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Abstract:
The concept of industrial cluster has become one of the most prominent ones both in theoretical discussions, policy making and actual business. It is generally believed that under certain conditions, efficiently performing cluster through positive externalities can become an engine of regional development. Due to potential market imperfections public intervention is frequently required. The concept has gained significance in Eastern and Central European Countries including Poland. Sound cluster-based policy requires a detailed identification of dominant cluster as well as embryonic clusters.

In the past few years at the central level of Poland and at the level of some of its provinces (eg. Pomerania, Mazovia, Opole, Silesia) cluster-mapping exercises were performed as part of an effort to modify/inform regional development strategies. Apart from several domestic studies an analysis by an international team for the European Commission for the whole area of Central and Eastern Europe was carried out.

The present paper critically reviews the aforementioned studies identifying major methodological bottlenecks. It seems that more emphasis should be placed on the issue of co-location of both vertically related industrial sectors as well as horizontal agglomeration. Spatial autocorrelation should also be included. Appropriate level of sectoral as well as spatial disaggregation of data is of outmost importance.

JEL Codes: B41, C81, R12, R30

Keywords: industrial concentration, cluster, cluster-based policy, statistical cluster mapping

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Introduction

The concept of industrial cluster\(^1\) has received an incredible attention in the last 20 years. It is frequently regarded as a key factor promoting regional economic development and boosting regional competitiveness. M. Porter’s definition is frequently utilized especially among business community and policy makers. Martin et al. (2008) postulate that Porterian cluster is not very far away from agglomeration as utilized in economic literature. Industrial districts and clusters result mostly from endogenous development appearing as self-organized phenomena and are mostly bottom-up initiatives. There is however a clear path-dependency and regional embeddedness involved.\(^2\)

The high und frequently unrealistic expectation of potential gains through the external effects associated with the daily functioning of industrial cluster in terms of higher revenues, greater innovative potential, higher productivity led to emergence and implementation of cluster-based policies. With time CBP became an important element of policy making both at regional and national levels in many areas of the world. Surprisingly, there is, however, very little actual evidence of the supposed virtues of industrial clustering both for participating firms as well as regions of their location in particular for CEE countries\(^3\). Should therefore welfare-maximizing government intervene in the market in order to boost the development of clusters?

The Porterian definition of cluster can be however judged as rather imprecise and vague. Martin and Sunley (2005) in there sharp critique call it even a very chaotic

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1 M. Porter defines regional clusters as: Geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example universities, standards agencies, and trade associations) in particular fields that compete but also co-operate.” (Porter 1998, p. 19). There is a variety of cluster-related concepts in the literature of the subject which are frequently utilized interchangeably for instance industrial district (Becantini 1991).

2 For instance Paul Krugman in his Nobel Prize lecture noted that industrial centers in the US developed once industrialization commenced in places with significant tradition in manufacturing industries.

3 Martin et al. (2008) find for French data that doubling the size of a cluster as measured by employment results in a very modest increase in productivity of 4 per cent for an average cluster firm. The relationship between cluster size and associated benefits is of an inverted U-shape – the benefits start to decrease as congestion cost set in. Furthermore, the modest benefits present are to a large extent internalized by firms but not perfectly internalized thus some kind of positive externality exists. Szultka et al. (2004) provide some partial evidence of the associated benefits in the case of Polish clusters.
concept. What features of the concept are key and thus could direct the identification of clusters? To us these include:

- regional concentration of vertically/horizontally linked sectors
- critical mass of market and non-market institutions (thick market)
- dense network of formal and informal relations between market agents
- co-opetition (cooperative behavior) – fierce competition with simultaneous cooperation in some fields
- detectable benefits for the participants of a cluster and for the regional economy (positive externalities).

One has to be very cautious though because it is extremely difficult not to choose arbitrary cut-off points or threshold levels. Fundamental issues still seem not to be unresolved. These include: regional concentration and proximity (clusters can vary considerably in their spatial dimension which makes there geographical delimitation notoriously difficult), the exact size of the minimum critical mass of a cluster for location-specific externalities to arise, the minimum density of linkages which allows for emergence of network externalities, etc. A dense network of horizontal and vertical linkages among firms is a key features of the cluster concept. Statistical cluster mapping exercise, however, cannot account for them. An assumption that density of linkages is a function of the number of proximate firms and institution within a location sounds rational but is clearly not enough.

An important step in formation of coherent cluster-based policy are results of comprehensive cluster-mapping study. Statistical cluster mapping is a relatively new empirical approach used to identify clusters. Cluster mapping studies lack however precise theoretical underpinnings for instance they do not take into account the existence of pecuniary externalities. Mapping involves both defining sectoral dimensions of potential clusters (taking into account the potential vertical and horizontal linkages among cluster’s sectors) as well as detecting there actual location and existence in space (literally mapping the clusters).

4 Porter himself is not very precise: “the relevant geographic unit for a cluster varies by cluster and region”.
5 Not mentioning the impossibility of taking into-account other region-specific features such as institutional set up or quality.
6 Pecuniary externalities related to market interactions among agents (Fujita, Thisse 2002).
Purely statistical identification of clusters could of course be considered as significantly biased. We have to stress here that the approach has its limits mostly due to data limitations. The data are mostly restricted to employment, production and/or value added and are often provided at too spatially aggregated levels. It is especially the case if the study spans several countries due to differences in the statistical systems of countries.\(^7\)

Ketels and Sölvell (2006) rightly point out two other major limitations:

- Cluster definitions miss region-specific nature of clusters\(^8\)
- Relying on employment data (the preferred choice in the empirical literature) leads to bias towards labor-intensive industries.

Statistical cluster mapping has some strong opponents. For instance, Martin and Sunley (2005) refer to them as “statistical acrobatics” which is either based on complex or highly arbitrary assumptions. They also suggest that these studies can only suggest the existence and location of ‘possible clusters’\(^9\). On the other hand statistical mapping of clusters differs to other utilized approaches in that it is not biased by arbitrary selection or definition of clusters biasing numerous existing individual cluster case-studies.

We strongly agree with this criticism and thus suggest that quantitative cluster mapping should be first acknowledged by authors of such studies and than, in order to at least partially eliminate its shortcomings, it should be followed by extensive qualitative analysis leading to identification of ‘true’ clusters.

There were numerous top-down statistical cluster mapping studies performed at national and regional level in many OECD countries around the turn of the century (eg. US – Porter 2003, UK - DTI 2001, Sweden – Lindqvist et al. 2002, France – Pommier 2001).

The concept of cluster and CBP was also adopted, however, relatively later, by transition economies of the Central and Eastern Europe. Since adoption similarly to

\(^7\) The panel of data utilized is thus frequently unbalanced. Comparability of the results between countries can be obviously questioned.

\(^8\) There exists a line of thought in the literature pointing to the uniqueness of each identified regional cluster.

\(^9\) Surprisingly enough within the same paper Martin and Sunley (2005) criticize the use of the term ‘potential cluster’.
other OECD states it gained a lot of attention and became an important element of economic policy. Poland adopted and implemented cluster-based policy both at national (support schemes for interregional clusters) and regional level. In order to inform the policy-makers several nation-wide cluster studies were carried out in Poland. In addition regional and municipality level studies were performed. Yet as different studies adopted different methodological approaches there results cannot be directly compared. Apart from cluster mapping exercises also numerous less elaborated cluster case-studies were executed. These ad hoc bottom-up approaches usually more informative and in-depth are frequently highly arbitrary and cannot be compared with other studies. Their major weakness is the use of highly subjective methodologies in particular in the area of cluster definition and identification.

For CBP to be effective it must provide public subsidies either for increasing the size of existing clusters or for improving the different externalities associated with agglomerations. Generally speaking market imperfection of some kind must exist and the benefits of public intervention should outweigh the potential costs (including potential government and systemic failure).

The CB policy itself potentially can and will be misguided if a clear and precise definition of cluster is not adopted from the very beginning. The lack of it will be automatically utilized by rent seekers. Furthermore, it seems that conditions to receive public support must be restrictive from the very beginning. Public support should be limited and only temporary with the phasing-out scheme present from the very beginning.

OECD points out that cluster-mapping is a strategically important step in the formation of and implementation of coherent and effective CBP. For these reasons correct identification of clusters carried out within formalized cluster mapping is quickly becoming a priority for Polish economic policy. Lack of clear and precise definition of cluster itself plus a very arbitrary criteria for the so-called cluster initiatives within policy areas have already led to the abuse of the policy and will result in subsequent misallocation of funds.

In order to clear up the existing confusion Poland requires an extensive research project which would compare different analytical approaches and identify an optimal one fitting nation-specific features. The project should also empirically identify the
internal and external consequences (both benefits and costs) of clusters. Policy recommendations should follow\textsuperscript{10}.

The present paper gives a critical overview of two selected nation-wide cluster mapping studies for Poland. The first one was performed by GIME (Gdansk Institute for Market Economics) within its cluster mapping project CMP (Szultka et al. 2004, OECD 2005). The second one authored by Ketels and Sölvell (2006) is a result of a larger international study financed by the European Commission within the scheme of the so-called EU Cluster Observatory.

The reminder of the paper is structured as follows. Section 2 discusses the results of two aforementioned statistical mapping studies and gives their critical analysis. Section 3 some introductory analysis of most recent available data set in order to better illustrates questions raised in the second section. The final section concludes.

2 Critical review of selected cluster mapping studies

In 2002 DTI (2002) performed a nation-wide study aimed at identification of regional clusters in the UK. The analysis encompassed all sectors of economic activity and was firm-based on data up to 1999 (data on type of activity, employment levels and location). It was mainly quantitative study with the focus on systematic statistical analysis of relative localization. Location quotient (LQ) for employment levels measuring relative concentration of a given industry or sector in a region or area was the utilized measure. Martin and Sunley (2005) point out, however, that the use of relative measure of spatial concentration for employment (which is typically utilized) could be significantly biased. The total number of enterprises as well are there distribution by employment size should also be taken into account.

The methodology of DTI involved several distinctive steps including: identification of regional high points\textsuperscript{11} at a fine level of disaggregation (5-digit), grouping the high points into the basis of clusters, examining the remaining industries, classifying identified regional cluster along several dimensions (stage of development, depth, depth, depth, depth).

\textsuperscript{10} The present research project 1649/B/H03/2010/38 granted by the Ministry of Science and Higher Education of the Republic of Poland aimed exactly at that.

\textsuperscript{11} High points were defined as industries which accounted for at least 0.2 per cent of the regional workforce and which were at least 25 per cent more concentrated than the average (LQ>1.25).
significance, employment dynamics, nature of cluster links) and testing the result in qualitative manner (interviews with regional and local authorities).

Interestingly enough, DTI (2002) postulates that it’s impossible to devise a hard-and-fast, definitive typology of clusters, a priori. Indeed, it can be argued that any attempt to construct a cluster typology should emerge from, rather than be imposed on, empirical investigation. Adopting a precise definition of a cluster a priori could be thus misleading or could misguide the analysis.

**Cluster Mapping Project (GIME\(^{12}\))**

Polish Cluster Mapping Project (CMP) consisted of both quantitative as well as qualitative analysis\(^{13}\). In its quantitative part it was to a large extent based on the methodology developed by DTI (2002). The analysis was performed on the basis of a detailed data set for employment at the level of 3-digit NACE groups in its sectoral dimension and the level of powiats or local administrative districts (LAD4) in its spatial dimension. The panel of data was static (there was no temporal dimension – all data for 2001).

Identification of clusters in GIME’s study had several steps. In the first stage, significant concentrations in terms of employment at the level of powiats or local administrative districts (LAD4) were identified. Clusters were defined as bundles of vertically and horizontally linked 3-digit NACE sectors. In bundling both co-location of activity as well as analysis of linkages in I-O tables were utilized. Around 20 broadly defined clusters were identified in this way. The potential overlay of cluster definitions was purposefully minimized. Significant concentrations were identified with the use of location quotient for employment. The a priori chosen threshold for LQ index was set to 1.25 (concentration of employment 25 per cent or higher above the national average). The choice of the threshold for LQ similarly to the British study was very arbitrary.

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\(^{12}\) GIME is one of the most renowned independent economic policy think-tanks in Poland established in 1989. It played a significant role in the introduction of the cluster concept and in the formation of current cluster-based policy.

\(^{13}\) The methodology as well as results of the study are extensively described in a report by Szultka et al. (2004). The analysis of results of the surveys carried out in the qualitative stage were published in OECD (2005).
Secondly economic areas with the highest probability of cluster existence were identified. Two factors were taken into account – the magnitude of concentration index in key sectors of a given cluster and the cluster depth – significant concentration in most or in all of a given cluster’s branches. The results were presented on stylized maps.

In the next stage, after a careful analysis, a number of locations were selected having the highest probability of cluster existence in 9 both traditional and non-traditional core branches. Qualitative analysis followed with comprehensive surveys performed among randomly selected “potential cluster” agents in order to identify characteristic features of clusters (density and extent of linkages among enterprises and with the R&D sector, innovativeness, efficiency, regional embeddedness, internationalization, institutionalization, existence of the so-called cluster initiatives, workers mobility, etc.)\(^\text{14}\). The analysis took into account extensive knowledge of regional features as well. Statistical analysis of the obtained results was performed.

The results indicated that location within a localized cluster-like economic system is performance–enhancing, enhances competitive potential of enterprises and thus could stimulate economic development (Szultka et al. 2004, OECD 2005).

Taking into account specific national features cluster identification methodology as proposed by GIME has its both pros and cons. The positive features of the study are the following:

- analysis of co-location patterns as well as I-O linkages for transition economy
- analysis performed at spatially disaggregated level => interregional clusters detected
- quantitative analysis followed by qualitative analysis

The negative aspects on the other hand include:

- Relatively broad definition of clusters
- No account of spatial autocorrelation was taken into account at the initial stage of the analysis\(^\text{15}\)

\(^{14}\) Altogether 283 surveys were performed among randomly selected enterprises within 18 significant concentrations - potential clusters.

\(^{15}\) E.g. Brodzicki and Ciolek (2008) identified in their spatial econometric study statistically significant spatial autocorrelation for Polish manufacturing industry at the level of NUTS2 regions.
The problem of spurious correlation was not taken into account to a full extent.

- Geographical dimension of clusters not clearly defined
- Threshold for LQ arbitrarily and a priori chosen at the level of 1.25
- Number of surveys performed per potential cluster relatively low (statistical significance of results)
- No account taken of the number and size of enterprises within significant concentrations

**Ketels and Sölvell (2006)**

Ketels and Sölvell\(^{16}\) performed a statistical cluster mapping exercise at a regional level across 10 new MS of the EU within a structure of the project carried out for the European Commission. They operationalize definition of a cluster as: a presence of a given cluster category within a specific region. They adopt and adjust the Porterian definition of cluster categories\(^{17}\).

In his seminal study M. Porter (2003) analyzed geographic distribution of economic activity by detailed industry across the 50 states of the United States leading to cluster definitions. He identified three different types of industries: industries more or less evenly spread around which is indicative of serving local markets (local industries), spatially concentrated industries which is mainly due to second nature features (traded cluster-industries) and first nature dependant natural-based industries which location is related to exogenous location of natural deposits and resources. In Porter (2003) a single industry can belong to numerous clusters. The total employment in all indentified clusters thus exceeds total national employment. Altogether Porter (2003) identified 41 traded clusters in the US economy with an average of 29 industries in each cluster.

Ketels and Sölvell (2006) insist that US provides a case of a vast integrated market were relatively unrestrained location choices have been made for a considerable period of time and thus it constitutes a superior example to the case of only recently integrated and still hampered by barriers internal market of the EU. They consider


\(^{17}\) They define cluster categories as *lists of specific industries (cluster sectors) that tend to co-locate.*
cluster definitions based on locational patterns in the US to better reflect the true underlying forces of linkages between industries. There explanation is reasonable and very suggestive however is it really appropriate for less developed economies?. Their one-sided adoption of US based definitions in fact assumes technological homogeneity across the world and complete lack of first and second nature differences among regions. If the same definitions are applied to advanced economies of the EU it will not constitute a major problem. However when applied to transition economies of Central and Eastern Europe a potential bias could arise. Formation of a cluster is a result of dominance of centripetal over centrifugal forces at sectoral and intersectoral level which could be traced back to existence of technological (non-market) and pecuniary (market – based) externalities. Transition economies despite of the evident catching-up are still far away from the US-dominated global technological frontier (technological backwardness) and their market characteristics are far away from advanced countries (for instance in terms of number of firms, product differentiation, strategic interrelations, market power, type and fierceness of competition, distortions due to week institutions, the share of SOEs in different sectors). The development of clusters in CEE is hampered to a large extent by soft barriers such as depletion of social capital in the communist area (lack of mutual trust for instance) – specific institutional features are still pronounced.

This approach could be treated as correct as long as we assume that technology diffusion is perfect and thus is spatially homogenous. In reality Poland and other CEECs are still far way form global technological frontier despite of the clear convergence process that has progressed significantly since transition. Porterian definitions can off course be utilized but should stand against the evidence on the ground in a transition economy.

The team of the EU Cluster Observatory (Lindqvist, Malmberg and Sölvell 2002) adopted Porter’s cluster definitions (cluster categories) but had to implement certain modifications. The US industrial classification systems SIC had to be translated (with significant problems) to the European NACE classification, a definition of a region
had to be chosen (NUTS-2) and significantly disaggregated employment data had to be collected (NACE 4-digit level)\textsuperscript{18}.

The part of the study for Poland was carried out on data on employment at the level of 4-digit NACE groups at the level of NUTS2 regions\textsuperscript{19}. One could thus question the results on the basis of not enough spatial disaggregation. Similarly to GIME the panel of data was static – data for 2001 were utilized. A major impediment to thorough cluster analysis in Poland is that the more disaggregated the data the more values are withheld due to confidentiality (having a balanced data set with no missing observations gives a natural advantage).

The identified clusters were further classified and ranked in terms of their size (absolute level of employment of 15 000 employees in a region), specialization (specialization quotient of 1.75\textsuperscript{20}) and dominance (the share in regional employment exceeding 7 per cent). The thresholds for three aforementioned indices reflected the top 10-percentile of their respective distributions. This can also be questioned on methodological grounds but at least some justification is present. Identified clusters were given a star if they fulfilled the abovementioned criteria – one per each of the criterions and than ranked accordingly (3-star rating scheme). According to authors, only cluster breaking a certain critical mass threshold will be able to attain a minimum intensity of linkages allowing for strong external effects and beneficial spillovers.

The results were also cross-checked against the data on national level: cluster-specific export performance and microeconomic business competitiveness as well as in discussions with representatives of national and regional authorities.

Generally speaking the results of the study are rather disappointing and not very informative. A generally common knowledge was proven. This could be mostly attributed to the choice of the level of spatial aggregation.

\textsuperscript{18} European Cluster Observatory had to overcome significant problems in order to collect and analyze data on comparative basis across all European states. For instance data splitting algorithms had to be utilized

\textsuperscript{19} The data for Poland were made available by the Central Statistical Office of Poland (GUS) based on Z6 form.

\textsuperscript{20} Authors utilize the concept of specialization quotient which in fact is a modified LQ with an assumption of a different benchmark.
Summing up we can show both positive and negative sides to the study by Ketels and Sölvell (2005). The negative sides include:

- High level of spatial aggregation of data
- No account of spatial autocorrelation
- No account of number and size of enterprises within agglomerations taken into account
- Geographical dimension of cluster – no case for interregional clusters
- Weak qualitative analysis of cluster – weak conformation

The positive features of the Ketels and Sölvell’s study are the following:

- The same methodology applied to 10 MS – comparability across regions in different countries of the EU
- Relatively fine definition of clusters – Porter’s definition adopted (negative aspects of this decision were made obvious above)

3 Some initial empirical analysis

We will now perform some initial analysis of newly acquired data set obtained from GUS in order to illustrate some points raised in the previous section. The data set available to us contains information on employment, number of enterprises as well as distribution of enterprises between size groups at the 3-digit NACE sectors (222 sectors) and LAD4 regions (370 powiats) for 2006.

We will start with an analysis of overall agglomeration patterns of manufacturing industry sectors similarly to the Swedish mapping project. We utilize their agglomeration index $A_{kb}$ which takes values from 0 to 1$^{21}$. In accordance with our expectations agglomeration index varies significantly among the analyzed sectors.

The most spatially agglomerated manufacturing industry sectors are manufacture of television and radio receivers (NACE 323), manufacture of ceramic tiles and flags (NACE 263) and building and repairing of ships and boats (NACE 351). The most

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$^{21}$ It takes the following form $A_{kb} = \frac{1}{2} \sum_{b=1}^{R} \frac{a_{b,r}}{A_b} - \frac{T_r}{T}$, where $R$ - no of regions, $a_{b,r}$ - Total employment in sector $b$ in region $r$, $A_b$ - total employment in sector $b$ in the whole country, $T_r$ - total employment in region $r$, $T$ - total employment in the whole country.
spatially dispersed sectors include manufacture of other food products (NACE 158) and printing and service activities related to printing (NACE 222). Heterogeneity of agglomeration patterns must be clearly taken into account.

Following the DTI methodology we calculate a simple measure of relative spatial concentration – the LQ index for 3-digit NACE groups at LAD4 and NUTS2 regions\(^\text{22}\). The maps in the appendix present the location of NACE 323 manufacturing of television and radio receivers at two different spatial aggregation levels. It is quite clear that the analysis performed at the NUTS2 level significantly biases the results. The bias will be the higher the more spatially agglomerated is a given sector.

The second point we would like to rise is the choice of cut-off points in the process of identification of the so-called “high points” or significant concentrations (identification algorithm). Figures 1 and 2 in the appendix show the number of significant concentrations (n) depending on the level of alpha (LQ quotient) and gamma (share in regional employment) for 3-digit sectors at NUTS-2 and LAD 4 level. The first thing we would like to note that for alpha equal to 1 and gamma equal to 0 (the criterion is thus excluded) the number of significant concentration at LAD4 level is 15 times higher that at the NUTS2 level. The number of significant concentrations is very sensitive to the cut-off value of both applied criteria. Looking at the figures we can note that the cut-off values for identification of high points should not be arbitrarily chosen a priori but should stem out form a thorough analysis of the available data set.

4 Conclusions

It seems that the overall methodology of cluster mapping has to be adjusted in order to fit the nation-specific elements (data availability, differences in definitions etc.). General methodology must be optimized to suite specific circumstance.

Clear and precise definition of cluster should be adopted first but than scrutinized. In defining clusters one should acknowledge the level of technological advancement of a given economy – the scope, the type and extent of linkages could be different for an integrated economy close to world technological frontier and relatively backward small economy in transition. This necessitates comparison of frequently adopted

\(^\text{22}\) We aggregated LAD4 data upwards to LAD4 level.
definitions of cluster categories of Porter (2003) with the national features. At least both should be crosschecked.

The analysis should be carried out at the finest possible level of sectoral and spatial disaggregation – data allowing. Access to adequate data set is of course a typical bottleneck necessitating compromises to be made – a fact that we acknowledge.

It seems that for Poland a minimum are 3-digit NACE sectors analyzed at the level of LAD 4 or powiats. NUTS2 voivodeships are simply too large. Furthermore, at this level potential spatial autocorrelation must be taken into account (should be identified in the data at the beginning).

In identification of local high points (above average concentrations) methods typical for market potential literature should be utilized. We should take into account the influence of bordering or proximate concentrations. These could be utilized with the implementation of first neighborhood matrices.

The data analyzed should not be limited to employment data only. A minimum requirement is the information on the number of firms by sector type and their distribution by size of employment within a given sector.

In economy in transition replicating the analysis at different data point seems necessary. In the two described studies their authors utilized data for 2001 – a very specific date for Poland – the year of significant downturn with sharp increase in unemployment levels and significant asymmetric effects across regions and sectors. Furthermore, economic transition progresses fast. The impact of entry into the EU cannot be considered trivial as well especially in the mid to long run. Thus latest available data year should be utilized – data allowing.

Cluster cross administrative borders which can be considered a major challenge when applied to regional economic policy decisions but also to cluster mapping studies. Regional focus of a cluster cannot be assumed a priori. Interregional cluster do exists.

The proper cluster mapping study should consist of two important stages – elaborated quantitative analysis of available data sets leading to identification of significant agglomerations of mutually linked industries followed by a qualitative analysis of intensity and extent of actual linkages within these agglomerations.
Last but not least, Martin and Sunley (2003) in their famous critique postulate a high degree of caution in particular in the application of the cluster-based policy. The lack of a feasible method of empirically identifying and analyzing clusters can be seen from that perspective as a major impediment to implementation of rational policy.
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Figure 1 Number of significant concentrations ($n$) depending on the level of alpha* and gamma for 3-digit sectors at NUTS-2 level

Figure 2 Number of significant concentrations ($n$) depending on the level of alpha* and gamma for 3-digit sectors at LAD4 level
Map 1 Location of NACE 323 in 2006 as shown by LQ index at NUTS2 and LAD4 level