

SPATIAL CONCEPT OF MARKET ZONES IN THE CZECH REPUBLIC

Pavla Bednářová

Abstract

Regional economy introduces space into economic theories and to practical procedures – a spatial economic system is introduced which is understood as "a complex of elements in interaction". The aim of the article is to create a spatial concept of market regions (market zones) on the basis of the detection of market spatial interactions with an accent on the actual commutation relations while accepting the current administrative division of the Czech Republic (CR). In connection with the main aim it is necessary to identify market centres (price determining places), determine their gravitational force with regards to their surroundings. As a result of the interconnection of market, administrative and transport principle, 10 market centres of the first degree were detected in the CR and they were all metropolitan cities with high concentration of demand, high centre dominance and strong spatial relations towards its surroundings. These centres also often have the highest prices. The centres of the second degree, in the CR 14 towns in total, are hierarchically below and in connection with regional price disparities these are centres with lower level of regional prices. Having taken into account all three approaches to the hierarchy of market centres, a final map of market regions was created (in Geographic information system GIS) which captures the distribution of market centres of the first and second degree, the boundaries of the market zones belonging to the centres with the accent on actual commutation relations while accepting the current administrative division of the Czech Republic.

Key Words: Market Centres, Market Zones, Localisation, Spatial Concept, Nodal Centre.

JEL Classification: R12, R23

Introduction

The article was written as a part of the applied research project TD020047 "Regional Price Index as the Indicator of the Real Social and Economic Disparities" supported by the Technology Agency of the Czech Republic - the Omega Programme, which deals with the issue of spatial comparison of price levels of regions in the Czech Republic. The neoclassical theoretical concept is based on an assumption that the price is determined by the interaction of supply and demand where the supplying party tries to maximize its profit while the demanding party strives to maximize its utility from consumption. Market mechanism of pricing and adaptation of supply and demand is applied. Regional economy introduces space into economic theories and to practical procedures – a spatial economic system is introduced which is understood as "a complex of elements in interaction", including producers, consumers, communities, economic centres, and all these components are interconnected by flows of property, energy, services, persons and information. Spatial organization of production reflecting relations between demand, supply and price is based on economic relations including the influence of distance on costs, demand space potential of the sale/consumption, spatial relations of businesses in competition in hierarchical relations of economic centres in the space, the influence of transport corridors, the distribution of population with regards to the creation of market zones, consumer mobility, location rent and other factors.

The aim of the article is to create a map prepared in GIS¹ illustrating **spatial concept of market regions** (market zones) on the basis of the **detection of market spatial interaction with an accent on actual commutation relations while accepting the current administrative division of the Czech Republic**. In connection with the main aim it is necessary to identify market centres (price determining places), determine their gravitational force with regards to their surroundings and to

¹ Geographic information system GIS enables to collect and maintain spatial data provides tools for their analysis and for graphical presentation of resulting spatial models of the area of interest. <http://www.geoport.praha.cz/>

answer the question whether the administrative division corresponds to the defined market zones. For the delimitation of market centres the regression analysis method was used for the detection of mutual dependences between the regional price level and localisation factors – demand, supply and agglomerative. For the marking of the line interface of market zones (catchment area) to market centres, the method of the comparison of the administrative division of the CR with the borders of so called functional regions delimited by a certified methodology on the basis of the data about direction flows of inbound and outbound commutation between municipalities in the CR was used. The gained information was used to create a map (in the GIS system) which highlights centres of the first and second degree and market regions belonging to them together with characteristics optimal for the construction of a regional index of a price level.

1. Market centres

The starting point for the identification of market (price determining) centres is so called **Walter Christaller's Theory of Central Places** [7], which deals with the issue of spatial system of settlement, size and distribution of settlements in the settlement structure mainly on the basis of economic characteristics depending on consumers' and business men's behaviour in real time. The basis of this theory is an assumption that small settlements are able to produce only a limited range of goods or services according to their own dispositions and more varied and richer entertainment is provided by larger centres in an accessible distance. The more often the inhabitants use the given goods or services, the closer or further away the centre providing them is and gradually the spheres of power of a particular centre are created, influenced by their time accessibility and transport costs. Regions thus emerge with centres including at least the certain number of inhabitants (threshold population) capable of supporting the specific economic facility, which represents so called economic threshold of effectiveness. The original theory was extended by A. Lösch [10] by the examination and definition of market zones belonging to the market centres, or by W. Isard [8] who focused on theoretical aspects of localisation in the context of regional economy. Spatial modelling and numerical experiments in relation to the Theory of Central Places was also dealt with by S. Openshaw and Y. Veneris [11]. Significant domestic contributions to the issue of spatial interactions were focused on the delimitation of the potential of the sphere of influence of regional centres and gravitational tendencies, e.g. M. Hampl [4], [5]. Other studies dealt with the assessment of an administrative division of a territory, e.g. V. Hubáčková and T. Krejčí [6], M. Halás and M., Klapka [3] and with the proposal of a potential territorial-administrative structure based on the modelling of modified real-world interactions.

A Market Centre represents a place which provides products, services and administrative facilities for inhabitants of a specific "catchment" area. [7] The basic prerequisites of the market centres construction are:

- **Spatial aspects** of supply and demand (the existence of a market zone for the given service)
- **Localisation of economic subjects** (threshold number of inhabitants, factors influencing the localisation (placement) of these subjects).

Market centres gradually develop a service function also for their wider surroundings (background areas) influenced by time accessibility and transport costs. More expensive and less frequently needed services (goods) have a higher limit of accessibility than less expensive or more frequently used services (goods). A centre is connected with its catchment area by centripetal and centrifugal bonds. The centre provides the catchment area with work opportunities, civic amenities, cultural facilities, services. The catchment area, on the other hand, provides the centre with human potential, resources, agricultural products and free-time facilities. The significance of a centre is assessed according to so called **centrality**, which means that according the extent of services or goods provided so called hierarchy of central places originates. Centres of higher degree provide its catchment area with more services, goods, administrative services, cultural, social and sport facilities, etc., and they thus have wider scope of facilities and thus bigger catchment area, market zone. Centres of lower degree provide less goods and services, less civic facilities and they service only a smaller or just small territory. Spatial delimitation of a market zone can then be done on the basis of so called demographic force which captures social, economic and spatial interactions and which is derived from the principle of the least effort – from the assumption that a man always tries to rationalize their behaviour and thus to minimize the effort leading to the required targets. It is in connection with the spatial behaviour directly related to the impedance effect of distance on which can be applied Reilly model (i.e. the law of gravity retail) setting out the liner interface centres of spheres of influence. [12]

2. Arrangements of central places

In the spatial hierarchy of market centres three possible ways of their creation can be used as a starting point: market, transport and administrative [7].

1) **Market principle** - structural characteristics of a centre is determined by its size, number of inhabitants, population density, and the number of businesses.

2) **Transport principle** - nodality principle aims at the integration of the transport system, it observes interaction, commutation and transport relations between centres, e.g. commutation to schools and services, schooling facilities, health care facilities (pharmacies, hospitals, surgeries, emergency services), number of beds, civic facilities).

3) **Administrative principle** - principle of hierarchy is based on the assumption of an unequivocal affiliation of lower centres to a particular higher centre.

In connection with the spatial delimitation of **market regions**, and mainly with the definition of market centres, it is necessary to respect recent trends which have a significant influence on differences in price levels in individual regions. Some of the significant trends are:

- A crowding effect when the increase in concentration of companies and inhabitants in centres leads to the increase in prices of factors and goods which are immobile and the offer of which is fixed (housing or land).
- Extension of the offer of new services in centre places of higher degrees as a result of the increasing purchasing power of the population.
- Due to the qualitative development of transport and technologies (commutation to work, growing number of personal cars, suburban transport, long-term storage of food), the demand for services and goods is not performed solely in the place of residence – the centres of lower degree are left out and slowly deteriorate.
- Expanding market centres can be observed around prominent market centres.
- As a result of agglomeration tendencies, production is becoming concentrated with increasing returns to scale and high income-generating potential in central regions of higher degrees.

3. Delimitation and hierarchy of market centres in the CR

All the three principles with respect to their relevance were taken into account when **determining market centres (price determining places) of the first degree and market centres of the second degree** – see Diagram 1.

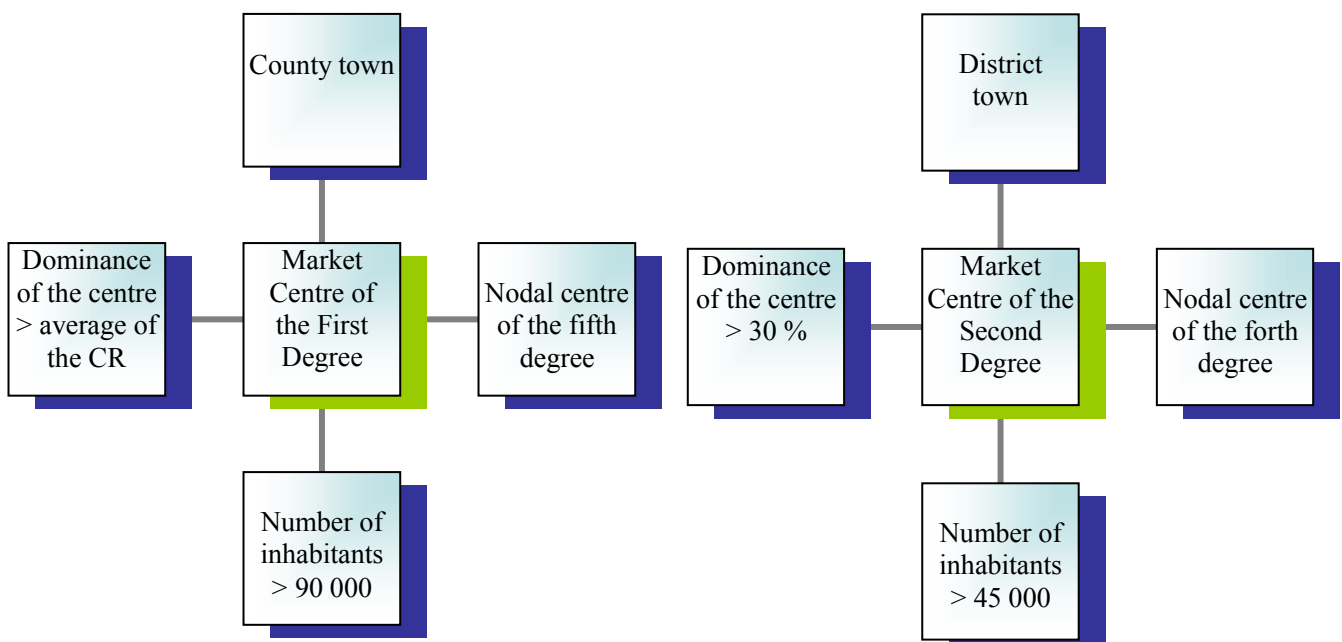


Diagram 1: Delimitation of market centres in the CR

Source: authors' own data

Market centres of the first and second degree reflect the three defined principles:

1) *Administrative principle* - **principle of hierarchy** (Tab. 1) is based on the assumption of an unequivocal affiliation of lower centres to a particular higher centre. The system of the classification of the territorial structures in the CR is, in compliance with the system of Eurostat, divided into two parts: classification of CZ-NUTS and the system LAU (Local Administrative Units). The affiliation of districts (LAU 1) to counties (NUTS 3) according to the classification CZ-NUTS has been in force since 01/ 08/ 2011. [2]

2) *Market principle* - **structural characteristics** of a centre (Tab. 1). A part of the project TD020047 is a detection of mutual relations of regional price disparities with the agglomeration structure in the Czech Republic in the regional division. [1] When trying to explain the spatial distribution of social and economic activities, localisation effects play a role. Localisation effects were specified in their entire width – hard localisation factors, soft business localisation factors and soft individual localisation factors. [1] With regard to the final determination of localisation factors as a source of price differences on a regional level, mainly hard (measurable) localisation factors can be used. 24 significant localisation causes were studied from the viewpoint of the causes of regional price difference. They were subsequently divided into demand factors, supply (cost) factors and agglomeration factors. For the detection of the dependence on the level of counties in the CR, a regression model was used on the basis of which **factors with the positive effect on price differences were determined** and these are population density in counties (counties with the highest density in the CR are Moravian-Silesian Region, Ústí nad Labem Region, Liberec Region and Zlín Region), and then the share of the number of inhabitants living in towns with the number of inhabitants exceeding 50000. The negative influence on the price level has been proved in an independent variable of the number of inhabitants in cities, which means that growing cities along with the growing demand also enable increasing competition on the supply side, decrease in costs of business and this creates a pressure on the decrease in the price level. An analysis of the relation between regional price levels and capital parameters and competition environment in the region was performed by means of a correlation and regression analysis of the relations between the regional price level and capital strength parameters at the county level. The conclusions of the analysis show, that in the regions **no relation between the regional price level and the specific nature of market structures or capital parameters in the region was proved**. [9]

For the delimitation of market centres on the level of districts, identical relations between the variables can be expected, and therefore **the number of inhabitants in cities and the dominance of a centre** (which represents a share of the number of inhabitants of a district town in the total number of inhabitants in a district) were selected as structural parameters. In the CR in 2013, 42.7 % of inhabitants lived in a set of 76 district towns and this ration has been slightly decreasing in time in connection with suburbanization². Apart from town districts in which 100 % of inhabitants live in the specific towns (districts Prague, Plzeň-city, Brno-city a Ostrava-city) and country/rural districts of the largest cities where on the other hand 0 % inhabitants live (districts Prague-east, Prague-west, Plzeň-south, Plzeň-north and Brno-country), districts with high dominance of a district city include the ones where the district city either reaches a significant size in terms of population or it is a relatively isolated town in a rural area (districts in Ústí nad Labem Region, districts Liberec, Jablonec nad Nisou, Pardubice, Hradec Králové, Kladno, Písek, České Budějovice, Jihlava, Zlín, Prostějov, Olomouc,...).

3) *Transport principle* - **nodality principle** was reflected by the inclusion of the results of a project solved by M. Žižka [14], in which on the basis of the data on direction flows of inbound and outbound commutation between municipalities in the CR and the use of certified methodology 411 functional subregions in the CR were delimited and their hierarchy was performed³. The centres were divided into local (1), of sub regional importance (2), of micro regional importance (3), of regional importance (4) and of very high regional importance (5).

For the identification of market centres (Tab. 1) only centres with the classification 4 (regional importance) were selected, which means the centres with the characteristics of a:

² In the year 2003, 43.9 % of the population of the CR lived in district towns, in the year 2005 it was 43.6 % – see Shrnutí věcných poznatků z procesu výběru a využití ukazatelů regionální statistiky pro kartografickou vizualizaci charakteristik socioekonomického vývoje ČR, <http://www.regionálnírozvoj.cz/catalogue2006/chaps/54/5405.htm>.

³ The classification of centres is based on the principle where on the higher level all the requirements of the lower level need to meet.

- Catchment centre – significant commutation
 - Conditions of a sub regional unit according to the Rural Development Programme of the CR
 - Important employer (in the category 100 to 199 employees)
 - A high school with a registered office in the given municipality (existence)
- and with the classification 5 (of very high regional importance):
- A university with the registered office in the given municipality and the population over 90 thousand.

Tab 1 **Market centres of the first degree** (yellow markings) and *market centres of the second degree* (blue markings) in the Czech Republic (2013).

		Administrative centres	Number of inhabitants	Dominance of the centre	Nodal centre
CZ010 Prague, the capital	CZ0100	Praha	1 243 201	100	5
CZ020 Central Bohemian Region	CZ0201	Benešov	16 520	17,1	4
	CZ0202	Beroun	18 958	21,55	4
	CZ0203	Kladno	68 519	42,6	4
	CZ0204	Kolín	31 026	31,7	4
	CZ0205	Kutná Hora	20 349	27,4	4
	CZ0206	Mělník	19 139	18,3	4
	CZ0207	Mladá Boleslav	44 272	35,4	4
	CZ0208	Nymburk	14 881	15,5	4
	CZ020B	Příbram	33 450	29,3	4
	CZ020C	Rakovník	16 289	29,4	4
CZ031 South Bohemian Region	CZ0311	České Budějovice	93 253	49,3	5
	CZ0312	Český Krumlov	13 253	21,6	4
	CZ0313	Jindřichův Hradec	21 698	23,5	4
	CZ0314	Písek	29 720	42,1	4
	CZ0315	Prachatice	11 189	21,9	4
	CZ0316	Strakonice	22 922	32,5	4
	CZ0317	Tábor	34 858	33,9	4
CZ032 Plzeň Region	CZ0321	Domažlice	11 110	18,2	4
	CZ0322	Klatovy	22 367	25,6	4
	CZ0323	Plzeň-město	168 034	100	5
	CZ0326	Rokycany	14 002	29,3	4
	CZ0327	Tachov	12 570	23,7	4
CZ041 Karlovy Vary Region	CZ0411	Cheb	32 617	35,3	4
	CZ0412	Karlovy Vary	49 864	42,5	4
	CZ0413	Sokolov	23 879	31,8	4
CZ042 Ústí nad Labem Region	CZ0421	Děčín	50 104	37,9	4
	CZ0422	Chomutov	49 185	39,3	4
	CZ0423	Litoměřice	24 136	20,2	4
	CZ0424	Louny	18 476	21,3	4
	CZ0425	Most	67 332	58,8	4
	CZ0426	Teplice	50 024	38,8	4
	CZ0427	Ústí nad Labem	93 523	78,2	5
CZ051 Liberec Region	CZ0511	Česká Lípa	36 805	35,7	4
	CZ0512	Jablonec nad Nisou	45 453	50,4	4
	CZ0513	Liberec	102 301	59,6	5
	CZ0514	Semily	8 576	11,5	4
CZ052 Hradec Králové Region	CZ0521	Hradec Králové	92 904	57,1	5
	CZ0522	Jičín	16 282	20,5	4
	CZ0523	Náchod	20 417	18,2	4
	CZ0524	Rychnov nad Kněžnou	11 215	14,2	4
	CZ0525	Trutnov	30 808	25,7	4
CZ053 Pardubice Region	CZ0531	Chrudim	22 996	22,1	4

	CZ0532	Pardubice	89 432	53,0	5
	CZ0533	Svitavy	17 040	16,2	4
	CZ0534	Ústí nad Orlicí	14 364	10,3	4
CZ063 Vysočina Region	CZ0631	Havlíčkův Brod	23 345	24,6	4
	CZ0632	Jihlava	50 510	45,0	4
	CZ0633	Pelhřimov	16 203	22,4	4
	CZ0634	Třebíč	37 095	33,0	4
	CZ0635	Žďár nad Sázavou	21 669	18,2	4
CZ064 South Moravian Region	CZ0641	Blansko	20 845	19,3	4
	CZ0642	Brno-město	377 508	100	5
	CZ0644	Břeclav	24 956	21,7	4
	CZ0645	Hodonín	25 049	16,1	4
	CZ0646	Vyškov	21341	23,7	4
	CZ0647	Znojmo	33 805	29,8	4
CZ071 Olomouc Region	CZ0711	Jeseník	11 579	29,0	4
	CZ0712	Olomouc	99 489	42,7	5
	CZ0713	Prostějov	44 234	40,4	4
	CZ0714	Přerov	44 538	33,7	4
	CZ0715	Šumperk	26 806	21,8	4
CZ072 Zlín Region	CZ0721	Kroměříž	28 921	27,1	4
	CZ0722	Uherské Hradiště	25 266	17,6	4
	CZ0723	Vsetín	26 668	18,4	4
	CZ0724	Zlín	75 278	39,1	5
CZ080 Moravian-Silesian Region	CZ0801	Bruntál	16 913	17,7	4
	CZ0802	Frydek-Místek	57 135	26,8	4
	CZ0803	Karviná	56 848	22,0	4
	CZ6225	Havířov (okr. Karviná)	76 348	29,5	4
	CZ0804	Nový Jičín	23 676	15,5	4
	CZ0805	Opava	57 931	32,7	4
	CZ0806	Ostrava-město	295 653	100	5

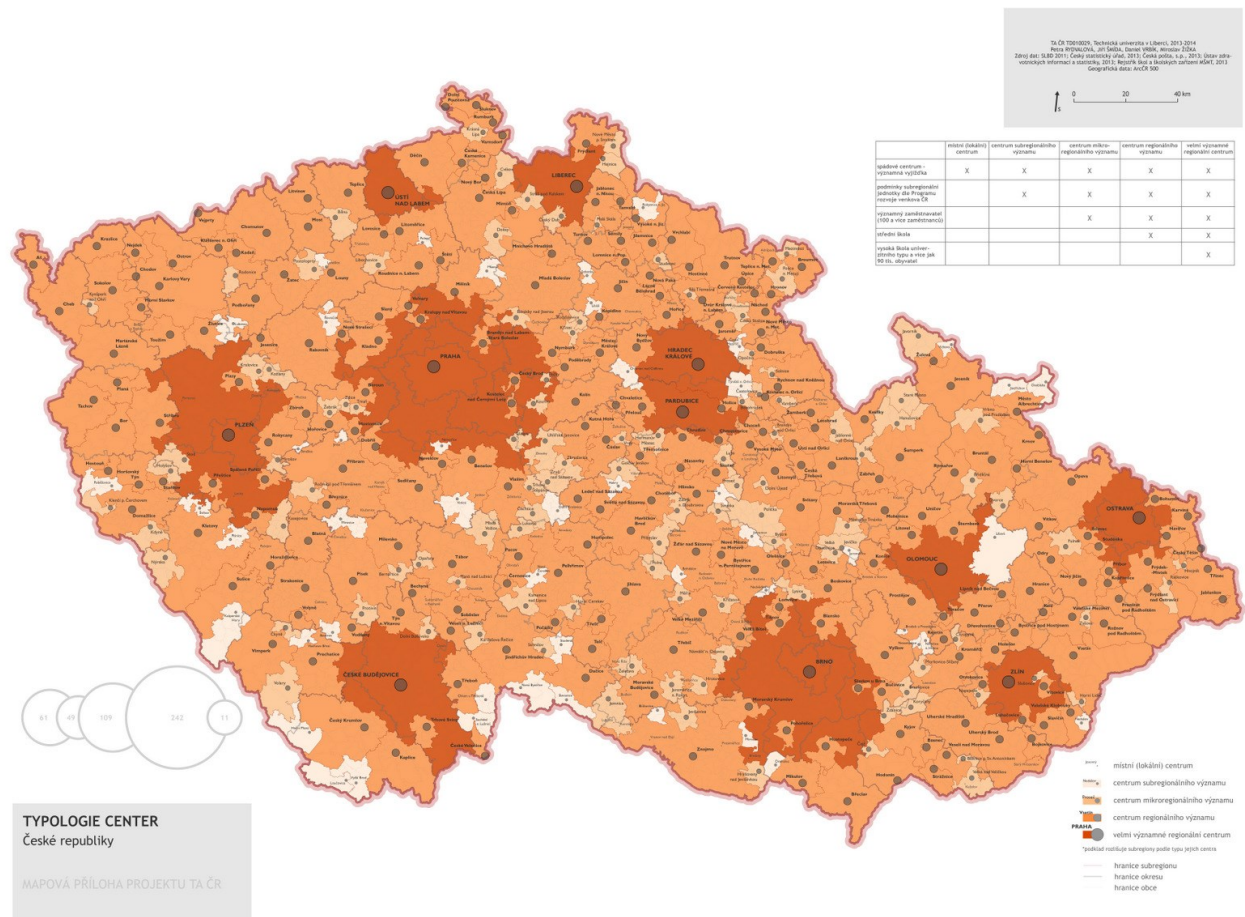
Source: authors' calculations (data from ČSÚ 2014, RISY 2014)

As a result of the interconnection of market, administrative and transport principle, 10 market centres of the first degree were detected in the CR and they were all metropolitan cities with high concentration of demand, high centre dominance and strong spatial relations towards its surroundings. These centres also often have the highest prices. [1] Besides completely dominant Prague, the centres with accented price-determining regional importance include České Budějovice, Liberec, Hradec Králové, Pardubice and Ústí nad Labem which acts as a strong regional centre in Northern Bohemia. In Moravia the centres with accented price-determining regional importance highest in the hierarchy are: Brno, Ostrava and Olomouc. The centres of the second degree, in the CR 14 towns in total, are hierarchically lower and in connection with regional price disparities these are centres with lower level of regional prices. [1] Apart from county and district cities also Havířov belongs among the market centres of the second degree based on the number of inhabitants (76,348 inhabitants) with the dominance just under 30 % and with the regional importance 4.

4. Spatial concept of market regions

Having taken into account all three approaches (market, administrative and transport) to the hierarchisation of market centres, a final map of market regions was created which captures the distribution of market centres of the first and second degree, the boundaries of the market zones belonging to the centres with the accent on **actual commutation relations** while accepting the **current administrative division** of the Czech Republic.

Map 1: Market regions in the CR with the characteristics optimal for the construction of the regional index of price level



Source: own map output

Conclusion

A spatial economic system which is understood as "a complex of elements in interaction", including producers, consumers, communities, economic centres, and all these components are interconnected by flows of property, energy, services, persons and information. Spatial organization of production reflecting relations between demand, supply and price is based on economic relations including the influence of distance on costs, demand space potential of the sale/consumption, spatial relations of businesses in competition in hierarchical relations of economic centres in the space, the influence of transport corridors, the distribution of population with regards to the creation of market zones, consumer mobility, location rent and other factors. These invoices were used for detection of market centres in the Czech Republic through the procedures of the Walter Christaller's Theory of Central Places. As a result of the interconnection of market principle (the number of inhabitants in cities and the dominance of a centre), administrative principle (the affiliation of districts - LAU 1 to counties - NUTS 3) and transport principle (nodal centre defined on the basis of the data on direction flows of inbound and outbound commutation between municipalities). 10 market centres of the first degree were detected in the CR. These centres are all metropolitan cities with high concentration of demand, high centre dominance and strong spatial relations towards its surroundings. These centres also often have the highest prices. The centres of the second degree, in the CR 14 towns in total, are hierarchically below and in connection with regional price disparities these are centres with lower level of regional prices. Having taken into account all three approaches to the hierarchy of market centres, a final map of market regions with the characteristics optimal for the construction of the regional index of price level was created (in Geographic information system GIS) which captures the distribution of market centres of the first and second degree, the boundaries of the market zones belonging to the centres with the accent on actual commutation relations while accepting the current administrative division of the Czech Republic. The next task in research is to determine if regional price levels correspond to defined market zones and, if so, then identify the direction and strength of these interconnections.

Acknowledgment

This article is a part of the applied research project TD020047 "Regional Price Index as the Indicator of the Real Social and Economic Disparities" supported by the Technology Agency of the Czech Republic, the Omega Programme.

Literature

- [1] BEDNÁŘOVÁ, P. and Š. LABOUTKOVÁ. The Effect of Agglomeration on the Regional Price Levels in the Czech Republic. In: *Proceedings of the articles from the 6th annual international scientific conference "Region in the development of society 2014"*. Brno, 2014. ISBN 978-80-7509-139-0.
- [2] CZSO. *Czech Statistical Office*, 2014. [cit. 2015-02-12]. Available at https://www.czso.cz/csu/czso/klasifikace_uzemnich_statistickych_jednotek_-cz_nuts-_2011
- [3] HALÁS, M. and P. KLAPKA. Regional division of Czechia on the basis of spatial interaction modelling. *Geografie, sborník ČGS 2010*, **115** (2): 144 – 160.
- [4] HAMPL M. Současný vývoj geografické organizace a změny v dojížděcí za prací a do škol v Česku. *Geografie, sborník ČGS 2004*, **109** (3): 205-222.
- [5] HAMPL, M. *Geografická organizace společnosti v České republice: transformační procesy a jejich obecný kontext*. Praha: Univerzita Karlova v Praze, 2005. ISBN 80-86746-02-X
- [6] HUBÁČKOVÁ V. and T. KREJČÍ Regionální vliv Slovákka pohledem Reillyho modelu, na příkladu České republiky. In *Proceedings of the articles from the "X. mezinárodní kolokvium o regionálních vědách"*. Brno: ESF MU, 2007.
- [7] CHRISTALLER, W. *Die zentralen Orte in Süddeutschland*. Gustav Fischer, Jena. 1933
- [8] ISARD, W. *Location and space-economy; a general theory relating to industrial location, market areas, land use, trade, and urban structure*. Cambridge: Technology Press of Massachusetts Institute of Technology, 1956.
- [9] KRAFT, J. The Relationship between Regional Price Index, Market Structures and Capital Parameters of Region. *The research report of the project TD020047 "Regional Price Index as the Indicator of the Real Social and Economic Disparities"* Liberec: TU in Liberec, 2014.
- [10] LÖSCH, A. *The Economics of Location*. New Haven: Yale University Press, 1954. ISBN 0300007272.
- [11] OPENSHAW S. and Y. Veneris. Numerical experiments with central place theory and spatial interaction modelling. *Environment and Planning* 2003, **35**(8): 1389 – 1403.
- [12] REILLY, W. J. Methods for the study of retail relationships. *University of Texas Bulletin*, 1929. University of Texas: Austin, 2944.
- [13] RISY. Regional Information Service, 2014. [cit. 2015-02-09]. Available at <http://www.risy.cz/cs/vyhledavace/statisticka-data/detail?Kapitola=2>
- [14] ŽIŽKA M , et al. Results of the project „*Definition of subregions for distinguishing between them and the solution of social and economic disparities*“. Available at [http://vyzkum.ef.tul.cz/td/upload/files/presentation-en.pdf\(2013\)](http://vyzkum.ef.tul.cz/td/upload/files/presentation-en.pdf(2013))