European harmonised Labour Market Areas — methodology on functional geographies with potential

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Abstract

EN

The Labour Market Area (LMA) has become a well–established and widely discussed concept in regional geography and statistics.

This interesting concept, essential for the creating of typologies modelling real life situations, has been intensively studied in Eurostat's Working Group on Regional, Urban and Rural Development Statistics, both in two dedicated Task Forces (on harmonised LMAs in 2014/2015 and on LMAs at the European scale in 2018/2019) and as a subject of EU grants in 2016/2017.

A number of workshops have been organised with the participation of National Statistical Institutes (NSIs) and the academic community to discuss and solve methodological and IT issues, to develop guidelines on the delineation of LMAs and to exchange knowledge.

The aim of this Statistical Working Paper is to demonstrate the wealth of knowledge and experience gained during the period 2014–2019 and to summarise the results of the work done on LMAs, thus defining a basis for further statistical and methodological research and for the application of the concept to national and EU territorial policies.

The paper tells the story of the evolution of the concept of LMAs during the joint work of Eurostat and the NSIs.

The contents are focused on key LMA related topics such as legal and policy framework for LMAs, methodology, challenges, use cases, link to other territorial classifications and functional geographies.

The paper also builds upon the information on methodological activities in the field of the LMAs presented in 2018 at two international conferences co–organised by Eurostat: Quality in Official Statistics held in Krakow, Poland and the Conference of European Statistics Stakeholders held in Bamberg, Germany.

DE

Arbeitsmarktregionen (LMA von englisch „Labour Market Areas") sind in der regionalen Geographie und Statistik bereits ein etabliertes und viel diskutiertes Konzept. Dieses interessante Konzept, das für die Erstellung von Typologien zur Modellierung realer Lebenssituationen von wesentlicher Bedeutung ist, wurde in der Eurostat–Arbeitsgruppe für regionale, städtische und ländliche Entwicklungsstatistik sowie in zwei speziellen Task Forces (in 2014/2015 über die Harmonisierung der LMA und in 2018/2019 über LMA auf europäischer Ebene) und als Gegenstand von EU–Zuschüssen in 2016/2017 intensiv untersucht.

Unter Beteiligung der nationalen statistischen Ämter und der wissenschaftlichen Gemeinschaft wurde eine Reihe von Workshops organisiert, um methodische und IT–Fragen zu erörtern und zu lösen, Leitlinien für die Bestimmung der Arbeitsmarktgebiete zu entwickeln und Wissen auszutauschen.

Ziel dieses statistischen Arbeitspapiers ist es, den im Zeitraum 2014–2019 gesammelten Wissens– und Erfahrungsschatz aufzuzeigen und die Ergebnisse der Arbeiten an den LMA zusammenzufassen, um so eine Grundlage für die weitere statistische und methodologische Forschung und für die Anwendung der LMA im Rahmen nationaler und EU–Raumordnungspolitiken zu schaffen. Das Papier erzählt die Geschichte der Entwicklung des Konzepts der LMA während der gemeinsamen Arbeit von Eurostat und den nationalen statistischen Ämtern. Der Inhalt konzentriert sich auf wichtige LMA–bezogene Themen wie rechtliche und politische Rahmenbedingungen für

LMA, Methodik, Herausforderungen, Anwendungsfälle sowie die Verknüpfung mit anderen territorialen Klassifikationen und funktionalen Regionen.

Das Papier baut auch auf den Informationen zu methodischen Aktivitäten im Bereich der LMA auf, die 2018 auf zwei von Eurostat mitorganisierten internationalen Konferenzen vorgestellt wurden: Quality in Official Statistics in Krakau, Polen und Conference.

FR

Le « Bassin d’emploi » ou « Zone de marché du travail » (ZMT) est un concept déjà bien établi et largement débattu en géographie et en statistiques régionales.

Cet intéressant concept, essentiel pour la création de régions modélisant des situations de la vie réelle, a été étudié de manière approfondie au sein du groupe de travail d'Eurostat sur les statistiques du développement régional, urbain et rural, à la fois dans deux groupes de travail dédiés (sur les ZMT harmonisées en 2014/2015 et sur les ZMT à l'échelle européenne en 2018/2019) et dans le cadre de subventions de l'UE en 2016/2017.

Un certain nombre d'ateliers ont été organisés avec la participation des instituts nationaux de statistique et de la communauté scientifique pour discuter et résoudre les problèmes méthodologiques et informatiques, élaborer des directives sur la délimitation des zones du marché du travail et échanger des connaissances.

Ce document de travail statistique a pour objectif de démontrer la richesse des connaissances et expériences acquises durant la période 2014–2019 et de résumer les résultats des travaux effectués sur les ZMT, définissant ainsi une base pour de nouvelles recherches statistiques et méthodologiques et pour l'application du concept aux politiques territoriales nationales et européennes.

Le document décrit l'évolution du concept de ZMT au cours des travaux conjoints d'Eurostat et des autorités statistiques nationales.

Le contenu aborde des sujets clés liés aux ZMT tels que le cadre juridique et politique des ZMT, la méthodologie, les défis, les cas d'utilisation, les liens vers d'autres classifications territoriales et géographiques fonctionnelles.

Le document s'appuie également sur les informations au sujet des activités méthodologiques dans le domaine des ZMT présentées en 2018 lors de deux conférences internationales co–organisées par Eurostat: Qualité des statistiques officielles tenue à Cracovie, Pologne et la Conférence des acteurs européens de la statistique tenue à Bamberg, Allemagne.

Editor

Valeriya Angelova–Tosheva

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1 Introduction

This chapter describes the history of Eurostat's work on Labour Market Areas (LMAs) carried out together with several National Statistical Institutes (NSIs) and the research community in the past ten years. It also explains why, from statistical and geographical perspective, Europe needs functional geographies such as LMAs.

1.1 Background

The Labour Market Area (LMA) is a well–established and discussed concept in regional geography and statistics. The concept of LMAs has existed for over 50 years, based on different definitions and known under various names (Labour Market Regions, Employment Zones, Commuting Zones, Travel–To–Work–Areas, Daily Urban Systems, Working Catchment Areas etc.). LMAs do not generally follow the administrative division of countries and regions but reflect the behaviour of persons employed towards their places of residence and the location of their employment (10). According to the definition of a LMA, adopted by Eurostat, a LMA is a statistically defined, economically integrated territory, where the majority of people both live and work.

As a potentially interesting concept in creating typologies that reflect real life situations, the subject has been intensively studied in the Working Group on Regional, Urban and Rural Development Statistics, both in two specific Task Forces (TFs) (on harmonised LMAs in 2014/2015 and on LMAs at the European scale in 2018/2019) and also in a range of EU grants in 2016/2017. The countries involved (including those funded by EU grants) were Belgium, Bulgaria, Denmark, Finland, France, Germany, Hungary, Italy, Netherlands, Poland, Portugal, Switzerland and the UK. This Statistical Working Paper aims at outlining the results of the work done on the LMAs as a basis for further statistical and methodological research and for application of the concept to national and EU territorial policies. This paper also builds upon the information on methodological activities in the field of the LMAs presented earlier at two conferences co–organised by Eurostat: Quality in Official Statistics 2018 held in Krakow, Poland(1) and the Conference of European Statistics Stakeholders 2018 held in Bamberg, Germany(2).

(1) https://www.q2018.pl/papers–presentations/?drawer=Sessions*Session 19*Valeriya Angelova–Tosheva

(2) https://coms.events/cess2018/data/abstracts/en/abstract_0058.html

1.2 Rationale behind the Labour Market Areas: better data from a statistical perspective

The European Union has defined far–reaching policy development objectives in the context of the Cohesion Policy and within the context of the United Nations Sustainable Development Goals. These political initiatives share the challenge to provide adequate, statistical information on which to base the necessary policy actions. In order to implement the policy initiatives in the European context, there is a growing need for not only higher geographical detail and references related to administrative units, but also for information, that reflects the inherent structure of the social and economic reality at which European decisions and projects need to be targeted. As such, the structuring of information according to functional areas is complementary to the established administrative areas and regions. The concept of LMAs has the potential to play a significant role in the effective deployment of resources at both a European and national level.

The established system of the territorial classification of NUTS based on administrative structures of Member States could be supplemented by 'functional geographies' with concepts such as LMAs. The concept of LMAs attempts to reflect the phenomenon that with increasing mobility, NUTS regions coincide to a lesser degree with the places where people live and work. LMAs are functional geographic areas defined for the purposes of compiling, reporting, and evaluating employment, unemployment, workforce availability and related topics.

The need for functional geographies for statistical purposes is indisputable. Administrative boundaries often break up single LMAs. Commuting across NUTS and country boundaries can lead to significant differences between total employment (workplace–based) and resident working population (domestic employment) in the same region. Economic indicators such as GDP per inhabitant or environmental indicators such as amount of waste generated per inhabitant are affected in regions with asymmetric commuting patterns (significant incoming commuting flows). Luxembourg, the NUTS regions of Inner London and Brussels are only a few examples of territories where employment, GDP data and environmental indicators are distorted when presented as divided by inhabitants. Hence, as the concept of LMAs includes a functional criterion such as commuting patterns, LMA definitions can prevent some potential misinterpretations of data, which arise at the level of NUTS 3.

For the last ten years, Eurostat has intensively worked on the concept of EU–wide harmonisation starting with a study together with the research community to investigate the value added, feasibility and best practices in the EU[3]. The approach for delineation of LMAs proposed to the Member States is a simple, transparent, reproducible, consistent, and policy–independent bottom–up method that needs only small area commuting flows as an input (for instance at LAU level). It is based on the so–called Travel–To–Work–Areas, as originally developed in the UK. Furthermore, a script based on open–source software (R) supported the IT implementation of the method[4]. The algorithm operates with a set of four parameters (minimum and target size of employment, and minimum and target levels of self–containment). In the frames of a grant programme and the two Task Forces, several countries tested the IT tool, proved the feasibility of implementing the proposed harmonised method and produced LMAs for national and EU policies including cross–border LMAs. Training materials on the IT tool are also publicly available[5]. As at January 2020 some work remains to fully reconcile the developed R code with the Fortran code originally developed by Newcastle University to produce TTWAs in the UK, as the outputs generated by the two sets of code are not wholly comparable. There is a planned programme of work to hopefully reconcile these differences, and for the R code to be amended accordingly.

([3]) https://ec.europa.eu/eurostat/cros/system/files/Study%20on%20comparable%20Labour%20Market%20Areas.pdf

([4]) The R package is available for free download at: https://CRAN.R–project.org/package=LabourMarketAreas

([5]) https://ec.europa.eu/eurostat/cros/content/trainings_en

2 Legal and policy framework

This chapter provides information on the legal framework for sub–national data collections and discusses linkages between LMAs and other functional geographies included in a legal act. It also gives some ideas on potential benefits of using LMAs for policy purposes.

2.1 The amended NUTS Regulation on territorial typologies

The legal framework for data collections and dissemination of sub–national data is based on administrative regions (the different levels of NUTS). In December 2017, the Tercet Regulation[(6)] was published. By this Regulation, a number of territorial typologies like urban–rural or metropolitan regions (NUTS 3 based), the degree of urbanisation and the typology for cities and Functional Urban Areas (FUAs) (based on Local Administrative Units (LAUs)) have been introduced into the NUTS Regulation[(7)]. The Tercet implementing Regulation published in 2019 provides uniform conditions for the harmonised application of these territorial typologies[(8)]. LMA and LAU based typologies included in Tercet share the same statistical building block (in most cases LAUs) and both LMAs and FUAs are based on commuting flows. The LAUs themselves are included in the NUTS Regulation and the Member States but also EFTA and candidate countries are providing Eurostat with their LAU lists on an annual basis.

From statistical and geographical points of view, it is important to understand the differences between LMAs and FUAs. City statistics have for a long time used the concept of the FUA. This is defined as combining a city with its commuting zone. Once all cities have been defined, a commuting zone can be identified based on commuting patterns using the following steps:

Step 1: If 15 % of employed persons living in one city work in another city, these cities are treated as connected cities with a common FUA.

Step 2: All municipalities with at least 15 % of their employed residents working in a city are identified.

Step 3: Municipalities surrounded by a single functional area are included and non–contiguous municipalities are dropped.

Thus, the FUA focuses on specific cities and includes only those areas for which it is evident that people commute into that city.

(6) Regulation (EU) 2017/2391 of the European Parliament and of the Council of 12 December 2017 amending Regulation (EC) No 1059/2003 as regards the territorial typologies (Tercet), OJ L 350, 29.12.2017

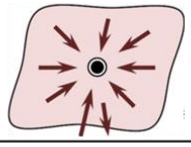
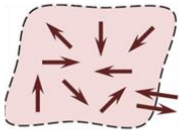
(7) Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 26 May 2003, on the establishment of a common classification of territorial units for statistics (NUTS), OJ L 154, 21.6.2003

(8) Commission Implementing Regulation (EU) 2019/1130 of 2 July 2019 on the uniform conditions for the harmonised application of territorial typologies pursuant to Regulation (EC) No 1059/2003 of the European Parliament and of the Council C/2019/4877 OJ L 179, 3.7.2019, p. 9–11

The LMA is a broader concept that considers regions as a whole and is not specific to individual cities. More than one city can thus be included in a single LMA.

The LMAs are often used in similar context to the FUAs. The LMAs are not designed to replace the FUAs, because they are different concepts used for different purposes. The FUAs are based on nodal commuting flows to a central place and cover a limited territory around the cities, while the LMAs aim to cover the entire territory of the country as well as the territory of the EU and are based on analysing all commuting flows between the LAUs, or other small area statistical building blocks. Figure 1 shows the differences of the two concepts.

Figure 1: FUAs vs LMAs

FUAs	LMAs
Type of interaction	
Nodal type of interaction (commuting is always observed towards a city) 	Unconstrained structure of interactions (no central place needed) 
Geographical coverage	
Only a limited territory around the city	Full coverage of the countries' territories
Rules for delineation	
Defined by 3 parameterised steps; no specialised software needed	Iterative algorithm, IT tool with 4 parameters
Input data needed for delineation	
Commuting flows at LAU level	
Purpose of its maintenance	
Production of city statistics	Production of data on local labour markets areas
Frequency of the update	
Usually every ten years	
Application of SAE techniques	
Rather straightforward as the FUAs are limited to larger regions	Rather complex for small (national) LMAs due to the sample size

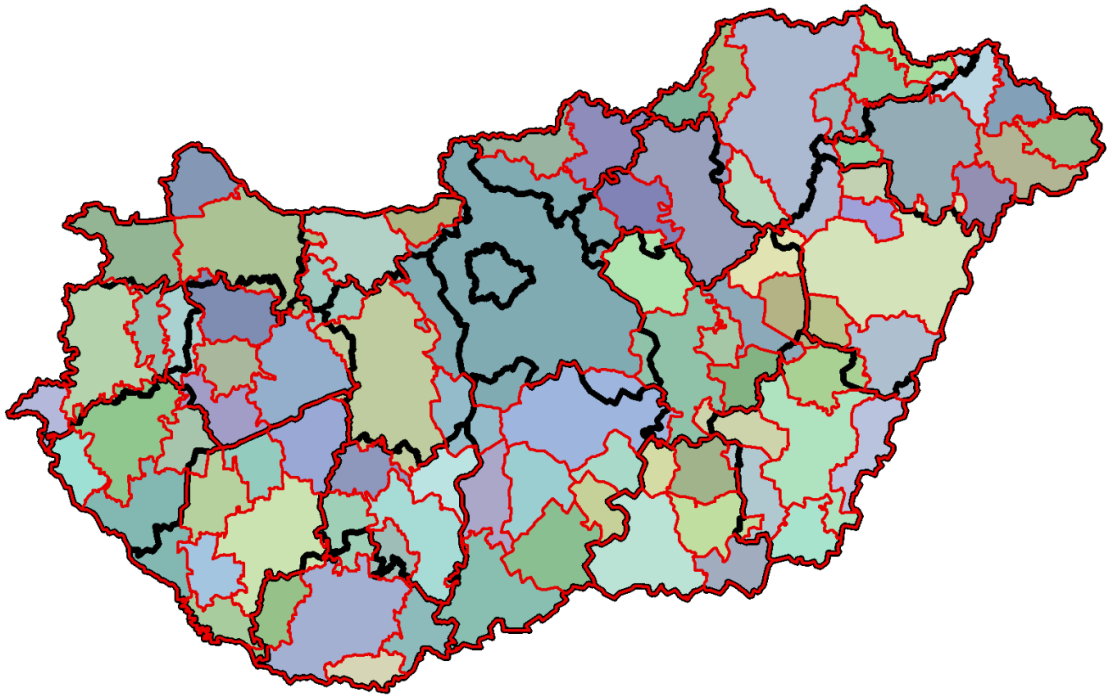
Source: based on Eurostat final grants report

2.2 Potential policy use of harmonised Labour Market Areas

Firstly, LMAs can highlight where NUTS–3 (or NUTS–2) regions break up single LMAs. As explained in section 1.2, when commuting across NUTS–3 boundaries leads to significant differences between employment (job–place–based) located in a region and population working (residence–based), indicators such as GDP per head and some environmental indicators will be affected with lower

values in regions with more out–commuting and higher values in areas with more in–commuting. Data by LMAs complementing data by NUTS and other territorial typologies would allow policy makers to better address various employment, social policy and environmental issues. Map 1 illustrates the difference between the functional and administrative geographies in Hungary (the NUTS 3 boundaries in black and LMAs boundaries in red).

Map 1: LMAs (in red) in Hungary vs the administrative division



Source: The NSI of Hungary

Secondly, LMAs could play an important role in policy areas where the phenomena of interest does not necessarily respect administrative boundaries, like mobility, monitoring of population inflows/outflows, regional and cross–country commuting, skills mismatches, availability of human capital, education mobility, occupations and educational attainment, fields of study, employment/unemployment by educational attainment, and educational attainment/outcome, territorial and social cohesion. Several of these policy issues are relevant for the European Pillar of Social Rights and Sustainable Development Goals (especially the goals on education and decent work). Furthermore, LMAs would have the capacity to make the analysis of the real life labour market situation more relevant also regarding the European Social Fund Impact Assessment for post 2020 and monitoring.

Thirdly, LMAs might be used as an important auxiliary scale for studies on transport, housing and urban planning and modelling. The LMAs would reflect commuting patterns for modelling mobility and passenger transport demands, access to services and better spatial analysis of the housing demands. In addition, the use of the concept could offer an interesting possibility for road safety data spatial analysis.

In terms of specialisation in particular economic activities, the LMAs could be a powerful tool to, for example, study the Blue economy and its development over time (for more information on industrial districts please see chapter 5).

Finally, yet importantly, LMAs could be an important scale for targeting policy interventions, for monitoring territorial dynamics in a placed based and integrated approach. Linking with other territorial typologies, LMAs are able to captures large, medium and smaller cities and rural areas that require cooperation arrangements to work in practice and to promote a balanced and polycentric development within Europe (for more information see chapter 6).

3 The European method for delineation of harmonised Labour Market Areas

The aim of the method is to aggregate neighbouring Local Administrative Units (LAUs), or other small area statistical building blocks for which input statistical data are available, to create LMAs. The LMAs are required to satisfy validity conditions related to internal cohesion and external separation principles, and are based on functional relationships as evidenced by commuting flows.

The EU (TTWA) method operates with two properties: (1) self–containment and (2) number of workers (persons employed). The self–containment is the proportion of the labour force that lives and work in an area. For both properties, minimum and target values have to be defined to run the algorithm. Consequently, four parameters set the constraints to define what is considered to be a LMA:

1. minimum self–containment (minSC),
2. target self–containment (tarSC),
3. minimum number of workers (minSZ),
4. target number of workers (tarSZ).

The parameter tarSC is always greater than minSC. The default values for tarSC are between 0.75 and 0.8 but in specific situations higher values can also be selected. For the parameter minSC, the default values are between 0.6 and 0.6667. In other words, 0.8 self–containment means that only one out of 5 resident workers is commuting out of the LMA, 0.75 means that three out of four resident workers work inside the LMA, 0.6667 corresponds to two out of three, 0.6 to three out of five etc..

Self–containment is measured for both the supply and the demand side. Supply side self–containment (SSC) is the number of people living and working in an area divided by the number of workers living in the area. Demand side self–containment (DSC) is the number of people living and working in an area divided by the number of jobs (taken by resident or non–resident workers) in the area.

The method considers a cluster of municipalities to be an LMA if the validity condition is fulfilled:

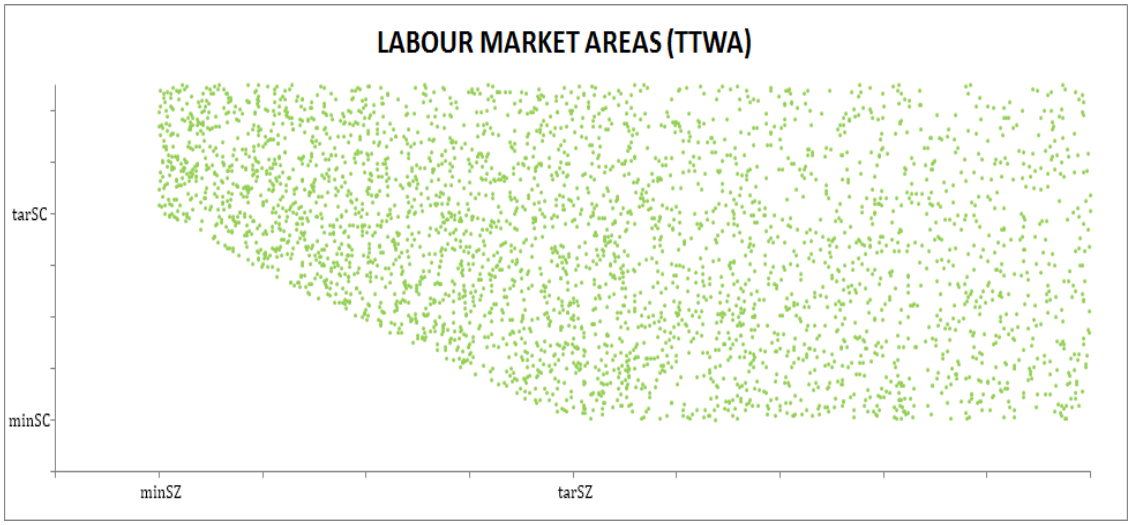
$$\frac{\text{minSC}}{\text{tarSC}} \leq \left(1 - \left(1 - \frac{\text{minSC}}{\text{tarSC}}\right) \cdot MAX\left(\frac{\text{tarSZ} - \boldsymbol{SZ}}{\text{tarSZ} - \text{minSZ}}, 0\right)\right) \cdot \left(\frac{MIN(\boldsymbol{SC}, \text{tarSC})}{\text{tarSC}}\right)$$

Condition 1: Validity function f(SZ, SC)

As regards SC, the condition has to be fulfilled by both supply and demand side self–containment.

This can be translated into the following chart (Figure 2) that depicts the relationships between these four parameters:

Figure 2: Relationship between the parameters



Source: The final report of the 2014/2015 TF

In practice, the algorithm starts by assessing every Statistical Building Block (SBB) (eg. LAU) against the validity condition above. If there is a SBB that does not fulfil the condition, the SBB that gives the lowest value for the right–hand side of the condition is selected. This SBB_A is then assessed against all other SBBs to find the one SBB_B, which has the most important commuting flows according to the following formula:

$$MAX\frac{\text{Commuters}(SBB_A \rightarrow \text{SBB}_B)^2}{\text{Workers}_{SBB_A} \cdot \text{Jobs}_{SBB_B}} + \frac{\text{Commuters}(SBB_B \rightarrow \text{SBB}_A)^2}{\text{Workers}_{SBB_B} \cdot \text{Jobs}_{SBB_A}}$$

where: 'Commuters' stands for the commuting flow,

'Workers' stands for the residents employed in the SBB and

'Jobs' stands for the population employed in a SBB (residents and non–residents together).

The SBB_B is the one with the most important commuting links to SBB_A. Therefore, SBB_A and SBB_B are grouped. The grouping of SBB_A and SBB_B (SBB_{AB}) is now considered as one entity and the joined commuting flows to the other SBBs will be recalculated.

Then the procedure restarts, with the SBBs and groupings of SBBs (e.g. SBB_{AB}) being treated equally.

However, in cases where the ranking of SBBs do not fulfil the validity condition, and a grouping of SBBs that has the lowest value for the right–hand side of the validity condition, the grouping of SBBs is dismembered and each SBB is re–grouped.

The sequence of the re–grouping follows the ranking according to the right–hand side of the validity condition starting with the SBB_Z with the lowest value.

SBB_Z is then re–grouped with another SBB or grouping of SBBs according to the formula above expressing the relationships between commuters, workers and jobs, unless – because of the merge with SBB_Z – the new grouping fails the validity condition. In such a case, SBB_Z will be put in a reserve list, as SBB_Z cannot be re–grouped to a SBB in its previous group.

SBB_X, previously identified having the second lowest value of the right–hand side of the validity condition, is re–grouped next, and so on, until all the SBBs have been re–grouped. Once such a

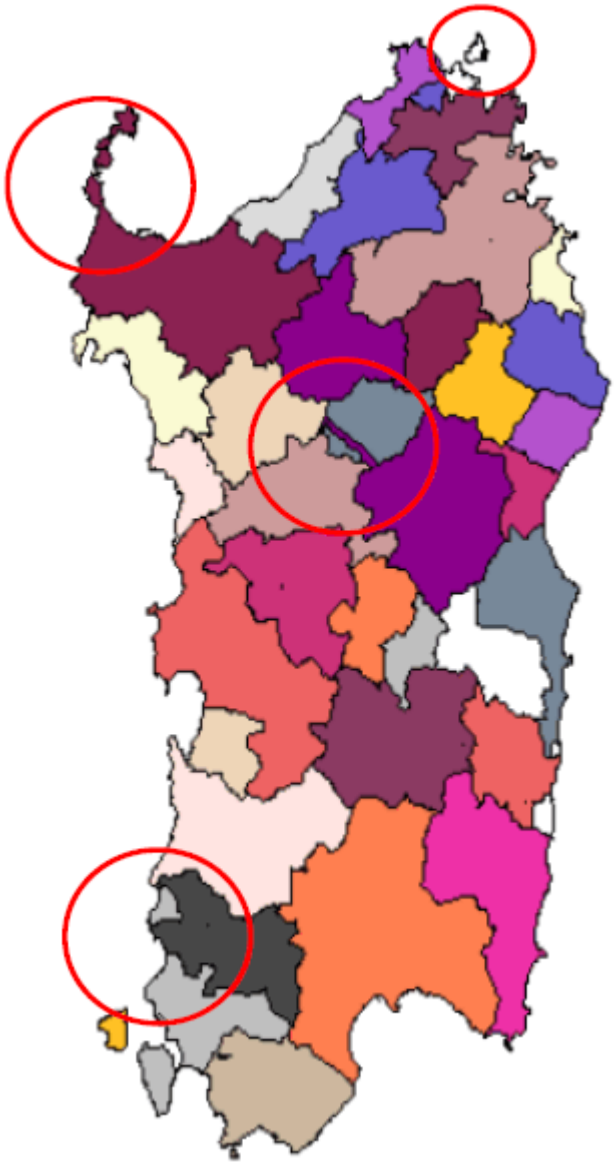
regrouping is finalised, the commuting flows have to be recalculated before the procedure can restart.

The process stops when all SBBs or groupings of SBBs fulfil the validity condition.

The output of the algorithm may not be the final solution. The fine–tuning procedure is designed to check for contiguity and deals with enclaves/exclaves. The need of fine–tuning is illustrated in Map 2 below using the example of Sardinia. LAUs on the reserve list are highlighted in red.

In the frames of the 2016/2017 grant programme, guidelines on LMAs containing detailed description of the workflow have been delivered by ISTAT[9]. The guidelines guarantee the sustainability of the project's results and continuity of the implementation of the harmonised LMAs.

Map 2: The example of Sardinia – LMAs before the fine–tuning



Source: The NSI of Italy

(9) https://ec.europa.eu/eurostat/cros/content/guidelines–production–lmas–version–august–2017_en

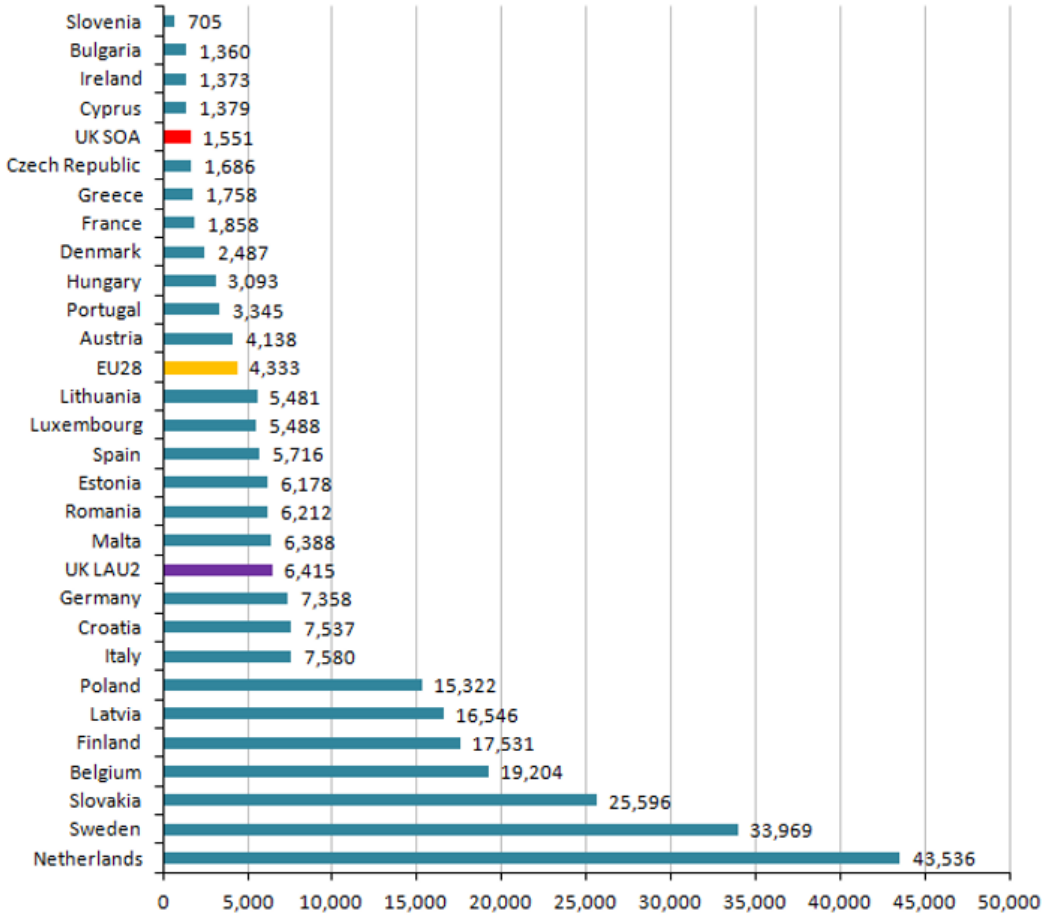
4 Challenges

This chapter explains key challenges faced by the experts who participated in the two Task Forces and in the Eurostat's grant programme. The countries have been working together with Eurostat and the academic community on a mutual strategy for LMAs, which allows for international comparability and policy usage.

4.1 Building block sensitivity

The size of the underlying geographic building block of subnational commuting data used for the delineation of LMAs is crucial for functional areas' accuracy. Ideally, the statistical building block should be as granular as possible to provide the highest achievable accuracy of the boundaries of the output geographies. It is important to keep in mind that the input dataset contains two geographies (origin and destination) that that creates the cell size statistical risk. The 2014/2015 Task Force on harmonised LMAs has recommended in its final report the usage of LAU–2 as a universal building block. However, in some countries data are only available at the level of LAU–1 or even at NUTS 3. Figure 3 below shows that there is also a significant variety in the population size by LAU–2 in different countries which has a strong impact on the size of the output LMAs (from around 700 average LAU population in Slovenia to more than 43 000 in the Netherlands in 2016).

Figure 3: Average LAU–2 population in 2016



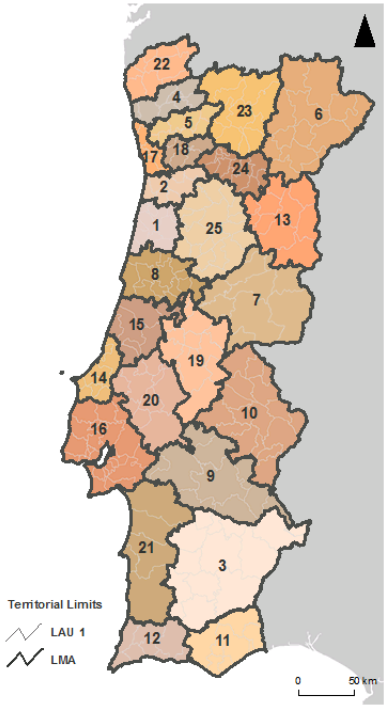
Source: The ONS, UK

From 2017 onwards, the situation has changed since Eurostat agreed with the NSIs on the so–called LAU simplification. Countries were given the opportunity to choose which level of LAUs to report to Eurostat in the annual LAU lists. Bulgaria, Denmark, Greece, Lithuania, Malta and the UK decided to report the former LAU–1 level as a default.

The next two maps illustrate the impact of the different building block size on the resulting LMAs using the example of Portugal (based on LAU–1 commuting data) and Poland (based on LAU–2 commuting data), both from the 2011 Census. Based on the different building blocks Portugal has produced 25 LMAs, while Poland has produced 339 LMAs. Both countries have discussed these results with national stakeholders and agreed on them. As it will be explained in the next section, the sensitivity of the parameters might also have played a role in the results.

A further development of the ideas of the LMAs' network was to search for a universal building block, which might be the 1 km^2 grid cell. The grid cells do not change over time, are independent of administrative boundaries changes and data by grid cells could be aggregated to any other functional geography of interest.

Map 3: LMAs based on LAU 1



Source: The NSI of Portugal

Map 4: LMAs based on LAU 2

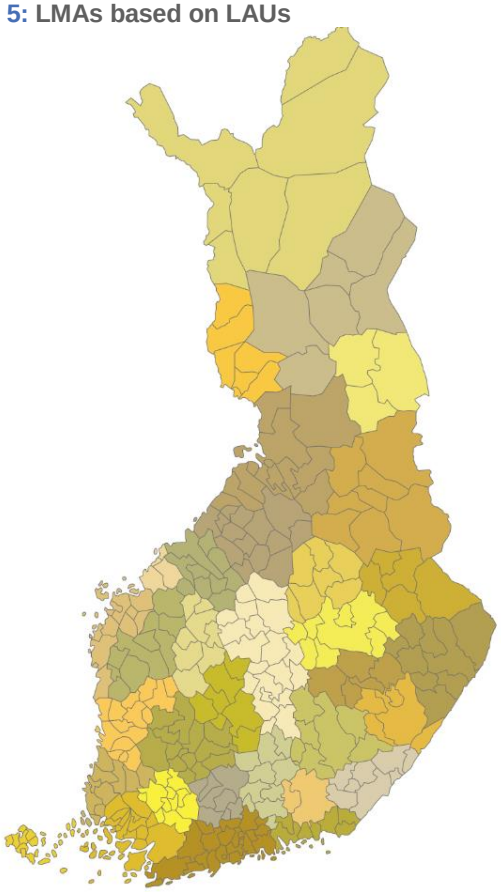
Source: The NSI of Poland

In 2019, ISTAT successfully tested the R package with 1 km^2 grid employment data although it took noticeably more processing time. Finland[10] made another experiment using two different sets of SBBs – LAUs and postal areas. The outcomes are presented on the next two maps. Some postal areas on the reserve list are highlighted in blue. The results based on postal areas were considered quite promising. However, there are some methodological issues to be further investigated. Very small statistical building blocks such as grid cells, census tracts or postal areas might have nil or very small number of jobs, working residents or commuting flows. Natural features could cover a number of statistical building blocks. In all these different situations, the result would be a large number of units on the reserve list, which could only be artificially assigned to LMAs that fulfilled the condition.

Generally, the question on the size of the building blocks is still open and the choice depends on the available geographical granularity and quality of the input data. The 2018/2019 Task Force concluded that one needs a compromise between a too high and too low geographical granularity of the input data.

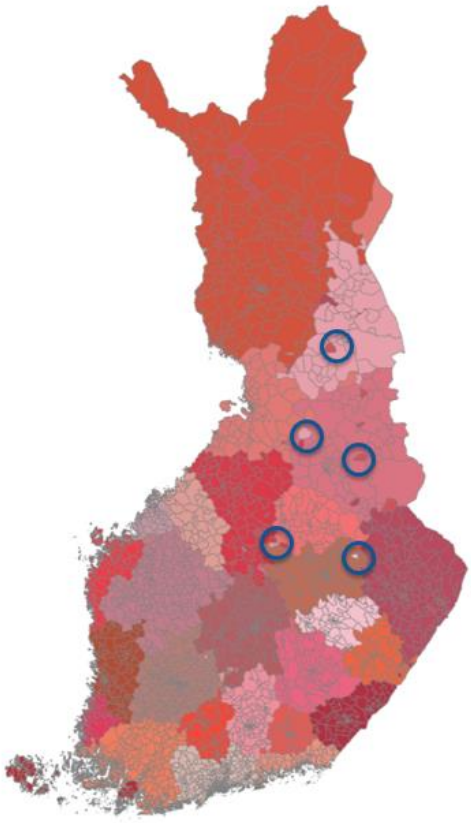
([10]) Parameter values used by Finland are minSZ=3000; minSC=0.6667; tarSZ=40000; tarSC=0.9

Map 5: LMAs based on LAUs



Source: The NSI of Finland

Map 6: LMAs based on postal areas



Source: The NSI of Finland

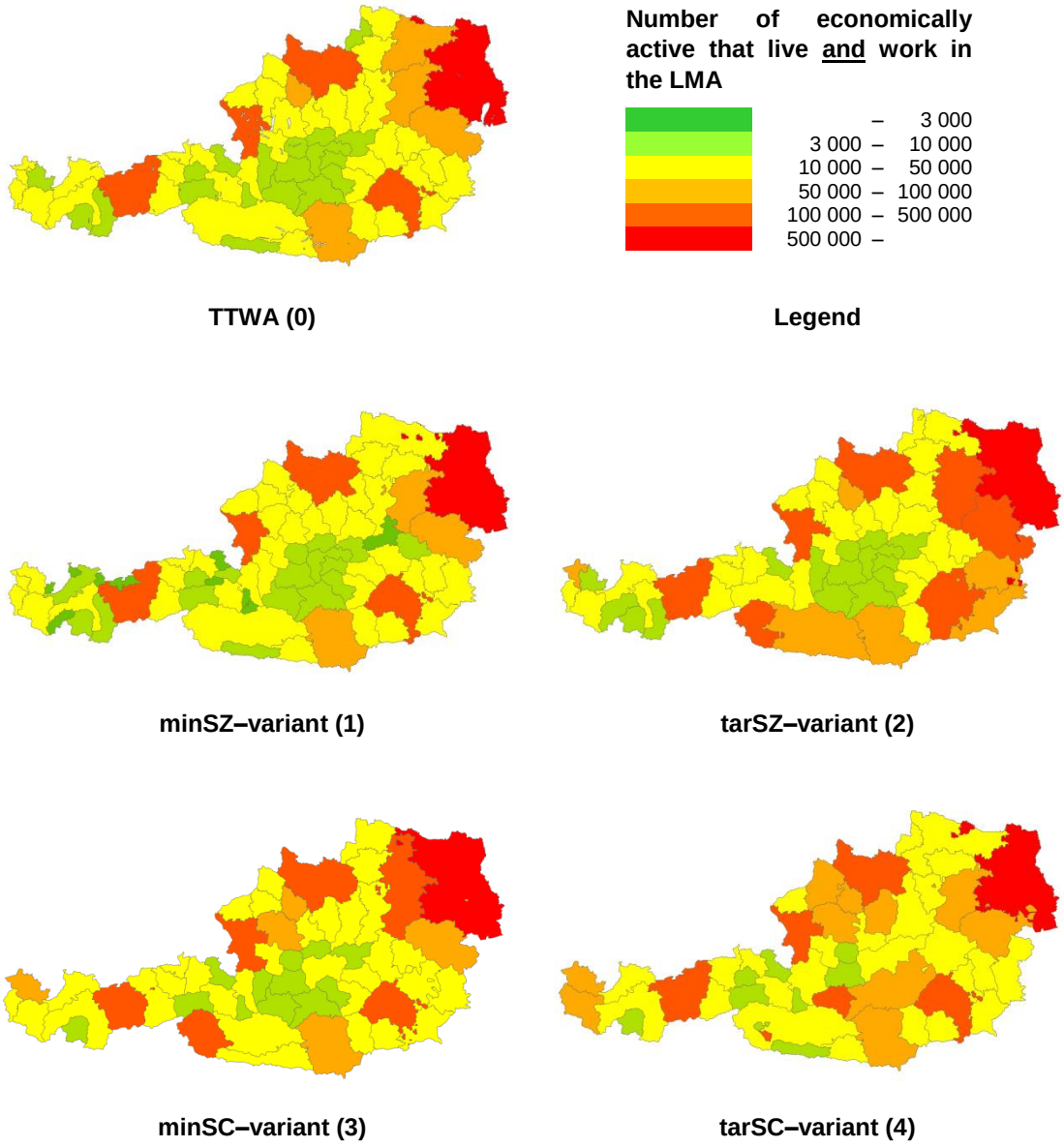
4.2 Sensitivity of the parameters

As mentioned in the above section, the algorithm is sensitive not only to the size of the statistical building blocks but also to changes in the parameters. While trying to find an optimal set of parameters, the 2014/2015 Task Force carried out sensitivity analysis by starting with four default values as originally applied by the UK in their Travel–To–Work Areas method and changing the parameters one–by–one keeping the remaining three parameters constant as shown in the table below.

		Sensitivity analysis			
	TTWA default (0)	minSZ-var. (1)	tarSZ-var. (2)	minSC-var. (3)	tarSC-var. (4)
minSZ	3 500	1 000	3 500	3 500	3 500
tarSZ	25 000	25 000	50 000	25 000	25 000
minSC	66.6 %	66.6 %	66.6 %	70.0 %	66.6 %
tarSC	75.0 %	75.0 %	75.0 %	75.0 %	85.0 %

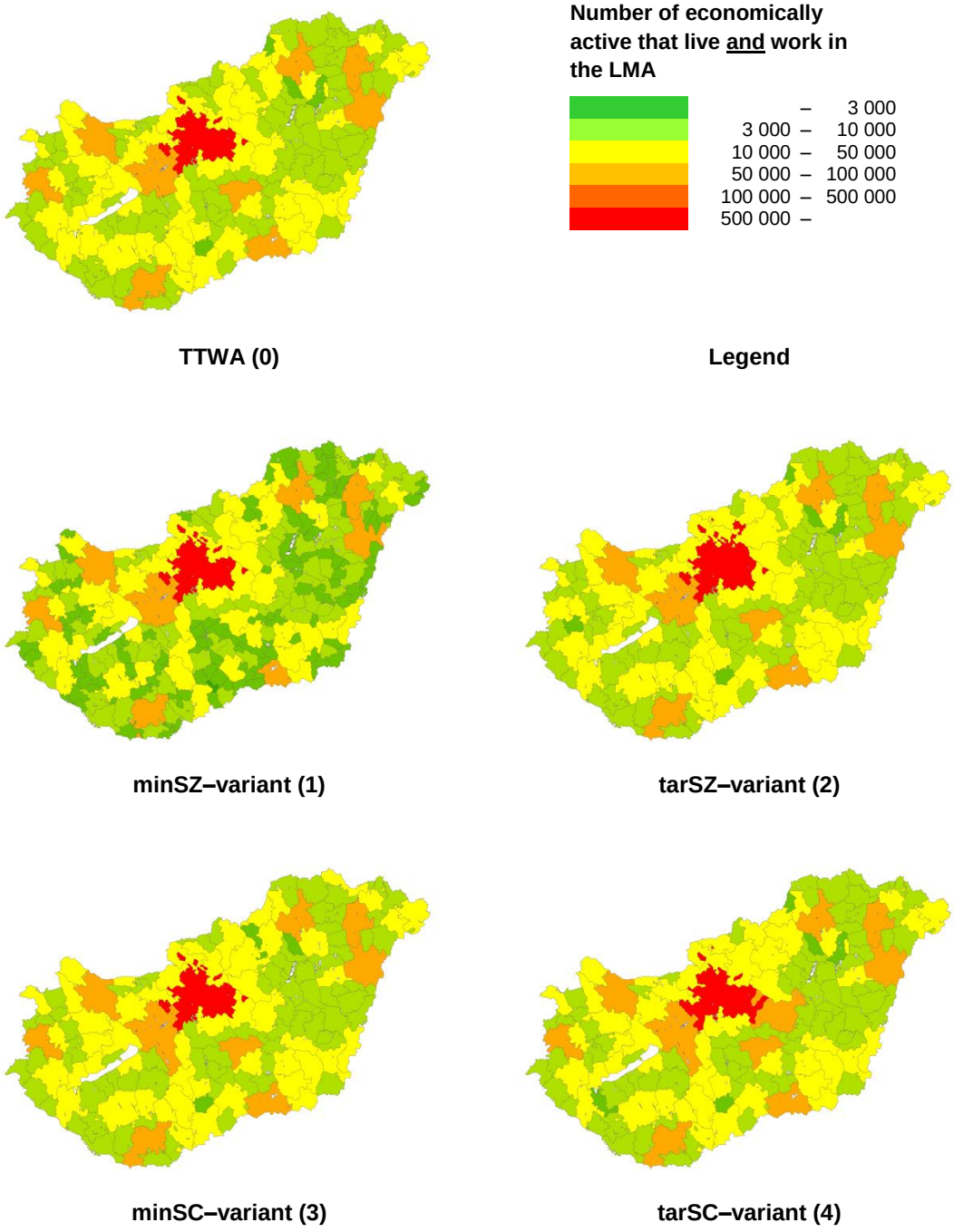
The default and all four variants of parameters have been applied to Austria, Hungary, the Netherlands and Sweden. The following four graphs illustrate the results of the sensitivity analysis.

Figure 4: Results of the sensitivity analysis for Austria



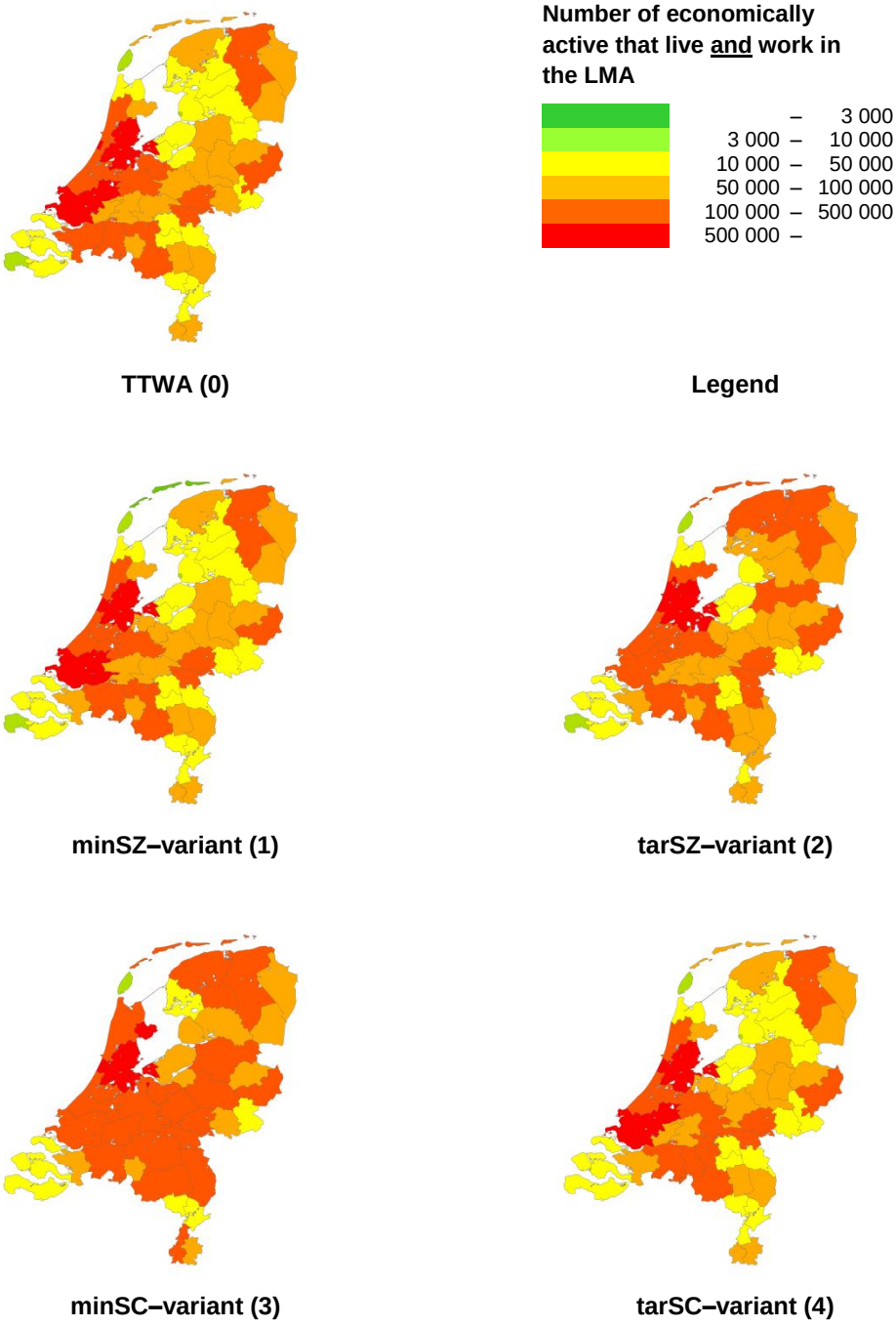
Source: The final report of the 2014/2015 TF

Figure 5: Results of the sensitivity analysis for Hungary



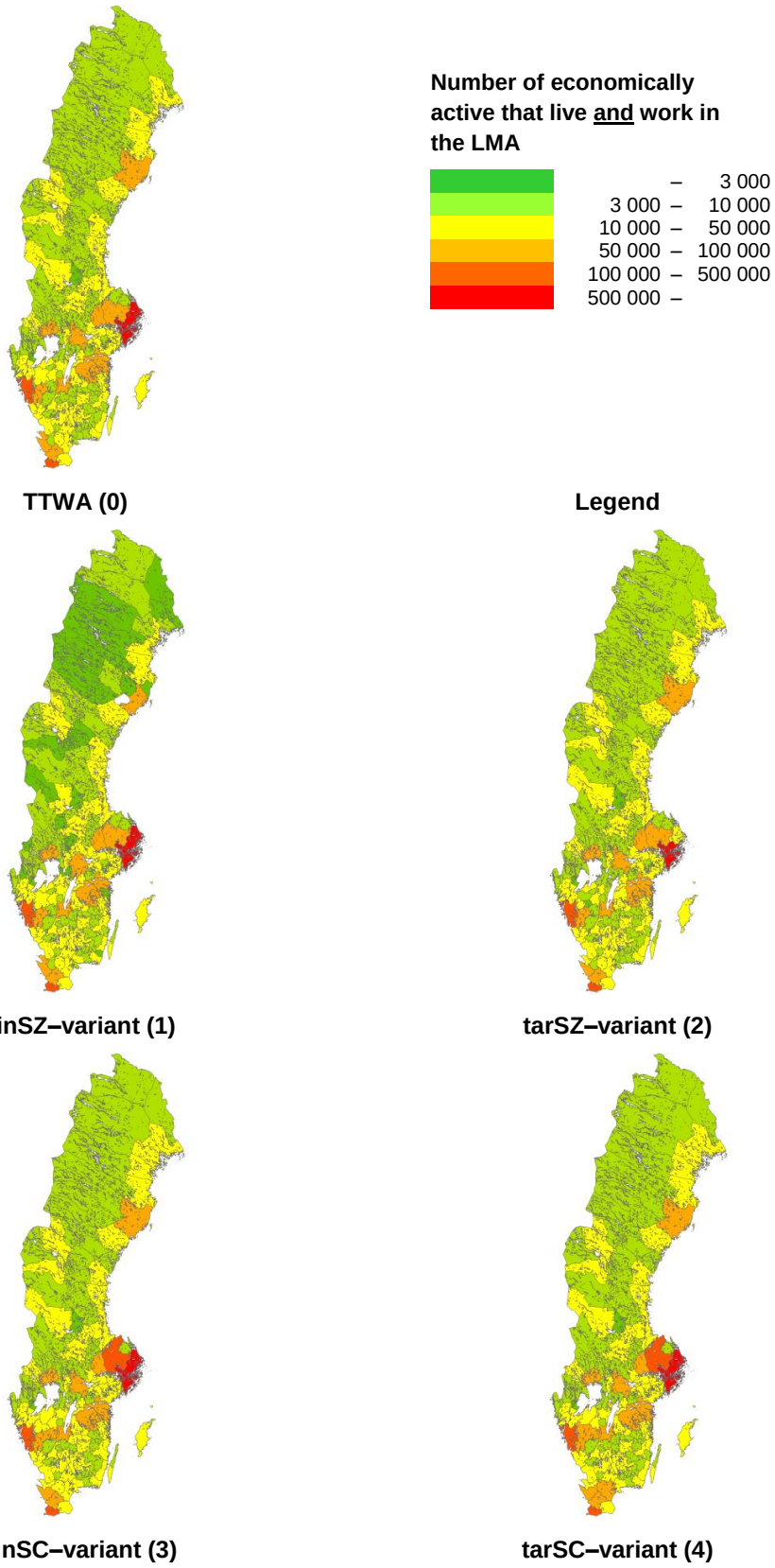
Source: The final report of the 2014/2015 TF

Figure 6: Results of the sensitivity analysis for the Netherlands



Source: The final report of the 2014/2015 TF

Figure 7: Results of the sensitivity analysis for Sweden



Source: The final report of the 2014/2015 TF

The Task Force discussed the results of the sensitivity analysis intensively. One substantial finding was that countries react with different sensitivity to the change in parameter values. As an example, the number of LMAs skyrocketed in Hungary when the minimum size was set on 1000 workers, while in other countries the number of LMAs stayed rather stable with this variant. Netherlands reacted sensitively to the increase of the minimum self–containment and Sweden to the increase of the target self–containment.

During the project phase (2016/2017) the Statistical Office of Hungary developed a systematic and automated way of testing the parameters, which is seen as a good basis for analysing the outcomes and the method itself. Furthermore, the analysis of border stability based on different parameters is a good basis for evaluation of the outcomes. However, one should be cautious while using this evaluation approach since the most stable boundaries may simply include very few large LMAs[(11)].

In the final report of the Task Force on harmonisation, it was stressed that the focus should be on larger LMAs with European relevance. The particular idea on how to achieve the goal of having LMAs relevant not only to the national scale but also to a European scale was generated later on by the 2018/2019 Task Force (for more information see section 4.4).

4.3 Needs of input data for future updates

As already mentioned, both LMAs and FUAs are based on commuting data. In order to be able to continue the work on the establishment of a European geo–dataset of harmonised LMAs as well as the data collection at FUA level, consideration over the updating of these boundaries is required. The update should be possible at least every ten years based on Census or register data. The local labour markets and the commuting behaviour can be very dynamic. A new factory or a new motorway could change the direction and magnitude of the commuting flows and extend the reasonable commuting distance in a given area.

The most important source for commuting data is generally the Census. The information on individuals' place of work and place of residence enables the compilation of commuting flow patterns between different administrative areas such as municipalities or census tracts, and statistical building blocks (if different). The resulting commuting matrix provides the input data for the algorithms that identify FUAs and LMAs. In 2018, Eurostat presented the sub–national commuting data needs to the Task Force on the future EU Censuses of Population and Housing in the light of the post Census strategy. The main principle for the future would be that Eurostat does not collect commuting data but needs to ensure that the Member States will have the information needed for the updating of the FUAs and the LMAs. Further breakdowns of the commuting data by age, sex and economic activity are not essential but the availability of these data will increase the analytical potential of these functional geographies. In all but one of the EU countries, sub–national commuting data are available; however obtaining comparable cross–border commuting data may be an issue requiring a resolution.

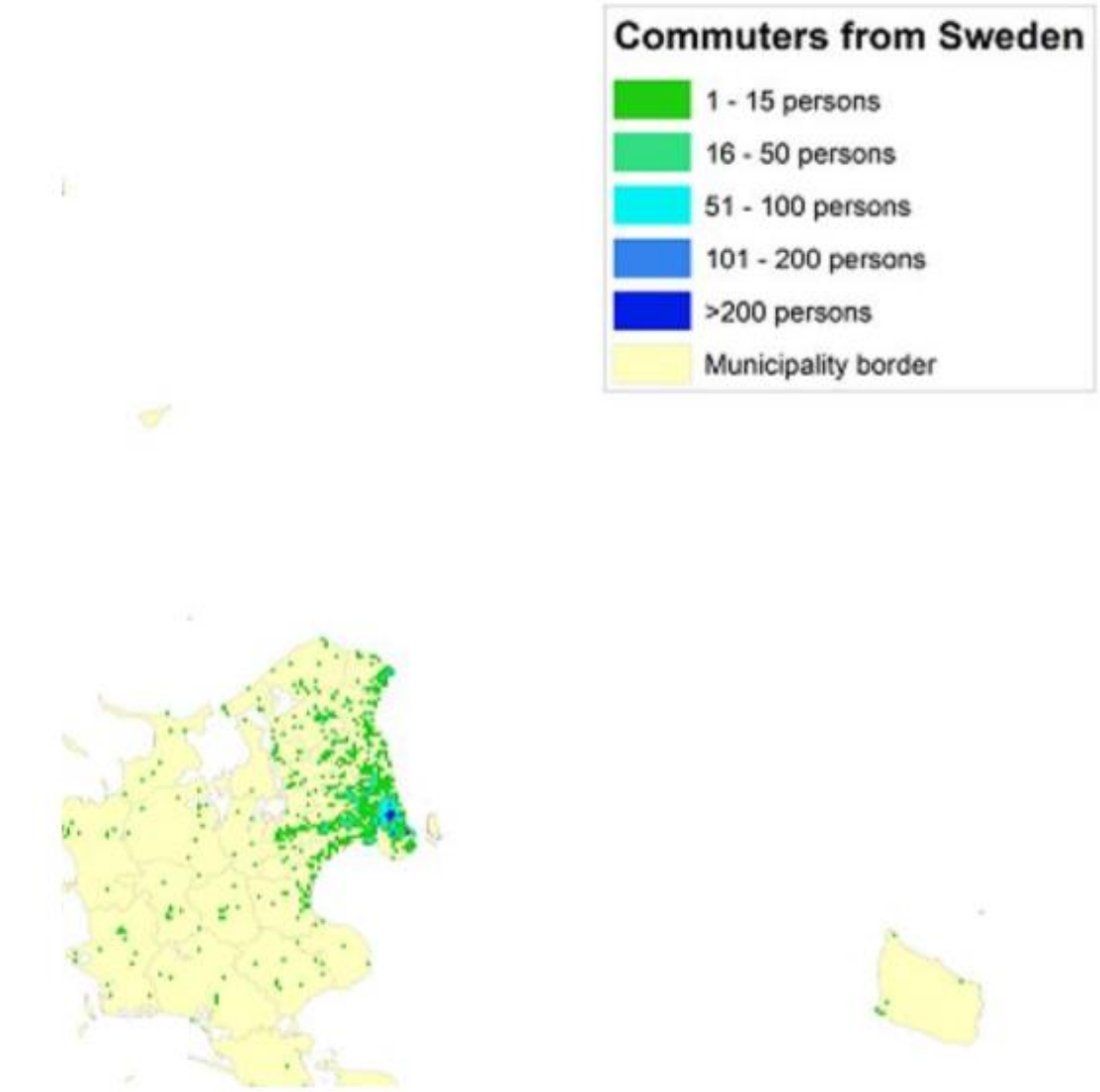
Another data source that countries may rely on are the administrative data on people, business and activities. The experience of Portugal showed that administrative data, even with a higher geographical resolution, does not always gives better results than Census data and should be used cautiously. Other countries working with administrative data faced the problem of the identification of the actual place of work vs the headquarters' address of the employer. On the other hand, the administrative data offers an alternative to the Census–based commuting data, being less cost–intensive and often updated on an annual basis.

The Nordic countries have a long–standing tradition in using administrative data for producing statistics. The amazing example below demonstrates the potential of administrative data, labour force survey data and mobile phone data in a cross–border context. It presents the share of incoming cross–border workers from Sweden to the region of Copenhagen in Denmark per 1 km grid cells. Not

(*11*) https://ec.europa.eu/eurostat/cros/content/methodological–report–hungary–part–2_en

surprisingly, the cross–border commuters are focused in the city of Copenhagen but outside this area, the workers are not evenly spread. From a cross–border perspective, it is interesting to mention that the two strips of concentration west of Copenhagen follow the two main motorways and railways connecting the city with the countryside. Evidently, good transport network connections determine the behaviour and the destinations of the cross–border commuters. These data have been produced in the frames of a project called 'Border Region Data collection' financed by DG REGIO[12].

Map 7: Cross–border workers from Sweden per 1 km grid cells in the area of Copenhagen



Source: Statistics Denmark

In the light of the increasing policy interest in an EU–wide employment grid and local information on mobility including by purpose of the trip, the LMAs seem to be a potential future case for the usage of mobile phone data and/or the integration of administrative and big data sources.

(12) https://ec.europa.eu/regional_policy/en/newsroom/news/2018/11/11–06–2018–enhancing–border–regions–data–collection–final–report–of–a–pilot–project

4.4 National vs European Labour Market Areas

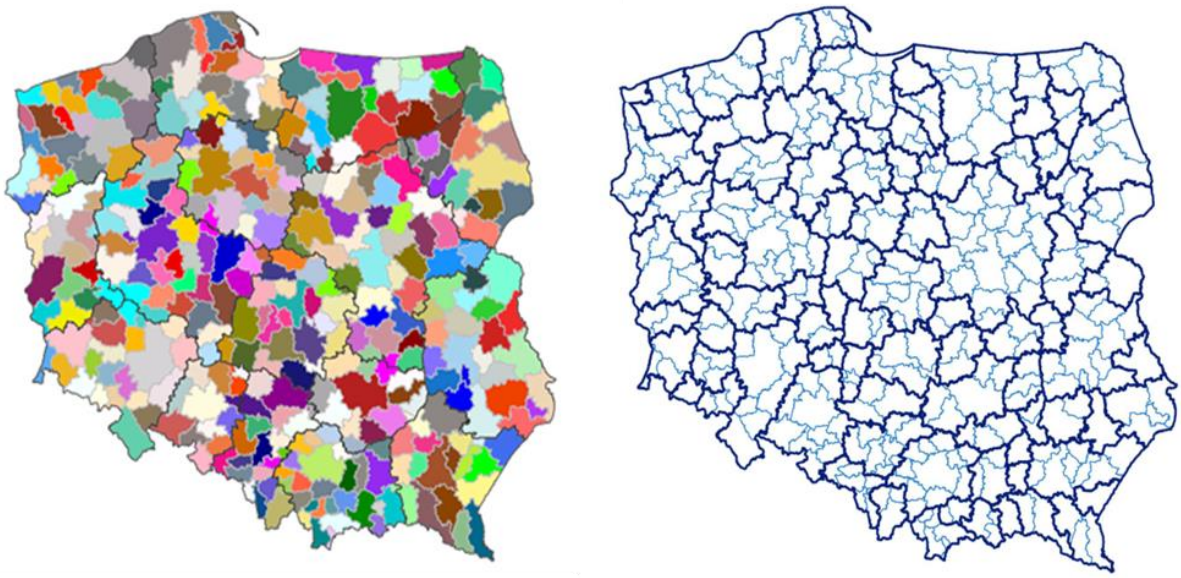
The 2018/2019 TF has generated and intensively discussed the idea of 2 hierarchical levels of LMAs (similarly to the NUTS). National LMAs based on the harmonised method but using national criteria are needed to meet the requirements of national users. The national LMAs are usually smaller in terms of employment size. On the other hand, European stakeholders need comparable LMAs across Europe. They should be larger in size, which together with a meaningful comparative analysis across Europe allows for production of statistics on employment and other indicators from social surveys. While the national LMAs are better established, agreed with national stakeholders and already used for policies, additional work on the European scale of LMAs was required.

The solution came naturally from past experience and knowledge gained during the grant phase of the project. The settlement asymmetries of the Portuguese mainland territory between North/South and Coast/Inland make it difficult to obtain a homogeneous geography in terms of population and area in the definition of functional regions. On the other hand, the two Portuguese metropolitan areas (Lisbon and Porto) have a very strong capacity of polarisation of commuters from other municipalities, accounting for 40 % of the Portuguese population. In order to overcome these issues, Statistics Portugal worked with high self–containment constraints and high values of minimum and target employment size (Min SC 0.80, Tar SC 0.85, Min SZ 35 000, Tar SZ 100 000). Since the national LMAs, with 25 LMAs consistent with the number at NUTS 3 level, were considered as relevant at the European scale, this set of parameters have been proposed for testing to the experts from the other countries. The results were appropriate in countries with very different morphologies. Some parameter value adjustments to reflect on socio–economic differences in other Member States would be acceptable.

Regarding the starting point, two different approaches have been implemented to produce European LMAs – groupings of national LMAs to accommodate the hierarchical approach (for instance Poland, Italy and Switzerland), or groupings of LAUs (Portugal where the national LMAs are equal to the LMAs at the European scale). One should be careful in the choice of the self–containment parameter values as the usage of national LMAs for building blocks of European LMAs may result in too large LMAs around big cities, which might need to be sub–divided afterwards.

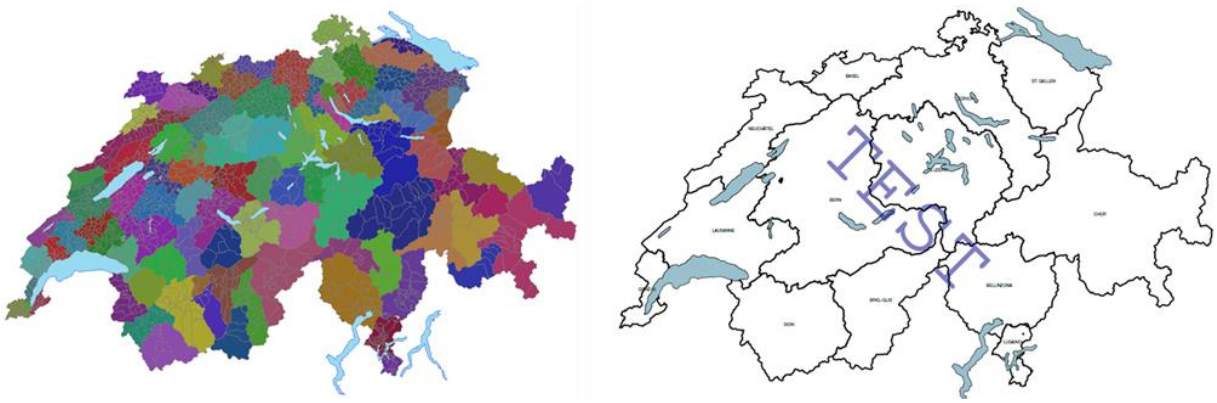
The next few maps illustrate the two scales of LMAs. For instance, the national parameter value set of Poland (Min SC 0.667, Tar SC 0.80, Min SZ 4 000, Tar SZ 30 000) produces 339 LMAs while the ‘Portuguese’ parameter values applied to the national LMAs as input building blocks results in 83 LMAs at the European scale. In a similar vein, the Swiss national parameter values (Min SC 0.57, Tar SC 0.75, Min SZ 3 000, Tar SZ 5 000) produces 101 national LMAs vs 12 LMAs using the ‘Portuguese’ parameter values, etc.

Map 8: National vs European LMAs in Poland



Source: The NSI of Poland

Map 9: National vs European LMAs in Switzerland



Source: The NSI of Switzerland

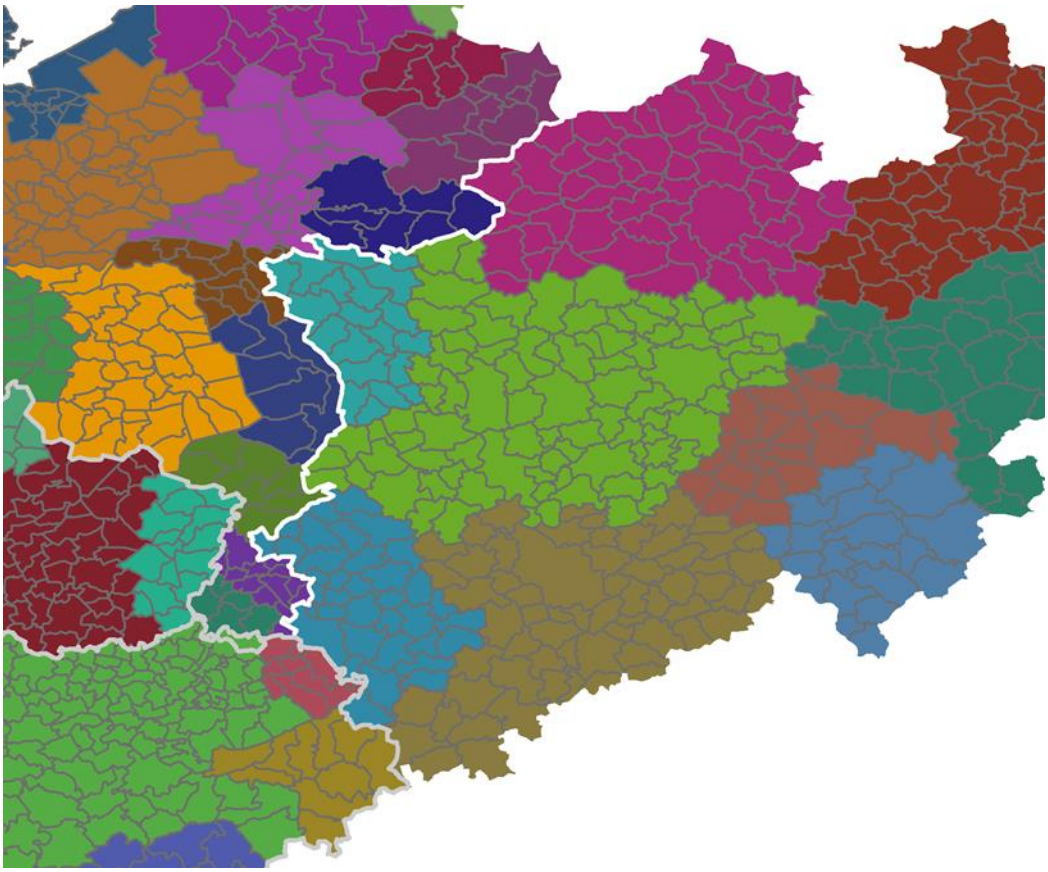
4.5 Cross–border Labour Market Areas

Very relevant to the European scale are the cross–border LMAs. The main challenge in defining cross–border LMAs is to ensure that input data are consistent in the neighbouring countries and contains flows in both directions. Very often data contain only information on the country of work but not the LAU (or other suitable geographic information) where the cross–border commuter works (in case of Census data), or the other way round (in the case of administrative data) – where the exact place of residence of the incoming commuters is unknown.

One of the projects in the frames of the 2016/2017 grant program carried out by Statistics Netherlands in collaboration with colleagues from Belgium and North Rhine–Westphalia (NRW) state in Germany was devoted to cross–border LMAs. For all three participants, the live–work matrix was incomplete and required some estimations. As already stated, the situation that information is

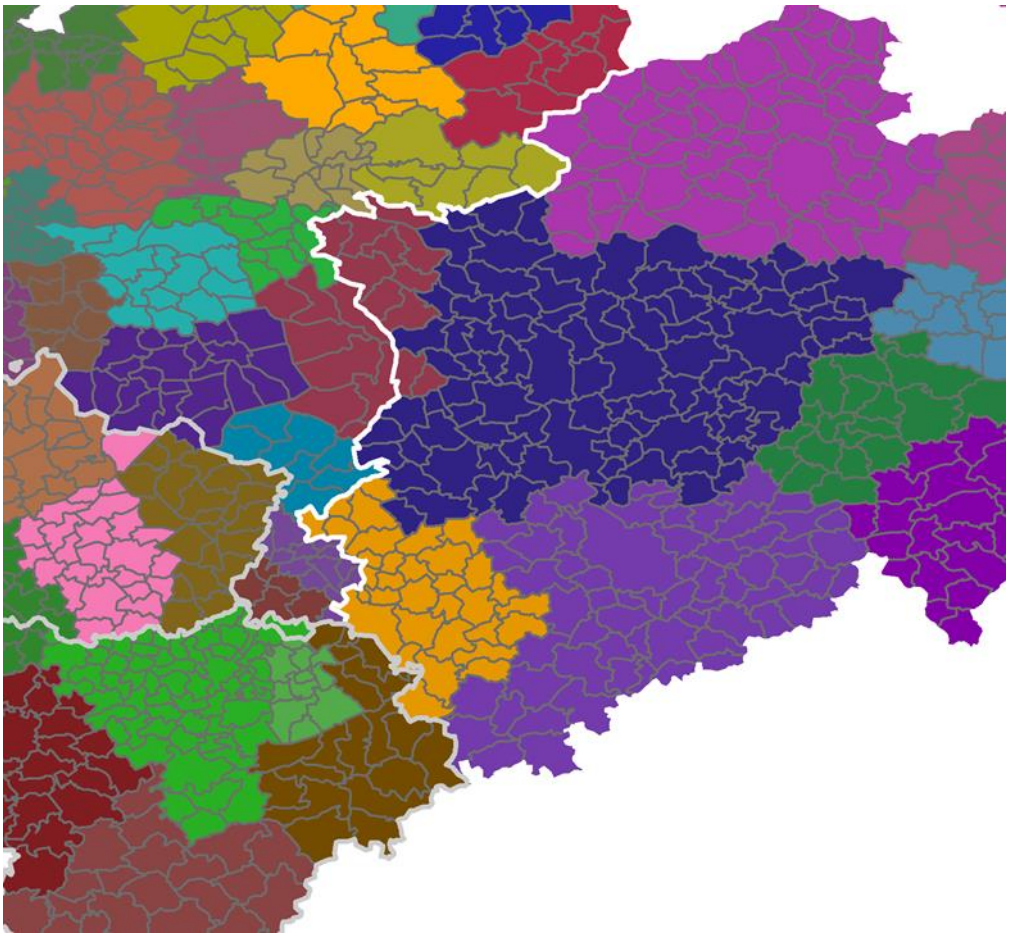
missing is not unique for the Netherlands and the bordering countries. This is the common situation when cross–border flows are measured. In most cases, one would have to exchange micro–data between countries and link the administrative data on persons. For the purposes of this project, the missing data has been imputed through calculation of the likelihood of persons commuting across the border based on commuting distance and nationality of the workers. However, the experts recommended the development of more sophisticated methodology for the future. The LMAs at the Dutch–Belgium border and at the Dutch–NRW border have been constructed with national commuting data plus the estimated cross–border commuting flows. The result was that inclusion of cross–border commuting data had not so much influence along the borders but gave large effects on the construction of the LMAs inside the countries. It was concluded that the inclusion of cross–border information results in more logical clusters. The next four maps provide an overview of the results.

Map 10: LMAs without cross–border information: the Netherlands and NRW



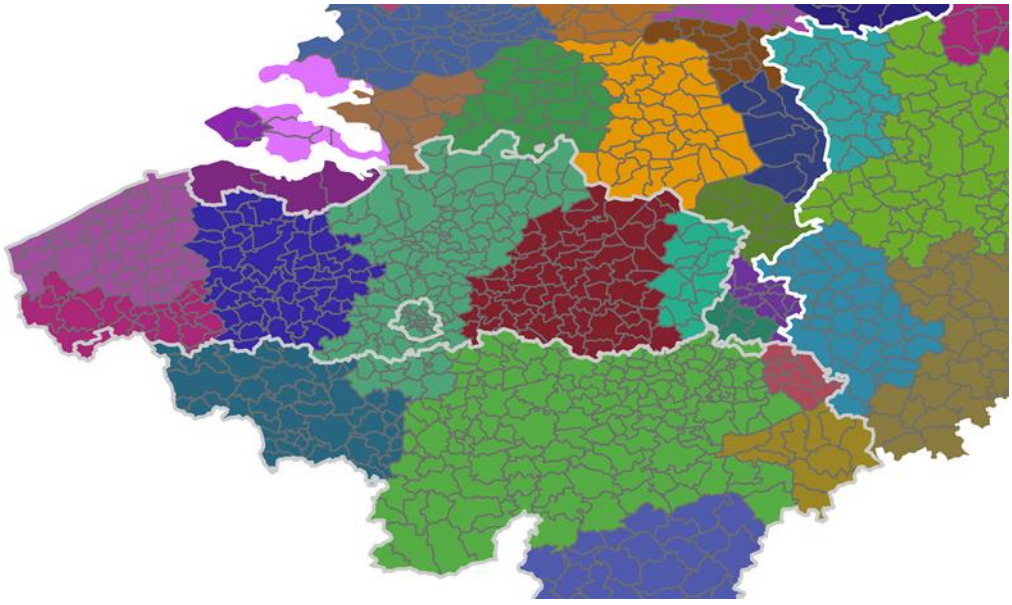
Source: The NSI of the Netherlands

Map 11: LMAs with cross–border information: the Netherlands and NRW



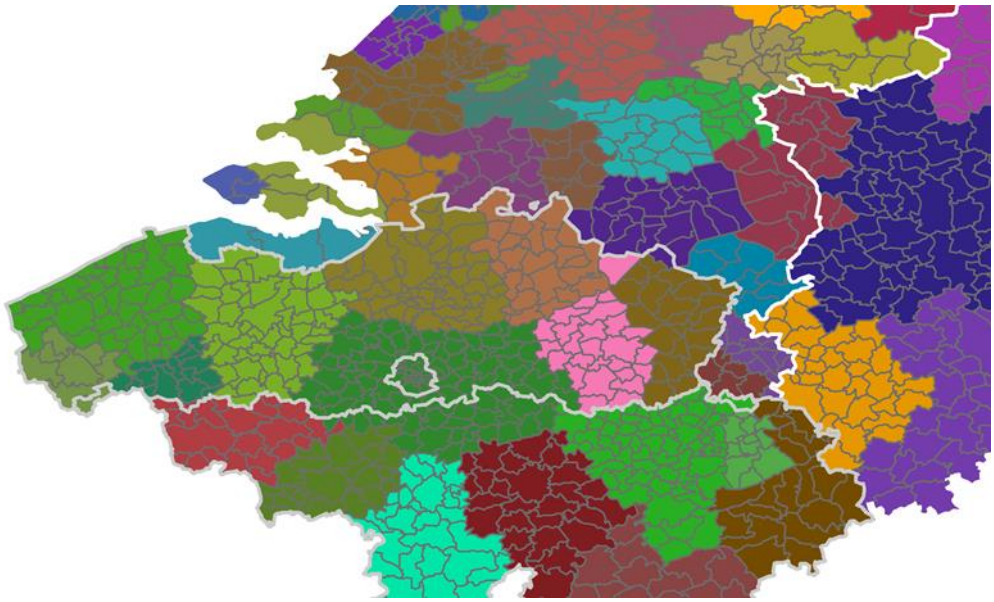
Source: The NSI of the Netherlands

Map 12: LMAs without cross–border information: the Netherlands and Belgium



Source: The NSI of the Netherlands

Map 13: **LMAs with cross–border information: the Netherlands and Belgium**

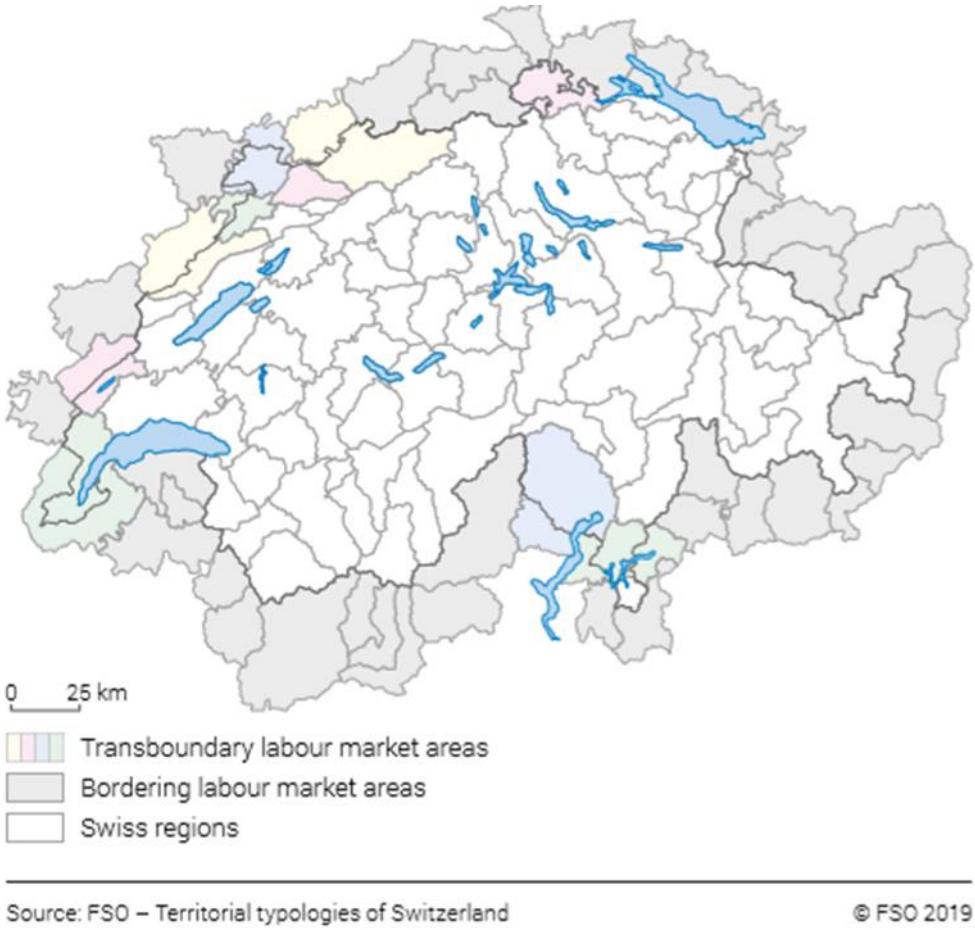


Source: The NSI of the Netherlands

In a recent publication, the Swiss experts raised further methodological and technical issues related to cross–border LMAs. They tested several ways to define transboundary LMAs. As the objective was to maintain LMAs that makes sense when considering Switzerland only, the solution consisted in using a commuting matrix between predefined Swiss LMAs and municipalities (LAU) abroad. Enclaves were eliminated. Furthermore, transboundary regions that only had one or two foreign municipalities ("isolated" municipalities) were not selected, municipalities being reallocated to the neighboring region in their country. The method required a significant pre–processing work in order to gather the commuting data from all countries concerned. Ten transboundary LMAs were thus defined in Geneva, the Jura mountains region, Basel, Schaffhausen and Ticino[13].

([13]) https://www.bfs.admin.ch/bfs/en/home/news/whats–new.assetdetail.8948838.html

Map 14: **Cross–border LMAs defined by Switzerland**



Source: The NSI of Switzerland

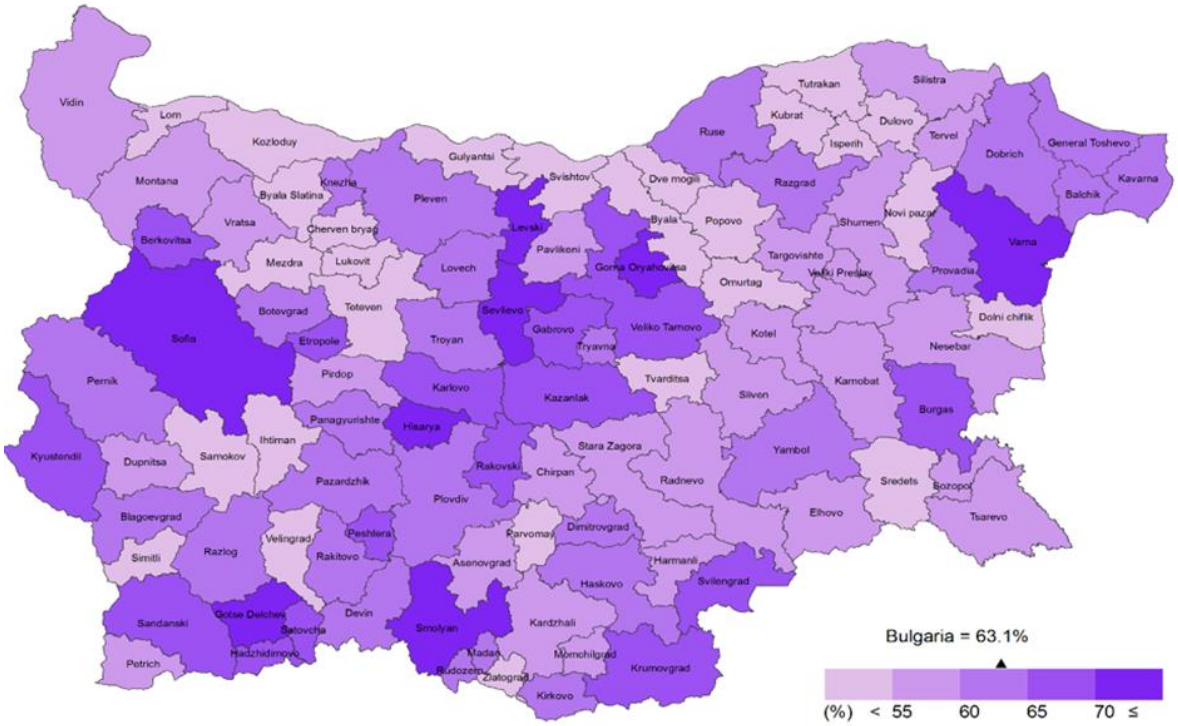
4.6 Statistical data production at the level of Labour Market Areas

LMAs are designed to support employment, labour mobility and urban planning policies as well as other sectoral monitoring and policies. To make any functional geographies usable not only for research but also for policy–making, we need statistics at that geographical level. The countries working in the LMAs network used different approaches and data sources to start populating their LMAs' databases.

As a part of the grant's tasks, the statistical office of Bulgaria produced some experimental data for LMAs by combining an administrative data source (the National Employment Agency) with data from the Labour Force Survey (LFS) and the Enterprises' survey on employment, wages and salaries and other labour costs.

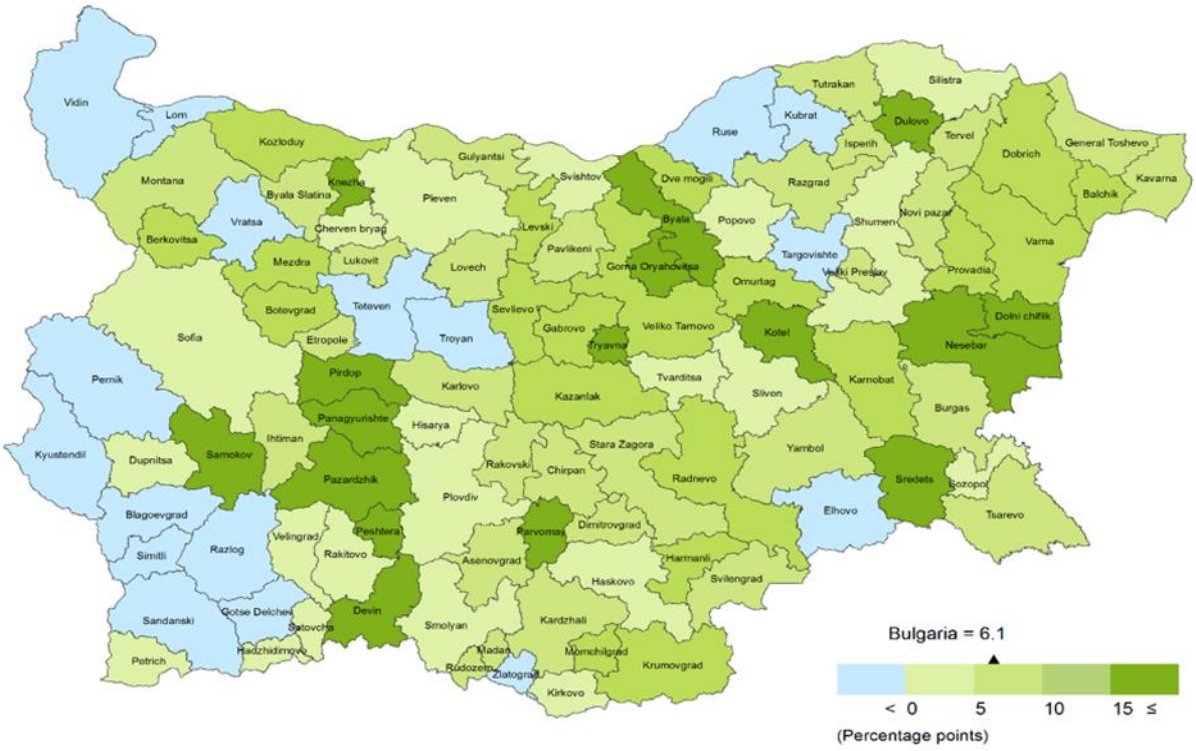
To make use of the LFS data, the original sample weights have been additionally calibrated to ensure consistency with the population data for the age groups of interest by LMAs. The next few maps gives the flavour of what one could do through mapping different sources onto LMAs.

Map 15: Employment rate by LMAs in Bulgaria, 2015 (% share of population aged 15–64)



Source: The NSI of Bulgaria

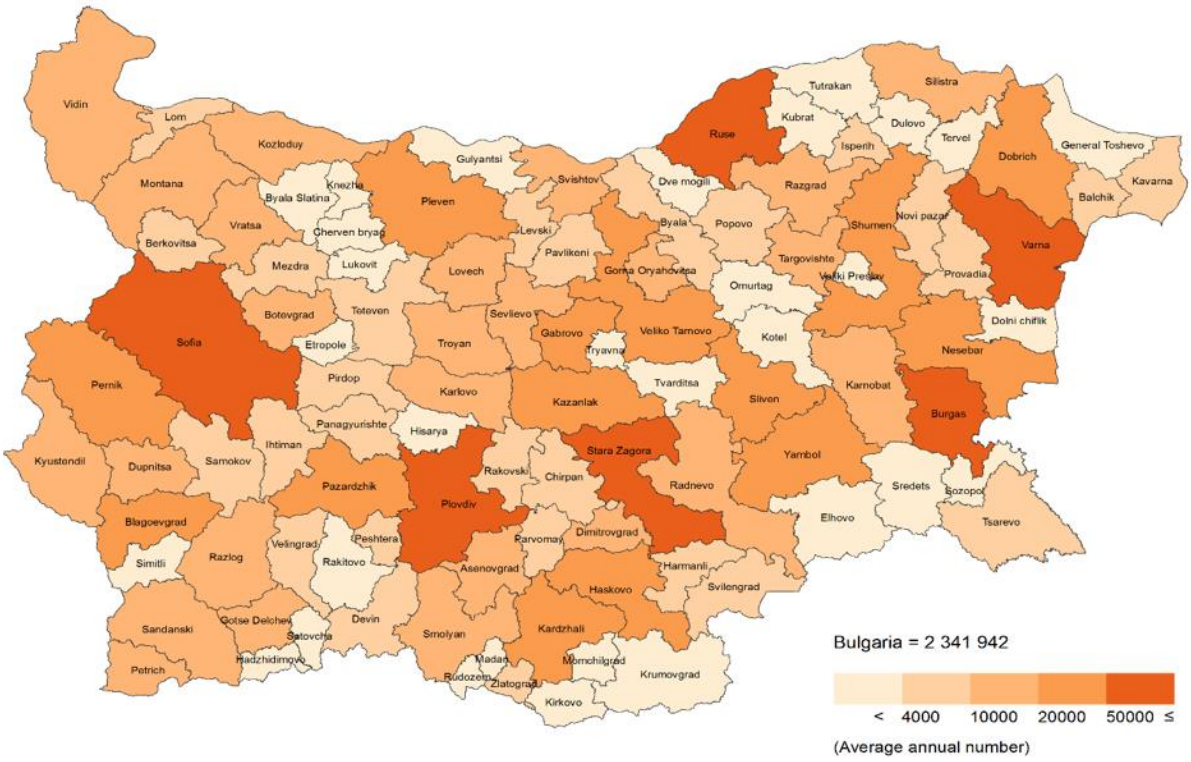
Map 16: Gender gap in the employment rate by LMAs in Bulgaria, 2015 (% share of population aged 15–64)



Source: The NSI of Bulgaria

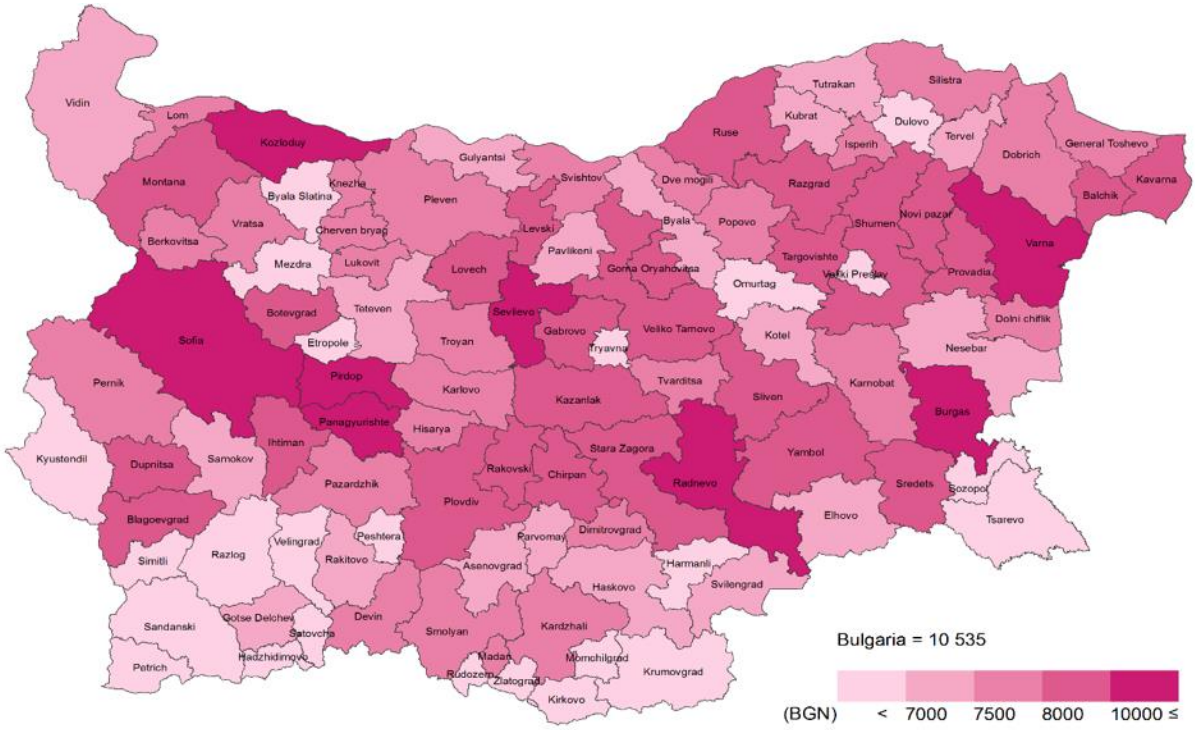
Since the Enterprises' survey on employment, wages and salaries and other labour costs is an exhaustive survey, a simple aggregation of LAU data allowed for producing LMA statistics. The same applies for the data taken from the National Employment Agency. One should keep in mind that the register data are based on different definitions than those used in the LFS.

Map 17: Number of employees under labour contract by LMAs in Bulgaria, 2015



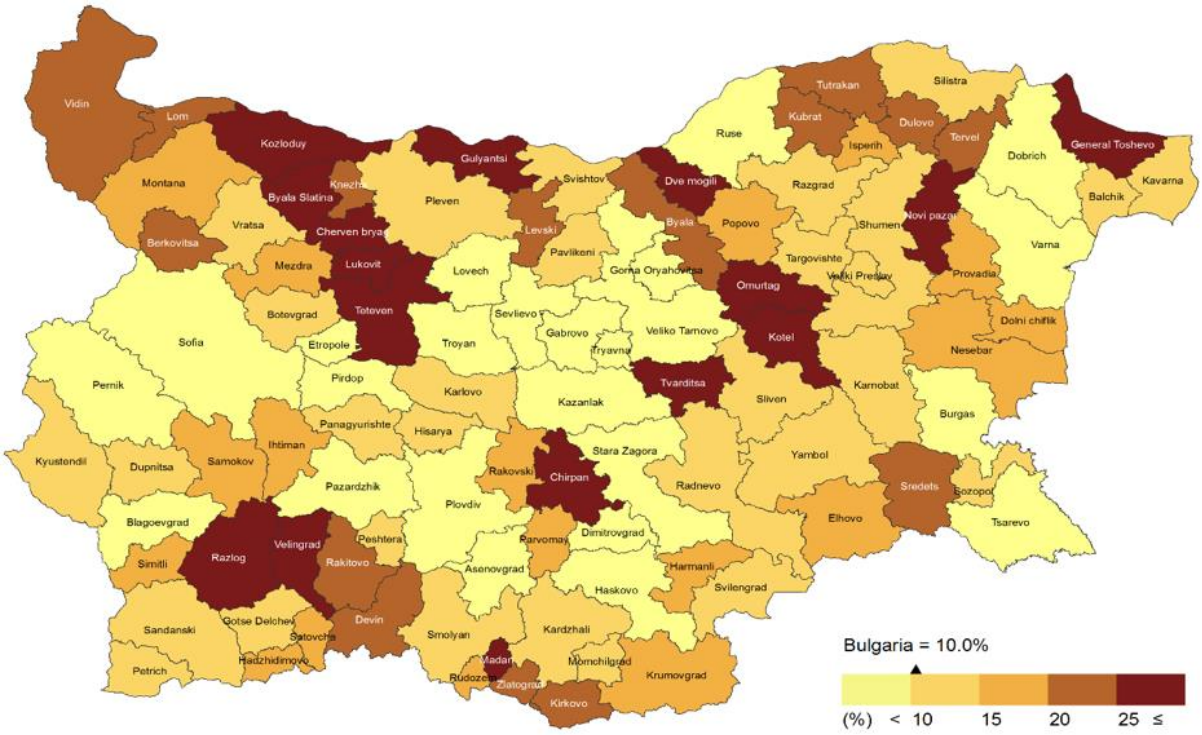
Source: The NSI of Bulgaria

Map 18: Average annual gross wages and salaries of the employees under labour contract by LMAs in Bulgaria, 2015



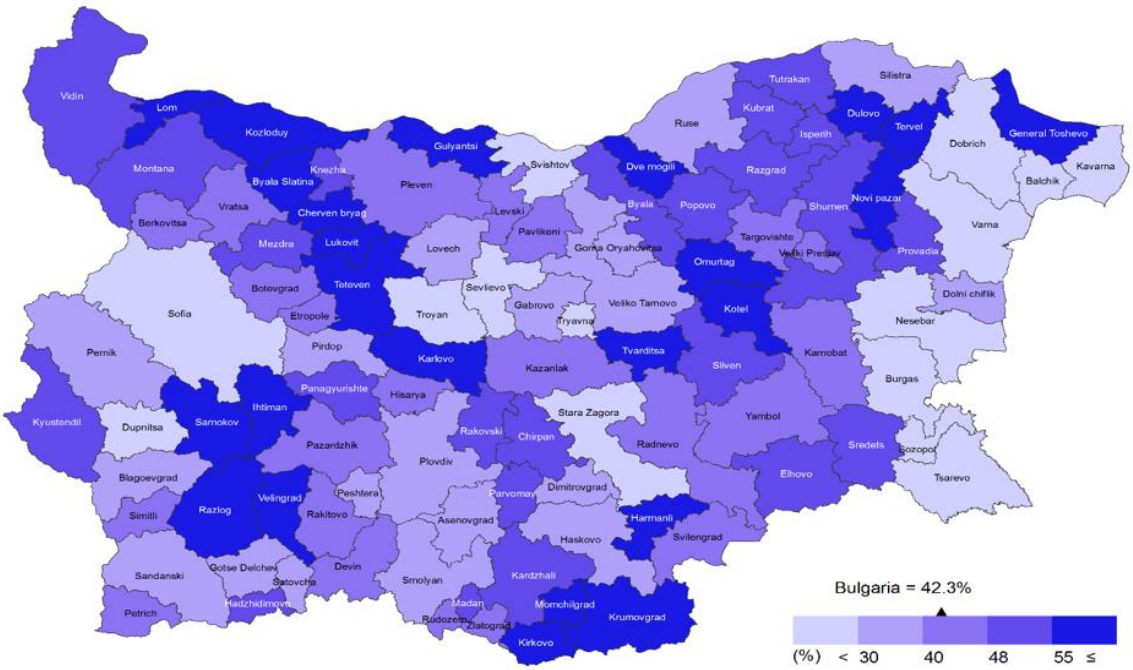
Source: The NSI of Bulgaria

Map 19: Register unemployment rate at the labour offices by LMAs in Bulgaria, 2015



Source: The NSI of Bulgaria

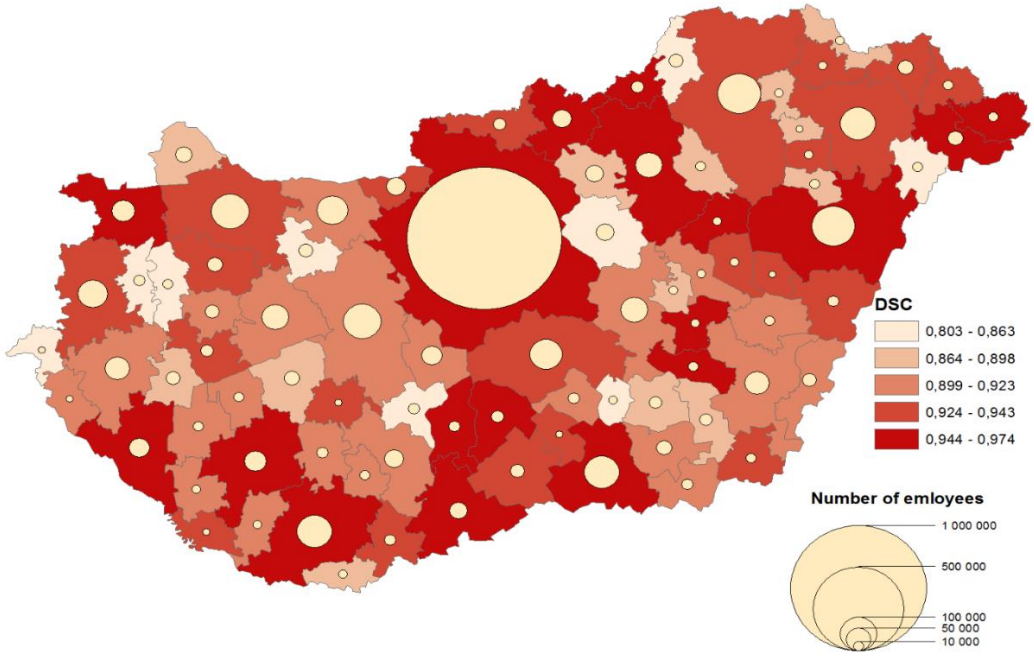
Map 20: Share of the register long–term unemployment (more than 1 year) by LMAs in Bulgaria, 2015



Source: The NSI of Bulgaria

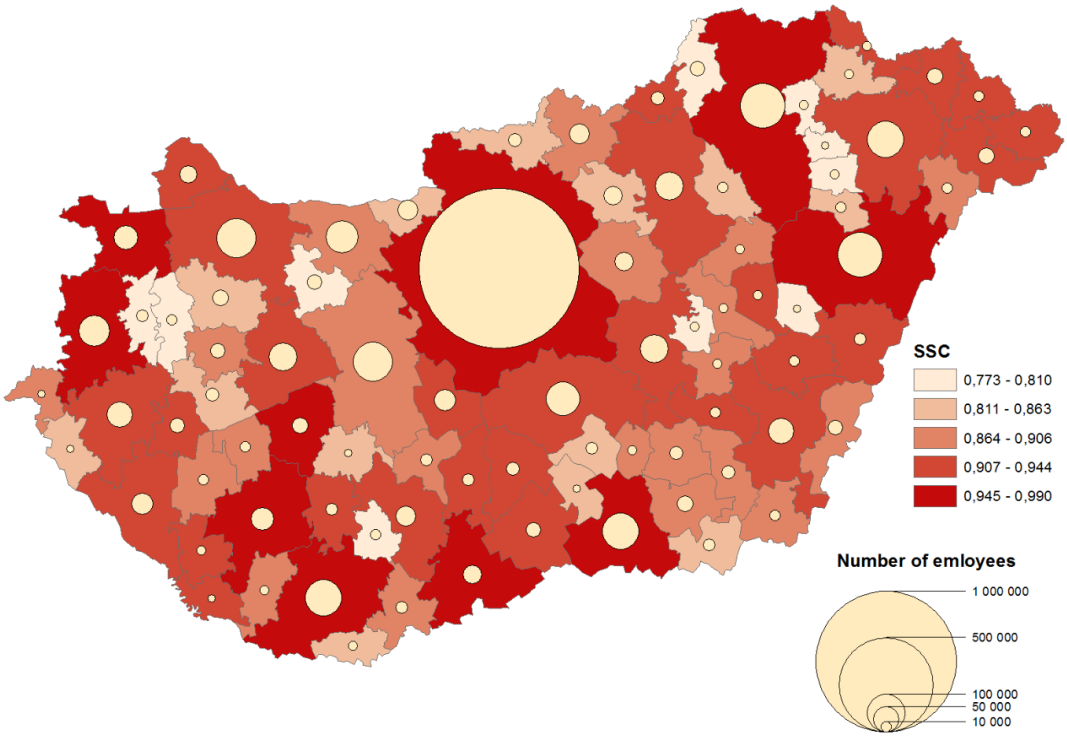
The next three maps show how the statistical office of Hungary used the input commuting data and other Census data to produce derivative indicators by LMAs.

Map 21: Demand side self–containment and size of the LMAs in Hungary



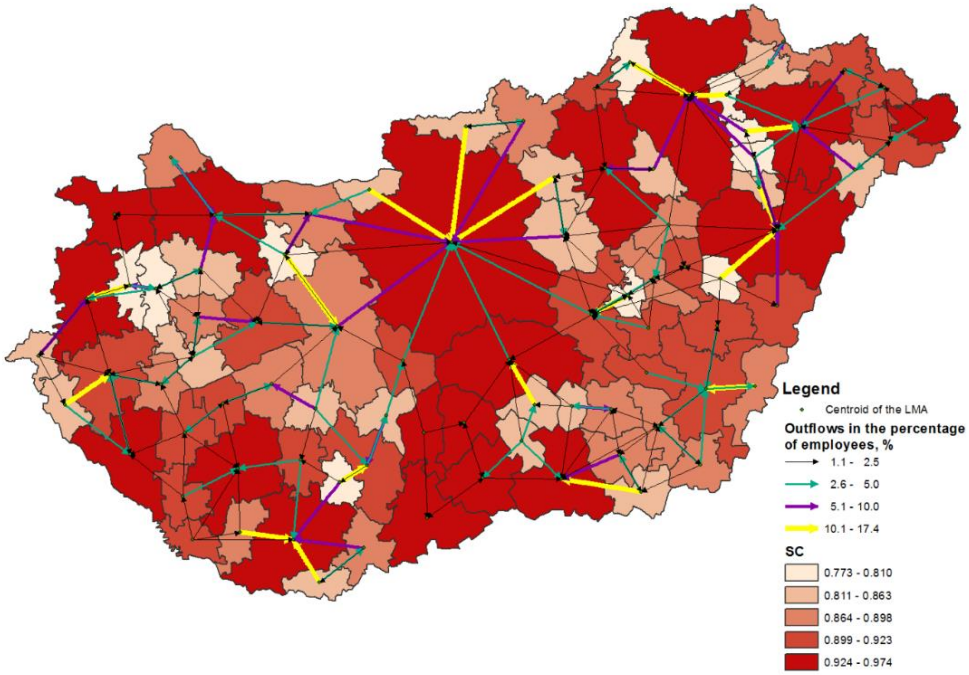
Source: The NSI of Hungary

Map 22: Supply side self–containment and size of the LMAs in Hungary



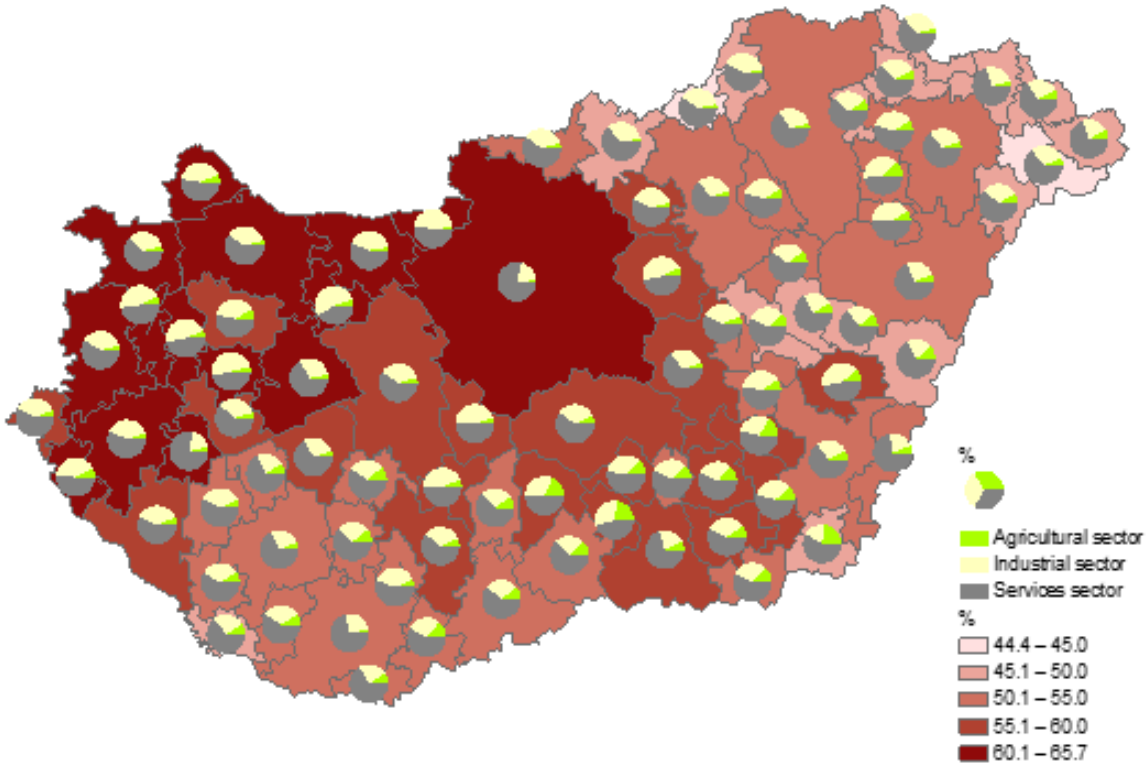
Source: The NSI of Hungary

Map 23: Commuting outflows and self–containment of the LMAs in Hungary



Source: The NSI of Hungary

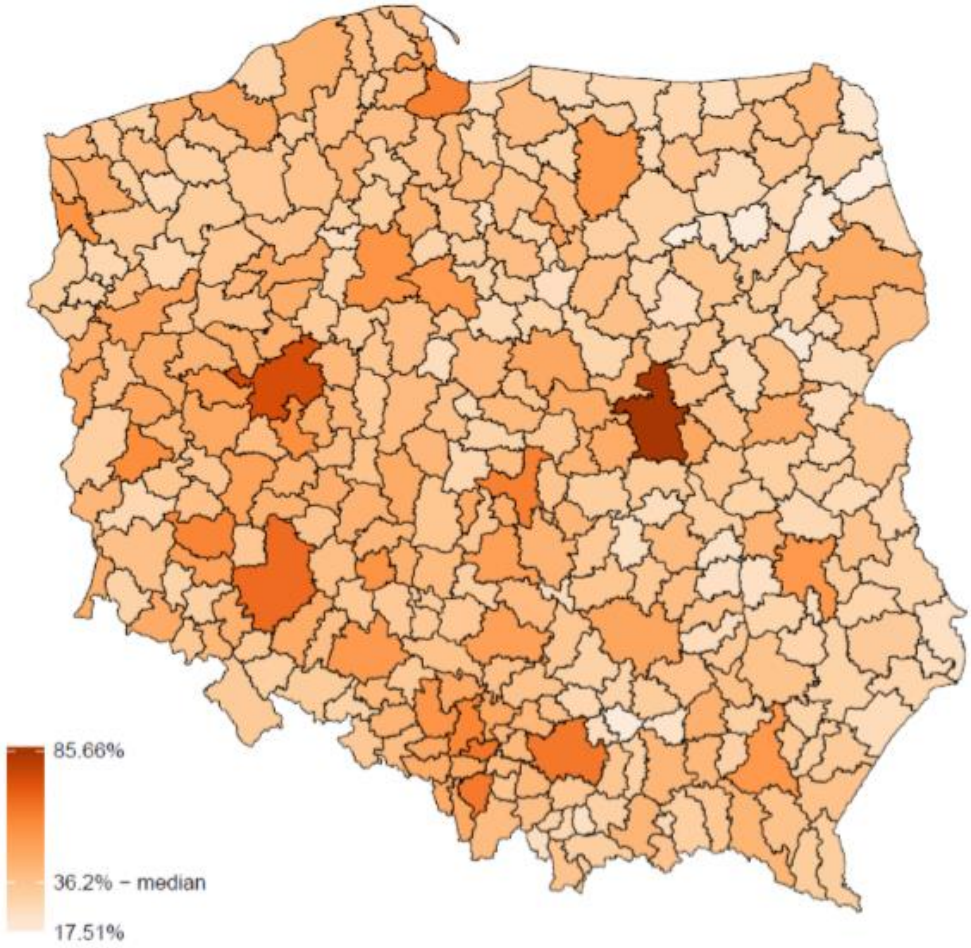
Map 24: Employment rate and the distribution of employment by sectors, 2011



Source: The NSI of Hungary

Statistics Poland has also aggregated existing data from Census building blocks to LMA level. Below are the results.

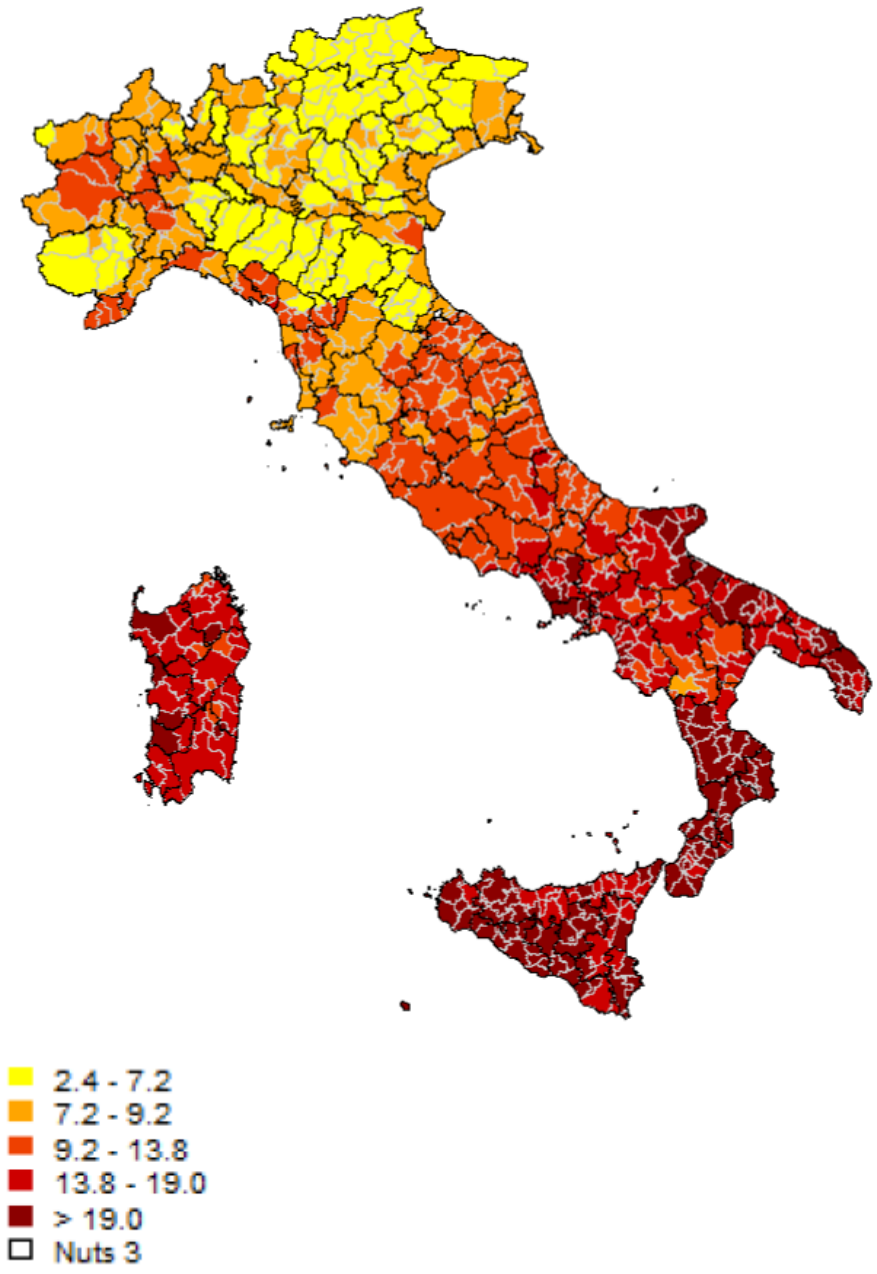
Map 25: Employment rate in Poland, 2011



Source: The NSI of Poland

Italy is regularly producing labour market data for LMAs based on the LFS and Small Areas Estimations (SAEs) techniques. The method used to produce the data shown on the map below is Space–time unit level EBLUP (Empirical Best Linear Unbiased Prediction).

Map 26: Unemployment rates by LMAs in Italy, 2016



Source: The NSI of Italy

Several other countries also have experience in using SAE in the framework of the City statistics data collection ([14]). Eurostat generally encourages NSIs to apply SAE not only for data production at LMA level but also for city statistics level. Eurostat's Guidelines on small area estimation for city statistics and other functional geographies' have been published in 2019[(15)].

A further possibility under discussion within the European Statistical System for making statistics not only for LMAs but also for any other customised territorial typology is the geo–coding of social surveys and business statistics.

([14]) https://ec.europa.eu/eurostat/cros/content/trainings_en
http://ec.europa.eu/eurostat/cache/metadata/Annexes/urb_esms_bg_an3.pdf
http://ec.europa.eu/eurostat/cache/metadata/EN/urb_esms_ee.htm
http://ec.europa.eu/eurostat/cache/metadata/EN/urb_esms_es.htm

([15]) https://ec.europa.eu/eurostat/en/web/products–manuals–and–guidelines/–/KS–GQ–19–011

5 Use cases of Labour Market Area

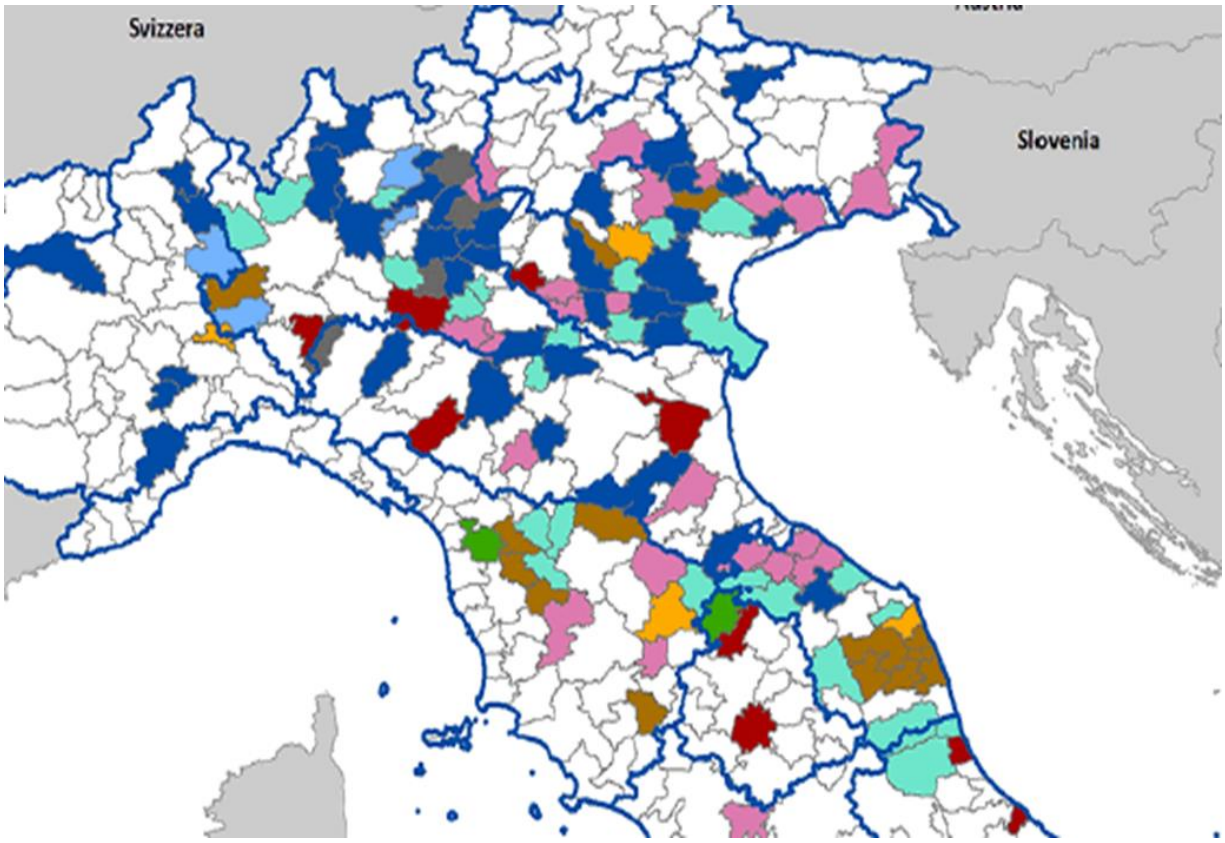
The purpose of this chapter is to demonstrate the broad applicability and the value added of the concept of the LMAs and their analytical potential. LMAs, based on the TTWA definition in the UK, have already been used by a number of research institutions in Europe and overseas to analyse in depth various socio–economic phenomena. The results obtained by the NSIs have been presented at several workshops in Rome and Paris organised by Istat in the frames of the 2016/2017 Eurostat's grant program. All materials are available on the Collaboration in Research and Methodology for Official Statistics website[16].

5.1 Labour Market Areas as industrial districts

In Italy, it is a tradition to produce and analyse industrial districts. An industrial district is a functional geography identified on the basis of LMAs with a dominant manufacturing NACE activity measured in employment in micro, and small to medium size enterprises. The potential of the industrial districts has been discussed within the LMAs network in the perspective of industrial policies. The map below shows the results for Italy based on the 2011 business census data. 141 industrial districts out of 611 LMAs have been identified. These 141 LMAs absorb 24.5 % of the total employment and 37.9 % of manufacturing employment. It is interesting to mention that the vast majority of the LMAs in the south of Italy do not have a particular economic specialisation. SAS and R code for delineation of industrial districts with different specialisations, developed by Istat, have been made publicly available[17].

([16]) https://ec.europa.eu/eurostat/cros/content/events–4_en
([17]) https://ec.europa.eu/eurostat/cros/content/industrial–districts_en

Map 27: Industrial districts in Italy, 2011



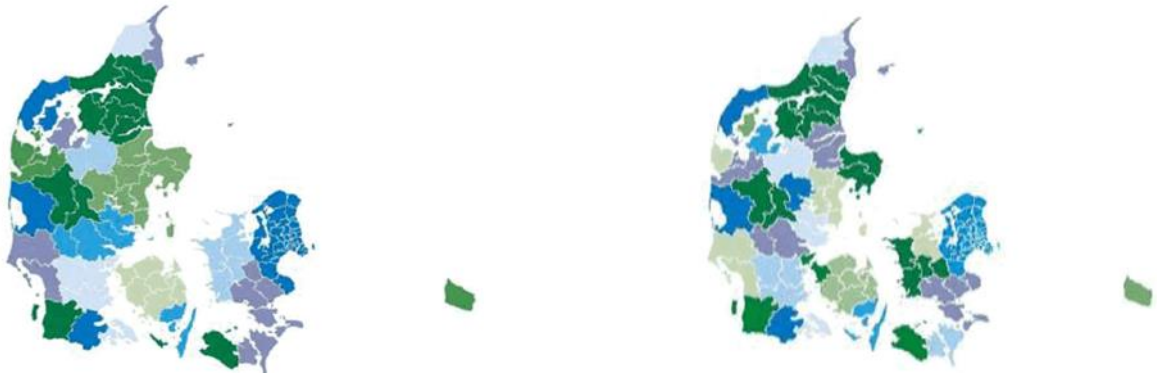
Source: The NSI of Italy

5.2 Alternative Labour Market Areas for commuters sharing specific characteristics

Map 28 shows the gender specific LMAs obtained by Statistics Denmark. The assumption is that various population sub–groups have distinctive commuting patterns. Generally, LMAs represent the outcome of an 'averaging' of the journey–to–work patterns of different gender, socio–economic and occupational groups. Here, the self–containment of LMAs is assessed disaggregated by gender. The results are 24 LMAs for men and 32 LMAs for women, which means that men generally commute longer distances than women. The largest gender gap in the number of LMAs generated was found for the age group 30–59.

The topic is very relevant to Sustainable Development Goal 5 – Gender equality. The latest SDGs monitoring report shows that the indicator 'Inactive population due to caring responsibilities' is moving away from the EU target[18].

Map 28: Gender specific LMAs in Denmark



Source: The NSI of Denmark

Furthermore, Statistics Denmark is producing and maintaining education specific LMAs. The difference in number of resulting LMAs in this case is much more striking compared to the gender specific LMAs. 43 LMAs have been generated for people with short or unknown educations compared with 9 LMAs for people with an academic education. Evidently LMAs for workers with low qualifications only, compared to those for workers with high qualifications, are considerably smaller in size. The scientific literature provide evidences that the situation is similar for LMAs for higher earner commuters. Generally, commuting data tends to produce LMAs of roughly similar size (due to few people commuting very long distances). However, higher earner commuters generally commute longer distances than other commuters do.

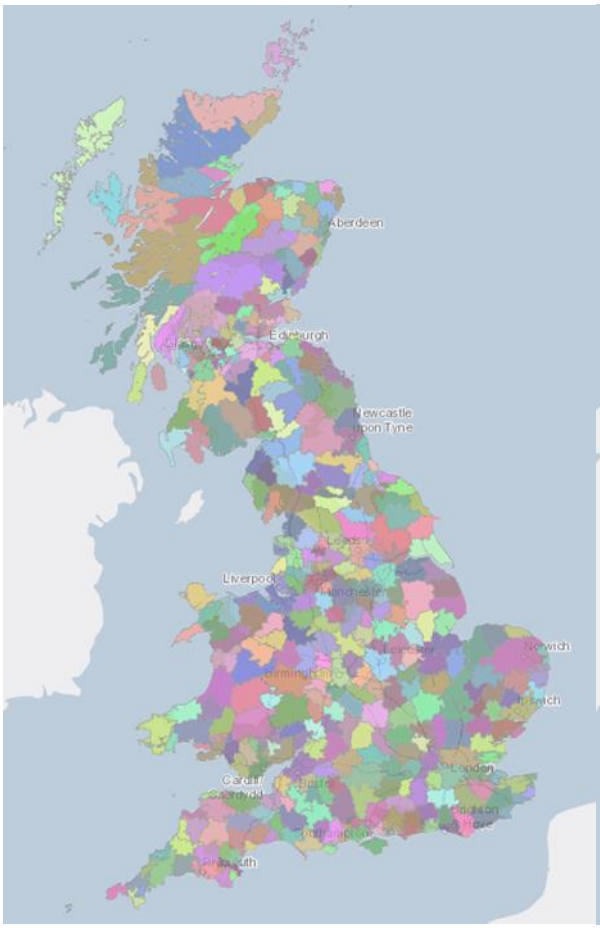
Map 29: Education specific LMAs in Denmark

Source: The NSI of Denmark

(18) https://ec.europa.eu/eurostat/cache/website/sdg/sdg_key/sdg_key_2019/index.html?lang=en

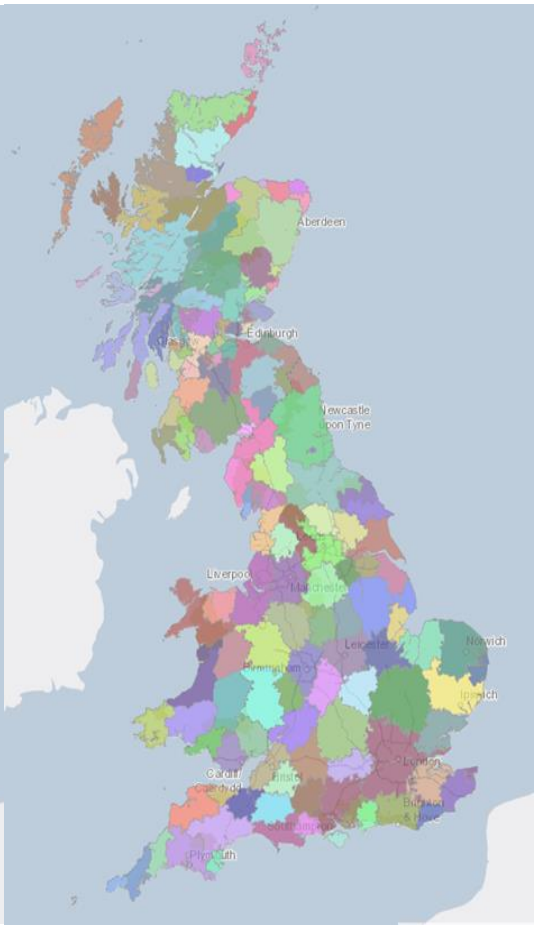
The Danish results are in conformity with those in UK as one can see from the next two maps.

Map 30: LMAs by low qualifications of the workers



Source: The ONS, UK

Map 31: LMAs by high qualifications of the workers

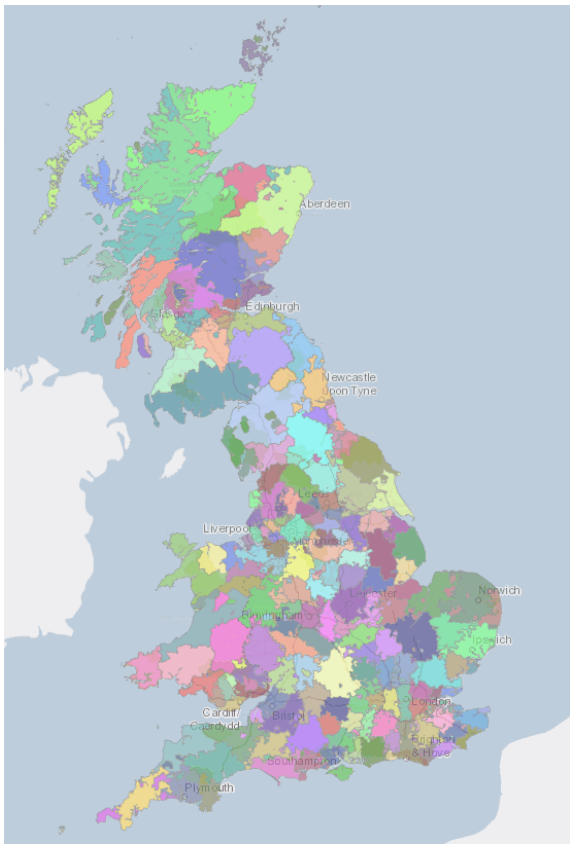


Source: The ONS, UK

The UK has also produced LMAs for people using different mode of transport for commuting. The next two examples confirm the finding of the grid study on the commuters from Sweden to Copenhagen that a greater availability of transport infrastructure results in larger LMAs.

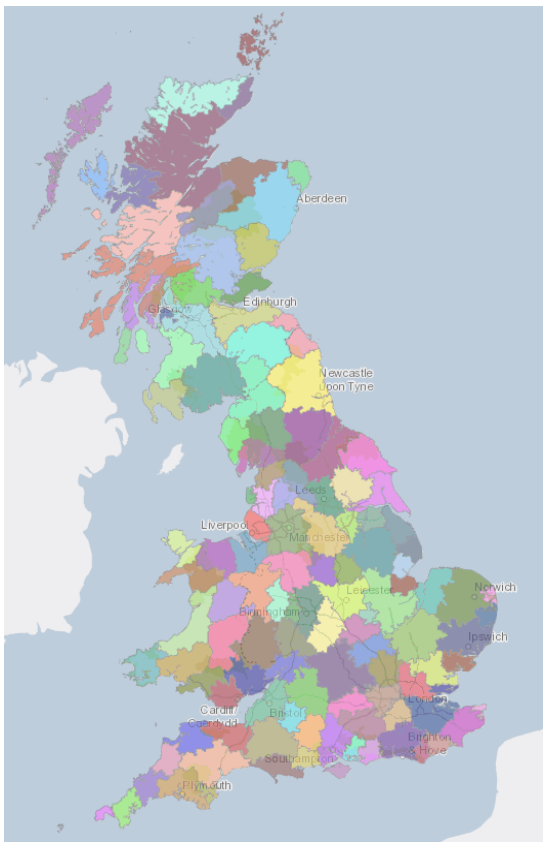
Generally, the experience of countries with long time series of LMAs, such as Denmark, Italy and the UK, shows that the number of LMAs based on the total working population decreases over time when calculated using the same parameter values.

Map 32: LMAs for commuters by bus



Source: The ONS, UK

Map 33: LMAs for commuters by car



Source: The ONS, UK

5.3 Labour Market Areas as Housing Market Areas

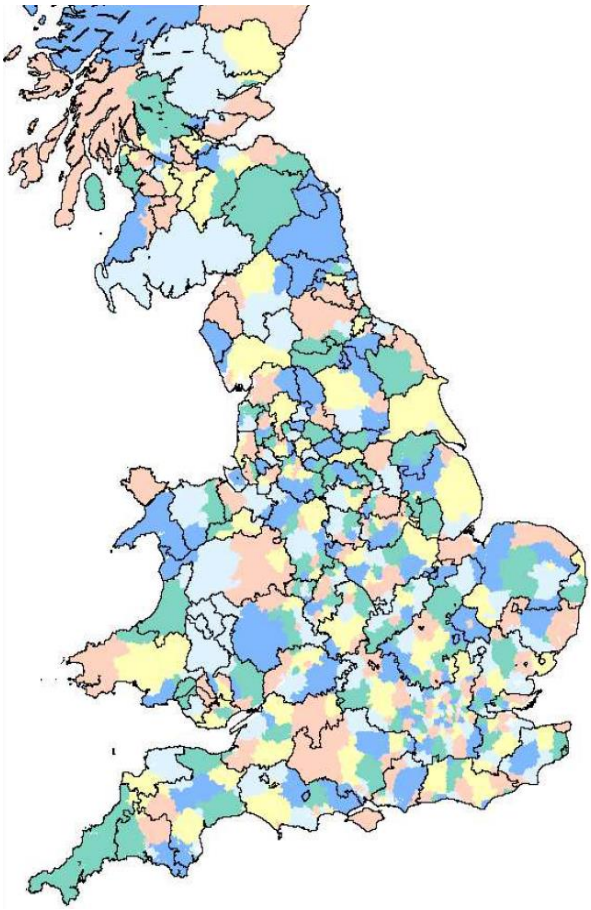
A number of studies discuss the definition of Housing Market Areas (HMAs). The aim is to define HMAs that are homogeneous in terms of housing prices. Some researchers interpret the HMAs as specific LMAs since the residential location depends on the distance that the individuals are willing to commute.

In 2007, the Spanish Institute of economic researches investigated several approaches for defining HMAs. The scope of the case study was Catalonia. The empirical results show that with a comparable number of resulting HMAs, 'commuting' HMAs were the most homogeneous in terms of housing prices.

This research theme is also pursued outside Europe. The diversity of research topics relevant to the LMAs is demonstrated in a chapter of an American book called "Smoothing the Borders of Labor Markets and Payment Areas". The authors have made a link between LMAs, Housing and Payment areas in the healthcare system, expressed in wages differentiation, in order to propose the most effective mechanism for the state to reimburse the hospitals.

Newcastle University carried out a more recent project funded by the National Housing and Planning Advisory Unit – 'Geography of Housing Market Areas in England'[19]. The researchers experimented with combining commuting data with migration data. Regarding the method experimentation for this project the choice to be made was between 1) extending the basic aggregative approach of the TTWA algorithm by first producing a lower–tier set of areas and then grouping these into a higher–tier and 2) producing the higher–tier first and then disaggregating within it to define a lower–tier. The map bellow presents the HMAs based on 66.7 % migration self–containment (the geographical scope is Great Britain).

Map 34: HMAs based on 66.7 % migration self–containment



Source: Newcastle University

It was found that Migration data produces HMAs, which can be highly variable in size (because people living in a metropolitan regions like London move between houses much further apart than do people in areas that are very rural or are specialised in traditional industries).

(19) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/6349/1775488.pdf

5.4 Usage of the LMAs' algorithm for production of other functional geographies

Evidently, the European (TTWA) method can be used not just for definition of LMAs but far beyond. For example a research paper proposed the application of the method for defining retail conurbations. All 150 stores of one retail enterprise across Newcastle, Middlesbrough and the surrounding area have been studied. Big data from the customers' loyalty cards with home addresses have been used. Two thresholds are set for defining conurbations: self–containment and internal flow size. The threshold on minimum internal flow size prevents the algorithm from creating very small regions. Self–containment is the main driving force behind the algorithm. It is determined by calculating the internal supply and demand flows. Here the size is expressed in total transactions in one year. After testing different combination of parameters 66.67 % self–containment and 500 000 internal flows (number of purchases) have been chosen. The results were 13 conurbations without gaps or overlaps.

The authors considered that the European method for delineation of LMAs gave better results than any other used before for delineation of retail conurbations, perhaps because commuting and shopping flows are inter–related.

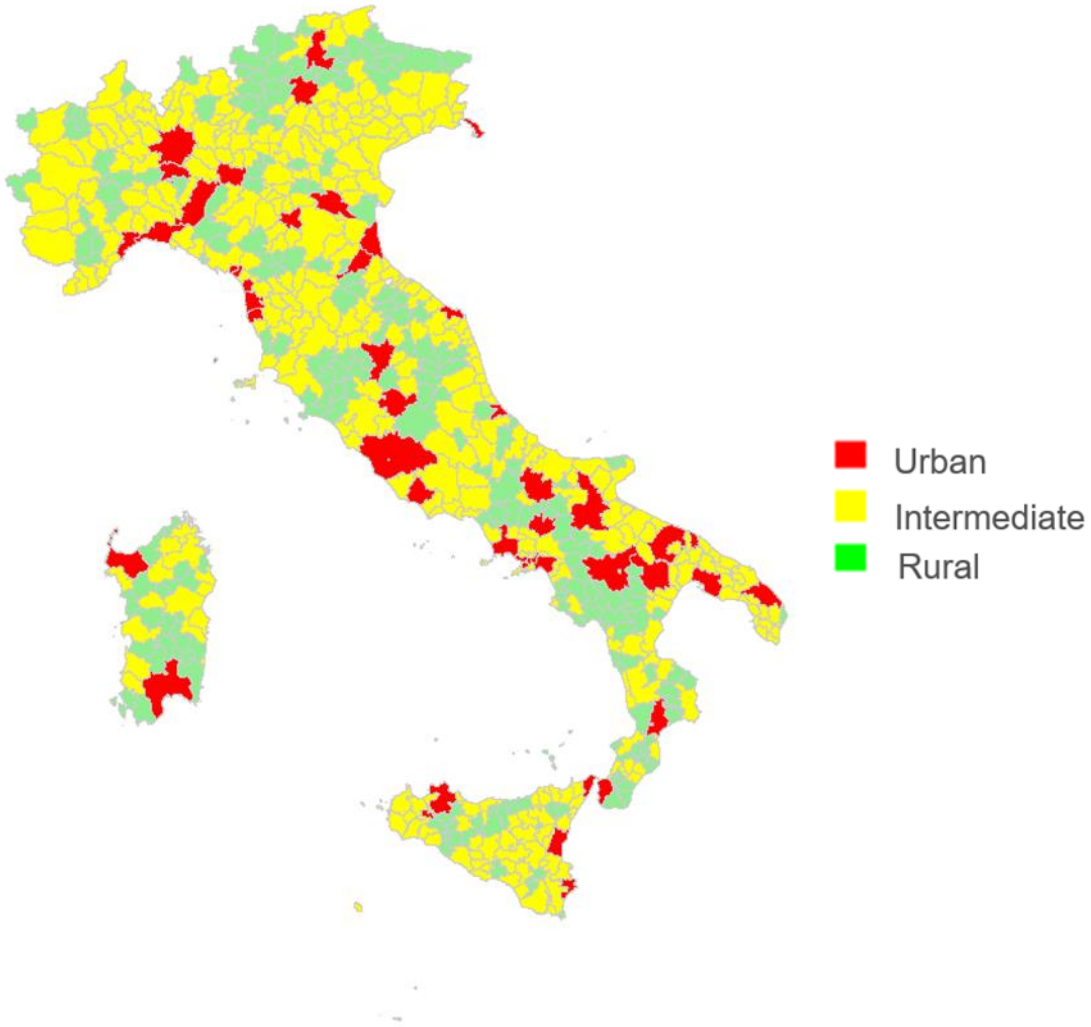
6 Territorial classifications

6.1 Link to the urban–rural typology and degree of urbanisation

Since there is a growing policy need of defining Functional Rural Areas (FRAs) to complement the definition of rural areas as defined by the Tercet, in 2018/2019 the members of the TF on LMAs at the European scale have tested several approaches of classifying the LMAs while linking them with the degree of urbanisation. The next map shows the results for Italy while using the rule for percentage of commuters going to LAU of a particular degree of urbanisation class[20].

([20]) A LMA is rural if than 50 % of commuters goes to a rural LAU. A LMA is urban if more than 50 % of commuters goes to a densely populated LAU. A LMA has an intermediate density if fewer than 50 % of commuters goes to a densely populated LAU and fewer than 50 % of commuters goes to a rural LAU.

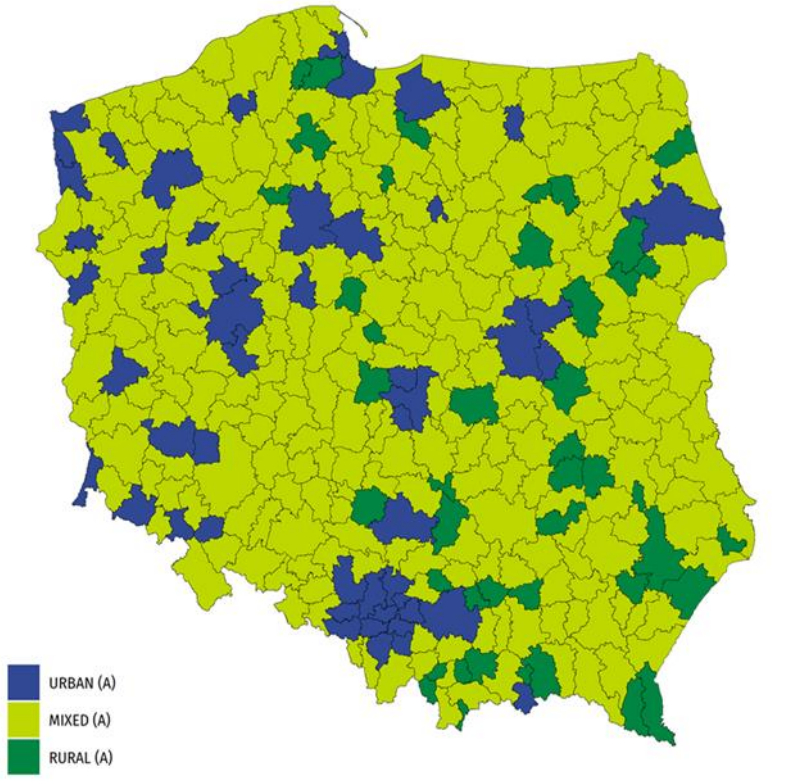
Map 35: Classification of the national LMAs of Italy according to the degree of urbanisation



Source: The NSI of Italy

Statistics Poland has further experimented with two other definitions based on the degree of urbanisation of the place of residence of the population and residents place of employment for workers. The difference in the results are highlighted in red on the second map.

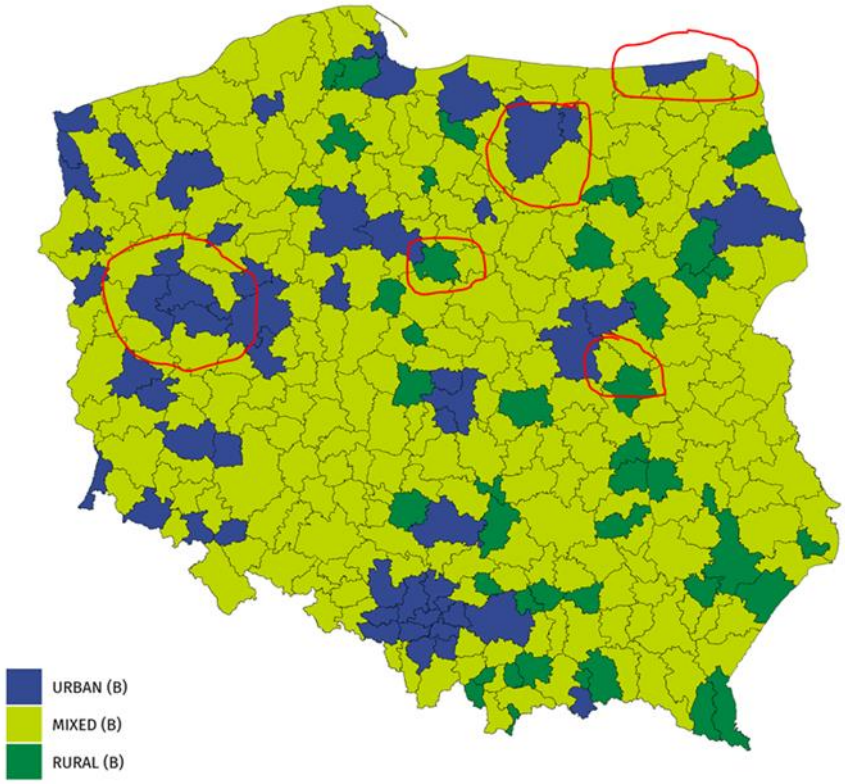
Map 36: Classification of the national LMAs in Poland based on share of people living in different degree of urbanisation classes[21]



Source: The NSI of Poland

([21]) A LMA is rural if 75 % or more of its population lives in rural LAUs, A LMA is urban if 75 % or more of its population lives in cities, A LMA is mixed if it is neither rural nor urban.

Map 37: **Classification of the national LMAs in Poland based on share of employed residents living in different degree of urbanisation classes**[22]



Source: The NSI of Poland

The LMAs experts' network concluded that linking LMAs to other territorial typologies makes sense and adds value to the concept. A subject for future work would be the extension of the analysis to remote rural LMAs and rural LMAs next to towns and suburbs that would be very much in line with the OECD classification (rural area within a FUA and rural region close to a FUA).

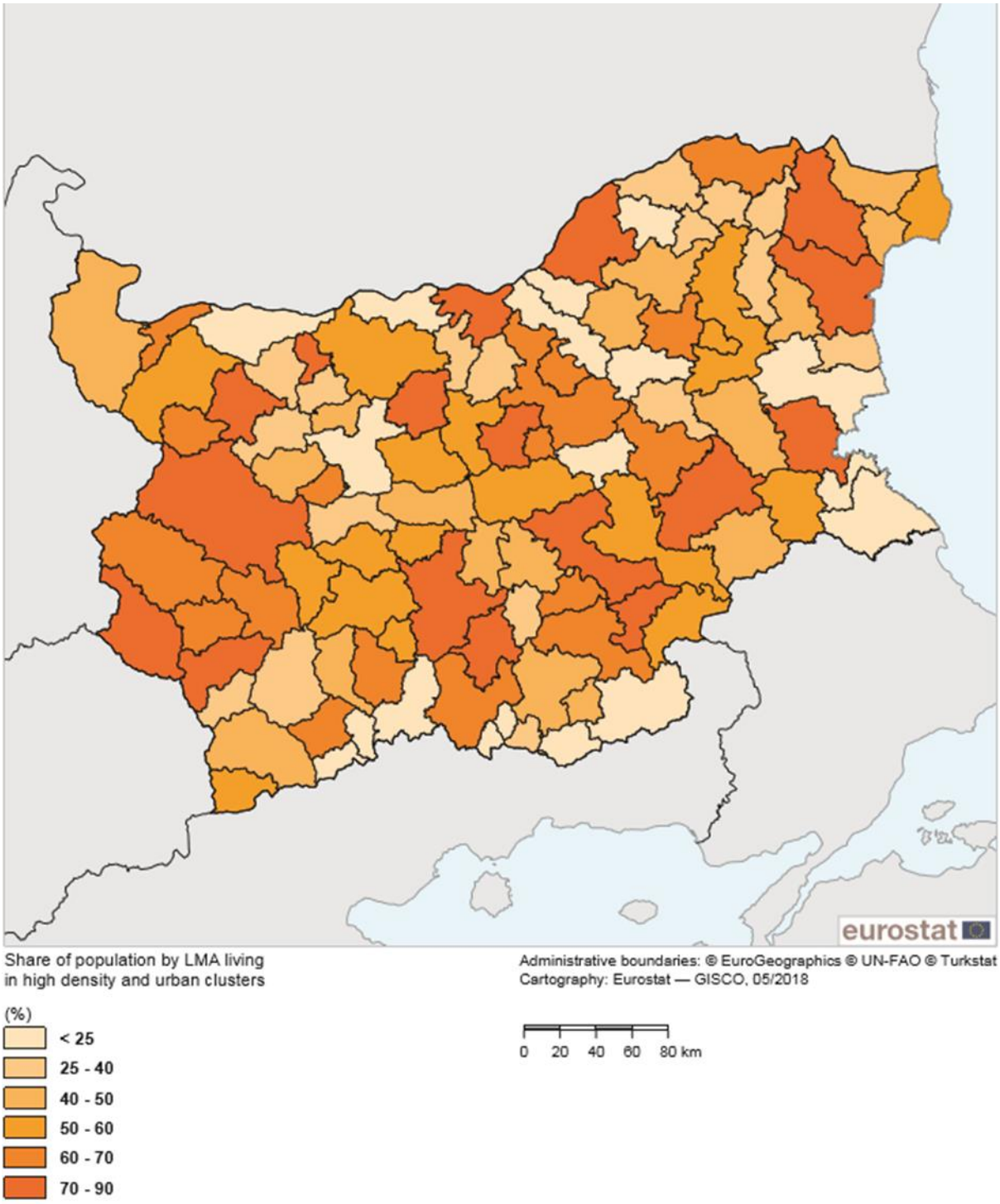
Following–up the test done by the Member States, Eurostat wanted to check whether the LMAs themselves capture the rurality. The examples of Bulgaria and Portugal have been used. Maps 38 and 39 show the share of population by individual LMA living in high density and urban clusters[23] and demonstrate how the LMAs reflect the rurality. It is interesting to see that the rural LMAs in Bulgaria are generally smaller in size while the rural LMAs in Portugal are rather bigger as a size (the LMAs with the lowest share of population living in high–density and urban clusters). Maps 40 and 41 go deeper showing the distribution of the population by different type of density cluster. Although the scale does not allow us to zoom into the maps presenting the clusters, it gives an idea of the analytical power of the grid statistics combined with functional geographies such as the LMAs. The 2011 Census population grid is available on the Eurostat's webpage[24].

(22) A LMA is rural if 75 % or more of its employed residents live in rural LAUs, A LMA is urban if 75 % or more of its employed residents live in cities, A LMA is mixed if it is neither rural nor urban. The difference between the results presented on map 36 and 37 are highlighted in red.

(23) https://ec.europa.eu/eurostat/statistics–explained/index.php?title=Territorial_typologies_manual_–_cluster_types

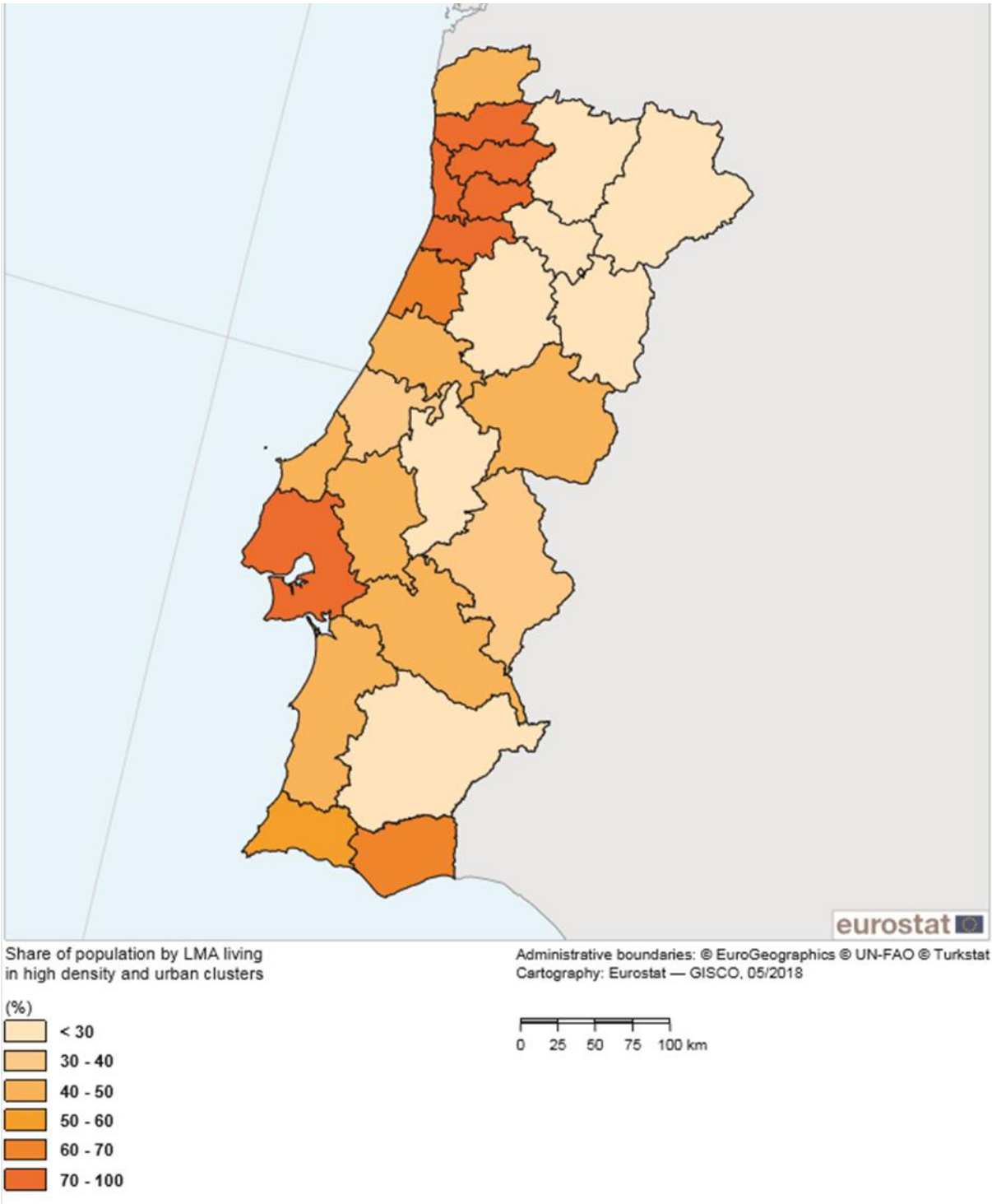
(24) http://ec.europa.eu/eurostat/web/gisco/geodata/reference–data/population–distribution–demography/geostat

Map 38: Share of population by LMA living in high density and urban clusters in Bulgaria (2011 population grid data)



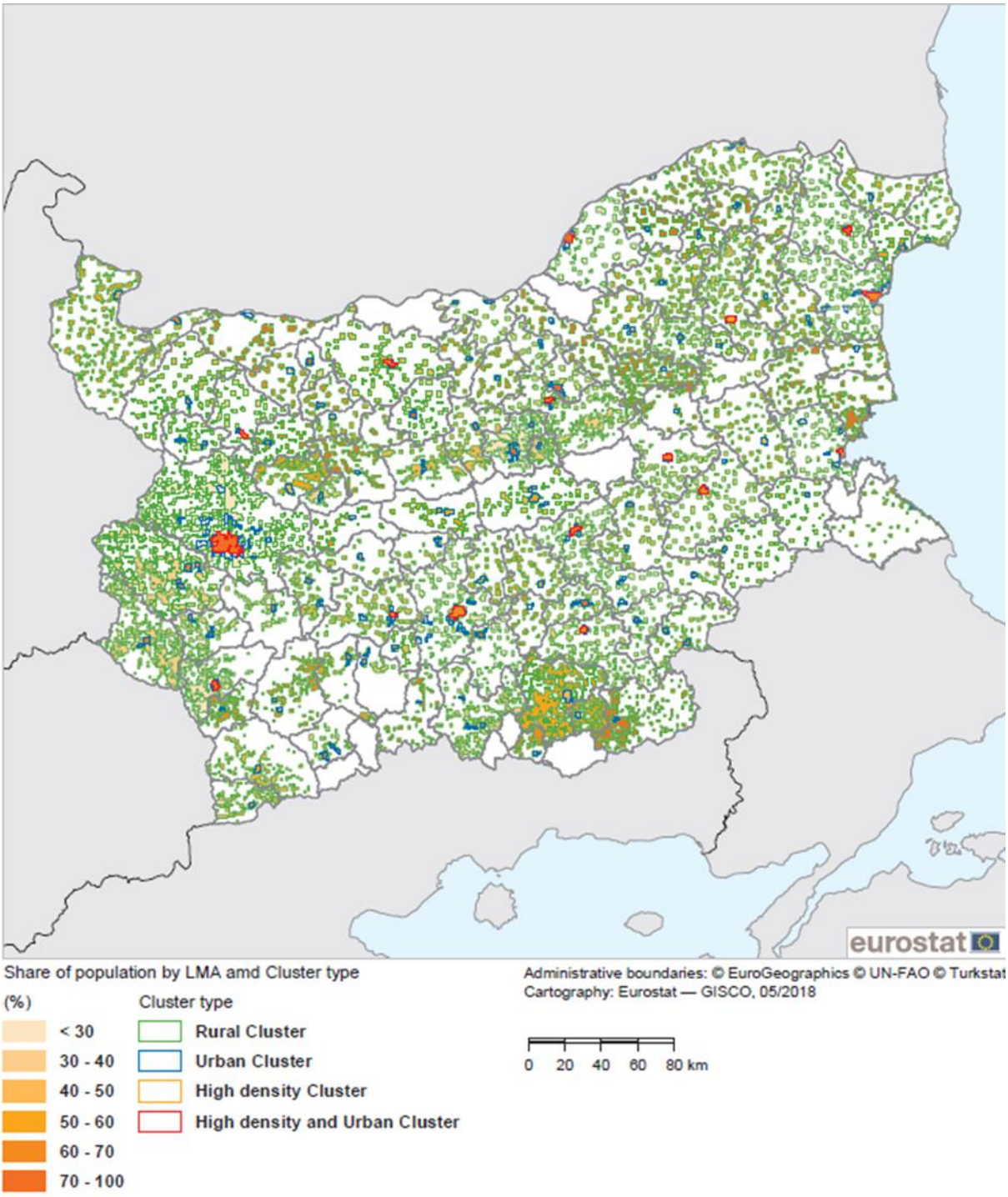
Source: The NSI of Bulgaria, complemented by Eurostat's calculations

Map 39: Share of population by LMA living in high density and urban clusters in Portugal (2011 population grid data)



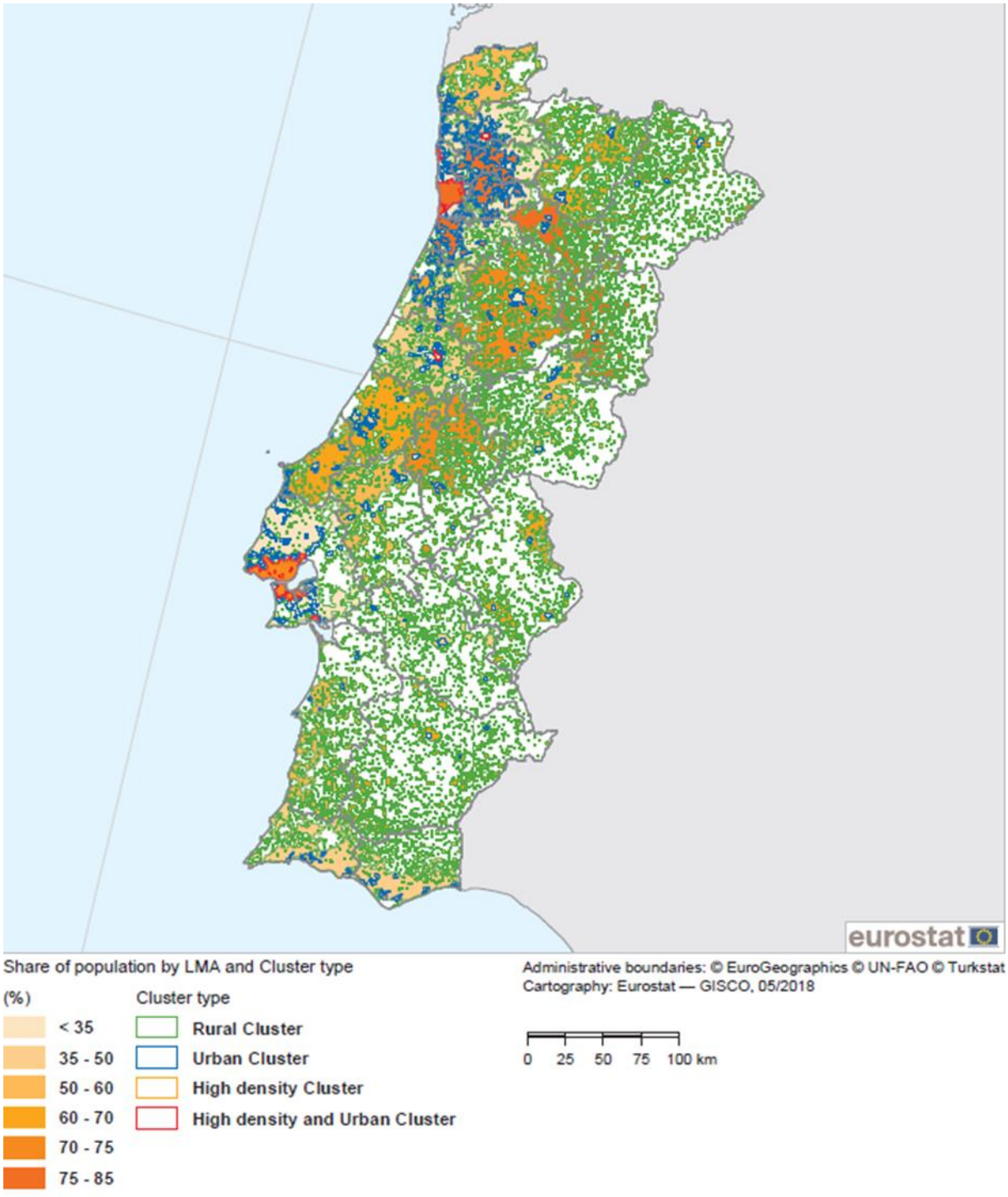
Source: The NSI of Portugal, complemented by Eurostat's calculations

Map 40: Distribution of the population by different type of density clusters in Bulgaria (2011 population grid data)



Source: The NSI of Bulgaria, complemented by Eurostat's calculations

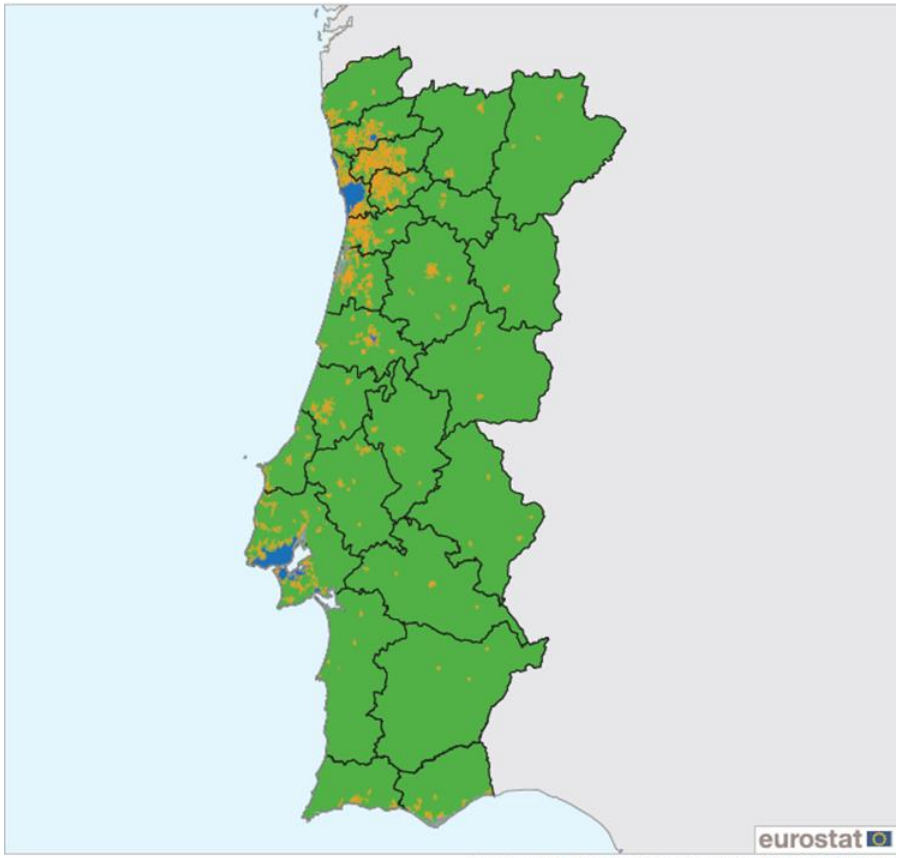
Map 41: Distribution of the population by different type of density clusters in Portugal (2011 population grid data)



Source: The NSI of Portugal, complemented by Eurostat's calculations

Another experiment done by Eurostat related to the urban–rural typology was to check whether the methodology for classification of the NUTS 3 regions as urban, rural and intermediate could be applied to the LMA geography[25]. The results of the experiment are quite promising. Maps 42 and 43 provide some background information by combining the LMAs' boundaries of Bulgaria and Portugal with the urban centres, urban clusters and the rural grid cells. Maps 44 and 45 present the classification of the LMAs according to the rules for the urban–rural typology. The Portuguese classification look very similar to the classical urban–rural typology by NUTS 3 region since the LMAs of Portugal are comparable with the NUTS level 3. Applied to the LMAs in Bulgaria, the methodology captured better the diversity of the territory compared to the classical urban–rural typology at NUTS 3[26] where most of the Bulgarian regions are classified as intermediate.

Map 42: Cluster types and LMAs in Portugal

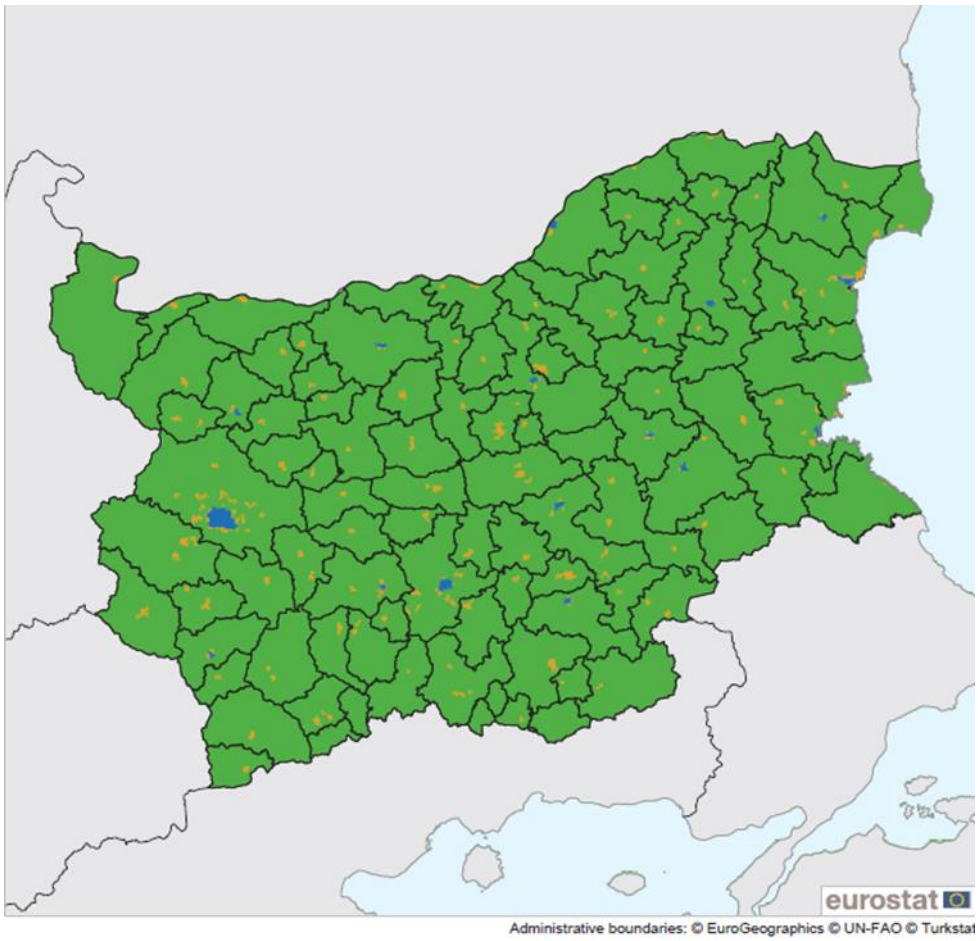


Source: For the LMAs boundaries – the NSI of Portugal

(25) https://ec.europa.eu/eurostat/statistics–explained/index.php?title=Territorial_typologies_manual_–_urban–rural_typology#Classes_for_the_typology_and_their_conditions

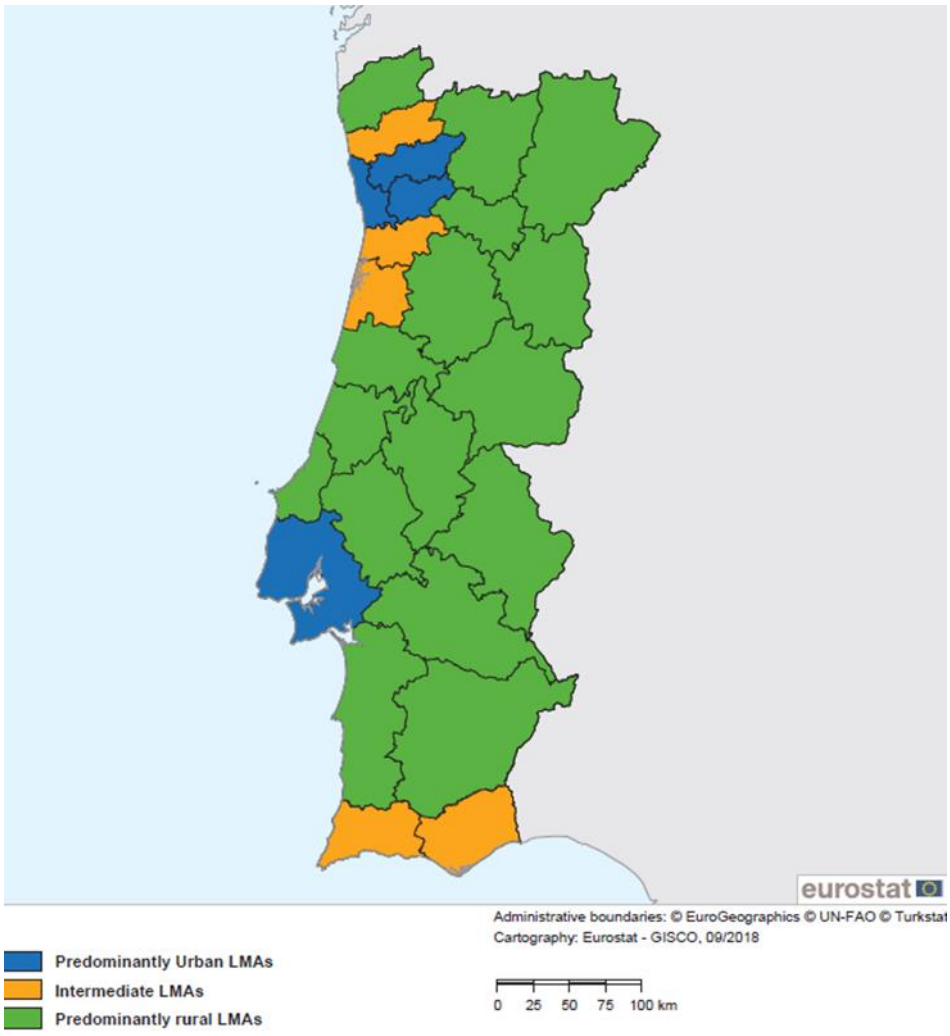
(26) https://ec.europa.eu/eurostat/cache/RCI/#?vis=urbanrural.urb_typology&lang=en

Map 43: Cluster types and LMAs in Bulgaria



Source: For the LMAs boundaries – the NSI of Bulgaria

Map 44: LMAs in Portugal classified according to the urban–rural typology

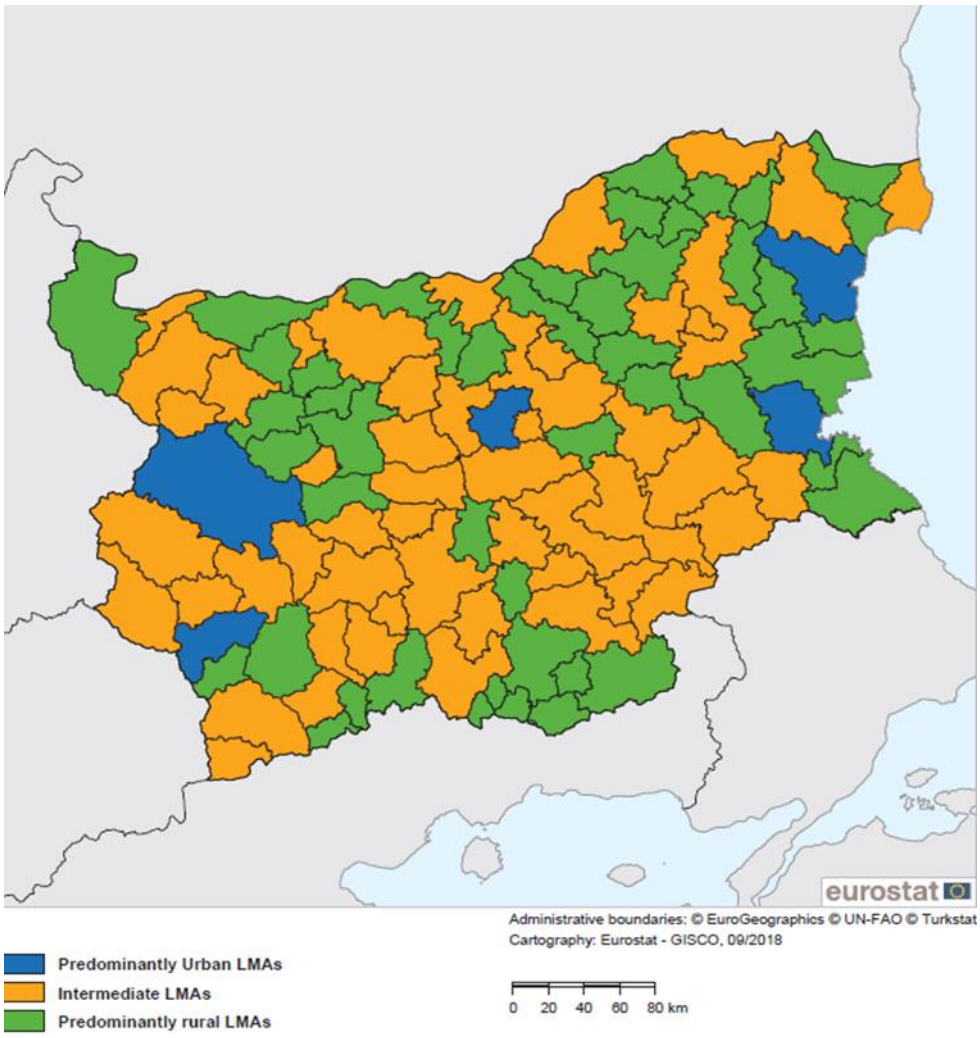


Note: based on GEOSTAT population grid from 2011, additional data from Columbia University, Center for International Earth Science Information Network - CIESIN (2015): GHS population grid, and NUTS 2016.

Source: Eurostat, JRC and European Commission, Directorate-General Regional and Urban Policy and Directorate-General Agriculture and Regional Development
Boundaries of the LMAs from National Statistical Institutes

Source: The NSI of Portugal, complemented by Eurostat's calculations

Map 45: LMAs in Bulgaria classified according to the urban–rural typology



Note: based on GEOSTAT population grid from 2011, additional data from Columbia University, Center for International Earth Science Information Network - CIESIN (2015): GHS population grid, and NUTS 2016.

Source: Eurostat, JRC and European Commission, Directorate-General Regional and Urban Policy and Directorate-General Agriculture and Regional Development
Boundaries of the LMAs from National Statistical Institutes

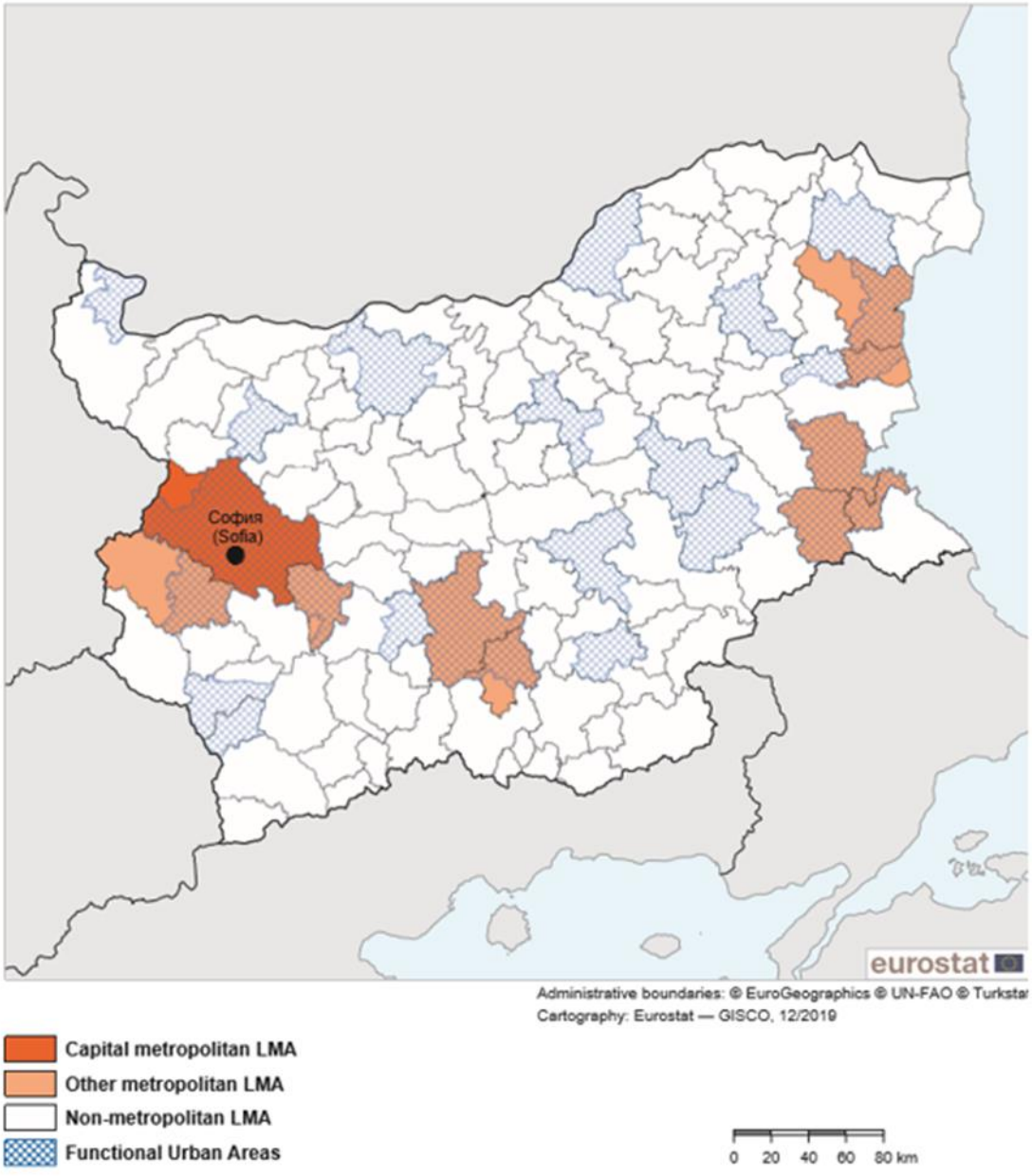
Source: The NSI of Bulgaria, complemented by Eurostat's calculations

6.2 Link to the Functional Urban Areas and the metropolitan typology

The Task Force on LMAs at the European scale discussed also another way of linking LMAs with other territorial typologies, in particular with typologies, which are legally recognised – linking LMAs with FUAs and metropolitan regions. Below are the results of the application of the rules for metropolitan typology to the LMAs in Bulgaria and Portugal as if they were NUTS regions. One could see from the maps that some LMAs have no FUA at all and in general FUAs are restricted to one

LMA (which seems logical, they are also defined based on commuter flows). Unlike in more closely urbanised regions such as northern Italy, in Bulgaria there are a few cases where two or more LMAs share a common FUA.

Map 46: The LMAs in Bulgaria classified according to the rules for metropolitan typology



Note: based on population grid from 2011 and LAU 2018.
Source: Eurostat, JRC and European Commission Directorate-General for Regional Policy
Boundaries of the LMAs from National Statistical Institutes

Source: The NSI of Bulgaria, complemented by Eurostat's calculations

Map 47: The LMAs in Portugal classified according to the rules for metropolitan typology

Note: based on population grid from 2011 and LAU 2018.
Source: Eurostat, JRC and European Commission Directorate-General for Regional Policy
Boundaries of the LMAs from National Statistical Institutes

Source: The NSI of Portugal, complemented by Eurostat's calculations

7 Conclusions and recommendations for the future

1. The importance of the functional geographies designed to complement the established system of the territorial classification of NUTS, based on the national administrative structures of Member States is undisputable. Social, economic and environmental phenomena such as employment, GDP, commuting patterns, pollution and waste generation often do not respect administrative boundaries. Hence, since they include a functional criterion such as commuting patterns, the Labour Market Areas can correct some of the potential misinterpretations of data at the administrative regional level, especially when normalised by the number of inhabitants.
2. Eurostat and the national experts recommend to maintain two hierarchical levels of Labour Market Areas; one on a larger scale, comparable with the size of the NUTS 3 regions and applicable to Europe, and a national one that better reveals the regional and local diversity within the country.
3. The cross–border Labour Market Areas are especially relevant on the European scale. The authors of this paper see the need for further development of the methodology for data imputation – applicable in all cases of incomplete matrix of the cross–border flows. Valuable tools in that regard could be the use of mobile phone data combined with administrative data sources and linking different sample surveys, for example. The mobile phone data still needs to be proven as a substitute for commuting data.
4. Labour Market Areas have the potential to play an important role in many different policy areas, for instance territorial and social cohesion in the light of the Urban Agenda, Sustainable Development Goals, and the Rural Development Policy. The particular fields of usage could include:
    - urban, housing and transport planning and modelling;
    - assessment of access to jobs and services
    - spatial monitoring of the matching of demand and supply for skills/education levels;
    - investigation of the probable need to diversify regional economic profiles;
    - observation of urban–rural partnerships and cross–border commuting.
5. Data availability is also crucial for future policy use. Data for different geographies can be made available by using Small Area Estimation techniques and aggregations of data for statistical building blocks, either at NUTS 3, LAU or at a more granular spatial level. Eurostat's guidelines on Small Area Estimations are already available for consultation. Geocoded statistics can also be aggregatable to any given level, which includes functional geographies like Labour Market Areas.
6. Linking Labour Market Areas to other territorial typologies opens other opportunities for further statistical analysis.

7. The power of geospatial information such as grid or point based data could play a significant role for the future evolution of the concept, as well as for the required data availability. The geo–coding would allow for longer time series and, as previously mentioned, for aggregated information. Although in some cases the re–weighing of the sample might still be required, together with a Small Area Estimation.
8. Further stakeholder consultations are necessary to establish existing and emerging policy needs regarding Labour Market Areas. Whilste at the national level the policy needs are, in some countries, known, in other countries these needs, as well as those at the European level, are less clear, this still needs further dialogue between Eurostat, Member States and the policy–making Directorates Generals. This is especially relevant for the future development and policy application of Labour Market Areas.

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Abbreviations

EBLUP	Empirical Best Linear Unbiased Prediction
EFTA	European Free Trade Association
FRA	Functional Rural Area
FUA	Functional Urban Area
HMA	Housing Market Area
LAU	Local Administrative Unit
LFS	Labour Force Survey
LMA	Labour Market Area
minSC	minimum self–containment
minSZ	minimum number of workers
NACE	Statistical classification of economic activities in the European Community
NRW	North Rhine–Westphalia
NSI	National Statistical Institute
NUTS	Nomenclature of territorial units for statistics
OECD	Organisation for Economic Co–operation and Development
SAE	Small Area Estimation
SBB	Statistical Building Block
SDG	Sustainable Development Goal
tarSC	target self–containment
tarSZ	target number of workers
Tercet	Territorial classifications and typologies
TF	Task Force
TTWA	Travel–To–Work–Area

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European harmonised Labour Market Areas – methodology on functional geographies with potential

The Labour Market Area (LMA) is already a well-established and widely discussed concept in regional geography and statistics.

This interesting concept, essential for the creating of typologies modelling real life situations, has been intensively studied in the Eurostat's Working Group on Regional, Urban and Rural Development Statistics, both in two dedicated Task Forces (on harmonised LMAs in 2014/2015 and on LMAs at the European scale in 2018/2019) and as a subject of EU grants in 2016/2017.

A number of workshops have been organised with the participation of National Statistical Institutes and the scientific community to discuss and solve methodological and IT issues, to develop guidelines on delineation of Labour Market Areas and to exchange knowledge.

The aim of this Statistical working paper is to demonstrate the wealth of knowledge and experience gained during the period 2014-2019 and to summarise the results of the work done on the LMAs, thus defining a basis for further statistical and methodological research and for application of the concept to national and EU territorial policies.

The paper tells the story of the evolution of the concept of LMAs during the joint work of Eurostat and the National Statistical Authorities.

The contents is focused on key LMA related topics such as legal and policy framework for LMAs, methodology, challenges, use cases, link to other territorial classifications and functional geographies.

The paper also builds up on the information on methodological activities in the field of the LMAs presented in 2018 at two international conferences co-organised by Eurostat: Quality in Official Statistics held in Krakow and the Conference of European Statistics Stakeholders held in Bamberg.

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