SODOBNI SISTEM KLASIFIKACIJE TRGA NEPREMIČNIN

MODERN CLASSIFICATION SYSTEM OF REAL ESTATE MARKETS

Małgorzata Renigier-Biłozor

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IZVLEČEK

Tema študije je klasifikacija stanovanjskega trga nepremičnin v urbanem okolju, kjer je kot osnovno orodje za določevanje objektivnih primerjalnih kriterijev izbrano razvrščanje. Glavni cilj raziskave je bil razviti postopek za točkovanje stanovanjskega trga nepremičnin, katerega rezultati bil bile kakovostne informacije oziroma znanje o trgu nepremičnin, kar bi pomembno prispevalo k sprejemanju zanesljivih odločitev na trgu. Klasifikacija je bila izvedena ločeno za povpraševanje in ponudbo. V ta namen je bilo uporabljenih več razredov informacij, ki se nanašajo na stanovanjske, gospodarske, družbene, prostorske in lokacijske dejavnike ter lahko pomembno vplivajo na odločitve na nepremičninskem trgu. Ključna pri predlagani metodologiji je določitev točke primerjave ali tudi točke benchmarking. *Ta se določi za namene izračuna točk za razvrščanje, ki temeljijo na predpostavki najvišje stopnje podobnosti glede na druge objekte in se določijo na podlagi teorije grobih množic. Točka primerjave lahko predstavlja stopnjo podobnosti (nerazločnosti, kot je poznano v teoriji grobih množic) pojava v množici. Rezultati raziskave so pokazali povezavo med kakovostjo urbanega prostora in stanovanjskim trgom, predvsem pri načrtovanem razvoju območja in izboljšavi kakovosti življenja, manj pa za primere gospodarske blaginje območja.*

KLJUČNE BESEDE

trg nepremičnin, klasifikacija, sistem razvrščanja, urbani razvoj

ABSTRACT

In this study, rating is proposed as a modern tool providing objective comparability criteria to classify the residential market within the urban space. The main aim of this study was the development of the rating score procedure for residential market as a specific knowledge platform to help in the making of reliable decisions. The classification was conducted for demand and supply separately with the use of categories of information relating to residential, economic and political, social, spatial and location factors that can have the most important influence on market decision-making. The crucial stage in this methodology was establishing the benchmark point (BB) to calculate the rating score that was determined on the assumptions of the highest value of the similarity in relation to other objects with the use of a rough set theory. This point might represent the level of similarities (indiscernalities, as in rough set theory) of the features in the set. The results demonstrate that there is a link between the condition of urban space and the residential market but in the case of the expectation of further area development and quality of life rather than the economic prosperity of a region.

KEY WORDS

real estate market, classification, system-rating, development of urban area

1 INTRODUCTION

Cities and regions wishing to achieve a dominant position in the network via their policy try to attract as many entities and types of activity as possible. When examining the structure and the character of the surrounding space, it is possible to determine whether there are attractive prospects, and whether there is growth potential in the analyzed area. The link between real estate markets and potential of urban growth was revealed a long time ago (e.g. D'Arcy and Keogh, 1999; Leung, 2004). Real estate markets play an increasingly important role in the global economy and attract a growing number of international investors, which is why the demand for reliable classification and scoring systems will continue to grow and become an essential tool in the process of investment planning. The positions of particular cities that will be developed according to established criteria can be crucial when choosing an investment location, and can affect the range of influence of the central site for the entire region.

Making optimum decisions should rely on reliable data describing reality, in line with the decision-maker's preferences (Saaty, 2008). However, it should be highlighted that necessary parameters for decision making are: availability of information (uncertainties – risks) and rationality of decision making (bounded rationality implies human shortcuts). However, access to reliable data or information is difficult nowadays, not so much because of lack of access to them, but due to excessive amounts of such data (so-called information noise) and difficulties in the proper selection of the right type of data. Classification of the real property market's potential based on the conditions and specific character of the analysed urban space allows for its evaluation and, on the other hand, for inspiring its development and adjustment to current and future needs.

The *main problem* in the field involves the development of a comprehensive classification of the real estate market relevant to the specific character of real estate market operations, which involves complex procedures and decisions, as well as the unique character of real estate data. These factors prevent the smooth flow of information, which is required for the implementation of rational decisions and actions in business, investment, financial and promotional projects. Providing access to the knowledge of the real estate market, developed in the form of a simple message, is the only way to solve this problem. The author assumed that this can be achieved by developing a rating measure of the real estate markets providing general and clear information classifying the object of analysis.

The *main aim* of this study was the development of a rating score procedure for real estate markets. Proposed by author classification can be used as a tool providing objective comparability criteria in the adopted reference perspective. The prepared results allow for the identification of economic and social processes in the spatial aspect, which leads to a better and more efficient self-organization of space. This study analyzes the assumption that there is a direct interaction between the conditions of human existence and, generally speaking, the quality of life and the structure of the urban areas determined by the macro and micro location conditionals and the development and growth potential of residential real estate markets. Data used in the rating process characterize the location area in detail, along with real property entities, introduce objective comparison criteria for real property markets, and help in making rational decisions with respect to the location of investments.

Object. The object of the analysis was the residential real estate markets represented by residential apartments, taking into account the commonality of their use. The study was conducted on the basis of 16

provincial markets within the time period 2012-2014 that constitute the most important space of impact onto other regions and the best point of reference – representation of their region, also on account of more complete access to data. The study contains 122 attributes that were used for the rating classification of real property markets (see Appendix 1).

Research method. The author proposed the methodology of the rating score in the form of a multivariate procedure. In the analytical part of the procedure to determine the rating for real estate markets the valued tolerance relation formula, existing mainly as an extension model of the classical rough set theory, was applied. The development of a benchmarking level was the most significant point in this analysis because it has an influence on the classification of the further ratings levels of specific variables. Due to the small number of observations (cases), there are limited possibilities of using statistical methods, which are generally based on the assumption of a larger number of cases compared to the data describing them. Therefore, the rough set theory was applied as a method that takes into account the small size of the data.

2 RELEVANT LITERATURE – THE NEED FOR PROPERTY MARKET RATING

"Rating" is an economic term with a variety of meanings. In the discussed context, a rating was defined as the process and the results of the evaluation and classification of a given phenomenon. Ratings might be applied on different markets – categorization based on nature of goods: (1) capital, (2) labor and service, (3) commodity markets. Originally, the rating was created to the classification of the capitals (1) and it is called credit rating. Based on the original assumptions the author try to develop methodology of this kind of classification such rating, particularly devoted to the real estate market.

Generally, ratings are performed by credit rating agencies (CRA), as well various institutions, which use ratings for their own needs, mostly banks, investment funds and insurance companies. Basically, we can define credit ratings as a system for evaluating and classifying investment risk. In the last few years we have noticed that credit ratings enjoy growing popularity as a source of information about the risk of bankruptcy, and the financial condition of the analysed entity. Despite delayed and inaccurate predictions, credit ratings are a highly effective analytical tool. The independent and objective nature of CRAs has been recognized and emphasized by EU law (Regulation (EC) No. 1060/2009 of the European Parliament and of the Council of 16 September 2009 on credit rating agencies and Commission Delegated Regulation (EU) No. 447/2012 of 21 March 2012 supplementing Regulation (EC) No. 1060/2009 of the European Parliament and of the Council on credit rating agencies by laying down regulatory technical standards for the assessment of compliance of credit rating methodologies). However, the credit rating methodologies (Lynch, p. 24.) cannot simply be copied to the real estate market in the view of the specificity of the real estate market. We need the methodology to adjust to this domain because of the specific nature of the real estate data and market. The methods and procedures that may be developed and implemented should account for the following defects in real estate data: significant variations in the quantity of available information, absence of data, small number of transactions, significant variations in attribute coding, non-linear correlations between the analyzed data and the type of the underlying market, etc. The solutions should support market analysis at the potential (theoretical) and actual (applied) levels.

Markets are generally classified in view of the type of traded estate (land plots, buildings, apartments), parties to the transaction (local government, central authorities, individuals), type of real estate (residen-

tial, commercial, industrial, recreational, agricultural) and geographic reach (local, regional, national, international). Taxonomy and segmentation imply detailed classification of real estate markets, based on the preferences of specific buyer groups or condition of buildings. These classifications use basic criteria, which may not be enough regarding current increased access to knowledge and requirements of market participants. A more sufficient market classification was presented, among others, by Goodman and Thibodeau (1998, 2003), in which residential property was classified based on criteria such as spatial variation, neighborhood and physical attributes. Keener Hughen and Dustin (2014) developed models to classify the market within parameters determining the evolution of the demand on the basis of developers' activities concerning inclusionary housing policy. The analyses explored the relationship between real estate development decisions and inclusionary housing policies in different types of economic environments. Another interesting analysis was conducted by Sato and Xiaob (2015), who analysed the interactions between labour and housing (and land) markets in a city. They proved that labour market conditions affect the land price, land development, housing price, housing consumption, and city configuration. On the other hand, Liu et al. (2006) indicated that interaction effects and nonlinear relationships between market prices and hedonic variables complicate the direct interpretation of market classification and fluctuation.

The necessity of determining the structural and spatial classification of real property markets results from various needs. D'Arcy and Keogh (1999) argued that the role of the property market in determining urban competitiveness is significant. They proved that the real estate market has a direct influence on high and sustainable urban economic growth. Moreover, the significant link between the real estate market and urban space was proved by The Torto Wheaton Research (2002). They showed that real estate prices in Amsterdam over 300 years displayed no trends, although it had deep volatility, and they indicated that there might be a high probability that some features connected with the social, political and economic condition of the city may have an impact on this phenomenon. Moreover, Leung (2004) raise the issue that conjecture between the growth and decline of cities and housing markets should be irrefutably and scientifically established.

Analysis of the relationship between urban areas and real estate markets is a current issue for several reasons. Firstly, the development of cities is strongly determined by the development of real property markets as an important element attracting people to a given location. On the other hand, a real property market is shaped not only by real properties, but also by certain features of its environment: the immediate one (e.g. prices, vacancy), and, more and more frequently, the more distant one, related to the macro-economic determinants, e.g. inflation, the prosperity of the area, global crisis, the condition of the banking sector, etc. (Jud and Winkler, 2002; Leung, 2004; Źróbek and Grzesik, 2013; Biłozor and Renigier-Biłozor, 2014). The development of cities depends on their attractiveness, expressed by the number of attracted people, and in particular inhabitants and capital. On the other hand, Kotler (2011) claims that nations and urban areas position themselves on their ability to attract certain groups of human and physical capital and at the same time discourage other groups (e.g. low-income families, the homeless, or criminal types). Secondly, housing market fluctuation may result from fluctuation in urban areas (Dobkins and Ioannies, 2001; Leung, 2004). Urban city variability may help us understand the relationship between the macroeconomy and the real estate market, and how the real estate market

will change in the frame of globalization and financial integration. Nowadays, at a time of an exceptionally fast downward demographic tendency of developing countries and developed countries, the attractiveness of residential markets is a very important competitive element of cities and regions. There is a strong feedback loop between the residential property market and a city, because the development and attractiveness of residential property markets are conditioned by economic, political, social, spatial and location factors offered by urbanized space. On the other hand, the development of cities depends on the attractiveness of real property markets as an effect of conducting efficient territorial marketing by cities, which is taken into account by potential city dwellers as a very important element of the "migrant decision" (Kotler et al., 1993; Dinis, 2006; Bernat et al., 2014). Furthermore, the attractiveness of the real estate market is a very important element in the procedure of city branding construction, which constitutes a fundamental part of forming and meeting residents' satisfaction (Dinnie et al., 2010).

An accurate prediction of the real estate market potential is essential to prospective homeowners, developers, investors, appraisers, tax assessors, and other real estate market participants, such as, mortgage lenders and insurers (Case, 2000; Frew and Jud, 2003; McCue and Belsky, 2007; Foryś, 2011; Global Real Estate Transparency Index, 2014). Kan et al. (2004) conducted a more comprehensive analysis the real estate markets to increase mortgage-based securities. Moreover, learning lessons from the last outbreak the Global Financial Crisis (2007-2008), primarily initiated by the insolvency of mortgage borrowers, it can be assumed that current and objective monitoring of the real estate market is an absolute requirement to maintain balance, increase security and minimize the risk of crisis in many aspects of human existence in urban space. Although recent year have witnessed the growing popularity of various support systems, comprehensive and effective information systems that facilitate the real estate market continue to be in short supply. The scarcity of relevant information and objective knowledge results from the shortcomings of market effectiveness analyses (Case and Shiller, 1989; Fama, 1990; Kaklauskas et al., 2011; Renigier-Biłozor and Wiśniewski 2012, Bilozor, 2014; Stec et. al. 2014).

The potential and power of classifying real estate market in the rating form was indicated by TEGOVA (2003) and Kalberer (2012). They defined "Property and Market Rating" as a versatile instrument for assessing the quality of property. However, these authors recommended the use of a developed procedure to assess individual properties' risks for securitization purposes rather than for markets in general. Others authors find real estate market ratings a useful tools for a variety of practical purposes. They are used to developing portfolio investment strategies (Anglin and Yanmin, 2011, Collett et al, 2003) and formulating long-short portfolio strategies on housing indices for more risky and less risky assets characterized by low liquidity (Berach and Skiba, 2011).

Rating has the potential to increase market effectiveness analyses as a source of objective knowledge. In the light of the research the author proposed the development of a "ratings of real estate market" as a modern tool that can be used in analyses and predictions of real estate market potential.

3 METHODS OF RESEARCH

The main aim of this study was the development of a rating score procedure. Because the general assumption of the rating is to provide quick, objective, reliable and updated information, a dataset has to be developed as a specific knowledge platform for dedicated analyses. Every rating is developed for a

broad group of recipients who have varied levels of knowledge about the analyzed real estate market. A rating scale for classifying real estate markets is proposed in Table 1.

Table 1: Rating scale for classifying real estate markets.

Group	Description of market characteristics
Investment level (A category)	**"High"** High return on investments; Positive market outlook; High market growth potential; High potential for economic and spatial growth; Self-regulatory capacity, flexible response to economic changes; The situation on the real estate market fosters positive social change; Satisfactory price-cost relationship; Stable behavior of real estate market actors; Low threats to the growth of the real estate market; The situation on real estate market fosters positive social change.
Development level (B category)	"Moderate" Moderate return on investments; Moderate market outlook; Certain threats to market growth potential; Moderate potential for economic and spatial growth; Lower self-regulatory capacity, less flexible response to economic changes; The situation on the real estate market fosters moderately positive social change; Greater discrepancies between the cost and prices of real estate; Less predictable behavior of real estate market actors; Moderate threats to the growth of the real estate market; The situation on the real estate market fosters moderately positive social change.
Stagnant level (C category)	**"Low"** **Low return on investments; Negative market outlook; High threats to market growth potential (supply and demand on the real estate market); Low potential for economic and spatial growth; Low self-regulatory capacity, significantly less flexible response to economic changes; The situation on the real estate market does not foster positive social change; High discrepancies between the cost and prices of real estate; The behavior of real estate market actors is likely to be unpredictable; High threats to the growth of the real estate market; The situation the real estate market does not foster positive social change.**
Crisis level (D category)	"Lack"/"deficit" No returns on investments; The market is stagnant with no prospects for growth; No potential for economic or spatial growth; The market is undergoing reorganization. The price-cost relationship cannot be determined; The behavior of market participants cannot be predicted; Very high threats to the growth of the real estate market; The situation on the real estate market drives negative social change.

Source: own study basis on Renigier-Biłozor et al. (2014).

The real estate markets were scored on a 10-point rating scale and were divided into four rating level groups: investment, development, stagnant and crisis. Except for the crisis level group, which has a single score – D, there are three scores per group: AAA/BBB/CCC, AA/BB/CC and A/B/C. Scores AAA/BBB/CCC represent the highest rating, AA/BB/CC – a medium rating, and A/B/C – the lowest rating in a given group.

The determination of the rating score for the real estate markets was prepared in the form of a procedure aimed at obtaining a significant element supporting decision making in the market (Fig. 1). The author proposed the methodology of the rating score in the form of a multivariate procedure. The procedure consisted of the several stages that are methodological opened.

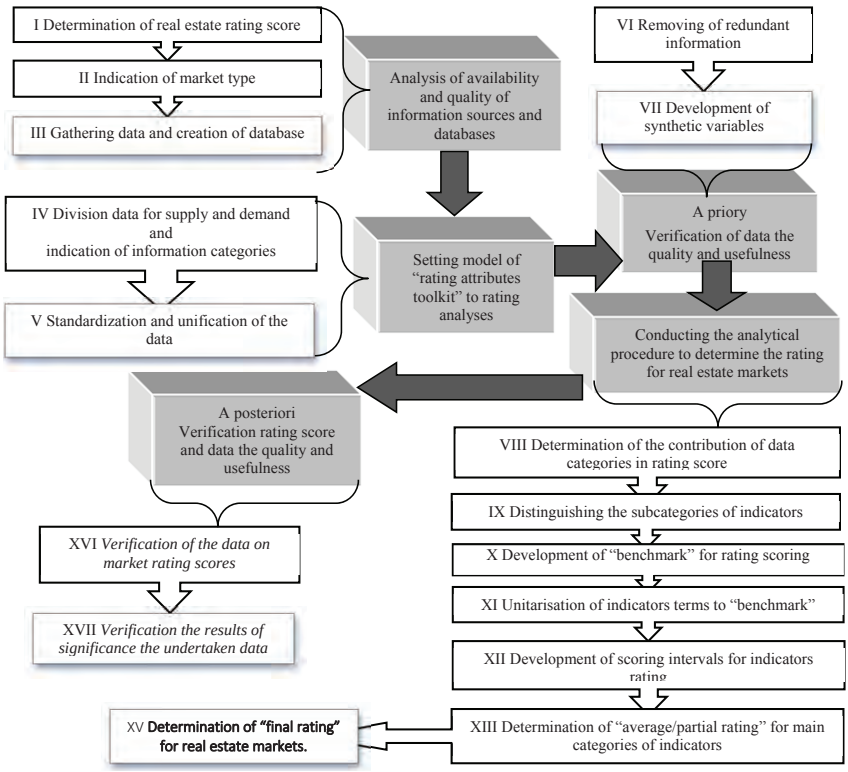

Figure 1: Procedure of the rating score for the real estate markets. Source: Author's elaboration.

The proposed rating score procedure assumed a few main stages leading to the development of a reliable rating for real estate markets. One of the stages is related to the analysis of availability and quality of information sources and databases. In the initial phase, it is necessary to define the purpose and the scope of the study within the determination of the overall rating score. A precise description of the type and the segment of the real estate market, and the utility function of the real estate is necessary to develop reliable results. The next step assumed the review and analyses of the sources of information from available databases. The following stage assumed the setting model of a "rating attributes toolkit" for rating analyses. In this context, the division of data for information categories (i.e. social, economic, etc.) within the supply and demand side of indicators should be prepared. In order to obtain comparable data for different subjects of the field, analysis of the standardization and unification of the data has to be conducted. A priory verification of data on the quality and usefulness is the subsequent stage in the procedure. In this stage, the procedure assumed the removal of redundant information that enables the elimination of dispensable, unnecessary data with the use of correlation analyses. In order not to lose important information, the development of synthetic variables was assumed. The next stage expected a conducting of the analytical procedure to determine the rating for real estate markets. The procedure assumed a few main steps connected with distinguishing the subcategories, unitarisation data and development scoring results. The above stages were presented and descripted more precisely in the paper Renigier-Biłozor et al. (2017).

The analytical procedure assumed the determination of the benchmarking (reference point) that constitutes the main (basis) platform for the analytical ranking of rating levels. For the analysis, the valued tolerance relation formula, existing mainly as an extension model of the classical rough set theory, was applied. The development of a benchmarking level is the most significant point in this analysis because it has an influence on the classification of the further ratings levels of specific variables. The author assumed that it is some point that represents the level of similarities (indiscernalities) of the features in the set. It is known from theory and practice that two identical real properties or two real property markets do not exist. The problem that appears here consists in finding the manner of comparing similarities of real property markets.

Due to the small number of observations (cases), there are limited possibilities of using statistical methods, which are generally based on the assumption of a larger number of cases compared to the data describing them. Therefore, the rough set theory was applied as a method that takes into account the small size of the data. Moreover, the assumptions of this theory are relatively simple, clear and repetitive in subsequent rating years without changing. The rough set theory is used to analyse data that is qualitatively and quantitatively ambiguous, imprecise and varied. The classical rough set theory was developed (Pawlak, 1982) to analyse the imprecise and vague data which is commonly found in the real estate market and accompanies decision making (fuzzy decision making) in that market. Moreover, the theory with a valued tolerance relation extension is used in many sciences, and it is often applied as the main support tool in decision-making systems (Polkowski and Semeniuk-Polkowska, 2010; Zavadskas and Turskis, 2011; Renigier-Biłozor, 2011; Renigier-Biłozor and Wiśniewski, 2011; Chung and Tseng, 2012). The rough set theory assumed the development of a decision table – the determination of the domains of different conditional attributes (real estate market attributes) and the decision attribute (rating of the market). The equivalence classes of the indiscernibility relation were determined based on similarity between the analyzed properties markets with the use of Value Tolerance Relation that allow to obtain "fuzzy" similarities.

4 RESULTS – SIMULATION OF RATING PROCEDURE

The prepared results allow for developing a rating measure of the real estate markets providing general and clear information classifying the object of analysis. That classification can then be used in property market rating as a tool providing objective comparability criteria in the adopted reference perspective. Within the range of this study the authors assumed that the rating would be performed for residential real estate markets represented by residential apartments, taking into account the commonality of their use. The study was conducted on the basis of 16 provincial markets within the time period 2012–2014. All the proposed provincial cities constitute the most important space of impact onto other regions and the best point of reference – representation of their region, also on account of more complete access to data. The database, called the "rating toolkit", was developed in the previous work of the author, entitled "Rating attributes toolkit for the residential property market" (Renigier-Biłozor et al., 2017). The determination of databases for real estate market rating was prepared in the form of a procedure aimed at obtaining a reliable a knowledge platform for rating analysis. The study contains 122 attributes that were used for the rating classification of real property markets (see Appendix 1).

The next step of the procedure assumed the development of data categories scope. The existing knowledge was compiled to develop a set of indicators for the overall evaluation of the real estate markets. An attempt

was made to develop features that can have the most important influence on market decision-making on the basis of literature analysis (mentioned in the above literature review) and thoughtful observations by participants in the real estate market. These include categories of information strictly relating to the residential, economic and political, social, spatial and location realms. Each of these realms represents a different range of information that more or less affects quality of life. Thus, in the long term, it has an influence on decisions concerning the buying, renting or selling of residential real estate. Variables were classified and labelled during the construction of the database on supply or demand indicators (see App. 1). Such a division was proposed due to the diversity of the target group for these two market phenomena. This division was also dictated by significant differences in the growth potential of the analysed real estate markets. The following stage was an a priori verification of the quality of data in the rating attributes toolkit. The aim of the aforementioned verification was the removal of redundant information. For this purpose, cross-correlation analysis was applied (the Pearson correlation analysis and Kendall's τ). The developed analyses allowed for a decision to be made on the reduction of redundant combinations of variables.

The further stage assumed conducting the analytical procedure to determine the rating score that is the main part of the presented study. In the aforesaid procedure the first step concerned the establishing of the contribution of indicators of each category in rating score. The contribution was developed on the basis of assuming the importance of each category in the real estate rating classification. The percentage contribution of toolkit indicators on the rating score is considered in the following way: I set of residential indicators – 40%, II set of economic and political – 20%, III set of social – 20%, IV set of spatial and location – 20%. Residential indicators constituted the most significant type of data, followed by political and economic, social, spatial and location indicators. The lower contribution of data expressed by economic, social and location indicators was assumed, due to the indirect connection with the current situation in the real estate market. Those factors are still very important, but instead initiated and inspired changes in the longer period, which means that they did not play a foreground role or have an impact on the diagnosis of the real estate market condition. However, it is important to underline that the residential indicators are the evidence of the current situation, the condition in the market that has been created due to social, economic or spatial features. Moreover, in each of the set categories the subcategories of indicators determining (det.) or destimulating (des.) supply or demand were distinguished.

The next issue was the determination of a reference point (basic platform) to calculate the rating level for the database. First of all, the adopted rating levels were assigned to a numerical form: AAA – (1), AA – (2), A – (3), BBB – (4), BB – (5), B – (6), CCC – (7), CC – (8), C – (9) and D – (10). The reference point was BB level – a rating score was designated due to the observation that demand still outpaces supply in Poland's emerging real estate market. Rating scores were determined individually for supply and demand due to various market functions and the supply-demand imbalance.

Designation of the BB level (called the benchmark, reference point, basic platform) was established for each indicator separately with the use of an assumption of the rough set theory and value tolerance relations on the basis of the formula below:

$$R_j(x,y) = \frac{\max\left(0, \min\left(c_j(x), c_j(y)\right) + k - \max\left(c_j(x), c_j(y)\right)\right)}{k} \quad (1)$$

where: $R_j(x, y)$ – relationship between two sets with membership function [0,1]

x, y – number of provincial real estate market (x = 1:16; y = 1:16)

$c_j(x)$, $c_j(y)$ – value of jth indicator of the analyszed real estate market

j – number of indicator

k – coefficient adopted as standard deviation for a given real estate market attribute, allow to consider objects as a indiscernible without having identical values.

The formula, marked as (1), has been developed and discussed by Stefanowski and Tsoukias (2000). It been applied in real estate market analyses by d'Amato (2007), Renigier-Biłozor (2011). The formula is used to compare two data sets and obtained result within the [0, 1] range marks the level of the indiscernibility relation. In the formula output, there is a level of indiscernibility relation between the object and the rule, assuming a **k level** of threshold for the measure of the attribute.

For example in case of indicator 1 (see app. 2) the relationship between the object $c_1(1)$ (x=1 its Gdańsk; $c_1(1)$= 44.0) and object $c_1(2)$ (y=2 its Olsztyn; $c_1(2)$= 36.8) where k=8.966 has a value 0.20. This value is obtained as follows:

$$R_1(1,2) = \frac{\max(0; 36.8 + 8.966 - 44.0)}{8.966} = 0.20$$

In view of the above, the benchmark (BB) was calculated on the basis of the results produced by the valued tolerance relation matrix for every indicator of every market. The formula presented below assumed that BB_j is equal to the maximum sum of R_j for those market (from 1 to 16) that achieved maximum results of R_j(x,y) that indicated the biggest similarity and representation among others markets.

$$BB_j(x) = \sum_{y=1}^{16} R_j(x, y); BB_j = \max_{x=1:16} BB_j(x) \quad (2)$$

These benchmarks need to be realistic and objectively measurable. In the light of the analysis, the benchmark level is established on the assumption of the highest value of the similarity in relation to other objects. The aim of this analysis was to obtain the objective level of the relative comparison values in a specific set of particular the variables that it was possible to determine in this field of research. An example of the conducted analysis is presented in Table 2. This table consists of the result of the calculation benchmark (BB) level for indicator no. 1.

Table 2: Determination of BB point (benchmark) for indicator No. 1 (j = 1) with the use of the value tolerance relation.

Market's number	**1**	**2**	**3**	**4**	**….**	**16**
1	1	0.2	0	0	…	0.63
2	0.2	1	0.68	0	…	0.57
3	0	0.68	1	0	…	0.24
4	0	0	0	1	…	0
….	0.59	0.61	0.29	0	…	0.96
16	0.63	0.57	0.24	0	…	1
BB1(x)	3.54	**5.49**	4.93	1.08	…	5.39

Source: Author's calculation

The table indicates that the benchmark point was established at the level of the second market (x=2) because $BB_1(2)$ was the highest (5.49). The benchmark point for indicator No. 1 was constituted as $c_1(2)$=36.80, which was the ranking of the quality of local government for market No. 2 (that is Olsztyn – see append. 2). The benchmark point was determined for every indicator in the above way.

The following step concerned the unitarisation of indicators of terms to the "benchmark" level. The unitarization of indicators was established based on the formula below:

$$U_j = \frac{c_j(x) - BB_j}{\Delta c_j} \tag{3}$$

where:

$$\Delta c_j = \max_{x=1:16} c_j(x) - \min_{x=1:16} c_j(x)$$

The results of the unitarisation value for the sets were sorted in ascending order. An example of the conducted analysis for indicator No. 1 is presented in Table 3.

Table 3: determination of U_1 value (indicator No. 1).

Market's number	13	4	8	14	6	3	11	2	5	7	10	16	1	12	15	9
BB1 = 36.80 and $\Delta c_1 = 32$ U_1	-0.478	-0.422	-0.191	-0.172	-0.116	-0.091	-0.059	0.000	0.109	0.109	0.109	0.122	0.225	0.241	0.509	0.522

Source: Author's calculation

The next issue was the development of scoring intervals for indicator ratings. The scoring intervals were established separately for determinants and destimulants with the assumptions below:

- for determinants: if BB = 0 than AAA = 1 and D = -1
- for destimulants: if BB = 0 than AAA = -1 and D = 1

The determinants positively influence the features that shape the housing real estate market condition, while the destimulants have a negative influence on them.

To account for the aforesaid, the intervals were determined separately for determinants and destimulants (Tab. 4).

Table 4: Scoring intervals for the indicator's rating.

Rating levels for determinants			**Rating levels for destimulants**		
Numerical classification	The range of levels	Rating scale	Numerical classification	The range of levels	Rating scale
-1.00	below -0.910	D	-1.00	below -0.876	AAA
-0.8	-0.710 to -0.900	C	-0.75	-0.626 to -0.875	AA
-0.60	-0.510 to -0.700	CC	-0.50	-0.376 to -0.625	A
-0.40	-0.310 to -0.500	CCC	-0.25	-0.126 to -0.375	BBB
-0.20	-0.110 to -0.300	B	0.00	-0.125 to 0.100	BB
0.00	-0.100 to 0.125	BB	0.20	0.110 to 0.300	B
0.25	0.126 to 0.375	BBB	0.40	0.310 to 0.500	CCC
0.50	0.376 to 0.625	A	0.60	0.510 to 0.700	CC
0.75	0.626 to 0.875	AA	0.80	0.710 to 0.900	C
1.00	higher than 0.876	AAA	1.00	higher than 0.910	D

Source: Author's calculation

On this basis every indicator from the "rating attributes toolkit" was evaluated. An example of the determination of the indicator's rating is shown in Table 5.

Table 5: Results of the rating for indicator No. 1 (determinants) and indictor No. 4 (destimulants).

Market's number	Rating for determinants		Market's number	Rating for destimulants	
	Ui for indicator no. 1	Rating score		Ui for indicator no. 4	Rating score
13	-0.478	CCC	**1**	-0.194	BBB
4	-0.422	CCC	**11**	-0.167	BBB
8	-0.191	B	**13**	-0.083	BB
14	-0.172	B	**15**	-0.028	BB
6	-0.116	B	**10**	0.000	BB
3	-0.091	BB	**4**	0.028	BB
11	-0.059	BB	**9**	0.028	BB
2	0.000	BB	**12**	0.083	BB
5	0.109	BB	**6**	0.194	B
7	0.109	BB	**16**	0.194	B
10	0.109	BB	**14**	0.222	B
16	0.122	BB	**8**	0.250	B
1	0.225	BBB	**3**	0.389	CCC
12	0.241	BBB	**7**	0.444	CCC
15	0.509	A	**5**	0.556	CC
9	0.522	A	**2**	0.806	C

Source: Author's calculation

The next step was the determination of a "partial rating" for subcategories indicated in step IV. The partial rating scores were determined individually for residential, economic, social and location sub-categories within the supply and demand of sets. An arithmetic mean was calculated from indicators belonging to the given subcategory. For example, the following values were determined for Gdańsk in the economic and political set for supply: ind.4 – BBB (score 4); ind. 5 – A (score 3). ind. 6 – BBB (score 4); ind. 7 – A (score 3); mean – 3.50 (A).

Due to the fact that every category has a different contribution in the final rating, it was necessary to prepare more detailed intervals to account for variations within each rating score ("+" and "-" signs). Plus (+) and minus (-) signs must be appended to rating symbols to indicate their relative position within each rating category. The intervals were determined within the main categories to determine final ranking scores. Additionally, those intervals were set to account for the fact that the calculated "partial rating" scores for the main categories (e.g. AAA) would not always equal 1. The final rating scores were determined for the analyzed markets by calculating the mean for partial rating scores, taking into account the percentage of each subcategory in the final result. Final rating scores were designated based on the intervals of rating scores. The results of the final rating score for demand and supply of analysed markets is shown in Table 6.

Final rating scores were determined to minimize the impact of the potential subjective classification of various indicators. The rating score for analysed markets was quite good (the worst was at the B- level) in general. The score resulted from the choice of subjects for experiment and the simulation of the developed rating methodology. There were main markets in the country with the greatest potential for development and the best economic condition within the region (province). Moreover, the rating for supply and demand was not identical for particular markets. This is understandable because the balance between supply and demand does not exist in the real cases in the property markets.

The analysis indicated that Wroclaw received the highest results for supply (an area in the strong stage of recent development and with good future expectations of urban growth), and the lowest was received by Bialystok (the relatively poorest area of the country, and with uncertain future expectations for urban growth). Simultaneously, the rating for demand was different for most markets. Poznań received the highest result (an area with a good quality of life, and in a strong stage of development, and with good future expectations for urban growth), and Łódź received the lowest (an industrial area with a poor quality of life, and with uncertain future expectations for urban growth). However, the following markets received a high evaluation of demand rating: Opole and Rzeszów (BBB), with a relatively high unemployment rate and poor living conditions, especially in comparison to the nearest main neighbouring markets, but with a big potential for growth in comparison (contrast) with the poor development of the urban areas closest to where they are.

For a better interpretation, a visualization of results is presented on the maps (Fig. 2 and 3). It must be stressed that just the real estate markets which were analysed are presented on the maps. All the proposed markets constitute the most important space impact onto other regions and the best point of representation of their region. Analysing the maps, we cannot notice the existence of any obvious space trend. There is no connection between size of the city and rating of the residential markets due to the fact, that the markets' condition doesn't depend from the availability of area, but more from the social, economic and quality of life from overall point of view and future perspective of the city development.

The space of the analysed country was not divided into better (with a higher rating score) or worse (with a lower rating score) part of the area regarding real estate markets. We can just notice that the best markets are mostly surrounded by the worse (Fig. 2, e.g. Warszawa - Bydgoszcz, Kielce, Bialystok; fig.2, e.g. Katowice – Kielce . Łódź). It is possible that the markets with the highest score work as a magnet and aggravate the condition of the main market (town) surrounding them. Therefore, it can be assumed that the analysed (main) property markets works autonomously and strongly compete to attract people by using their own strategy.

Table 6: The final rating score for the residential real estate markets.

Rating of supply			**Rating of demand**		
Gdańsk	3.47	A-	Gdańsk	4.35	BBB-
Olsztyn	5.40	BB-	Olsztyn	4.60	BB+
Szczecin	4.68	BB+	Szczecin	5.12	BB
Bydgoszcz	5.59	B+	Bydgoszcz	5.41	BB-
Białystok	**6.31**	B-	Białystok	5.64	B+

Rating of supply			Rating of demand		
Poznań	5.02	BB	**Poznań**	**3.15**	A
Warsaw	3.46	A-	Warsaw	3.38	A-
Łódź	4.62	BB+	**Łódź**	**5.78**	B
Wrocław	**3.24**	A	Wrocław	4.29	BBB-
Lublin	5.09	BB	Lublin	5.28	BB
Kraków	4.31	BBB-	Kraków	4.32	BBB-
Rzeszów	4.97	BB	Rzeszów	3.54	BBB+
Zielona Góra	5.27	BB-	Zielona Góra	5.06	BB
Kielce	6.05	B	Kielce	5.71	B+
Katowice	3.85	BBB	Katowice	3.42	A-
Opole	4.99	BB	Opole	4.08	BBB

Source: Author's elaboration

Figure 2: Rating of real estate markets for supply. Source: Author's elaboration.

Figure 3: Rating of real estate markets for demand. Source: Author's elaboration.

The last stage of the elaborated procedure assumed the verification rating score and data on the quality and usefulness a posteriori. This analysis will be conducted in the next study. The author assumed using the parametrical (e.g. Hellwig's method) and non-parametrical (rough set theory) methods for this analysis.

5 DISCUSSION

Due to the globalization, the implementation of IT solutions and the increasing mobility of people, making decisions in the real property market is no longer limited to the analysis of local and technical factors of real properties. Residential properties constitute not only a common element for securing basic existential needs and capital location, but they are also an important factor determining the conditions and development and investment potential of a given region. The main problem in the field involves the development of a comprehensive classification of the real estate market relevant to the specific character of real estate market operations, which involves complex procedures and decisions, as well as the unique character of real estate data. Providing access to the knowledge of the real estate market, developed in the form of a modern classification system (rating), is the only way to solve this problem.

The main objective of real estate market ratings is to create a universal and standardized classification system for evaluating the real estate market potential and a reduction of speculative information noise. The main aim of this study was the conducting of an analytical procedure to determine the rating for real estate markets concerning condition of urban space. The efficiency of the presented studies depends to a significant degree on the availability and reliability of data, and the methodology of the analysis. The elaborated procedure consists of 5 main stages with 17 steps that are methodologically open and can be moderate due to the frame of analysis. Within the scope of the study the final rating for the main Polish residential markets was established. In this case the methods of Boolean inference, value tolerance relations and scoring analysis were used.

The established rating provided a current, reliable, useful and comparable picture of the situation of individual cities or regions (markets) that can help to improve the decision-making process. The presented analysis indicated that Polish markets are not divided into particular regions. It should be underlined that markets received maximum A and minimum B-. Considering that Poland is generally in quite a good condition, and with good future expectations (EU funds), rating scores below BB might be alarming. The classification indicated that the analyzed markets regarding the provincial capitals have better, worse or alarmingly weak potentials for residential market growth. This should be considered by entities in real estate markets (e.g. buyers, sellers and investors), and on the other hand by the initiators or inspirers of urban space changes (e.g. local government. business society, etc.).

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Appendix 1: Sample of rating attributes toolkit for residential property market

Group I – supply-side indicators:	
a) social set	1 – ranking of quality of life for "quality of local government" (max 100 p.)-det.* 2 – number of deaths of those older than 50 (per 1000 residents) - det. 3 – contribution of individuals in the post-productive age (per cent) - det.
b) economic and political set	4 – fuel prices per litre – des.* 5 – number of new registered businesses industry and construction (per 10000 residents) - det. 6 – local government spending on public utilities and environmental protection (per resident) - det. 7 – local government spending on investments (per resident) - det.
c) residential set	8 – vacancy rate for office properties (per cent) – des. 9 – vacancy rate for retail properties (per cent) – des. 10 – vacancy rate for warehouses properties(per cent) – des. 11 – number of apartments (per 1000 residents) – det. 12 – usable dwelling space(per resident) – det. 13 – average number of rooms in a dwelling– det. 14 – value of new mortgage agreement (per resident) – det. 15 – total number of issued construction permits (per 10000 residents) – det. 16 – number of issued construction permits – individual (per 10000 residents) – det. 17 – number of apartments with started constructions (per 10000 residents) – det. 18 – number of completed apartments (per 10000 residents) – det. 19 – number of completed rooms (per 10000 residents) – det. 20 – the average number of rooms in completed apartments – det. 21 – the average area of a room (per m2) - det. 22 – number of developers on the local market (per 10000 residents) – det. 23 –number of property transactions (per 10000 residents) - det. 24 – value of property transactions (per 1000 residents) - det. 25 – affordability of rental housing (number of square meters that can be financed from an average local salary per month) – det. 26 –difference in the structure of (<=40) supply of usable area per transaction and offers on the primary market (per cent) – des. 27 – difference in the structure of (40; 60) supply of usable area per transaction and offers on the primary market (per cent) – des. 28 – difference in the structure of (60; 80) supply of usable area per transaction and offers on the primary market (per cent) – des. 29 – difference in the structure of (>80) supply of usable area per transaction and offers on the primary market (per cent) – des. 30 – structure of (>80) supply of usable area per transaction on the primary market (per cent) – det. 31 – structure of (>80) usable area supply for offers/quotation on the primary market (per cent) – des. 32 – balance of supply and demand for apartments below or equal to 50m2 on the primary market (per cent) - det. 33 – balance of supply and demand for apartments over to 50m2on the primary market (per cent) - det. 34 – difference in the structure of (<=40) supply of usable area per transaction and offers on the secondary market (per cent) – des. 35 – difference in the structure of (40; 60) supply of usable area per transaction and offers on the secondary market (per cent) – des. 36 – difference in the structure of (60; 80) supply of usable area per transaction and offers on the secondary market (per cent) – des. 37– difference in the structure of (>80) supply of usable area per transaction and offers on the secondary market (per cent) – des. 38 – structure of (>80) supply of usable area per transaction on the secondary market (per cent) – det. 39 – structure of (>80) supply of usable area per transaction per offers on the secondary market (per cent) – des. 40 – local government spending on housing policy (per residents) - det. 41 – number of property offers, average from the most popular websites in Poland (per 1000 residents) - det.
d) spatial and location set	42 – per cent of land covered by zoning plans – det. 43 – level of retail area (m2/1000 residents) – det. 44 – supply of office area (m2/1000 residents – det. 45 – supply of warehouse area (m2/1000 residents) – det.

Group II – demand-side indicators:	
a) social set	46 – forecasting of population number for 2020 (per cent in comparison with 2013)-det. 47 – forecasting of population number for 2035 (per cent in comparison with 2013) –det. 48 – number of private cars (per 10 residents) – det. 49 – ranking of quality of life for health (max 100 p.) – det. 50 - ranking of quality of life for satisfaction with life (max 100 p.) – det. 51 - ranking of quality of life for safety (max 100 p.) – det. 52 – unemployment rate (per cent)- des. 53 – unemployment rate (per cent average from last 5 years) – des. 54 – difference between regional and local unemployment rate (per cent) – det. 55 – population growth (per 1000 residents) – det. 56 – net migration rate (per 1000 residents) – det. 57 – number of marriages (per 1000 residents) - det. 58 – number of students (per 1000 residents) – det. 59 –contribution of individuals in the productive age (per cent) – det. 60 – contribution of individuals in the pre-productive age group(per cent) – det. 61 – contribution of individuals in the post-productive age (per cent) – det. 62 –number of sports clubs (per 10000 residents) – det. 63 – number of cultural centres (per 100000 residents) – det. 64 – number of cinemas (per 100000 residents) – det. 65 – number of hypermarkets (per 100000 residents) – det.
b) economic and political set	66 – average rent in a new shopping centre (affordability per average local salary-m2)–des. 67 – average rent in the office blocks (affordability per average local salary–PLN/m2)-des. 68 – number of science and technology parks - det. 69 – fuel prices (per litre) – des. 70 – number of suspended business activities(per 1000 residents)-des. 71 – number of new businesses (per 1000 residents) – det. 72 – number of self-employed individuals (per 1000 residents) -det. 73 – number of businesses employing 0-9 workers(per 10000 individuals in the productive age) - des. 74 – number of businesses employing 10-49 workers (per 10000 individuals in the productive age) -des. 75 – number of businesses employing 50-249 workers (per 10000 individuals in the productive age) -det. 76 – number of businesses employing 250 and more workers (per 10000 individuals in the productive age) -det. 77 – number of businesses with foreign capital (per 10000 residents)- det. 78 – Gross Domestic Product (Poland=100p.) – det. 79 – local government income (per resident) – det. 80 – local government spending (per resident) – det. 81 – difference between the national average salary and the average salary on the local market (per cent) – det.
c) residential set	82 – the average number of individuals in an apartment – det. 83 –availability of apartments on the primary market in terms of average salary(m2)– det. 84 – availability of apartments on the secondary market in terms of average salary(m2)– det. 85 – offered purchasing power on the local housing market (average salary on the local market / average price per 1 m2 of property on the local market) – det. 86 – transaction purchasing power on the local housing market (average salary on the local market / average price per 1 m2 of property on the local market) – det. 87 – availability of mortgages in terms of m2 (average property price / average credit rating of a family or individual) – det. 88 – availability of mortgages on the secondary market in terms of PLN credit (m2) – det. 89 – availability of mortgages on the primary market in terms of PLN credit (m2)– det. 90 – value of new mortgages (per resident)– det. 91 — number of real estate agents on the local market (per 10000 residents) – det. 92 – number of real estate appraisers on the local market (per 10000 residents)-des. 93 – number of property transactions (per 10000 residents) - des. 94– value of property transactions (per 1000 residents) - det. 95 – average time on the secondary market (in days) – des. 96 – difference between the average offered and transaction price of m2 the real estate on the primary market (PLN) –des.

97 – difference between the average offered and transaction price of m2 the real estate on the secondary market (PLN) –des.
98 – changes in local property offered prices (per cent) –det.
99 – changes in local property transaction prices (per cent) – det.
100 – difference between changes in offered and transaction prices on the secondary market (per cent) -des.
101 – difference between changes in offered and transaction prices on the primary market (per cent) -des.
102 – affordability of rental housing on the secondary market (number of square meters that can be financed from an average local salary per month) –det.
103 – difference between the minimum and maximum transaction prices on the primary market (PLN/m2) –det.
104 – balance of supply and demand for apartments below or equal to 50m2 (per cent) 105 –balance of supply and demand for apartments of over to 50m2 (per cent) -det.
106 – difference between the minimum and maximum transaction prices on the secondary market (PLN/m2) –det.
107 – difference between offered and transaction prices for low standard (PLN/m2) –des.
108 – difference between offered and transaction prices for medium standard (PLN/m2) –des.
109 – difference between offered and transaction prices for high standard (PLN/m2) –des.
110 – difference between low and high standard for offered prices (PLN/m2)– det.
111 – difference between low and high standard for transaction prices (PLN/m2) – det.
112 – ratio of replacement value per 1 m2 of property to the transaction price (per cent) – det.
113 – ratio of replacement value per 1 m2 of property to the offered price (per cent) – det.

d) spatial and location set	114 – per cent of green areas (per cent) – det. 115 – cycle path (per 10000. residents) – det. 116 – length of bus-lane (km) – det. 117 – roads with hard surface (km per 10000 residents) – det. 118 – roads with hard surface (km per km2 of city) – det. 119 – number of green parks in the region – det. 120 – population density (per km2)– det. 121 – number of buses (per 1000 residents) – det. 122 – number of high schools (per 100000 residents) – det.

*det. – determinats. des. – destymulants

Appendix 2. Database of the rating attributes toolkit.

		Number of indicator for 2014 year.								
		1	2	3	4	5	6	7	...	122
o.n.	Markets	soc.	soc.	soc.	econ.	econ.	econ.	econ.	**...**	spat. and loc.
1	Gdansk	44.0	9.58	21.30	5.23	26	234.61	1607.42	…	2.82
2	Olsztyn	**36.8**	7.75	18.50	5.59	18	496.34	852.20	…	2.29
3	Szczecin	33.9	9.61	21.10	5.44	32	250.11	733.60	…	3.18
4	Bydgoszcz	23.3	9.76	21.60	5.31	19	197.11	586.89	…	2.50
5	Białystok	40.3	7.45	18.10	5.50	18	174.11	1048.67	…	3.73
6	Poznan	33.1	10.03	21.30	5.37	21	124.77	891.87	…	4.74
7	Warszawa	40.3	10.21	22.40	5.46	20	215.86	1055.70	…	4.58
8	Łodz	30.7	13.24	24.30	5.39	19	334.11	1034.03	…	3.09
9	Wrocław	53.5	9.40	21.50	5.31	22	363.91	822.74	…	3.80
10	Lublin	40.3	8.27	20.40	5.30	16	305.87	1577.41	…	2.62
11	Krakow	34.9	8.94	21.00	5.24	19	286.78	528.65	…	2.77
12	Rzeszów	44.5	7.11	17.80	5.33	17	410.25	1331.75	…	2.73
13	Zielona Gora	21.5	8.42	20.40	5.27	24	150.92	545.78	…	2.53

		Number of indicator for 2014 year.								
		1	2	3	4	5	6	7	...	122
o.n.	Markets	soc.	soc.	soc.	econ.	econ.	econ.	econ.	**...**	spat. and loc.
14	Kielce	31.3	8.92	21.60	5.38	16	220.73	983.01	…	5.00
15	Katowice	53.1	10.70	22.50	5.29	15	322.81	1404.23	…	4.93
16	Opole	40.7	9.49	21.20	5.37	20	327.14	982.64	…	3.33
		No. of indic. for 2012y.								
		1	2	3	4	5	6	7	…	122
	Gdansk	n.d.*	9.11	20.70	5.65	26	191.50	2465.97	…	2.82
	Olsztyn	n.d.	7.43	17.60	5.82	17	236.61	781.83	…	2.29
	Szczecin	…	…	…	…	…	…	…	…	3.67

* n.d.– no data

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Małgorzata Renigier-Biłozor
University of Warmia and Mazury in Olsztyn. Faculty of Geodesy, Geospatial and Civil Engineering.
Department of Real Estate Management and Regional Development
Prawochenskiego 15 Str., 10-724 Olsztyn, Poland
e-mail: malgorzata.renigier@uwm.edu.pl