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Spatial agglomerations in the Polish automotive industry

Skupienia przemysłu motoryzacyjnego w Polsce

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Abstract. The authors attempt to shed light on the emergence of spatial agglomerations and clusters in the relatively short history of the Polish post-communist automotive sector. Two main questions are addressed: (1) what types of agglomerations dominate in the Polish automotive industry? and (2) to what extent do the existing Polish geographical concentrations in the automotive industry resemble Porter's clusters? The evidence is based on the authors' database covering 955 plants involved in production for the automotive industry. Three ideal types of agglomeration present at this stage of the development of the industry are: a TNC-led satellite platform, a hub-and-spoke district and a specialised cluster. The formation of Porter's clusters is only at its initial stage, and only one agglomeration may be regarded as a 'developing cluster' using Enright's typology. In general, the Polish case confirms that Porter-type cluster formation is a long evolutionary process. At present, the competitive advantages of Polish agglomerations include factor conditions, whereas the linkages, non-production competencies and institutional environment lag behind.

Key words: industrial clusters, spatial agglomeration, Poland, automotive industry.

Introduction

Academic literature on the cluster phenomenon has proliferated in recent decades. Since the time of the influential publications by Michael Porter, several dozen books on the subject have been published, including many conceptual studies. However, as Pitelis *et al.* (2006, p. 2) aptly point out, still "there is remarkably little understanding what clusters are, what they require for success and what impacts they are likely to imply in different contexts, locally, nationally and internationally".

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There are at least three important dilemmas related to the cluster concept. The first concerns the term itself. A considerable semantic ambiguity is connected with the word 'cluster', and the term is sometimes an umbrella under which different spatial forms of agglomeration are covered (Belussi, 2006). What is more, as Grosz (2006, p. 7) points out, the word has a double meaning in that it "describes a process (clustering) and final product (cluster) at the same time".

The second problem is the question of spatial scale. Clusters are investigated on a number of geographical scales, from a local neighbourhood (a street or a city block or a small town) to entire nations, to groups of nations (Malmberg and Maskell, 2002). Many scholars claim that industrial clusters constitute a local, not a regional specificity. D. Wolfe (2002), for instance, argues that clusters emerge at a more detailed scale than regional innovation systems. At the same time, identification of industrial clusters is often conducted on the scale of larger regions or countries (*Report...,* 2003). There is a limited number of systematic cluster analyses on the local scale, apart from case studies, as L. Van den Berg *et al.* (2001) argue. Furthermore, the notions 'local' and 'regional' are often used somewhat vaguely. Similar mechanisms or forces are held to explain both why garages spring up together in a particular street and why Central and Eastern Europe developed as an important area of heavy industrialisation under communism.

The third dilemma is connected with policy. Few concepts have gained such vigorous attention from practitioners and policy makers in recent years. Over the past decades, the 'cluster model' has been seized on as a tool for promoting localities, regions and nations (Asheim *et al.*, 2006). Various bodies treat it as a way of achieving economic success in a globalising world. But some scholars argue that because the performance of various agglomerations is highly place- and context-specific, opportunities for using industrial districts and clusters as universally applicable blueprints for the regeneration of declining economies are limited (Amin and Robins, 1990, from Staber and Morrison, 2000; Asheim *et al.*, 2006). Some even criticise 'industrial district and cluster models' as being too optimistic about the development prospects of locally concentrated production systems in global economies (Amin, 1993; Harrison, 1994).

During the last fifteen years, profound changes have taken place in the geography of several manufacturing industries within Europe. As a result of massive foreign direct investment, new areas of production have emerged in Central and Eastern European (CEE) countries: for example, the clothing concentration in Bulgaria (Begg *et al.*, 2000), the furniture industry in Lithuania (Jucevicius, 2002) or consumer electronics in Poland (Radosevic, 2004). Few sectors reflect this change better than the automotive industry. Central European countries (Czech Republic, Hungary, Poland and Slovakia) evolved from the low end of European car production in the 1990s (Tuilder and Ruigrock, 1998) toward the more sophisticated role of a semi-peripheral integrated mar-

ket (Kurz and Wittke, 1998) with growing embeddedness of producers and a significant level of a high value-added product (Pavlinek *et al.*, 2008). This was followed by tremendous changes in the geography of automotive production. The spatial reconfiguration of the automotive industry in CEE Cs raises several questions regarding the process of formation and evolution of concentration of original equipment manufacturers (OEMs) and their suppliers on a local and regional scale.

The authors have attempted to shed some light on the emergence of spatial agglomerations of the Polish automotive industry during the relatively short span of the country's post-communist history and in the context of limited access to central public support. Using the example of the Polish automotive industry, featuring the highest level of employment and output in the CEE Cs, we address two main questions:

– What types of agglomerations dominate in the automotive industry in Poland, and what are the factors behind their development?
– To what extent do the existing geographical concentrations of automotive industry in Poland resemble clusters in Porter's sense?

This paper consists of five sections. The first section ponders the main concepts explaining the geographical concentration of industries, before section two presents current trends in the automotive industry fostering concentration. The third section, preceded by a short methodological chapter on cluster measurability, provides an analysis of automotive agglomerations in Poland. The results are discussed in section four, while the final section covers the main conclusions.

Conceptualising the phenomenon of spatial clustering

Belussi (2006, p. 84) is quite right to remark that "there is no agreement in literature about the ways in which to define and classify industrial districts and clusters". There are several terms describing the phenomenon of grouping of activities in space: agglomerations, clusters, industrial districts and spatial concentrations. However, when delving into the nature of spatial agglomeration, one can easily observe that the fundamental difference is the presence of interactions between co-located companies or lack thereof. Two concepts describing the former type have gained extreme popularity: Marshallian districts and Porter's clusters.

A. Marshall, in his groundbreaking works, distinguished between two manufacturing systems: the vertically integrated production unit and the industrial district. Agglomeration economies acquired in Marshallian industrial districts stem from three sources: (1) fast and easy flows of knowledge between companies, (2) development of sophisticated production factors – supporting and related industries and services, and (3) emergence of a demand-led labour market.

In recent decades, new industrial districts (sometimes called neo-Marshallian districts) have been perceived as new milestones in understanding the growth of co-located companies. Neo-Marshallian industrial districts constitute a territorial system of small and medium-sized firms (Goodman and Bamford, 1990) that not only compete strongly, but also cooperate in relatively stable networks, quite often on the basis of common social values and family relations. G. Becattini (1990) argues that for certain types of productions, the set of operations provided by many co-located small businesses can substitute efficiently for a manufacturing system based on large and vertically-integrated firms. Contrary to Marshall's assumptions, new industrial districts acquire external markets aggressively, this being the main factor behind their dynamic growth. Cooperation between companies and public authorities also supports growth in the regional economy significantly (Markusen, 1999; Storper, 1995). These districts are able to sustain their growth on the basis of economies of scope.

The industrial cluster in Porter's sense is understood as a "geographic concentration of interconnected companies, specialised 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 cooperate" (Porter, 1998, p. 197). The cluster consists of a group of "firms in a particular activity, usually with a geographical dimension, with horizontal and vertical intra- and inter-sectoral linkages in the context of a facilitatory socio-economic institutional setting, which cooperate and compete in an (inter)regional market' (Pitelis *et al.*, 2006, p. 2). The definitions quoted above therefore allow us to deduce the main features of industrial clusters:

– Geographical concentration of companies operating in the same or similar industrial branches (Rosenfeld, 1997; Mytelka and Farinelli, 2000; de Langen, 2002; Enright, 2003);
– Interactions and functional linkages between companies and institutions. The cluster includes both vertical and horizontal linkages (Doeringer and Terkla, 1995; Rosenfeld, 1997);
– Continuous competition and cooperation (Porter, 1990).

Malmberg and Power (2006, p. 57) add two more important criteria:

– "there should be some form of self awareness among the cluster participants and joint policy action (…);
– the cluster should be, in one way or another, successful".

Porter's paradigm has been criticised, but is classically used to explain the sources of competitive advantage of nations, regions and localities. Competitive advantage lies behind the company or given industry (Porter, 1998, 2000): it resides instead in the locations at which their business units are based. There are four determinants of the cluster's emergence and development (sources of its competitive advantage) modelled in the form of a diamond: factor conditions (production factors), demand conditions, related and supporting industries,

strategy and rivalry. These four sets of factors help explain why co-located companies may ensure continuous and systematic growth. The influence of one element on a cluster's development depends on the remaining nodes. The weakness of one node seriously limits the process of enhancing competitiveness. C. Van der Linde (2003) argues that competitive clusters emerge on the basis of all four determinants and that low competitiveness is often shown in the clusters built exclusively upon factor conditions.

There is vigorous debate on the similarities and differences between the industrial district concept and Porter's cluster (Belussi, 2006). Both concepts include two common core elements in their definitions: agglomerations of firms and interactions between them. This allows them to be distinguished from a simple spatial agglomeration in which no interaction occurs (Belussi, 2006). The Marshallian notion as regards industrial districts is certainly more rigid when related to an organisational model (SME companies), efficiency (external economies of scale and 'industrial atmosphere'), spatial range (at least subregional) and minimum number of companies. In turn, the stress on the role of institutions and firm strategies, joint actions and innovativeness among the prerequisites for cluster success is typical for Porter's clusters.

Marshallian districts and Porter's clusters do not definitely describe all forms of spatial agglomerations, as A. Markusen (1996) points out. She identifies three additional types: a hub-and-spoke industrial district, revolving around one or more dominant, externally oriented firms; a satellite platform, an assemblage of unconnected branch plants embedded in external organisation links; and the state-anchored district, focused on one or more public-sector institutions[2]. The first type of district is based on one or more key enterprises which have numerous linkages with smaller local suppliers, service providers, as well as external manufacturers. It is the 'hub' of the industrial network, whose linkages resemble a 'spoke': they are oriented towards the dominant company. Other than that, relations (between SME as in a Marshallian district) are rare or non-existent. The key company is usually supported by local governments, and SMEs are neglected.

A satellite platform, or precisely a TNC-led platform, as Paniccia (2006) calls it, is shaped by a large external enterprise or enterprises attracted to the area by specific factor conditions, for instance state incentives, cheap and/or qualified labour, good accessibility to markets and so forth. Such an agglomeration is the set of subsidiaries, which are in an inferior position to the dominant enterprise. Decisions about the future of the region are taken outside its boundaries, and the agglomeration lacks non-production functions. The major investment is made by non-local enterprises, and profits are transferred outside the district. There is a poorly developed local organisational culture: a lack of common values between producers is evident.

[2] The third type as loosely related to the subject of the article is not discussed here.

It may be noted that the satellite platform differs fundamentally from the other types discussed above in its lack of interactions between co-located companies. Therefore, it is a special case of a geographical concentration of companies on a bounded territory not interlinked with each other. Dicken (2003) uses the term 'generalised cluster' for such a situation.

For the sake of clarity, the analysis described below was used to compare mentioned above (Table 1) in relation to just four basic features: geographical span, occurrence or lack of interactions, types of participating company (in terms of size and ownership) and specialisation. We adopt the terms 'spatial agglomeration' and 'geographical concentration' as general terms describing the grouping of activities in space. Where an agglomeration has a distinct specialisation, but does not resemble the category of either Porter-type cluster, Marshallian districts, hub-and-spoke or satellite platform, we call it a 'specialised cluster', following Dicken's proposal (2003). In turn, a complex cluster stands for a larger agglomeration which comprises smaller regional or local concentrations of the types discussed above.

Table 1. Types of spatial agglomerations
Typy skupień

Type of agglomeration *Typ skupienia*	Geographical span *Zasięg geograficzny*	Interactions between companies *Relacje między firmami*	Types of participating companies *Typy firm w skupieniu*	Specialisation *Specjalizacja*
Agglomeration or spatial concentration (Goodall, 1987; Dicken, 2003)	from local to across state borders	all situations possible	not specified	either specialised or generalised
Marshallian or neomarshallian district (Marshall, 1929; Becattini, 1990)	subregional to regional	occur, dense web of mutual relations	small and medium-sized enterprises	specialised
Porter-type cluster (Porter, 1998; Belussi, 2006)	from local to across state borders	occur, dense web of mutual relations of companies and cooperating institutions	diversity of types + related companies + institutions	specialised
Hub-and-spoke (Markusen, 1996; Paniccia, 2006)	local to regional	occur, coordinated by the key enterprise	key enterprises + their suppliers or subcontractors	specialised
TNC-led satellite platform (Markusen, 1996; Paniccia, 2006)	from local to across state borders	do not occur	subsidiaries of TNCs	either specialised or generalised

Source: authors' compilation based on definitions proposed by the scholars quoted in the first column.
Źródło: zestawione przez autorów na podstawie definicji badaczy wymienionych w 1 kolumnie tabeli.

Agglomeration formation is a dynamic process and several types of spatial concentrations vary because they are at a different stage in the life cycle. For instance, it may be assumed that what is today a TNC-led satellite platform may become a Porter's cluster within 50 years. The intriguing question arises as to whether this is a staged process or to what extent clusters follow similar paths. While this is a fascinating research agenda, for now we will confine ourselves to existing proposals of cluster stages. Fornahl and Menzel (2003) distinguish "stylised stages of cluster development": emerging, growing, sustaining and stagnating/declining clusters. The different stages are separated here by two main factors: first, the number of firms in the region and respective industry (including related ones), and second, the variety of linkages and knowledge used mainly in the region. Drawing from the European Commission (*European Competitiveness*..., 2003), Enright (2003), Grosz (2006) and Belussi (2006), five stylised phases can be distinguished.

1. The embryonic cluster. In a given territory, a geographical concentration of enterprises emerges. The reasons behind this development may be various: from favourable factor conditions to pure chance (see Arthur, 1989).
2. The potential cluster. In this phase, the creation of a 'cluster specific environment' is under way. The diversity of companies grows, the cluster supply chain gains new elements (e.g. intermediary suppliers, specialised producer services). People acquire skills in the dominant industry.
3. The developing cluster. The cluster has achieved the critical mass of companies to create agglomeration advantages. External companies recognise the virtues of the cluster and tend to (re)locate within its limits. Institutions have appeared that further enhance cluster competitiveness: R&D centres, professional schools and so forth. However, non-market relations are still not well developed.
4. The working cluster. Non-market relations between companies are established. There is a dense network of mutual interactions. Strong awareness of common interest is present. The cluster is highly innovative and highly competitive.
5. Decline or renewal (cluster in transition). The primary factor behind cluster emergence and growth becomes less important – the cluster is in danger of losing its international importance. A new trigger is necessary to retain a competitive advantage.

Other than the above stages, M. Enright (2003) proposes an interesting type of cluster, the 'wishful thinking' (promotion- or policy-driven) kind. These are chosen by governments for support, but lack a critical mass of companies or favourable factor conditions.

For the sake of regional policy, it is important to consider the degree of embeddedness of companies in different types of spatial agglomerations. Embeddedness depends on many factors: types of dominant firms (e.g. sub-

sidiaries of transnational companies or domestic firms), the competences and autonomy of plants and relationships between companies, especially through supply links (Dicken *et al.*, 1994; Schoenberger, 1999). The Porter-type cluster and neo-Marshallian districts are characterised by the most far-reaching embeddedness, while activities of firms in a TNC-led satellite platform may be short-lived. A hub-and-spoke district is in turn highly dependent on the activity of a lead company.

Current trends in the automotive industry and the role of geographical proximity

The geography of the automotive industry has undergone tremendous changes in the past two decades. These were visible on the global, regional and local scales, at least. At global level, new areas of automotive production emerged as a result of expansion and relocation from the European Union, USA-Canada and Japan to 'emerging automotive countries' (Latin American and South-Eastern Asian along the China) and to the former communist countries of Central and Eastern Europe (Humphrey *et al.*, 2000; Lung, 2002). This has led to the emergence of interregional production systems at the expense of national production systems (Hudson and Schamp, 1995, quoted in Larsson, 2002).

The automotive industry has always generated agglomeration effects, due to the large scale of production and employment, the extensive of the supplier network and the many sectors involved directly and indirectly in the supply chain. However, current trends have substantially reinforced spatial concentration on a regional and local scale. Outsourcing of 'non-core' industrial processes, reduction in stocks, just-in-time (JIT) and in-line-sequencing (ILS) deliveries combined with modularisation are now widespread practices in the industry. Many scholars argue that interaction between the supplier and assembly plant in a JIT regime works most effectively when the partners are located in close proximity. Kenney and Florida's (1992) survey revealed that 41.4% of Japanese suppliers are located within 100 miles of their major assembly plant customers. Reid (1994) found significant differences between companies using JIT regimes and other producers, suggesting that JIT delivery causes spatial clustering effects on a very local scale. Klier (2005), in his extensive study of the supplier networks of 10 automotive OEMs in the USA, questions this presumption, arguing that "'just in time' does not always mean 'next door'". He discovered that in the case of high quality transportation infrastructure, for the OEM, it is more important to have a large share of suppliers within a day's shipping distance (400 miles) and not necessarily in the immediate vicinity of the customer. Therefore, spillovers are rather on a regional than a local scale.

However, in countries whose the road infrastructure is not so well developed, there is often a necessity for location close to an assembly plant to be found. In

Poland, for example, OEMs require some first-tier suppliers to be located within a zone 20 minutes from the assembly factory or even on-site in the case of sub-assembly activities (Fiat, GM). In general, in JIT regimes, the need for proximity seems to be dependant upon the properties of a given component that need to be delivered and the nature of the relations between the OEM and its suppliers (Frigant and Lung, 2002). The build-to-order-approach is another trend which reinforces spatial clustering. As car manufacturers can no longer afford to produce according to the philosophy that some cars are difficult to sell, they have to be closer to consumer preferences. Time between order, production and delivery must be shortened, and the regime generates higher diversity and flexibility in the models and versions produced. The build-to-order system causes fundamental changes in the whole automotive industry from production push to the production pull supply chain and requires good communication and very quick responsiveness on all levels.

All the trends in organisation of production discussed above have contributed to the emergence of "supplier parks" or "industrial parks", in which several companies are located 'next door' to a final customer, performing production, sequencing or assembling operations. Whole car modules (cockpit, front end, doors, etc.) are then delivered just in time and in-line-sequence onto the assembly line. The trend for suppliers to be integrated directly in the supplier park is developing quickly and is expected to become even stronger in the future, as suppliers recognise the virtue of physical proximity to the final assembler with the logistics of short delivery distances (Schmelzer, 2001).

An extensive study on car parts manufacturers in Poland (Domański *et al.*, 2006, 2008; Domański and Gwosdz, 2009) revealed that the importance of location and distance between customers and suppliers depends on several factors. The most important are: position of the company within the supply chain, involvement in JIT or ILS supply modes, value added in production and profitability of production. In general, whereas ILS and JIT usually require close proximity to the customer, the higher the value added and profitability, the more limited the role of distance. Engine manufacturers, for instance, may supply several continents from one location. Logistical costs also seem less important where the profitability of production due to the low cost of labour and other inputs is high. A striking example is provided by Faurecia, which delivers complete sequenced car seats (in ILS mode) from Wałbrzych in Lower Silesia to the Ford plant in Belgium, a distance exceeding 1,000 km. High profitability means that some suppliers may also choose to pay for storage of their products near the customer's location instead of locating their production there (Domański *et al.*, 2006).

Spatial concentrations in the Polish automotive industry

Data and methods of analysis

The most significant issue in cluster analysis is the problem of measurability. There is no single approved method of identifying agglomerations and clusters (Feser and Luger, 2003). Three main groups of methods are the most popular: the high points method based on location quotient (LQ) and shift share analysis, input–output analysis (I/O) and expert methods based on case studies. Scholars of New Economic Geography use indicators for new firm formation processes, flows of knowledge between the actors and performance of a main cluster's actors which may better describe the relationships in a cluster (Boschma and Lambooy, 1999; Feldman, 1999; Mytelka and Farinelli, 2000). The authors stick here mainly to the traditional indicators – location quotient and shift-share ratio, due to the large number of firms and regions studied. However, supply and institutional links were captured for the main OEM and discussed in regional case studies (chapter *Identifying*..., p. 170).

Location quotient easily shows the geographical concentrations of given industries and is the most popular in the first step of cluster analysis (Malmberg and Maskell, 1997; Ellison and Glaeser, 1997). Location quotient (LQ) allows for the identification of areas with under- ($LQ<1$) and over-representation ($LQ>1$) of an industry compared to the share of a region/locality within the whole economy (measured by the number of companies or employment). $LQ=1.25$ (*Business*..., 2001; *Methodology*..., 2001) or $LQ=3$ (Malmberg and Maskell, 1997) is sometimes taken as a threshold for regional specialisation. A more obvious value is $LQ=1$, which shows the proportional share of employment in a given industry in an administrative unit to the share of employment in the whole economy. LQ analysis should be supported by establishing the threshold number of companies needing to be set up in a given location. One or two large companies with a complete lack of SMEs somewhat limit the possibility for a cluster to emerge. Sometimes LQ calculations are accompanied in the second step by shift share analysis while changes of the shares of a given industry in the total economy employment are calculated.

While it is relatively uncomplicated matter to assess empirically the degree to which companies in a particular industry are agglomerated spatially, it is more difficult to investigate the degree of spatial concentration across groups of firms which are related along other dimensions (Malmberg and Maskell, 1997). The I/O method allows relations within industrial clusters to be identified in the most reliable way (Debresson, 1996; Feser and Bergman, 2000; Hill and Brennan, 2000; Feser and Koo, 2001). The major weakness here is the lack of accessible data for some regions and especially localities. In some OECD countries, innovation matrices based on the interaction matrices made during the

innovation process are used. These are constructed by tailor-made research, e.g. the Community Innovation Survey, which was i.a. applied, in the case of automotive component clusters in Germany (Whalley and den Hertog, 2000).

It must also be remembered that Porter-type clusters are difficult to identify using standard industrial classifications, which fail to capture many important companies operating in related fields (Porter, 1998, 2000; Feser and Luger, 2003). A good example is that the state of Massachusetts was not identified as a cluster as regards medical devices, because companies there belonged to a few different classes, like electronic equipment and plastic products (Porter, 2000).

We used the following methodology in identifying of automotive agglomerations in Poland. In the first step, a detailed database was constructed on the plant level. It covers 691 plants directly involved in production for the automotive industry and 264 other plants present in the automotive supply chain, but with the industry as the secondary customer for them. In the former group, manufacturers of electric equipment, plastic and rubber parts, seats, batteries and other automotive components classified as other than NACE 34 were included, providing that the automotive sector is their main customer. Individual plants are characterised by several variables: ownership, start-up year, employment (in 1998 and 2006), output and linkages (main customers and suppliers). The data were acquired directly from companies, commercial databases (HBI Bonnier, the Polish Chamber of Automotive Industry) and from the Polish Central Statistical Office.

Location quotients were counted for all counties (i.e. powiats) in Poland (fig. 1). Counties with LQ>1 or at least three automotive plants were regarded as production centres. Then, using the nearest proximity method, neighbouring centres were merged into larger agglomerations. Areas with an LQ lower than 1, but with a strongly positive shift-share ratio (between 1998 and 2006), were classified as potential agglomerations. Counties were chosen as the basic unit of analysis, because they correspond well with the local labour markets and constitute the lowest administrative unit in Poland for which important statistical data is available (unemployment level, for instance). In the next step, types of agglomerations were distinguished. We classified them using the following criteria:

– type of agglomeration (using the ideal types discussed in chapter one);
– geographical span (from local to cross-state border);
– competitiveness (from internationally significant to rather weak);
– role in the regional/local economy (based on share in total employment in the area);
– advancement of Porter-type clusters emergence (as proposed in chapter one).

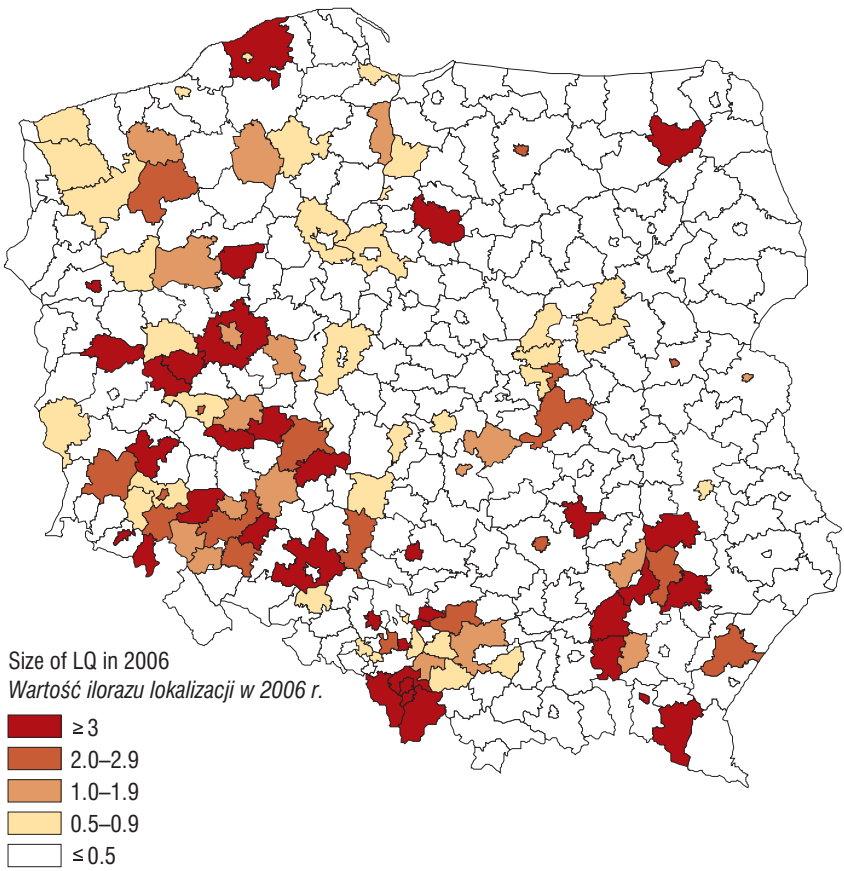

Fig. 1. Location quotient by counties (powiats)
Authors' own elaboration.

Iloraz lokalizacji według powiatów
Opracowanie własne.

Identifying spatial agglomerations in the Polish automotive industry

The Polish automotive industry has undergone tremendous changes in the last 15 years. It has evolved from an isolated and peripheral position to being a market highly integrated with the European and global production network (see Domański and Gwosdz, 2009; Winter, 2008). The main driver of change has been the activity of the Trans-National Corporations (TNCs). Multinationals took over major Polish producers, including three passenger car assembly plants, and had established more than 200 greenfields by the end of 2006.

The cumulative value of FDI in the years 1990–2005 exceeded 10 billion USD, which places Poland in a leading position among CEE Cs, along side the Czech Republic. In 2006, there were 2,483 companies in the automotive branch narrowly defined (NACE 34), 713 of these employing 10 or more people (Central Statistical Office).

The reorganisation of the industry influenced its geography markedly. There have been two parallel processes: growing geographical concentration and shift of the industry towards the southern and western part of the country.

The growing spatial concentration of the automotive industry within Poland may be shown by changes in the Gini coefficient. For Polish regions, the index calculated in relation to population and employment (value in bracket) increased from 0.24 (0.23) in 1998 to 0.35 (0.33) in 2006. One may argue that both values of the Gini coefficient in 2006 are relatively low. However, it is worth pointing out that the increased spatial concentration of the automotive industry in Poland is coinciding with the major geographical shifts of the industry within Poland alluded to above.

The rise of a distinct regional concentration in south-western Poland, which covers areas from Poznań in the west to Kraków in the south-east is the most visible phenomenon of development over the last decade. The concentration has a complex structure and entails three regional agglomerations: Upper Silesia-Kraków, the A4 motorway corridor in Lower Silesia and Wielkopolska (fig. 2). Each of these in turn encompass smaller spatial concentrations (fig. 3). There is a distinct regional agglomeration in south-eastern Poland. Part of it is the 'aluminium cluster' located in the northern corner of the Podkarpackie region. Other than that, one may observe that Warsaw and its metropolitan area host a subregional concentration. A smaller agglomeration may also be found in the Świętokrzyskie Region. Northern Poland shows the presence of a few rather dispersed production centres (Słupsk, Brodnica, Gdańsk and Tczew). Ełk and Olsztyn are isolated centres of automotive activity in north-eastern Poland, an area mostly deprived of the automotive industry. Potential subregional agglomerations (LQ<1, but significant shift-share increase) are Western Pomerania and Łódź.

In terms of geographic span, there are two 'across state borders' agglomerations (Upper Silesia-Kraków and the A4 motorway corridor in Lower Silesia), these constituting part of a Central European cluster[3], as well as two regional and two subregional entities (Table 2). Within the largest agglomerations that have a complex structure (encompassing several distinguished types in the first chapter), smaller geographical concentrations are nested, some of them per-

[3] The agglomeration is part of a broader supra-regional concentration of the automotive industry that emerged in the former socialist states of Central Europe. It covers the neighbouring federal state of Saxony in Germany and several Czech regions, western Slovakia and North-West Hungary (Grosz, 2006; Pavlinek *et al.*, 2008). In Poland it encompasses several smaller agglomerations which differ in their characteristics. The most important are the following three: the Upper Silesia-Kraków agglomeration, the Poznań hub and the A4 corridor in Lower Silesia.

forming the role of nodal points of the whole structure (usually the location of a car assembly plant). To explore the nature of major agglomerations, the brief characteristics of each should be listed.

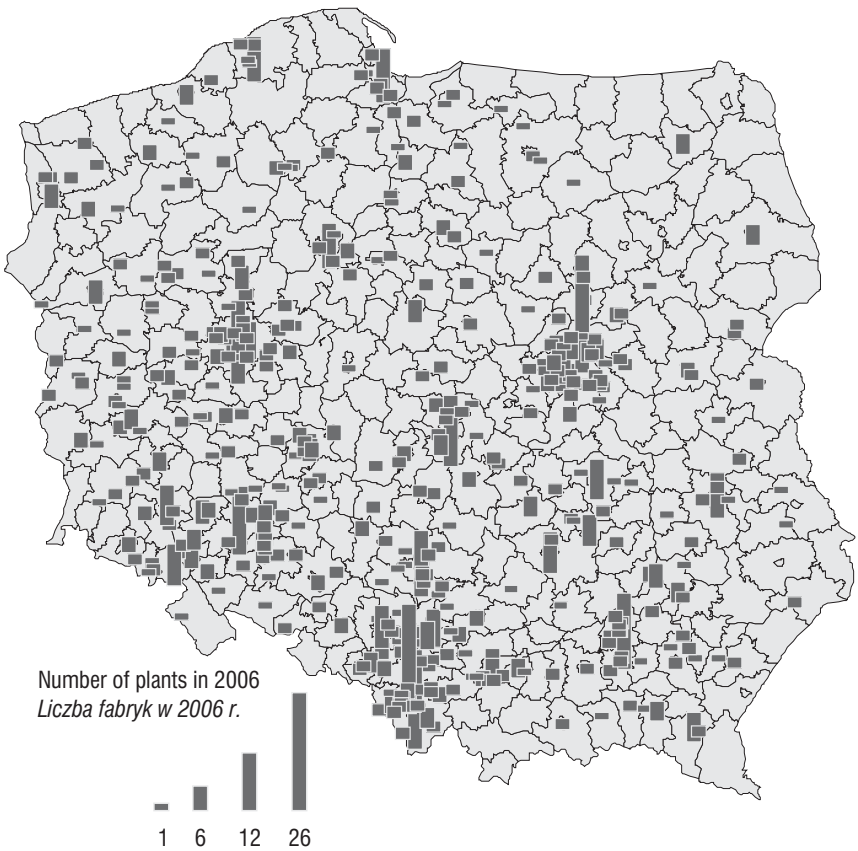

Fig. 2. Number of plants by localities
Authors' elaboration.

Liczba fabryk według miejscowości
Opracowanie własne.

Characteristics of major agglomerations are discussed in greater details below.

Upper Silesia-Kraków

This spatial concentration is the core of the Polish automotive industry. The area generates more than half of Polish annual sales in this sector. The geographical span of the agglomeration covers the old industrial region of Upper Silesia and adjacent centres of Bielsko-Biała in the south and Częstochowa in

the north along with the agglomeration of Kraków in the east. The concentration shows the highest degree of diversity in the automotive industry in Poland. Located here are final manufacturers: Fiat, GM (both passenger cars) and the newly established MAN truck plant, over 100 tier-one and tier-two producers

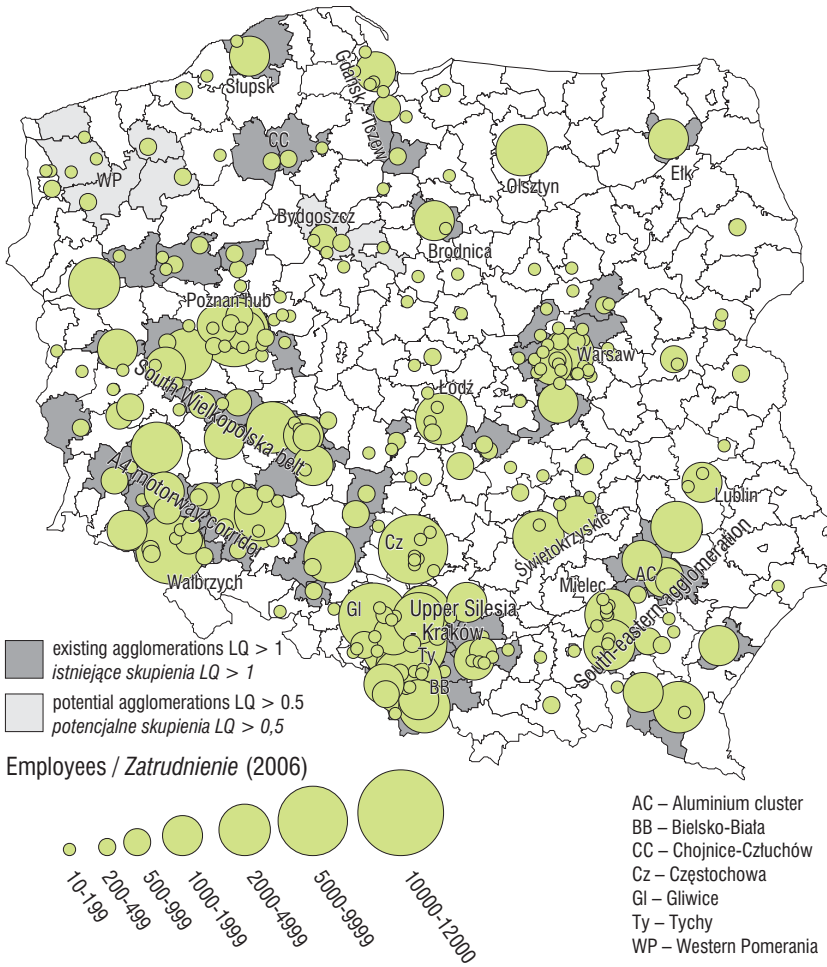

Fig. 3. Spatial agglomerations in the Polish automotive industry in 2006
Authors' own elaboration.

Skupienia przemysłu motoryzacyjnego w Polsce w 2006 r.
Opracowanie własne.

(among them mega suppliers and system integrators like Delphi, TRW, Valeo, Lear and Johnson Controls) as well as companies in related industries. This provides the region with considerable potential for the creation of synergies.

Table 2. Basic characteristics of larger concentrations in the Polish automotive industry
Charakterystyka ważniejszych skupień przemysłu motoryzacyjnego w Polsce

Agglomeration *Skupienie*	Employment *Zatrudnienie*		Automotive plants *Fabryki motoryzacyjne*		Other suppliers[1] *Inni dostawcy*[1]	Location quotient *Iloraz lokalizacji*		Share in area's total employment *Odsetek ogólnej liczby pracujących*		Shift-share *Przesunięcie udziału*
	1998	2006	1998	2006	2006	1998	2006	1998	2006	2006–1998
Existing agglomerations / *Istniejące skupienia*										
Upper Silesia-Kraków	32805	52814	114	149	38	2.65	3.99	4.17	7.43	3.26
The A4 Motorway corridor in lower Silesia	7999	25791	38	68	17	0.89	2.59	1.40	4.81	3.41
The Poznań hub	6876	12917	38	47	20	1.27	1.97	2.01	3.67	1.66
The Southern Wielkopolska belt	6005	13853	26	27	7	2.22	3.52	3.5	6.55	3.05
South-Eastern	24020	19042	35	52	13	3.49	2.50	9.19	4.66	–4.53
Aluminium cluster	6436	8895	23	32	6	5.02	5.17	7.86	9.60	1.74
Warsaw	18487	8958	79	71	23	1.20	0.48	1.89	0.90	–0.99
Potential agglomerations / *Potencjalne skupienia*										
Łódź	2283	3478	16	21	13	0.45	0.67	0.71	1.23	0.52
Western Pomerania	1284	1517	9	12	6	0.37	0.48	0.59	0.90	0.31
Poland	146238	183996	581	691	264	1.00	1.00	1.58	1.86	0.28

[1] plants that supply to the automotive industry, but the industry is of secondary importance to them.
Note: isolated production centres and local agglomerations (two counties or less) were not included.
Source: authors' own calculations.

[1] fabryki, które są dostawcami do przemysłu motoryzacyjnego, ale branża ta nie jest ich głównym klientem.
Uwaga: w tabeli pominięto odosobnione ośrodki produkcyjne i skupienia lokalne (obejmujące dwa powiaty i mniej).
Źródło: obliczenia własne.

Three periods to the evolution of the agglomeration can be distinguished. A decision taken by the government to establish a small car factory (of FSM) produced on the Fiat licence was the initial trigger. The greenfield plant was built in the early 1970s in the dormitory community of Tychy, and an old engine plant was expanded in Bielsko-Biała. Simultaneously, several co-operating plants were founded in the region. In 1992 Fiat took control of FSM. The Italian manufacturer concentrated on assembly, selling off parts plants to first-tier companies (Magneti Marelli, Teksid, CF Gomma and Lear). The third phase was connected with the decision of GM to locate a new manufacturing facility in Gliwice (1996). This triggered a move to locate other plants in the vicinity. Apart from companies involved in the production network of Fiat and GM, several other subsidiaries were established here, lured by a labour pool, good accessibility and incentives. In general, the main competitive advantages of the agglomeration stem from four factors:

– high geographical concentration of component suppliers in automotive and supporting sectors (metal manufacture and processing, glass making, electrical engineering);
– the agglomeration, covering the area of the highest concentration of industry and population in Poland, offers easy access to specialist producer services and represents a large market;
– R&D and higher education centres (Bosmal, TRW, Delphi, Valeo and Technical Universities in Gliwice, Kraków and Katowice);
– proximity to Original Equipment Manufacturers (OEM), which perform the role of hub co-ordinating a network of co-located cooperating companies.

Tychy (Fiat Auto Poland – FAP) and Gliwice (GM Manufacturing Poland – GMMP) are nodes of the whole agglomeration. Here the trends in organisation of production discussed earlier, such as modularisation, JIT and ILS deliveries, and outsourcing of 'non-core' processes all contribute to significant local clustering. As the most embedded car manufacturer in Poland (local content above 70%), FAP is the nodal point of above 40 suppliers located within a radius of 50 km from Tychy, out of which 15 are established within a radius of 20 km[4]. Another hub is the GMMP facility in Gliwice, although its local supplier network is smaller – about 20 companies located within 50 km of Gliwice.

The third key place is the town of Bielsko-Biała, with the oldest automotive traditions in the whole area. Although cars are no longer assembled here, Bielsko retains its position as a centre of production and, even more importantly, of R&D and decision-making (Fiat headquarters in Poland, Bosmal R&D centre, Fiat-GM Powertrain engine plant, over twelve other plants, including 11 TNC subsidiaries).

[4] The 20 kilometres here represent a zone of a maximum 20-minute-distance from the assembly factory, required by OEMs from some first-tier suppliers. A 50-kilometre radius is an approximation of the range of a regional supplier's network.

Częstochowa, on the northern fringe of the concentration, is another interesting example. As a result of its longer traditions in the metal and textile industries, the area has become a specialised cluster. Two groups of companies operate here: small and medium-sized indigenous companies specialised in brake-lines and subsidiaries of TNCs. The Brembo plant in Częstochowa is the global centre for producing brake discs for commercial vehicles. TRW runs its largest (nearly 4,000 employees) and oldest (established 1990) industrial complex in any of the CEE Cs here – including its headquarters in Poland, two production plants and the R&D centre.

The A4 motorway corridor in Lower Silesia

The emergence of the Lower Silesian automotive agglomeration is the most striking example of recent changes in the geography of the automotive industry in Poland. Even in 1998, there was only moderate concentration – LQ equalling 0.89, compared with an impressive 2.59 in 2006. The development of this concentration is mainly the result of the activity of foreign investors, which have established more than 100 new plants here. There are several reasons for the attractiveness of the area. It is well connected with West European markets and sources of supply by the A4 motorway, and it offers a substantial pool of skilled labour and ready land for investment (mainly covered by a Special Economic Zone programme). Imitation behaviour and a 'follow the customer' strategy cannot be neglected here either. The region offers the biggest concentration of Japanese companies, including Toyota (transmission and two engine plants), NSK (steering systems), Amatsuji Kokyu Seisaku (balls for bearings), Sanden (compressors) and others.

By contrast with the Upper Silesia-Kraków area, the Lower Silesian agglomeration at present has a structure resembling a typical satellite (export) platform. It is dominated by branch plants of foreign companies, to the extent that most of them are devoid of any non-production functions. A notable exception is the Volvo Bus (R&D and IT centre) in Wrocław. The links between companies are low; the region lacks second- and third-tier companies, especially domestic. The latter are usually small and lack the capital and competencies to produce for first assembly. However, there are serious preconditions for a regional Porter-type cluster to emerge here. The process of locating Tier 1 and Tier 2 suppliers in the region is underway. Proximity to assembly plants in the Czech Republic (Skoda Auto in Mlada Boleslav and PSA in Kolin) and eastern Germany (VW in Dresden) as well as in Poland (VW in Poznan, GM in Gliwice) will hasten the inclusion of Lower Silesia plants into OEM supply chains.

The Poznań hub

This agglomeration fits well into the hub-and-spoke type. The dominant companies here are a Volkswagen subsidiary and two bus producers: MAN and the Polish-owned Solaris. In addition, three important parts suppliers are established here: Bridgestone (tyres), Centra – the largest battery producer in the CEE Cs (Exide group), and Kimball Electronics.

The gravitating force of the Poznań Volkswagen plant deserves closer inspection. The plant was acquired by VW in 1992 and then enlarged substantially. Light commercial vehicles – the Caddy and Transporter T5 – are manufactured here. Local content for the models varies between 30% and 40% respectively. Out of 50 suppliers located in Poland, 15 are found within a 20 km distance. The plant works on a very sophisticated and complex lean production scheme – 4 models of the T5 and 3 of the Caddy are manufactured on the production line. All supplies come to the factory on a JIT and ILS basis[5]. A supplier park is located 6 km away from the main assembly plant with direct connection by the A4 motorway. A dozen suppliers and subcontractors (employing over 1,200 in total) manufacture the main modules – cockpits, trims, doors, exhaust systems, seats, front end body work and so forth. In general, good accessibility, easy access to producer services and a qualified workforce with a tradition of good workmanship are the main competitive advantages of the agglomeration.

The southern Wielkopolska belt

This is a belt of counties stretching from Świebodzin county in the west to Kalisz in the east. With the exception of the former, the share of the automotive industry in total jobs is no lower than 3%, amounting to 17% in the Grodziski county. The present structure of this agglomeration is the legacy of two development phases. Up to 1989, only three production centres were here (Krotoszyn, Kalisz and Ostrów Wielkopolski). In the latter town, due to longer traditions in the industry, a small specialised cluster emerged. Companies based here produce exhaust systems and filters, and their share in the Polish production for the aftermarket was as high as 58% in 2004. In addition, there are two subsidiaries of TNCs specialised in HVAC[6] components: Calsonic Kansei and Delphi. The latter runs an R&D department here. The second phase of automotive development in the belt entailed the emergence of large labour-intensive factories in the mid-1990s. At that early stage of international expansion of foreign suppliers, the Wielkopolska region was often chosen as a location for its geographical and cultural proximity to Germany. Nowadays, 30% of all jobs

[5] Interestingly, that production scheme was partially forced by the small area available and a lack of storage in the main production plant.

[6] HVAC – Heating, Ventilation, Air Conditioning.

are found in wiring harness plants (the largest are the Japanese Sumitomo and German Leoni) and the next 26% in two upholstery workshops owned by domestic producer Inter Groclin[7]. Their embeddedness is relatively low, and in the light of growing labour costs in Poland, dependency on labour intensive tasks leaves the prospects for the industry in some towns uncertain[8].

The south-eastern agglomeration

This area has a long tradition in the engineering industry (mainly aircraft). It has three characteristic properties. First, present here are several large factories that were built as part of the Polish system for the defence industry from the 1930s through to the 1950s. The majority were privatised and restructured in the 1990s and 2000s, and a few still belong to the state. Expertise in the engineering industry and spin-offs from the WSK-PZL conglomerate (i.e. a diesel engine and injection pumps factory) has led to the emergence of a cluster of SME specialised producers in the town of Mielec. Thirdly, new investors attracted here by the skills of local labour and government incentives (two Special Economic Zones) contributed to the emergence of the so-called 'aluminium cluster', with centres in Stalowa Wola and Gorzyce. At present, this is one of the largest concentrations of aluminium wheel producers in Europe, with leading companies such as ATS Stahlschmidt and Maiworn and Uniwheels. Other companies specialising in aluminium parts include Federal Mogul (pistons) and producers of car replicas, Leopard (Cobra) and Kirkham Motorsports (Gepard). Although this agglomeration is a very recent phenomenon – most of the companies were established here after 1996 – it has several attributes of a potential Porter-type cluster. Vertical co-operation is growing, specialised producer services are emerging and public institutions are also active in strengthening the potential cluster (the boards of Mielec and Tarnobrzeg SEZ and the Technological Park in Mielec). In contrast, in the northern part of the agglomeration, there is the city of Lublin, fighting to retain its automotive industry after the bankruptcy of the local Daewoo subsidiary. In this former hub-and-spoke type agglomeration, only small-scale assembly of LCVs is currently carried out by International Truck Alliance and a handful of parts producers (mainly companies which spun off from Daewoo Motor Poland) are active.

In general, qualified and cheap labour is the most valuable asset of the whole South-Eastern agglomeration, but other factor conditions are not favourable. The main problems of the slightly declining agglomeration are poor accessibility of the whole area, peripherality to main services and educational centres and remoteness from the main markets in Western Europe.

[7] Inter Groclin is the largest Polish-owned company (in terms of both output and employment) to emerge in the industry post 1990.

[8] A marked decline was observed in this cluster after 2007, due to closures of SEWS plant in Ostrzeszów and a reduction in employment at the Leoni (Rawicz) and Inter Groclin subsidiaries in Wolsztyn and Karpicko.

Warsaw and its metropolitan area

In terms of the number of plants, this spatial concentration hosts the largest number of domestic SMEs (over 70 firms with 10+ employees), a few subsidiaries of foreign producers and lastly the oldest Polish car assembly plant, at present controlled by the Ukrainian AvtoZaZ. However, by contrast with all other agglomeration except Lublin, the area has lost out heavily in significance terms since 1990. It currently concentrates 5% of all jobs in the industry – significantly less than in 1998 (13%). The automotive industry, which was born here in Poland historically, no longer constitutes an important part of the local economy (LQ<0.48, contributing to just 0.6% of total jobs). Several reasons lie behind the decreasing role of the automotive industry in the capital city area. Throughout the 1990s and 2000s, there have been efforts to restructure the former state assembler FSO (established in the 1950s). Daewoo, which finally bought the factory and modernised it thoroughly, was hit by the bankruptcy of its mother company in Korea. The company, seriously endangered with total cessation of operations, was recently acquired by the Ukrainian assembler AvtoZaZ. The troubles of the car maker affected its suppliers located in the area.

What is also striking, the Warsaw agglomeration that experienced a concentration of new production plants in various sectors of industry failed to attract any new automotive companies after the initial years of the economic transformation. This can be explained by the high costs of labour and land, compounded with poor motorway access. Only one large plant built after 1990 is active in the area, namely Faurecia at Grójec, while a medium-sized Ford assembly plant in Płońsk operated for five years only and closed in 2000 after a liquidation of tariffs on cars produced in European Union. As mentioned earlier, the Warsaw metropolitan region is one of the biggest spatial concentrations of domestic companies, but only a few of them are present in the supply chains of major manufacturers. They produce mainly for the aftermarket, using the opportunity of a sizeable local market – and striving to survive rather than growing in strength.

The current stage in the clustering process of the Polish automotive industry

The nature of Polish automotive agglomerations rules out any talk of an advanced and well-functioning Porter's cluster at the moment (Table 3). This would require a number of conditions to be met at the same time. The first would be the maintained or increased long-term significance of a cluster. Here the most dynamic of current agglomerations, the A4 motorway corridor in Lower Silesia, is only at the take-off stage with its regional and local linkages between companies in their infancy. The Warsaw agglomeration, with the

Table 3. Assessment of spatial agglomerations in the Polish automotive industry
Ocena skupień przestrzennych przemysłu motoryzacyjnego w Polsce

Agglomeration *Skupienie*	Type *Typ*	Geographic span *Zasięg geograficzny*	Competiteveness[1] *Konkurencyjność*	Role in the area economy[2] *Rola w gospodarce lokalnej*	Advancement of clusterisation process *Zaawansowanie w procesach powstawania gron*
Upper Silesia-Kraków	complex	across state borders	nationally significant	significant	developing cluster
Częstochowa	specialised cluster	local	rather weak	significant	embryonic cluster
Gliwice	hub-and-spoke + satellite platform	local	regionally significant	significant	nodal point of a developing cluster
Tychy	hub-and-spoke + satellite platform	local	regionally significant	dominant	nodal point of a developing cluster
The A4 corridor in lower Silesia	satellite platform	across state borders	nationally significant	visible	embryonic cluster
The Poznań hub	hub-and-spoke	local	regionally significant	visible	nodal point of an embryonic cluster
The Southern Wielkopolska belt	satellite platform	subregional	rather weak	significant	part of an embryonic cluster
Ostrów Wielkopolski	specialised cluster	local	rather weak	visible	embryonic cluster
South-eastern	complex	regional	regionally significant	visible	in renewal
Aluminium cluster	specialised cluster	subregional	regionally significant	significant	potential cluster
Mielec county	specialised cluster + satellite platform	local	rather weak	major	part of potential cluster
Lublin area	hub-and-spoke	local	rather weak	visible	declining
Warsaw	hub-and-spoke + agglomeration of SMEs	subregional	regionally significant	insignificant	declining

[1] degree of competitiveness was based on the classification of ISC (2004).
[2] as % of total employment: 6 predominant (>50%); 5 dominant (<50%); 4 major (<20%); 3 significant (<10%); 2 visible (<5%); 1 insignificant (<1%); 0 invisible (<0.1%)
Note: potential agglomerations and local isolated production centres are not included in the assessment. Parts of agglomerations are distinguished if they have a distinct character – they are either different from the entire agglomeration or represent a specific 'ideal type'.
Source: authors' elaboration.

[1] stopień konkurencyjności na podstawie klasyfikacji ISC (2004).
[2] jako % liczby pracujących: 6 silnie dominujący (>50%), 5 dominujący (<50%), 4 główny (<20%), 3 znaczący (<10%), 2 zauważalny (<5%), 1 nieznaczny (<1%), 0 niezauważalny (<0,1%).
Uwaga: w tabeli pominięto odosobnione ośrodki produkcyjne i skupienia potencjalne. Wyróżniono fragmenty skupień, które mają odrębne cechy lub charakter określonego „typu idealnego".
Źródło: opracowanie własne.

longest tradition in the sector, lost its competitive advantage after 2000 before a 'working cluster' had had a chance to evolve. Only in the Upper Silesia and Poznań regions have growth trends that started before the Polish transformation of 1989 continued.

Secondly, a critical number of companies and specific types of companies are also required. A large number of firms is needed to develop agglomeration economies, such as in the Upper Silesia-Kraków developing cluster. The desired type of companies includes a final assembly plant as a focal firm that organises the local and regional network of linkages. If labour skills are to develop, certain products need to be manufactured. This can be achieved, for example, with an engine manufacturing plant. The existence of local competencies can, in turn, help in the emergence of specialised production clusters that will have a good chance of evolving into a full-blown Porter-type cluster. Evidence of this process is found in the different degree of evolution of clustering in the southern Wielkopolska belt and the 'aluminium cluster'. Both have developed in an area with 'good workmanship' traditions, but while the first stopped at the stage of the export platform where large factories are poorly interrelated with each other and with the environment, in the 'aluminium cluster', the formation of a cluster specific environment (qualified labour, growing pools of companies) is underway, and vertical and horizontal linkages are growing steadily.

Thirdly, the role of cooperation with the sector's environment is important. Poland, quite astonishingly, has no regional organisation promoting automotive clusters in the way that, for example, the Hungarian PANAC, Austrian Automobil Cluster Oberösterreich, or German Verbundinitiative Automobil do. There is dispersed activity of individual towns (e.g. Tychy) and of economic zones, but industrial organisations are either of a nationwide nature (Polish Chamber of Automotive Industry) or represent the interests of groups of companies (e.g. SPCM, representing small and medium-sized domestic companies). The lack of a dedicated automotive policy does not hamper the emergence and growth of new spatial agglomerations in the sector, but it may influence the embeddedness of the companies at later stages of the industry development.

Some Special Economic Zones (SEZ) have become important areas of concentration of automotive companies. This has happened in spite of the fact that between 2000 and 2006, the automotive industry was seriously underprivileged as a company from this branch could apply for exemptions 20 percentage points lower than other activities upon which with tax privileges were conferrable. However, for many investors, the availability of investment-ready land and efficient administrative services at the implementation stage is more important than tax breaks. The role of SEZs in the creation of a strong agglomeration on a local scale was especially marked until the early 2000s, at which point they still encompassed only a relatively limited number of locations. Concentrations of automotive companies in the Katowice, Wałbrzych and Mielec zones repre-

sented one of the main motors behind industrial growth and restructuring in these industrial districts. Currently, the gravitating force of several older SEZ sites is lower, as the zones are highly dispersed (over 160 sub-zones were active at the end of 2006) and are instantly created in locations convenient for single investors. In general, the role of the SEZ may be interpreted as initiating and strengthening local clusters in a few regions preferred by automotive companies. They have favoured areas in South-Western Poland, which have been characterised by proximity to customers and suppliers in Western Europe, good access to main roads and labour market in terms of size of the available workforce and the local skills and industrial traditions. At the outset, the concentrations in SEZs were typical TNC-led export platforms, but over the course of time, internal links have developed thanks to the attraction of lowertier suppliers, as well as cooperation with previously established domestic companies.

The Upper Silesia-Kraków agglomeration is the most advanced on its path to the formation of a 'working cluster'. This agglomeration is passing the initial stage of clustering with its typical moderate level of innovation and existing linkages at risk from external corporate decisions. This cluster has several elements and factors necessary for the formation of a successful cluster, including a dense network of automotive and related companies, R&D and educational centres, pools of qualified labour and, last but not least, good motorway access to existing and emerging automotive centres in neighbouring countries. It also hosts the largest number of successful domestically owned first- and second-tier suppliers in Poland. This latter fact confirms the thesis that Porter-type clusters foster growth of domestic companies better than other places.

A comparison of Upper Silesia-Kraków with Baden-Württemberg and the West Midlands shows that the gap between Poland's most advanced agglomeration and mature West European clusters remains large (Table 4). The same holds true of other Central European agglomerations. Signs of improvement have appeared, however. The industry is on the rise. Several TNC subsidiaries are acquiring non-production competencies (Domański *et al.*, 2008). Typically, these firms run broader operations in Poland (several factories, like Delphi or TRW) or have their main European factory in Poland (Volvo Bus). Furthermore, companies which have built a number of factories in Poland predominantly located them within the same region (Toyota, TRW, Valeo, VW), a trend that has not only stimulated internal flows of goods and workers, but also attracted second-tier producers and forged more attractive milieus for third-party plants already established.

Table 4. Comparison of four European automotive clusters (as of 2003)
Porównanie czterech europejskich skupień przemysłu motoryzacyjnego w 2003 r.

Cluster *Skupienie*	Sales in USD billions *Łączne przychody firm w mld USD*	Plants (NACE 34) *Fabryki (tylko PKD 34)*	Employment in thousands *Zatrudnienie w tys. osób*	R&D personnel in thousands *Kadra badawczo-rozwojowa w tys.*	Number of global or European headquarters[1] *Liczba globalnych lub europejskich siedzib zarządów firm*
Baden-Württemberg (Germany)	57.7	261	220.0	30.0	11
West Midlands (UK)	21.1	236	65.3	4.0	6
Upper Silesia-Kraków (Poland)	8.9[2]	118[2]	28.5[2]	1.1[3]	0
Central and West Transdanubia (Hungary)	.	90[4]	22.0	0.3[3]	0

[1] headquarters of final assemblers (OEMs) and of the 100 largest automotive suppliers in the world.

[2] as of 2004.

[3] as of 2006.

[4] excluding the businesses of physical persons.

Authors' own calculations based on *European Monitoring Centre of Change*, Grosz (2006), *The top 100 global OEM parts suppliers* (2006), *Eurostat* and own investigations.

[1] siedziby zarządów montażystów końcowych (fabryk samochodowych) i 100 największych dostawców na świecie pod względem przychodów.

[2] dane dla 2004 r.

[3] dane dla 2006 r.

[4] bez osób fizycznych prowadzących działalność gospodarczą.

Obliczenia autorów na podstawie: *European Monitoring Centre of Change*, Grosz (2006), *The top 100 global OEM parts suppliers* (2006), *Eurostat* oraz badań własnych.

Conclusions

The changes to the geographical shift of the Polish automotive industry discussed here attest to the large and growing role of geography and spatial proximity in this sector. This is confirmed by the increasing spatial concentration and the shift towards areas with good market and supplier access. Motorways play a special role here, as seen from the high pace of industrial growth in south-western Poland.

Hub-and-spoke and TNC-led satellite platforms are the most frequent agglomeration types in the Polish automotive industry. It is noteworthy that the for-

mer type is universally characteristic of this sector. Car factories typically play the role of the hub. Their output and organisation of production give them the greatest pulling power, both locally and regionally, much above that of bus and coach assembly plants. The Polish example is also illustrative of the high degree of spillover, both local and regional, that follows the locating of an assembly facility. Our conclusion in this respect contradicts that of Klier (2005), who has demonstrated in the USA that such spillovers are mostly true and work on a broader scale[9]. Clearly, this is a result of the difference between the road infrastructure in the two countries. The role of geographical proximity between the supplier and customer is also seen on further tiers of the supply chain in the automotive industry, but the pull of customers is smaller and is manifested more on the regional than the local scale.

The ubiquity of the TNC-led platform agglomeration type is not surprising in the face of the strong dependency of the sector on international investors, as well as the young age of many automotive agglomerations. For this type of agglomeration, the key issue is the pace at which investors become embedded and agglomerations converted into Porter-type clusters. In our view, their development paths will be closely linked with: (1) the type of factor conditions that have contributed to their emergence; (2) the evolution of unique competences (specialisation) in a given type of production; and, in the case of larger agglomerations, also (3) the emergence of economies of scale and diversity. Rapid development of production linkages and non-production competency in the 'aluminium cluster' is an interesting trait. This might be a result of the earlier existence of the competency and of the special nature of the industry itself.

No Marshallian industrial district has been found. The local agglomerations of Mielec and Ostrów Wielkopolski display some of its features, such as the presence of small and medium-sized enterprises and a network of cooperation. They are too small, however, to see agglomeration advantages and are better described as a broad category of specialised clusters.

Looking at the advancement of the clustering process, it must be said that there are no Porter's clusters in Poland at the present moment. The Upper Silesia-Kraków agglomeration, which is the closest to the 'working cluster' phase, is still at a development stage. Generally, Polish agglomerations have so far only properly developed two apices of Porter's famous diamond, i.e. factor conditions and demand conditions. In this respect, our results are compatible with the research by Grosz (2006), who stressed that even the largest Hungarian agglomeration, Transdanubia, is still "far below the level of an advanced, well-functioning automotive cluster" (p. 6). It seems that Hungarian and Polish (and presumably also other CEEC) agglomerations have common weaknesses, including: weak non-production competency leading to low intensity of cooperation

[9] According to Klier (2005), they are "of a regional rather than local" scale. Regional in this case means several states within 400 miles, which in Europe would mean supra-regional.

with the local research and development environment, the fact that strategic competencies are located outside and the weakness of companies with local capital, which have entered the supply network to only a limited extent. All of this affects a limited information and innovation flow.

The diversity of the agglomeration types identified by the authors suggests that there is no single recipe for public intervention. Three issues are quite clear, however. First, there is a need for a nation-wide platform to promote cooperation in the automotive industry to be established. Second, the main stress should be put on strengthening links between companies and between firms and their institutional setting, rather than merely on attracting yet more new foreign subsidiaries. Third, incentives for companies (e.g. financial grants) should be diversified in line with to the most desired activities in a given area, in order to avoid a lock-in in single or 'low-end' activities.

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SKUPIENIA PRZEMYSŁU MOTORYZACYJNEGO W POLSCE

Celem autorów jest naświetlenie procesu tworzenia się skupień i gron porterowskich (*clusters*) przemysłu motoryzacyjnego w Polsce po 1989 r. Postawiono dwa główne pytania badawcze: jakie typy skupień dominują w polskim przemyśle motoryzacyjnym? w jakim zakresie istniejące w Polsce skupienia mogą być określane jako grona porterowskie? Podstawą do wnioskowania była autorska baza danych obejmująca 955 fabryk produkujących na rzecz motoryzacji, a wykonana w ramach grantu *Polski przemysł samochodowy – zmiany pozycji i powiązań w europejskiej przestrzeni ekonomicznej* (KBN 3 P04E 016 25).

Artykuł składa się z pięciu części. W pierwszej omówiono główne teorie i koncepcje wyjaśniające powstawanie koncentracji przestrzennych działalności gospodarczych. Współczesne trendy w branży motoryzacyjnej, wpływające na wzmocnienie tendencji do skupiania się firm (m.in. dostawy *just in time* oraz *in-line sequencing*, modularyzacja, parki dostawców) przedstawiono w części drugiej. Najobszerniejszy rozdział trzeci zawiera charakterystykę skupień przemysłu motoryzacyjnego w Polsce. Rezultaty badań empirycznych dyskutowane są w rozdziale czwartym, który poprzedza wnioski, gdzie zawarto m.in. porównanie rezultatów niniejszej pracy z wynikami badań innych autorów.

Zmiany przestrzenne w przemyśle motoryzacyjnym w Polsce świadczą o dużej i rosnącej roli uwarunkowań geograficznych. Efektem jest zwiększająca się koncentracja przestrzenna zakładów oraz przesunięcie aktywności produkcyjnej w kierunku obszarów odznaczających się dobrą dostępnością do rynków zbytu oraz bliskością do dostawców. Główną rolę odgrywa położenie w pobliżu autostrad, widoczne zwłaszcza w szybkim tempie powstawania fabryk motoryzacyjnych w korytarzu autostrady A4 w południowo-zachodniej Polsce.

Występujące na obecnym etapie rozwoju przemysłu motoryzacyjnego w Polsce trzy typy idealne skupień przestrzennych (wyróżnione za: Markusen, 1996; Dicken, 2003) to: okręg typu „oś i szprychy" (*hub-and-spoke*), platforma satelicka (*TNC-led satellite platform*) oraz skupienie wyspecjalizowane (*specialized cluster*).

Koncentracja typu „oś i szprychy" jest jedną z najbardziej charakterystycznych w przemyśle motoryzacyjnym. Zakłady montażystów końcowych (zwłaszcza fabryki samochodów osobowych) pełnią w tym względzie rolę ogniskującą, grupując wokół siebie dostawców I i II rzędu.

Powszechność skupień typu „platforma satelicka" nie jest zaskoczeniem, zważywszy na silną zależność branży od inwestorów zagranicznych oraz krótki czas funkcjonowania wielu fabryk. Dla tego rodzaju koncentracji kluczowym pytaniem jest tempo zakorzeniania się firm i ich ewolucji w skupienia typu porterowskiego. Według naszego oglądu, tempo to będzie ściśle powiązane z: (a) czynnikami produkcji, które wpłynęły na powstanie danej koncentracji, (b) wykształceniem się unikalnych kompetencji (specjalizacji), a w przypadku większych skupień (c) pojawieniem się efektów skali i różnorodności.

Nie zidentyfikowano natomiast skupień o charakterze okręgów marshallowskich. Część cech takiej aglomeracji – obecność małych i średnich firm lokalnych oraz istnienie sieci powiązań między nimi – dotyczy koncentracji w Mielcu i Ostrowie Wielko-

polskim. Są one jednak za małe, by osiągnąć korzyści aglomeracji, dlatego termin „skupienie wyspecjalizowane" lepiej oddaje ich charakter.

Badając postępy w procesach koncentracji stwierdzono, że na obecnym etapie rozwoju przemysłu motoryzacyjnego w Polsce nie wykształciły się pełne grona porterowskie. Najbliższe temu modelowi jest skupienie górnośląsko-krakowskie. Skupienia przemysłu motoryzacyjnego Polsce noszą najwyżej dwie cechy słynnego „diamentu przewagi konkurencyjnej" M. Portera, tj. czynniki produkcji i warunki popytu. W tym względzie wyniki niniejszych badań potwierdzają rezultaty pracy Grosza (2006) dotyczącej koncentracji przestrzennej przemysłu motoryzacyjnego na Węgrzech. Autor ten podkreśla, że nawet największemu skupieniu węgierskiemu w Kraju Zadunajskim daleko jeszcze do poziomu dobrze funkcjonującego skupienia porterowskiego. Można stwierdzić, że funkcjonujące w Polsce i na Węgrzech – a zapewne także w innych krajach Europy Środkowej i Wschodniej – skupienia przemysłu motoryzacyjnego mają wspólne słabe strony, takie jak: (a) niewielkie kompetencje badawczo-rozwojowe – stąd słaba współpraca z sektorem badawczo-rozwojowym, (b) uzależnienie od zewnętrznych decyzji strategicznych w związku z dominującą rolą inwestorów zagranicznych, (c) słabość firm z miejscowym kapitałem, które tylko w ograniczonym zakresie uczestniczą w sieciach produkcyjnych.

Ogólnie rzecz biorąc przypadek przemysłu motoryzacyjnego w Polsce potwierdza hipotezę, że wytworzenie się skupień typu porterowskiego jest długoterminowym procesem ewolucyjnym. Obecne przewagi konkurencyjne polskich skupień opierają się głównie na czynnikach produkcji (tanich, ale równocześnie dobrze wykwalifikowanych i zmotywowanych pracownikach, bliskości do rynków zbytu w Europie Zachodniej), podczas gdy słabo wykształcone są sieci powiązań, kompetencje pozaprodukcyjne i otoczenie instytucjonalne.