

Exploring the Spatial Distribution and Location Choice of Companies in a Hungarian Agglomeration

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Abstract

Globalisation has led to the dominance and geographical expansion of urban areas. Companies consider a complex set of criteria when deciding on their locations, including the agglomeration area and the presence of similar companies or related businesses. This study examines the spatial distribution and industrial clustering of companies within the agglomeration of Győr, Hungary's sixth-largest city. The sample comprises 256 companies across 68 settlements, with data processed through map, quadrat and industry analysis. The analyses identified six settlements within the agglomeration where nearly half of the companies are located, five factors that seem to facilitate company location, and five main industrial sectors, four of which are closely related. The article concludes that the agglomeration area of Győr is characterised by a high degree of spatial concentration of companies, industrial clustering and the emergence of industry sub-centres.

Keywords

agglomeration, spatial distribution, industrial clustering, location factors, Győr, Hungary

Introduction

As globalisation processes reorganise the spatial division of labour, the importance of studying localisation has become indisputable. This is because the resources needed for sustained competitive advantage in the global economy are inherently local (Porter, 1998). Over a century ago, Weber (1929 [1909]) theorised that companies do not choose locations randomly, but consider a complex set of factors when making location decisions. The exploration of these factors constitutes a significant research area in both economics and regional economics. Two fundamental issues in regional microeconomics are the theories of location and the spatial distribution of economic activities (McCann, 2001). Most theories approach location selection from a microeconomic perspective, examining the spatial distribution of companies as a result of their pursuit of optimal outcomes, such as cost minimisation and profit maximisation (Legros et al., 2016). This paper examines the spatial distribution of companies and activities in accordance with the findings of location theories.

Location theories aim to address four key questions related to the production process, namely, what, how, where, and for whom to produce (Stutz & De Souza, 1998). Traditional theories primarily focused on manufacturing and agriculture. However, with the dominance of the urban economy and the growing share of the service sector today, non-economic aspects have also gained prominence. Consequently, when making location decisions, companies now consider spatial expectations and the fundamental characteristics of the location and its environment (Lengyel & Rechnitzer, 2004).

Globalisation has increased the dominance of urban areas, with 56% of the world's population now living in cities, a figure expected to grow (The World Bank, 2023). The central business district

(CBD) has become a symbol of urbanisation, characterised by a high concentration of social and economic activity (Hartshorn, 1992). As a result of social suburbanisation processes in recent decades, urban areas have expanded, and economic activities have begun to decentralise. During suburbanisation, the city extends beyond its administrative boundaries and starts agglomerating with neighbouring municipalities (Archer & Smith, 2003; Veres, 2017; Kiakou, 2021).

The concept of agglomeration can be interpreted in various ways, such as a group of settlements comprising large cities and their surroundings, or as a spatial concentration of economic units. This study, following the interpretation of the Hungarian Central Statistical Office (KSH, 2014), defines agglomeration as a settlement structure characterised by population growth and significant housing construction activity, resulting in a coherent, spatially integrated settlement body. Urban regions attract market actors who can benefit from the city's advantages while facing a reduced burden when settling in the surrounding catchment area (Lengyel & Rechnitzer, 2004). After the turn of the millennium, the deconcentration of economic activities accelerated, garnering increased attention in academic literature (e.g. Archer & Smith, 2003; Crane & Chatman, 2003; Moritz, 2018; Nilsen et al., 2020; Kiakou, 2021). The importance and relevance of this research topic lie in the transformative impact of the spatial reallocation of activities, which has changed commuting patterns, the scope of municipalities, vocational training, transport infrastructure and operating conditions (Koós, 2010).

This study aims to investigate the spatial distribution and industrial clustering of companies in Győr's agglomeration. Győr, the county seat of Győr-Moson-Sopron county, is located in the northern part of the Western Transdanubian region, within the triangle formed by three capital cities: Budapest, Bratislava, and Vienna (Annex 1). Its favourable location contributes to its continuous development, making the region one of the most dynamically growing areas in the country. Győr is an attractive destination for companies and foreign venture capital investments due to its high supply in almost all sectors, proximity to the border, large population and role as a transport hub (Rechnitzer & Kecskés, 2015). It is the second largest agglomeration in Hungary, comprising 68 municipalities and a population of 245,197 inhabitants, with 132,111 residing in the centre, making it the sixth-largest city in the country (KSH, 2014; 2022a; 2022b).

The study first reviews the most important theories of location, the factors influencing location decisions, and the suburbanisation of economic activities. It then describes the research methodology and analyses the spatial location and distribution of companies operating in the agglomeration of Győr to reveal their spatial concentration, trends in industry clustering and other potential factors that may influence company location.

Literature review

Location theories aim to explore the factors that influence the location choices of companies, public services, and households, as well as to formulate findings that can be used to develop general location models (Fujita, 2010; Legros et al., 2016). However, this study focuses exclusively on the location choice of companies and is based on five theories: Marshall's (1920 [1890]) and Weber's (1929 [1909]) agglomeration theories, Alonso's (1964) monocentric city model, Porter's (2000) clustering theory, and McCann's (2001) polycentric city model.

Since Thünen's (1826) first general theory of location, theories examining companies' location choices have undergone considerable development. Weber (1929 [1909]) focused on economic agglomerations, analysing their impact on location decisions. Similarly, Marshall (1920 [1890]) studied industrial agglomerations and sought to uncover the reasons behind the spatial concentration of specialised industries. Both Weber (1929 [1909]) and Marshall (1920 [1890]) theorised that the concentration of numerous firms in similar or identical industries creates positive externalities in location choices, thereby acting as a motivating factor in the decision-making process.

The next stage of location theory is characterised by the connection between spatiality and the theory of market areas. This development is primarily attributed to Lösch (1954 [1944]), who expanded on Christaller's (1933) theory of central locations to illustrate the spatial distribution of locations, and Isard (1956), who sought to optimise all significant factors. Subsequently, globalisation dynamics necessitated the examination of complex, interrelated and interdependent location factors. For example, Porter (2000) explored the advantages of clustering and agglomeration,

which are closely associated with settlement decisions. The examination of spatial distribution has become the primary field of research in regional microeconomics.

Building upon Thünen's (1826) theory of agricultural land use, Alonso (1964) replaced Thünen's concept of an 'isolated city' with a central business district and examined the surrounding urban land use. According to Alonso's theory, the city centre serves as the sole market, housing both business establishments and households. These economic actors select their optimal locations by considering transport and land use costs. Utilising Alonso's (1964) monocentric city model, McCann (2001) attempted to map the spatial location and ordering of economic sectors. Based on his findings, the order of sectors starting from the city centre is as follows: business services, residential services, manufacturing, logistics services and agriculture. It is important to note that these zones are not rigidly defined, and his findings are more applicable to theoretical research. The monocentric urban model needs to be adjusted to better reflect reality, as other economic centres often emerge alongside the city centre, creating a polycentric model. In the polycentric model, the most profitable business services and government offices are located in the urban business district, followed by manufacturing centres mainly near transportation hubs, and finally by commercial/logistics centres on the outskirts of the city (Stutz & De Souza, 1998; McCann, 2001).

The suburbanisation process occurs in two stages, with population deconcentration preceding the relative deconcentration of economic activities (Chiang, 2012). After the turn of the millennium, the increase in suburban residents was accompanied by an accelerated deconcentration of economic activities (Nilsen et al., 2020; Wu et al., 2020; Săgeată et al., 2023). Although urban environments offer many non-transferable advantages, there is an outflow of economic activities from cities (Dej & Jarczewski, 2018), as some traditional location factors seem to lose their importance.

Several driving forces contribute to industrial decentralisation, including lower population density and a broader labour supply. When a company relocates outside the city centre, it can hire onsite employees from more distant regions. The development of transport infrastructure, which can be both a cause and an effect of suburbanisation, also acts as a driving force. This is particularly evident with the development of highways and expressways, along which the concentration of companies can be observed (Brueckner, 2000; Săgeată et al., 2023). Furthermore, companies often find more affordable and higher-quality land in suburban areas, making it an important location factor for industrial firms (Konopielko et al., 2021). Another motivating factor for decentralisation is excessive corporate concentration in the centre, which can lead to additional costs over time (Combes & Duranton, 2006). However, it should be noted that industrial suburbanisation is not accompanied by a decline in the number of companies in the city centre; both are increasing in parallel (Wu et al., 2020). When making location decisions, companies evaluate both material and non-material factors, including transport options, raw materials, markets, labour, externalities (such as urbanisation and localisation benefits), energy, infrastructure, capital, land, buildings, environmental conditions and government policies (Hayter, 1997). Prioritising these factors is challenging, as the considerations for choosing a location can vary significantly across different economic sectors. Companies that utilise natural resources are location-dependent, making the presence of specific natural resources a decisive factor in their choice of location. A study commissioned by the EU (Netherlands Economic Institute and Ernst & Young, 1994) found that for traditional industries, the proximity and quality of the national market, roads, and railways are crucial. For manufacturing, the presence of an appropriately skilled workforce is important. These factors are equally significant for high-tech industries; however, the quality and skills of the workforce, the proximity of similar activities, government attitude and regional attractiveness are also decisive. For transport and warehousing companies, proximity to transport infrastructure is key. In the services sector, the proximity and quality of transport infrastructure are crucial factors, alongside labour, while for research and development, proximity to the European market, the presence of similar activities and the quality of the labour force are important. In addition, Archer and Smith (2003) found that an urban environment is essential for effective office functions.

The European Union research (Netherlands Economic Institute and Ernst & Young, 1994) is supported by Choi's (2020) study of urban areas in South Korea. Choi found that jobs requiring cognitive knowledge (e.g. science professionals, education professionals, and legal and administrative occupations) are more spatially clustered, as an urban framework is crucial for organisations

needing cognitive skills. Similarly, organisations requiring employees with technical skills (e.g., information and communication professionals, technical occupations, transport- and machine-related trade occupations, electric- and electronic-related trade occupations) also tend to spatially concentrate and cooperate across companies to reduce industry uncertainties and exploit agglomeration advantages. Consequently, clustering and the emergence of localisation economies, with firms in the same industry located close to each other, are triggered (Baldwin et al., 2008).

Research methodology and data collection

As suggested by the above overview, inequalities exist in the spatial distribution of firms and industries. Additionally, Hungary is characterised by growth poles and significant spatial disparities in the location and concentration of economic activities. This research has three main objectives: (1) to examine the spatial distribution and concentration of companies, (2) to explore factors that influence company location and (3) to investigate the presence of industry clustering (also as a potential location factor) in the agglomeration of Győr. To achieve these objectives, the sample was first determined. There are 879 companies (with more than 10 employees) in Győr and its agglomeration; of these, 261 were included in the sample, as only companies located in agglomeration municipalities were considered. However, five companies were excluded from the analyses due to incomplete data, resulting in a final sample of 256 companies. The analyses are based on data from the year 2022, provided by Opten Ltd.¹ In Figure 1, the agglomeration areas comprising 68 settlements included in the study are shown in light grey, while the locations of the companies included in the study are indicated by blue dots.

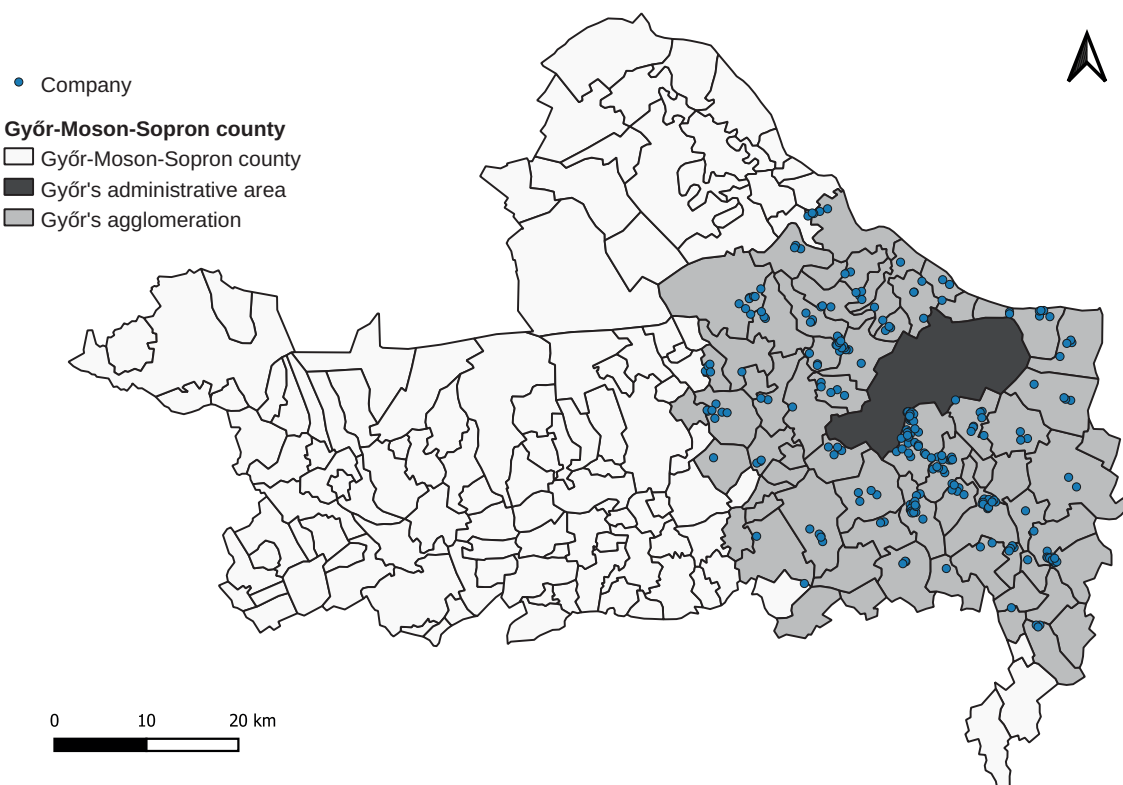


Figure 1. The study area and the analysed companies

Source: Authors' compilation.

Following the area delimitation, the coordinates of the companies included in the analysis were collected and made available for plotting. Subsequently, a point pattern analysis was conducted to

¹ The authors wish to thank Opten Ltd. (<https://www.opten.hu>) for providing free access to their database.

examine the location and spatial distribution of the companies, revealing their spatial concentration. To achieve the first research objective, the companies were mapped using their coordinates. A quadrat analysis was then conducted, dividing the area into equal parts to examine the companies' locations. Factors such as the road network, physical and industrial proximity, population and local tax exemption were considered to identify elements facilitating company location. For the third research objective, the companies were grouped by industry classification, according to the Hungarian Standard Industrial Classification of Economic Activities (TEÁOR'08), based on the NACE system of the European Union. The 256-point distribution was analysed by industry to detect trends in industry clustering. To achieve this, the companies were represented on a map based on their industry, and settlements with the highest concentration were highlighted and studied.

Findings and discussion

This chapter presents the findings and analyses the results of the research in relation to the three main research aims.

Spatial concentration and location factors

As shown in Figure 2, the spatial distribution of companies reveals a notable concentration at several points within the study area.

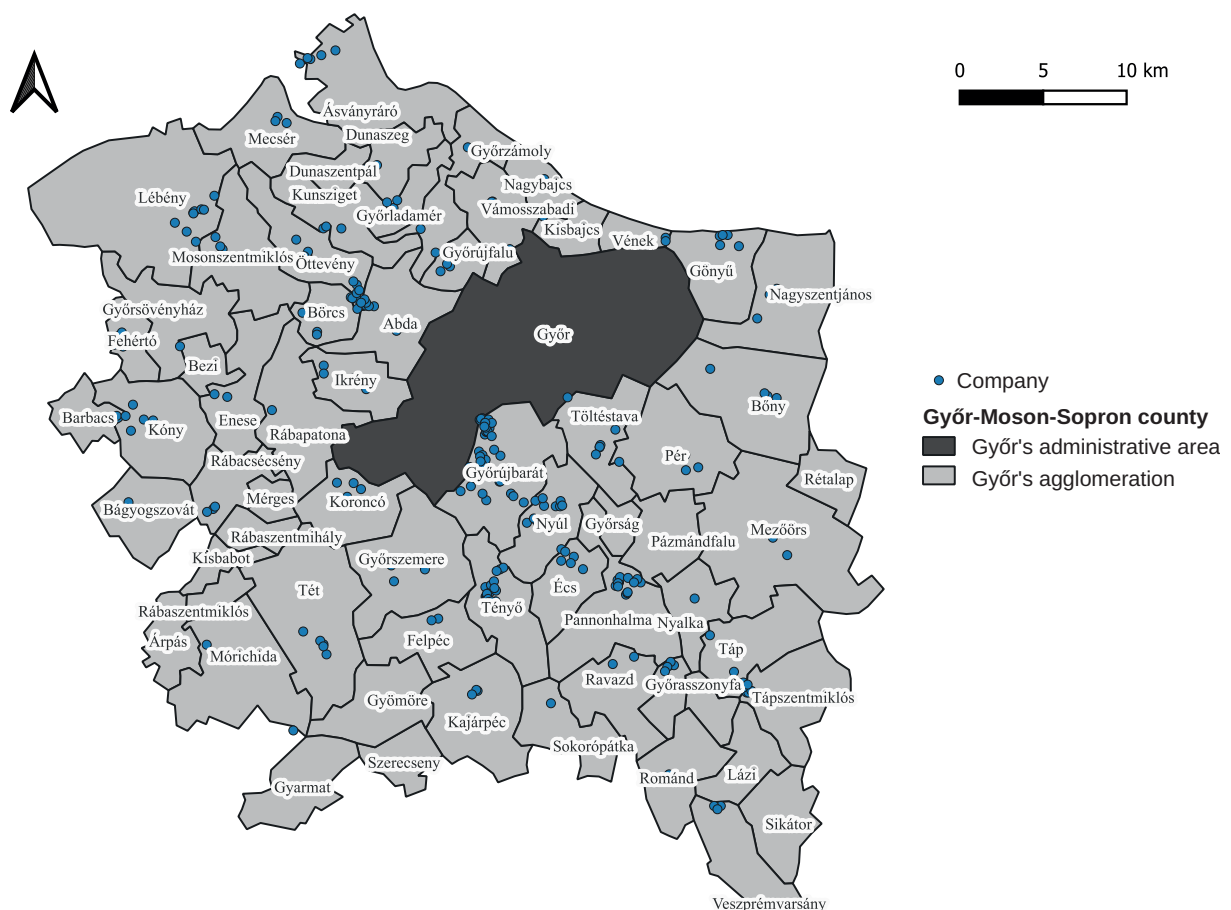


Figure 2. Spatial distribution of the examined territorial units and companies

Source: Authors' compilation.

Although the clustering of companies is clearly visible in Figure 2, a more precise analysis using a statistical method is warranted. Given the spatial point data, the 256-point distribution was

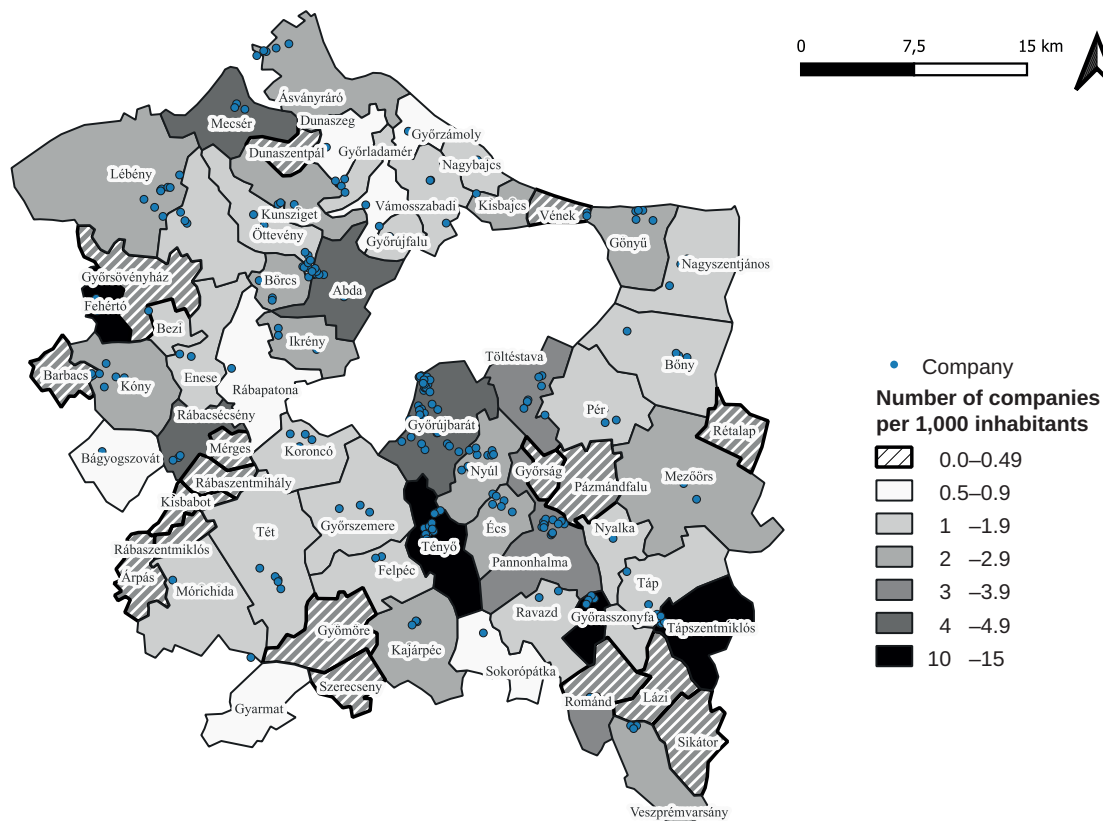


Figure 4. The number of companies per 1,000 inhabitants in the agglomeration settlements

Source: Authors' compilation.

The selection of Tényő as a business location is likely due to its proximity to Győrújbarát, Nyúl and Pannonhalma, which are connected to Győr by a main road and have high investment potential. Another reason for the concentration of businesses in these settlements could be the local business tax exemption, which, however, ended in Tényő in 2022. Currently, two agglomeration settlements, Tarjánpuszta and Fehértó offer local business tax exemptions (Magyar Államkincstár, 2023). This can explain the high number of companies in these municipalities with fewer than 500 inhabitants.

Figure 5 shows the motorway and the main roads in Győr and its agglomeration area. The figure demonstrates that most of these larger concentrations (Abda, Győrújbarát, Nyúl and Pannonhalma) are located along the highway and main roads, and companies predominantly choose locations along these routes.

As shown in Annex 2 and Figures 2 and 3, Győrújbarát, Tényő, Abda, Nyúl, Pannonhalma and Tápszentmiklós stand out, with 43.75% of the enterprises located in these municipalities, forming sub-centres next to Győr. A larger sub-centre is also evident, as Győrújbarát, Nyúl, Pannonhalma and Tényő are neighbouring settlements. The proximity of these densely populated and concentrated municipalities can be another influencing factor for companies when selecting a location.

Industrial clustering

To explore the reasons behind these concentration points, a sectoral analysis was conducted, as different business activities may have varying motivations.

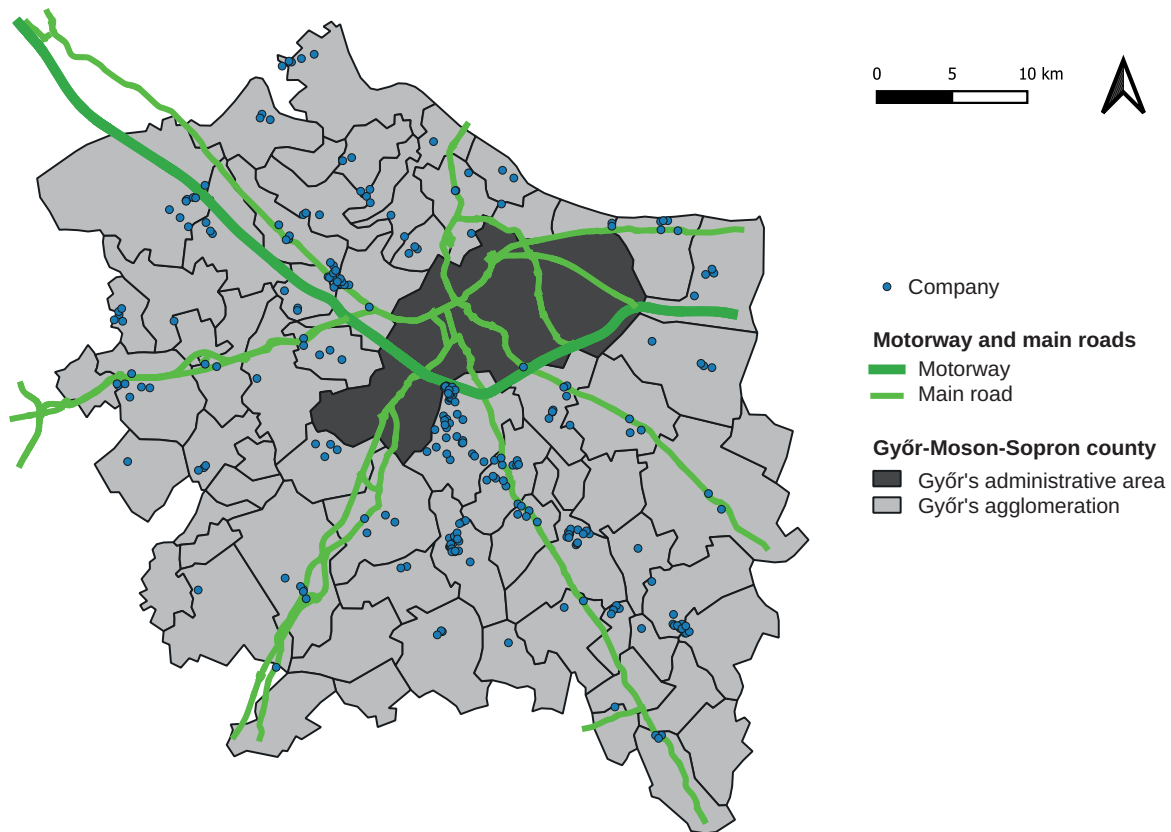


Figure 5. The motorway and the main roads in Győr and its agglomeration area

Source: Authors' compilation.

Table 1. Distribution of the examined companies by main activity in the sector

Industrial sector according to main activity	Number of companies
Manufacturing industry	56
Trade, automobile manufacturing	47
Construction industry	41
Delivery, storage	35
Agriculture, forestry, fishing	26
Accommodation service, hospitality	17
Administrative and service support activities	13
Professional, scientific, technical activity	8
Human health and social care	4
Art, entertainment, leisure	3
Water supply, wastewater collection, treatment, waste management, decontamination	3
Information, communication	1
Real estate	1
Education	1
Total	256

Source: Authors' compilation.

As shown in Table 1, the sectoral categorisation of the surveyed enterprises by primary activity reveals five main sectors (each represented by more than 20 companies) located in the suburbs.

Specifically, 21.875% (56 companies) belong to the manufacturing industry, 18.36% (47 companies) to the trade and motor vehicle manufacturing industry, 16.02% (41 companies) to the construction industry, 13.67% (35 companies) to the transport and storage industry and 10.16% (26 companies) to the agriculture, forestry and fishing industry. The dominant industries, therefore, are construction, manufacturing, trade and motor vehicles, and transport and storage, exhibiting the highest concentration.

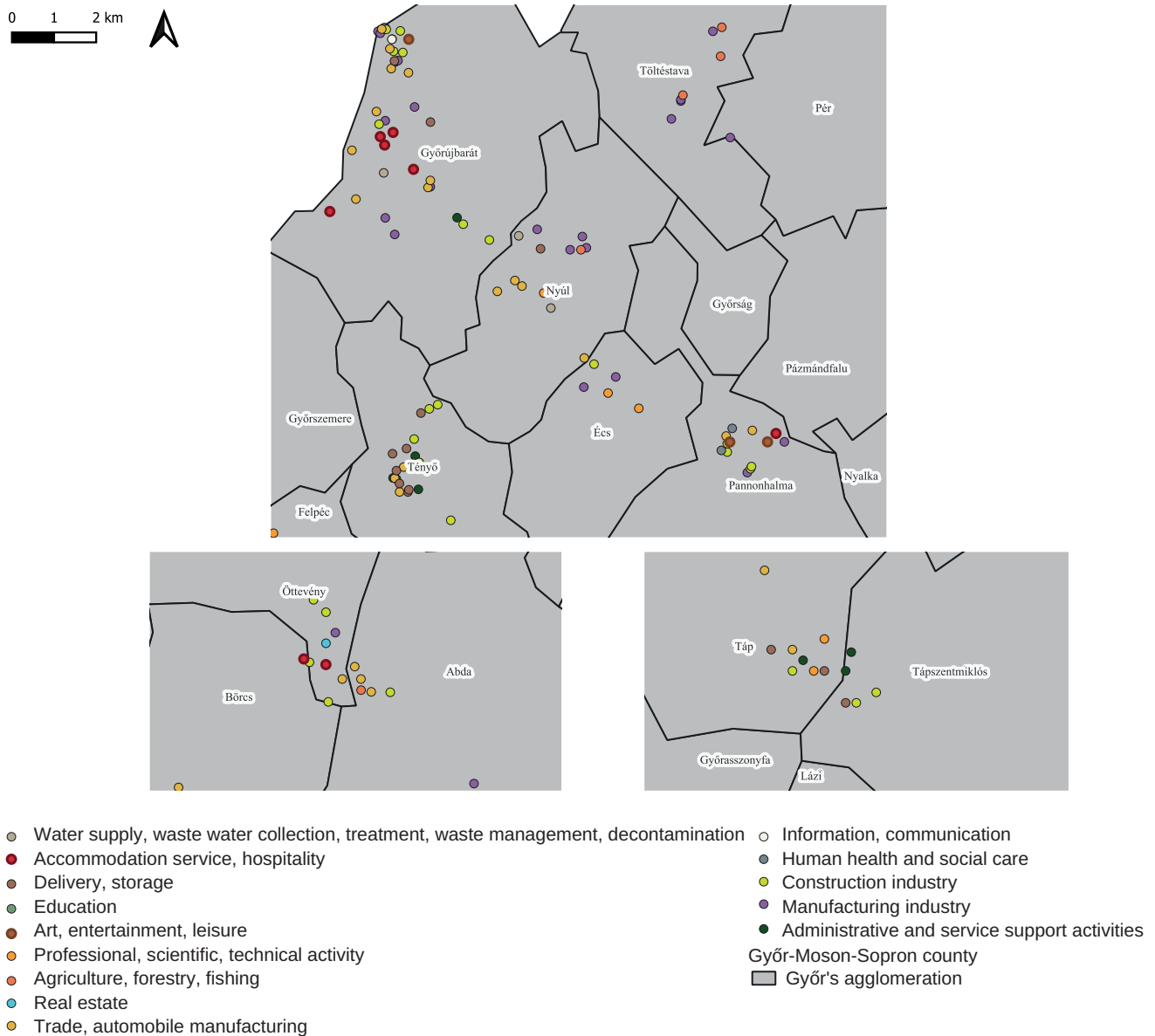


Figure 6. Spatial distribution of companies by main activity sector in the sub-centres

Source: Authors' compilation.

Examining the sub-centres (settlements with more than 10 companies) identified by the number of companies, we observe that in the case of Győrújbarát, the manufacturing industry (12 companies, including three packaging materials manufacturers and four metalworking companies), the construction industry (seven companies) and the distributive trades industry (six wholesale and two retail companies) are concentrated. In Tényő, the main activities are transport and storage (seven companies) and construction (five companies), but there are also a high number of administrative and support activities (four companies). In Abda, construction (five companies) and trade (four companies) are predominantly concentrated. For the other sub-centres, the industrial

concentration is less pronounced, with six industrial enterprises in Pannonhalma and Nyúl, and five in Tápszentmiklós (Figure 6). These data suggest a tendency towards localisation economies, where companies in the same industry or producing complementary products are located close to each other.

Conclusion

One result of globalisation has been the increasing dominance of urban areas, leading to a high concentration of social and economic activities in cities. However, contemporary suburbanisation processes have not only decentralised the population but also prompted the relocation of companies to suburban areas. Building on these phenomena, this study examined the spatial distribution of companies in a Hungarian agglomeration, focusing exclusively on a suburban area. The study aimed to investigate the location and spatial distribution of economic activities in the agglomeration of Győr, revealing the spatial concentration of firms, the clustering of industries, and the emergence of sub-centres alongside the central settlement (Győr). Additionally, the study explored factors that facilitate company location in the study area. The findings suggest that Győr's agglomeration is characterised by a high degree of spatial concentration of companies, industrial clustering and the emergence of industry sub-centres.

These results offer valuable insights into the economic structure of the agglomeration and enhance our understanding of companies' location decisions. The study examined a total of 256 economic actors, revealing a high degree of concentration around the county seat, Győr, particularly on its south eastern side. Furthermore, nearly half of the enterprises (43.75%) are concentrated in six municipalities with the highest concentration: Győrújbarát (15.23% of the agglomeration's companies), Tényő (7.42%), Abda (5.86%), Nyúl (5.08%), Pannonhalma (5.08%) and Tápszentmiklós (5.08%). This finding aligns with the polycentric model (Stutz & De Souza, 1998; McCann, 2001), as Győr, with 618 companies, exhibits significant overconcentration, while smaller sub-centres are formed by a high concentration of firms. Similarly, examining the Warsaw Urban Agglomeration, Chmielewski et al. (2014) found that smaller sub-centres with relatively high populations and predominantly industrial and service activities had developed along the main road network lines.

To analyse these phenomena in greater depth, we also examined companies by industry. Five main sectors were found to concentrate in the suburbs: manufacturing, trade and motor vehicles, construction, transport and storage, and agriculture, forestry and fishing. The results show that these dominant industries exhibit a greater propensity to cluster. Similar results were observed in the sub-centres, where these sectors are concentrated in large numbers. These findings align with Choi's (2020) research, which indicates that these industries primarily require employees with technical skills, who tend to spatially concentrate. Moreover, they support studies on the valorisation of localisation economies (e.g. Marshall, 1920; Beckmann, 1999; Andersson & Löf, 2011), which suggest that in the wake of globalisation, firms prefer the presence and geographical proximity of enterprises in the same or similar industries or producing complementary products.

We examined factors that companies might have considered when selecting a location in the agglomeration. Based on the statistical results of the research, five potential location factors were identified: (1) spatial proximity to the central business district; (2) spatial proximity to sub-centres formed by a high concentration of companies; (3) spatial proximity to companies performing the same or similar activities or manufacturing complementary products; (4) spatial proximity to transport hubs, particularly main roads and motorways; and (5) local business tax exemption. Identifying of additional location factors requires further investigation.

The authors acknowledge the limitations of their study. For example, the issue of spatial dynamics has not been addressed, and only one aspect of freedom of location – local business tax exemption – has been considered. Examining temporal trends would allow for a description of the suburbanisation process of economic activities, while research into the regulatory framework of economic activities would reveal factors that, alongside local business tax exemption, can hinder or promote location freedom. These are considered further lines of research, the results of which could further enrich and refine the present findings. The results also provide a relevant basis for future research. In this study, a general survey was conducted, and further micro-level studies are

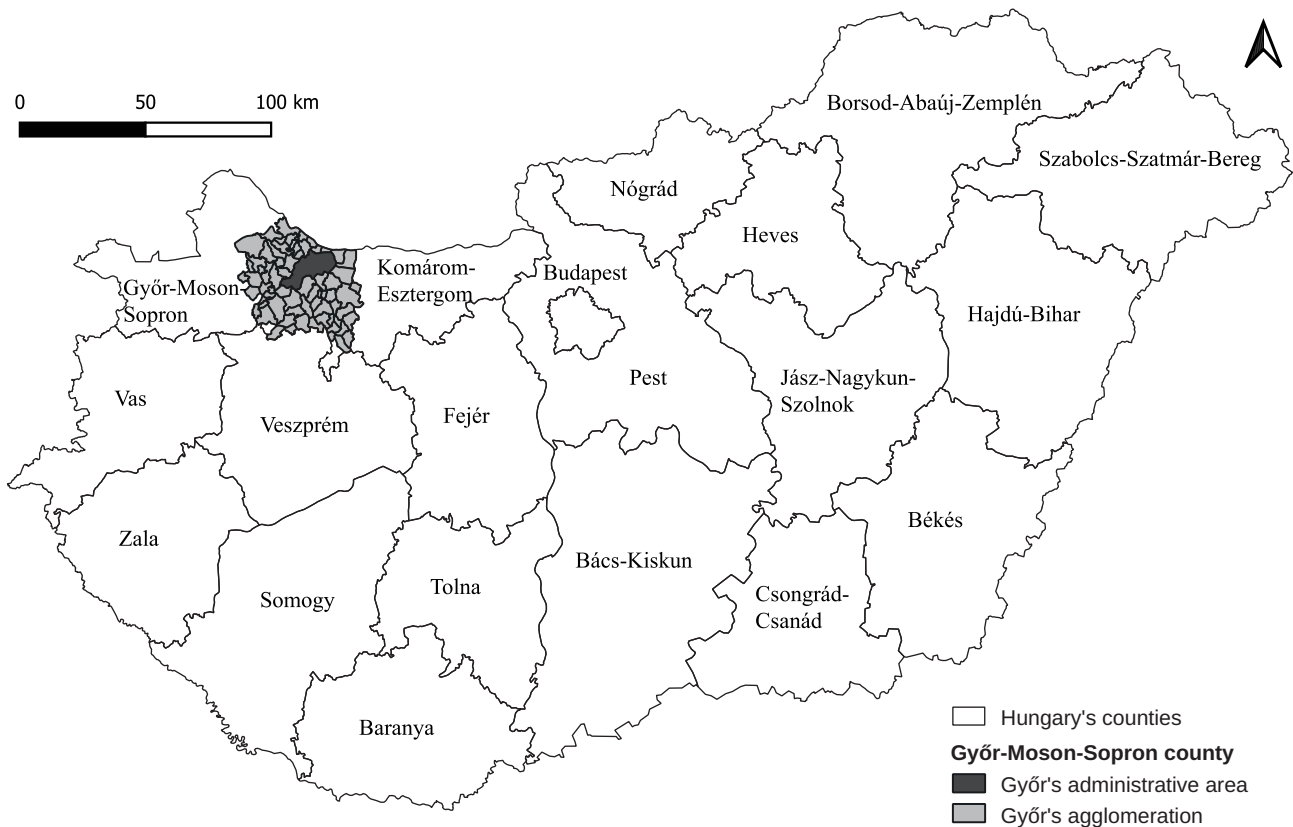
needed to fully investigate the range of factors that motivate location choices in the agglomeration of Győr. By broadening the scope of the variables included in the research, further investigations can be conducted. In the future, to avoid measurement errors, we aim to investigate regularities in the location of companies using point spatial data and additional statistical methods. Additionally, Győrújbarát, Nyúl, Pannonhalma and Tényő are neighbouring settlements that collectively form a larger sub-centre. Future studies will explore the reasons behind this significant spatial clustering.

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Annex 1.

Hungary's counties and the location of the examined area, the agglomeration of Győr



Annex 2.

Number of companies per municipality

Settlement	Permanent population on January 1, 2023		Number of companies (October 1, 2022)	Number of companies per 1 000 people	
Győrújbarát	8 141	1.	39	4.791	6.
Tényő	1 828	27.	19	10.394	3.
Abda	3 368	9.	15	4.454	8.
Nyúl	4 709	2.	13	2.761	13.
Pannonhalma	3 602	7.	13	3.609	9.
Tápszentmiklós	928	40.	13	14.009	1.
Töltéstava	2 630	17.	9	3.422	10
Lébény	3 346	10.	8	2.391	16.
Gönyű	3 406	8.	7	2.055	23.
Kóny	2 780	13.	7	2.518	15.
Écs	2 260	21.	6	2.655	14.
Ásványráró	2 225	22.	5	2.247	18.
Fehértó	499	48.	5	10.020	4.
Tarjánpuszta	427	49.	5	11.710	2.
Tét	4 181	3.	5	1.196	39.
Bőny	2 318	20.	4	1.726	30.
Győrszemere	3 679	6.	4	1.087	43.

Annex 2. – cont.

Győrújfalú	2 526	18.	4	1.584	32.
Ikrény	1 974	24.	4	2.026	24.
Koroncó	2 758	14.	4	1.450	36.
Mosonszentmiklós	2 714	16.	4	1.474	35.
Nagyszentjános	2 017	23.	4	1.983	26.
Öttevény	3 105	11.	4	1.288	38.
Vámoszabadi	3 927	5.	4	1.019	44.
Börcs	1 428	29.	3	2.101	19.
Győrladamér	1 903	25.	3	1.576	33.
Kajárpéc	1 329	32.	3	2.257	17.
Kunsziget	1 430	28.	3	2.098	20.
Mecsér	660	43.	3	4.545	7.
Pér	2 749	15.	3	1.091	41.
Rábacsécsény	618	44.	3	4.854	5.
Veszprémvarsány	1 062	36.	3	2.825	12.
Dunaszeg	2 444	19.	2	0.818	46.
Enese	1 838	26.	2	1.088	42.
Felpéc	1 008	37.	2	1.984	25.
Győrzámoly	3 949	4.	2	0.506	50.
Kisbajcs	957	39.	2	2.090	21.
Mezőörs	968	38.	2	2.066	22.
Nagybajcs	1 224	34.	2	1.634	31.
Rábapatona	2 809	12.	2	0.712	48.
Ravazd	1 280	33.	2	1.563	34.
Bágyogszovát	1 346	31.	1	0.743	47.
Bezi	531	46.	1	1.883	27.
Gyarmat	1 423	30.	1	0.703	49.
Győrasszonyfa	531	47.	1	1.883	28.
Mórichida	848	41.	1	1.179	40.
Nyalka	539	45.	1	1.855	29.
Románd	331	50.	1	3.021	11.
Sokorópátka	1 144	35.	1	0.874	45.
Táp	743	42.	1	1.346	37.
Total	104 440		256	2.451	

Source: Authors' compilation