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Measuring EU Rurality: An updated Peripherurality Indicator

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ABSTRACT

In the last decades, EU rural areas have been experiencing major transformations, which have made any traditional urban-rural divide outdated (OECD, 2006). Going beyond urban-rural dichotomy, the paper moves from the analysis of the PeripheRurality Indicator (PRI), computed by Camaioni *et al.* (2013) for all EU NUTS 3 regions. For each of them, PRI includes both conventional socio-economic indicators and geographical characteristics. Nevertheless, this paper enriches PRI's original territorial and geographical dimension, by taking explicitly into account even the degree of rurality of neighbouring regions. Eventually, it returns 16 EU typologies of urban-rural areas. Then, such a classification is tested on 2007-2011 Common Agricultural Policy (CAP) expenditure data. Indeed, the paper considers the coherence of fund allocation with the real characteristics of EU rural space.

Keywords: Rurality, Peripherality, Spatial analysis

1. Introduction

This paper aims to enrich the role of territorial and geographical dimensions in assessing the degree of rurality of EU-27 NUTS 3 regions. Rural regions still play a key role within the EU

economy and society, although major transformations and an increasing heterogeneity have occurred since EU Eastern enlargements. With regard to those transformations, Camaioni *et al*. (2013) introduced a composite and comprehensive PeripheRurality Indicator (PRI), which updates traditional urban-rural divides suggested by OECD (2006). PRI provides a new representation of EU rural geography, jointly considering conventional rural features (e.g., low population density, key role of agriculture, etc.) and geographical aspects, such as remoteness.

Nevertheless, space and geography play an even larger role in defining rurality at local level. Indeed, when considering remoteness, even neighbouring areas' one may affect it: two regions, which share the same extent of rurality according to the PRI, can actually differ if the former is close to a large metropolitan area while the latter is surrounded by other rural areas. Indeed, the current *post-industrial rurality* framework (Sotte *et al.*, 2012) stresses integrations across rural space and between rural and urban territories as critical. When sharing a neighbouring space, two regions may affect each other on given common issues (e.g. policy implementation). Thus, any indicator of rurality should carefully consider even the degree of rurality across the neighbourhood (Camaioni *et al*., 2013). Furthermore, a more spatially-integrated approach in policy formulation could also result in better framed policies (Esposti, 2011): for instance, the policy Common Agricultural Policy (CAP), which supports the EU agriculture and its rural space, would largely benefit from a more spatially-integrated approach at local level. In fact, CAP fund allocation is largely unbalanced across EU urban-rural regions.

The paper is organised as follows. Section 2 shortly discusses the PRI in the light of the wider debate about defining EU rural areas, from the most "conventional" approaches to more innovative and multidimensional ones. Section 3 analyses PRI territorial distribution across Europe, by also considering the role of the neighbouring regions in affecting major differences observed at local level. By jointly considering those two dimensions, it is possible to disentangle 16 different typologies of urban-rural regions. Section 4 applies this classification to the analysis of the allocation of CAP expenditures across Europe. Section 5 concludes the paper.

2. The PeripheRurality Indicator in the light of alternative definitions of rurality

In a multidimensional perspective, the need for a new classification of rural areas comes from the evolution of the concept itself of rural areas. Lacking a strong theoretical foundation, the concept has largely evolved over time (Johnston, 1970; Timmer, 1988; Esposti and Sotte, 2002; Sotte *et al.*, 2012). Changes in the main definitions of rural areas call for new approaches in their classifications (Camaioni *et al.*, 2013). Since the 1990s *post-industrial rurality* has emerged. Accordingly, two features now characterise rural areas (Sotte *et al.*, 2012): i) a greater importance of territorial issues (e.g., stronger integrations across the rural space and between rural and urban areas[1]); ii) their polymorphism (i.e., the co-existence of different forms of rural-rural and rural-urban integration patterns).

In particular, polymorphism has been seldom tackled by conventional measures of rurality (especially those based on sector-based or demographic indicators). It couples with the lack of homogeneous definitions of rural areas[2], which is due to remarkable differences in terms of

[1] Rural regions are now assigned the role of supplying urban societies with a larger set of services associated to public goods, such as environmental and cultural goods (Sotte *et al.*, 2012).

[2] Even the identification of those areas where rural development policy (i.e. a EU policy) is expected to be implemented is assigned to Member States, which are autonomously in charge of defining their own rural areas.

demographic, socio-economic, and environmental conditions occurring across the EU rural space (European Commission, 2006; Hoggart *et al.*, 1995; Copus *et al.*, 2008).

Despite those difficulties, some homogeneous definitions of urban-rural typologies have been provided at EU level. Both OECD (2006) and the EC (Eurostat, 2010) follow a similar approach in defining them: they just refer to population density at local level and the presence of large cities. Such an approach just measures rural areas through a single indicator, eventually collapsed into a discrete ordinal variable. Such a measure returns just three urban-rural typologies, seeming too rough to capture increasing polymorphism across Europe.

Moving from those major pitfalls, many works have classified EU rural areas, adopting a multidimensional approach (Copus, 1996; Bollman *et al.*, 2005; Copus *et al.*, 2008; Terluin *et al.*, 1995; Psaltopoulos *et al.*, 2006; Lowe and Ward, 2009). Camaioni *et al.* (2013) suggest further improvements to this field of study, by defining a PeripheRurality Indicator (PRI). They apply conventional Principal Component Analysis (PCA) to a 24-variables dataset, which covers socio-demographic features, economic structure, land use, accessibility/remoteness (over different territorial scales). Their analysis refers to NUTS 3 territorial level, considering 1288 regions[3]. Firstly, PCA returns a standardised score for each region on five uncorrelated Principal Components (PCs)[4]. Eventually, according to them an ideal urban benchmark (i.e., a region with the most urban features across Europe) is identified. In particular, the urban benchmark is represented by the cities of Paris and London. Secondly, the statistical "distance" between any EU region and this benchmark is computed (Camaioni *et al.*, 2013). So, by construction, the greater the PRI the more rural and peripheral a given region is. Thus, the PRI captures both a socio-economic and a spatial distance from urban features, hence its definition (Camaioni *et al.*, 2013).

Besides the large number of regions taken into account[5], an additional novelty of that work refers to the fact it explicitly refers to geographical issues: indeed, the PRI considers both the physical distance of each region from major EU urban areas and its accessibility according to physical infrastructures. Thus, it provides an original representation of the EU urban-rural geography, shedding light on the integration between rural and urban areas (Camaioni *et al.*, 2013).

Nevertheless, the set of territorial information the PRI provides can be enhanced further. Indeed, a spatially-enriched PRI can be obtained by explicitly including more information on the rural-urban characteristics of the neighbouring space, as well.

3. The PeripheRurality Indicator: Which Role for Neighbouring Regions?

Figure 1 (left panel) returns PRI main patterns across Europe: the greater its value, the more rural and peripheral is any given region. Camaioni *et al.* (2013) already observe that the lowest values occur across capital-city regions and, more generally, across the central Europe urban space. On the contrary, PRI highest values occur throughout EU peripheries (Mediterranean regions, Eastern Europe, Northern Scandinavia). From a more general perspective, PRI wide variability sheds light on a new EU geography, suggesting a long-standing core-periphery pattern.

[3] They adopt the NUTS 2006 classification, excluding those regions that are located far away from Europe (e.g. the French *Departements d'outre-Mer*). Further comments and caveats on the dataset selection are returned in Camaioni *et al.* (2013).

[4] They range from "Economic and geographical centrality" to "Manufacturing in rural areas" and to "Land use: forests vs. agricultural areas" (Camaioni *et al.*, 2013).

[5] Previous studies, such as Shucksmith *et al.* (2005), had just focused on NUTS 2 level regions.

Additional information on those territorial divides also comes from the analysis of the spatially-lagged values of the PRI, which were already computed in Camaioni *et al.* (2015). Per each NUTS 3 region, the right panel of Figure 1 returns the average value of the PRI across its neighbours. This value is computed through a (*n* x *n*) row-standardized spatial weights matrix (**W**), whose generic element w_{ij} , is defined as:

$$w_{ij} = w_{ij}^{*} / \sum_{j=1}^{n} w_{ij}^{*} \qquad (1)$$

In (1), the generic element w_{ij}^{*} can take two different values: $w_{ij}^{*} = 1$ when $i \neq j$ and $j \in N(i)$; $w_{ij}^{*} = 0$ when $i = j \; or \; i \neq j \; and \; j \notin N(i)$, where $N(i)$ is the set of neighbours of the *i*-th region. Here, a *first-order queen contiguity matrix* defines neighbourhood: two regions are considered as neighbours only if they share a common boundary or vertex (Anselin, 1988)[6]. A major issue refers to islands, which show no contiguous regions. For the purpose of this work, we assume that for those regions the lagged PRI equals the PRI itself[7]. As for the PRI, the greater the spatially-lagged PRI value, the more rural and peripheral the neighbours of a given region are.

By jointly comparing these two values, it is possible to disentangle those regions that show different urban-rural characteristics compared to their neighbours. In general terms, we observe the PRI showing a positive spatial dependence across EU NUTS 3 regions. Both the value of the Moran's I statistics (Moran, 1950; Cliff and Ord, 1981), being equal to 0.547, and the Moran's plot shown in Figure 2 confirm it: most of EU regions show similar levels of rurality compared to their neighbours. Nevertheless, deviations from this tendency also arise: some rural regions are close to urban neighbours, while some cities are surrounded by rural areas. To detect those different regional typologies, we can split the Moran's plot, by referring to PRI's quartile distribution. Thus, 16 (i.e., 4X4) different partitions of the EU space are returned (Figure 2).

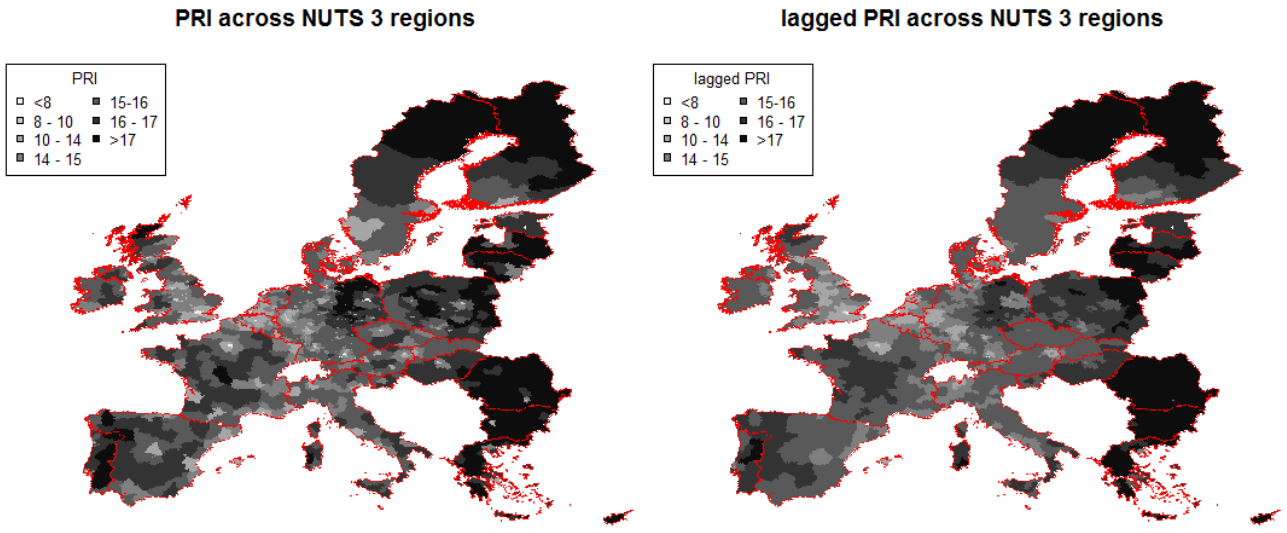


Figure 1: *PRI and lagged PRI across Europe (values by NUTS 3 region)*

[6] The first-order queen contiguity matrix and the spatially-lagged PRI are computed using the package 'spdep' (Bivand and Piras, 2015) in the R software (R Core Team, 2013).
[7] Camaioni *et al.* (2015) make alternative assumptions on islands and their neighbours.

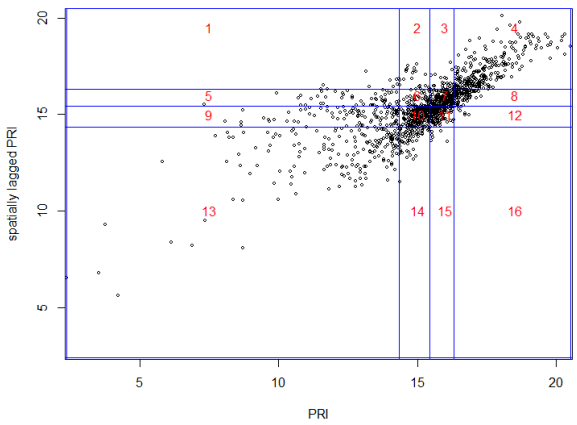


Figure 2: *Moran's plot for the PRI and typologies of regions*

Each regional typology comprises a different number of regions. As already pointed out, most of observations occur along the main bisector: those regions share similar urban-rural features with their own neighbours. Nevertheless, 78 urban regions are surrounded by more rural areas (typologies #1, #2, #5 in Figure 3). Other 15, rural regions are spatially close to urban areas (typologies #12, #15). The territorial distribution of each of the aforementioned urban-rural typologies sheds light on a new urban-rural EU geography. For instance, some EU capital cities such as Madrid or Helsinki are urban areas, but they are surrounded by very rural regions. Conversely, some of the UK rural areas, which show very high PRI values, have urban contexts as their neighbours, being highly affected from them. In more general terms, the regions across the Eastern and Northern peripheries of the EU seem to share similar values of the PRI and spatially-lagged PRI. On the opposite side, in Western Europe, urban and rural are more deeply intertwined (e.g. in France, Germany, Italy and Spain). This is probably due to the specific characteristics of the medium-sized cities network, which exists in those countries.

Spatially-lagged PRI (by PRI quartile)	PRI (by quartile) 1	2	3	4	
4	8	20	21	237	rural neighbours
3	50	40	158	79	
2	90	195	134	6	urban neighbours
1	174	67	9	0	
	very urban			very rural	

The table returns the number of NUTS 3 regions by urban-rural typology. Colors are the same adopted in the map

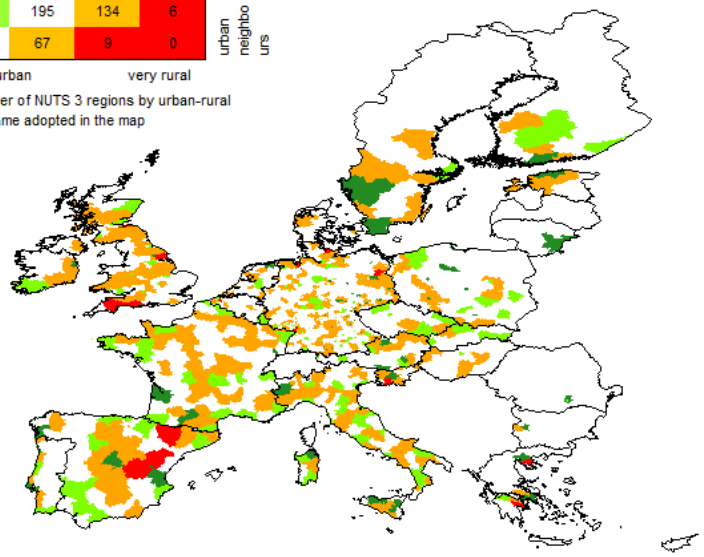


Figure 3: *Urban-rural typologies across Europe and number of NUTS-3 regions in each typology*

4. The allocation of CAP expenditure across different urban-rural typologies

This new urban-rural classification, which takes into account even spatial spillovers, may widely improve the analysis of CAP expenditure allocation throughout the EU. The topic has been widely debated: Camaioni *et al*. (2013; 2015) have already analysed the territorial distribution of Rural Development Policy (RDP) ex-post expenditure. In particular, they have stressed the importance of three main drivers: a 'country effect'; a 'rural effect' (i.e., the more rural a region the larger the amount of support); a 'pure spatial effect' (i.e., the influence of the neighbouring space and of its degree of rurality), which has been estimated adopting alternative spatial model specifications (Camaioni et al., 2015). Camaioni *et al*. (2014) have also analysed the distribution of the overall CAP expenditure across the EU space, disentangling it by pillar (Pillar One and RDP) and by measure. Eventually, correlation between CAP expenditure at NUTS 3 level and rurality (as expressed by the PRI) is assessed: CAP expenditure seems to be less "rural" and less "agricultural" than stated. Indeed, when considering expenditure per unit of land and per unit of labour, the CAP supports urban and central regions more than rural ones (Camaioni *et al*., 2014).

This work updates that descriptive analysis, by underlining major territorial unbalances in CAP ex-post expenditure across the aforementioned 16 urban-rural typologies. This analysis refers to the same data used by Camaioni *et al*. (2014), namely 2007-2011 payments from both EAGF and EAFRD. Data source is the European Commission (DG Agriculture): here, individual data have been aggregated to NUTS 3 level, to keep the anonymity. For the sake of simplicity, here we just refer to three broad typologies of expenditure, namely total CAP expenditure, Pillar One expenditure and Pillar Two (RDP) expenditure. Two pillars largely differ in their own ultimate goals: Pillar One is aimed at supporting agricultural activities and farmers' income; the second Pillar (namely RDP) implements several measures to support competitiveness of agricultural holdings in rural regions, diversification of the economy in rural areas, improvement in the quality of life within rural areas. In particular, here we refer to three indices of CAP expenditure intensity: expenditure per hectare of utilised agricultural area (€/UAA); expenditure per annual work unit employed in agriculture (€/AWU); Expenditure per thousand Euros of agricultural gross value added (€/.000 €)[8].

Nevertheless, Camaioni *et al*. (2014) point out that when expressing the intensity of CAP support by means of agriculture-related variables, extremely high values may occur across urban areas. This situation happens when values for UAA, AWU and agricultural gross value added are particularly small: it implies artificially-high levels of expenditure intensity for some of the most urban regions, throughout Europe. Thus, in order to get rid of those distortive effects, 30 urban regions were already excluded from the analysis in Camaioni *et al*. (2014). Here, same decisions are undertaken: of the excluded observations, more than a half (16 out of 30) are in typology #13 (i.e., the most urban regions with the most urban neighbours); 7 are in typology #9; 6 are in typology 5 and 1 is in typology #2. Even latter typologies refer to urban regions, but, in this case, they show rural neighbours.

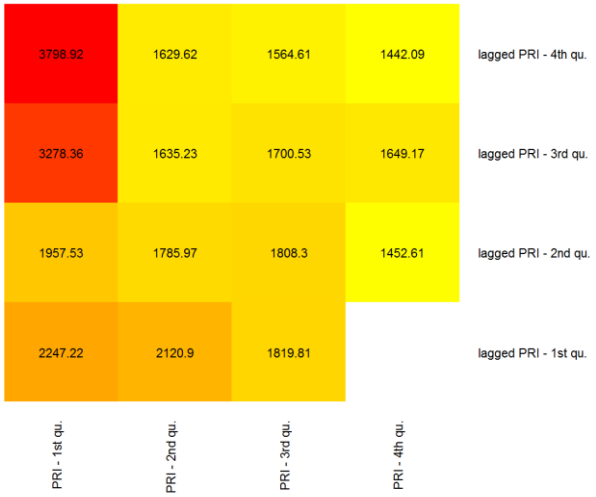
For the sake of simplicity, Figure 4 just refers to the expenditure intensity per hectare of UAA. Average expenditure intensities of total CAP, of Pillar One and of Pillar Two are returned for each of the aforementioned urban-rural typologies[9]. These results represent a refinement of previous studies. They confirm that urban regions are generally more supported than rural ones throughout the EU. Nevertheless, some specific typologies of EU urban regions appear to be extremely supported by the CAP (in both its first and second pillars): they mostly are very urban regions that are also surrounded by very rural areas. Results slightly change when disentangling both Pillar One

[8] Further details about adopted methodology to compute those indicators are shown in Camaioni *et al.* (2014).
[9] Figures referring to alternative intensity expenditure indices are available upon request.

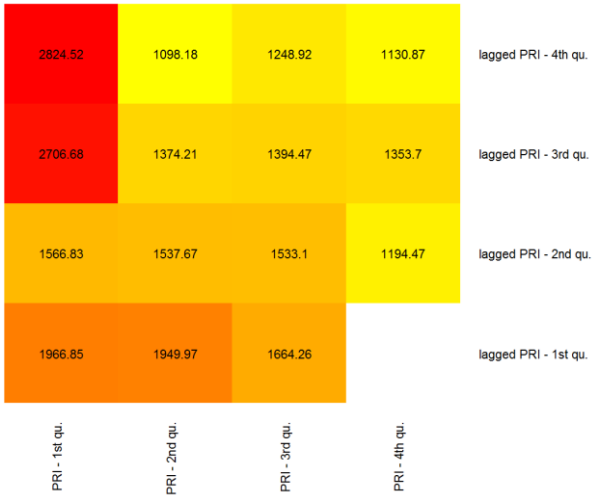
and Pillar Two expenditure. Indeed, Pillar One expenditure intensity is also above the average for those regions that, although showing mixed urban-rural features, are surrounded by urban areas. On the opposite side, when focusing on RDP expenditure intensity, rural regions which are spatially close to other rural areas appear to be supported as well. By converse, all those regions that show more urban neighbours are expected to receive a lower amount of intensity support. Indeed, in this case, the least supported regions are the ones in the second and third range of the PRI quartile distribution, whose neighbours are in the first range of the PRI quartile distribution.

Furthermore, and in more general terms, even this analysis confirms the well-known compensation effect between Pillar One and Pillar Two expenditures at territorial level. Indeed, some typologies of regions that are little supported in terms of Pillar One expenditure tend to be more supported by Rural Development expenditure and vice-versa (Camaioni *et al.*, 2014).

a) CAP expenditure



b) Pillar One expenditure



c) RDP expenditure

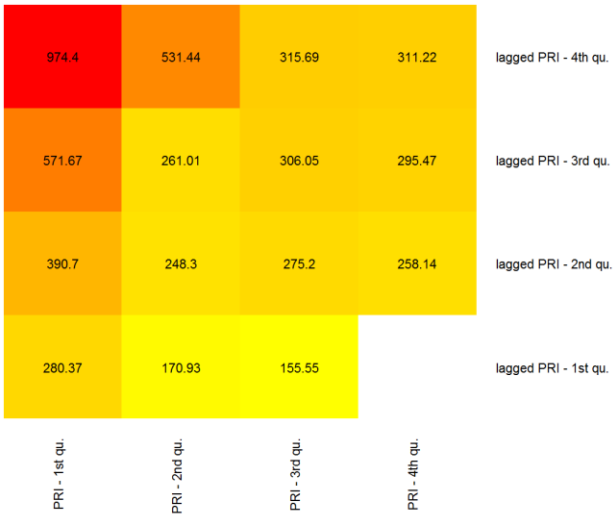


Figure 4: *Expenditure intensity (€ per hectare of UAA), by urban-rural typology*

5. Conclusions

This paper aims to update previous works on the analysis of major urban-typologies across Europe. Moving from the composite and comprehensive PRI, computed by Camaioni *et al.* (2013), this paper returns 16 different urban-rural typologies, which also include information about urban-rural characteristics in the neighbouring space. Indeed, according to a multidimensional approach in defining rurality, geography plays an important role in shaping the integration (and the relationships) between urban and rural areas. Although showing the same extent of rurality according to the PRI, two regions actually differ if the former is close to large metropolitan areas while the latter is surrounded by other rural areas. Furthermore, the returned taxonomy is definitely richer than the three urban-rural typologies suggested for instance by the OECD (2006). In fact, a more complex urban-rural geography characterises the EU space, and policy-makers could benefit from being supplied with new enhanced tools to measure their own policies at territorial level.

Indeed, the complexity of EU geography is likely to matter in affecting the spatial allocation of CAP expenditure throughout Europe. This paper actually confirms the results obtained by Camaioni *et al.* (2015), which have already pointed out two major findings: the existence of a negative rural effect in the allocation of RDP expenditure (namely, the less the region is rural, the higher the expenditure intensity) and the existence of a positive spatial effect. Furthermore, by jointly considering these two drivers (i.e. rurality and space together), some more detailed results seem to be returned. Indeed, this analysis makes possible the identification of the most supported regions in Europe: they are those urban regions that are also surrounded by very rural areas. This is true for the overall CAP expenditure, as well as when considering disentangled expenditure.

Thus, the 'urban-rural integration', whose existence was found by Camaioni *et al.* (2015), mostly results in the allocation of additional resources to the urban areas rather than to the rural countryside. When being located close to cities and other metropolitan areas, rural regions are likely to be even weaker in their ability of attracting EU funds.

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