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REAL ESTATE MARKET AT A CROSSROAD - ERA OF AFFORDABLE HOUSING IS GONE

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Abstract:

Within a broad discussion on property price formation and property market specifics, this paper aims to investigate the relationship between property price trends and the number of transactions occurring on the housing market. Specifically, we test whether housing transaction volumes and rents are good predictors of housing prices and discuss causalities and differences in this relationship in the sales and rental property markets. We provide evidence from selected European property markets on the relationship between property price trends and the number of transactions occurring in these markets. We argue that an increased number of transactions is predictive of an increase in property prices, but prices tend to be rigid in the opposite (downward) direction. Thus, a cooling down of demand for properties may rather decrease the number of transactions than push down property prices. This appealing result may shed light on understanding why property prices appreciate across time and countries.

Keywords:

housing market; property price; transactions; rent; housing affordability; market turnover; inflation; mortgage loans

JEL Classification: O18

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1. Introduction

From a historical point of view, housing prices have several reasons to grow. In one of the most influential papers on housing prices, Glaeser et al. propose a model explaining why housing prices soar. While from the 1950s to the 1970s, the prices increase due to improving dwelling quality, from the 1970's on, the quality does not grow at pace with prices. Instead, they claim that increased difficulty in obtaining regulatory permission to build new homes is accountable for increasing housing prices. They suggest that the ability of local residents to block new construction projects results in higher prices (Glaeser et al.,2005). Recent research has confirmed increased residents opposition for new projects planned by developers (Klement, 2022). In fact, transaction costs consisting in obtaining regulatory permission limit property supply over decades and made prices soar to unaffordable levels (Cermakova, 2022) forcing people to live in cheaper regions and commute to work (Lukavec, 2017) or affecting regional development and migration and burdening public budgets with need of providing social housing. Lack of housing inventory and stagnation of new construction makes the price of property very sensitive to changes in demand. The demand for properties is usually understood as a function of income, price, rents, credit availability, wealth, and demographic factors (Hromada, 2021b). Supply equals the sum of the available inventory of houses (i.e., second-hand houses on the market) and the supply of new houses. The supply of new houses is a function of price, costs, credit availability, seasonal factors, and delays in the building process (Charles, 2016). Price of second-hand houses, (substitutes of new houses) reflects the variables influencing the new houses price (Ruzicka, 2022). Within this economic framework researchers aim to understand and predict property price trends and identify possible bubbles. We bring evidence from selected European property markets about the relationship between property price trend and number of transactions occurring on this market. We argue that increased number of transactions is predictive of increase in property price, but prices tend to be rigid in the opposite (downward) direction. Thus, cooling down of demand for properties may rather decrease number of transactions than push down property prices. This appealing result may bring light into understanding why property prices appreciate across time and countries, while property price losses are location specific and usually recuperated within a rather short period of time.

2. Literature overview

Understanding the reasons for continuously increasing property prices and identifying credible indicators of future price development have attracted much attention from researchers. As factors contributing to property price formation are numerous and diverse, data from different countries often indicate different results. We bring below an overview of existing research.

Jud & Winkler (2002) conducted an extensive study about the determinants of housing prices appreciation in metropolitan areas across the US. They find that population growth, real income changes, construction costs, and interest rates heavily impact the prices. Interestingly, they positively associate lags of stock market indices with the housing prices through the wealth effect. They find large diversity across the areas caused by location-specific effects they attempt to explain by restricting estate policies and land-use limitations. A strong negative link

between real interest rate and housing prices is confirmed by a panel data study by Yiou (2021). Panel data study of monetary policy rates confirms that short-term interest rates also substantially negatively impact housing prices. (Iossifov et al. 2008). Venhoda (2022) brings evidence that macroprudential policy instruments may also be significant for the property prices. Using data from Bank for International Settlement, Chen et al. (2021) find a strong link between loose monetary policy and a rise in real housing prices and also their research confirms that the strength of the relationship between monetary policy and housing prices is associated with financial liberalization in the country. Duca et al. (2021) emphasize the role of the credit market, house price expectations and monetary and macroprudential policy in their study. Yet, the authors conclude, in line with the previously mentioned contributions, that there is plenty of diversity in the housing price patterns across the globe. Regardless of the specifics of property price formation in different regions, in all cases, the property prices are based on adaptive expectations. Thus, property markets are prone to bubbles and bursts (Roulac, 1996 or Coskun, 2020).

There is extensive research testing the property market demand-side determinants. This research is focused, in most cases, on individual countries or regions. Égert et al. (2007) researched the above-mentioned conventional determinants of housing prices in Central and Eastern Europe (CEE). Factors such as GDP per capita and real interest rate are excellent predictors of the housing prices in CEE. On the other hand, the authors conclude that demographics in CEE, equity prices, and labour market development have a lower impact on housing prices than in other non-CEE OECD countries. In addition, the number of housing loans is another strong determinant of housing prices. Borowiecky (2009) employs a VAR model of the Swiss housing economy from 1991 to 2007. Real GDP had a minor impact on housing prices in the short run. The housing prices in Switzerland are most sensitive to construction prices and changes in demography. They also argue that the real estate market is particular to the location and even small countries such as Switzerland are very heterogeneous.

The critical role of loans and available credit in housing prices is researched by Brissimis & Vlassopoulos (2009). The strong positive relationship between housing credit and housing prices is well established. However, the causation relationship between the two measures is not. Theoretically, higher credit can cause an increase in the housing prices, but it can be vice versa as well. The study is conducted on the Greek dataset. And the authors employ multivariate cointegration techniques for the analysis, concluding that, in the long run, housing prices are not responsive to disequilibria in the lending market. However, they provide evidence of a strong association between the amount of housing credit and housing prices in the short run.

Researching the supply side of the housing market, Conefrey et al. (2013) divide the stock of available homes into subgroups: the newly built houses and the second-hand houses. The authors show that the newly built houses exert the most decisive impact on the housing prices. This part of the supply is most capable of adjusting the prices and, therefore, is associated chiefly with whole market movements.

Various papers (Lisi 2019 or Kaderabkova et al., 2020, 2021) investigate the inverse impact of housing markets on countries' economies. They discuss the effect of housing prices on the labour market. The transmission from rising housing prices to the macroeconomy output and further into the labour market is channeled through the consumption effect and increased investment in new housing. The authors conclude that the increase in housing prices reinforces economic growth. Nocera et al. (2018) employs the Bayesian structural VAR model and examine the housing demand shocks on the macroeconomy across European countries and the effect of monetary policy on these shocks. They find that the impact of monetary policy shocks and housing demand shocks differ markedly among the researched countries. They identify the housing wealth effect in Ireland and Spain. An increase in 1% real estate values is directly responsible for a rise of 0.15% in household consumption. Both countries experienced severe real estate bubble bursts, and therefore the finding might hint at real estate value association with consumer confidence. Housing shocks in Ireland and Spain substantially more impact the aggregated demand than in other countries.

Cadil (2009) analyses the Czech housing market and uses VAR analysis to show that the flat market is more prone to bubbles than detached houses. The housing prices in the Czech Republic showed to be demand-driven and based on adaptive expectations. Another finding of the investigations is that the housing price changes are reliable predictors of changes in rents. (Hlaváček et al., 2009). Gatzlaff et al. (1995) provide a review of real estate market efficiency. They conclude that short-run housing prices are positively autocorrelated. However, they claim the housing returns regress to the mean in the long run. Further, they conclude that housing market transaction costs inhibit investors from exploiting anticipated price movements in the market. Akkoyun et al. (2013) explore further on this topic and find the number of transactions being a predictor of housing prices. The authors research correlation between housing prices and the number of houses sold. They use US monthly, quarterly and annual data. Interestingly, the transaction volume and prices positively correlate in the short run but do not correlate in the long run. Arslan et al. (2015) examine the relationship between house prices and transaction volume on data from England and Wales. Initially, they find a negative relationship. However, after decomposing price changes into anticipated and non-anticipated changes, they conclude that anticipated price movements reinforce transaction volumes. Meanwhile, non-anticipated changes decrease the volume of transactions. These findings might help understand the expectations of the housing market subjects. Genesove & Mayer (1994) suggest a positive relationship between housing prices and transaction volumes explained by changes in the equity structure of the estate owners. Data from the Boston condominium market show that a higher loan-to-value ratio is associated with higher listing prices and a longer time to sell. The resultant selling price is also higher.

A study on housing prices growth rates co-movement (Jara et al., 2016) shows that banking integration among developing countries increases the housing prices synchronicity. The most synchronized housing prices are among the developed countries and the developing countries' housing prices relationships turn out to be less synchronized. The final finding of the paper provides evidence that financial stress eliminates synchronicity in all the researched countries. The authors explain the 2008 subprime mortgage crisis and develop a workable DSGE model

with houses, land, and services. Based on the model's behaviour, they argue that the crisis may have been caused by a productivity slowdown. The authors argue that the productivity decrease was the main trigger in the 2007 US housing market crash and the lax credit conditions only exacerbated the movement. This was also confirmed by Kahn (2008) and Kahn (2009).

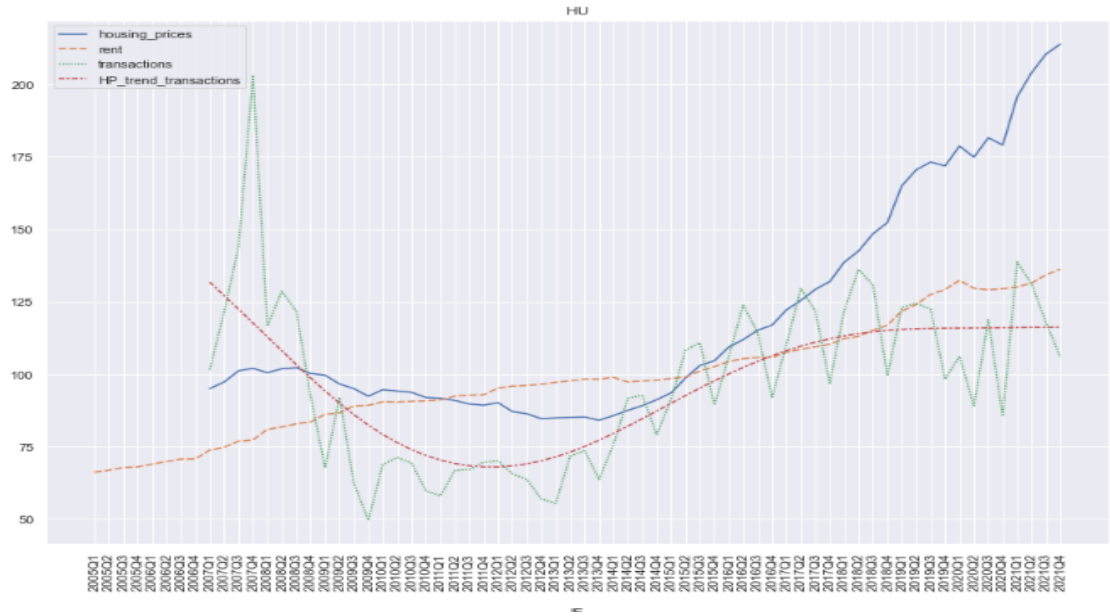
A study on housing prices in the era of pandemic COVID-19 reports some effects new to the property market. The growth rate decreased in touristic dependent areas while some other places accelerated the price development. Condominium prices have dropped relative to the detached houses indicating a preference for more extensive and private dwellings. Another pandemic effect is downward pressure on the rents resulting in lower returns on the housing investments (Duca et al., 2021). Del Giudice (2020) creates a biological-based model Lottka-Volttera (prey-predator). They estimate that in the Campania region (Italy), COVID-19 decreased housing prices by around 4% in the short- run and by about 6% in the mid-run. In most countries, however, the fall in housing prices in the first wave of Covid was minimal and lasted for a very short time. Most property markets in OECD countries recuperated losses in less than three months and prices experienced unprecedented growth highlighting housing affordability issues (Cermakova, 2022) and regional poverty differentiation (Luczak, 2022). Some might explain this soar in property prices as excessive demand over supply. Loose monetary policies combined with later COVID-19 induced savings prompted households to allocate their savings to real estate, especially housing, as confirmed by Jasova (2022). At the same time, the supply side of the housing market suffered a negative shock caused by inflation of construction costs, and likely is also less elastic than the demand. Akkoyun (2013) shows that housing prices in the US can be predicted by the number of transactions in the market. They are positively correlated. That means higher demand and consequent higher volume of transactions precede the increase in housing prices. Should an increased volume of transactions indicate an increase in housing prices in the near future, a question arises whether this relationship is valid also in the opposite direction. This paper will show that, interestingly, decreased demand will be translated into a decreased volume of transactions, housing prices, however, show substantial downward rigidity and the overall price level on property market would not decrease in response to stagnating or decreased demand for properties.

Within this broad discussion on property price formation and property market specifics, this paper aims to investigate the relationship between property price trends and the number of transactions that occurred in the housing market. Specifically, we test if housing transaction volumes and rents are good predictors of housing prices. Akkoyun (2013) and Genesove & Mayer (1994) claim that the relationship is positive, while Arslan et al. (2015) suggest that the association might as well be negative. This is important to know because own housing in Europe is less and less affordable and many governments endeavor to make housing more accessible and the dynamics of the market are not fully explained yet. The high housing prices compared to rents mean less return on investment in the housing, and it might also be a sign of a bubble in the housing market.

3. Data and Methodology

Let's first look at the graphical representation of housing prices, rent, and volume of transactions in selected European markets. In Hungary (Figure 1), we can observe that housing prices have been decoupling from the rents. Furthermore, the number of transactions seems to move along with the housing prices. This would seem to confirm the Akkoyun's position. In Great Britain, on the other hand, we do not see any clear relations from the graph. (Figure 2). It suggests different market dynamics in the UK's housing market. We will include the following European countries in our preliminary analysis France, Hungary, Ireland, Portugal, and the United Kingdom. We use the data provided by Eurostat, and the countries are selected on a data availability basis. Then, we will go for a detailed analysis of the Czech Republic property market development as we own a primary mined dataset that reflects the up-to-date behavior of market agents.

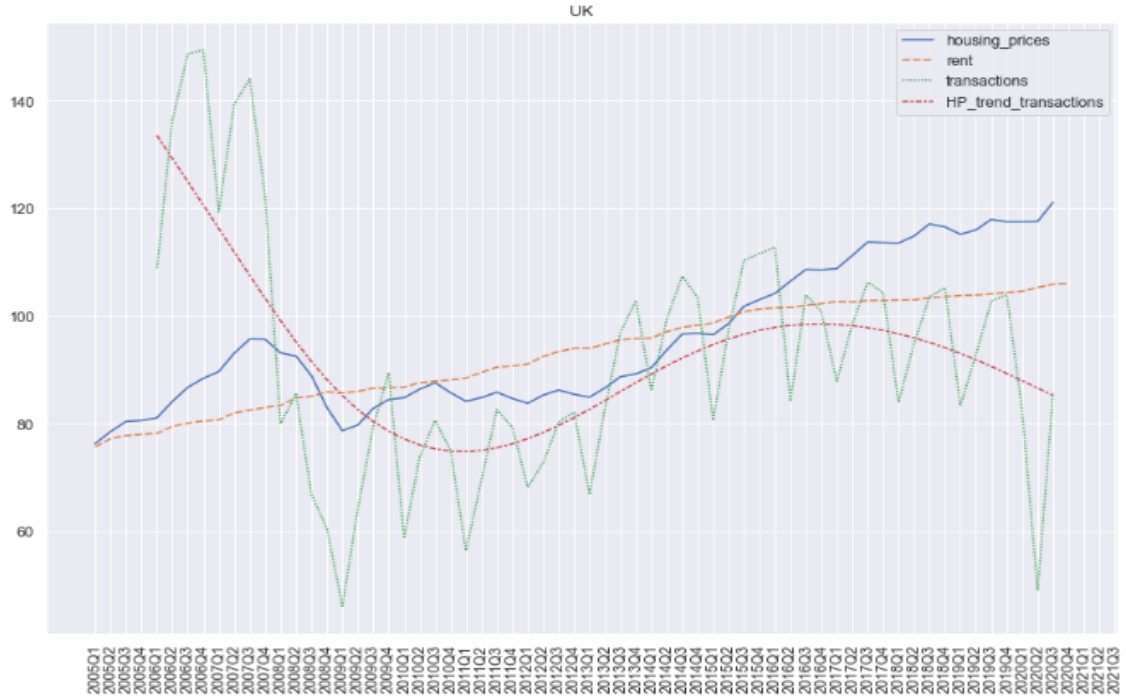
Figure 1: Housing prices, rent, and volume of transactions with transactions HP trend[1] in Hungary. Index:



2015=100

[1] The Hodrick-Prescott smoothing parameter is set to 1600

Figure 2: Housing prices, rent, and volume of transactions with transactions HP trend[1] in the United Kingdom. Index: 2015=100



In our preliminary analysis, we employ VAR models to investigate the predictivity of transaction volume on housing prices in five European countries (the United Kingdom, France, Hungary, Ireland, and Portugal). We use the quarterly index (2015 at 100%) of housing prices, the number of transactions, and the HICP rent component published by Eurostat. Every model is adjusted for the given country, and the aim is to shed light on the hypothesis that an increased number of transactions are predictive of increased prices. That is a positive correlation between the number of transactions and housing prices. To investigate the hypothesis, we searched for available data. Unfortunately, many European countries do not report a number of real estate transactions split into the categories, or their time series are very short. Therefore, we selected the countries with much available data on housing in Eurostat. The data is in the form of a quarterly index with 100 set as the mean of 2015. The shortest time series (Ireland) is 12 years long. In Table 1, we provide the descriptive statistics of each country's dataset used for the models.

Table 1: Dataset description

FR	housing_prices	rent	transactions
count	64.00	64.00	64.00
mean	104.39	96.79	106.49
std	7.53	4.68	20.43
min	90.75	85.54	59.78
25%	100.05	93.81	91.33
50%	102.55	98.96	103.18
75%	106.32	100.44	118.73
max	127.57	102.11	158.32

HU	housing_prices	rent	transactions
count	60.00	60.00	60.00
mean	118.77	102.58	97.30
std	37.63	16.73	29.21
min	84.13	73.84	49.64
25%	91.60	90.77	70.00
50%	100.88	98.32	94.80
75%	139.62	112.48	121.57
max	213.92	136.23	203.25

IE	housing_prices	rent	transactions
count	48.00	48.00	48.00
mean	109.14	105.50	86.23
std	23.50	20.79	32.40
min	74.32	78.80	28.96
25%	89.53	83.15	54.23
50%	106.26	104.55	90.99
75%	133.41	127.02	110.78
max	155.21	139.40	141.52

PT	housing_prices	rent	transactions
count	52.00	52.00	52.00
mean	116.86	100.08	121.05
std	23.76	7.55	40.34
min	92.25	88.54	58.19
25%	98.11	93.56	88.74
50%	107.02	100.02	118.08
75%	130.38	105.46	159.49
max	175.96	113.83	204.78

UK	housing_prices	rent	transactions
count	59.00	59.00	59.00
mean	96.79	93.98	92.41
std	12.96	8.44	23.23
min	78.69	78.20	46.13
25%	85.60	86.65	79.76
50%	93.09	94.80	87.84
75%	108.74	102.45	104.14
max	121.15	105.90	149.43

We also conducted the Johanson cointegration test of the series of the logged variables. *(Table 2)*. Conducting the Granger test of causality, the bi-directional relationship among the time series is not rejected*(Table 2)*. After the cointegration (Johanson' s cointegration test) and unit-root-test (Augmented Dickey Fuller) of the time series logarithms [2], we made differences of the

[2] In appendix

logarithms to make all three series stationary for each country. The models are either VAR(3) or VAR(4).

Table 2: Results of Granger test of causality and Johanson cointegration test for each country

```
GRANGER TEST of CAUSATION FR
                  housing_prices_x  rent_x  transactions_x
housing_prices_y            1.0000  0.0041          0.0000
rent_y                      0.0054  1.0000          0.0077
transactions_y              0.0004  0.0006          1.0000
JOHANSON COINTEGRATION TEST FR
Name   ::  Test Stat > C(95%)    =>   Signif
 ----------------------------------------
housing_prices ::  31.4      > 24.2761   =>   True
rent   ::  8.9       > 12.3212   =>   False
transactions ::  3.22      > 4.1296    =>   False
None
GRANGER TEST of CAUSATION IE
                  housing_prices_x  rent_x  transactions_x
housing_prices_y            1.0000     0.0          0.0000
rent_y                      0.0118     1.0          0.0124
transactions_y              0.0000     0.0          1.0000
JOHANSON COINTEGRATION TEST IE
Name   ::  Test Stat > C(95%)    =>   Signif
 ----------------------------------------
housing_prices ::  41.04     > 24.2761   =>   True
rent   ::  17.18     > 12.3212   =>   True
transactions ::  4.34      > 4.1296    =>   True
```

```
GRANGER TEST of CAUSATION HU
                  housing_prices_x  rent_x  transactions_x
housing_prices_y            1.0000     0.0          0.0460
rent_y                      0.0001     1.0          0.0015
transactions_y              0.0001     0.0          1.0000
JOHANSON COINTEGRATION TEST HU
Name   ::  Test Stat > C(95%)    =>   Signif
 ----------------------------------------
housing_prices ::  34.61     > 24.2761   =>   True
rent   ::  16.28     > 12.3212   =>   True
transactions ::  0.05      > 4.1296    =>   False
GRANGER TEST of CAUSATION PT
                  housing_prices_x  rent_x  transactions_x
housing_prices_y            1.0000  0.0000           0.000
rent_y                      0.6877  1.0000           0.304
transactions_y              0.0001  0.0002           1.000
JOHANSON COINTEGRATION TEST PT
Name   ::  Test Stat > C(95%)    =>   Signif
 ----------------------------------------
housing_prices ::  30.79     > 24.2761   =>   True
rent   ::  12.51     > 12.3212   =>   True
transactions ::  0.09      > 4.1296    =>   False
```

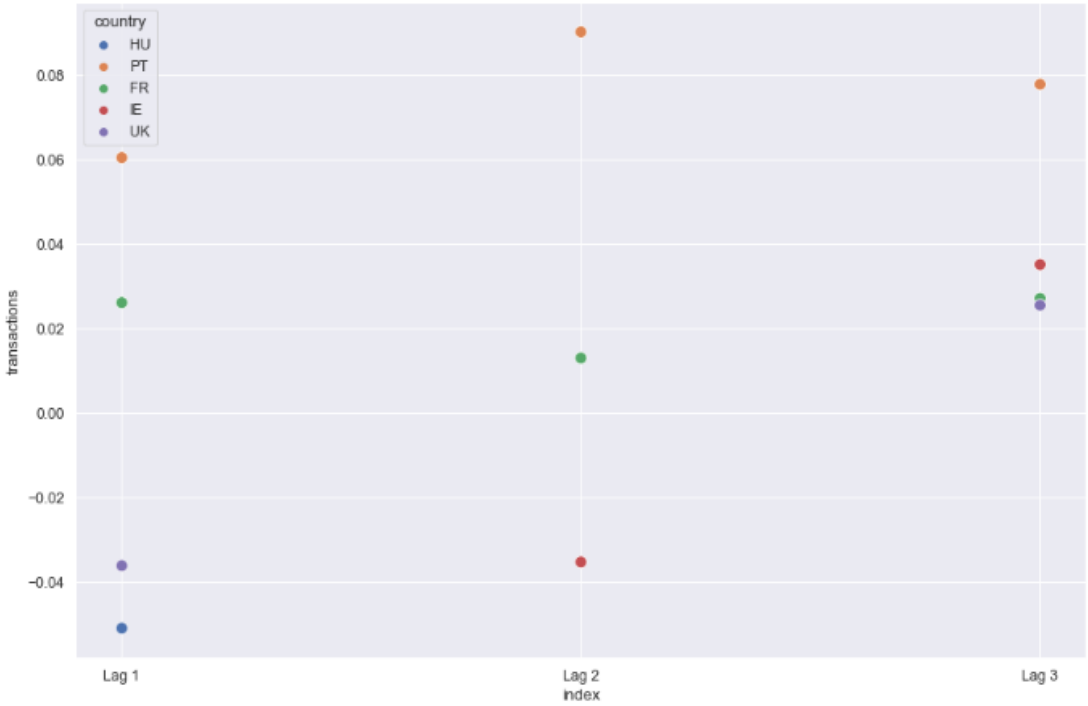
```
GRANGER TEST of CAUSATION UK
                  housing_prices_x  rent_x  transactions_x
housing_prices_y            1.0000   0.000          0.0000
rent_y                      0.0376   1.000          0.0009
transactions_y              0.0000   0.135          1.0000
JOHANSON COINTEGRATION TEST UK
Name   ::  Test Stat > C(95%)    =>   Signif
 ----------------------------------------
housing_prices ::  51.21     > 24.2761   =>   True
rent   ::  17.24     > 12.3212   =>   True
transactions ::  1.27      > 4.1296    =>   False
```

4. Discussion of results

4.1. Results for the European market

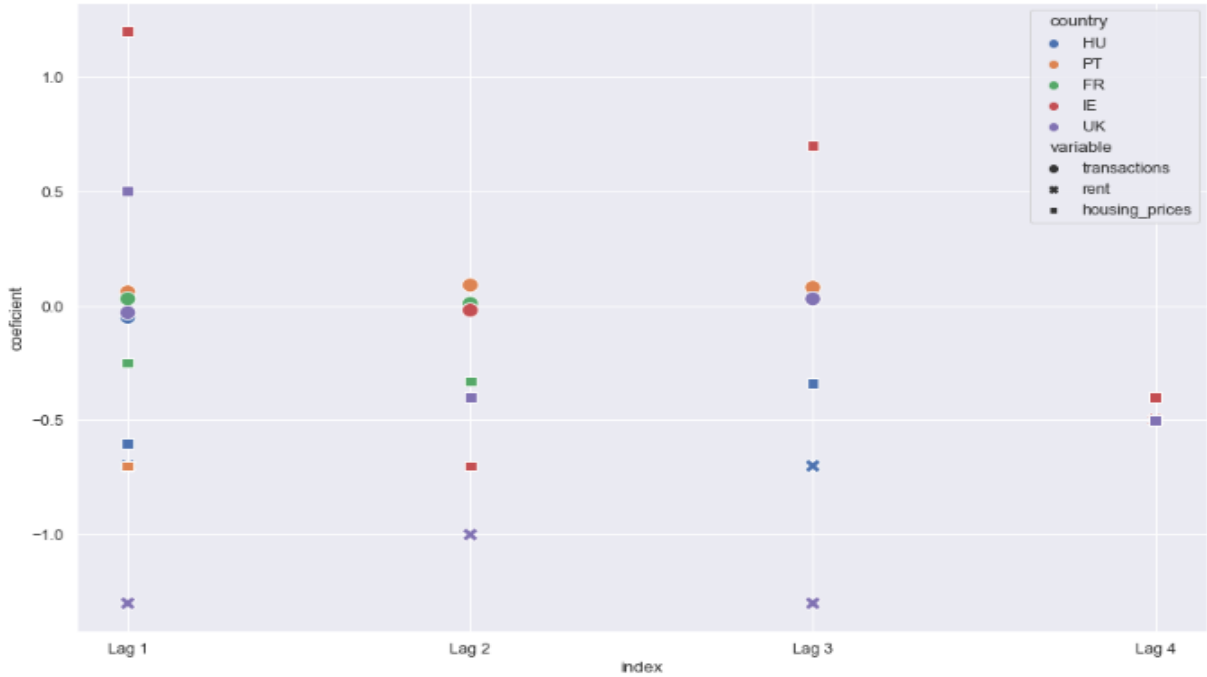
Our analysis provided significant results on the association between the amount of transaction and prices for some countries. The results show that Portugal has the most predictive power of the transaction volume on housing prices. Also, in France, we can speak about some predictability of transactions volume on housing prices. Results for other countries tested showed not to be significant which is in line with Borowiecky (2009) who argues that the differences in the predictability of transaction volume on housing prices can be attributed to heterogeneity in the markets across Europe. However, the important result is that the relationship direction is always positive. We provide the aggregated results for all countries' transaction amount coefficient on the housing prices in Figure 3.

Figure 3: Transaction coefficients of the VAR(3) model for each country on statistical significance level 90% (α=10%). The dependent variable is Housing prices. Insignificant coefficients are omitted.



When looking at all coefficients of the regressors (Figure 4), in Ireland and to a lesser extent in the UK, the strongest predictors of housing prices are their lags. The autoregressive nature of the housing prices follows the conclusion by Gatzlaff & Tirtiroğlu, (1995). Interestingly, the rents lags are negatively associated with the housing prices in the UK. The full results of the regressions are in the appendix.

Figure 4: Transaction coefficients of the VAR(3) model for each country on statistical significance level 90% (α=10%). Dependent variable is Housing prices. Insignificant coefficients are omitted.



The analysis shows that the housing prices are strongly autoregressive and the housing markets across countries differ significantly. As for the relationship of the number of transactions and the housing prices, the association is the strongest in Portugal. That is, demand changes influence the housing prices in Portugal. This phenomenon is less pronounced in France. In the other countries the association between transaction amounts and housing prices is not significant. Interestingly, the rents appear to be related negatively to housing prices in the UK. This might be caused by possible substitution between mortgage financing and paying rents.

As a contribution supported by primary data, we will now offer a detailed insight into the Czech Republic property market and observe recent trends and shocks present in this market. The reason for choosing the Czech market is the data availability, as we own a database of primary data mined from a property selling server. Our data are fully supportive of the hypothesis that increased number of transactions represented by decreased number of active advertisements are predictive of increased prices. Later, we will offer a comparison between sales market and rental market. We will show that rents are not downward rigid. Thus, stagnating or decreased demand in the rental market pushes rents down, creating disequilibrium in property price and yield from rent.

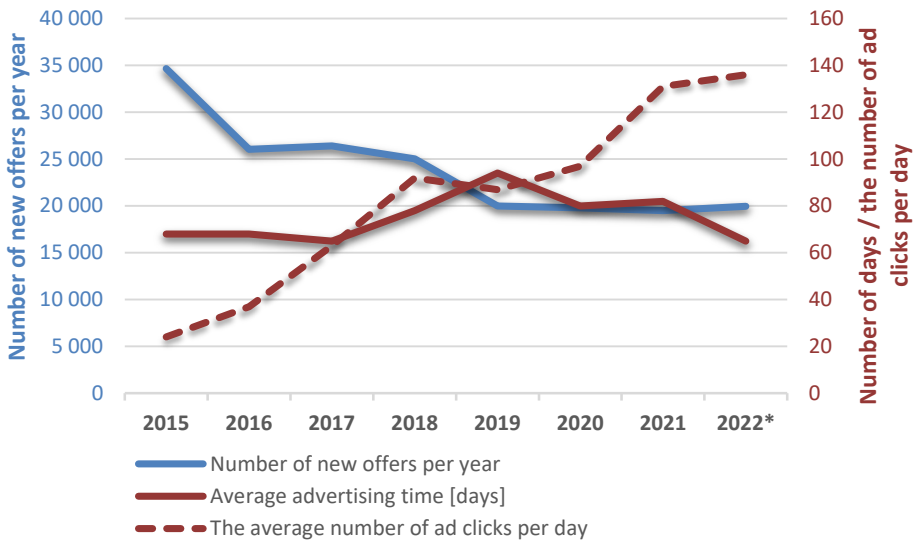
4.2. Key study for the Czech Republic

In the Czech Republic, it is possible to observe a similar development in the real estate market as in the other countries described above. The basis for creating the following statistical outputs is the EVAL software, produced by one of the authors of this article. This software can analyze, collect and evaluate real estate advertising from main real estate servers in the Czech Republic (e.g., https://www.sreality.cz/; https://reality.idnes.cz/).

Data collection takes place in a regular period of one month from 2007 to the present day. The obtained data are subjected to data reliability analysis. Duplicate and unreliable real estate ads are excluded from statistical processing. Data collection is performed for the categories of real estate flats for sale and flats for rent throughout the Czech Republic. Data collection is performed on a detailed scale. Therefore, it is possible to obtain information about any street in the Czech Republic, provided that data from real estate advertising from this street is available.

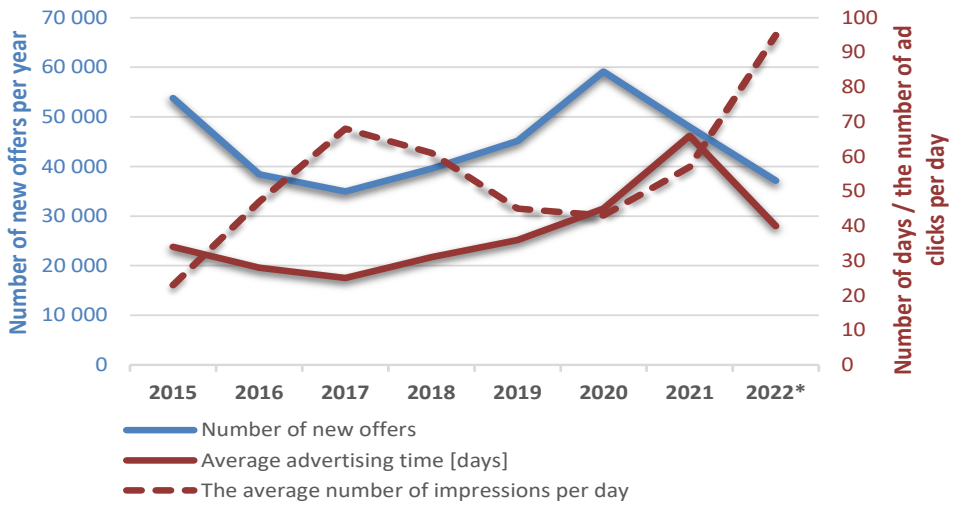
The relationship between the size of supply and demand in the housing market in Prague is shown on figures 5 and 6. Both figures confirm the above hypothesis. The variable “Number of new offers” represents a unique advertisement for a property first advertised in a given year. Average advertising time tells us how long the ad has been in real estate advertising. The average number of ad clicks per day represents information on the average number of times per day the ad was displayed to the requesting side.

Figure 5: The relationship between the size of supply and demand in the housing market in Prague - apartments for sale



Data source: https://www.sreality.cz/, 2015 – 2022.

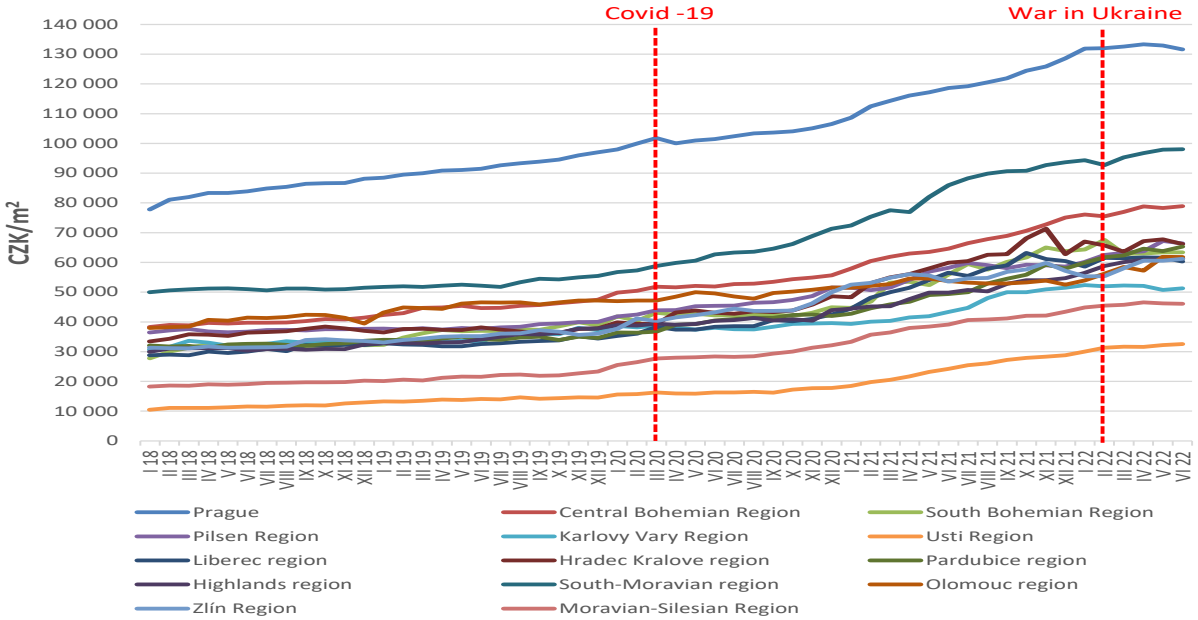
Figure 6: The relationship between the size of supply and demand in the housing market in Prague - apartments for rent



Data source: https://www.sreality.cz/, 2015 – 2022.

The following figure 7 shows the development of offer prices of flats intended for sale in regions in the Czech Republic. There is a significant increase in prices in all regions. This is mainly due to investors' expectations of high inflation and trying to keep the value of the savings. At the same time, investors have trouble finding alternatives to make safe investments. In the last few months, however, there has been a change in the trend in the Prague region, when prices begin to stagnate. This is because real estate prices have risen to such a high price level that real estate has become unaffordable for many investors. At the same time, the Czech National Bank significantly tightened the conditions for providing mortgage loans, which caused a significant drop in the number of newly agreed mortgage loans. The market downturn mainly affects large luxury apartments. Small apartments with a price of up to CZK 5,000,000 will practically disappear from the offer of real estate agencies immediately.

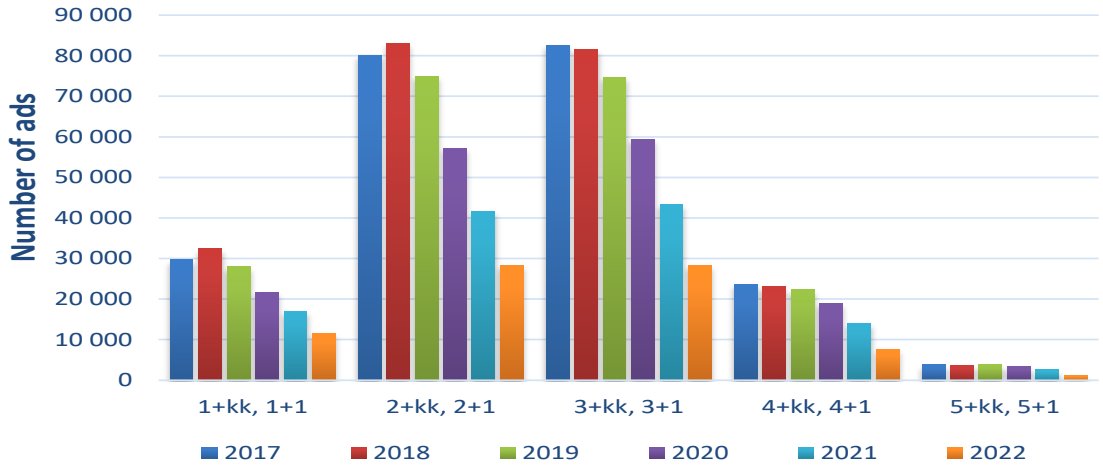
Figure 7: Development of offer prices of flats for sale in regions in the Czech Republic



Data source: EVAL software, January 2018 to June 2022, bid prices, medians.

The structure of the number of flat ads offered for sale in the EVAL software database is presented by Figure 8. Data for the period January 2017 to June 2022 are used. It was found that the following categories of flats are offered the most for sale on the residential market: 2+kk, 2+1, 3+kk and 3+1 ("kk" means kitchenette). This fact is mainly due to the structure of the housing stock in the Czech Republic. Overall, there is a significant drop in the size of the supply of apartments for sale.

Figure 8: The number of ads of apartments offered for sale



Data source: EVAL software, January 2017 to June 2022, corrected number of advertisements per year, the Czech Republic

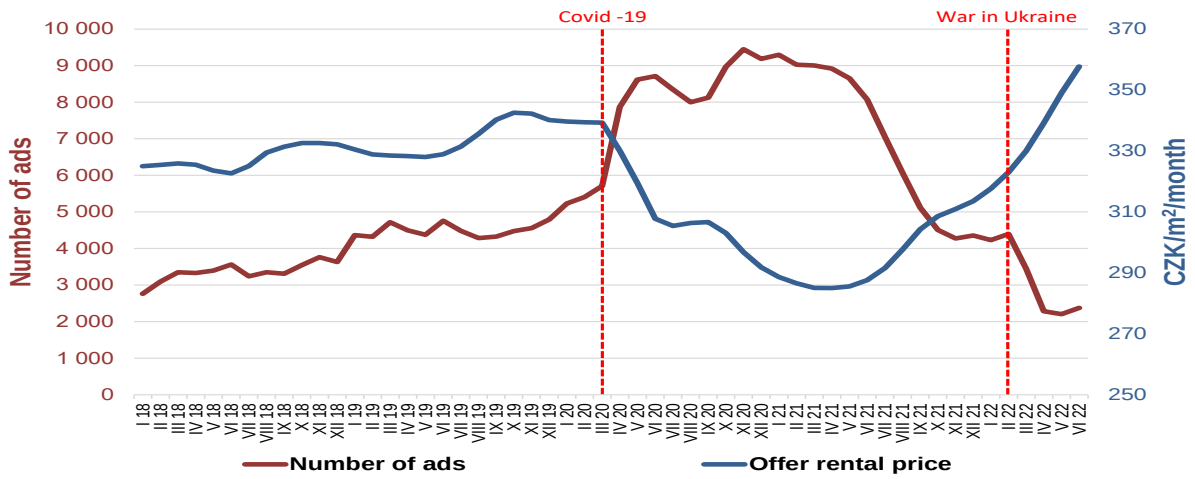
Figure 9 expresses the relationship between the size of the offer of apartments for rent and the rental price in Prague. Prague is dependent on income from tourism and the work of foreign workers. The number of advertisements for apartments for rent is starting to grow as early as the beginning of 2020, when short-term apartment renting through the Airbnb and Booking platforms gradually ceases to operate.

Since March 2020, there has been a jump in the number of advertisements, which was caused mainly by foreign workers who left the Czech Republic, quickly and in a panic. Of course, the completely paralyzed Airbnb and Booking platforms add to this. However, outgoing foreign workers played a key role on a mass scale. In addition, the situation was accelerated by the fact that at one-point (suddenly) thousands of apartments in Prague were returned to the rental market. The real estate market was not able to absorb this oversupply quickly.

The rental market in Prague was severely affected by this development until about the end of June 2020, when the situation improved slightly over the summer. However, in October and November 2020, the situation worsens again. In fact, the Figure 9 faithfully replicates the incidence of coronavirus in society (red line), although that is not its purpose.

Since March 2022, the real estate market has been hit hard by the war in Ukraine. In particular, a large number of war refugees from Ukraine are coming to Prague, and the rental real estate market does not have sufficient capacity to meet this demand. This leads to a sharp reduction in the size of the offer of available apartments for rent. A similar development can be observed in all major cities in Western Europe.

Figure 9: The relationship between the size of the offer of apartments for rent and the offer rental price in Prague



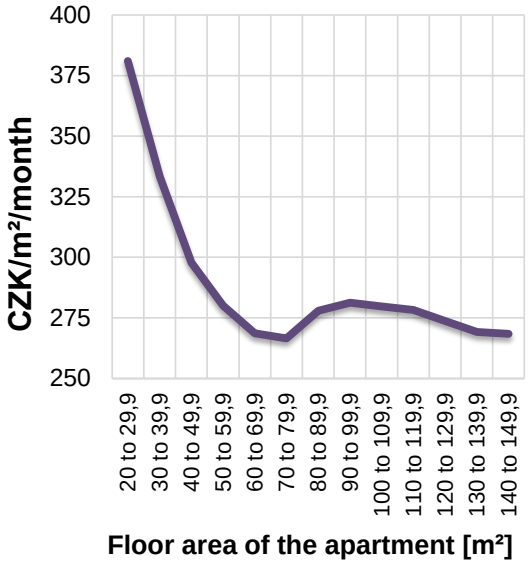
Data source: EVAL software, January 2018 to June 2022, bid prices, medians.

Figure 9 actually expresses the basic economic relationship between supply and demand in the market. As supply decreases (red line), the price rises (blue line) and vice versa. At present, the price level of rent in Prague is historically at the highest level.

Figure 10 shows that as the floor area of the apartment increases, the unit rental price decreases. This is due to the fact that there is the highest demand for small apartments for

rent. Small flats are best affordable in the total cost of renting an apartment (rent + services). Due to the sharp increase in energy costs, such small apartments are more in demand, because lower annual heating costs can be achieved. Due to the high rate of inflation, people have started to save and are more willing to be modest in their housing requirements than in previous years. The largest increase in the prices of flats for rent is observed in small flats in the last year.

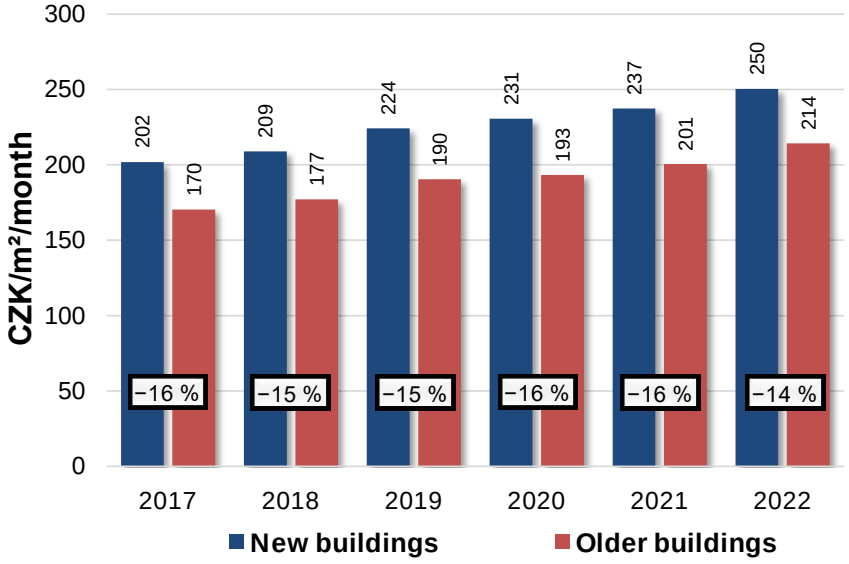
Figure 10: The relationship between the offer prices of apartments for rent and the floor area of the apartment



Data source: EVAL software, January 2018 to June 2022, bid prices, medians, the Czech Republic.

Figure 11 examines the differences between the rental price of an apartment located in a new building and in an older development. It was found that the difference in price is around 15% in favour of new buildings and over the years there are only minimal deviations. This criterion is not essential for the tenant. It is much more important whether the interior of the apartment is after reconstruction or is in its original unmaintained condition. In terms of the location of the apartment in the building, the cheapest apartments for rent are in the basement.

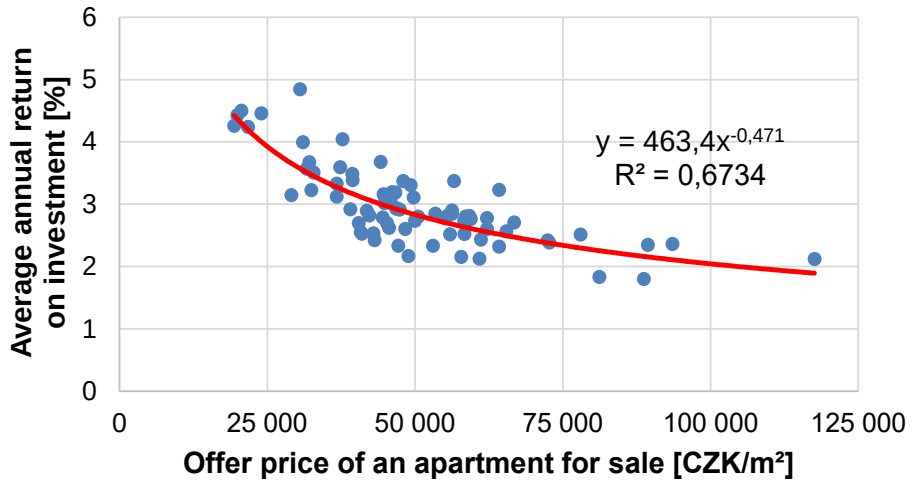
Figure 11: Comparison of offer prices of apartments for rent in new buildings and older buildings



Data source: EVAL software, January 2017 to June 2022, bid prices, medians, the Czech Republic.

Figure 12 describes the relationship between the average annual return on investment and the unit purchase price of the apartment. Individual blue dots in the figure represent districts in the Czech Republic. It was found that as the offer price of an apartment for sale increases, the average annual return on investment decreases. The figure shows the investor's recommendation to leave Prague and other expensive locations and move to cheaper regions.

Figure 12: The relationship between the average annual return on investment and the unit purchase price of the apartment



Data source: EVAL software, 2021 to 2022, bid prices, medians, the Czech Republic.

The Table 3 describes other relationships between the basic technical and economic parameters that are closely related to the real estate market in the Czech Republic.

Table 3: Statistical results of the real estate market

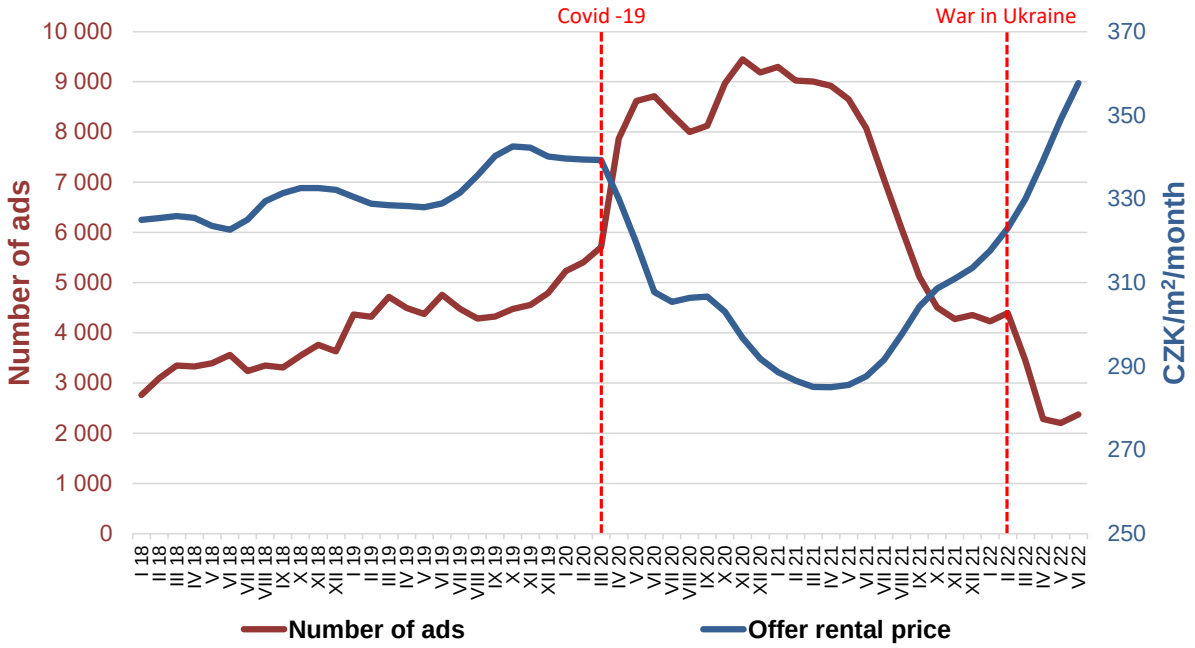
Parameter 1		Parameter 2		Coefficient of determination (R^2)
Parameter name	**Unit of Measure**	**Parameter name**	**Unit of Measure**	
Sale of apartment	CZK/m^2	Average annual rental yield	%	**0.6734**
Average annual rental yield	%	Average number of months needed to repay the mortgage loan	month	**0.703**
Average annual rental yield	%	Number of ads related to the sale of apartments per 1000 inhabitants	Number of ads	**0.0004**
Average annual rental yield	%	Number of ads related to the rental of apartments per 1000 inhabitants	Number of ads	**0.001**
Average annual rental yield	%	Number of ads on new apartments per 1000 inhabitants	Number of ads	**0.182**
Average annual rental yield	%	Share of persons facing distraint	%	**0.388**
Sale of apartment	CZK/m^2	Rent of apartment	CZK/m^2/month	**0.704**

Data source: own calculations, software EVAL, January 2018 to June 2022.

Our results from the rental market indicate a strong dependence between some monitored technical and economic parameters. The strongest correlation was found between the amount of rent and the total selling price of real estate. However, this is not a linear direct dependence but a power dependence. Furthermore, a strong relationship was found between the average annual rental yield and the average number of months needed to repay the mortgage loan. The strong dependence between the parameters “average yearly rental yield” and “share of persons facing distraint” proves to be a warning. This finding points to a dysfunctional subsidized housing system and significant abuse of social benefits associated with housing.

The Czech Republic data confirm our hypothesis about the predictive power of transaction volumes on property prices. The decreasing number of active advertisements for apartment sale as a result of an increased number of transactions in the previous period was followed by a property price increase. We have shown how increase in demand boosts property price. The price increase has been recently very dynamic due to supply inelasticity and due to decreased supply of properties for sale. We have found that supply of second-hand property decreases in periods of instability and high inflation which we are currently experiencing. High inflation or high expected inflation affects in general the number of transactions realized on the property market in two ways: one - second-hand property is not supplied due to a lack of safe investment allocation of revenues from property sale, and two – high inflation and economic turbulences increase investment and business risks of developers (unpredictable increase in building material cost, energy costs, wage costs, shortage of building materials, etc.), so new property is not produced and supplied on the market. Under current conditions in the CEE economies, construction firms and developers are able to guarantee construction budget on monthly basis but not longer. On the demand side, tightening of accessibility to mortgage loans makes the demand for properties less predictable which increases prudency of developers in planning new projects. All these arguments indicate low elasticity of supply of new and second-hand properties and explain decreased number of transactions rather than price decrease in periods of stagnating demand. To the contrary, on the rental market we have observed virtually immediate changes in rental price in response to changes in demand. It has been confirmed that an increase in demand for rentals will induce an increase of rents accompanied with an increased number of transactions made on the market. As rental contracts are usually concluded for short period of time, supply side as well as demand side of the rental market can react very quickly on actual trends on the rental market. In addition, short term commercial rentals (e.g. Airbnb), which is more common for small sized apartments, increase the elasticity of supply of flats for rent as owners can switch quicky from standard to short term rentals.

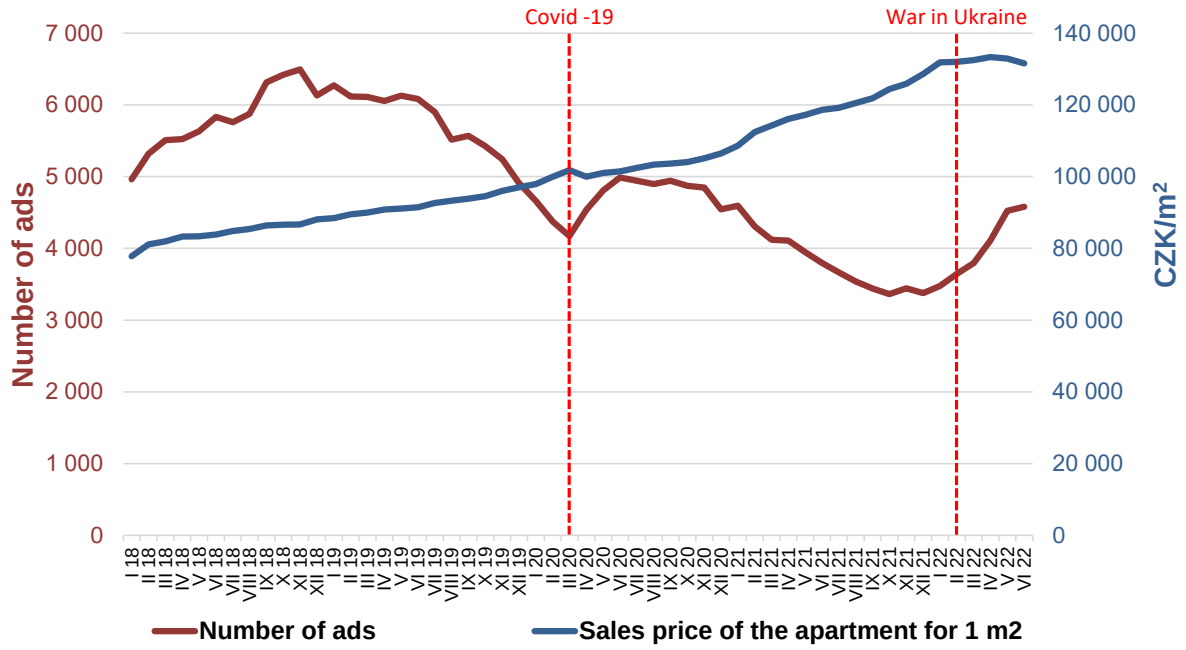
Figure 9: The relationship between the size of the offer of apartments for rent and the offer rental price in Prague



Data source: EVAL software, January 2018 to June 2022, bid prices, medians.

On the contrary, the supply of properties for sale is inelastic as construction of new units is limited by long administrative and construction processes taking up to 10 years in the case of the Czech Republic. This means that developers' decision to build a new property is made under different market conditions than are relevant in the moment of construction finalisation. The administrative delays are longer in cities and areas with high density of population where peaks in demand may boost prices very high. Under such conditions increased demand will hardly increase the number of transactions in the short time.

Figure 10: The relationship between the size of the offer of apartments for sale and sales price of the apartment for 1 m² in Prague



Data source: EVAL software, January 2018 to June 2022, bid prices, medians.

Conclusion

The literature suggests that the housing markets are very heterogenous across countries and within them. This paper aimed to examine the possible association of the demand for housing components. We used the housing price as the dependent variable and the number of transactions and rents as independent variables. Five European countries were selected based on data availability in the Eurostat database. We assumed and examined the bidirectional relationship between the variables, and therefore, we utilized a VAR model for our regression analysis. The results show that the number of transactions up to one year prior positively impacts the housing prices in France and Portugal. If the transaction amount grew in the past four quarters, it is more likely that the prices will rise and will increase more substantially in the current period in these countries. We identified a negative association between rent lags and housing prices in the UK. If the rents have been decreasing, we can expect higher growth in housing prices.

The article offers a deeper insight into the development and trends present in the European residential market whit a key study dedicated to the Czech Republic. The analyzed time interval from 2017 to June 2022 was chosen deliberately to be able to monitor the changes caused by the COVID-19 pandemic and the war in Ukraine. The authors analyzed this issue from various perspectives and examined the dependencies of selected technical and economic parameters of real estate and macroeconomic indicators.

The results show a growing regional disparity in the availability of owner-occupied and rented housing. In addition, the COVID-19 pandemic has accelerated this trend. Given that real estate prices are rising faster than wage growth, social tensions in society can be expected to increase due to the financial unavailability of adequate housing (in terms of size, quality and

location) for an ever-widening population. This trend will accelerate significantly in large cities. The share of rental housing will gradually increase as the affordability of owner-occupied housing decreases, which will affect the form of housing, especially for the young generation. Price development will develop differently depending on the development potential and attractiveness of individual regions. At the same time, income and wealth inequality will continue to grow. Residential housing will continue to be considered a conservative and safe investment. Real estate investment can be expected to take precedence over capital market investments, especially given the restrictions on the quantitative release of money by the FED and the European Central Bank.

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