PRICE MAPS AS A RISK LIMITING AND DECISION SUPPORTING FACTOR ON THE REAL ESTATE MARKET

Radosław Gaca, Ph.D.
Independent scientist
Private Real Estate Valuation Company
Bydgoszcz, Poland
e-mail: radoslaw.gaca@gmail.com

Assoc. Prof. Svetlana Gercheva, Ph.D.
Department of Finance
University of Economics
Varna, Bulgaria
e-mail: svetla_g1@mail.bg

Abstract

Real estate market is one of the most important elements of the investment market. As in the case of other markets, real estate investments are associated with various types of risk. One of the most important risk factor is access to information. As a part of the information important in taking decisions on the real estate market, in addition to information relating to the legal and actual status of a real estate and its surroundings, information about prices is one of most important factors. In particular access to information relating to property prices, including spatial and typological issue (dwellings, houses, land) is important in this case. In this paper, on the example of the price map of the City of Warsaw we present proposals for using price maps to assess and reduce risk in making decisions on the real estate market. As a part of the discussion, the paper presents both the advantages and disadvantages of using the described source of information. In the summary, we indicate the development directions and risks associated with the development of price maps.

Key words: real estate decision support, real estate management, real estate investment, real estate price maps

Introduction

Real estate market is one of the most important elements of the investment market. As in the case of other markets, real estate investments are associated with various types of risk. One of the most important risk factor is access to information. As a part of the information important in taking decisions on the real estate market, in addition to information relating to the legal and actual status of a real estate and its surroundings, information about prices is one of most important factors. In particular access to information relating to property prices, including spatial and typological issue (dwellings, houses, land) is important in this case. The indicated risk may be significantly limited if you have adequate market information. This type of information can be obtained from various sources, which include specialist reports on specific segments and areas of the market, individual opinions prepared by property appraisers or various types of price visualizations. Currently, a very popular form of price visualization are various kinds of map portals placed in the Internet. The advantage of this type of solutions is the ease in identifying the area of interest and the possibility of making individual, often detailed comparisons to real estate that is a potential subject of investment. At the same time presentation of information in a graphical form provides much greater analytical capabilities than their presentation in tabular or other descriptive form, which can be especially important for people who do not deal professionally with the real estate market (CAŁKA, BIELECKA, 2014). The GIS tools are commonly used to build such types of IT platforms containing spatial data. GIS technology allows the integration of various spatial and attribute information (GOTLIB et al., 2007). This information is then used in decision-making processes regarding the real estate market (DONLON, 2007). From this point of view, all kinds of studies aimed at creating price maps are extremely important for reducing the investment risk in the real estate market. Such maps can be prepared and dynamically updated and access to them is most often possible in the open formula.

The paper presents an analysis of both the sources of information and a critical assessment of their usefulness in the broadly understood real estate management, indicating both the advantages and disadvantages of existing solutions.

Previous research and literature review

The problem of visualization and processing of spatial data and their use in real estate management has been a dynamically developing research area for some time. The strong development of this branch of science located at the interface of geodesy, geography, spatial economy, real estate management and other sciences is caused both by the dynamic development of IT techniques and the increasing readiness of public entities to provide access to previously reserved information. Certainly for the members of the European Community, the influence of EU public administration on the described behaviors is provided by the EU regulations, in particular the INSPIRE Directive. The directive establishes thirty-four thematic groups of spatial data, which will have to be published in the form provided for by the data model resulting from the implementation provisions of the Directive (IR – Implementing Rules). These data collected and made available in the form of metadata must be made compulsory through the services provided for in the directive. The Directive does not impose the obligation to collect new data or the need to reorganize own resources. However, it requires that the member states provide access to the information they collect in a form adapted to the INSPIRE application schemes through network services. The data can be adjusted on-line or off-line. Information on the rules for the development of data sets for INSPIRE, in compliance with harmonized rules adopted by consensus, is included in the data specifications. The Directive does not indicate that the data mentioned in it must be made available free of charge.

In the current literature, authors have so far paid attention to both price maps and property value maps, focusing more on value maps. The difference between price maps and property value maps results from different rules for their preparation. Price maps are made directly on the basis of transactions with the possible use of interpolation methods and reflect the actual state of the market. The value maps are made using advanced analytical techniques, including regression models and others that allow to determine the value of individual properties. In the current research on the use of price maps in real estate management, the authors emphasize their importance as a source of information for various socio-economic goals and investment decisions, including those supporting the process of property taxation (ŹRÓBEK et al., 2005, 2006; BYDŁOSZ et al., 2010; CELLMER et al., 2012, 2014; KRYVOBOKOV, 2004). As mentioned by Batt (BATT, 2009) concept of maps usage for tax purposes dates back to ancient times, whereas the first land value maps were developed in the early 20th century in US and UK. Other authors (PRUS, 2010; BUDZYŃSKI, 2012) point to the special importance of price maps for the management of state and local government estates. Among the basic benefits resulting from the use of spatial information in managing the local government is mentioned as (GEOINFORMACJA, 2018):

- enriching decision-making processes with their spatial location, which facilitates the efficiency of their implementation and is helpful in the process of developing decisions,
- improving the flow of information by linking the matters to be carried out with space, which allows you to see immediately all official matters conducted in relation to the fragment of space under consideration,
- easier coordination of the work of the office's departments,
- facilitating communication (exchange of information) with other local government units, both at the level of an equal and superior level,
- reduction of the office's operating costs,
- easy accessibility of spatial data for residents.

The literature also emphasizes GIS technologies for decision making in the real estate market (PODOR, NYIRI, 2010), including in particular its initial analysis (BIBLE, HSIEH, 1996; CICHOCIŃSKI, 2007). However, in the current research relatively little space was devoted to the issue of risk limitation when making decisions by individual market participants, in particular non-institutional buyers.

The risk of the real estate market

Risk is an inseparable component of life. Every decision, especially investment one, requires its evaluation. According to Arrow (1979) "We invoke the risk and reaction of people to explain everything – from buying a lot in numerical games to the capitalist economic structure." People have tried to define both risk and attempt to limit it from time immemorial. The close connection of risk with human everyday life is already indicated by the very name of this phenomenon. The word "risk" originally meant in Arabic "making money for daily bread". In old Italian, the word *risicare* meant "dare". In this sense, the word "risk" can be understood as a free choice rather than an inevitable destiny. Therefore, the risk of investing can be identified on the one hand with the risk of incurring a loss, on the other hand with the potential degree of threat or chance in achieving the expected benefits. According to the second of the presented

approaches, the risk is therefore the danger of an investment effect inconsistent with expectations, that is, the one in which this effect may be worse or better than expected (loss or greater profit) (RĄCKA, 2017).

One of the main important element in the risk analysis is to distinguish it from the concept of uncertainty. In this case, the risk is a measure of the uncertainty of the results expected in the future as a result of specific actions (investments). A number of types of risks have been distinguished about the scope of research related to investment issues, both in-kind and, in particular, financial matters. These risks can be grouped depending on their source on systematic and specific risks. Systematic risk is assumed to be the risk resulting from external factors (external macroeconomic conditions) affecting the whole economy or its specific sectors equally. The risk typical for investing in a given type of assets is assumed to be non-systematic (specific). This risk is also defined as the risk subject to diversification. Table 1 presents the systematics of risk levels depending on the availability of information or the method of estimating the distribution of probabilities.

Table1. Systematics of risk levels.

Uncertainty levels	Characteristic
No risk (certainty)	The output quantities can be determined in an unambiguous way (laws of mathematics, physics, etc.)
Objective risk	There are known variants of the output quantities and probability of their occurrence (games of chance)
The right risk	Variants of output quantities are known, probabilities are unknown, but they can be estimated by experiment or on the basis of historical data (risk of financial investments, real-property, loss of life)
Subjective risk	Variants of output quantities are known, probabilities are unknown and must be determined subjectively by the decision maker
Uncertainty	Variants of output quantities and / or probabilities are unknown

Source: Own study based on (WILIAMS JR. C. A. et al. 1995).

From the analysed area's point of view the information collected and made available in the form of price maps has a significant impact on the reduction of the above-mentioned risks on the real estate market.

Price maps as an analytical tool, case study

As already indicated in the paper, price maps are one of the components of the real estate information system. Under Polish conditions, the rules for the preparation and presentation of price maps in relation to land designated for development and agricultural land were laid down in the Regulation of the Council of Ministers of 3 October 2011. Unfortunately, despite the passage of nearly seven years since the introduction of the provision, the land price maps made available by the entities established for this purpose in the open mode in the Internet network are rare. Likewise, price maps of residential properties are also rare in domestic conditions. Maps of this kind are currently developed and published only by the City of Warsaw and the City of Łódź.

In the case of Warsaw, the map of average prices is maintained as part of the Real Estate Price and Value Register by the Office of the Cadastre Survey of the Capital City of Warsaw. This service is currently available online at the address www.mapa.um.warszawa.pl. The map contains data on average prices of residential premises and data on transactions made with premises and land properties, divided into years. Information on the price level is shown on the map in the ranges up to 5,000 PLN/m^2 from 5 to 11 every 2 thousand, up to 15 and above 15,000 PLN/m^2. The accuracy of the map is about 200 m. The map allows to make a separate presentation of prices for premises sold on the primary and secondary market. The integration of the map in the form of a layer with other geospatial data allows you to search both areas of interest, based on the address and plot number. Fig. 1 shows the general appearance of the portal with the subject area of the Price and Value Register displayed. Fig. 2 presents an exemplary close-up to the level that enables identification of the street.

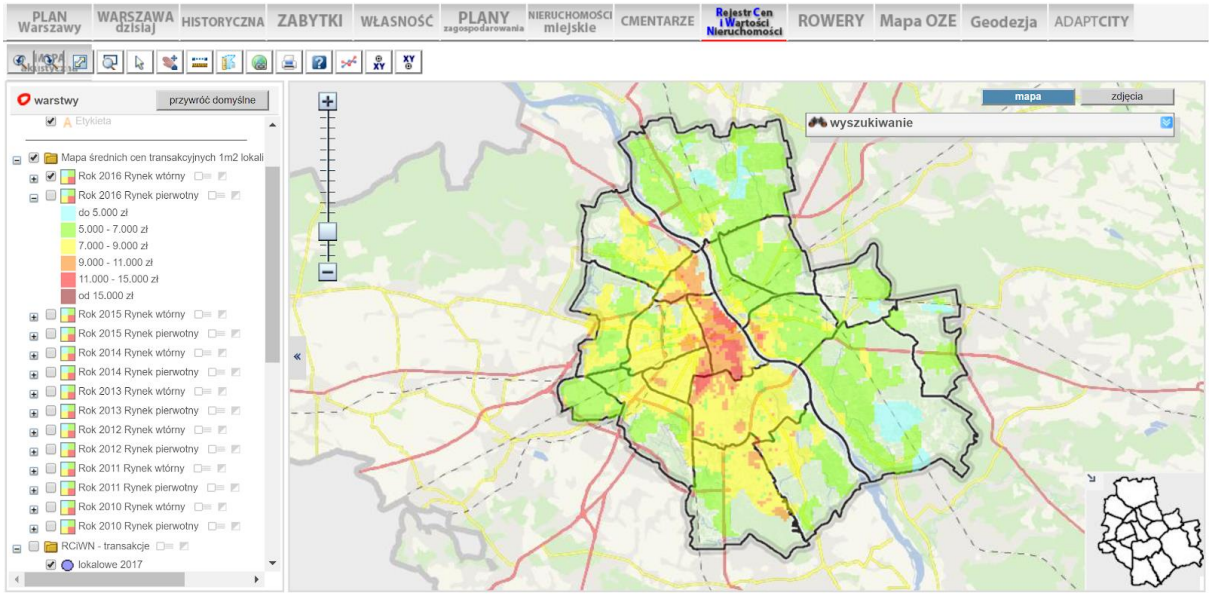

Fig. 1. Geoinformation portal of the Municipal Office of the Capital City of Warsaw, the thematic layer of the Register of Prices and Values.
Source: (OFFICE OF GEODESY OF THE CADASTRE OF THE CITY OF WARSAW: www.mapa.um.warszawa.pl.)

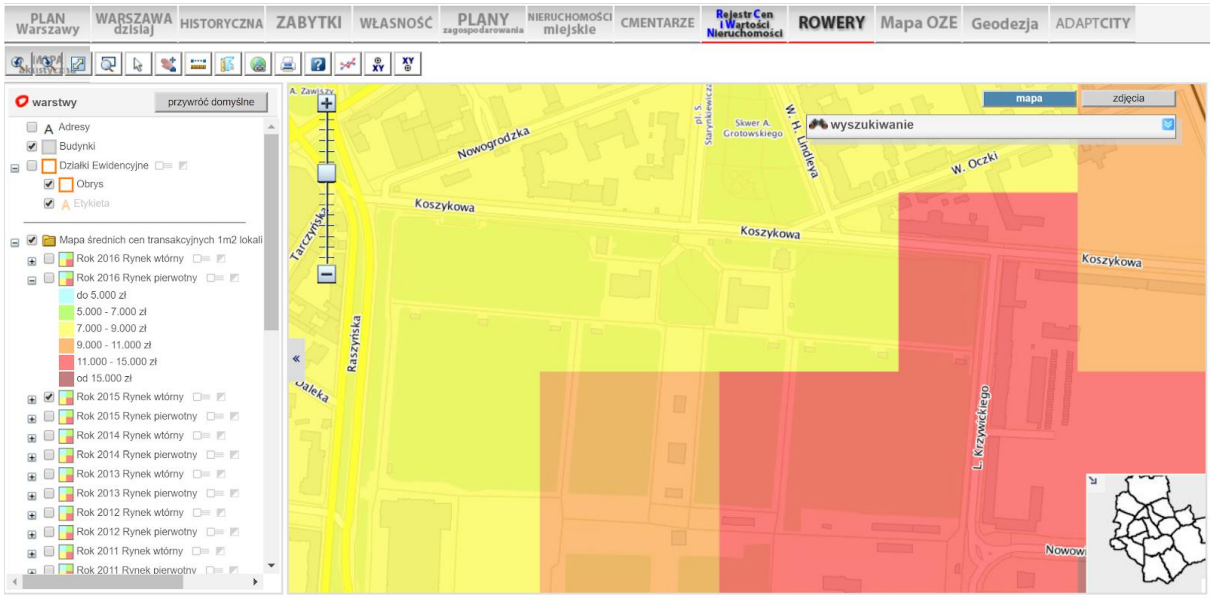

Fig. 2. Geoinformation portal of the Municipal Office of the Capital City of Warsaw, the thematic layer of the Price and Value Register, zooming to the street level.
Source: (OFFICE OF GEODESY OF THE CADASTRE OF THE CITY OF WARSAW: www.mapa.um.warszawa.pl)

As already indicated, on the basis of the map it is possible to set the price level for each location within the city. The ranges read for the five sample locations are shown below in Table 2.

In addition to the maps prepared and published by the administration authorities, price maps prepared and published by private entities are gaining more and more popularity. This direction is also observed in other countries. Map portals are an important source of information about the real estate market and in this respect may contribute to a significant reduction of investment risk in the real estate market. Due to the period of their updating, they allow not only to recognize the current market situation but also to analyse trends and trends. The indicated functionality also allows you to assess the attractiveness of particular directions of city development. Linking data from the price map with a map showing the spatial layout of the transaction, including their intensity, allows in this way by obtaining relevant market information for a significant optimization of the decision (GACA, 2009) and reducing the investment risk on the real estate market. Considering the attractiveness of visual presentation of data in the form of a map composition, one should also take into account the dangers and threats associated with

it. The first of these threats is undoubtedly the adoption of a formula for estimating intermediate values based on transactions underlying the model's construction. Taking into account the approximation form and the applied mathematical algorithm in the determined intermediate values constituting interpolation between the actual market events determining the level of prices existing in a given market area, they are not, for obvious reasons, unambiguous reference points in relation to a specific location. In these cases, in particular, pay attention to those places on price maps, where there is a large variation in transaction prices of real estate constituting the basis for building the model or for places where for various reasons there was no transaction. In such cases, there may be a situation in which the interpolated value will largely differ from the level of prices actually occurring there. Another type of threat or perhaps more impact on the real estate market of price maps is the possibility of so-called self-creation of the market. Universal access to information about price levels can lead to a specific phenomenon of autocorrelation, leading to excessive appreciation or depreciation of prices. Another threat with the same source is limiting changes and unnatural stabilization of prices.

Table2. Price range for the five sample locations.

Street	LPR [PLN/m^2]	UPR [PLN/m^2]	AV [PLN/m^2]	DV
Smolna 34	11000	15000	13000	15,38%
Barska 11	7000	9000	8000	12,50%
Kopińska 4	5000	7000	6000	16,67%
Piwna 34	11000	15000	13000	15,38%
Orla 8	7000	9000	8000	12,50%

Key: LPR lower price range, UPR upper price range, AV average, DV % deviation from the average.

Source: Own study based on the Warsaw www.mapa.um.warszawa.pl.

Conclusions

Real estate price maps describing graphically the condition and changes on the market are certainly an important source of information on the real estate market. The important advantages of price maps prepared in the form of thematic layers on portals using GIS technology is the ability to visualize a lot of information about real estate. Information from this source in connection with other market information allow for significant reduction of investment risk and constitute an important factor supporting market decision making. Due to the open access to the indicated data, they may have particular significance for individual investors. Of course, general data on the level of prices contained in the described sources cannot be treated as the only and absolutely reliable information. In this respect, they should be used for the initial analysis of the market and cannot replace opinions on the individual value of real estate performed by professional property appraisers.

References

ARROW, K.J. 1979. *Eseje z teorii ryzyka*. Państwowe Wydawnictwo Naukowe.

BATT, H. W. 2009. *Land Value Maps are Not New, But Their Utility Needs to be Re-Discovered*. International Journal of Transdisciplinary Research, 4 (1): 108–158.

BIBLE, D.S., HSIEH, C. 1996. *Application of geografic information systems for the analysis of apartment rents.* The Journal of Real Estate Research, 12(1): 79–88.

BUDZYŃSKI, T. 2012. *Propozycje zastosowań mapy średnich cen transakcyjnych gruntów w gospodarce nieruchomościami (Proposals for the use of maps of average transaction prices of land in real estate management).* Studia i Materiały Towarzystwa Naukowego Nieruchomości, 20(1): 135-144.

CELLMER, R. 2014. *Modelowanie przestrzenne w procesie opracowywania map wartości gruntów (Spatial modeling in the process of preparing land value maps).* Olsztyn: Wydawnictwo Uniwersytetu Warmińsko-Mazurskiego.

CICHOCIŃSKI, P. 2007. *Zastosowanie metod kartograficznych i geostatystycznych do wstępnej analizy rynku nieruchomości (Application of cartographic and geostatistical methods for preliminary analysis of the real estate market).* Studia i Materiały Towarzystwa Naukowego Nieruchomości, 15(3–4): 155–166.

DONLON, K.H. 2007. *Using GIS to improve the services of the Real Estate Company.* Papers in Resource Analysis, 10: 1-11.

GACA, R. 2009. *Reguły decyzyjne w procesie nabywania nieruchomości (Decision rules in the process of real estate acquiring).* Studia i Materiały Towarzystwa Naukowego Nieruchomości, 17(2): 57-63.

GOTLIB, D., IWANIAK, A., OLSZEWSKI, R. 2007. *GIS. Obszary zastosowań (GIS. Areas of application).* Warszawa: Wydawnictwo Naukowe PWN.

KRYVOBOKOV, M. 2004. *Urban Land Zoning for Taxation Purposes in Ukraine.* Possible methods under an Immature Land Market. Property Management, 22 (3): 214–229.

MACIEJEWSKA, A. 2018. *Geoinformacja zmienia nasz świat (Geoinformation changes our world).* Główny Urząd Geodezji i Kartografii.

PODOR, A., NYIRI, J. 2010. *GIS application in real estate investment.* Scientific Journal of Riga Technical University Economics and Business. Economy: Theory and Practice, 20: 94–99.

RĄCKA, I. 2017. *Jakość informacji na rynku nieruchomości w Polsce* (*The Quality of Information on the Real Estate Market in Poland*). Problemy Jakości (Problems of Quality), 4: 19–25.

WILIAMS, A.C. JR., SMITH, M.L.,YOUNG, P.C. 1995. *Risk Management and Insurance*. McGraw-Hill College.

ŹRÓBEK, S., CELLMER, R., KURYJ, J. 2005. *Land value map as a source of information about local real estate market.* Geodezja, t.11, p. 63-73.

ŹRÓBEK, S., CELLMER, R., JANOWSKI, A., KURYJ, J. 2006. *Propozycja technologii opracowania mapy wartości dla miasta Olsztyna.(Proposition of technology for the development of a value map for the city of Olsztyn.)* Przegląd geodezyjny, 10: 3-9.