Article
Socio-Economic and Spatial Characteristics of Wielkopolski National Park: Application of the Hedonic Pricing Method

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Abstract: The study aimed to determine the influence of the proximity of Wielkopolski National Park (WNP) on the value of dwelling units in Mosina municipality. The research was conducted based on 1182 residential property transactions in the period from 2014 to 2018. The input data were subjected to spatial and statistical analysis. The main part of the analysis was performed with the use of the hedonic price method (HPM)—WLS (weighted least squares). The use of statistical tools made it possible to find undeniable evidence that the housing prices are positively related to the presence of Wielkopolski National Park, which has also been confirmed by previous research works conducted in other parts of the world.

Keywords: impact of protected areas; housing prices; hedonic regression; national park

1. Introduction

The market value of a property significantly determines the price it can reach during a market transaction. The value of the real estate is influenced by a number of specific factors, which, depending on the type of property, include physical features such as the size of the plot, the technical condition of the building or the standard of finishing of the building [1]. The factor that has become important over the last few years is a location and its derivative which is an immediate vicinity [2–4].

A choice of a location depends, to a great extent, on the individual preferences of a purchaser. This feature is usually taken into account in the context of accessibility to social infrastructure (e.g., schools), service infrastructure (e.g., grocery stores) or transportation infrastructure (e.g., bus stops) [5–7]. Regarding a location, the factors that determine the state of the immediate surroundings, with a particular emphasis on environmental attributes, are also of great importance [8,9]. In the past years, it has been noticed that the proximity of valuable natural areas, which are favourable to recreation and enable active ways of spending free time, is a feature of undoubtedly high priority according to the hierarchy of “importance” of factors that affect the real estate market [10–13]. The presence of attractive natural areas in the immediate vicinity of a house or an apartment, apart from affecting the prices of the properties, has a direct influence on the demand for a specific type of dwelling unit [14–16].

The areas which are under legal protection not only allow access to nature but also significantly improve the quality of life and perform extremely important environmental functions. The list of benefits of such areas also includes good influence on human health, improvement of the quality of air and preservation of biodiversity [17–19]. Consequently, the above-mentioned advantages of naturally valuable areas have a positive influence on the value of neighbouring properties, which has been confirmed by many research works conducted so far [20–22].

The ground-breaking concepts for determining the impact of selected factors on the value of a real property, based on the hedonic pricing model (HPM), appeared in the 1920s. The first certified and documented study that was performed with the use of the HPM
method was the research conducted by G.A. Hass in 1922, during which the model of agricultural land values was determined [23]. Another key study was conducted in 1967, in which R. G. Ridker, the first in history, used the HPM method to analyse the impact of reduction of air pollution on the prices of dwelling units [24]. In the later years, the theoretical framework of the method was clarified and further specified by such authors as Rosen [25], Lancaster [26] and Maclennan [27]. Furthermore, HPM is one of the methods that can be used to value ecosystem services. Taking this into account, the method may find a wide application in the process of monetary valuation of the environment.

Studies related to the valuation of real estate and to the analyses of the processes that occur in the real property market are very often performed with the use of statistical methods used in mathematics [28–36]. Those methods can be divided into two fundamental groups: basic (traditional) and advanced (modern). Among the group of advanced methods, that constitute the basis of this study, there are such techniques as i.a., artificial neural networks (ANN), hedonic price model (HPM) and techniques related to spatial analyses that have become quite important lately [37]. Two methods that are most often used to identify and assess non-marketable goods are the hedonic price method (HPM) and contingent valuation method (CVM). The main difference between those two methods stems from the fact that in the case of the CVM method the values of non-marketable goods are determined based on questionnaire surveys that show preferences of a properly defined group of respondents [20]. However, taking into account the main objective of this study and the literature on the subject, it can be assumed that the market preferences of a potential purchaser are clearly reflected in the price of the dwelling unit because people, as a rule, opt for properties located near attractive natural areas. Therefore, the HPM method is the most appropriate analytical technique to perform the analysis of the real estate market taking into consideration correct attributes. What is more, the above-mentioned method works very well in this type of analysis, because it takes into account one of the basic characteristics of a property, which is heterogeneity.

Additionally, the HPM method is used in many other types of sciences: natural sciences [38,39], social sciences [40,41] and to analyse other types of markets [42–44]. The HPM method was a basic tool to assess i.a., the impact of selected environmental factors on the value of properties located in several major Polish cities, e.g., in Warszawa [32,45], Kraków [46] or Poznań [47]. The application of the HPM method in this study to assess the impact of legally established protected areas on the value of dwellings units is an extremely important study, despite the many previous examples of the use of this type of method for real estate market analysis. The analysis was performed on the basis of the HPM method described in detail in the literature, therefore this study may serve as a reference for comparable studies evaluating the influence of a selected attribute (proximity of areas under legal protection) on the value of real estate, especially in Poland. The study may not be considered novel or innovative, but it may be important in the process of monetary valuation of the environment.

2. Materials and Methods

2.1. Study Site and Data

The study was conducted in Mosina which is an urban-rural municipality located in western Poland. The northern part of the municipality borders with the agglomeration of Poznań which is an area of fundamental importance for the region and directly determines its development. According to Statistics Poland, the municipality is inhabited by 33,442 persons (according to the data from DEC 2020). The area of Mosina is 172 km².

The municipality is located in the immediate vicinity of Wielkopolski National Park which plays an important role in the context of protection of various types of post-glacial landscapes, plant communities and animals. The area of the park is 7584 ha and it is one of the smallest national parks in Poland. Around the park, there is a protective buffer zone and the total area of the park along with the zone is 14,840 ha (Figure 1). The majority of the area of Wielkopolski National Park is covered with forests but, due to intensive human activities,
the landscape is heterogeneous and there are not many large forest complexes there. The flora of the park is dominated by numerous species of plants typical for Central Europe such as sessile oak, common hornbeam and many Euro-Siberian species i.a. mountain-ash or Scots pine. Additionally, due to the diverse soil conditions, there are also such trees as i.a. the English oak and pine. It is worth mentioning that within the WNP there is also a rare attraction because of its magnificent flowers—the golden lily, which in Poland is under strict protection. In addition, other protected species can be observed, such Angelica palustris, Sorbus torminalis or the Drosera rotundifolia. In addition, it is worth noting an important mycobiota for this National Park. A study launched in 2018 [48] identified five species new to Poland—Botryobasidium robustius, Hebeloma subtortum, Leccinum brunneogriseolum, Pachyella violaceonigra and Sistotrema athelioides. The fauna of the Wielkopolski National Park is characterized by an abundance of species belonging to various systematic groups. Protected animals in the park include Lucanus cervus and Cerambyx cerdo, in addition, there are also common species such as Tomicus piniperda or Tomicus minor. Wielkopolski National Park is an area of great importance, especially for the local community. It is a region of nature conservation and it also allows the visitors to enjoy many benefits such as active recreation combined with direct contact with nature [49]. WNP is also characterized by an extremely important social dimension. Previous studies related to WNP [50,51] based on willingness to pay (WTP) have shown that the local community is generally interested in incurring costs for WNP. The assessment of the value of a national park and the size of possible costs depends, of course, on membership in different social groups taking into account such features as age or education, but it is undeniable that WNP is an important element gaining importance in the public consciousness.

The research was based primarily on the source data obtained from the District Centre for Geodetic and Cartograph Documentation in Poznań. The data is related to market transactions of residential premises that took place within Mosina municipality in the period from 2014 to 2018—1182 transactions in total (Figure 2). The obtained data was additionally verified, meaning, the transactions that were made in special, non-market conditions were removed from the database, e.g., a sale with a delayed date of a transfer, a sale with a delayed date of a transfer of a property to a purchaser or a bailiff auction, etc. The transaction data obtained from the District Centre for Geodetic and Cartograph Documentation in Poznań is a reliable source of information about the actual and current situation on the real estate market because it is collected directly from the notarial deeds. It makes the data widely applicable in the analysis of the real estate market.
The basic data stored in the database of this study (for each transaction) includes information related to: transaction date, transaction price, surface area (of a dwelling unit), surface area of additional premises (e.g., a storage room or a basement) and details regarding the floor the unit is located on. The main downside of this type of data is the lack of its completeness in terms of detailed characteristics of the main factors that affect the value of a property such as immediate surroundings or a technical condition of a building. An attempt to identify and indicate factors that significantly affect the value of residential premises based only on the data collected in this register cannot be considered, by definition, an acceptable approach. The primary reason for the above is the unique nature of each property and the fact that the value of the premises is also affected by several other factors which are not defined in the registry under review. To eliminate the above-mentioned issue related to the lack of completeness of the data, additional information was obtained about the analysed housing properties such as i.a.: details regarding the immediate neighbourhood and exact location.

2.2. Methods

The HPM method is a tool that is used to examine the correlation between a price of a property (e.g., an apartment) and its most important characteristics. The market participants usually purchase residential premises assuming that it is a good way of capital protection. The investment decisions are based on a detailed description of the property and its usefulness. In the case of a dwelling unit, the main factors that determine its investment attractiveness include surface area, number of rooms, age and technical condition of the building, availability of other amenities such as a parking space or a lift [22,37]. Additionally, an extremely important factor is location, which is usually considered in terms of accessibility to such facilities as schools, shopping centres and recreational areas [13,32]. What is more, there are other social and environmental factors related to location and immediate surroundings that directly affect the price that potential investors are willing to pay for a property [2,9].

The most important objective of the model designed with the use of the HPM method is to answer the question of how the selected, analysed factors affect a value of a property. The main idea of the HPM models is the assumption according to which the price of a property is defined by several selected attributes. Consequently, the obtained model makes it possible to determine the value of analysed features that constitute individual components of the final price. The attributes of real estate adopted for the analysis, such as location or access to legally established protected areas, constitute explanatory variables [20,21,37]. Hence, the price of a dwelling unit can be illustrated by a standard regression equation.

\[ P = \beta_0 + \sum_{i=1}^{K} \beta_1 X_i + u, \]  

(1)
where \( P \) is the price of a dwelling, \( \beta \) is the regression coefficient, \( X_i \) is an attribute of a dwelling, \( u \) is a random error.

To perform analyses of the real estate market employing the HPM method, a regression function based on the natural logarithm is usually used. This type of solution is very popular as there is a possibility to change the value of a selected attribute in proportion to the changes in other features. The linear models, that belong to a different group of tools, only allow assessing the level of influence of improvement or deterioration of a given attribute, e.g., technical state of all buildings in the analysed group of residential properties. The linear models do not allow to identify the impact of improvement or deterioration of the quality of a selected attribute for dwelling units of, for example, different surface areas. Additionally, the advantage of models based on a logarithmic function is also the easy way of interpretation of individual coefficients and elimination of the issue of variability of a random component [52]. Taking into account the above, this study is based on a logarithmic model.

In this research, one of the basic variants of hedonic regression was used: WLS (weighted least squares). The assessment with the use of the weighted least squares method was performed as follows: performance of OLS regression (ordinary least squares), performance of auxiliary regression where the dependent variables were the squares of the residuals, the input independent variables plus their squares. The values obtained from hedonic regression were used to create a series of weights, then the original model was assessed using the weighted least squares method [37].

The most important issue when analysing the real estate market is to select the right factors that most significantly affect the price of a property. A basic characteristic feature of residential premises is heterogeneity and, as a result, some features that are relevant for the price of a particular type of real property may be of marginal importance for another sort of real estate. In the case of residential units, significant characteristic features can be divided into three categories of variables that define: dwelling unit, neighbourhood and environment [20]. What is more, an additional category of variables can be created that would define social, economic and planning conditions within the local real estate market. Each group of variables includes many attributes depending on the type of premises and economic, social or local conditions (Table 1).

| Category | Variable | Author |
|----------|----------|--------|
| Characteristics of a dwelling unit | Surface area | Trojanek et al. [37] |
| | Number of rooms | Escobedo et al. [22] |
| | Type of dwelling unit | Park et al. [20] |
| | Age of a building | Sander and Haight [53] |
| | Parking space/garage | Ko et al. [54] |
| | Upper-floor location | Oh and Lee [55] |
| | Type of building construction | Trojanek et al. [37] |
| | Form of ownership | Marano and Tajani [56] |
| | Accessibility to basement | Trojanek et al. [37] |
| | Energy efficiency | Zancanella et al. [57] |
| Characteristics of neighbourhood | Distance to a town centre | Payton et al. [58] |
| | Distance to schools | Hwang et al. [59] |
| | Access to public transportation | Kim and Kim [60] |
| | Distance to shops | Oh and Lee [55] |
| | Distance to recreational areas | Tyrväinen [61] |
| | Bothersome neighbourhood (airport, etc.) | Kopsch [62] |
| | Distance to lakes | Sander and Haight [53] |
| Characteristics of environment | Distance to green areas, parks | Liebelt et al. [63] |
| | Distance to legally protected areas | Pearson et al. [64] |
| | Distance to other valuable natural areas (rivers, mountains, etc.) | Ko et al. [54] |
Table 1. Cont.

| Category                                      | Variable                                | Author                        |
|-----------------------------------------------|-----------------------------------------|-------------------------------|
| Characteristics of local social, economic and planning conditions | Air pollution                          | Chen and Chen [65]            |
|                                               | Amount of tax                           | Sander and Haight [53]        |
|                                               | Demographic structure                   | Adegoke et al. [66]           |
|                                               | Employment opportunities                | Payton et al. [58]            |
|                                               | Prospects of economic development       | Perdomo [67]                  |
|                                               | Average net income                      | Roebeling et al. [68]         |
|                                               | Occurrence of planning barriers         | Hussain et al. [69]           |

According to the characteristics of the research subject, the literature review and the basic assumption of the conducted analysis, the most important characteristic features in the first group include surface area, type of building construction, floor the unit is located on, accessibility to basement and height of a building. Variables from the other groups such as access to public transportation, schools and legally protected areas are also extremely important and when using the HPM method those are the primary factors that affect the price of dwelling units. Ultimately, some important features related to characteristics of a residential unit such as type of building construction or age of a building were not taken into account in the analysis. The last two features were not analysed because the vast majority of transactions in Mosina municipality concerned premises related to development investments which were performed at the same time and to units constructed with the application of the same technique.

Considering the above-mentioned assumptions, the hedonic function of the price may be presented in the following manner:

\[
\ln(P) = f(\text{structural characteristics, location, transaction time, accessibility to WNP})
\] (2)

Taking into account the selected variables, the next stage of the study was performed and it involved defining variables for the analysed properties. The variables were determined according to the adopted criteria. The actual distance to the selected attributes was measured with the use of QGIS 3.16.1 software.

2.3. Variables

2.3.1. Transaction Year

When it comes to real estate, the date of the transaction is extremely important. Due to its unique nature, the real property market is influenced by, i.a., social, political, demographic and economic conditions that change over time. The analysis covered the years 2014–2018. The greatest number of transactions related to residential premises was recorded in 2017 (330) while the lowest number was recorded in 2016 (192).

2.3.2. Surface Area of the Dwelling Unit

The actual surface area of the properties in the analysed set of residential premises was varied and it ranged from 26.12 m\(^2\) to 162 m\(^2\). Whereas, the average size of the surface area was 64.16 m\(^2\). The data was obtained from the database of the District Centre for Geodetic and Cartograph Documentation. The surface area is of key importance when it comes to the price of a property and it is usually assumed that the unit price of premises with a smaller surface area is greater compared to the unit price of similar premises but of a much larger surface area. This rule is not always the case and may depend on local conditions.

2.3.3. Floor

The floor that the dwelling unit is located on is an extremely important variable from the point of view of accessibility to the apartment and security. This attribute should be assessed taking into consideration the height of the building the premises are located in. It is assumed that the dwelling units located on the first and middle floors are usually...
more expensive. On the other hand, in taller buildings, where there is a lift, greater prices are achieved by apartments located on higher floors. The floor that the unit was located on, in the case of the assessed properties, was determined based on the author’s own analyses. In the analyzed group of transactions, the vast majority of dwellings were located on the ground or top floor (836), the remaining transacted dwellings were located on the intermediate floors (346).

2.3.4. Height of the Building

This is the feature that is directly related to the characteristics of the building in which the apartment is located and the floor that the dwelling unit is situated on. When comparing similar dwelling units located on the same floor in two different buildings, the height of a building can make a significant difference when it comes to price. Regarding the assessed set of transactional data, it was noticed that the heights of the buildings were different which was why this attribute was included in the analysis. In the analyzed transaction group, a comparable number of real estate transactions were identified in lower buildings (up to two floors)—629 transactions and in higher buildings (above two floors)—553 transactions.

2.3.5. Access to Public Transport

This feature was considered in terms of accessibility to bus stops; tram stops, for example, were omitted due to their lack in the analysed area. Public transport plays a significant role in Mosina municipality as it enables convenient access to Poznań what is especially important for those working in the capital of Wielkopolskie Voivodship. Within Mosina municipality, there are mainly stops for city buses and they are located at roadsides. The distance between a dwelling unit and the nearest bus stop was measured regardless of the type of stop. The specified value corresponds to the actual distance that a person has to cover to get from the residential unit to the bus stop, taking into account local pedestrian routes. For the analyzed transactions, the average distance to the nearest bus stop was 0.5 km, the minimum distance for one dwelling unit was 0.03 km, and the maximum distance was 2.21 km.

2.3.6. Distance to Schools

This is another important feature that is often taken into account by the real estate market participants. Access to school infrastructure in the form of primary schools and nursery schools was analysed. Other types of schools were excluded from the analysis because they are not of key importance when it comes to selecting a residential property. Older students, e.g., attending a high school that is located further away, can easily get to school using public transport. In the case of younger schoolchildren, the possibilities of using public transport are usually limited and potential commuting must be planned with all the appropriate precautions. From the point of view of this research, this is clearly an important issue, especially for young families. Usually, students choose a school that is located closest to their place of residence; therefore, in the study, the distance to the nearest school was measured taking into account the existing road network. The average distance for all dwellings to the nearest school infrastructure was 1.88 km, the minimum distance for one dwelling was 0.06 km and the maximum distance was 6.69 km.

2.3.7. Distance to the WNP

Wielkopolski National Park is a special area for the inhabitants of the region. It enables active recreation and direct contact with nature. A lifestyle based on, i.a., relaxation in areas that are not significantly transformed by a man has been gaining importance over the recent years. According to the conducted literature review, one of the effects of the proximity of valuable natural areas is the increase in the price of residential premises that are located in its immediate vicinity. In the study, the actual distance between the residential units and the nearest entrance to the park was measured. Based on the measured distances, we
identified that the average distance for this feature was 1.13 km, the maximum was 6.46 km, while for the minimum distance, several dwellings were located in close proximity to the entrance to the WNP.

2.3.8. Distance to the Centre of Mosina

This feature is one of the derivatives of location. Generally, properties located within a walking distance to the town centre are of higher prices compared to the residential units that are situated in the suburbs or on the outskirts of the municipality. As in the case of other attributes, the actual distance between the dwelling units and the centre of Mosina was determined. The mean value of the measured feature was 5.41 km. In the analyzed set, there were several dwellings located directly in the city center and for them, the minimum value of the attribute was recorded, while the dwelling located farthest from the city center was at a distance of 10.06 km.

2.3.9. Distance to Poznań

This is another attribute that is related to location. In the case of the analysed local real estate market, the distance to a large urban agglomeration is an important factor that should be considered when defining the processes occurring within the market. Poznań plays an important role in the development of the surrounding areas, the city guarantees many attractive workplaces and directly contributes to the increase in the quality of life. Within the local real property market, a certain trend has been observed, namely, the residents of Poznań prefer to move outside the city to the neighbouring areas. At the same time, those areas should be situated as close as possible to the city to guarantee easy and quick access to Poznań. For each property, the actual distance to the administrative borders of Poznań was determined. In the analyzed transaction group, the average distance to the administrative borders of Poznań was 6.80 km. For one of the analysed dwellings located in the southern part of the municipality, the distance was 17.81 km and this was the maximum value of the attribute.

The way the analyses were conducted can be divided into four basic stages. The first stage of the research was to select an appropriate method of valuation of the analysed features. Based on the literature review and the author's own study, the HPM model was selected as the most appropriate one for this type of research. The second stage was to select relevant variables that, based on the literature review and the characteristics of the local real estate market, were appropriate while taking into account the prices of the properties and were consistent with the main objective of this study. The third stage involved defining the selected variables for the analysed properties. The last, fourth stage, was to assess the appropriate parameters of the function with the use of SPSS Statistics software. The property price included in the model was the dependent variable and the analysed attributes were explanatory variables.

3. Results

The performed analyses were divided into two groups. The first part of the research consisted of the initial verification of the influence of accessibility to Wielkopolski National Park on housing prices and it was performed based on spatial analysis. The second part of the research, the most important one, was conducted based on statistical analyses—the hedonic pricing model.

3.1. Spatial Analysis

To initially assess the influence of accessibility to Wielkopolski National Park on the transaction prices of residential units in Mosina municipality, a spatial analysis was conducted with the use of QGIS software. The spatial analysis was divided into two stages. In the first stage, the collected transactions were divided into two groups: the treatment group and the control group. The treatment group included the units located in the immediate vicinity of Wielkopolski National Park (up to approximately 1 km—
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![Figure 3. Spatial analysis—up to 1 km away.](image)

Basic descriptive statistics for the explanatory variables and the dependent variable (mean and standard deviation) were compiled for each group. The average price of the units located within the distance to the park of up to 1 km is higher than the price of the premises situated outside the zone (Table 2).

| Variable          | Treatment Group | Control Group |
|-------------------|-----------------|---------------|
| Price (PLN/m²)    | 3731.41         | 3317.08       |
|                  | 628.58          | 558.18        |
| y2018             | 0.13            | 0.18          |
|                   | 0.34            | 0.39          |
| y2017             | 0.30            | 0.27          |
|                   | 0.46            | 0.44          |
| y2016             | 0.11            | 0.19          |
|                   | 0.32            | 0.39          |
| y2015             | 0.21            | 0.14          |
|                   | 0.41            | 0.35          |
| y2014             | 0.25            | 0.22          |
|                   | 0.43            | 0.41          |
| Surface area (m²) | 65.47           | 63.51         |
|                  | 19.04           | 13.63         |
| DCC (Distance to the centre of Mosina)-km | 5.33 | 5.45 |
|                  | 4.19            | 3.61          |
| DWNP (Distance to WNP)-km | 0.62 | 1.38 |
|                   | 0.21            | 0.76          |
| DP (Distance to Poznań)-km | 5.70 | 7.35 |
|                   | 5.15            | 5.83          |
| DT (Distance to a bus stop)-km | 0.34 | 0.58 |
|                   | 0.17            | 0.30          |
| DS (Distance to schools)-km | 2.21 | 1.72 |
|                   | 1.65            | 1.51          |
| F1 (ground and the top floor) | 0.84 | 0.67 |
|                   | 0.37            | 0.47          |
| F2 (other floors) | 0.16            | 0.33          |
|                   | 0.37            | 0.47          |
| H1 (a building up to 2 floors) | 0.72 | 0.44 |
|                   | 0.45            | 0.50          |
| H2 (a building of more than 2 floors) | 0.28 | 0.56 |
|                   | 0.45            | 0.50          |
| Number of observations | 395  | 787 |

The second stage of spatial analysis was conducted by dividing the analysed transactions into 6 groups. The classification was performed based on the distance to the borders of Wielkopolski National Park. The following classification criteria were adopted: <0.50 km, 0.50–0.75 km, 0.75–1.00 km, 1.00–1.25 km, 1.25–1.50 km, >1.50 km (Figure 4).
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- <0.50 km
- 0.50–0.75 km
- 0.75–1.00 km
- 1.00–1.25 km
- 1.25–1.50 km
- >1.50 km

Figure 4. Classification of transactions based on the distance to Wielkopolski National Park.

The main purpose of dividing the research material into 6 groups was to refine previous analyses and to present the changes in prices within each group. The most important descriptive statistics from the point of view of the analysis were compiled for each group—the mean and the median of prices (Table 3).

| Group           | Median of Prices (PLN/m²) | Mean/Average Price (PLN/m²) | Number of Observations |
|-----------------|---------------------------|-----------------------------|------------------------|
| <0.50 km        | 3906.02                   | 3660.18                     | 110                    |
| 0.50–0.75 km    | 3905.86                   | 3750.73                     | 166                    |
| 0.75–1.00 km    | 3493.43                   | 3512.48                     | 192                    |
| 1.00–1.25 km    | 3319.91                   | 3390.68                     | 392                    |
| 1.25–1.50 km    | 3341.08                   | 3319.98                     | 249                    |
| >1.50 km        | 3267.23                   | 2949.79                     | 73                     |

The average prices of residential premises in the analysed groups, determined based on the distance criterion, changed significantly in the assessed set of transaction data (Figure 5).
Spatial analysis allows observation of the initial correlation between the transaction price and the accessibility to Wielkopolski National Park. However, the analysis cannot be used to draw statistically significant conclusions regarding the impact of accessibility of Wielkopolski National Park on the prices because, in the analysis, other most important characteristics are not taken into account, namely, the ones that significantly determine the price of a dwelling unit within the local real estate market.

3.2. Statistical Analysis

The characteristic features of the residential units analysed in the study included attributes related to the dwelling unit (surface area, floor, height of the building), the location (access to public transport, access to schools, access to legally protected areas, distance to the centre of Mosina, distance to Poznań). Additionally, in the model, a feature related to the year in which the transaction was finalised was taken into consideration. The defined variables were chosen based on the availability of the data and the characteristics of the local real estate market. The adopted qualitative and quantitative variables were, first of all, defined in a way that allowed their use in the model (Table 4).

Table 4. Qualitative and quantitative variables used in the model.

| Feature      | Symbol | Characteristics of the Feature |
|--------------|--------|--------------------------------|
| Price        | Price  | Price of the residential unit (PLN/m²) |
| y2014        |        | 5 variables used in the model. If the residential unit was sold in a given year, they are assigned the value 1, otherwise, they are assigned the value 0. |
| y2015        |        |                                 |
| y2016        |        |                                 |
| y2017        |        |                                 |
| y2018        |        |                                 |
| Year         |        |                                 |
| Surface area | Surface area | Surface area of the residential unit in m² |
| DCC          | DCC    | Distance to the centre of Mosina (km) |
| DWNP         | DWNP   | Distance to Wielkopolski National Park (km) |
| DP           | DP     | Distance to Poznań (km) |
| DT           | DT     | Distance to a bus stop (km) |
| DS           | DS     | Distance to schools (km) |
| Floor        |        | 2 variables used in the model. If the residential unit is located on a specific floor it is assigned the value 1, otherwise, it is assigned the value 0. |
| F1 (ground floor and the top floor) |        |                                 |
| F2 (other floors) |        |                                 |
| Height       |        | 2 variables used in the model. If the building has a certain height it is assigned the value 1, otherwise, it is assigned the value 0. |
| W1 (a building up to 2 floors) |        |                                 |
| W2 (a building of more than 2 floors) |        |                                 |
In the next stage, relevant function parameters were assessed with the use of SPSS Statistics software. The natural logarithm of housing prices in the model was the dependent variable while the analysed attributes were the explanatory variables.

With the use of the weighted least squares method, it was possible to explain approximately 74% of the price fluctuations. Most of the variables used in the model turned out to be statistically significant. The predicted values of individual coefficients were correct. With the conducted analyses, based on the collected data, it was not possible to identify three coefficients for the variables y2017, F2 and H1 due to the lack of variation of the variable.

It was observed that, over the studied years (2014–2018), the date when the transaction was made had a significant impact on the transaction prices of residential premises. The global crisis that occurred in the period from 2007 to 2009, also affected the prices of dwelling units in Poland and their value was significantly lower over the years following the crisis [70]. However, referring to the latest reports of the National Bank of Poland related to housing prices, it can be noticed that after the downward trend which occurred in the above-mentioned period, the market has clearly recovered. The prices of dwelling units in the majority of Polish cities continue to rise, which is also the case for the analysed area.

Based on the statistical analysis performed for this study, it can be observed that the location-related features have a significant impact on the transaction prices of residential premises. The larger the distance to Poznań the lower the transaction prices. On the other hand, the dwelling units that are located in the centre of Mosina are cheaper than those located in other parts of the municipality. The obtained results confirm some preferences of the market participants such as living in a quieter area and, at the same time, in the regions that are well connected to a large urban centre. This was also observed in a study conducted within Wielkopolskie Voivodship [71].

Taking into account the major objective of this study, the statistical correlation between housing prices and the accessibility to Wielkopolski National Park is most significant. The use of a hedonic regression function based on a natural logarithm made it possible to determine the coefficient of change in the price of a dwelling unit concerning the change in the distance of the residential premises to the entrance to Wielkopolski National Park. The coefficient for the feature (DWNP) was assigned a value—0.126 (Table 5) which means that a unit located at a greater distance (1 km) from the entrance to the park achieved a lower price in the market by approximately 12.6% than a similar unit located in closer proximity. The application of the WLS model confirmed the conclusions obtained based on the preliminary spatial analysis.

Table 5. WLS estimation results (the dependent variable—the natural logarithm of the price of 1 m²).

| Coefficient | Standard Error | T-Value | p-Value |
|-------------|----------------|---------|---------|
| Constant    | 8.490          | 0.045   | 189.693 | 0.000   |
| y2018       | 0.030          | 0.014   | 2.133   | 0.033   |
| y2016       | 0.017          | 0.014   | 1.172   | 0.241   |
| y2015       | 0.033          | 0.013   | 2.600   | 0.009   |
| y2014       | 0.054          | 0.015   | 3.656   | 0.000   |
| Area        | −0.003         | 0.000   | −13.995 | 0.000   |
| DCC         | 0.001          | 0.008   | 0.056   | 0.909   |
| DWNP        | −0.126         | 0.013   | −9.662  | 0.000   |
| DP          | −0.011         | 0.003   | −3.702  | 0.000   |
| DT          | 0.181          | 0.034   | 5.364   | 0.000   |
| DS          | 0.001          | 0.014   | 0.079   | 0.937   |
| F1          | −0.020         | 0.013   | −1.556  | 0.120   |
| H2          | −0.050         | 0.019   | −2.646  | 0.008   |
| R²          |                |         | 0.739   |         |
| N           |                |         | 1182    |         |
4. Discussion of the Results

This study is one of the first assessments of the influence of accessibility to legally protected areas on the prices of residential properties. There are only a few studies that have been conducted so far that are related to the analysis of the impact of the proximity of a national park on the value of a real estate and they mainly concern such countries as Australia [64], the United States [72] and the United Kingdom [73]. Most often, the research works for which the HPM method has been used were various types of analyses of the impact of accessibility to urban green areas [20,22,32] or airports [37,52,62] on the prices of dwelling units. Moreover, the selection of factors that are adopted for this kind of analysis is often determined by local conditions and adequate knowledge of the local market. However, a direct comparison of the results obtained in this research with the existing studies may be difficult due to one of the most significant characteristic features of the real estate market—heterogeneity which may result from i.a., different locations or different types of residential properties.

It should be noted that the conducted analyses were based on a wide range of data on the transactions concerning the size of the research object. The analysed set of transactions included a total of 1182 residential units. Similar types of studies conducted in Poland, in the previous years, were based on a comparable number of transactions, or a larger number, however, those studies concerned much larger administrative units such as Poznań or Warszawa [37,45,52].

This research assessed how and to what extent the prices of residential premises change with regard to one of the most important features of the local real estate market—accessibility to Wielkopolski National Park. In the study, this feature was defined by the actual distance between the dwelling unit and the entrance to the park, taking into account the local road infrastructure. The Euclidean distance was not taken into account in this statistical analysis. The use of the network distance in the model has many benefits, however, most importantly, it gives the possibility of a reliable mapping of the processes occurring within the local market [12,20].

The use of a logarithmic model allowed us to identify the percentage change in the transaction price of a dwelling unit in relation to the change in the distance of the premises to the entrance to Wielkopolski National Park. Within the local real estate market, accessibility to Wielkopolski National Park proved to be a statistically significant attribute affecting the prices of real property. At the same time, it is important to note that real estate is a particularly important good. The price of real property may depend on several features that are typical for the local nature of the real estate market. Any kind of analyses of the real estate market should be conducted comprehensively. Additionally, the method of the impact of selected attributes may vary depending on the type and spatial extent of the property market. When conducting analyses of the real property market, it is important to be aware that the impact of significant factors on prices may change over time and it also depends on the changes in local planning, social, economic and political conditions [74–76].

The analysis carried out allowed us to categorize the variables and indicators adopted for the analysis into one of two groups in relation to price: enablers-constraints or barriers-drivers (Table 6).

| Nature and Manner of Influencing the Price of a Dwelling |
|---------------------------------------------------------|
| Advantageous attributes                                  |
| ++ (high)                                                |
| Less distance to Wielkopolski National Park              |
| + (low)                                                  |
| Transaction year                                         |
| Less distance to Poznań                                   |
| Smaller surface area of the residential unit            |
| Disadvantageous attributes                               |
| -- (high)                                                |
| Less distance to a bus stop                              |
| Building of more than 2 floors                           |
| – (low)                                                  |
| Less distance to schools                                 |
| Ground floor and the top floor                           |
| Less distance to the centre of Mosina                    |
According to this study, there is a statistically significant correlation between prices of residential premises and accessibility to Wielkopolski National Park. However, even though the obtained results are properly justified, there are some certain limitations to the solution mainly resulting from the lack of data. In the context of residential units, one of the most important features seems to be the standard of finishing (interior of the unit). However, in this study, there was no technical possibility to include this variable in the model due to the lack of information on this attribute in the available sources of data. Taking this variable into account when constructing the WLS model would certainly contribute to increasing its accuracy and it would be possible to describe, in a more precise way, the actual processes and mechanisms occurring within the local market. Moreover, the restrictions of the presented method may be related to the fact that the impact of proximity to legally protected areas in other cities/regions of Poland may be different as it depends on regional conditions. Finally, it is worth noting that the Mosina commune occupies an area of 172 km$^2$, which makes the study area isn’t very large. Consequently, it is difficult to draw universal conclusions that could be formulated for larger study sites.

In connection to the above, this type of research should be conducted in other cities/regions of the country for legally protected areas, to have the possibility to compare the conclusions to the results obtained in this study. To increase the possibility of comparing the studies, future analyses should be based on similar assumptions related to the selection of real property, variables and applied methodology. Application of this type of approach in future research may guarantee determination of the regional impact of the analysed feature on prices of residential units.

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