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ANALYSIS OF THE RELATIONSHIP BETWEEN RESIDENTIAL PROPERTY VALUE AND LAND VALUE

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STATEMENT OF AUTHORSHIP

I hereby testify that this paper and the work it presents are entirely my own. When it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice. I give this testimony freely, out of respect for the scholarship of other professionals in the field and in the hope that my own work, submitted here, will earn similar respect.

Szymon Mojzesowicz

ABSTRACT

Purpose – The purpose of this paper is to examine the relationship between unbuilt plot values and (within the same property) finished development values, both expressed in PLN per 1 sqm (respectively land area and usage area). Although it is visible at glance that the relationship exists, as the land value is hidden inside the finished house value in the market, the application of mathematical and statistical analysis can develop an additional analysis tool for initial recognition of properties under construction which are placed outside the standard and mean relationships that rule the market, being at the same time average properties. This might be helpful in the initial process of risk assessment

Design/methodology/approach – The research methodology relies on a mathematical / statistical analysis of results of valuations prepared for bank loan purposes. Particular tests have been undertaken such as: Spearman rank correlation coefficient, Pearson Product moment coefficient, regression testing.

Findings – There is a strong correlation between analyzed variables. It is possible to show a difference area graph which is significant in terms of confidence of range of house values referring to land value factor

Originality/value – This is an additional basis to be used for analysis of the market. It is designed in order to use a mathematical approach based on an assumption of locationally independent value distribution. It provides a new approach to building value, based on a indirect market evidence (emerging from land value to house value comparison)

Keywords - value, residential market, relationship between values

WYCIĄG

Cel – celem tego opracowania jest zbadanie zależności pomiędzy niezabudowanymi działkami budowlanymi a wykończonymi domami (obie wartości dotyczą tej samej nieruchomości). Obie szacowane wartości odniesione są do 1 mkw odpowiednio powierzchni użytkowej lub powierzchni gruntu. Po mimo tego, że na pierwszy rzut oka widać zależność pomiędzy tymi dwoma zmiennymi, zastosowanie analizy matematycznej i statystycznej do zbadania względnych zachowań zmiennych pozwala na przygotowanie narzędzia do wstępnej identyfikacji nieruchomości w budowie które, będąc przeciętnymi na tle rynku, plasują się poza średniorynkowymi trendami. Narzędzie takie może być bardzo pomocne we wstępnym procesie oceny ryzyka zabezpieczenia.

Podejście/metodologia – Metodologia badania opiera się na matematycznych / statystycznych metodach analizy wyników wycen nieruchomości przeprowadzonych dla celu zabezpieczenia wierzytelności kredytodawcy bankowego. M. in. przeprowadzono test rangowy Spearmana, test Pearsona i test regresji w zależności pomiędzy zmiennymi.

Wyniki – Istnieje silna zależność pomiędzy analizowanymi zmiennymi. Jest możliwe pokazanie na wykresie obszaru, który wskazuje zakres wartości osiąganych przez domy dla założonej wartości gruntu.

Innowacyjność/wartość – Przeprowadzone badanie stanowi dodatkową podstawę analizy rynku. Badanie zaprojektowano jako podejście matematyczne, w oparciu o założenie lokalizacyjnie niezależnego rozkładu jednostkowych wartości nieruchomości. Dodatkowo badanie wykazało zasadność analizy wyekstraktowanej wartości samych naniesień, opartych pośrednio na danych rynkowych (porównanie transakcji nieruchomości zabudowanych i niezabudowanych)

Słowa kluczowe - value, residential market, relationship between values

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GLOSSARRY

House value – value of the whole property (including land) expressed in PLN per 1 sqm of usage area of the house

Land value – value of the unbuilt land, expressed in PLN per 1 sqm of area

Building value – The value of the building (and only building) counted as a house value minus land value, expressed in PLN per 1 sqm of usage area

Building cost – the cost of producing the building, expressed in PLN per 1 sqm of usage area

CHAPTER ONE - INTRODUCTION

Polish residential market background

During the last 20 years of Polish 'new times', after overthrow of the communism, the real estate market has experienced a number of changes which has influenced the whole economy of the country. This evolution has been supported firstly, by a very insignificant and recently by the very important participation of the valuers and banks. In the early 90's it was a matter of having cash to buy a plot and becoming a self investor was unaffordable for over 95% of citizens of Poland. Even if someone managed to buy a plot, he had to face another problem – how to buy building materials? Besides this, building permission limited the architecture, usage area etc.

During these last twenty years the supply / demand ratio, CPI, EU entering process, EU financial subsidies and other important factors created various trends in residential property market prices area. The 2006 – 2007 economic boom in terms of the property market caused a massive propagation of investment awareness. A lot of people realised that buying a plot in January 2007 (with mortgage of course) can give them an investment yield of 100% in 12 month! Let say, a teacher or nurse could have had a loan for 100 000 PLN for a plot and sold it for 200 000 PLN the next year to another furious investor who then sold it again, during the boom, with another 50% profit. That was the reality of last two years (JLL reports, transaction evidence). Some other investors went further…they noticed that there was a great amount of buyers, who due to the free financing access, want to buy a house, there and then. They simply paid as much as they could borrow from a bank. We witnessed an enormous increase in the number of new developers at that time. Most of them had mortgaged their own properties and pretended they had built them for themselves and not for sale. Banks, on the other hand, pretended they believed in this story, as the loan had been given and had been paid back after 12 months, when the brand new house was suddenly purchased.

Parallel to this process we has been experiencing the greatest ever growth in the number of banks entering Polish market. Every corner of the city centre was occupied by a bank branch. It was very symptomatic that banks agreed to pay twice as much for rents for their branches than any other tenant! (www.finanse.egospodarka.pl; www.deloitte.com/pl).

During these times the development business was in extreme prosperity. With a significant shortage of housing in Poland, good access to financing, almost unlimited possibilities for the investments, good access to materials, unprecedented disproportion between affordable year salary and possible profits coming from the property business, the market ran fast like never before. Every participant of business dealings, sooner or later, subconsciously looked for two factors influencing the profitability of the investment – 'as is" value and future development value. This was, and still is, a kind of a virtual meeting point for both sides of sale process – buyers and sellers. The bank and the buyer interested in credit, looked for both values as the collateral requirements. On the other hand the seller, in most cases at the same time – developer, looked for both mentioned values in terms of the yield of the investment.

As mentioned above, the need of the supportive role of the valuation increased in its importance. Suddenly, most cases referred to properties being land plots (at the time of valuation) and planned developments for the future. Banks needed to have an enormous number of appraisal reports stating both values. Real estate valuers struggled to serve the market at that time.

The situation has changed now because of the credit crunch. Banks, again, are not blind to the limitations of their customers and people realized that what goes up, must go down; the prices too. A normality returns. But however, the conditions has been significantly changed. Loans are being given and some developers run their businesses with success. This comes from an independent factor. We, as a country, are still very short of houses and flats. This is the driver of demand which can probably drive our market for the next 10 years, at least. (Jones Land la Salle, 2009; REAS, 2009) We needed, need now, and will need to build houses and flats for thousands of families, no matter what happens in the broader context. Mr. Kowalski, an ordinary Polish worker, will take a loan for a house because, what we've learned from last 20 years is that, it is better and possible to get a mortgage and pay it back through your whole life, than save up for the whole of your life and buy a house when old. A new generation of people in Poland don't know any other circumstances. They think and act like Europeans, where having a mortgage is quite a normal thing. In Old Europe, mortgages place on 40% of GDP index level, in Poland 9% (www.deloitte.com/pl).

This background of the Polish market shows that not matter what happens around, this country of almost 40 m. people has a rising residential property market, so the process of monitoring of the level of values is still indispensable.

The idea of this research emerges from the practical aspects of the valuation process in the growing Polish house market of and due to the aforementioned specific Polish development practises. Those communistic limitation times passed and capitalistic ones came in for good. Nowadays, once someone gets a monthly paid salary, they can take a higher or lower loan for a mortgage, buy a plot without any limitations and then start the development. However, there have been no limits for private investors for almost 20 years already and the market became free, the perspicacious observer can notice a legacy from the past. In general, most Polish loan takers who decide to have a house – take the loan for purchasing an unbuilt plot and then manage the development themselves being at the same time the investors and contractors on their own developments. This kind of loan usually needs to be supported by a valuation of the unbuilt plot value and finished house value. The bank needs to secure the loan, at the time of borrowing money for purchase of land, with the actual value of the land, and further gives money for the development (trying to predict the future value of finished house). Thus every valuation made for residential project consist of simple pair of data, which are *land value* and *house value*.

The methodology of the valuation in the Polish market, approved by the Polish Federation of Valuers' Associations, says that the market value of the land plot, estimated using comparison approach, comes from the calculation based on the market prices per 1 sqm. The same refers to house valuations (PLN per 1 sqm of usage area of house).

This is the foundation of this research: examining those pairs of values searching for relationship between them.

Purpose clarification

The purpose of this research is to answer the question whether there is a more or less clear relationship between land values and house values. This question emerges from the data and analysing this topic seems to be very useful for valuers and controlling systems. In simple words, by observing the market for the last few years, one can consider:

- If there is any describable correlation between two levels of values and furthermore, if this correlation is locationally independent?
- If it is relevant to assume that a few extremely different locations (like e.g. Wroclaw, Krakow and Gdansk), having the same level of residential land values have also the same range of achievable house values?

It can be seen at first sight that there is a positive correlation between those two values. The higher the land cost per sqm, the higher the price of the final development will be. This is obvious because both prices are under the influence of general market tendencies such as supply and demand and are also created partially by the same attributes like location, neighbourhood, prestige etc. (This is to be under further consideration throughout the next chapter).

However, the research needs to go further.

- What if we had a tool, which could be used as a map of value predictions?
- What would the shape of the graph be if we put land values on a horizontal coordinate axis and house values on the vertical one?

According to the specific character of data, it seems to be reasonable to talk about values of the land and the range of values of the houses as the unbuilt plots are more stable in terms of pricing attributes and more similar to each other. This leads to the idea of shape of the graph which could be a kind of *band*.

- What if we can simply look at the graph and say more about the value of the planned development even if it is the one of the first ones in the area and there are not too many relevant comparables?
- What if we can compare both values after appraising them with the graph and check if they follow market mean price trends? If not, maybe this could point to additional risks of planned developments?

These questions describe the purpose as they show the need to research this topic and find an additional tool for appraisers, loan officers and others involved, to compare the results of every valuation of this kind with general market tendencies and trends regardless of location (within Poland) and the influence of time.

To provide such a tool is the most profitable aim of this research. This tool could help appraisers analyze both sectors of the market (land and house prices) when data of only one of them is available and help loan officers to make an initial

check of the valuation provided by comparing outcomes from the valuation report with the *band* graph updated constantly.

CHAPTER TWO – LITERATURE REVIEW

Factors influencing values and price modelling

The literature based on property attributes that influence the value shows that the global market of residential properties seems to be quite homogenous in some group of attributes. Generally, there are a few main factors influencing values. Some of them are universal for all properties and all markets. There is a logical chain which leads to value – buyers needs and preferences, demand for appropriate properties, prices increase, recorded deals as the evidence, and high value at the end. In terms of the valuation process, understanding human decision – making processes is important, as ultimately market participants and the interaction of supply and demand determines the price of property (DALY, GRONOW, JENKINS, PLIMMER (2003, p. 297).

Within this chain mechanism, independently of continent and country people's needs are reflected in market supply and in the process. Thus, the mentioned attributes must be considered here thoroughly to answer two main questions:

- Which of the attributes influence the prices and valuation the most? and
- Which of them refer to both analyzed property types: unbuilt land plots and finished developments?

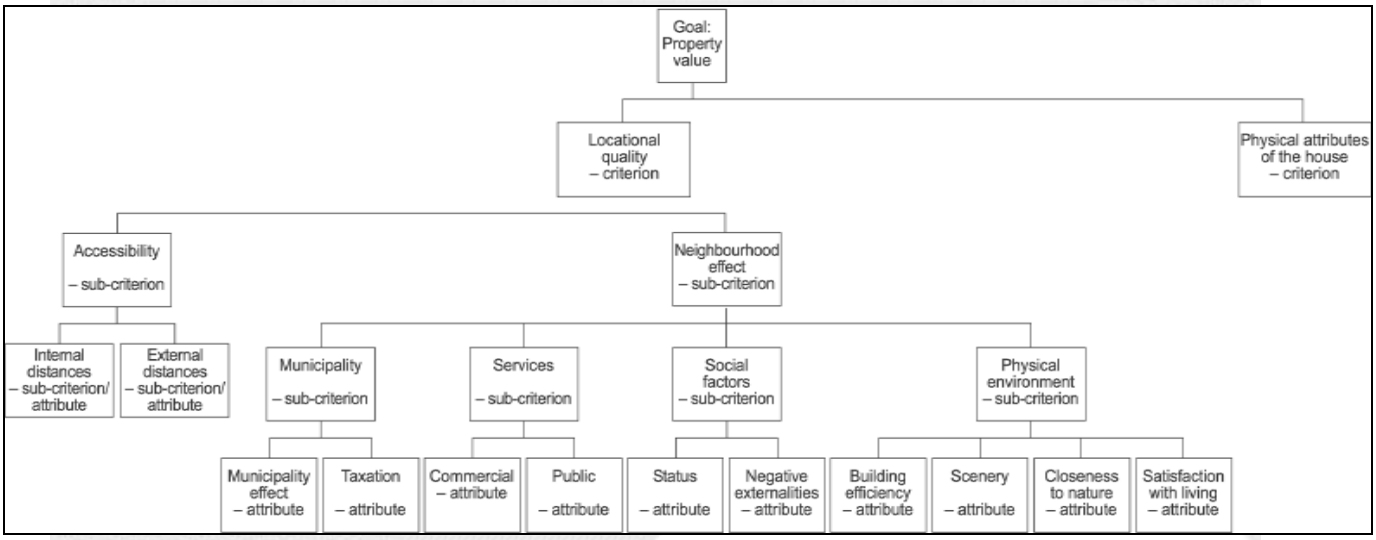
Undoubtedly the greatest influence on the prices is location.

- *location*

'Location, location, location' says the real estates mantra. The first who coined this phrase was Harold Samuel in 1944, who founded Land Securities which started as a Land Securities Investment Trust Limited with three houses in Kensington and some government stock as its only assets, and 24 years later became the Largest UK's company. (Telegraph Media Group Limited, 2009, www.telegraph.co.uk). DALY, GRONOW, JENKINS, PLIMMER (2003, p. 303) as a result of the research of consumers' preferences throughout UK, Ireland and Australia produced a table where location and proximity to amenities were placed at the top two places in the three countries. The location has been pointed to as the primary value attribute.

On the other hand, KAUKO (2003, p.259) derived, based on a several different studies "(e.g. Hoesli *et al*., 1997; Laakso, 1997; Laakso *et al.*, 1995; Miller, 1982)" the hierarchical structure of the value tree, which divides the goal – Property value, only into two criteria: Locational quality and Physical attributes of the house. This kind of approach support the thesis, that location with its further variable sub-categories has the greatest influence on the value.

Fig.1 – The hierarchical structure of the value tree (*cit.)* KAUKO (2003, p.259)



Location might have a variety of meanings. Some of customers understand a wide range of location "things" like proximity to amenities or right neighbourhood while some of them rather divide those attributes for separate features. This points out next attribute.

- *neighbourhood*

This attribute seems to be the second on the list of the most important factors. Most of the buyers consider the neighbourhood when purchasing a property. Some of them significantly stress possible future changes of the neighbourhood as well. It is well known, that even the best property, next to power plant or homeless shelter decreases in value. Sometimes, it is a clear example of NIMBYism but still it emerges from the market participants needs or fears. NIMBY (abr. Not In My Back Yard), NOPE (Not On Planet Earth), the BANANA (Build Absolutely Nothing Anywhere Near Anyone), and the TEDAO (Tear Everything Down At Once) or people who fight LULUs (Locally Unwanted Land Uses) (http://www.urbandictionary.com) are in some way the additional confirmation of importance of the neighbourhood next to the mentioned research results.

This attribute (neighbourhood) may be understood by market participants in different ways such as location. It might be interpreted us the physical and social quality of the environment or alternatively as a composite neighbourhood effect proxy. Variable influencing value, commonly used in researches, is Specific Negative Externalities – "damages caused by air pollution, noise, visual effects, etcetera" KAUKO (2003, p.252).

KAUKO also pointed out another attribute influencing value like Public Services and Taxes. Although taxes factor refers mostly to North America, and not Poland, the public services might be influential in Polish circumstances. Anyway, this attribute also confirms the proposed path of this research as it is also a part of the wide location attribute understanding so it remains the same for an unbuilt plot and a finished development.

According to the hierarchical structure of the value tree mentioned before, KAUKO (2003, p.250), location including neighbourhood aspects, determines on the value of the property the most. This rule refers to both the finished developments and unbuilt plots. WOLVERTON (1997) stated that "home size (…) is usually highly correlated [and linearly related to home price], and it is reasonable to expect larger homes to also occupy larger lots".

This was the foundation of the topic of this paper.

In the case of finished developments, other attributes like physical attributes of the house and a property's aesthetic appearance are "remediable over time and not pertinent in influencing value. In particular, these inadequacies were deemed less important with regard to influencing value than property's locality" DALY, GRONOW, JENKINS, PLIMMER (2003, p. 304) (citation refers to Australian respondents opinion versus UK and Ireland ones). KRYVOBOKOV (2007, p. 257 – 286) analyzed the sub - attributes within location attribute as a one of the value drivers. He used several regression models to research the most important from over 20 different sub-attributes. The results showed that some of the location attributes had to be specially considered in CEE valuations and some of them might be ignored. Nevertheless, all of them were location sub-attributes so they were independent from the actual use of the property (land plot or finished value) which is important in terms of this particular research.

Taking into consideration the fact that the property value is mostly influenced by the location and the neighbourhood, it seems to be a reliable idea that the price of land may in general lead to a range of prices of the finished development. This range of prices of a finished development leaves space for the additional influence of physical attributes of the house. More about methodology in the next chapter.

The mathematical relationship between values/prices

It seems that not too much research has been produced regarding this particular topic (especially about the relationship between values of unbuilt land and finished houses) but KAUKO (2003, p.253) next to the other variables affecting the value (mentioned above), refers to density factor and proposes two opposite hypotheses about the relationship between plot efficiency and house price, “assuming that all other factors are equal: the increased land price level caused by higher land use is switched to the dwelling prices; and more efficient land use implies a negative house price premium because of a reduced satisfaction for the resident”. Both hypothesis are stated in a slightly different situation. In our case, the data which is analyzed, has covered Kauko’s assumptions of the equality of other factors, because it is the same property. We also, for the same reason, do not consider planning. The only similarity with Kauko’s thesis, and at the same time the most important, is the occurrence of the relationship and its orientation.

During the literature review conducted while researching, the use of SPSS software has been noticed in research paper of GALIMORE, FLETCHER, CARTER (1996). Those authors conducted a research about modelling the influence of location on value. The research paper refers to Multiple regression analysis (MRA) which involves the prediction of one variable (price) from data derived from other variables (the factors which influence the value). Although Galimore’s research considers the attributes that are not consider in this paper, the methodology and software used there is very similar to the one used here. It is essential to reference that Galimore also agrees with statements of this research paper saying: “ The number and nature of influences on the perceived value of property are large and various. Some of these influences, such as interest rates, income levels, and inflation, are important in determining general levels of value at given points of time; and therefore useful in predicting changes over time. The purpose of this study [Modeling the influence of location on value. – *author’s note*), however, was on

produce MRA-based valuations as within the same time-frame. Additionally, the effect of such influences within a geographical area (moreover for the same location – *author's.note*) tends to be uniform across all properties".

This confirms the relevance of investigation by taking into consideration values of the same property, at the same time, in the same location and in the same market just at different stages of development. However, most of the literature review refers to the method of data analysis and statistical approach to data.

The measurement of dispersion is the analysis that shows the variation in numerical data, NAOUM (2007, p. 98-130).

A normal distribution test within the data of the both values is considered in this paper so that the standard deviation index counting needs to be conducted (as well as skew checking). If the test shows normal distribution the next step will be taken – central tendency measurement.

Measurement of central tendency is a type of analysis applied to a group of data which has to be represented by a typical value, NAOUM (2007, p. 98-130). This kind of analysis is to be conducted in the group of land values and finished house values separately. The results are predicted to be significant within narrower subgroups of voivodships. An additional comparison between relationships' trends within mean, median and mode of the subgroups of both values can support the location attribute's influence on the value.

The next test that was considered when analyzing the database was a non-parametric test calls *Spearman rank correlation test* which is used when two sets of scores are compared in terms of whether and how strong the correlation coefficient is. NAOUM (2007, p. 98-130). With this test it will appear as a positive / negative coefficient and how strong the correlation is (between -1 and 1). "but in interpreting correlation it is important to remember that 'correlation is not causation'. There may or may not be a causation connection between the two correlated variables…' NAOUM (2007, p. 129). This will be further considered and checked during the result analysis.

CHAPTER THREE – METHODOLOGY

Database description

The study approach is based on a suspicion that there is a possibility to determine the more or less stable range of values of finished developments, knowing just the level of values of the land in a particular area. This emerges from valuation practice and prices' spread in several areas of the country.

The data used in this research was collected during 2008 ant 2009Q1 in Warsaw Real Estates Advisors Office, LEGE ARTIS BDM. Thanks to the courtesy of this company 10000 valuation reports were examined and finally 1207 valuation reports with assessed both relevant values (land and houses) were collected as a database. It is essential to point out that ALL of the valuation reports stating both aforementioned values were considered so data used here comes straight from the market without any initial selection. All of the valuation reports followed RICS regulations and Polish Valuation standards. All properties were residential type, single family houses, popular architecture (0 level + additional area under slopped roof), popular solid technology made (bricks / other ceramic materials, cellular concrete bricks and concrete construction parts, wooden roof construction). The age of the houses varied between 0 – 10 years.

A set of data (inputs) was based on:

- Land area (sqm)
- House usable area (sqm*)
- Assessed Land Value (PLN**)
- Assessed Finished Development Value (PLN**)

*House usable area based on documentation delivered during the valuation process, or in case of finished house valuation – from measuring while inspection. In Poland, there are two possible standards of measuring usable area – Polish: PN - 70/B-02365 and EU: PN-ISO 9836:1997. Both of them differ slightly in detail but additional research has been conducted and, considering the shape of houses analyzed here, the bias might be a maximum of 5%.

**there are two possible situations – unbuilt land with development planned on it (so we have simply value 'as is' and 'future' value) and already a finished house (so we have additional value of unbuilt land and value 'as is' as a finished development value). Every situation gives the both values.

The area of the whole country has been considered although the majority of data comes from Mazowieckie voivodship. It shouldn't actually make any difference as we have assumed that the relationship seems to be irrelevant to the particular location. Thus the data were analyzed in two groups: the whole country and Mazowieckie separately. The data analysis has shown that these assumptions are correct.

Hypothesis statement

HYPOTHESIS H1

There is a strong positive correlation between Land value (XL) and House value (XH) although it is not a strictly linear or other function as it applies the range of house values to the particular adjusted level of land value (XL)

***H1:* XL → {XHmin; XHmax}; F(XL) ≠ XH; F(i)ϵØ**

NULL HYPOTHESIS H0

There is no significant correlation between Land value (XL) and House value (XH)

***H0:* XL → {XHmin; XHmax}; XHmin = 0; XHmax ϵ {0:∞}**

Methodology stages description

- *micro sample pilot analysis.* This stage has been conducted in order to prepare a model for the further analysis. 100 data pairs (unbuilt land values and finished house values) have been taken into consideration and pilot analysis were provided with the graph preparation and the initial conclusions. This model was prepared to make sure that the whole research analysis mechanism works properly. At this stage due to the initial conclusions, all methodology improvements have been implemented and rechecked. Some new ideas have emerged, such as:
  - Validity of additional analysis of the result of the subtraction of the land value from the finished development value. Is it a building value?
  - Additional analysis of percentage of land value in the whole finished development value

- *database resources review and completion.*

- *database analysis*. After setting up the model of analysis (on a small sample of data) and the completion of the database, there will be a thorough analysis of quantitative, interval type data.

  All the data must be described by measures of central tendency, dispersion and significance which are very useful in this case. The next step in analysis of the data is to identify the relationships between two variables which is actually the main point of interest in this research. This process will be proceeded by using SPSS software and its appropriate correlation coefficient testing.

  The methodology group of tests that are being used consist of:

  - ✓ Normal distribution testing of the land values
  - ✓ Normal distribution testing of the houses values
  - ✓ Use of statistical test appropriate to the type of data. This is a quantitative, interval type, not normally distributed data so a Spearman rank correlation test will be used.
  - ✓ Result interpretation
  - ✓ Correlation analysis
  - ✓ SPSS graphic interpretation
  - ✓ Excell graphic interpretation
  - ✓ Data recoding – in order to make the results more useful, the land values could be recoded for the interval subgroups by rounding off the values for every 10 PLN. This may result in a more clarified view of the chart.
  - ✓ Results interpretation and comparison

CHAPTER FOUR – RESEARCH OUTCOMES

Results analysis

As it was mentioned above, the 1207 sets of data has been analyzed in this research. 15 aspects of every piece of data were considered during database completion, such as:

- No. of record
- Date of valuation
- Voivodship
- Poviat

- Commune
- Town
- Street (with number)
- Land area
- House usage area
- Land value
- Finished value
- Land value per 1 sqm (L)
- House value per 1 sqm of usage area (H)
- Atificial value of building per 1 sqm (w/o land) (as a subtraction of land value from total house value incl. land) (H-L)

Finally, as a basis for the further analysis, the two sets of data were prepared:

- LAND VALUES per 1 sqm (L)
- TOTAL HOUSE VALUES per 1 sqm of usage area (H)

Using the SPSS software, histograms of both sets were prepared.

Fig.2 – Land values histogram

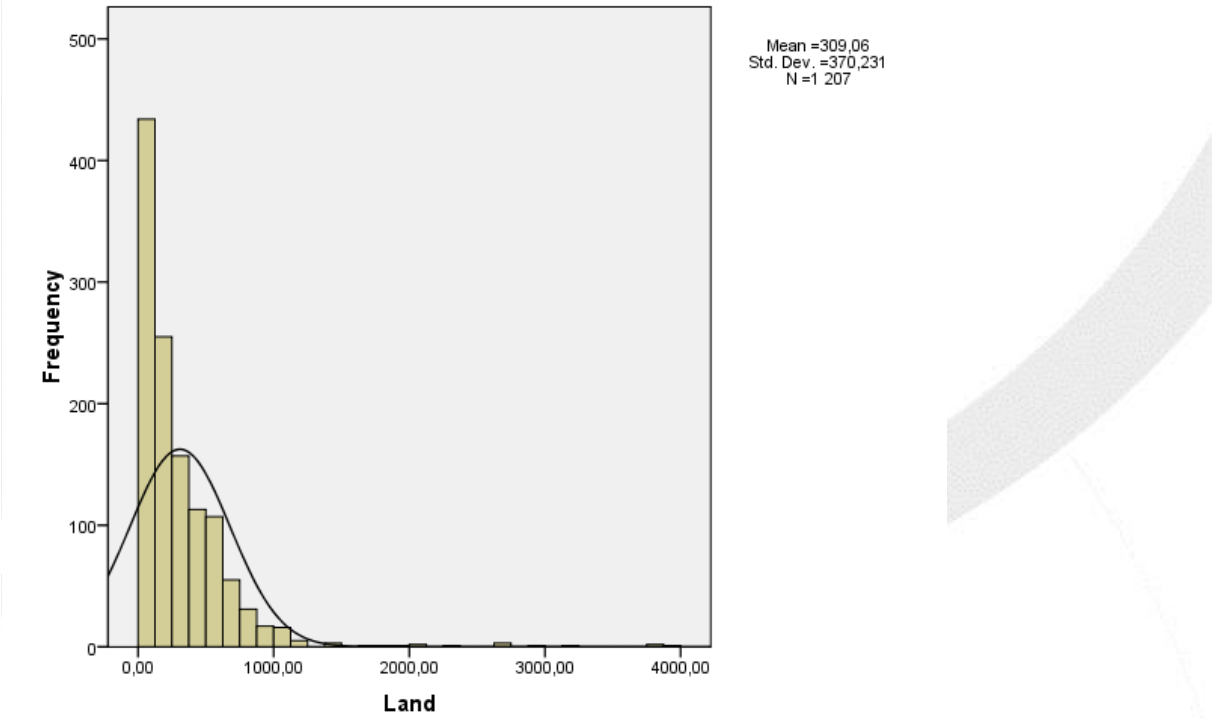
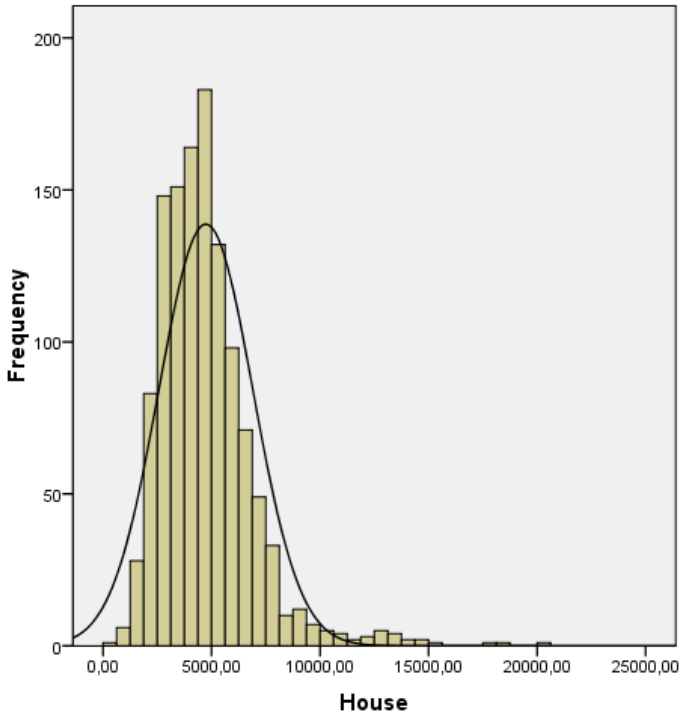


Fig.3 – House values histogram



It can be seen, that both groups of data do not represent a normal distribution thus the central tendency testing was not provided.

To support the conclusion of not normal distribution, the next step was to test the groups for normal distribution by *Kolmogorov-Smirnov test* using SPSS Software Package. This non-parametric test is usually used for stating the normality of the data.

The results are shown in the tables below.

Table 1 – S-K test results for Land values

One-Sample Kolmogorov-Smirnov Test

		Land
N		1207
Normal Parameters[a]	Mean	309,0645
	Std. Deviation	370,23140
Most Extreme Differences	Absolute	,203
	Positive	,139

	Negative	-,203
Kolmogorov-Smirnov Z		7,043
Asymp. Sig. (2-tailed)		,000
a. Test distribution is Normal.		

Table 2 – S-K test results for House values

One-Sample Kolmogorov-Smirnov Test

		House
N		1207
Normal Parameters[a]	Mean	4735,9147
	Std. Deviation	2168,58042
Most Extreme Differences	Absolute	,096
	Positive	,096
	Negative	-,069
Kolmogorov-Smirnov Z		3,334
Asymp. Sig. (2-tailed)		,000
a. Test distribution is Normal.		

Due to the fact, that the Kolmogorov-Smirnov tests for the distribution not being normal, the significance in both above cases (Asymp. Sig. (2-tailed)), being „0" shows that the data sets are not normally distributed.

Although in some specific approaches, the normality is not a strict condition, the general rule is to use the non-parametric tests for correlation testing than parametric hence, the correlation coefficient that were analyzed in terms of the relationship between both sets of data was *Spearman rank correlation coefficient test* (2-tailed) conducted with SPSS Software package.

Table 3 - Spearman rank correlation coefficient test

Correlations

			Land	House
Spearman's rho	Land	Correlation Coefficient	1,000	,764**
		Sig. (2-tailed)	.	,000
		N	1207	1207

	House	Correlation Coefficient	,764**	1,000
		Sig. (2-tailed)	,000	.
		N	1207	1207

**. Correlation is significant at the 0.01 level (2-tailed).

The level of significance (Sig. (2-tailed)) again show „0" which lead to a conclusion stated in the hypothesis.

In order to additionally check the correlation between variables of land value and finished house value (of the same properties), due to the fact that both are numerical, (currency measured in PLN) the *Pearson product moment correlation coefficient* has been tested (2-tailed)

Table 4 - Pearson product moment correlation test

Correlations

		Land	House
Land	Pearson Correlation	1,000	,688**
	Sig. (2-tailed)		,000
	N	1207,000	1207
House	Pearson Correlation	,688**	1,000
	Sig. (2-tailed)	,000	
	N	1207	1207,000

**. Correlation is significant at the 0.01 level (2-tailed).

As is visible above, the significance again refers to zero which shows a strong correlation between the variables.

Actually, all of the tests conducted above could have been predicted with a high level of probability. This conclusion comes from the nature of both values. Both refer to similar attributes so it is rather obvious that there is a correlation. The level of significance of the results if the tests support the hypothesis very strongly. Accordingly to this discussion, there is a foundation for assumptions that the correlation might be linear so an additional test of regression has been conducted.

Table 5 - Regression test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	**3489,847**	59,018		59,132	,000
	Land	**4,032**	,122	,688	32,938	,000

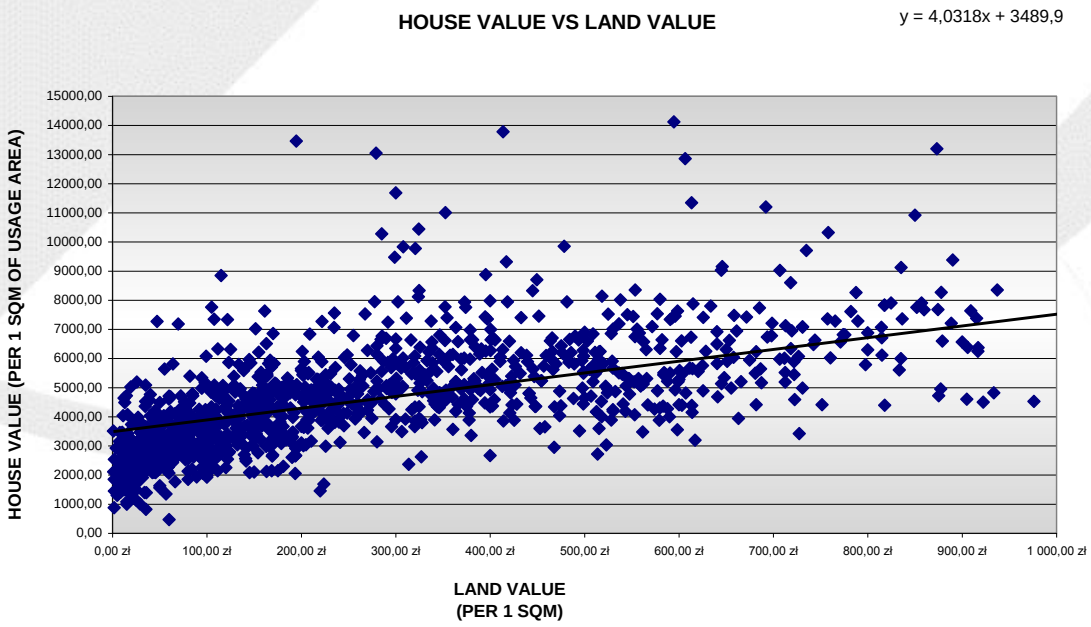
a. Dependent Variable: House

For the purpose of this test, the dependent variable was set as house value and the independent – land value. This assumption comes from aforementioned characteristics of both variables and the fact, that land values are more stable. The suggestion we stated was that there is a range of house values referring to land value.

The level of the significance is “0” which supports the hypothesis of the strong correlation.

Another analysis of the database was conducted in Excel. The scatterplot below shows the graphic interpretation of all of the data.

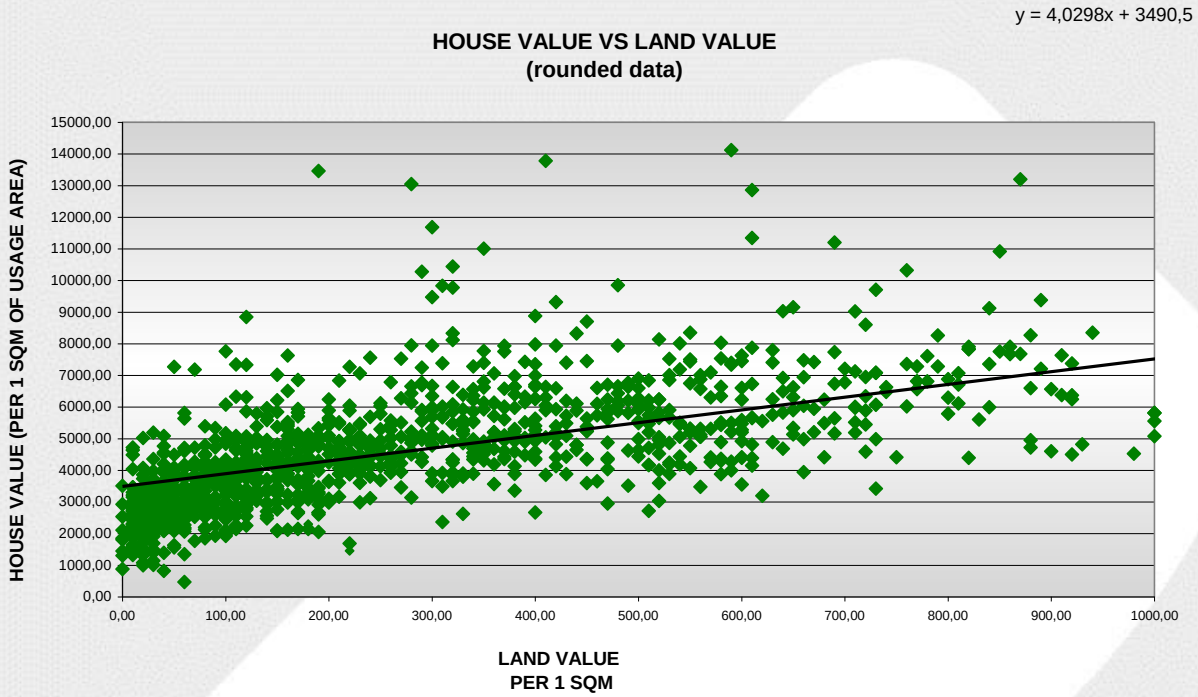
Fig.4 - House value vs land value



The graph above shows a concentration of dots in an area which is rather similar to a ribbon. The higher concentration on the left side of the graph is a result of the spread of the values, whereas a lower level of values of land more often take place on the market. The equation of the black trend line (top right) confirms the results of the regression SPSS test (bolded coefficients in table 5).

In order to achieve a clearer graph of the data, a kind of recoding has been done. All of the “independent like” variables (land value) have been rounded to 10PLN.

Fig.5 - House value vs rounded land value



As it can be seen, a very slight difference in trend line equation coefficients appeared so the results are not distorted.

The same parallel analysis has been conducted in SPSS software using the difference area graphs for raw data and rounded land values.

Fig.6 – Difference area graph - House value vs land value

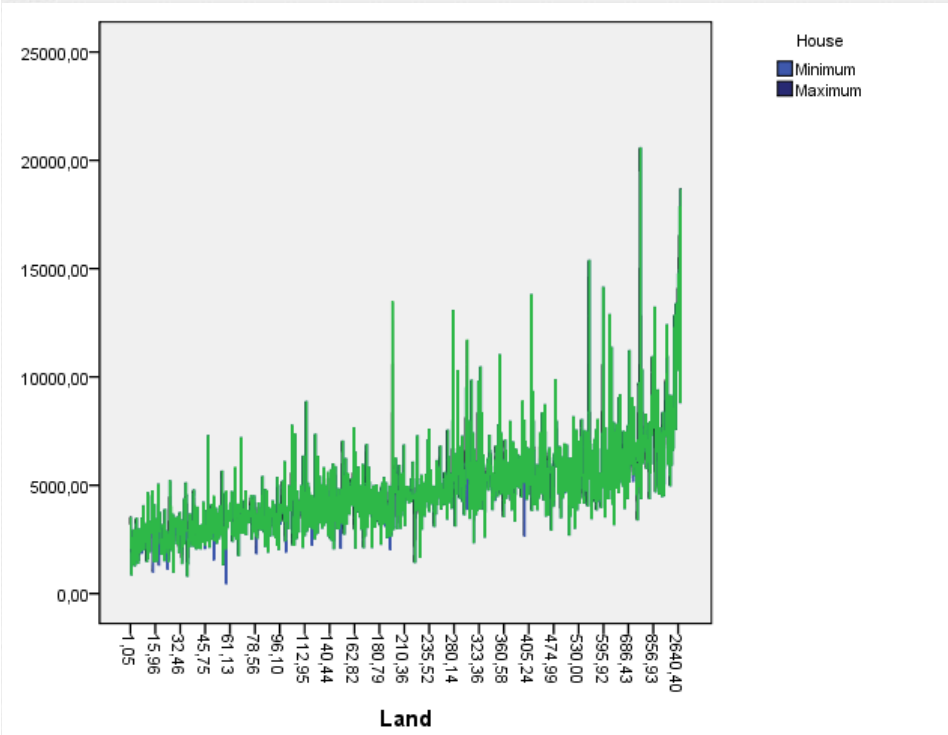
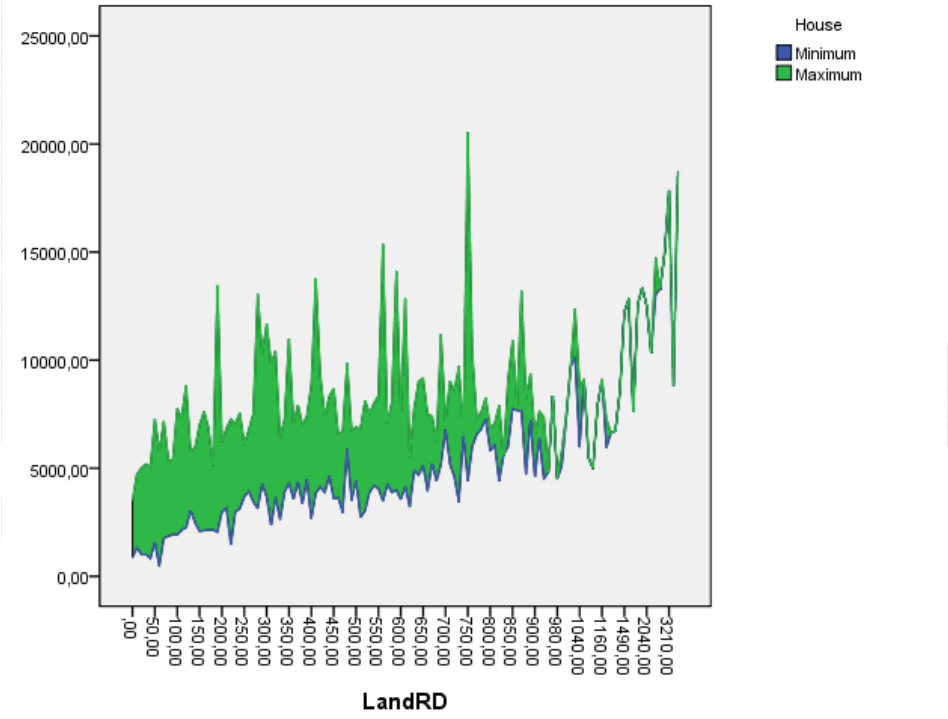
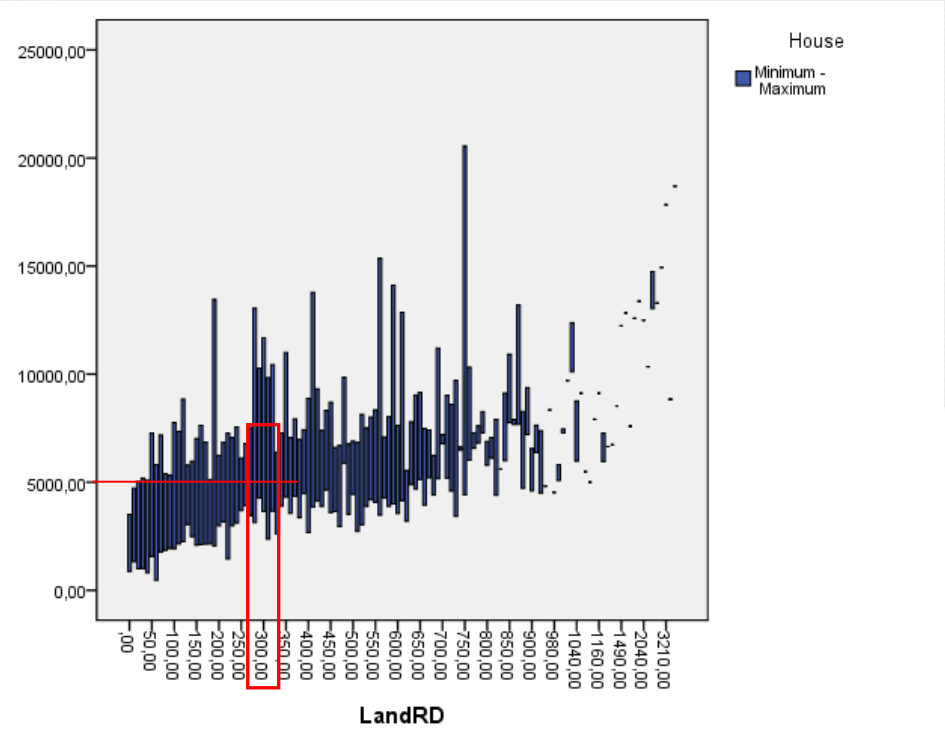


Fig.7 – Difference area graph - House value vs rounded land value



The other possible way of interpreting of the results of the comparison of analyzed data is SPSS simple range bar graph. This one, in terms of the tool that was deigned in this research, seems to be the most useful.

Fig.8 – Simple range bar graph - House value vs rounded land value



Results critical appraisal and discussion

One of the drawbacks of the final graph showing the analysed relationship is the high amount of the peaks which deform the desired band shape of the graph. Those peaks were identified during the analysis and all of them were caused by over standard, extra conditions relating to property attributes such as very good location, very small usage area of the house (which results in high value per 1 sqm), etc.

The data relating to the highest peak is shown below

Table 6 – sample record (peak value)

No	Date of valuation	Voivodship	Poviat	Commune	Town	Str
539	2008-06-04	mazowieckie	piaseczyński	Konstancin-Jeziorna	Konstancin Jeziorna	Niecała

Str No.	Land area	House Usable area	Land value	Finished value	House value per 1 sqm	Land value per 1 sqm
5	3 344	374,5	2 500 000	7 700 000	20 560,75	747,61

The only extra attributes of this property are a quite big area of land (which raises the 1 sqm house value) and extremely good location for residential properties. Konstancin is one of the most expensive places to live in Poland. This is definitely a property that shouldn't feature within the graph!

The other peaks (down or up) also have some special characteristics. This supports the hypothesis that the value of the average house (finished one) with high probability will vary within the values plotted on the graph. Obviously, more data would only help smooth out the shape of the graph.

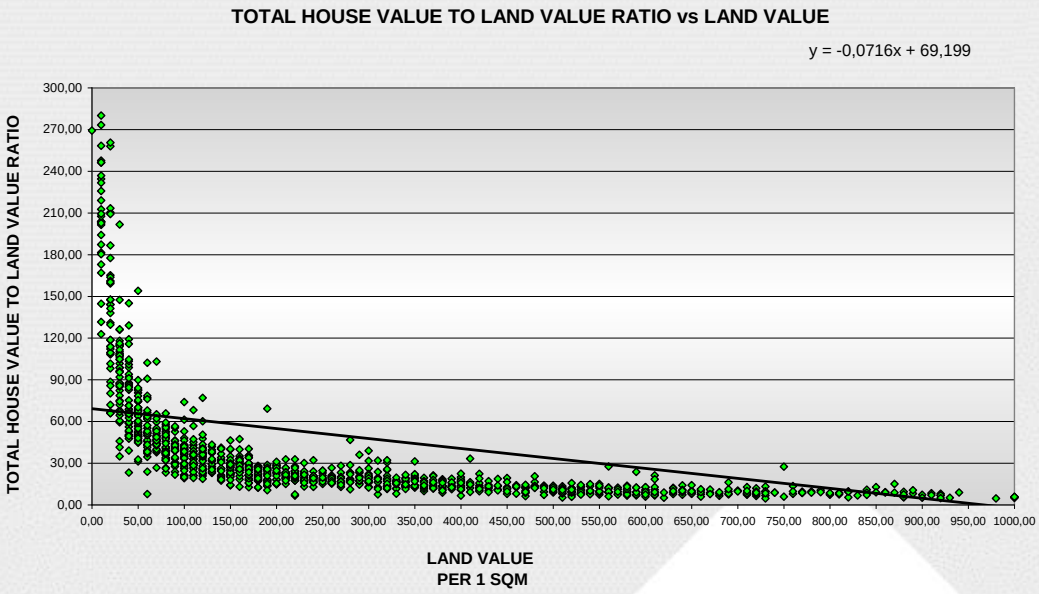
This research does not take into consideration all of the properties attributes but this was the most important assumption, leaving the value influencing attributes aside, as they are mostly the same for unbuilt land and finished development, and to concentrate only on the utility of the comparison of the range of house values versus land value factor. In terms of the initial idea, the shape of the graph is compacted enough to state an appropriate thesis for every market (indexed by land value factor). The user of this potential tool, might analyse the market in terms of the land prices and assume a secure level of house value, e.g. 5000 PLN per 1 sqm of house usage area, in the market, where land costs ca. 300 PLN per 1 sqm. That was the goal of this study.

As it was clearly stated before, this will never compare with deep analysis of the market but it is quite easy to update, giving at the same time quite high security with predictions of the value. Those peaks identified above, can also provide an additional evidence of the possibility of the occurrence of an out of the band graph property being valued on the market (being financed by a bank at the same time).

The results of the research supported the predictions of the relationship between both values. Even though, The correlation does not exactly mean the causation, NAOUM (2007, p. 129), in this particular situation, it partially does. For obvious reasons, it is beyond the discussion. According to the nature of both values, there is a chance to change the view of the results of the analysis by computing the multiplier and preparing a graph which will show the total house value to land value ratio in the function of the land value (graph below). The results show another tendency; that the higher the land value, the lower the ratio. This additionally points out that whatever the relationship between the analyzed values is visible, it does not exist under a particular level of land values, which is the level of building cost which remains a stable component of the market value. In other words, in actual market

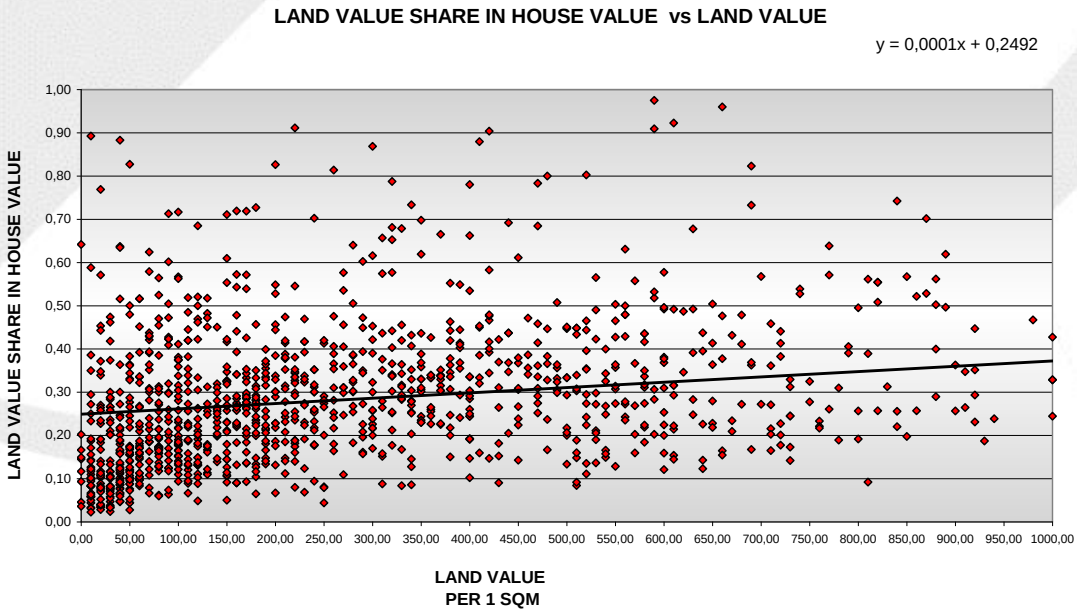
conditions in Poland, there are no sales below the cost of producing the development, even in areas with very low land values.

Fig.9 – Total house value to land value ratio vs land value (rounded to 10 PLN)



The final analysis of the results considered the share of the land value in the house value. As is shown on the graph below (especially expressed by linear trend line equation; m=0,0001), the mentioned share seems to be quite indescribable. The concentration of the dots in the bottom left part of the graph comes from the low level of value of the land, the share of which in house value is counted.

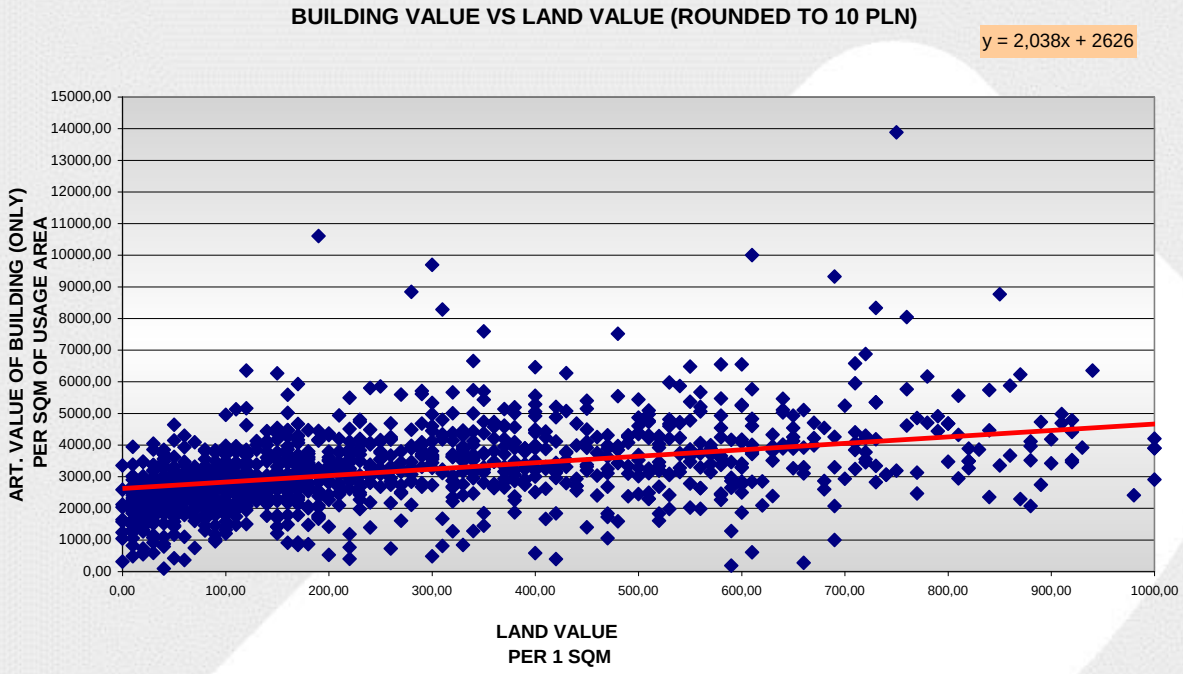
Fig.10 – Land value share in house value vs land value



Additional issues

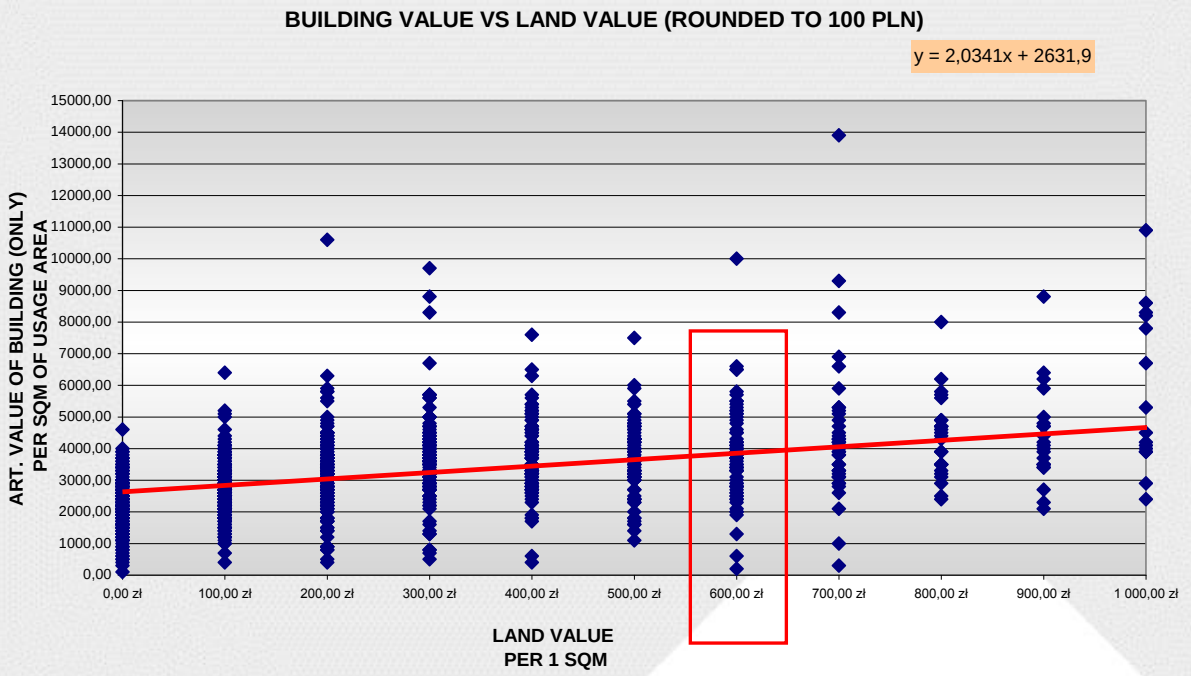
During the analysis of the results, some additional useful aspects have emerged. Even although the valuation model is based on the transaction as unbuilt land plots prices (in case of land) or finished developments (in case of houses), there is always a possibility of identifying the market value of the building (and only building) as a subtraction of the land value from the finished house value. This number cannot be a basis for valuation but might be very useful for analysis. Using the database analysed here, it was a simple operation to highlight these numbers for all records. The results of this subtraction versus land value factor are shown below.

Fig.11 – Building value vs land value (rounded to 10 PLN)



The graph above shows similar trends as the main one (showing house values). Although the “m” coefficient in the equation of the linear trend line is almost twice lower compared to the land value versus house value trend line, the relationship in both cases is positive and quite similar. This analysis might be useful for testing the investment feasibility. For a better explanation and clarity of the practical application possibilities, the land factor has been rounded to 100 PLN, which surprisingly did not change the linear trend line coefficients significantly ! This means that rounding this independent factor (land) does not affect the results very much so the relationship seems to be rather robust (graph below).

Fig.12 – Building value vs land value (rounded to 100 PLN)



Planning the investment, (e.g. residential building) it can be stated with reasonable confidence that if the development is placed in an area, where land costs are ca. 600 PLN per 1 sqm, the acceptable, secure level of costs per 1 sqm of building, vary between 2000 and 6000 as this is the range of built house value per 1 sqm, so there is quite a high possibility of covering the costs of investment in the future market price. It can even be read straight from the graph, that the most acceptable level of cost is 4,000 PLN per 1 sqm of building. The red line, which is the linear trend line, is called here the *"cost return line"* and it is another tool for analysis based on a collected database.

CHAPTER FIVE – PRACTICAL USEFULNESS

There are some specific sectors in which workers could be interested in research of this kind:

- Banks' procedures

Actually in Poland, about 95% of commercial banks use AMRON database (Analysis and Monitoring of Real Estate Market). Some of the results of this research (of further

research in this field) could be implemented into the system. Implementing this study into the bank's analysis software controlling systems could result in "red flashing lamp" when the client wants to take a loan for something which is going to be worth three times less than mean property on local market. This could also point out a highlight the possibility a valuation being corrupted by other factors. All of these concerns could be detected at the very beginning of the financing process analysis even by a low level officer. During a period of market volatility, an accurate valuation and comparison of it against regularly updated market data becomes particularly important. It is possible that, as a result, besides the graph, some kind of table of risk could be provided for bank purposes. By narrowing or widening the width of the *band* on the graph, we could simply describe the sectors of projects with high and low risk or liquidity in the market. This seems to be unnecessary in a mature markets but the Polish market is still growing and needs more tools until we have thousands of transactions per year in one district such as takes places in Western Europe or the US.

There will always appear a question of the significance of the database based on valuations and not directly on transactions, but as it has been mentioned several times in the methodology description, there are two main pros supporting the significance:

- All the valuations bare directly based on the transactions (within an actual time period)
- There is no better way to compare values "as is" and "future" than both referring to the same property. Using a transaction data for such purposes might result in bias and can be conducted successfully only for the average level of prices.

As long as banks use valuations for securing their loans, they accept mathematically transferring the transaction prices into values as a base which is robust enough to support the process. The results of this research might mainly be useful for initial checking of the results of valuations, not the prediction of the future values of developments. This kind of tool, systematically updated, might be always accurate for actual market conditions, whilst on the other hand indirectly showing additional trends in prices. The width of the band on the graph (using the same, fixed percentage of data) can simultaneously bring other information about market conditions, such as stability of prices in the particular sector.

The other possible usefulness of the results of this research as well as the band graph is the simple access to the additional *cost return line*. Based on a analysis conducted in Chapter four – research outcomes / additional issues, the location of the property, described by the land value per 1 sqm, might result in an additional figure which is an artificial value of 1 sqm of usage area of the building, excluding the land (this idea is analysed and described thoroughly in the mentioned chapter). Even although this figure is not significant in terms of a valuation process, as it is a result of subtraction and not an evidence based figure, it might be useful for initial analysis of valuations at the beginning of the credit process. The more easily accessible, directly or indirectly, evidence based updated tools are in such a process, the better.

Another possible practical application of the results is the implementation of the database into mass valuation models. Banks, especially in tough conditions, more than ever before, have to value their property portfolio to assess their condition. The additional knowledge of the relationship between land values and finished developments values might be helpful in the sector of the collateral valuations for the loans secured with individual residential developments.

Generally, due to the fact that all the data are evidence based and the analysis mechanism might be successively updated, there is quite a wide range of possible uses in practice in terms of the banks' security needs.

- Appraisal workmanship

Appraisers in Poland still need to look for comparable micro markets, especially in suburbs or places far from big cities. This happens because there is a lack of transactions that take place over short time intervals which, combined with a high time trend, affect the valuation. Giving an extra index to every location by a land value level seems to be one of the best and the most precise ways of mapping the whole of Poland's real estate market and identifying comparable areas. This could result in a high possibility of adjustment while comparing parallel markets such as up to 10,000 people towns, equally far from the biggest cities, equally communicated etc. The level of prices of residential land might provide additional evidence of parallels between particular micro locations compared and could widen the view of the market.

The other advantage of this research in terms of valuation, is the possibility to identify poor transactions of properties, falling far below the *band* graph. It is essential to remember that this would only be a support which could never replace reasonable analysis. However, reinforced by a few thousand pieces of data, it could become a robust support tool whilst being at the same time easy to update.

There is also a *cost return line* usefulness in the field of the appraisal workmanship, especially for additional support of the assessment of the planned costs on the property under construction and the assessment of the possibility of meeting the feasibility criteria of the investment. Actually, the artificial data which is shown as a *cost return line* on the graph, shows the average level of the return value in the building (and only the building). This can be helpful at least in the assessment of the most secure level of the building process cost per 1 sqm of usage area of the finished house (Y), in the particular location where land costs X per 1 sqm. This means that using the band graph, equipped with the additional cost return line, the appraiser, based on a land transactions analysis, can simply point out to the investor that the most secure budget, which will be covered by predicted future value with the highest probability is the usage area times Y. In some appraisal reporting, this kind of information, analogically to the mentioned banks' purposes, can be a basis to asses the risk of the investment (if the total cost is far over the cost return line, and the planned development doesn't have any extra characteristics).

As in the case of banks, the possible range of uses of this filed of research seems to be wide and depends on appraisers' needs.

- Public offices service, tax offices

There are some other possibilities in using these kind of tools, such as the aforementioned issue of mass appraisal for taxation table preparation. In Poland, there are still many unresolved issues of this nature. Of course, at this stage of the research, it is impossible to achieve such a wide range of useful applications but this is still a step in the right direction. The whole issue of the cadastre taxation in Poland, sooner or later will become a reality. The plans for now are to assess properties with mass valuation models and implement the law giving an obligation to pay the new tax in an amount counted as a percentage of the value. This decision is very difficult for any government to take because of it's unpopularity. New taxes are inconsistent with current government policy in Poland. On the other hand, we need additional income to keep our national budget in optimal shape. It is essential to

project the possible profits and losses before the law is implemented in such a situation, to make sure that this change will improve the state of the country.

There is no problem with assessing future tax incomes of evidenced buildings but it seems to be quite hard to assess the income within communes, where the development process has just started. In such situations, the analyzed tool could help as a map of values which, connected with the transactions of the unbuilt plots, could result in finished house assessment. With coordination with a building permission database (buildings under construction list), this could result in a quite detailed list of values as a basis for tax payment. All of these sources combined together might be a basis for tax income forecasting. This is just one possible implementation in the tax offices' valuation processes. Other ones, not considered here, might come from a deeper analysis of the structure of the process of valuations for tax office purposes.

CHAPTER SIX – SUMMARY

Generally, the assumed relationship, which has been stated as a hypothesis is confirmed. The expected shape appeared to be slightly different but the area between the most probable house values range is wide enough to cover the specific attributes of the properties not considered in this research. The relationship, and its strength, comes from the nature of both values. The house value, even though it is market evidenced by comparison approach, has a few components, such as land value, cost of building production process and investor's profit. All of them might vary in time, depending on market conditions, demand, supply, etc. but after all, the lowest possible price which could be paid as transaction price in an arm's length transaction, is always at least close to the cost approach valuation. This mean that whenever the demand for unbuilt land rises, the land price might rise and finally the house price as well. *This research has not considered any special circumstances such as fire sales or other pushed transactions*.

The assumption of the compatibility of a particular land value to a range of house values seems to be confirmed by the results. The width of range of house values justifies other than location attributes. As can be seen on the graphs, there is quite a high level of confidence that in average conditions, the value of a finished

house (including land) might achieve the highlighted range of values, no matter where in Poland the investment is, merely that the land value must be at particular level.

There is a question of time trends affecting the results. The only possible way of researching this topic is to collect much more data and add a third axis to analyse a 3D graph showing a plane rather than a line. On the other hand, there are general factors driving the trends on the market and analysis of the residential market shows that there are now significant discrepancies in terms of price trends between land plots and houses.

An interesting issue emerging from this research, concerns the share and importance of the costs of the building process and investors' profits in this market sector. This could be researched and the results combined with the results of this research could help provide an additional analysis of particular components and values in the residential sector in general.

According to this research, the value distribution in market, assessed directly on the basis of the values and indirectly on the basis of the market evidence, seems to be organized in some way that might be described. The most important conclusion emerging from this paper is that values in the residential sector of the market are related among themselves which means that there are hidden rules which rule the process of price modelling. The deep analysis of these rules may be very useful and become a basis of an approach to the process of valuation assessment. No matter which drivers at any stage of the market development will drive the prices of land, the same will refer to houses. This means that, as an additional factor of appraisal service quality, referencing of the valuation report's results to the timely and locationally independent band graph of values, might become a kind of need in terms market security. The over-valuing or under-valuing could be easily identified at once if there is are extra characteristics of the property.

The originality of this research is based on a quite new simple approach to value database and, in terms of its simplicity and usefulness, should be under further development in future. Even though it needs to be updated consequently and systematically, it constantly gives a result in the shape of the graph (differential area or range bars), which is understandable and easy to interpret. Such tools have a great value to the market as, with web site access, they could quickly become

commonly used by the participants in the market and raise the overall service quality and accuracy.

In conclusion, this research has sought not only to investigate, understand and describe the relationship between the land values and house values but out of it, to provide a basis for the development of a practical working tool to assist in and improve the accuracy and predictive qualities of valuations.

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