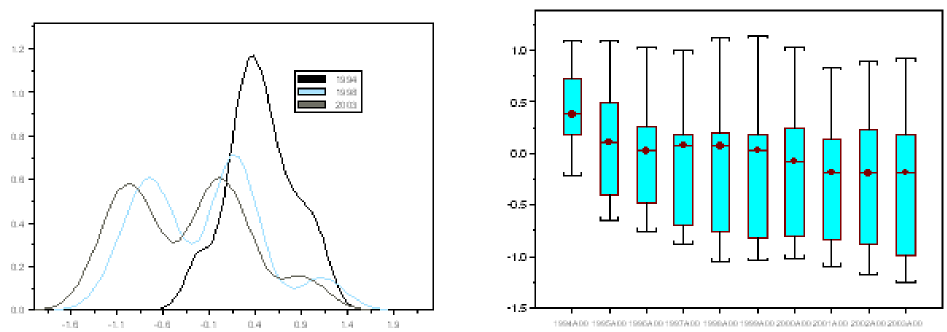


Figure 9 – Relative *ln AVA/AWU* dynamics across the regions of Cluster 3 – 5 year horizon

a. Stochastic kernel b. Counter plot

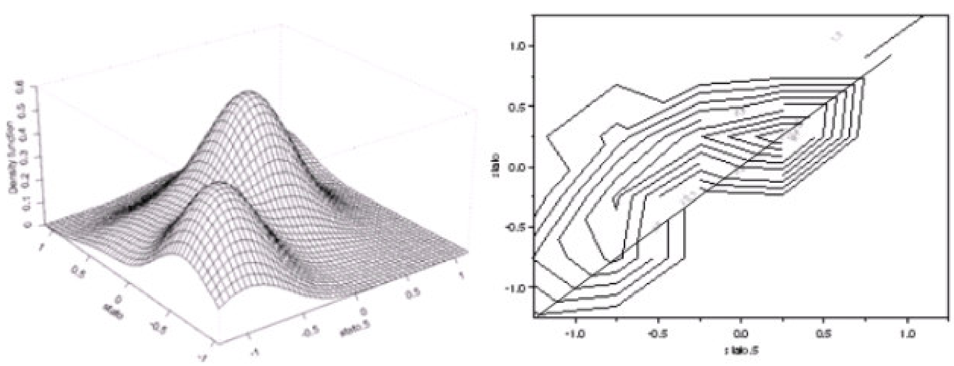


Figure 10 - The shape of the distribution of regions of Cluster 4

a. Densities of relative *ln AVA/AWU* b. Box plots - Densities of relative *ln AVA/AWU*

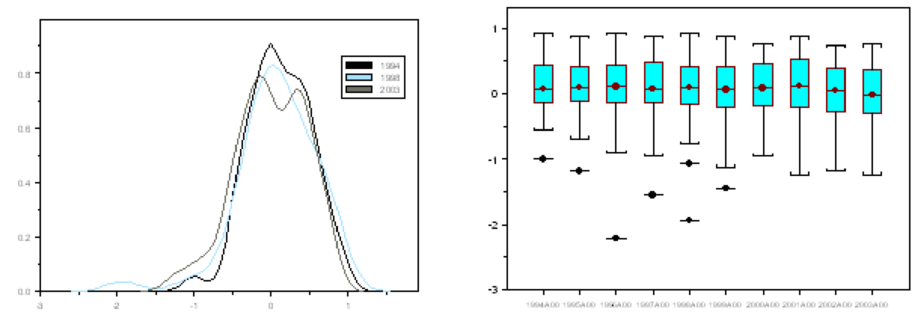


Figure 11 – Relative *ln AVA/AWU* dynamics across the regions of Cluster 4 – 5 year horizon

a. Stochastic kernel b. Counter plot