

Changes in the density and location of supermarkets in Bratislava

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Abstract. The main area of research is the dynamically developing capital city Bratislava and traditional supermarkets in its territory. The aim of the article is to examine the changes in the number of supermarkets in Bratislava and its districts between 2016 and 2021. In this publication, we apply analysis and synthesis in all phases of problem solving. We also use induction, deduction and the method of comparison. Finally, we apply the entropy calculation in a figurative sense to retail geography. The result will be the density of coverage of supermarkets in Bratislava and its individual city districts as a prerequisite for future development and in-depth research devoted to this issue.

Key words: Location, Geographical Concentration, Supermarkets, Entropy

JEL Classification: C23, M31, R12

1 Introduction

The dynamically growing capital city of Bratislava attracts the attention of retail geography, which forms the core of this article. Due to the constantly changing population and high mobility, besides the construction of new housing units as well as workplaces, this city is interesting also for the construction of new retail stores. Under this term in the article, we mean traditional stone supermarkets with food assortment. The issue is very lively and therefore needs to be constantly observed and latest changes to be recorded. The main question is whether the coverage and distribution of all supermarkets in Bratislava and its districts is sufficient for consumers.

The aim of the article is to examine the changes in the number of supermarkets in Bratislava and its districts during the period between 2016 and 2021.

We observe the situation in the capital during the mentioned timeframe and we record changes in the number and density of supermarkets within individual city districts. Based on the obtained data, we calculate the relative entropy. The resulting

information serves as a basis for further research devoted to the related issues examined in depth.

2 Current state of the problem

Several authors deal with the mentioned topic focusing on the concentration of retail units in cities. By defining the theoretical and actual number of retail units and comparing these two numbers, the authors obtained information on the surplus and deficit of retail units in individual cities (Bilková and Križan, 2013). Authors such as Lang, Marcon, and Puech see special concentration outcome through a methodology that is based on the distance used to improve the spatial economy of all economic activities through accurate assessments of spatial organization (Lang, Marcon, Puech, 2016).

2.1 Supermarkets

Recently, retail has undergone changes. At present, apart from the epidemiological situation in the world, the consumer is looking for a supermarket, where he will also get his senses stimulated. It is a form of a traditional supermarket where the consumer can enjoy small snacks in various forms, before, during or after shopping. Shopping thus becomes an experience. According to the author Kotler, retail includes all activities related to the sale of goods or services directly to the final consumer for personal, non-commercial use. Any organization can be involved in this type of sale, be it a manufacturer, wholesaler or retailer. It does not matter how and where the goods or services are sold (Kotler, 1995). The online world of which we are a part, pushes us into shopping from the comfort of living-room using the internet. However, from the point of view of retailers owning grocery stores, their biggest benefit is that the online supermarket cannot compete in creating the so-called shopping experience. Customers welcome options such as breakfast in the supermarket, especially in the big cities. In Slovakia, therefore, we focus mainly on the capital, where, for example, in the most recent networks of YEME supermarkets, they provide the aforementioned services.

2.2 Geographical concentration

From the point of view of location, it is necessary to pay attention to retail outlets that already exist and to build new stores on the basis of these data. Consumer preferences must also be taken into account. The existence of retail units at the interregional and regional level is mainly due to the right strategy based on a precise analysis of the market environment (Cimler, 1994; Kunc et al. 2012). Another important factor that will tell us a lot about the correct location is the population density in a given place. At first glance, it may seem that the problem of the lack of stone retailers affects more rural areas, but this is not the case. In cities, although the supermarket has some form

of accessibility, it depends on the overall availability from the consumer's point of view. This is very closely related to the customer's income level, supermarket prices and location (Karamychev, van Reeve, 2009). There are two options here: food is economically available but not located in the area or food occurs in the locality but is not accessible from an economic point of view, e.g. the goods are sold out or too expensive.

The ideal sample is a city like Bratislava, because a large portion of the population is concentrated here. There are several reasons why this is so. First of all, Bratislava creates many job opportunities, hosts many universities and students and last but not least, new buildings are growing really fast. All the above facts are closely related to our issue, i.e. the construction of new retail stores and their proper location. The food market has a clear tendency to concentrate, leading to the creation of global businesses (retail chains) and strategic business alliances. Concentration also takes place at the level of organizational and spatial accessibility (retail units are concentrated in the shopping center, retail space, etc.) (Jánska et al. 2017).

3 Methodology

The presented article can be characterized as analytical in terms of the methods used. The methods used correspond to the article's character, especially general scientific methods, analysis and synthesis in all phases of solving the problem. At the same time, we use scientific and philosophical methods such as induction and deduction, the method of comparison. Finally, we use a method known for retail geography, entropy calculation.

The concept of entropy is based on the basic law of physics, according to which everything leads to a state of maximum disorder or randomness. Using the entropy calculation formula, we can measure the spatial variance of the population. Entropy in a figurative sense can also be used to calculate the concentration of supermarkets in the capital. The more dispersed the population in the universe, the higher the entropy. To approximate the concept of entropy, it should be noted that geographers use it to measure the outflow of people from the countryside. When the entropy is low, the dispersion of the population decreases, and thus the concentration of the population is higher (Cliquet G., Fady, A., Basset G., Groizean J-P., 2006).

The aim of the article is to examine the changes in the number of supermarkets in Bratislava and its districts during the period between 2016 and 2021.

The research took place in Bratislava, the capital of Slovakia, as it is the largest metropolitan area in Slovakia. The method consists in determining the geographical distribution of all supermarkets with food assortment and their concentration in Bratislava using digital maps from Google and subsequent calculations according to the formulas below.

Based on the defined goal, a hypothesis was formulated:

The total density of coverage of supermarkets in Bratislava and its districts increased in 2021 compared to 2016.

3.1 Calculation of relative entropy

The formula for calculating entropy applied to supermarkets assumes that with their development will increase their area coverage.

Formula used to calculate the territorial coverage of supermarkets in Bratislava:

$${}^k\mathbf{E} = - \sum \mathbf{f}_i * \mathbf{log} \mathbf{f}_i \quad (5)$$

$i = 1$, where:

E -entropy

k -number of divided geographical areas

log -logarithm

f_i -number of retail units within the area

Relative entropy application:

$$\mathbf{RE} = \mathbf{E} / \mathbf{log} \mathbf{k} \quad (3)$$

k is calculated in the interval $[0, 1]$ to ensure the simplest comparison with the competition (Cliauet G., Fady A., Basset G., Croizean J-P., 2006). To calculate the relative entropy in Bratislava, $k = 5$ due to the administrative division into 5 districts (Bratislava 1, Bratislava 2, Bratislava 3, Bratislava 4, Bratislava 5).

Table 1 Number and type of stores by brand in Bratislava in 2016 and in 2021¹

Brand	Type of store	No. of stores	No. of stores
		2016	2021
Billa	supermarket	20	27
Carrefour	hypermarket	2	0
CBA	supermarket	3	1
DELIA	small shop	9	31
Jednota	supermarket	4	3
Kaufland	department store	6	7
KON-RAD	supermarket	1	1
Lidl	discount supermarket	16	18
Malina	small shop	5	28
Môj obchod	small shop	8	9
Samoška	supermarket	7	1
Terno	supermarket	11	43
Tesco	hypermarket/supermarket	26	30
YEME	supermarket	1	4

¹ Source: Jánska et al. 2017, Own processing

Sum	119	203
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Table 1 shows the number of retail units per chain in 2016 and 2021. Based on the data obtained in 2021, the highest number of stores have Terno and Delia. The decline occurred between retail chains such as Samoška, Carrefour and CBA. There were no changes in KON-RAD stores. The newest retail chain on the market is the YEME food network.

Table 2 Distribution of stores in the city districts of Bratislava in 2016 and in 2021²

Year	BA I	BA II	BA III	BA IV	BA V	Sum
2016	20	32	20	18	29	119
2021	38	58	40	26	41	203

Table 2 quantifies the number of supermarkets in individual city districts of Bratislava. In 2021, most food chains were concentrated in the district of BA II - Podunajské Biskupice, Ružinov, Vrakuňa. On the contrary, the lowest number of stores is found in the district of BA IV - Devín, Devínska Nová ves, Dúbravka, Karlova Ves, Lamač, Záhorská Bystrica. The total number of retail units increased by 84 supermarkets during the research period.

4 Results and discussion

The article focuses on supermarket chains, while assuming that they provide a complete range of fresh foods at low cost and profit margins (Jánska et al. 2017). This is consistent with, for example, the work of Leat et al. (2011). In 2016, field research located 119 stores under 14 chains (Jánska et al. 2017). In 2021, the survey of supermarkets was made on the basis of data collected from digital maps from Google and brands' websites.

Table 3 Calculation of relative entropy for a complete set of supermarkets in individual districts of Bratislava in 2016³

District	f_i	$\log f_i$	$f_i \log f_i$
Bratislava 1	0,168067	-0,774517	-0,130171
Bratislava 2	0,268908	-0,570397	-0,153384
Bratislava 3	0,168067	-0,774517	-0,130171

² Source: Own processing

³ Source: Jánska et al. 2017

Bratislava 4	0,151261	-0,820274	-0,124075	
Bratislava 5	0,243697	-0,613149	-0,149423	
	E	k	log k	RE
	0,687224	5	0,69897	0,983195

Table 4 Calculation of relative entropy for a complete set of supermarkets in individual districts of Bratislava in 2021⁴

District	f_i	$\log f_i$	$f_i \log f_i$	
Bratislava 1	0,187192	-0,727712	-0,136222	
Bratislava 2	0,285714	-0,544068	-0,155448	
Bratislava 3	0,197044	-0,705436	-0,139002	
Bratislava 4	0,128079	-0,892523	-0,114313	
Bratislava 5	0,201970	-0,694712	-0,140311	
	E	k	log k	RE
	0,685297	5	0,69897	0,980438

Tables 3 and 4 show the relative entropy of all supermarket chains in Bratislava in 2016 and 2021. In the current research, we do not need to distinguish between the size of supermarkets or their mutual competition. We are currently interested in the number of stores in Bratislava. The calculation is performed for all five districts of the capital. It is necessary to calculate a non-standard number of decimal places for the accuracy of the result.

Table 5 Calculation of relative entropy for individual supermarket chains in 2021⁵

Brand	E	log k	RE
Billa	0,68534	0,69897	0,98050
CBA	0	0,69897	0
DELIA	0,58179	0,69897	0,83235
Jednota	0,27643	0,69897	0,39549
Kaufland	0,58707	0,69897	0,83991
KON-RAD	0	0,69897	0

⁴ Source: Own processing

⁵ Source: Own processing

Lidl	0,64879	0,69897	0,92820
Malina	0,56515	0,69897	0,80855
Môj obchod	0,49903	0,69897	0,71395
Samoška	0	0,69897	0
Terno	0,67171	0,69897	0,96100
Tesco	0,67382	0,69897	0,96402
YEME	0,60206	0,69897	0,86135

Previous calculation is needed as a basis for future research, which will take into account the competition between supermarkets and a deeper analysis according to their size.

The value of f_i and $f_i \log f_i$ was calculated for each retail brand in order to obtain the relative entropy of each retail chain in Bratislava.

In 2016, KON-RAD was the only chain to reach an entropy value of 0. On the contrary, Tesco achieved the highest entropy value in 2016 (Jánska et al. 2017).

From the above table no. 5, we can interpret that KON-RAD did not change in terms of entropy compared to 2016, on the contrary, CBA and Samoška networks with entropy 0 have been reduced in Bratislava till 2021. It follows that the three mentioned retail chains have poor coverage in Bratislava. Networks such as Billa, Terno and Tesco represent the strongest coverage. This means that they serve the major territory of Bratislava.

Given the fact that the population of Bratislava is constantly growing, we believe that this factor is closely related to the growth of supermarkets in the same area. Where demand grows, so does supply. During the years we studied, the largest increase in the number of inhabitants in Bratislava was recorded in 2019 (Open Data Bratislava, 2019). The Statistical Office speaks of an increase of 4862 citizens (Štatistický úrad Slovenskej republiky, 2019).

5 Conclusion

The hypothesis: "The total density of coverage of supermarkets in Bratislava and its districts increased in 2021 compared to 2016." was confirmed.

Based on the data from Table 2, we can confirm that there was a significant increase in the number of stores in each of the five districts of Bratislava. The largest increase was recorded in the district of BA II. Compared to 2016, the number of stores increased by 84 new retail stores located in 2021.

The results of relative entropy for the capital as a whole compared to two milestones 2016 and 2021 show a negligible decrease in relative entropy. Despite this finding, we can state that the value of relative entropy currently indicates a significant coverage by retail stores in Bratislava. For consumers, this means that the city has enough traditional supermarkets. In 2021, in the district of Bratislava IV, we observe the largest decline

in the coverage of food chains. At the same time, we record the most significant increase in retail coverage in the Bratislava III district.

From Table 5 we can deduce that some supermarket chains are gradually disappearing and being replaced by new networks such as YEME, where the customer gains a shopping experience - experiential marketing. To keep the entropy high, it is necessary to constantly monitor the problem along with changing external factors.

The retail market in Slovakia, like the markets of other Central European countries, is characterized by an enormous increase in distribution concentration and radical changes in distribution channels. Most supermarkets in retail chains have a centralized shopping and distribution centers. Supermarkets account for a large portion of processed or fresh food sales among a limited number of preferred suppliers. Territorial changes in the distribution of supermarkets will continue to reflect changes in food demand, current trends in healthy food, changes in settlement or the creation of new districts (Jánska et al. 2017).

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