Noise Level in Relation to Real Estate Prices in Selected Settlements in Poland

Małgorzata KRAJEWSKA and Kinga SZOPIŃSKA, Poland

Key words: acoustic climate, noise strategic map, residential real estate, market value of real estate, Poland

SUMMARY

Acoustic climate of a given area ought to be a factor of considerable significance in investment processes in an urbanized area, especially in a residential real estate market, due to its extensive influence on the living standards of its inhabitants. In the following article the authors have given an analysis of the residential market of housing units located in areas of acceptable and excessive noise levels in preselected regions of Poland. With this end in view an entirely new source of information, has been used in the research – an acoustic map which has been defined and applied to produce the outcome of the analysis. It allowed for the recognition of whether or not the noise level influences decisions made by investors existing in a local residential real estate market.

SUMMARY

Klimat akustyczny na danym obszarze winien być ważnym czynnikiem branym pod uwagę w procesie inwestowania w przestrzeni zurbanizowanej, zwłaszcza na rynku nieruchomości mieszkaniowych, gdyż w znacznym stopniu decyduje on o poziomie życia mieszkańców. W artykule przeprowadzono analizę cen na rynku lokali mieszkalnych, położonych w strefach o dopuszczalnym i ponadnormatywnym poziomie hałasu wybranego obszaru badawczego na terenie Polski. W tym celu wykorzystano nowe źródło informacji jakim jest mapa akustyczna, którą zdefiniowano i na której przedstawiono wyniki analizy. Pozwoliło to na rozeznanie czy poziom hałasu wpływa na decyzje inwestorów działających na lokalnym rynku nieruchomości w segmencie lokali mieszkalnych.

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1. INTRODUCTION

Noise is defined as any undesirable, disturbing and harmful sounds causing environmental discomfort. Produced by sources of various kinds, it contributes to the creation of acoustic climate of the environment, in other words an assembly of acoustic phenomena in a given area (Kwiecień, Szopińska, Sztubecka, 2010). Noise sensitivity is a subjective term dependent upon predispositions of a person as well as sound characteristics. Thus, certain sounds may in the same time cause pleasant sensations or be disturbing depending on a recipient. Acoustic climate existing in a given area should be a major factor taken into consideration in an investment process of an urbanized area due to its significant contribution to inhabitants' quality of life, especially regarding residential real estate (Szopińska, Sztubecka 2010).
Residential properties, as goods satisfying basic needs of a man (such as sleeping, eating, relaxation, family life, studying, housework etc.), have been categorized in Poland into: detached houses, semi-detached and terraced houses, tenement houses, apartments in residential buildings (including commercial and residential premises as well as cooperative member's ownership right for residential premises). Residential real estate in Poland is a consumer market to the greater extend and only relatively small part of it is an investment market (Nykiel 2010), which would particularly indicate a significant role of environmental factors while making investment decisions. Due to the fact that housing resources mainly consist of multi-family residential buildings - approximately 67% (Rymarzak 2010), apartment market which is regarded the most developed one, was the subject of the analysis.
Assuming that transaction prices of properties reflect their characteristics, an attempt to answer the question whether the acoustic climate of the surroundings of a selected research area of Poland influences the residential real estate market has been made and whether the noise level should be the quality influencing the market value.
Market value of a property (Ustawa o gospodarce nieruchomościami...1997) is denoted by its real price, possible to obtain on the market, estimated in relation to transaction prices considering the following assumptions: the contract parties were independent from each other, were not acting forced by any circumstances and declared firm intentions to sign a contract, the time essential for the property exposition on the market and negotiating terms have expired.
In the process of market valuation of a property several factors are taken into consideration. These include the type of property, its location, usage, technical infrastructure equipment, its condition as well as current real estate market value (Ustawa o gospodarce nieruchomościami...1997). The previously mentioned legal regulations do not directly indicate the necessity of taking noise level into consideration in a valuation process, however, they do outline an open list of notions which should be completed in relation to environmental conditions, which means the conditions of the neighborhood adequate to a valuated property (Krajewska 2011). Since a valuator's role is taking both favorable and unfavorable

environmental issues into consideration (Maczyńska, Prystupa, Rygiel 2005), thus if the market is able to notice the problem of noise through the prices, the valuator should as well take the very issue into consideration because of the market.
The spatial analyses were performed with the use of Noise Strategic Map (NSM), the latest (the first acoustic maps in Poland were created in the years 2005-2006), professional source of information concerning the surrounding space.

2. ACOUSTIC MAP

Directive 2002/49/EC is the major legal act regulating the problem of noise protection which aims at unifying procedures related to estimating the level of environment's exposure to noise within the member states. According to the directive, Noise Strategic Map (NSM) is an averaged map of noise generated into environment by various groups of sources, which enables holistic evaluation of a level of noise exposure within an urban area, provides the possibility to determine the origins of such phenomena as well as the opportunity to prepare general prognoses of alterations of its levels (Directive…2002). It is the responsibility of state members of European Community to restrict the level of noise in the areas where its harmful influence might affect inhabitants and to protect areas of appropriate acoustic climate. Poland, as a member of European Community is obliged to comply with its law regulations, including the above-cited directive.
The primary legal act that regulates the noise exposure safety issues in Poland is the Environmental Protection Act (Ustawa Prawo Ochrony Środowiska…2001). According to article 112 noise exposure protection means providing the most proper condition of acoustic climate by maintaining the level of noise which does not exceed admissible values defined by L_{DWN} and L_N indicators (Krajewska, Szopińska 2011). The permissible environmental noise level depends on the nature of its source as well as a purpose of the affected area. The values oscillate in the range between 40-60dB (Rozporządzenie w sprawie dopuszczalnych poziomów hałasu...2007).
NSM consists of a descriptive and graphical part. The first one includes characteristics of an area, acoustic predispositions on the basis of planning documentation of a commune, identification and specification of noise sources as well as diagnosis of endangered areas. The graphical part consists of maps presenting acoustic climate of a study area. They include immission maps, acoustic conflict maps as well as level indicators of inhabitants overnormative noise exposure (Rozporządzenie w sprawie zakresu danych…2007).
According to art. 7 of Directive 2002/49/EC member states were obliged to compile strategic maps reflecting the situation in the preceding year for all their agglomerations including statements of the period of completion.:

- until June 30, 2007 – for agglomerations exceeding 250 thousand inhabitants,
- until June 30, 2012 – for all the agglomeration within their territory.

In the view of the directive "agglomeration" is defined as a territory with the number of inhabitants over 100 thousand and population density allowing for being recognized as an urban area by a Member State.
In Polish Legal System this notation is supported by art.117 of Environmental Protection Law. According to the article the diagnosis of the condition of acoustic environment is performed within the national environment monitoring program, on the basis of the results of

noise measurement tests for agglomerations of above 100 thousand inhabitants. NSMs have been developed for all the major cities of Poland which exceed 250 thousand inhabitants including: Warsaw, Krakow, Szczecin, Wroclaw, Poznan, Olsztyn or Bydgoszcz. Currently SMAs are being developed for local governments of agglomeration of 100 thousand inhabitants (Graph 1).

Graph 1. Map of Poland with the cities of developed Noise Strategic Map (NSM)

Source: own work.

3. APARTMENT MARKET ANALYSIS CONSIDERING NOISE LEVEL

In the present article it has been stated that participants of local real estate market take into account noise level affecting the neighborhood while making investment decisions such as purchasing an apartment. Verification of this notion will be carried out considering a preselected region of Poland, based on a spatial analysis of transaction prices of housing units in relation to an existing noise level defined by NSM.

3.1 Research Area Characteristics

The researched market is residential real estate segment of housing units being a subject to real property ownership rights.

The research area is located in the city of Bydgoszcz, one of the vastest settlement centers of Poland, located in the northern part of the country. The city is situated on the banks of the Brda River and Bydgoszcz Canal, whose eastern part borders the Vistula River. The research

involves several districts: Akademickie-Wschód, Przylesie, Bohaterów and Bajka in Fordon, an administrative unit of Bydgoszcz. The multi-family residential function is predominant in this area which dates back to two periods of history – the 80-ies of the 20th century as well as the first decade of the 21st century.
The structures were incorporated into the accompanying greens consisting of conifer trees such as self-sown pine. Service-oriented structures of basic functionality provides complimentary function of the area. Road access is provided by the streets listed in table 1.

Table 1. Streets characteristics in a given area

No.	Street name	Road category	Road type	Surface type	Surface condition*)	Speed limit [km/h]
1	Fordońska	national	main	Asphalt of good condition	a	80, 50
2	al. Prof. S. Kaliskiego	Local	service		a	50
3	Akademicka	district	main		b	50
4	Jana Brzechwy	Local	service		m	50
5	gen. Władysława Andersa	district	main		b	50
6	Igrzyskowa	Local	other		o	30
7	Bydgoskich Olimpijczyków	Local	other	Dirt road	o	50
8	Christiana Andersena	Local	other	Asphalt of good condition	m	50
9	Wojciecha Korfantego	Local	service		m	50
10	gen. Franciszka Klebberga	Local	service		m	50
11	Józefa Twardzickiego	Local	service		m	50
12	gen. Zygmunta Berlinga	Local	other		m	30

*) g – good, m – medium, a – alerting, b – bad, o – other.
Source: own work.

Noise generated by engine vehicle traffic in the streets creates higher noise zones which significantly affect the surrounding area (Asensio et al. 2009). The size of the emission as well as the transgressions depend on traffic level and in the same time the following road parameters: type and condition of the surface, number of lanes and their direction, existing traffic lights as well as speed limits for cars and trucks (Szopińska 2011).
The period of prices examination included the period of 2009-2010 that is the time following the price correction on the apartment market in Poland, the post-crisis times after which market prices stabilization emerged (Siemińska 2010; Siemińska 2011; Analizy rynku… 2011). It allowed for restraining from making corrections on the basis of price level changes caused by time lapse (time trend equal to 1,0).

3.2 Market Analysis in Spatial Context

For the previously defined nature and area of the market as well as the period of prices researching, information of 156 residential unit transactions were gathered, assuming all of them were settled considering the law of supply and demand and are treated as “cleared” market evidence (Kucharska-Stasiak 2010), which in subsequent stages might be used for market valuation.

Location of apartments in various buildings brought about the emergence of two submarkets out of them:

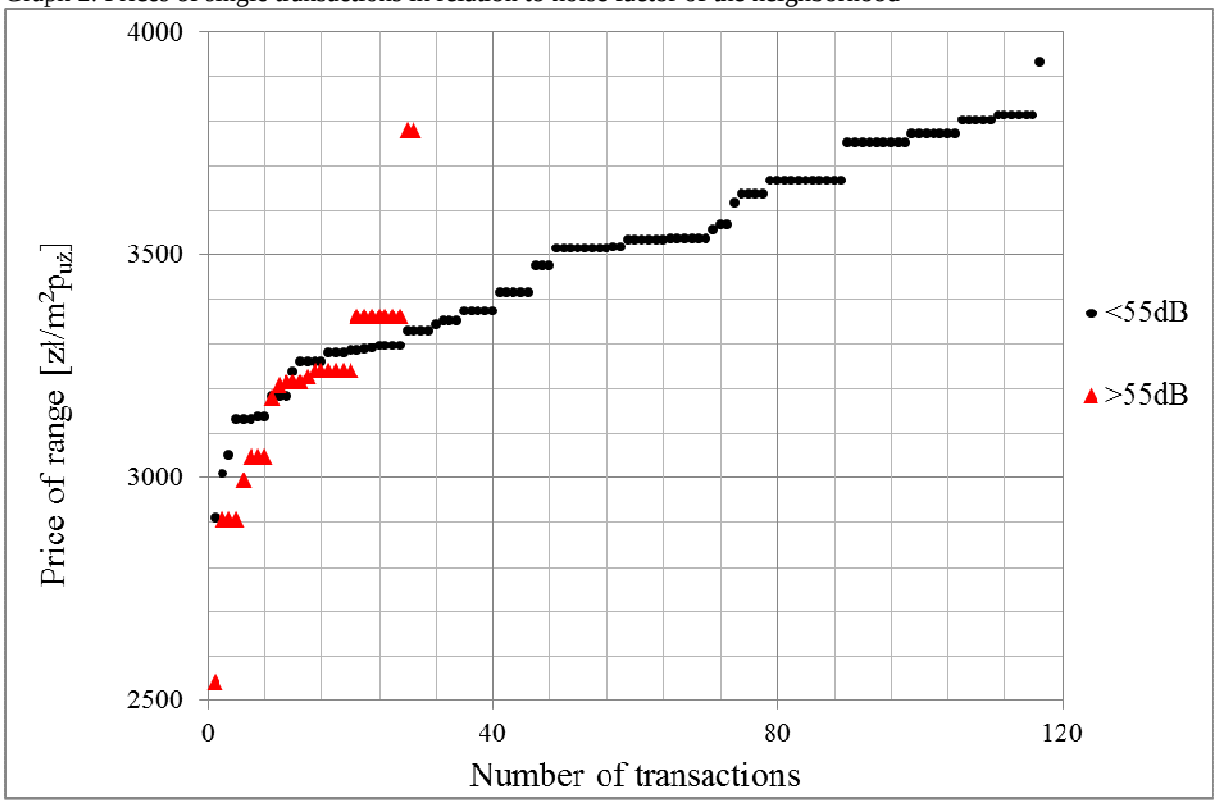
1. The one, concerning housing units located in the buildings from the 80ies. – 146 transactions in total of which the average prices were placed between 2541,30zł/m^2 ÷4110,68zł/m^2 of useable floor area.
2. The one, concerning housing units constructed after the year 2000 – 10 transactions of which the average prices were placed between 4023,86zł/m^2 ÷ 5380,35zł/m^2 of useable floor area.

A submarket may be established when a specific group of buyers generate demand for a specific category of real estate (Appraisal Institute 1996; Polska Federacja…2000).
The first submarket, considered more authoritative due to higher number of transactions has been selected for further analyses.
In the subsequent stage, average prices of apartments in the buildings from the first submarket have been grouped according to the following price ranges:

- those of average prices placed in the range up to 3000 zł/m^2 of useable floor area,
- those of average prices placed in the range from 3000 zł/m^2 to 3500 zł/m^2 of useable floor area,
- those of average prices placed in the range exceeding 3500 zł/m^2 of useable floor area.

The price ranges included apartment transactions of the same general location, same utilities similar transport accessibility, similar technical condition of buildings and the same management system. They varied in size (total floor area ranged from 30,73m^2 to 78,86m^2) finishing standards, floor level as well as detailed location, which as a property feature, includes noise level generated by engine vehicles.
While attempting to find the answer to the question whether noise influences apartment prices, data concerning very similar properties was gathered with the use of ceteris paribus principle (which means unchanged remaining circumstances), and varying only in terms of one feature which is their detailed location, including noise level factor. The technique allows for researching highly complex problems with the sacrifice of some realism (Kucharska-Stasiak 2010). Unfortunately, it was apparently impossible to eliminate every distinguishing feature of the apartments in the course of the study, especially those individual ones concerning the finishing standards, total floor area or floor level. Therefore, it has been assumed that introducing three price ranges including similar properties, only varying in some individual qualities, into the analysis will greatly decrease the influence of these attributes on the value, thus detailed location will remain the only distinguishing feature. Such an analysis policy has been acknowledged right, since the purpose of the research was not the pursuit of the importance of noise level as a feature but the question whether, being an environmental condition, it influences the decision making process of market participants.
The number of transactions in single price range has been presented in graph 2 and table 2 and their spatial orientation with the division into districts, in graphs 3 and 4. The information originating from the real estate marked was presented in relation to an extract of a strategic acoustic map of the city of Bydgoszcz (considering lack of possibility to print in color, the following work presents just a portion of information from the NSM, which is a map of road traffic noise level excess of L_{DWN} marker). For the of multi-family housing properties accepted road traffic noise level must not excess 55dB.

Graph 2. Prices of single transactions in relation to noise factor of the neighborhood



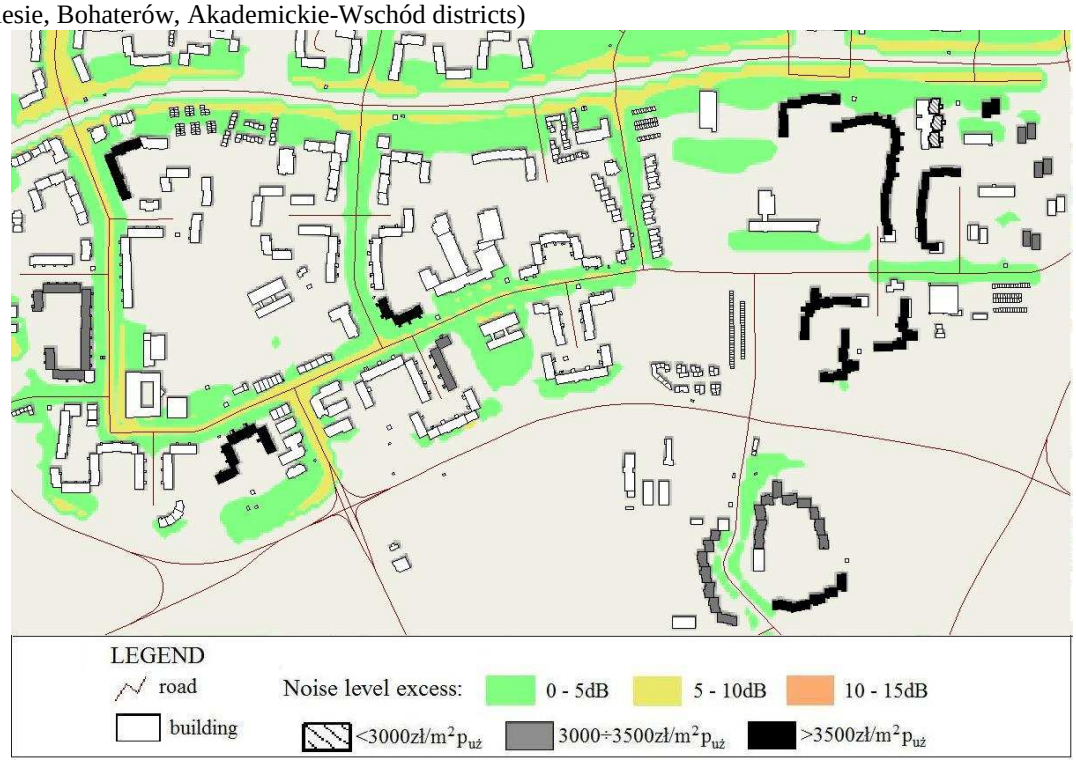
Source: Krajewska M., Szopińska K., (2011), Klimat akustyczny a wartość nieruchomości mieszkaniowych, 3rd International seminar on urban investments, Cracow, p. 447-455.

Table 2. The number of transactions in price ranges depending on meeting acoustic standards by resident areas

No.	Kind of Area	The number of transactions in price ranges		
		below 3000zł/m^2 useable floor area	3000÷3500zł/m^2 useable floor area	above 3500zł/m^2 useable floor area
1	2	3	4	5
1	For the analyzed area	6	68	72
2	Residential areas meeting acoustic standards (level of nise Dreas not excess 55dB)	1	47	**70**
3	Residential areas which do not meet acoustic standards (exceeded levels of noise over 55dB)	5	**21**	2

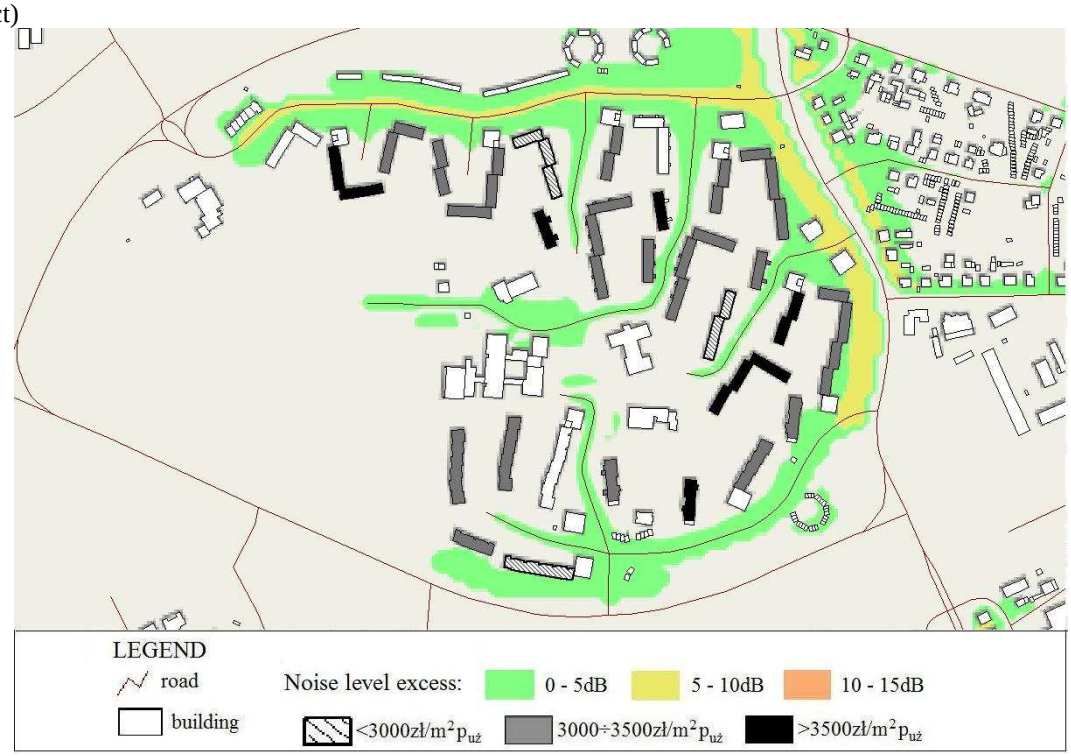
Source: Krajewska M., Szopińska K., (2011), Klimat akustyczny a wartość nieruchomości mieszkaniowych, 3rd International seminar on urban investments, Cracow, p. 447-455.

Graph 3. Spatial location of appartment transactions in relation to a map of excess road traffic noise L_{DWN} (Przylesie, Bohaterów, Akademickie-Wschód districts)



Source: own work.

Graph 4: Spatial location of appartment transactions in relation to a map of excess road traffic noise L_{DWN} (Bajka district)



Source: own work.

The analysis allows for drawing the following conclusions:

1. Most of multi-family residential buildings in the area of the study in Poland – the districts of Fordon in the city of Bydgoszcz is located outside the zone of excess traffic noise levels.
2. Out of 118 credible market transactions concerning sales of apartments located in buildings of acceptable noise level areas, most of them (60%) originated from the range of the highest price values: >3500zł/m^2 of useable floor area and only 1 transaction from the lowest value range below 3000zł/m^2 of useable floor area. The remaining ones of approximately 30% came from the range of 3000÷3500zł/m^2 of total floor area;
3. Out of 28 transactions of apartments situated in buildings of excess noise level, majority of them (75%) obtained lower price level of 3000÷3500zł/m^2 of total floor area and 18% of those – the lowest – below 3000zł/m^2 of total floor area and only two of them obtained the highest level;
4. The claim that real estate market participants take unfavorable acoustic climate of the surrounding area into consideration while purchasing residential properties, which results in lower price of a given apartment.
5. The behavior of local real estate market participants considering noise level in their decision-making allows to believe that it is a market feature and should as well be taken into consideration by real estate appraisers in the process of property valuation.

4. CONCLUSION

Preliminary research results have shown the way purchasers of residential properties of a given territory react, by means of price variations, to acoustic climate of a property and its neighborhood being of their interest. Unfavorable environment interaction such as noise is reflected in lower market prices paid for residential properties located in areas of excess noise level. Thus it is possible to claim that noise level is the market feature influencing the value. Due to the fact that the issue is noticed by purchasers it should be transferred to a valuation process as well. Acoustic map is certainly a helpful, credible and new source of information concerning noise levels. According to European Union Directive 2002/49/EC, it is available in numerous Polish agglomeration or it will appear in a near future. The ability to take advantage of it is a challenge for all the real estate market participants and particularly for real estate appraisers, who should be obliged to use it in valuation processes. Because all the changes taking place in environments (such as accompanying noise) and the real estate market are dynamic phenomena, the necessity of constant monitoring emerges in order to provide solid information to the market participants, so they could make accurate investment decisions and so that authorities and experts could develop their skills and which in turn brings the need of further researches and analyses.

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BIOGRAPHICAL NOTES

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