

**UNIVERSITY OF MISKOLC  
FACULTY OF ECONOMICS**

**DÁNIEL OROSZ**

THESIS STATEMENTS OF

**TERRITORIAL DIMENSIONS OF THE  
RESIDENTIAL REAL ESTATE MARKET OF THE  
XXI. CENTURY IN HUNGARY**

PH.D. DISSERTATION

**MISKOLC, 2023.**

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PH.D. DISSERTATION

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# 1. CHOICE AND JUSTIFICATION OF RESEARCH TOPIC

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In my dissertation, I deal with residential real estates, especially with regard to their territorial dimensions in the 21st century in Hungary. Residential real estate is the most important asset of many Hungarian households, and buying or selling a home is one of the most important financial decisions in our lives. It is influenced by the wealth accumulated by previous generations, income, location, size, condition and many other factors that can be measured more or less well.

Many European countries are struggling with the challenge of providing a safe environment, affordable and adequate housing for their population. Examining the countries of the EU-27, in 2018 46% of people lived in an apartment, a little more than a third (34.7%) in a family house, and almost a fifth of people lived in terraced or semi-detached houses. In the same period, Eurostat also prepared a report on housing conditions, in which it determined the amount of space available in the apartment as a primary consideration. The so-called crowding rate, the value of which is determined by the number of available rooms, the size of the household, and the age and situation of the people living in the household. Based on this, more than 17.1% of EU-27 citizens live in crowded housing (Eurostat 2020).

Based on my domestic and international literature research, I came to the conclusion that the real estate market is not usually examined as a whole but is divided into parts based on special characteristics and typically analyzed separately from each other. The real estate market includes land and the buildings on it, the purpose of which is to satisfy the needs of natural persons or businesses.

Real estate investing means buying real estate for profit. It is much easier to invest your wealth in real estate than in any other asset, since you do not have to have the entire purchase price, just a fraction of it is enough. Many economic and social indicators can affect the development of residential real estate market processes. However, among all the factors, the income level of the population, which determines how much money people are willing and able to pay for the selected apartment, is definitely one that deserves to be highlighted, thus what housing prices can develop in a specific area (country, region, settlement) in a given period, in an examined real estate market.

Several factors influenced my choice of topic. On the one hand, the research of the factors influencing the development of real estate prices is increasingly becoming the focus of attention, since buying a property is an important decision from a housing, economic, and even investment point of view. On the other hand, scientific analyses related to the territorial differences of the residential real estate market and related to the various economic and social factors affecting the prices of residential real estate are not available in large quantities in the literature.

## 2. RESEARCH BACKGROUND

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I started my PhD studies in 2017 as a staff member of the University of Miskolc, Institute of World and Regional Economics, Department of Regional Economics. In the first years of my research work, the "EFOP-3.6.2-16. No. project titled "Aspects of the development of an intelligent, sustainable and inclusive society: social, technological, innovation networks in employment and the digital economy". I examined the situation of "smart" cities primarily in Hungary and focusing specifically how contribution of the "smart homes" on "smart" cities performance.

An important role in the selection of the topic was also played by a National Scientific Students' Associations Conference special prize thesis, which I had previously written during my master's program, which I prepared under the guidance of my current supervisor. During the doctoral studies, I had the opportunity to expand the thesis, carry out deeper analyses, and learn about the more complex regional processes related to the Hungarian residential real estate market. I have also used my research results in education, from 2018 on the master's program in regional and environmental economics, within the subject "Regional programming and management", from 2019 on "Labour market mobility" and "Labour market", and from 2020 I participate in teaching of the "World Economies" subject.

A few years ago, I came across Géza Tóth's book „Availability and Application in Regional Investigations”, and based on what was described, I came to the conclusion that the path analysis model can also be used as an investigation method in the topic which I am investigating. I have used the results of my research work in developing the contents of several courses of mine (e.g.: GIS - analysis of residential real estate prices using map maker software).

### 3. RESEARCH PURPOSE

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The basic purpose of my dissertation is to summarize the trends and territorial differences of housing construction in Hungary, and to show, in the case of the selected types of residential properties, with the help of various statistical methods, what factors can affect the prices and the number of newly built residential properties.

My thesis focuses on three main areas:

- To present Hungary's residential real estate market situation,
- to examine territorial differences in relation to the built apartments,
- to determine the factors affecting residential real estate prices.

The latter, as well as territorial differences, would be research problems for me, since analyses related to the residential real estate market are less focused on examining the relationship between the price of real estate, the number of newly built real estate, and the relationship between economic and social factors, especially taking territorial dimensions into account, while the exploration of these relationships may arise as a significant demand, e.g. in the case of different settlements in our country.

In order to present the residential real estate market situation, in addition to data from the KSH and TEIR, I mainly used the help of domestic publications. I present the spatial differences of the built apartments using a shift-share analysis. In my thesis, I also examined the above-mentioned price influencing factors using linear regression and a road model. I will present which factors most influence the price of residential properties in the thirty largest cities of Hungary (except Budapest).

During my research, I am looking for answers to the following questions in advance:

- How the housing stock in Hungary developed in the 20th and 21st centuries?
- What kind of territorial differences can be identified with regard to the built apartments at the national, regional, county and district level?
- What kind of social and economic factors affect residential property prices and the number of residential properties built?
- What kind of territorial correlations can be experienced in terms of residential real estate prices and built residential real estate?
- What trends can be identified in the real estate market in the 21st century in Hungary?

In the first part of the dissertation, in addition to the economic theories affecting real estate, I present various real estate market concepts and the most frequently used domestic and international valuation methods, as well as some research related to the topic. In the second part, I discuss the situation of the Hungarian real estate market before and after the regime change, touching on the area of housing statistics and housing policy, as well as the short history of housing estate construction. In the third part, I present the methods used during the analysis, after which I intend to determine the evolution of territorial differences in the number of housing constructions with shift-share analysis, principal component analysis, territorial autocorrelation, and after that I examine with the help of regression models and the path analyses method, which factors had and still have an impact on residential real estate prices (Figure 1). I compare my current results with the results of my previous research in order to find out whether my previous research results still hold their place today.

### 3. RESEARCH PURPOSE

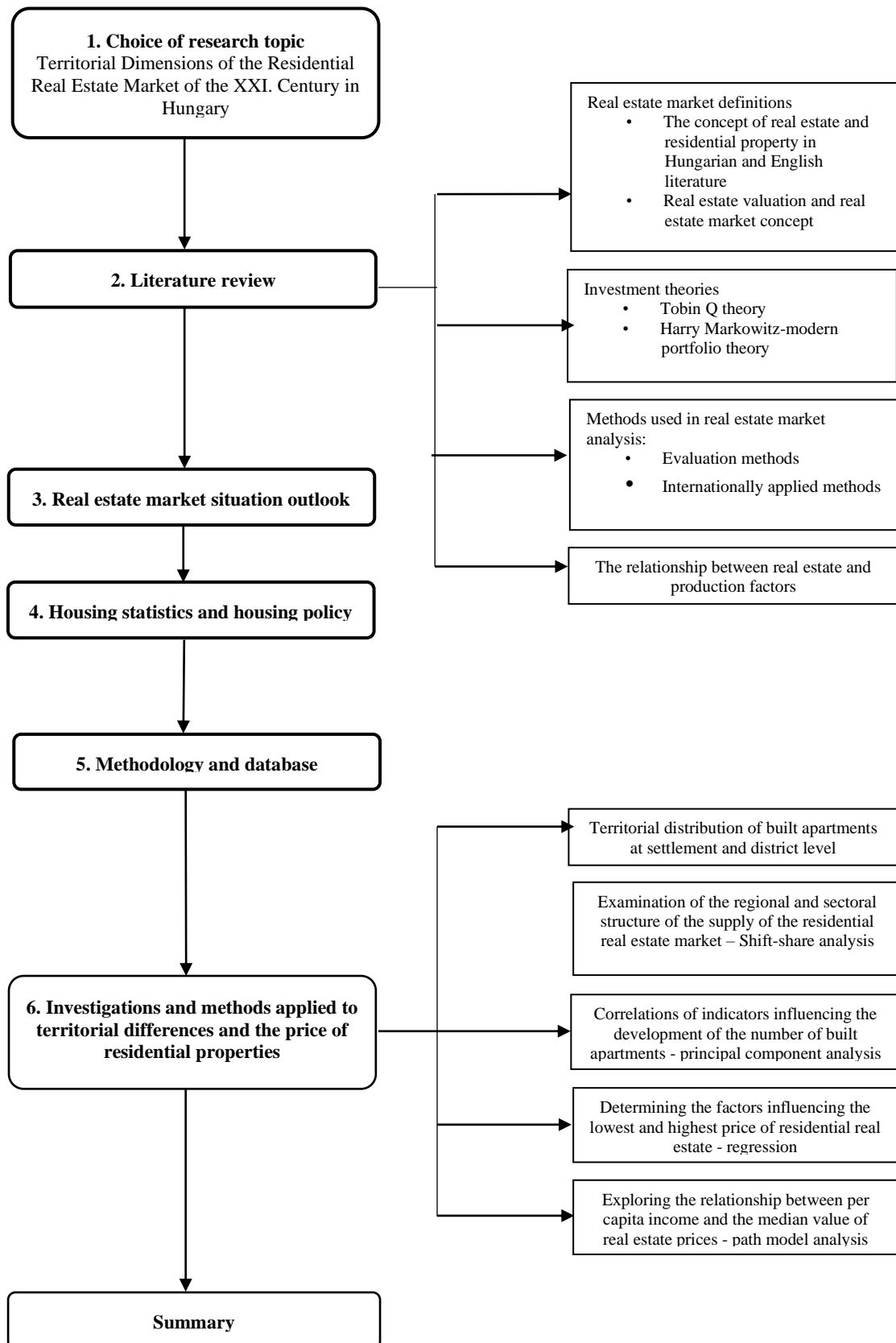


Figure 1: Structure of my dissertation  
Source: own compilation

## 4. New and quasi-new statements of the research

I formulated five hypotheses in my dissertation. I present the new and quasi new statements of my research in the following chapter.

(H1) The dynamics of residential real estate construction in Hungary is primarily evaluated on the basis of time-series data compared to the data of previous years. However, the statements, which often seem extremely optimistic, can be significantly nuanced if the performance of our country's newly built residential properties is also examined in an international context. According to my assumption, the number of newly completed apartments, especially considering that if we compare it to the existing building stock, it can be considered low compared to the majority of European (EU) countries. I also assumed that in the decades following the regime change, the construction industry achievements affecting the housing stock were more significantly aimed at renewing the existing housing stock.

Uses the concept of the renewal rate of the entire housing stock, e.g. the MNB's 2019 housing market report (the ideal value of 1% means that approximately 44,000 apartments should be built in Hungary every year, despite the fact that more than half a million apartments are currently empty), which is difficult to interpret over a longer period of time, since it starts from the housing stock of a given year and assumes that only those properties with which this has not happened before are renewed year after year. The share of newly built apartments in the percentage of built apartments was 0.63%. Partly due to this very slow pace of renewal, 8.2% of the housing stock is not of acceptable quality according to the housing market report of the Hungarian National Bank. The renewal of the domestic housing stock is also low in regional comparisons. The lag is especially large in Budapest, where the annual renewal is 0.4 percent compared to 1.5 percent in Vienna (MNB 2019).

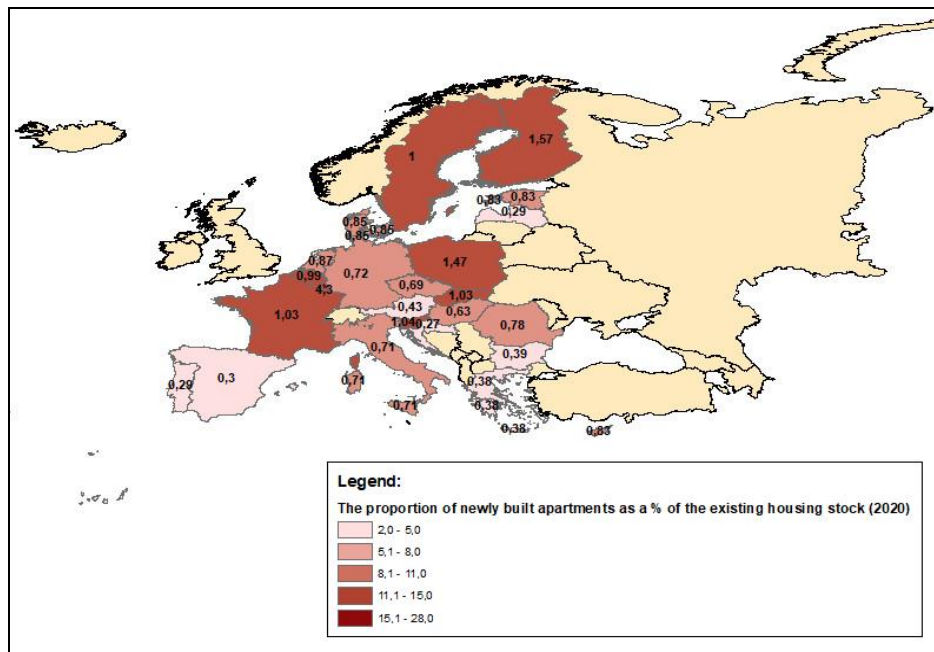


Figure 2: Share of newly built apartments in % of the existing housing stock in 2020 in the EU  
Source: My own *compilation* based on data from the OECD, DELOITTE, and the statistical offices of the countries

The word "renewal", which is interpreted only for newly built apartments, can be misunderstood in this form, so in order to avoid it, in the next part of my dissertation, I use the



## 4. New and quasi-new statements of the research

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indicator "the proportion of newly built apartments in % of the existing housing stock". Figure 2 shows the proportion of newly built apartments as a percentage of the existing housing stock for the year 2020. The north-south division of Europe, which also exists in many other cases, is clearly visible. These values remained very low in most Southern European countries. The worst performing countries were Portugal and Latvia in 2020, and Finland performed the best in terms of this indicator. Poland was highlighted among the Central and Eastern European countries.

Examining the 2020 data for Hungary, it can be said that it ranked 17th out of the 24 countries examined, in terms of the proportion of newly built apartments, in relation to the existing housing stock (2020 data was not available for Ireland, Malta and Lithuania). In the European Union, in addition to the already mentioned Finland and Poland, Slovenia, Slovakia, France and Sweden are the ones that were able to meet the above-mentioned ideal value of 1% (Figure 2).

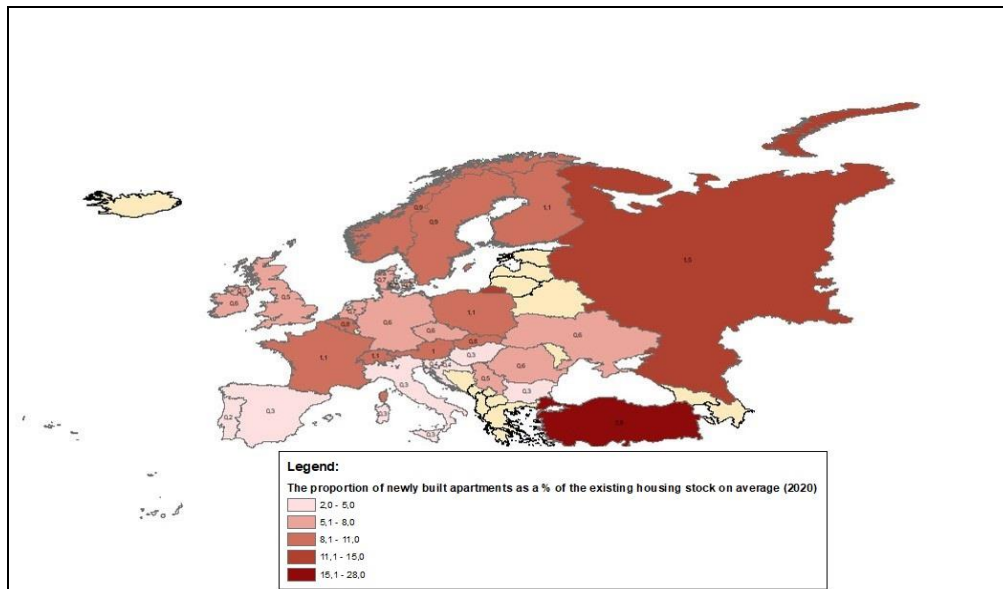


Figure 3: The proportion of newly built apartments as a % of the existing housing stock on average for the period 2011-2020

Source: Own compilation based on Parragi B. 2021

Parragi B. (2021) also examined the indicator in a 10-year context. Figure 3 shows - based on the averaged values - which European countries were able to reach 1% per year in the period from 2011 to 2020. Turkey and Russia performed well above the average (2.8%, 1.5%). On the other hand, only 0.3% of the apartments in Hungary were renewed on average each year in this ten-year period. Regarding this indicator, our country can be classified in the group of southern European countries.

I examined the changes in average net incomes and housing prices in the last ten and five years based on the Eurostat database. Between 2010 and 2020 among the EU countries housing prices rose the second highest degree in Hungary (after Estonia). Based on Figure 4, it can be concluded that in most countries, net incomes rose more than house prices. In the first half of the period from 2010 to 2020, which was still burdened by a milder crisis, in most countries, incomes increased significantly more than housing prices, thanks to which the population was able to acquire residential property more easily.

## 4. New and quasi-new statements of the research

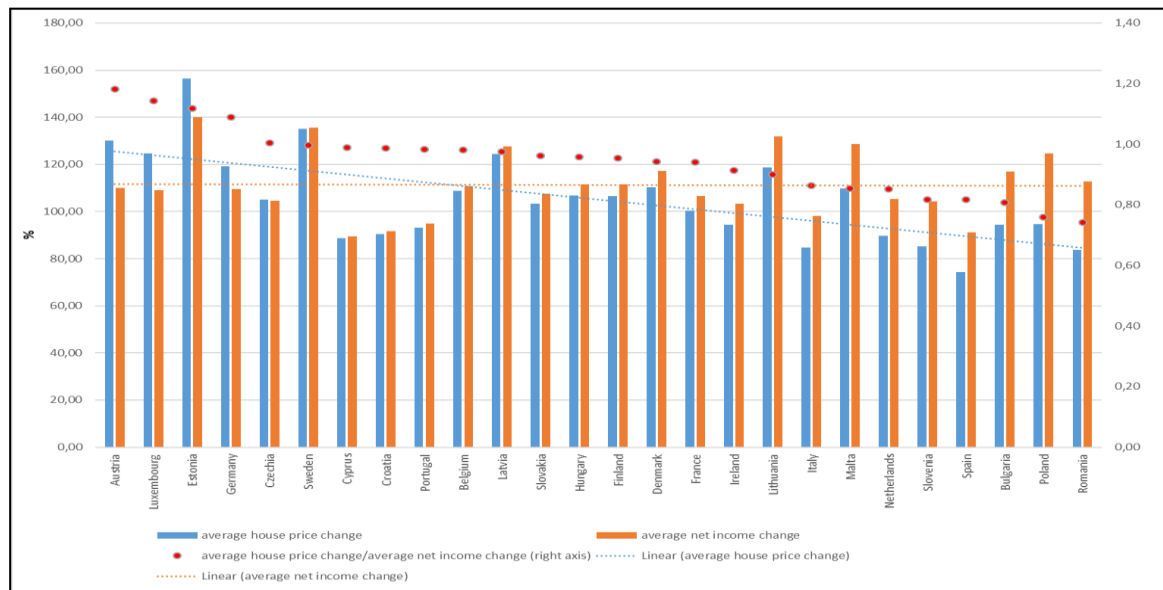


Figure 4: Changes in average net incomes and house prices in European Union countries between 2010 and 2015 (2010=100%)  
Source: own compilation based on Eurostat data

In the period from 2015 to 2020, however, in many European Union countries, real estate prices increased more than incomes. Except for Luxembourg, house prices have increased the most compared to incomes in Hungary, which the majority of Hungarian experts' attribute to the family/housing policy introduced by the Hungarian government (Figure 5).

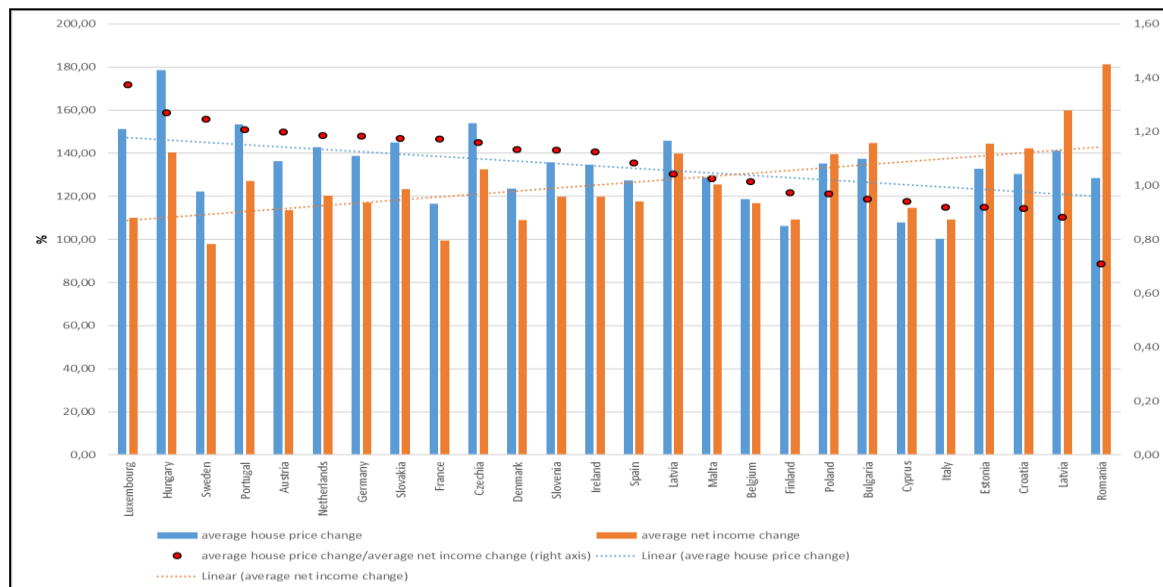


Figure 5: Changes in average net incomes and house prices in European Union countries between 2015 and 2020 (2015=100%)  
Source: own compilation based on Eurostat data

## 4. New and quasi-new statements of the research

**(T1): Compared to the existing building stock, the number of newly built apartments in Hungary lags behind the majority of European Union and other European countries. The maturity of the indicator in the period 2011-2020 was 0.3% on average, despite the fact that from 2012, families in particular were able to receive significant subsidies for the construction of real estate. In this period, only Portugal - in the European Union - had a lower value. Within the European Union, significant differences can be observed between northern and southern European countries. Regarding the indicator, our country can be classified in the group of southern European countries. In the first half of the period from 2010 to 2020, which was still burdened by a milder crisis, incomes in most countries increased significantly more than housing prices, thanks to which the population was able to acquire residential property more easily, while in the second half of the recovery period, there were several countries where customers needed more and more savings.**

(H2) According to my assumption, the available statistical methods are suitable for the quantifiable detection of direct and indirect effects of real estate processes, using indicators for characterizing changes in economic phenomena.

The real estate market is strongly linked to the credit market. Regardless of the type of investor we are talking about (e.g.: institutional, large investor, private individual), transactions are very rarely self-financed. The impact of the economic crisis was felt in the Hungarian residential real estate market until 2015. At that time, the real estate market boom began again in our country, which was partly due to those buyers who were buy their first apartment, as well as those who moved to a larger apartment or bought an apartment due to moving apart. In addition, the appearance of various forms of family support is also a driving force in keeping the real estate market at a level as this started housing construction and encouraged large investors to start their investments (Figure 6) (ingatlanok.hu).

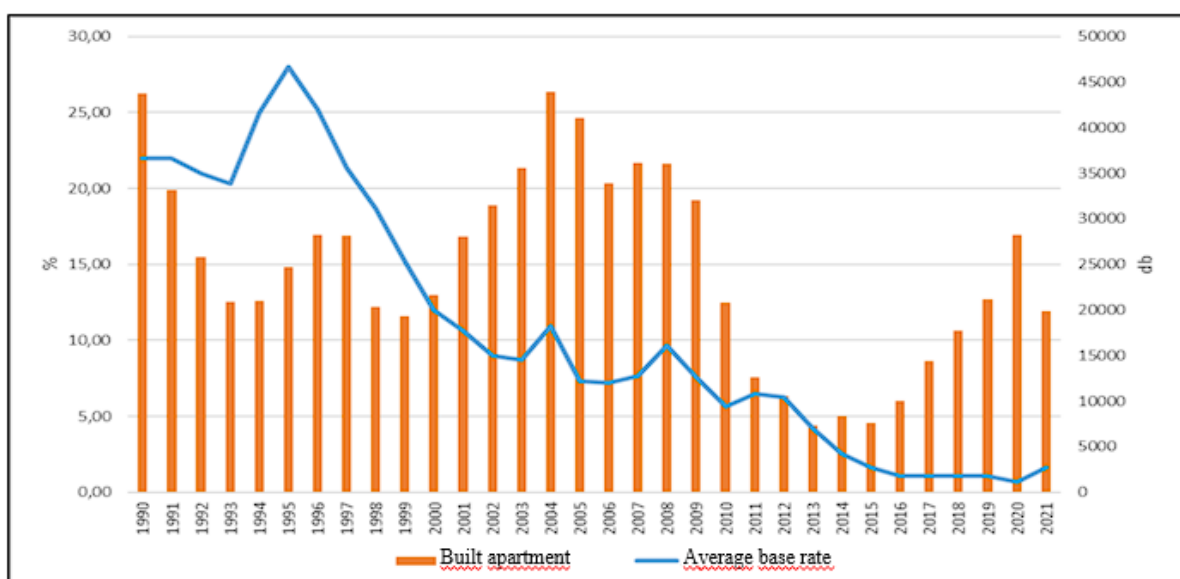


Figure 6: Number of built apartments (right-hand axis) and the average central bank base interest rate (left-hand axis) (1990-2021)

Source: Own compilation based on MNB and TEIR data

## 4. New and quasi-new statements of the research

Based on the visual analysis of Figure 6, it can be concluded that due to the tendentious interest rate decline that can be traced essentially throughout the examined three decades, no significant relationship measurable with a close correlation coefficient can be expected between the number of newly built apartments and the level of the base interest rate. However, even relatively small increases in interest rates are clearly followed by a decline in the number of apartments built.

Table 1: Correlation between the average basic interest rate and the number of built apartments (=1990)

	Average base interest rate/Number of built apartments											
Amount of delay	0y	1y	2y	3y	4y	5y	6y	7y	8y	9y	10y	11y
<b>Coefficient of correlation</b>	0,348	0,272	0,195	0,169	0,210	0,307	0,414	0,511	0,618	0,732	0,799	<b>0,807</b>
<b>Level of significance</b>	0,051	0,139	0,302	0,381	0,285	0,119	0,036	0,009	0,001	0,000	0,000	<b>0,000</b>

Source: Own compilation based on MNB and TEIR data

I calculated the correlation values for the 1990-2020 average base interest rate and the number of built apartments. I examined how many years later the average base interest rate change shows the strongest relationship with the number of built apartments. I concluded that the relationship between the number of built apartments and the average basic interest rate cannot be traced within the investigated thirty-year period (Table 1).

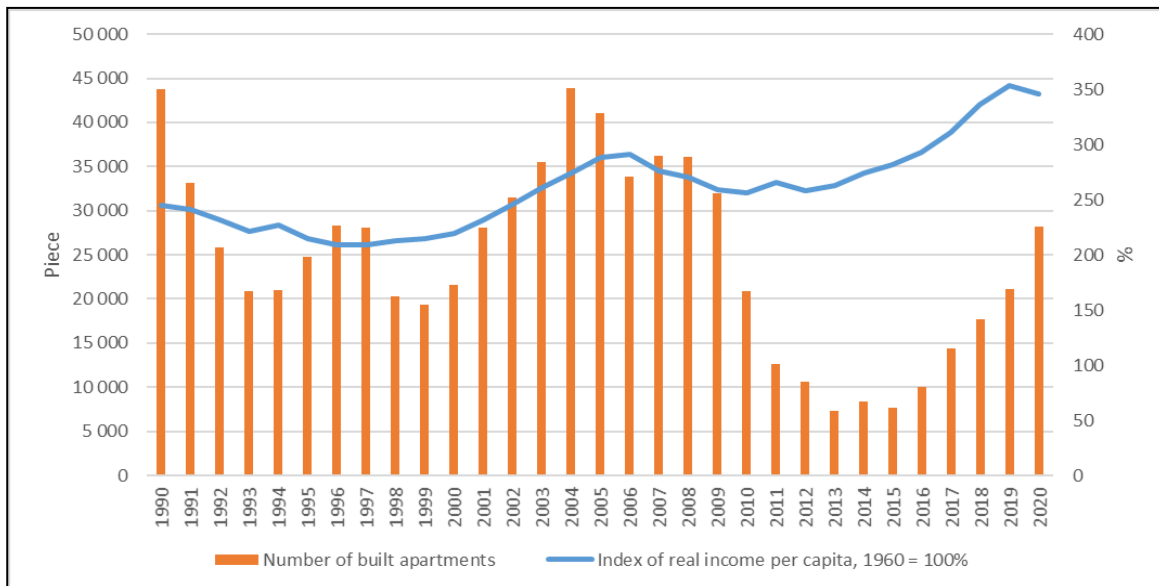


Figure 7: The number of built apartments and the development of real income per capita (1990-2020)

Source: Own compilation based on HCSO data

Based on the analysis of Figure 7, it can be concluded that changes in real incomes are clearly followed by an increase in the number of housing constructions with a delay, the characteristics of the relationship between the two indicators are shaded by the correlation coefficient in the same year.

## 4. New and quasi-new statements of the research

Table 2: Correlation between income and the number of built apartments (=1990)

Amount of delay	Real income index/Number of built apartments							
	0y	1y	2y	3y	4y	5y	6y	7y
Coefficient of correlation	-0,089	-0,026	-0,040	<b>0,417</b>	0,231	0,055	-0,147	-0,359
Level of significance	0,632	0,893	0,839	<b>0,027</b>	0,246	0,791	0,483	0,085

Source: Own compilation based on TEIR data

Based on Table 2 and the figure above, it can be observed that changes in real incomes and the number of newly built apartments do not move together. In this case, the strongest relationship (0.417) can be observed at a 3-year delay.

The crisis did not affect the price of new and used homes equally. The cyclical operation of the residential real estate market in Hungary is adjusted to macroeconomic cycles. From 2008 to 2011, the economic recession resulted in a drop of about 9% in the average price of newly built apartments on the market (Figure 8), even though the national economic output showed a slight increase from 2009 (Harnos 2017). This was due to the uncertain environment created by the crisis, with falling wages and job losses, since in such an environment families will restrain their spending and will not invest in residential real estate (diPasquale & Wheaton 1992).

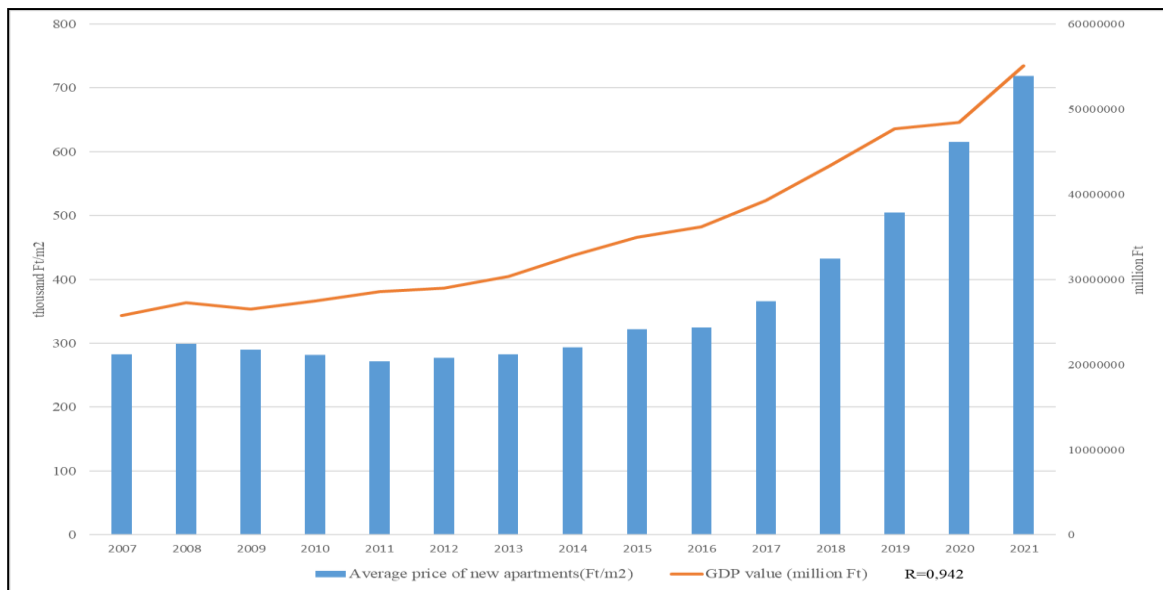


Figure 8: Development of GDP and the price of new apartments in Hungary

Source: Own compilation based on HCSO data

In the change in the specific price of used apartments, there was a roughly one-year lead immediately before the 2008 recession, while a 1-1.5-year delay was experienced towards the end of the crisis (Figure 9). This can be explained by the fact that, from 2011, the demand for new apartments resulted in an increased supply of used apartments, since some of those who buy new apartments are replacing their existing apartments. In the case of used apartments, due to falling house prices (prices fell twice as much compared to the market for newly built apartments), the sellers waited and because of this, the supply was greatly reduced (Harnos

## 4. New and quasi-new statements of the research

2017). The Hungarian residential real estate market could feel the impact of the economic crisis until 2015. The boom in the real estate market only started after that. This boom was due to those buyers who were buy their first apartment, as well as those who wanted a bigger apartment or bought an apartment because they were moving apart. In addition, many forms of family supports have exerted a great pull on the residential real estate market (Harnos 2017).

In the first half of 2019, domestic housing prices continued to rise. In the second quarter, the annual growth rate of housing prices was nominally 17.1 percent on national average, which is higher than the 16.3 percent at the end of 2018. However, price dynamics moderated in Budapest, from 24.8 percent at the end of 2018 to 22.5 percent. Based on preliminary data from the third quarter of 2019, the pace of housing price growth continued to slow down in Budapest and moderated on a national average (MNB 2019).

A new situation has arisen in the residential real estate market due to the accelerating deterioration of money and the result of falling home loan interest rates in recent years. Today, among home loans with a fixed interest rate until the end of the term, there are also some that can be taken out with a negative real interest rate. This means that in many cases the debtor must pay back less interest on her home loan on an annual basis than the amount she borrowed loses its value during this time (MNB 2019).

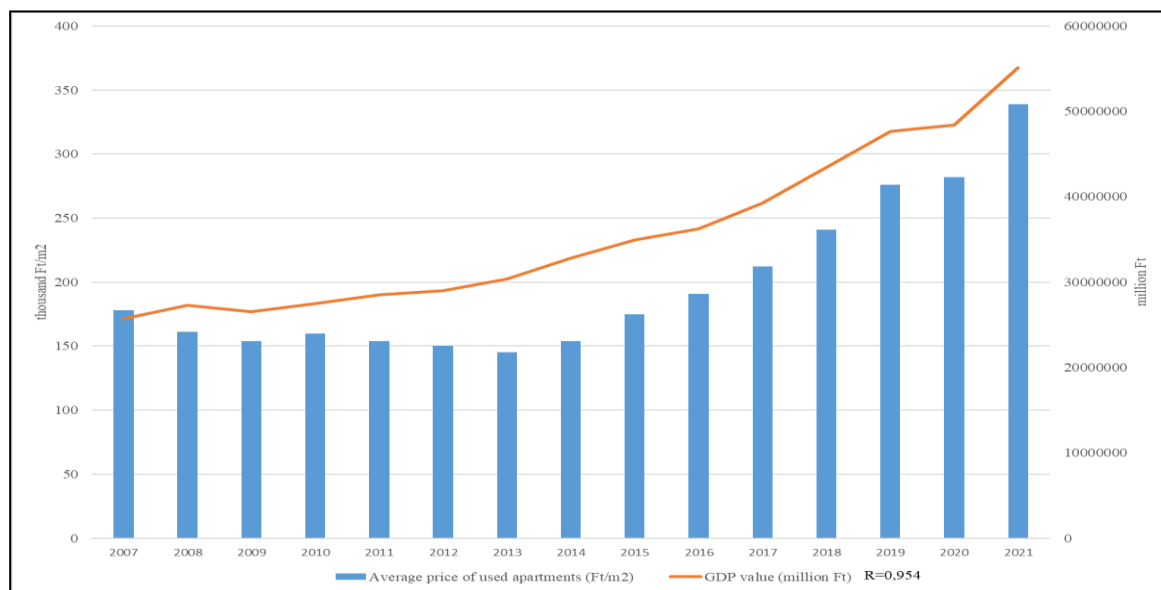


Figure 9: Development of the GDP and the price of used apartments in Hungary

Source: Own compilation based on HCSO 2019 data

In 2008, 36,000 apartments were built nationwide, in 2010, just under 21,000, and in 2015, a total of 7,600. By 2019, the situation had greatly improved, and more than 21,000 apartments were built again. In Hungary, buildings with 1–3 apartments dominate: family houses make up almost two-thirds of the housing stock. The proportion of panel buildings is significant primarily in the capital (35%), county seats (43%) and industrial centers built in the 1960s and 1970s. A significant part of the housing stock in Tatabánya, Székesfehérvár, Miskolc, Dunaújváros, Százhalombatta, Tiszaújváros, Kazincbarcika, 60-70%, is in panel buildings (KSH, 2016).

## 4. New and quasi-new statements of the research

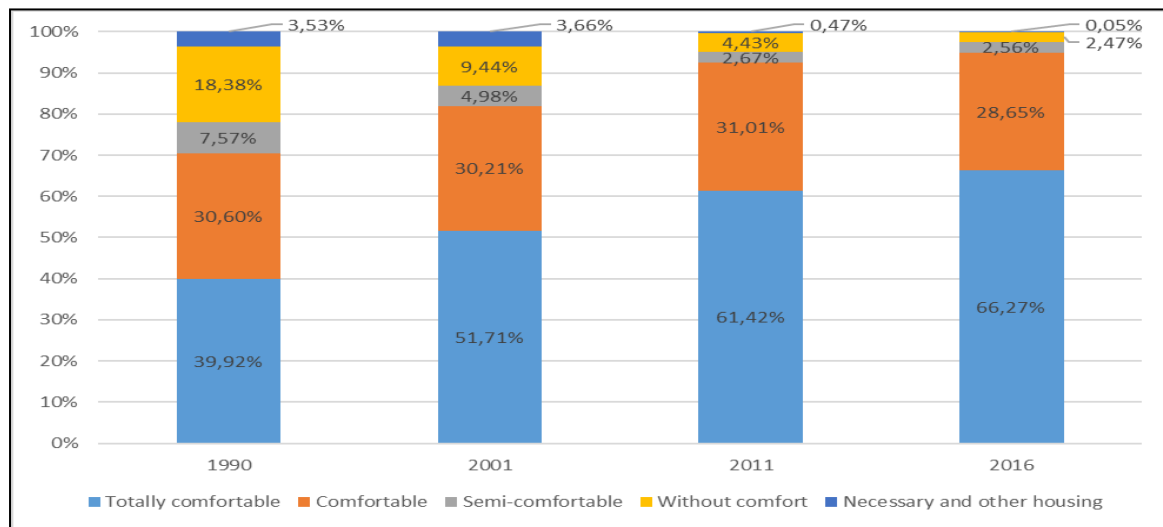


Figure 10: Distribution of the inhabited housing stock by level of comfort (1990-2016)

Source: Own compilation based on HCSO data

"The quality of the housing stock is improving, and the proportion of non-acceptable quality (substandard) housing is also decreasing, in 2015 this accounted for 8.2% of the housing stock. At the same time, there are connected settlement groups in the country where the quality of the apartments is permanently poor and there is no meaningful new housing construction" (KSH, 2016).

The equipment and comfort of the apartments significantly affects the quality of life of the population. Thanks to increasingly modern architectural technologies and the modernization of older apartments, the equipment and comfort of the housing stock is constantly increasing. Even in 1990, the proportion of flats with all comforts did not even reach 40%, by 2016, 95% of flats were all-comfortable or comfortable, so belong to the two highest categories (Figure 10) (Mikrocenzus, 2016).

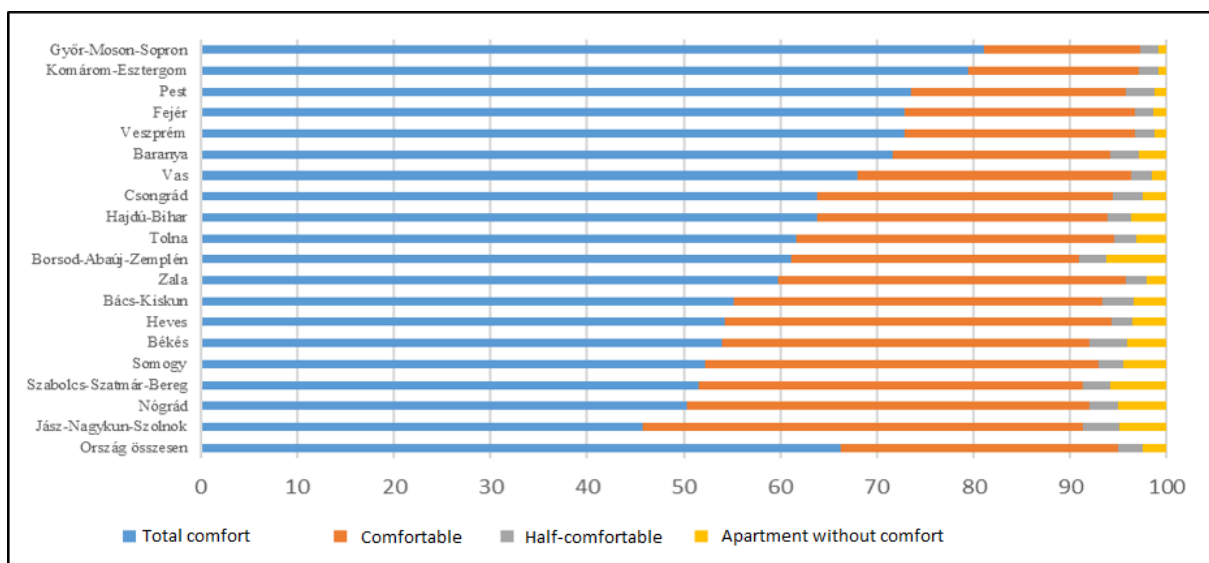


Figure 11: Distribution of inhabited apartments according to comfort in the counties of our country (2016)

Source: Own compilation based on HCSO data

## 4. New and quasi-new statements of the research

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If we look at the county level, 80% of the inhabited apartments in Győr-Moson-Sopron and Komárom-Esztergom counties had overall comfort, but it also exceeded 70% in Pest, Fejér, Veszprém and Baranya counties (Figure 11). This value just exceeded it in Nógrád and Szabolcs-Szatmár-Bereg counties, however in Jász-Nagykun-Szolnok county it did not even reach 50%. The level of comfort of the apartments can be closely linked to the supply of wired infrastructure. In the areas where these existing infrastructure networks are expanded, it can be said that the quality of the apartments improves, as this can increase, for example, tourism and accommodation providers try to modernize old apartments, and new apartments can be built to a higher quality. In the counties that have just reached 50% or not, we can explain that the comfort level of the apartments is not adequate, that many apartments in these counties are inhabited by elderly people and therefore they do not take advantage of the opportunity to modernize, they want to continue their everyday life in their usual environment. (Microcensus 2016)

**(T2) On the basis of the long time-series studies, it became clear that thanks to the tendentious interest rate declines that can be traced essentially throughout the three decades since the regime change, there is/cannot be a significant relationship between the number of newly built apartments and the level of the base interest rate, which can be measured with a close correlation coefficient. However, even relatively small interest rate increases are followed by a visually identifiable drop in the number of newly built apartments.**

**The number of built apartments is only weakly to moderately strongly related to changes in real incomes (3-year lag) and the number of births. The average price per square meter of apartments essentially follows changes in nominal GDP one-to-one. In recent decades, the quality of the housing stock in our country has improved a lot, which, however, still shows significant regional differences.**

(H3) According to my assumption, the majority of the built apartments in our country are concentrated in a well-defined narrow circle of settlements/districts. With the help of the examination of the newly built apartments of the settlements and districts, district/settlement groups with different characteristics can be well defined, or the results of the housing construction subsidies of the past years can also be demonstrated at the regional level. In terms of economic and social indicators, between the regions and settlements located at the forefront and at the end of the ranking, extremes can be observed that go beyond the level of specific economic and income inequalities in terms of the number of built residential properties.

In the following, I will provide a national outlook, in the framework of which we will get a more comprehensive picture of the country's residential properties. Table 3 illustrates the development of the number of built apartments between 2000 and 2020. Examining the mentioned 20 years, a total of 498,480 apartments were built, of which almost half (56.04%) were built by natural persons. Until the economic crisis, relatively many apartments were built in Hungary, and then in the years following the crisis, the real estate market underperformed, and from 2017, slow growth can be observed again. The start of growth can be explained, among other things, by the home creating programs that were introduced around this time.



## 4. New and quasi-new statements of the research

Homes built by businesses make up 41.07% of all constructions, 1.26% by municipalities, and the remaining 1.62% by other organizations in the 20 years under review.

Table 3: Number of built apartments by builder, 2000-2020

Year	Total number of apartments built (pieces)	Number and proportion of dwellings built by natural persons		Number and proportion of apartments built by companies		Number and proportion of apartments built by municipalities		Other	
		N	%	N	%	N	%	N	%
2000	21 583	17 989	83,3	3 132	14,5	193	0,9	269	1,3
2001	28 054	20 833	74,3	6 255	22,3	183	0,7	783	2,8
2002	31 511	19 932	63,3	9 385	29,8	1 258	4,0	936	2,9
2003	35 543	21 866	61,5	11 102	31,2	1 394	3,9	1181	3,4
2004	43 913	25 161	57,3	16 534	37,7	577	1,3	5641	3,7
2005	41 084	20 694	50,4	18 353	44,7	724	1,8	1313	3,1
2006	33 864	18 591	54,9	14 674	43,3	295	0,9	304	0,9
2007	36 159	18 707	51,7	16 687	46,1	278	0,8	487	1,4
2008	36 075	18 895	52,4	17 014	47,2	122	0,3	44	0,1
2009	31 994	15 320	47,9	16 424	51,3	176	0,6	74	0,2
2010	20 823	10 300	49,5	10 388	49,9	52	0,2	83	0,4
2011	12 655	8 007	63,3	4 392	34,7	134	1,1	122	0,9
2012	10 560	7 177	68,0	3 218	30,5	60	0,6	105	0,9
2013	7 293	4 167	57,1	2 924	40,1	55	0,8	147	2
2014	8 358	4 911	58,8	3 236	38,7	180	2,2	31	0,3
2015	7 612	4 476	58,8	2 999	39,4	115	1,5	22	0,3
2016	9 994	4 852	48,5	4 958	49,6	149	1,5	35	0,4
2017	14 389	7 309	50,8	7 023	48,8	23	0,2	34	0,2
2018	17 681	8 203	46,4	9 312	52,7	41	0,2	125	0,7
2019	21 127	8 694	41,2	11 998	56,8	120	0,6	315	1,4
2020	28 208	13 280	47,1	14 717	52,2	167	0,6	44	0,1

Source: Own compilation based on HCSO data

In my dissertation, I consistently conducted the settlement-by-district investigations based on the database of the National Spatial Development and Spatial Planning Information System, which contained 3155 settlements.

## 4. New and quasi-new statements of the research

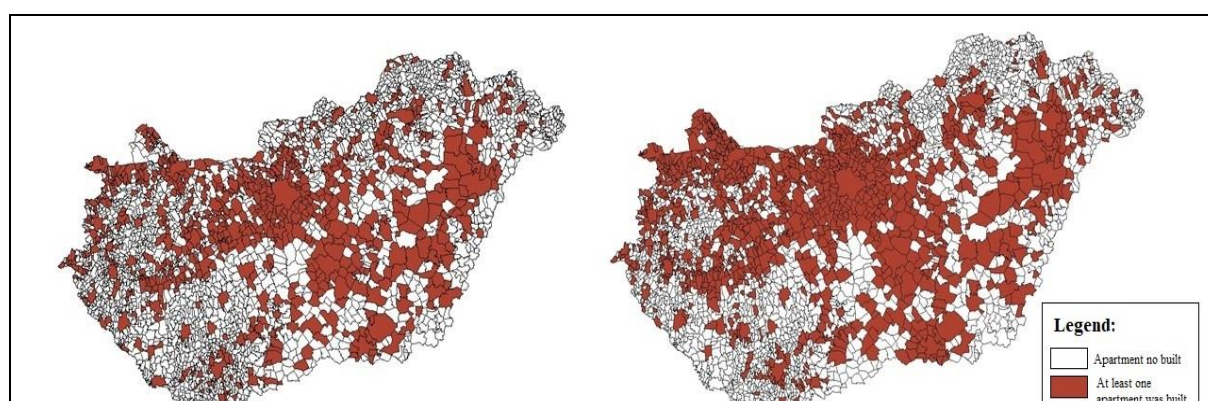


Figure 12: Settlements not involved in housing construction in 2013 (left side) and 2020 (right side)

Source: Own compilation

When exploring territorial differences in the residential real estate market of settlements, a methodological problem is caused by the change in the number of settlements. I illustrated the distribution of the built apartments on a logarithmic scale, as Budapest is an outlier, and the low values of the smaller settlements greatly distort the evaluation of the settlement series data.

Figure 12 clearly illustrates the settlements where at least one apartment was built and where none. Housing construction typically continues to lag in areas that are not favourable for investment. This is mainly typical of the small village areas of the Northern Hungary and the Southern Transdanubian regions, since the price of newly built apartments, when sold, differs significantly from the cost of acquisition. Typically, new housing developments appeared around those settlements where they had already been built before. This raises the need to analyse neighbourhood conditions.

Table 4: Our country's settlements by built apartments (2013,2020)

Number of built apartments (piece)	2013				2020			
	Number of settlements (piece)	Distribution of settlements (%)	Number of apartments built in a given category (piece)	Distribution of built apartments (%)	Number of settlements (piece)	Distribution of settlements (%)	Number of apartments built in each category (piece)	Distribution of built apartments (%)
0	2371	75,17	0	0	2038	64,60	0	0
1	375	11,89	375	5,14	351	11,13	351	1,24
2-9	317	10,05	1112	15,25	487	15,44	1847	6,55
10-49	72	2,28	1518	20,81	191	6,05	4438	15,73
50-99	9	0,29	625	8,57	49	1,55	3538	12,54
100-999	9	0,29	1893	25,96	35	1,11	7901	28,01
1000-	1	0,03	1770	24,27	4	0,13	10133	35,92
Sum	3154	100	7293	100	3155	100	28208	100

Source: Own compilation based on HCSO data

Compared to 2013, the number of built apartments increased significantly. As recently as 2013, investments were made in barely a quarter of the settlements, but by 2020, it was approximately 35.5% (Table 4).

## 4. New and quasi-new statements of the research

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The distribution of the number of built apartments differed significantly in 2020 compared to 2013. The number of districts where not a single residential property was built decreased significantly, and a large number of districts moved into a higher category in terms of the number of residential properties built.

Table 5: Districts of our country by built apartments (2013,2020)

Number of built apartments	2013		2020	
	Number of districts (N)	Distribution of districts (%)	Number of districts (N)	Distribution of districts (%)
0	13	7,43	11	6,29
1	15	8,57	6	3,43
2-9	62	35,43	53	30,29
10-49	58	33,14	35	20,00
50-99	12	6,86	28	16,00
100-999	14	8,00	35	20,00
1000-	1	0,57	7	4,00
Sum	175	100,00	175	100,00

Source: Own compilation based on HCSO data

In 2013, not a single apartment was built in 7.43% of the districts, by 2020 this value had decreased to 6.29%. A significant increase was observed in the number of districts where fifty or more apartments were built. In the category from 50 to 99, it more than doubled, in the category from 100 to 999, and in terms of apartment constructions with a number of over 1,000, this number increased from one district to seven. (Table 5).

Only 7,293 apartments were built in Hungary in 2013, and 28,208 in 2020, which corresponds to an increase of 286.78%. In 2013, 5.5% of the apartments built were one-room, 22.2% two-room, 28.38% three-room, and 43.9% four or more rooms. Examining the year 2020, it can be said that the number of rooms in the built apartments shifted towards properties with four or more rooms (one-room: 5.6%, two-room: 19.7%, three-room: 26.8%, four or more rooms: 47.9%), and a four-fold increase in the volume of built apartments was achieved. The growth process can be considered positive, although even so it does not reach the amount of apartments built in 2009 (31,994 units), not to mention the amount required to renew the housing stock at 1% per year, which is considered ideal (approx. 45,000 units).

## 4. New and quasi-new statements of the research

Table 6: Shift-share analysis according to the number of built apartments in the regions of our country (2020/2013)

Region	<i>one-room apartments</i>	<i>two-room apartments</i>	<i>three-room apartments</i>	<i>apartments with four or more rooms</i>	<b>Sr territorial</b>	<b>Sa sectoral</b>	<b>Si total</b>
Dél-Alföld	-136,7	-203,6	-30,9	43,0	-328,2	-19,4	-347,6
Dél-Dunántúl	-14,7	204,9	69,7	37,1	297,0	-21,0	276,0
Észak-Alföld	-34,5	205,1	223,2	68,2	461,9	15,6	477,5
Észak-Magyarország	-47,1	-194,0	-366,5	-279,3	-887,0	-9,8	-896,8
Közép-Dunántúl	0,5	39,8	-31,7	-15,7	-7,1	45,8	38,7
Közép-Magyarország	114,1	-402,6	51,7	337,8	100,9	-46,0	54,9
Nyugat-Dunántúl	118,4	350,4	84,6	-191,0	362,5	34,8	397,3

Source: Own compilation based on TEIR data

In the sixth chapter of my dissertation, I examined the regional and sectoral structure of the supply of the residential real estate market with the help of shift-share analysis based on the number of built apartments, at the county and regional level. This method was invented for the separate grouping of territorial and sectoral indicators of economic growth; it has so far been used only in a few cases in the domestic literature to learn about territorial processes of the real estate market. The shift-share analysis is based on double standardization, the calculations require "territorial" and "sectoral" data, where the "sector" dimension mainly refers to economic sectors and settlement size groups, in this thesis this is the distribution of built apartments by number of rooms as the "territorial dimension" and by counties, regions and other territorial divisions (Nemes Nagy. J. – Jakobi Á. – Németh N. 2001 p. 886).

The calculations show that the growth dynamics of the real estate market supply in the Southern Great Plain and Northern Hungary regions lags behind the national value (Southern Great Plain: -347.6, Northern Hungary: -896.8 built apartments assuming the national growth level). This has both components derived from the regional features (DA: -328.2, ÉM: -887.0 built apartments) and the structure of the sector (DA: -19.4, ÉM: -9.8). Based on my research, it can be seen (Table 6) that the deviation from the national average is in most cases explained by local reasons, while the sectoral structure is only more important in Central Transdanubia than independent local reasons.

Almost half of the positive values of "sectoral" effects occur in the Central Transdanubian region. The Western Transdanubian and Northern Great Plain regions account for the other 50% of the positive values. The negative values are spatially more concentrated in the Central Hungary region, and the dispersion is even greater when looking at the other regions. In terms of regions, the number of built apartments in the regions of Northern Hungary and the Southern Great Plains is below the average. The county analysis shows a slightly more nuanced picture. Above-average results can be seen in Győr-Moson-Sopron, Vas, Zala, Veszprém, Bács-Kiskun, Hajdú-Bihar and Pest counties. So, it can be said that the increase in the number of built apartments can be felt in the areas that make up the economically developed areas of our country (Figure 13).

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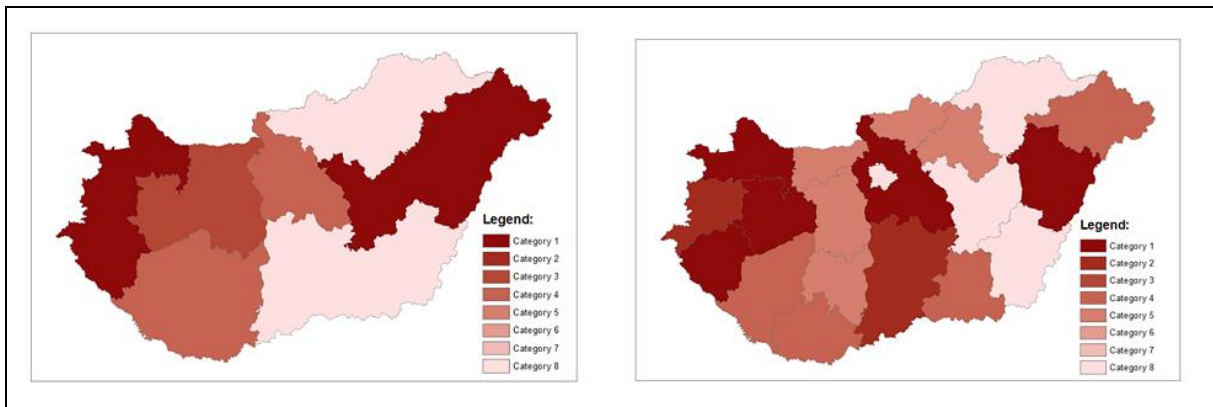


Figure 13: Based on shift-share analysis, the regions and counties of our country according to the number of built apartments.

Source: Own compilation based on TEIR data

I examined the changes in the concentration of built apartments in order to illustrate the evolution of the relationship between income and built residential properties. In order to evaluate the concentration of built apartments for the period 2013-2020, I calculated the Hirschman-Herfindahl concentration index for the apartment constructions in the districts, compared with the data series of the districts' total income. The total income of the districts and the built apartments can be determined based on the examination of the time series data of the Hirschman-Herfindahl concentration index. At the regional level, the number of built residential properties is more concentrated compared to the total income (Figure 14).

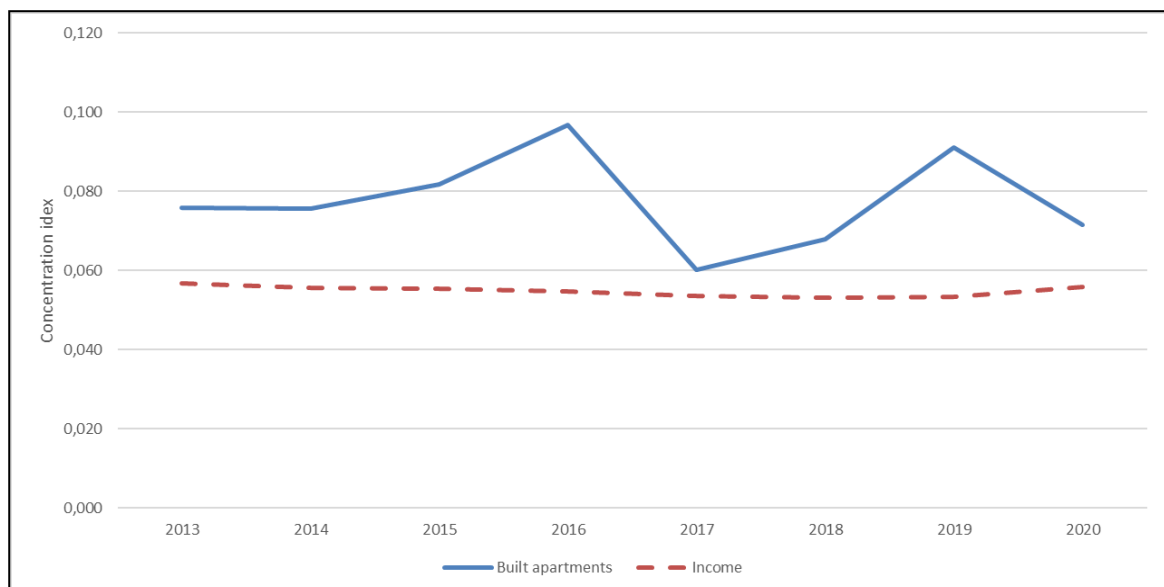


Figure 14: Changes in the values of the Hirschman-Herfindahl concentration index in terms of the built apartments and income in the districts of Hungary

Source: Own compilation based on TEIR data

I performed the regional autocorrelation calculations for the Local Moran indicator for the districts of Hungary. I made the Local Moran I calculations using GeoDa software. The

## 4. New and quasi-new statements of the research

interpretation of the results developed during the investigation is significantly influenced by the choice of the neighbourhood matrix, so I also used three different neighbourhood matrices. I used the nearest neighbour method during the further investigations. (Figure 15). To eliminate random errors, I performed the analysis with a high number of permutations (999). The value of the probability variable  $p$  is low, but the standard deviation ( $z$  score) of the values is high, which proves that autocorrelation exists. The Moran Scatter plot created during the analysis classifies the territorial units into four main types of territorial autocorrelation. The upper right (High-high cluster) and lower left (Low-low cluster) corners of the figure correspond to positive regional autocorrelation, negative autocorrelation values are also shown in the lower right (High-low cluster) and upper left (Low-high cluster) illustrates. Of the 197 territorial units included in the 2010 study, no significant autocorrelation can be detected in 170, the remaining 27 territorial units can be classified into four categories. Examining the data from 2010, 5 territorial units can be classified into the category in which the analyzed neighbourhoods and their neighbours had values of built apartments per ten thousand people that were significantly above the average.

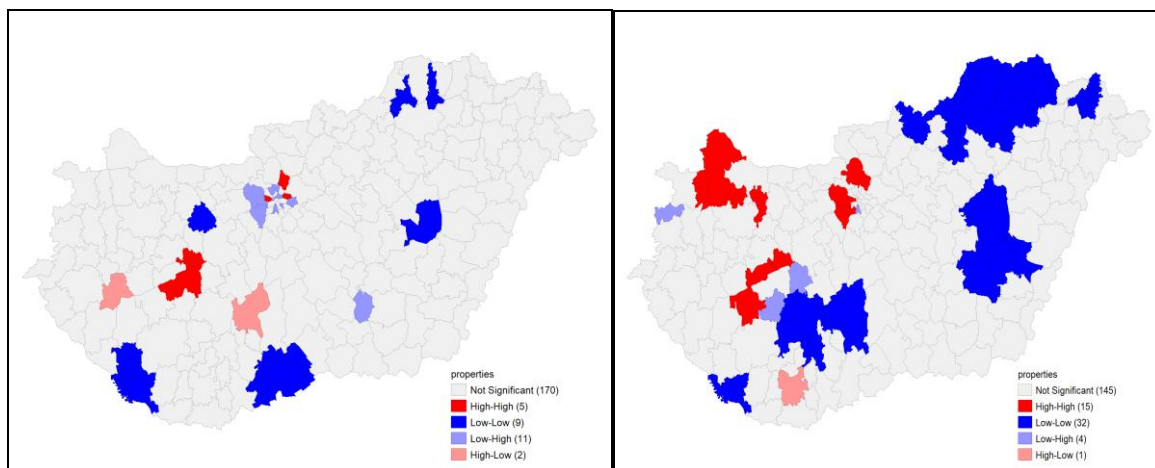


Figure 15: Neighbourhood effects - weak regional autocorrelation (2010, 2020)

Source: Own compilation

Of the 197 territorial units included in the 2020 study, no significant autocorrelation can be detected in 145, the remaining 52 territorial units can be classified into four categories. Examining the 2020 data, 15 territorial units can be classified into the category in which the analyzed districts and their neighbours had values of built apartments per ten thousand people significantly above average.

Overall, it can be said that based on the calculations, the number of built apartments per ten thousand people shows a divisive picture in the country.

Comparing the two years examined, it can be said that by 2020, thanks to the various housing and home building subsidies, it can be seen that an above-average number of apartments were built in those areas where the investments can pay off. This study confirms what was stated by Varga D. 2022 already mentioned in the dissertation's subsection 6.2.

## 4. New and quasi-new statements of the research

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**T3.a) Most of the built apartments in our country are concentrated in a well-defined, narrow circle of settlements/districts/counties and regions. As a result of the economic boom and the housing construction subsidies of recent years, the number of settlements/regions where no or an extremely small number of residential properties were built in 2013 decreased. Based on the examination of the time-series data of the Hirschmann-Herfindhal concentration index of the total income of the districts and the built apartments, it can be established that at the level of the districts, the number of newly built residential properties is more concentrated than the total income.**

**T3.b) The results of the shift-share analysis regarding the number of built apartments proved that certain regions (at the county level, the counties of Hajdú-Bihar, Veszprém, Pest, Győr-Moson-Sopron and Somogy) have a significant share of increases compared to the national level, in the same counties the "territorial effect" values, adjusted for the average change of residential property types, are also generally positive, while below-average performances are concentrated in other regions (Borsod-Abaúj-Zemplén, Budapest, Békés, Jász-Nagykun-Szolnok).**

**In the capital city, which is characterized by significant residential real estate construction at the national level, the growth falls short of the national average growth level (the total, regional and sectoral impact values are both negative). Overall, it can be concluded that due to the economic boom years of 2013-2020, as well as the housing construction support tools available during the period, the construction of residential properties in the more developed counties of the countryside gained more momentum, which contributes to the economic and social gap between the developed and less developed areas of the countryside. to increase differences.**

**T3.c) With the help of regional autocorrelation tests, it was possible to define clearly distinguishable district groups based on the number of newly built apartments. In the regions of Northern Hungary, Central Great Plains and South-West Hungary, the extent of adjacent regions with below-average values increased, while typically in North-West Hungary and in the areas around Budapest, the number of neighbourhoods adjacent to each other increased above the average, which also indicates the strengthening of autocorrelation.**

The dynamics of housing construction can be influenced by many economic and social phenomena, so I was looking for a statistical method that enables the management of a large number of variables, shows their correlations, so that the obtained result characterizes their characteristics and helps the evaluation. This is factor analysis (principal component analysis). Using principal component analysis, we condense the information content of the original indicators into fictitious variables, which does not involve significant data loss. The basic hypothesis of the analysis states that all standardized variables can be written as a linear combination of so-called factors (variables with no independent meaning). Its task is to provide the best possible estimate of the factor weights and factor values based on the data of the examined variables. (French L. 1976. p. 249)

## 4. New and quasi-new statements of the research

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"Principal component analysis reduces the number of variables with minimal loss of information, so its use is justified when the number of variables is high. The characteristic of the method is that each component explains the variance of the observed variables in the order of the eigenvalue, where the first factor accounts for the largest part, while the other factors contribute to the total variance in a decreasing manner." (Sajtos L. – Mitev A. 2007 p. 253)

(H4) Factors in the evolution of real estate prices, or the territorial dimensions of the number of built apartments form a complex system. The methods I want to use in my dissertation (factor analysis, path analysis model) are suitable for identifying the direct and indirect effects affecting the investigated system and for demonstrating the strength of these effects.

I performed the principal component analysis involving 20 specific variables, and four factors can be formed based on the analyses.

Economic and social phenomena must also be taken into account when developing the number of built apartments. Due to the many variables, it is advisable to reduce their number, one of the statistical tools of which is the principal component analysis (Kóródi M. – Dudás P. 2005. 454.).

The first factor (Figure 16) contains the variables that relate to the employment situation and welfare-related factors of the given region (e.g.: income per capita, number of cars per thousand people... etc.). In the second factor, there are indicators related to the comfort of the properties (e.g.: number of apartments connected to district heating, public sewer network, hot water network per thousand people). The third factor contains indicators related to the economy, including business (e.g., number of registered businesses and non-profit organizations per thousand people). Finally, the fourth factor included indicators related to the demographic situation (e.g.: proportion of the working-age population, number of live births and deaths per thousand people).



## 4. New and quasi-new statements of the research

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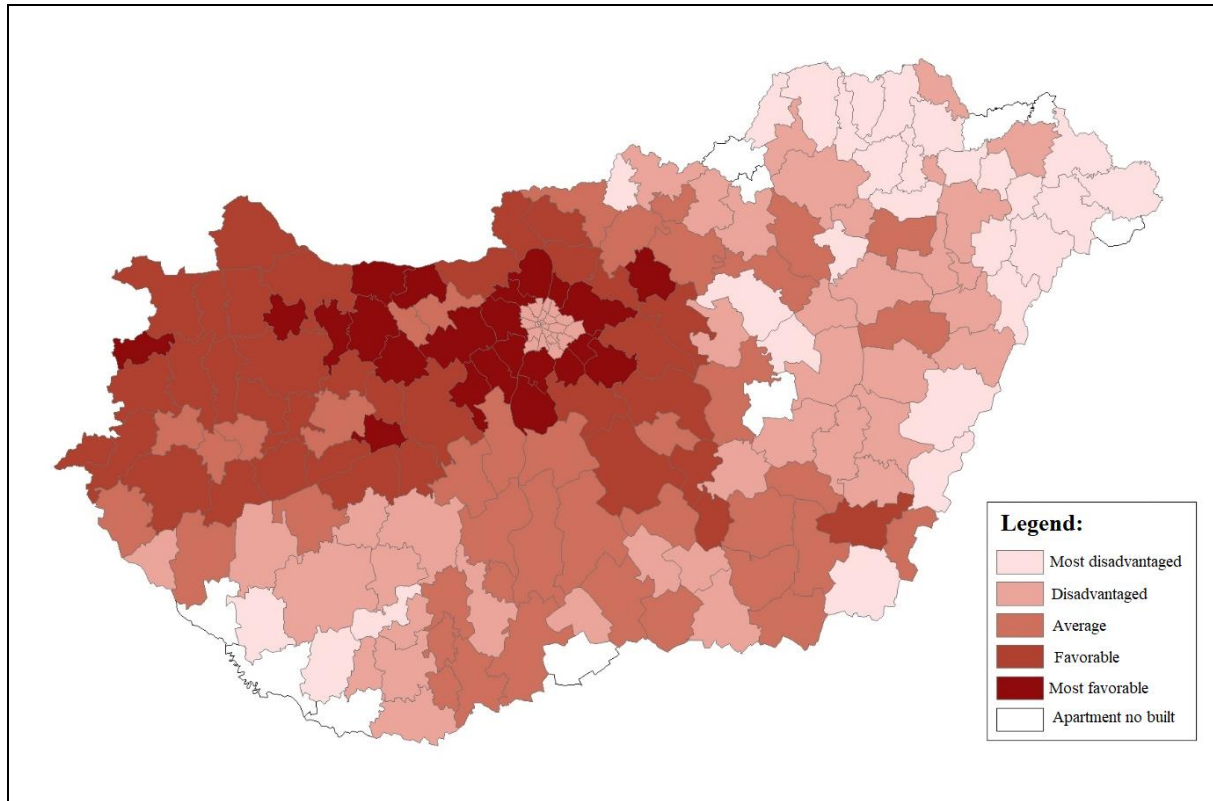


Figure 16: Districts of Hungary based on the employment situation and welfare factor  
Source: Own compilation based on TEIR data

Nationally, it can be said that the situation is mostly favorable in the central and north-western areas of the country, while the majority of districts with the most disadvantaged situations are located in the eastern regions.

Based on the own values of the housing quality and social activity factor, figure 17 differs greatly from the picture determined by factor 1. Due to the nature of the method, this is not surprising, since the factors do not correlate with each other. Examining comfort from the point of view of the number of built apartments, it can be seen that the most favorable values are obtained in those territorial units where the county seats and more developed urban areas are located.

According to the factor compiled by specific indicators, e.g. the districts of Tatabánya, Budapest, Pécs, Debrecen, Szeged, Dunaújváros, Tiszaújváros are in the most favorable situation, and even the districts of Kiskunmajsa, Mórahalmi, Ráckeve, Monori, Gárdonyi, Aszód are in the worst situation.

## 4. New and quasi-new statements of the research

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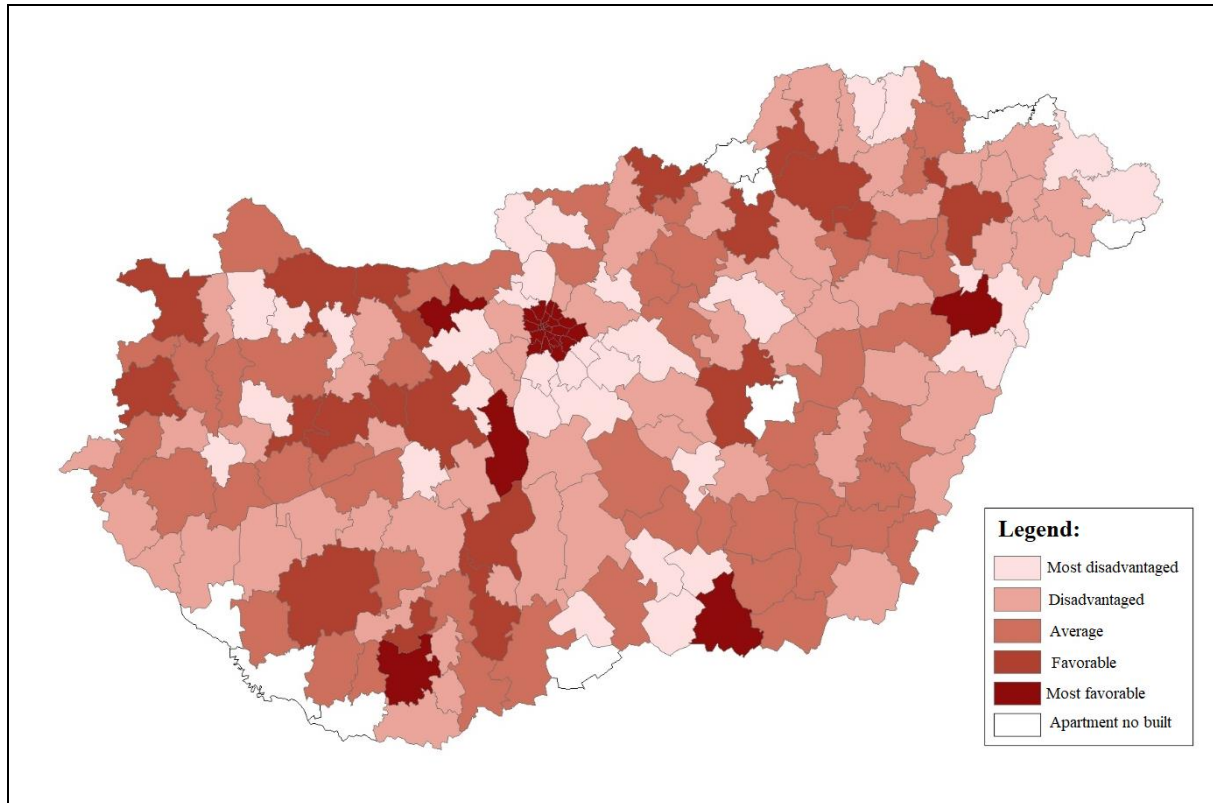


Figure 17: Districts of Hungary based on housing quality and social activity factor  
Source: Own compilation based on TEIR data

In my dissertation, I made an attempt to determine the factors influencing the lowest and highest prices of residential real estate with the help of regression models. Since there are many types of residential properties, in order to narrow down the research area, I examined three specific groups of residential properties: two-room brick and panel-built residential properties, as well as three-room family houses. I show the factors influencing the lowest and highest prices of the three real estate groups I have selected using a multivariate regression calculation, for the two examined years (2017 and 2019). I chose these two years because external factors had no influence on the data, such as the COVID-19 epidemic or the ongoing Russian-Ukrainian war. It was also a primary consideration to prove the usability of the path analysis model in relation to the evolution of real estate prices. I collected the offer prices of residential properties from the internet real estate advertising site ingtal.com in 2017 and 2019, the explanatory variables in the analysis come from the TEIR database. In the thesis booklet, I present the results through the two-room brick-built properties.

## 4. New and quasi-new statements of the research

Table 7: Summary data of the linear regression model of the highest price of two-room brick-built residential properties (2017)

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Standard errors of the estimate	Explanatory variables of the model
1	,692 <sup>a</sup>	,479	,460	5965788,02	Konstans, A
2	,819 <sup>b</sup>	,671	,646	4830503,79	Konstans, A, B
3	,861 <sup>c</sup>	,741	,711	4368005,90	Konstans, A, B, C
4	,896 <sup>d</sup>	,803	,771	3885928,94	Konstans, A, B, C, D
Explanatory variables:					
Konstans					
A: Number of students participating in higher bachelor's and master's programs in full-time education per 1,000 people (according to place of education)					
B: Number of registered enterprises with legal personality per 1,000 people					
C: Number of marriages per 1,000 people					
D: Number of kindergarten places per 1,000 people					

Source: Own compilation based on TEIR data

The number of students participating in higher bachelor's and master's programs has the greatest explanatory power. The higher education centers are in the big cities, the additional demand helps to make real estate more expensive there than in other settlements. The highly skilled workforce that comes out of this will probably affect the size of the real estate price, and the appearance of businesses in the model emphasizes the importance of solvent demand. The number of marriages and the number of kindergarten places in the model can mean that young married couples usually choose a two-room home as their first home in Hungary, which they change to a larger one in the event of a possible family expansion. The relatively positive demographic situation also contributes to higher real estate prices (Table 7).

The equation of the model describing the highest price:

$$Y = -35187156,004 + 129104,258A + 152899,275B + 4734015,867C + 555319,030D$$

The lowest price is determined to the greatest extent by the number of registered job seekers, in a negative direction. In other words, where the unemployment rate is higher, housing prices are lower, since there is not the right demand for real estate due to the lack of capital (Table 8).

## 4. New and quasi-new statements of the research

Table 8: Coefficients of the linear regression model of the lowest price of two-room brick-built residential properties (2017)

Model	Non-standardized coefficients		Standardized coefficients	t	Significance
	B	Standard error	Beta		
Konstans	6288071,418	3941796,523		1,595	,124
Number of registered jobseekers per 1,000 people	-134324,279	19352,241	-,736	-6,941	,000
D: Number of kindergarten places per 1,000 people	197030,930	83085,744	,249	2,371	,026
Number of registered criminal offenses per 1,000 people (by place of commission)	63909,153	20860,653	,319	3,064	,005
Number of practicing GPs per 10,000 people	-1369715,207	413801,552	-,348	-3,310	,003
Number of municipal libraries per 10,000 inhabitants	2250810,467	839695,890	,282	2,681	,013

Source: Own compilation based on TEIR data

The equation of the model describing the lowest price:

$$Y=6288071,418-134324,279A+197030,930B+63909,153C-1369715,207D+2250810,467E$$

Table 9: Summary of regression models (2017)

Factors affecting the highest price of a two-room panel-built property	Factors affecting the highest price of a two-room brick-built property	Factors affecting the highest price of three-room detached houses
<ul style="list-style-type: none"> <li>• the number of marriages</li> <li>• number of kindergarten places</li> </ul>	<ul style="list-style-type: none"> <li>• number of students participating in higher bachelor's and master's programs in full-time education</li> <li>• the number of registered legal entities</li> <li>• the number of marriages</li> <li>• the number of kindergarten places</li> </ul>	<ul style="list-style-type: none"> <li>• the number of 18-59 year olds from the permanent population</li> <li>• students participating in higher bachelor's and master's programs</li> <li>• the number of passenger cars</li> </ul>
Factors influencing the lowest price of a two-room panel-built property	Factors influencing the lowest price of a two-room brick-built property	Factors affecting the lowest price of three-room detached houses
<ul style="list-style-type: none"> <li>• number of students who obtained a higher degree</li> <li>• the income per capita</li> </ul>	<ul style="list-style-type: none"> <li>• the number of registered job seekers</li> <li>• the number of kindergarten places</li> <li>• number of registered criminal offenses</li> <li>• the number of general practitioners working</li> <li>• the number of municipal libraries</li> </ul>	<ul style="list-style-type: none"> <li>• the number of registered job seekers</li> </ul>

Source: Own compilation

## 4. New and quasi-new statements of the research

I collected my findings using linear regression models for 2017 in Table 9, and those for 2019 in Table 10. Overall, it can be said that considering both years (2017 and 2019), almost identical indicators appear as influencing factors. In the case of the models describing the highest prices, indicators related to the economy, welfare and higher education appear for both examined years, with regard to the lowest prices, indicators related to poverty dominate (crime, registered job seekers, etc.).

Table 10: Summary of regression models (2019)

Factors affecting the highest price of a two-room panel-built property	Factors affecting the highest price of a two-room brick-built property	Factors affecting the highest price of three-room detached houses
<ul style="list-style-type: none"> <li>• the number of marriages</li> <li>• number of kindergarten places</li> </ul>	<ul style="list-style-type: none"> <li>• number of registered legal entities,</li> <li>• the number of guest nights</li> </ul>	<ul style="list-style-type: none"> <li>• number of students with a higher degree,</li> <li>• the number of registered legal entities</li> </ul>
Factors influencing the lowest price of a two-room panel-built property	Factors influencing the lowest price of a two-room brick-built property	Factors affecting the lowest price of three-room detached houses
<ul style="list-style-type: none"> <li>• number of kindergarten places</li> <li>• average number of regular social assistance recipients</li> </ul>	<ul style="list-style-type: none"> <li>• the number of registered legal entities,</li> <li>• number of kindergarten places,</li> <li>• the number of general practitioners working</li> </ul>	<ul style="list-style-type: none"> <li>• number of registered job seekers</li> </ul>

Source: Own compilation

(H5) Significant differences can be observed in the distribution of the number of built apartments in our country. According to my assumption, the per capita income intended to be used during the path analysis model and certain indicators describing the economic and social situation adequately and sufficiently explain the evolution of prices.

In the 8th chapter of the dissertation, I examined the causes of housing price changes in Hungary's thirty largest cities (except Budapest) using the path analysis model method. I sought to explore the relationship between per capita income and median property prices. With this, I wanted to examine the relationship between per capita income and other socio-economic factors influencing the median value of housing prices.

## 4. New and quasi-new statements of the research

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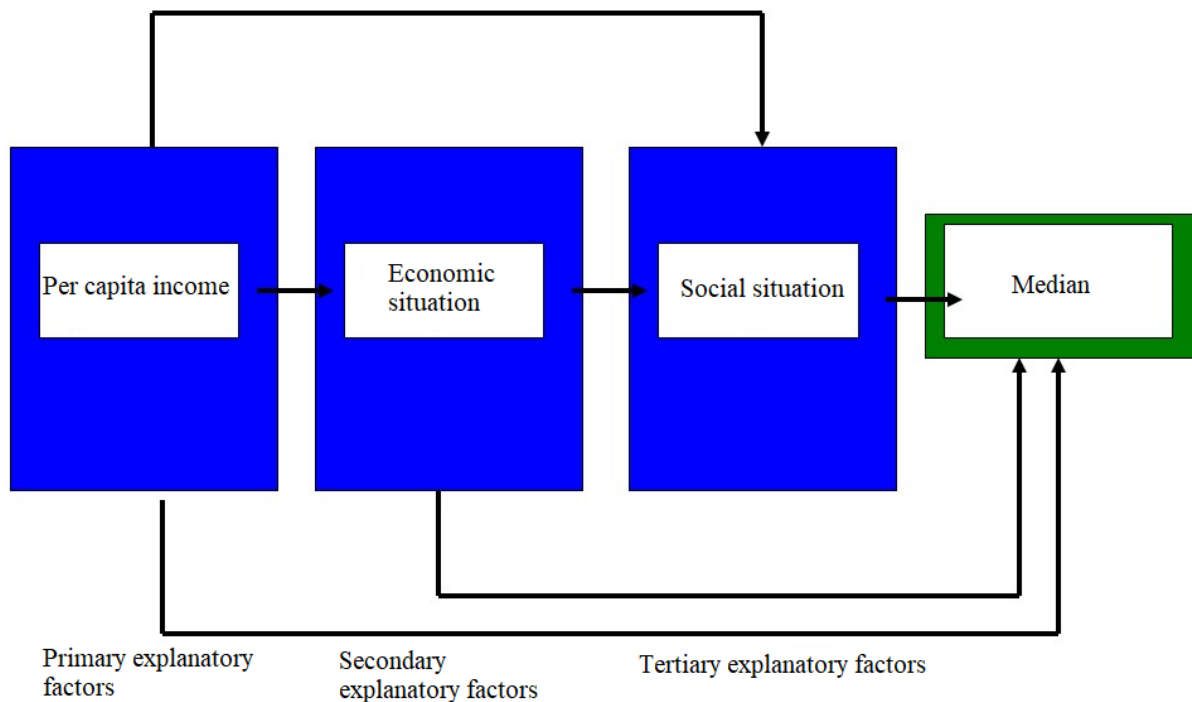


Figure 18: The causal relationship system of the explanatory variables groups  
Source: Tóth (2013) p. 86.

In my analysis, I considered the per capita income, social and economic indicators as independent variables, which explain the dependent variable, the middle value of real estate prices, henceforth the median. I made the following assumptions about the individual groups of variables:

- per capita income: the higher the income in a settlement, the higher the price of the property,
- economic situation: the more developed a settlement, the higher the price of the apartment,
- social situation: if the demographic situation in a settlement is more favourable, the median will probably be higher.

The examined economic and social phenomena interact with each other, not only together, but also separately (Figure 18).

As the first step of the path analysis, I tried to explain the territorial distribution of the medians together with all the independent variables using a simple multivariate linear regression.

Among the independent variables, the most significant explanatory power is the number of students participating in higher bachelor's and master's education per 1,000 people in full-time education (by place of education). This can be explained by the fact that there are higher education institutions in quite a few of the thirty selected cities, thanks to which the proportion of skilled labour will be higher, and this may indicate that the given settlement is in a better economic situation, so they can sell the properties at a higher price.

## 4. New and quasi-new statements of the research

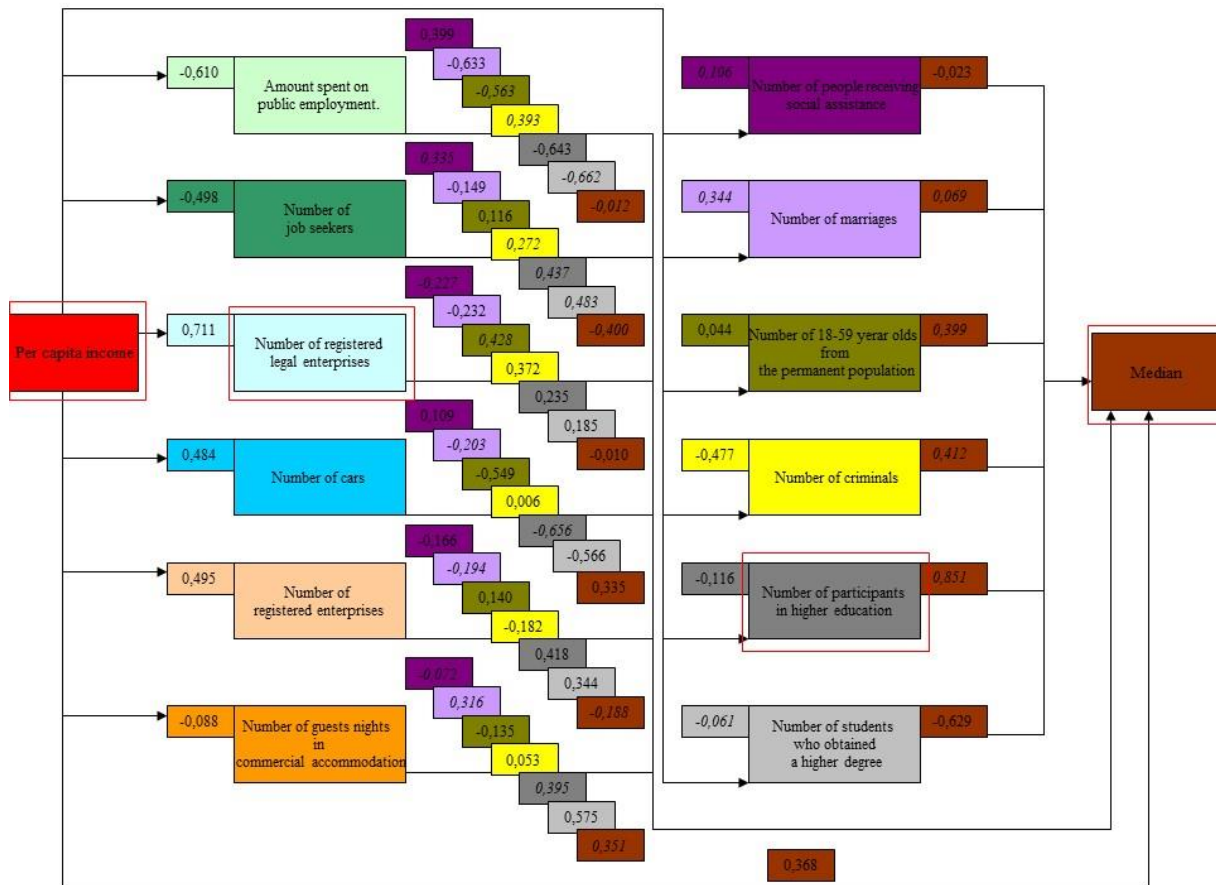


Figure 19: The role of the explanatory variables in explaining the median prices of two-room brick residential properties (2017)

Source: Own compilation based on TEIR data

Among the indicators describing both the economic and social situation, there are those that have a determining force in the formation of the final result. Among the economic indicators, the number of registered jobseekers, the number of private cars and the number of guest nights in commercial accommodation, and the most decisive of the social indicators are the number of students participating in higher bachelor's and master's programs in full-time education, but the 18- and 59-year-olds of the permanent population are also significant between, the number of registered criminals, and the number of students who obtained a higher degree. The median value of the two-room brick-built apartments in the selected thirty settlements will probably be higher where there are higher education institutions and, thanks to them, a high number of qualified workers. Furthermore, the presence of the working-age population is an important factor in price development, as they generate demand (Figure 19).

## 4. New and quasi-new statements of the research

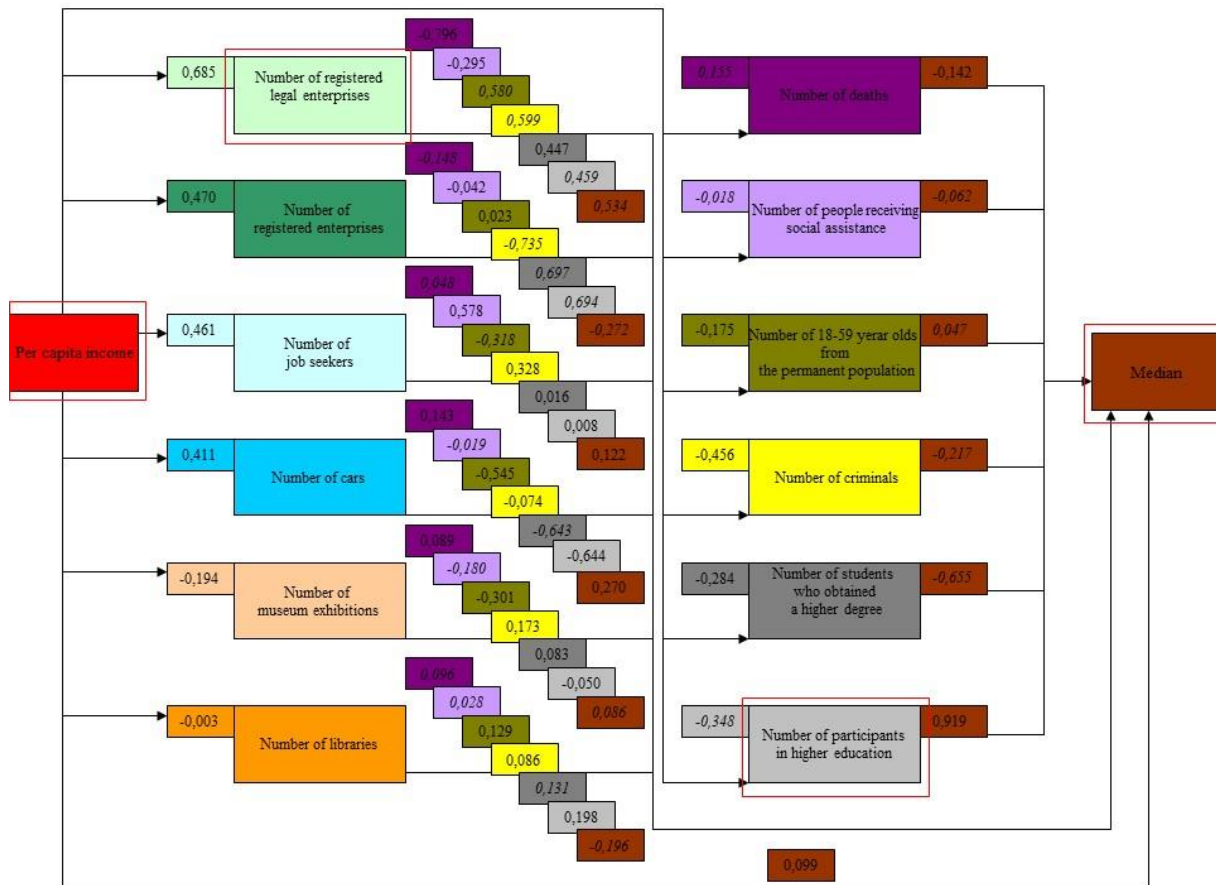


Figure 20: The role of explanatory variables in explaining the median prices of two-room brick residential properties (2019)

Source: Own compilation based on TEIR data

Comparing the two models, it can be said that the role of higher education institutions has remained unchanged, and that some determining factors have changed. In essence, however, in my opinion, the key factors remain the same, so the role of both economic and social factors is still important (Figure 20). The report of the Savings Index also confirms this claim that higher education institutions play a role in the change of real estate prices. The report examined the period between December 2020 and December 2021, in which there was a 10% increase in rents nationally, but a 15% increase was also experienced in housing prices. Even so, such a significant rise in prices is noticeable, dormitories are pushed into the background, and comes to the fore the purchase of an investment apartment, so that it can be rented out to students.

**T4) The path analysis model combined with factor analysis is particularly suitable for exploring the internal relationships of the complex system influencing real estate prices.**

**T5) In the case of the investigated property types, the conclusions regarding the highest and lowest prices quantitatively confirm the relationships that have only been guessed so far.**



## 5. AREAS OF USE OF RESEARCH RESULTS

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In the future, my goal is to expand the research area of my dissertation and map out other possible directions. I plan to continue the research at the settlement level, and during the path analysis, I would also like to expand the 30 settlements included in the analysis by including new settlements, in order to get a picture of the factors which affecting real estate prices not only from the larger settlements of the country. I further refine the results of the factor and path analysis with other methods (e.g.: cluster analysis) and by including additional indicators. I hope that the results presented in my dissertation will be useful for practitioners as well. The results of my research can be useful for the development of settlement development plans, as well as in the preparation of projects and analyses of real estate brokerage companies. I will also use the results of my dissertation for educational purposes.

Future directions of research may be:

- the results in space, or time-extended testing,
- detailed analysis and comparison of the European Union residential real estate market with the Hungarian market,
- application of new statistical methods, regarding the further examination of territorial differences,
- examination of other segments of the real estate market (e.g.: market of office buildings, commercial real estate).

## REFERENCES

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1. az diPasquale, D. & Wheaton, W. C. (1992): The markets for real estate assets and space: A conceptual framework. *Journal of the American Real Estate and Urban Economics Association*, 20, 181-197
2. Eurostat (2020): Lakásstatisztika. In [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Housing\\_statistics%2Fhu&oldid=498665&fbclid=IwAR28VLVanwcvPLb7-4kq1HIOKqrO\\_fhZ1vl-1H5O3o1UahnNLwWnInKLtxU](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Housing_statistics%2Fhu&oldid=498665&fbclid=IwAR28VLVanwcvPLb7-4kq1HIOKqrO_fhZ1vl-1H5O3o1UahnNLwWnInKLtxU) (Letöltés időpontja: 2023.02.06.)
3. Harnos L. (2017): A magyar lakáspiaci trendek alakulása a 2008-ban kirobbant gazdasági válság után, *Gazdaság & Társadalom / Journal of Economy & Society – 2017/3– 4.*, DOI: 10.21637/GT.2017.3-4.06
4. Ingatlanok.hu (2016): Ingatlanpiaci trendek 2016-ban, In: <https://ingatlanok.hu/hirek/20160229/ingatlanpiaci-trendek-2016-ban> (Letöltés időpontja: 2016. október 21.)
5. KSH (2018): Mikrocenzus (2016), Lakáskörülmények, Budapest
6. Kóródi M. - Dudás P. 2005: A gazdaság és a turizmus kapcsolata a rurális kistérségekben. *Területi Statisztika. Központi Statisztikai Hivatal. 8. évf. 5. Sz.*, pp. 454-461.
7. KSH (2016): TÉR-KÉP 2015, A lakáspiaci folyamatok területi egyenlőtlenségei, *Központi Statisztikai Hivatal*, pp.: 53-65.
8. Kóródi M. - Dudás P. 2005: A gazdaság és a turizmus kapcsolata a rurális kistérségekben. *Területi Statisztika. Központi Statisztikai Hivatal. 8. évf. 5. Sz.*, pp. 454-461.
9. MNB (2019): Lakáspiaci jelentés, Budapest, 44. p.
10. Nemes Nagy. J. - Jakobi. Á. - Németh N. (2001): A jövedelemegyenlőtlenségek térségi és településszerkezeti összetevői. *Statisztikai Szemle*, 79. évfolyam, 10–11. szám, pp. 863-884
11. Parragi B. (2021): Housing stock and renewal ratio in Europe in the last decade: Turkey leading the way, *ELTINGA-EECFB-BUILDECON*
12. Sajtos L. & Mitev A. (2007): Spss kutatási és adatelemzési kézikönyv. Alinea Kiadó, Budapest, 404 p.
13. Tóth G. (2013): Az elérhetőség és alkalmazása a regionális vizsgálatokban, *Központi Statisztikai Hivatal, Budapest*, 146. p.
14. Varga D. (2022): Építési Piaci Prognózis 2021-2024

## AUTHOR'S DISSERTATION RELATED PUBLICATIONS

1. Péter Zs. – Orosz D. (2022): Okos eszközök használata az Európai Unió vidéki térségeinek településein - válság a láthatáron, *A FALU* 37: 2 pp. 65-76. , 12 p. (2022)
2. Orosz D. (2021): Examining the Contribution of Smart Homes to the Smart Performance of Cities, *THEORY METHODOLOGY PRACTICE: CLUB OF ECONOMICS IN MISKOLC* 17: SI pp. 23-30., 8 p. (2021)
3. Orosz D. – Péter Zs. (2021): 'Smart solutions' relating to residential properties and their direct environment with special regards on cloud-based services in the capitals of the European Union's countries, In: Nataša, *URBANČÍKOVÁ Building Smart Communities for the Future: SMART solutions for energy: Proceeding of Papers Kosice, Szlovákia: Technical University of Kosice* (2021) 112 p. pp. 51-56., 6 p.
4. Orosz D. (2021): A válságok hatásai az ingatlanpiacra, *HANTOS PERIODIKA* 2.: Klmsz. pp. 133-144., 12 p. (2021)
5. Orosz D. (2021): Lakásállomány (VII.3. fejezet), In: Kocziszky, György (szerk.) *Észak-Magyarország, Budapest, Magyarország: HVG-ORAC* (2021) 830 p. pp. 495-504., 10 p.
6. Orosz D. (2020): Lakáspiaci tendenciák az Észak-magyarországi régióban, *ÉSZAK-MAGYARORSZÁGI STRATÉGIAI FÜZETEK* 17: 3 pp. 71-83., 13 p. (2020)
7. Orosz D. – Péter Zs. (2020): A FELSŐOKTATÁSI INTÉZMÉNYEK HELYE SZEREPE AZ OKOS VÁROSSÁ VÁLÁS FOLYAMATA SORÁN KÜLÖNÖS TEKINTETTEL HAZÁNK MEGYEI JOGÚ VÁROSAIBAN In: *Musinszki, Zoltán; Nagy, Zoltán (szerk.) TÁRSADALMI, TECHNOLÓGIAI, INNOVÁCIÓS HÁLÓZATOK ASPEKTUSAI: TÁRSADALMI INNOVÁCIÓK A TÁRSADALMI KONFLIKTUSOK SZOLGÁLATÁBAN*, Miskolc, Magyarország: Miskolci Egyetem Gazdaságtudományi Kar (2020) 162 p. pp. 46-56., 11 p.
8. Orosz D. (2020): „OKOS MEGOLDÁSOK” AZ INGATLANPIACON, KÜLÖNÖS TEKINTETTEL A VISEGRÁDI ORSZÁGOKRA, *HANTOS PERIODIKA 2020: 1* pp. 100-110., 11 p. (2020)
9. Péter Zs. – Orosz D. (2020): A vidéki területek ellenállóképességének javítása okos megoldások segítségével *KÖZÉP-EURÓPAI KÖZLEMÉNYEK* 13: 3 pp. 37-57., 21 p. (2020)
10. Orosz D. – Péter Zs. (2020): A FELSŐOKTATÁSI INTÉZMÉNYEK HELYE SZEREPE AZ OKOS VÁROSSÁ VÁLÁS FOLYAMATA SORÁN KÜLÖNÖS TEKINTETTEL HAZÁNK MEGYEI JOGÚ VÁROSAIBAN In: *Musinszki, Zoltán; Nagy, Zoltán (szerk.) TÁRSADALMI, TECHNOLÓGIAI, INNOVÁCIÓS HÁLÓZATOK ASPEKTUSAI: TÁRSADALMI INNOVÁCIÓK A TÁRSADALMI KONFLIKTUSOK SZOLGÁLATÁBAN*, Miskolc, Magyarország: Miskolci Egyetem Gazdaságtudományi Kar (2020) 162 p. pp. 46-56., 11 p.

## AUTHOR'S DISSERTATION RELATED PUBLICATIONS

11. Orosz D. – Péter Zs. (2019): A lakóingatlanokat és közvetlen környezetüket érintő „okos megoldások” különös tekintettel felhő alapú szolgáltatásokra az Európai Unió országainak fővárosaiban, *In: Sebestyén, Szép Tekla; Nagy, Zoltán (szerk.) Ember - Tér - Idő: Tanulmányok Kocziszky György tiszteletére. A Miskolci Egyetem Gazdaságtudományi Karának jubileumi tanulmánykötete*, Miskolc, Magyarország: Bíbor Kiadó, Miskolci Egyetem Gazdaságtudományi Kar (2019) 353 p. pp. 178-185., 8 p.
12. Orosz D. (2019): Collecting and systematizing "smart solutions" for resi-dential real estate, especially in Central and Eastern Europe, with special regard to the Visegrad countries, *In: Neme, Radek; Chytilova, Lucie (szerk.) Proceedings of the 13th International Conference on Strategic Management and its Support by Information Systems 2019: (SMSIS 2019)*
13. Péter Zs. – Orosz D. (2019): A megyei jogú városok útja az okos várossá válás folyamatában különös tekintettel a térinformatikai eszközök használatára *In: Kőszegi, Irén Rita (szerk.) III. Gazdálkodás és Menedzsment Tudományos Konferencia: Versenyképesség és innováció*, Kecskemét, Magyarország: Neumann János Egyetem Kertészeti és Vidékfejlesztési Kar (2019) 1 175 p. pp. 673-679., 7 p.
14. Orosz D. (2018): The role and appearance of real estate valuation in economic theories, *In: Doktoranduszok Fóruma - Gazdaságtudományi Kar szekciókiadványa 2017: Miskolc, 2017. november 16. Miskolc, Magyarország: Miskolci Egyetem Tudományos és Nemzetközi Rektorhelyettesi Titkárság (2018) 77 p. pp. 43-48., 6 p.*
15. Orosz D. – Péter Zs. (2017): Characteristics of Smart Home Systems, Directions and Development of the Domestic and International Markets *In: Dorisz, Györfő; Vivien, Kleschné Csapi; Zsolt, Bedő (szerk.) ICUBERD 2017: Book of Papers Pécs, Magyarország: University of Pécs (2017) 606 p. pp. 270-285., 16 p.*
16. Orosz D. (2017): Lakóingatlanokkal kapcsolatos fontosabb fogalmak és értékelési módszerek ismertetése a hazai és a külföldi szakirodalomban *In: Veresné, Somosi Mariann; Lipták, Katalin (szerk.) „Mérleg és Kihívások” X. Nemzetközi Tudományos Konferencia = „Balance and Challenges” X. International Scientific Conference: Konferenciakiadvány: A közgazdászok elindításának 30. évfordulója alkalmából Miskolc-Egyetemváros, Magyarország: Miskolci Egyetem Gazdaságtudományi Kar (2017) 891 p. pp. 773-781., 9 p.*