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## Non parametric methods to assess the role of the CAP in regional convergence in Hungary

Using the stochastic kernel, we analyse the Hungarian convergence path before and after accession to the European Union (EU), within its NUTS 3 regions (counties), and between those of the eastern EU Member States. Then, we develop a convergence analysis of GDP per capita PPS (Purchasing Power Parity) conditioned to Common Agricultural Policy (CAP) funds, in order to understand the role of the introduction of the CAP in the convergence of Hungarian rural areas. We find increasing divergence both within Hungarian NUTS 3 regions and between the eastern EU MS NUTS 3 regions, especially after Hungary joined the EU; a limited contribution of the CAP to the catching up of rural areas; and persisting difficulties of working with lacking rural disaggregated statistics.

**Keywords:** Non-parametric; sub-regional convergence; CAP; enlargement

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### Introduction

In the last decade, the eastern enlargement of the European Union (EU) focused attention on the EU policy objectives and instruments for cohesion. In fact, the eastern EU Member States (MS) showed a much lower level of GDP per capita (p.c.) than the EU-15 average, and their agricultural sector was still playing an important role in their economic structure. The EU pre-accession instruments (SAPARD, PHARE, ISPA), followed after the EU accession by the Cohesion and Structural funds, and by the Common Agricultural Policy (CAP), were meant to enhance the catching up of these countries with the established EU Member States<sup>1</sup>.

Since 2004, and more than a decade after the important reforms which interested the Cohesion policy and CAP, the initial convergence between the eastern EU MS and the best performing EU MS turned into divergence (Matkowski and Próchniak, 2004; Brasili and Costantini, 2005; Ezcurra *et al.*, 2007). Regional and sub-regional inequality spread (Monasterolo, 2011), affecting the living conditions of the agricultural population, especially those living in remote rural areas (Bertolini and Montanari, 2008; Csáki, 2008) and the new urban poor. The assessment of the convergence path of the eastern EU MS, with particular attention to the role played by the agricultural sector in that, could help policy makers understand the development bottlenecks and introduce better targeted policies that account for the regional and sub-regional disparities. The further application of this methodology to the current EU candidate countries would highlight income evolution at the disaggregated geographical level and the effect of the policy measures on that, helping to overcome the problems experienced in the last enlargement. This point is very topical: in fact, the EU is still affected by the consequences of the recent global financial and economic crisis, which also influence (negatively) the speed of the EU enlargement path towards the Western Balkans. In this regard Croatia, which became the 28th EU MS in 2013, already

shows evidence of regional divergence (that increased during the pre-EU accession period) and experiences the same pre-accession funds absorption problems already evidenced by other eastern EU MS.

Thus, this paper provides (a) an analysis of the convergence path of GDP p.c. PPS (Purchasing Power Parity) between the Hungarian NUTS 3 regions from 1997 to 2009, which is compared to (b) the convergence path of GDP p.c. PPS among the eastern EU MS (EU-10) (NUTS 3) from 1999 to 2009, and (c) an assessment of the role of CAP support (decoupled and Single Area Payment Scheme (SAPS) payments) on convergence in GDP p.c. PPS between Hungarian NUTS 3 regions, applying Quah's conditional convergence model (Quah, 1997a)<sup>2</sup>.

### Advances beyond the state of the art

The quest for growth has been pursued by development economists since the search for the determinants of the wealth of nations was initiated by Adam Smith in 1776. Then, it passed through Lewis's 'surplus labour' model, Rostow's stylised facts (Rostow, 1960) and Kutznet's critiques (Kutznet, 1955), the neoclassic visions by Gerschenkron (1962) and Gomulka (1971), until the opposition coming from the endogenous and new economic geography growth theories (Krugman, 1991).

Cohesion was also a central issue in the foundation and enlargement of the EU<sup>3</sup>. In 1989, the introduction of a set of policies and instruments under the Structural and Cohesion Policy framework was aimed at decreasing development inequalities between the former Objective 1 (now Convergence) regions, and the bulk of faster growing ones (the so called *blue banana*) through economic convergence. Since

<sup>1</sup> The cohesion objective is clearly stated in the Treaty of Rome (Art. 158, 1958) which states the creation of the EU. Since 1962, the CAP introduction (art. 39-43) was aimed at reducing income disparities between the agricultural and the other economic sectors, by promoting investments in agricultural and rural areas, and introducing support policies.

<sup>2</sup> Decoupled payments per farm weighted for the SAPS payments per county was chosen as conditioning variable, in order to include just payments directly affecting farm income (as a difference from the other investments or programme related payments, which impact on farm income just in the medium to long term).

<sup>3</sup> The objective of the European cohesion policy is defined in Articles 2 and 4, and Title XVII of the Treaty establishing the European Community. Cohesion policy should contribute to *promote economic and social progress as well as a high level of employment, and to achieve balanced and sustainable development*, and Article 158: *in particular, the Community aims to reduce the disparities between the levels of development of the different regions and the backwardness of the least favoured regions or islands, including rural areas.*

the second half of the 1980s, early results for the EU-15 showed (a) slow convergence and (b) the persistence of a core-periphery pattern at the regional level (Petraikos *et al.*, 2005). In fact, at the disaggregated level inequality spread (+10 per cent), despite the EU budget and measures for cohesion (Rodriguez-Pose, 2002). The enlargement path seems to have contributed to reducing disparities across countries but not across regions within countries (Overman and Puga, 2002). This is the case in Convergence regions, where most of the funds were allocated (Quah, 1996), highlighting the case of an equity/efficiency trade off, and a debate on the role of Cohesion Funds in the beneficiary countries (Sapir *et al.*, 2003). This is also the case in the eastern EU MS: in fact, almost a decade after the EU accession, inequality between the EU-27 is gradually diminishing while regional inequality increases. The capital towns are able to attract Foreign Direct Investment and develop, while agricultural and rural areas, especially at the eastern and southern borders, lag behind (Monasterolo, 2008).

Monitoring and evaluating the efficiency of policies for cohesion and convergence became a priority during the EU eastern enlargement of 2004. In fact, the EU population increased up to about 500 million, and a redistribution of the EU budget from the former beneficiaries to the newcomers, especially under the CAP because the eastern EU MS were characterised by very different structural features and problems unsolved in transition. In fact, at the time of accession the countries presented a lower economic performance: Hungary could reach 60 per cent of the average EU-25 GDP p.c., the level of the poorest regions in the EU-15 such as Iperios (Greece), while Latvia stopped at 30 per cent. The figures were even lower for Bulgaria and Romania, which joined the EU in 2007 (25 per cent of the EU GDP p.c.).

The case of Hungary caught our attention because it was considered the 'best performing' transition country (WB, 1997) and it was also among the first block of Central and Eastern European Countries negotiating the EU accession, but since 2008 the country has been undergoing severe economic (and political) troubles which hinder its EU membership. Moreover, Hungary is a good example of how the lack of institutional and implementing abilities, together with weak EC control of community funds, could vanish the *value added* of the EU policy, especially in the most peripheral and rural areas, finally increasing the internal development gap.

Previous analyses investigated income-level convergence in the enlarged EU following different methodologies: Matkowski and Próchniak (2004) and Paas *et al.* (2007) use parametric methodologies; Ertur and Koch (2006) use exploratory spatial analysis; Ezcurra *et al.* (2007) adopt a non-parametric approach, highlighting the role played by neighbouring regions for explaining the dispersion in the distribution of GDP per worker; Chapman and Meliciani (2012) use non-parametric and spatial regimes analyses. They mainly find evidence of catch-up during the integration process, but also a new north-west/east polarisation pattern which replaces the previous north-south one for the EU-15. In particular, Matkowski and Próchniak (2004) show that there is a clear  $\beta$ -convergence in income levels among eight EU accession countries in the period 1993-2005, and income differences between individual countries tend to diminish.

Åslund and Dabrowski (2007) find that economic growth in the last decade has, on average, been higher in the eastern EU MS than in the EU-15, and they use this as evidence of catch-up and convergence between the two blocks of countries, but they forget to highlight that most of the growth in the eastern EU MS was concentrated in and around capital cities (Gorton *et al.*, 2009). Chapman and Meliciani (2012), following the approach developed by Rodriguez-Pose (1998), analyse the relevance of socio-economic and specialisation groups in affecting the *within countries* convergence in the EU-27, using the sigma convergence and a spatial approach. They find that socio-economic clusters explain the divergence in regional GDP p.c. within eastern EU MS, where regions specialised in knowledge intensive services, and urban regions, are better off from the integration process while regions specialised in agriculture and in low tech industries have been falling behind.

We argue that an analysis of the growth path at a disaggregated territorial level (NUTS 3) is needed because this is the level at which most of the inequality emerged in eastern EU MS (Monasterolo, 2008). Looking at how sub-regions perform together in the eastern EU MS, would help better understand the bottleneck of EU funds allocation and absorption, thus improving the effectiveness of the EU funds and policy targeting. In this regard, it is important to study the path followed by agricultural and rural areas in eastern EU MS at the sub-regional level during the EU integration process because (a) is still widely unknown, and (b) it can help to understand the role of CAP support to convergence and the productivity convergence in agriculture<sup>4</sup> (Stilianos and Stilianos, 2010), issues which attract considerable attention in the EU policy agenda.

## Methodology

### Non-parametric approach and its application

The convergence hypothesis under the parametric approach ( $\beta$ - and  $\sigma$ -convergence) is based on the idea that given the same exogenous technology, countries with low per capita income and low capital per worker would provide higher returns to capital (Baumol, 1986). This, in turn, would attract more foreign capital assuring a higher accumulation rate and faster growth, the condition being that the economies are open to international markets. In fact, according to Solow's (1956) results, (a) an economy starting from a low GDP p.c. level (and low capital per worker) tends towards a steady state and grows faster than the economy starting from a higher income and capital level; and (b) economies approaching different steady states need not converge.

We recognise that the use of the synthetic parameters  $\beta$  and  $\sigma$  to assess convergence presents several limitations<sup>5</sup>;

<sup>4</sup> Agricultural labour productivity in NUTS 2 regions in the enlarged EU has been studied testing for  $\beta$  and club convergence (Stilianos and Stilianos, 2010), which do not allow us to understand the internal distribution dynamic between the initial and final year of analysis.

<sup>5</sup>  $\beta$ -convergence and  $\sigma$ -convergence differ from a conceptual point of view: in fact, the presence of the latter implies the presence of the former, but the opposite is not true: income differences between countries can rise and at the same time less developed countries may develop faster (Barro and Sala-i-Martin, 1992).

- They rely on neoclassic assumptions of stable economic growth (Quah, 1993);
- They are not able to catch the dynamics of the internal distribution (Quah, 1996) or to underline the existence of a subgroup of regions presenting different dynamics of growth from that of the average of the sample (Bernard and Durlauf, 1995; Quah, 1997b);
- They return different and often opposite results according to the data and the number of regions analysed;
- The estimation of  $\beta$  is characterised by a systematic tendency towards 2 per cent (Canova and Marcet, 1995), while  $\sigma$ -convergence is highly influenced by the presence of outliers, which leads to an underestimation of convergence;
- It was demonstrated that an initial evidence of catching up can subsist together with an increase in sub-regional divergence, as a trade-off between national and sub-regional convergence evidenced by the inverted U curve (Williamson, 1994), due to the concentration of economic activities in specific areas, or growth poles (agglomeration economies, Viesti and Prota, 2004).

Thus, in order to overcome such methodological and conceptual limits, we chose to apply a non-parametric approach. Since the beginning of the 1990s, the endogenous growth school has developed new, non-parametric approaches to the analysis of economic convergence<sup>6</sup>. Among them, Quah's (1993) econometric model based on the stochastic kernel presents several advantages because it provides a dynamic analysis of GDP p.c. density function, looking at the evolution of the cross-country distribution of GDP p.c. PPS. The stochastic kernel can be considered as a kind of transition probability matrix (or Markovian matrix) where classes are defined in a continuum because it estimates the whole marginal density function for the variable through the years. It also allows assessing the long term perspectives of the distribution of the chosen variable: in fact, the final output is an ergodic income distribution estimated on the observed variations in the analysed period.

As a difference from the parametric methods, this dynamic analysis is able to evidence the presence of two main characteristics: (a) *persistence*, when the classification of regions according to their GDP p.c. does not change (rich economies remain rich and the poor ones remain poor); and (b) *polarisation*, better known as the phenomenon of twin peaks or convergence clubs, where countries move toward different groups, diverging (the opposite of what is required for convergence)<sup>7</sup>.

Let us define  $F_t$  as the distribution of incomes (GDP p.c.) at time  $t$  and  $F_{t+1}$  as the distribution of incomes at the following time. There is an operator  $M$  (the stochastic kernel), that maps the evolution of the distribution from time  $t$  to time  $t+1$ . The operator  $M$  can be defined by:

$$F_{t+1} = M + F_t \quad (1)$$

Repeated for the distribution of all the analysed years, it is possible to obtain an operator  $M$  which describes the transition of the distribution from time  $t$  to time  $t+s$ . Assuming  $M$  to be invariant in time, we obtain an estimator for the future distribution of density, that is:

$$F_{t+2s} = MF_{t+s} = M(MF_t) = M^2F_t \quad (2)$$

$$F_{t+rs} = M_r F_t \quad (3)$$

If  $r \rightarrow \infty$ , then we obtain an estimate of the limit distribution of incomes at the end period which allows us to explore the changes that have occurred in the observed period, the distributive characteristics of GDP p.c. (namely, if the evolution in the future shows a similar trend to the previous years), and to assess if convergence takes place.

Through a graphical representation it is possible to follow the movement of the distribution through the years:

- On axis  $t1$  the possible values of the GDP p.c. PPS for each statistical unit at the initial period are reported;
- Axis  $t2$  shows the possible values in the long term (a not specified period in the future);
- The axis 'kernel' reports the estimates of the kernel function.

The graph should be read starting from the main diagonal of level  $(t1, t2)$ , whereas the points are determined from the same values at time  $t1$  and time  $t2$ . Two extreme cases can occur: (a) the straight line at 45 degrees, which defines a situation of persistence. In this case, if the kernel surface is entirely distributed along this diagonal, the observed countries do not change their position in time; and (b) the alignment of the kernel surface along the secondary diagonal, which indicates that the evolution of the distribution of GDP p.c. determines a reversal of the initial situation (in the long term, poor regions get rich and *vice versa*).

Perfect convergence occurs when the kernel surface is parallel to axis  $t1$  around a single modal value. All the units are distributed around the same income level at time  $t2$ , which means that in the long run poor regions would grow more than the richest ones until all the regions show similar income levels. The process of convergence is represented by an anti-clockwise rotation around the main diagonal line in two directions: in the case of income values below the average, rotation of the peaks disposed under the main diagonal; modal rotation above the main diagonal line in the case of wealthier regions.

### The conditioned convergence

The concept of conditional convergence (Barro and Sala-i-Martin, 1991, 1992) considers the structural differences of the economies, looking for the variables which are able to influence the convergence path<sup>8</sup>, in order to derive useful

<sup>6</sup> The introduction of non-parametric models able to observe the path followed by the statistical units in the time period considered was possible also thanks to the increase in statistical information.

<sup>7</sup> *Twin peaks* phenomenon, within persistence, are the most frequent features observed in Quah's analysis on economic convergence (1993).

<sup>8</sup> Assessing the presence of conditional convergence would mean that, if all the economies start from the same initial conditions, they would follow the same growth path, while if starting from different levels they would reach specific steady states to each economy.

insights for political economy. Thus, we move away from the hypothesis of a single steady state according to which every region converges, leaving the perspective for catching up of poorer regions.

It is possible to better specify the absolute  $\beta$ -convergence model conditioning the path followed by GDP p.c. to one or more influencing variables:

$$\frac{\left(\log \frac{y_{i,t}}{y_{i,0}}\right)}{t} = a - \beta l \log y_{i,0} + \gamma Z_{i,t} + u_{i,0,t}$$

where  $Z_{i,t}$  represents the variables able to influence GDP p.c. growth.

This approach observes only the relationship between the statistical units analysed in their average values. In order to overcome this limit, Quah (1997b) provides a methodological framework for the analysis of the distribution of conditioned GDP p.c., assessing how the conditional variable influences the distribution function (GDP p.c. PPS)<sup>9</sup>.

Moving from the  $\beta$ -convergence approach, it is possible to analyse if the conditioning variable  $Z$  explains the variable of interest  $Y$ <sup>10</sup>, highlighting possible differences in the two expected values  $E(Y|X,Z)$  and  $E(Y|X)$ , for the respective distributions  $Y|X,Z$  and  $Y|X$ .

When the two distributions are linear:

$$E(Y|X,Z) = \beta X + \gamma Z \tag{4}$$

it is possible to test if the regression coefficient  $\gamma=0$ .

Quah (1997a) explores the possibility for equality of the conditioning distribution of  $Y|X,Z$  and  $Y|X$ <sup>11</sup>, and the transformation of  $Y$  in  $Y|Z$ , which can be represented mathematically by the stochastic kernel, the operator which models the changing distributions, and thus the effects of conditioning. In case of equality of the two distributions,  $Z$  does not explain  $Y$ <sup>12</sup>.

Therefore, the stochastic kernel can perform the following operation:

$$F_{z,t} = M * F_t \tag{5}$$

where  $F_{z,t}$  is the distribution of variable  $Y$  conditioned to variable  $Z$  at time  $t$  and  $F_t$  is the unconditioned distribution of  $Y$  at time  $t$ . The operator  $M$  provides information on the origin of the evolution of the distributions through the years. It observes how the distribution changes when passing from an unconditioned variable to a conditioned one; then, the stochastic kernel is applied to the residuals of the time series of the conditioned distribution, providing results for the convergence analysis.

The use of the stochastic kernel still leaves to the researcher the choice for the conditioning variable to include, according to the structural and development peculiarity of the areas analysed.

## Data and sample

The composition of the sample and the time period chosen depend on data availability at NUTS 3 level. A non-parametric convergence analysis was made on the twenty Hungarian NUTS 3 regions (counties), GDP p.c. PPS from 1997 (the year when the EC agreed on the enlargement negotiation procedures at the Luxembourg European Council and initiated the participation in Community programmes as a pre-accession strategy for the candidate countries) to 2009 (chosen as the final year due to data availability). This variable allows us to better compare the wealth levels of different statistical units, accounting also for the different level of prices (Leonardi, 1998).

For the non-parametric analysis on the eastern EU MS NUTS 3 regions, we use Eurostat data for GDP p.c. PPS available from 1999.

It was not straightforward to gather statistical information on the CAP payments to Hungarian beneficiaries at the sub-regional level. We also wanted to include the CAP payments which directly contribute to farm income, because support to investments and support provided under specific programmes (for example, Rural Development, Leader approach) would show effects on farm income only in the medium term. Thus, we weighted data on the decoupled payment support at the regional level in Hungary (data provided by the FADN/RICA database) from 2004 to 2009 for the number of successful applications for SAPS support, provided at the NUTS 3 regional level by the Hungarian Payment Agency (*Mezőgazdasági és Vidékfejlesztési Hivatal*, MVH). Then, the obtained value is used as conditioning variable in the conditional convergence analysis of GDP growth.

## Results

### Non-parametric convergence analysis of the Hungarian NUTS 3 regions

Analysing the marginal density functions of GDP p.c. PPS distribution between 1997 and 2009, we see that Hungarian NUTS 3 regions<sup>13</sup> tend to (a) increase their economic performance, probably as a result of the end of the transition period and the EU pre-accession funds, but (b) their performance is very different. In 1997 NUTS 3 regions gather into three groups which are characterised by high internal variability, while in the following years a stronger convergence take place which leads to NUTS 3 regions gathering into two groups, one characterised by high internal volatility in terms of GDP p.c. PPS, and a richer one which keeps increasing its economic performance and shows higher internal cohesion (Figure 1).

This interpretation is confirmed by the stochastic kernel (Figure 2)<sup>14</sup>, which shows the evolution of GDP p.c. PPS: a small group of NUTS 3 regions headed by Budapest grew fast

<sup>9</sup> In fact, explaining the dynamics of the conditioned distribution corresponds conceptually to analyse the effects of the conditioning on the distribution of the study variable (Quah, 1997b).

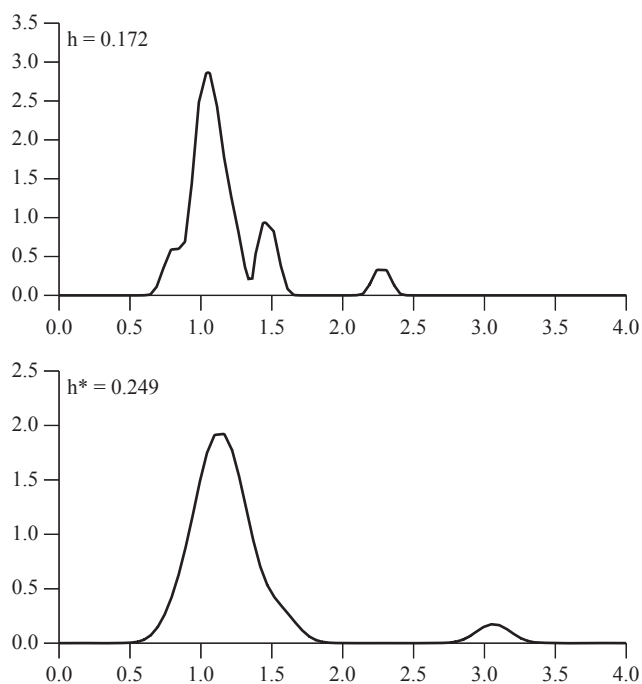
<sup>10</sup> It works also when  $X$  is included in the model.

<sup>11</sup> In case  $X$  is a null variable, we would study the relationship between the conditional distribution  $Y|Z$  and the unconditioned distribution of  $Y$ .

<sup>12</sup> The variations in  $Z$  do not influence the distribution of  $Y$ .

<sup>13</sup> The limited number of statistical units should be considered, when analysing the intensity of the peaks.

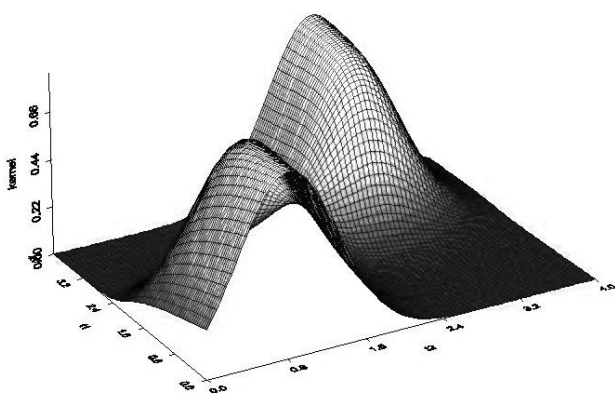
<sup>14</sup> The analyses are provided using the algorithm in Gauss. The graphic outputs are obtained with the S-Plus software.



**Figure 1:** Marginal distribution of GDP p.c. PPP in the NUTS 3 regions of Hungary in (a) 1997 and (b) 2009.

\* The *smoothing* parameter (or bandwidth)  $h$  has been computed as an average between the  $h$  proposed by Silverman (1986):  $h = 0.9 A(n)^{1/5}$ ; where  $A$  is the minimum value obtained between the standard deviation and the first quartile divided for 1.34, and the  $h [h = (\frac{4}{3n})^{1/5} \sigma]$  computed for a Gaussian estimate function.

Source: own elaborations on Eurostat data



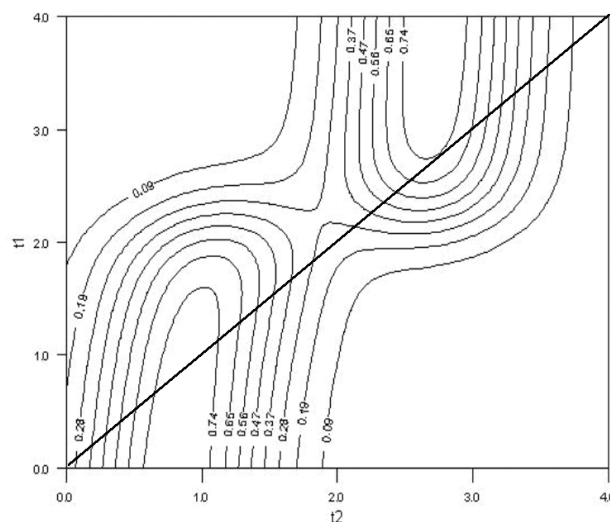
**Figure 2:** Stochastic kernel of GDP p.c. PPP in the NUTS 3 regions of Hungary.

Source: own elaborations on Eurostat data

while the other group, composed by the most of the mainly rural and less developed NUTS 3 regions tended to converge among themselves at lower income levels, confirming previous descriptive analysis (Csáki and Jambor, 2010).

As shown by the contour plot (Figure 3), these two groups of NUTS 3 regions evidence a tendency towards convergence within themselves in the long term (in fact, they dispose parallel to  $t/l$ ) at different GDP p.c. PPP levels (polarisation).

In order to see if the sub-regional convergence path followed by Hungarian NUTS 3 regions shares similarities with the rest of the eastern EU MS, we ran the same analysis on the other eastern EU MS, from 1999 to 2009. This is the first convergence analysis at such disaggregated level (NUTS 3)

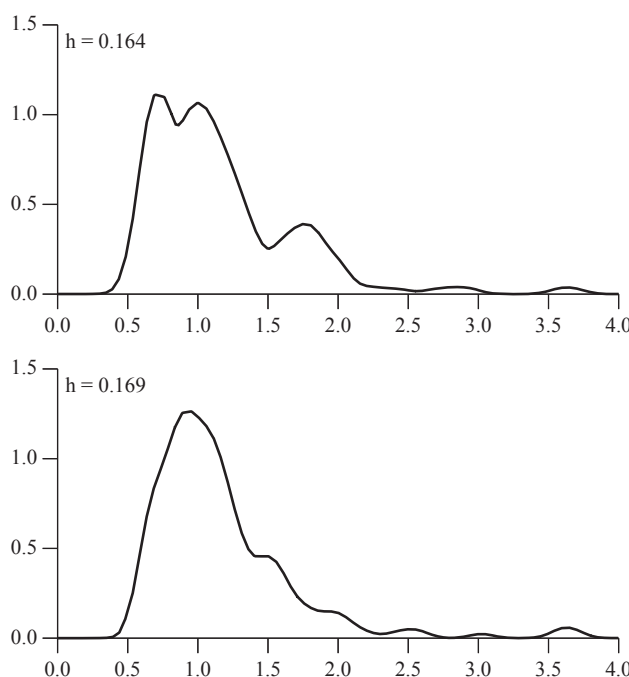


**Figure 3:** Contours of GDP p.c. PPP in the NUTS 3 regions of Hungary.

Source: own elaborations on Eurostat data

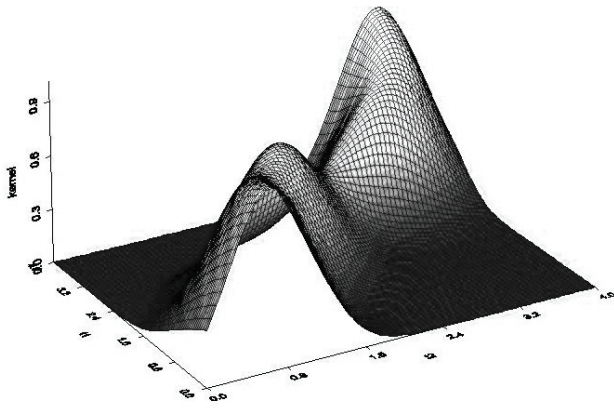
for all the eastern EU MS.

A very different situation appears: in 1999, the most of eastern EU regions show a similar economic performance characterised by a general increase in GDP p.c. PPP, and dispose mostly around the average level of GDP p.c. PPP (in fact, the marginal density function is clearly multi-modal). Instead, richer NUTS 3 regions (set on the right end of the distribution) gather in two very small sub-groups and show GDP p.c. PPP levels two times higher than the first group (Figure 4). This clear polarisation between regions showing average GDP p.c. PPP level and two much richer (and smaller) groups of regions persists through time (Figures 5 and 6). The poorer group experience different speed growth rates towards the average GDP p.c. PPP value, while the better off ones mainly remain at their average level.



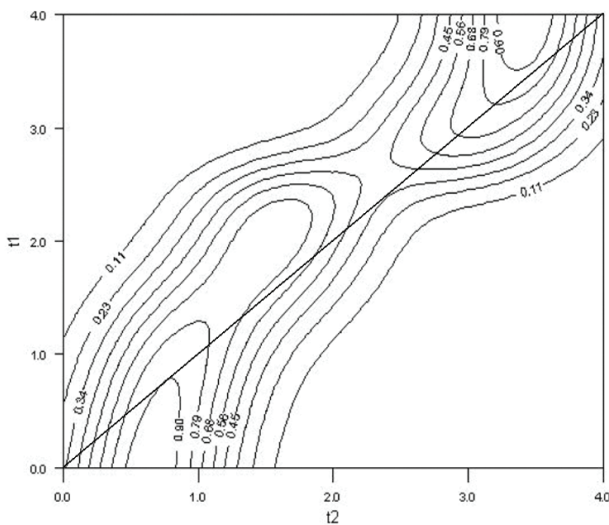
**Figure 4:** Marginal distribution of GDP p.c. PPP in the NUTS 3 regions of the eastern EU MS in (a) 1999 and (b) 2009.

Source: own elaborations on Eurostat data



**Figure 5:** Stochastic kernel of GDP p.c. PPS in the NUTS 3 regions of the eastern EU MS.

Source: own elaborations on Eurostat data



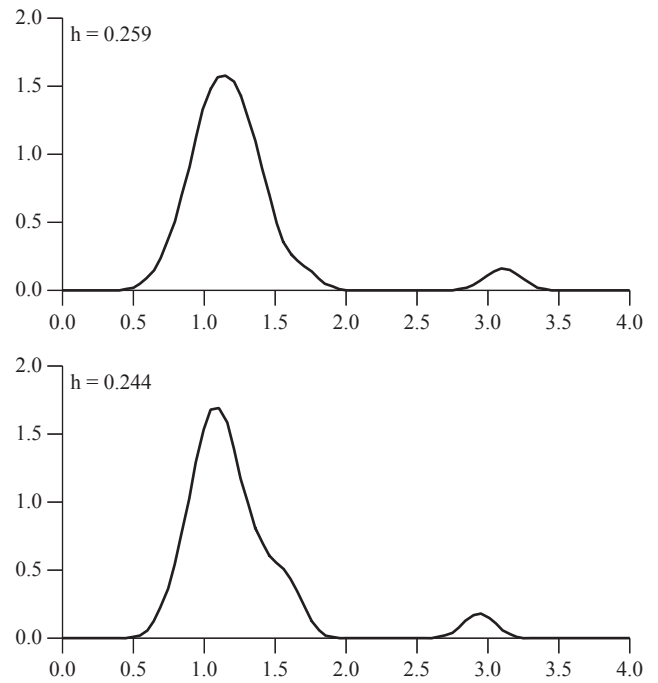
**Figure 6:** Contours of GDP p.c. PPS in the NUTS 3 regions of the eastern EU MS.

Source: own elaborations on Eurostat data

**Has the CAP introduction influenced the economic performance of poorer, mostly agricultural based and rural areas in Hungary?**

This question is important because the introduction of the CAP in the eastern EU MS was a debated issue. At the time of the EU enlargement, the eastern EU MS were more agricultural (in terms of agricultural land and percentage of the sector in the GDP), and their agricultural and rural areas were interested by important development delays. Thus, the CAP support was expected to play a relevant role for convergence.

In order to test it, we ran a non-parametric analysis of GDP p.c. PPS of Hungarian NUTS 3 regions conditioned to the CAP support (direct payments, CNDP) from 2004 (the year of the introduction of the CAP in the eastern EU MS) to 2008 (the last year for which data are available). We found that that the introduction of CAP payments did not affect considerably the convergence path at the NUTS 3 level: in fact, the conditioned marginal distributions (Figure 7) and the stochastic kernel (Figure 8) are very similar in the shape

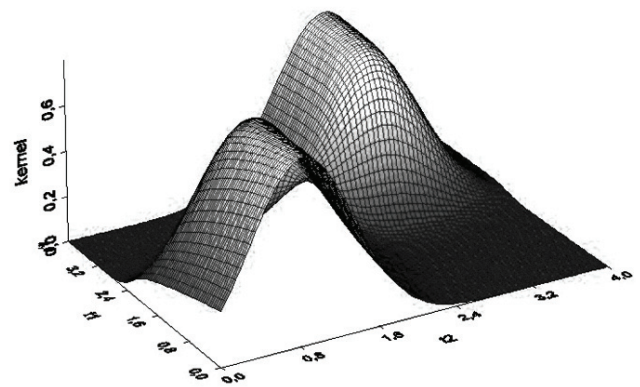


**Figure 7:** Marginal distribution of conditioned GDP p.c. PPS in the NUTS 3 regions of Hungary in (a) 2004 and (b) 2008.

Source: own elaborations on Eurostat data

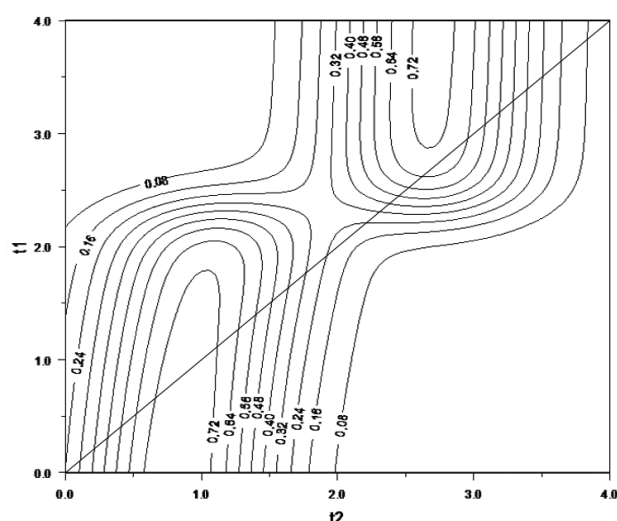
of the distributions and in the values to the unconditioned ones. The contour plots (Figure 9) still show polarisation in two groups of NUTS 3 regions on different GDP p.c. levels, with the poorer group (on the left) converging internally around the average value, while the richer one converges around values three times higher than the average.

In order to shed light on such a limited role played by the CAP introduction on agricultural rural areas, we looked at the allocation of CAP funds, namely the socio-economic, geographic and demographic characteristics of applicants and beneficiaries. We found that between 2004 and 2008 decoupled payment levels increased in every NUTS 3 region: they more than doubled in absolute levels, ranging between +74.2 per cent in Dél-Alföld and +155 per cent in Közép-Dunántúl (Table 1), and their share in total subsidies (Table 2) increased everywhere, between 17 per cent (Közép-Dunántúl) and 45 per cent (Nyugat-Dunántúl). By the way, the low nominal level of decoupled payments in comparison with the EU-15 average and the lower share directed to



**Figure 8:** Stochastic kernel of conditioned GDP p.c. PPS in NUTS 3 regions of Hungary.

Source: own elaborations on Eurostat data



**Figure 9:** Contours of conditioned GDP p.c. PPS in Hungarian NUTS 3 regions.

Source: own elaborations on Eurostat, FADN and MVH data.

poorer performing NUTS 3 regions (Észak-Magyarország, Dél-Alföld) could have contributed to the limited role played by CAP on convergence.

The lack of targeting emerges from the correlation analysis of the distribution of the SAPS funds to successful applications. The applications for public (SAPS and top-up) payments within the Agricultural and Rural Development Operational Programme (AVOP) in 2005<sup>15</sup> show that land size and the area of provenance affect both the quality and

**Table 1:** Evolution of decoupled payments per farm in Hungary by NUTS 3 region (EUR), 2004-2008.

Region	2004	2005	2006	2007	2008	Var 08/04 %
Közép-Magyarország	3,781	4,203	5,438	5,149	7,321	93.6
Közép-Dunántúl	5,227	6,711	7,701	11,276	13,342	155.3
Nyugat-Dunántúl	4,881	5,435	6,904	7,983	9,600	96.7
Dél-Dunántúl	5,184	5,766	6,702	7,14	10,625	105.0
Észak-Magyarország	3,179	4,197	5,910	6,726	7,004	120.3
Észak-Alföld	2,788	3,397	4,362	4,582	5,553	99.2
Dél-Alföld	2,525	2,439	3,145	3,624	4,398	74.2

Source: own elaborations on FADN data

**Table 2:** Rate of decoupled payments on total support to farms in Hungary by NUTS 3 region (EUR), 2004-2008.

Region	2004	2005	2006	2007	2008	Var 08/04 %
Közép-Magyarország	36.5	39.0	45.7	44.7	47.7	30.7
Közép-Dunántúl	32.8	35.8	41.3	35.7	38.4	17.1
Nyugat-Dunántúl	32.5	32.6	42.3	43.7	47.2	45.2
Dél-Dunántúl	30.4	28.1	36.2	39.3	41.3	35.9
Észak-Magyarország	43.1	37.1	46.4	45.7	53.0	23.0
Észak-Alföld	35.9	37.5	44.0	40.5	49.7	38.4
Dél-Alföld	36.7	37.5	43.7	43.6	49.4	34.6

Source: own elaborations on FADN data

quantity of demands. In fact, farmers with 0.3<sup>16</sup>-1 hectare presented the lowest number of applications and the majority were refused by managing authorities. The number of applications increases with the increase in average land size, and peaked for the land size class 1-5 ha. Farm size also influences the result of applications: the bigger the farm, the more successful the applications.

Following previous findings (Elek *et al.*, 2008; Katona Kovács, 2008) we performed a correlation analysis between the number of applications received, the payments (top-up + SAPS), farmers' age, and average farm size and farm location in less favoured areas (LFA) at the county level. We found no significant correlation between applications (or payments) and farm size and farm location in LFA, while we recorded significant – but negative – correlations between applications received, payments and farmers' age (over 55 years old). Therefore, the younger is the farmer, the higher the successful applications and payments for the county.

## Discussion

The non-parametric convergence analysis conducted on the 20 Hungarian NUTS 3 regions between 1997 and 2009 (GDP p.c. PPS) shows polarisation between the region with the capital town Budapest, which grew fast, and the rest of the regions. In particular, rural NUTS 3 regions tend to converge among themselves at low income levels. Between 1999 and 2009 even greater polarisation takes place among the eastern EU MS NUTS 3 regions, where few areas (the capital towns) show higher income levels, comparable with the EU-27 average. These findings show that a main stated objective of the enlargement, i.e. the integration through convergence of GDP p.c. of eastern EU MS in the EU to be supported by the EU Cohesion Policy, did not take place.

The comparison between the conditioned and unconditioned analysis shows that, despite weak improvements of poorer NUTS 3 regions, the CAP payments were not able to influence the convergence of lagging behind areas, which are mostly mainly agricultural and rural (7.4 per cent of employment in the primary sector), playing a limited role for the cohesion. This result confirms the issues which were raised, at the time of EU accession, by academics and policy makers from the eastern EU MS about the lack of targeting and efficiency of CAP funds for the newcomers. As Gorton *et al.* (2009) and Csáki and Jámber (2010) showed, the eastern EU MS had to adapt to a CAP structure and function designed to fit the needs of the EU-15 while agricultural and rural areas in the eastern EU MS had to face serious structural and productivity challenges.

The short time series available and the low number of statistical units analysed represent a serious limit for the conditional convergence analysis. Also, the FADN data on CAP support that we used for the analysis are not fully representative of the farm reality in the EU-27. In fact, the FADN sample is only composed of farms which exceed the minimum economic size of 1 ESU (EUR 1,200 SGM). Despite countries having different minimal thresholds, this level was

<sup>15</sup> The only public data available refers to 2005. Source: Hungarian Agricultural and Rural Development Agency.

<sup>16</sup> The land size limit for being eligible to SAPS payments was set at 0.3 (instead than 1 ha), because of plots parcelisation.

chosen to catch the most relevant part of the economic activity but it fails to assess the structural and economic situation of smaller and poorer farms which do not benefit from public support.

Finally, we must underline the preliminary explorative role of these analyses, which have been influenced (in the methodologies and time period chosen) by the persisting limitations in official statistics, especially at disaggregated levels. Further analysis, which will benefit from a longer time series for GDP p.c. PPS and CAP support data at the sub-regional level, will consist in an ex-post evaluation of the EU structural and cohesion funds in Hungary at the NUTS 3 level, in order to understand the role of national governance and managing authorities in planning and implementing policy measures co-financed by the EU instruments for cohesion.

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