Evaluation of impact of the Covid-19 pandemic on rental housing prices in the city of Brno between 2020 and 2021

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Abstract. The aim of the paper is an application of the basic principles in determining rental housing prices and factors that may affect them. In the experimental part, an analysis of rental housing in the city of Brno is performed for the 2020 – 2021 period affected by the covid-19 pandemic. The analysis is processed for individual city districts and divided according to apartment layout. Finally, all outputs are compared and the real estate market development is determined with a focus on the biggest changes and their occurrence.
Keywords: rental housing, apartment, market price, the city of Brno, Covid-19

1 Introduction

At present, there are several basic options on the market for addressing housing needs. One of the most sought alternatives is owner-occupied housing, while the other common one is rental housing, where determining rent prices depend on many factors. The most important factors include apartment size, layout as well as location.

The Covid-19 pandemic emerged very suddenly, and the majority of real estate experts feared a decline in property prices similar to 2007. A study by [1] raises a question of revisions most likely to affect apartment prices. SHAP values were used to apply given models, with the values obtained subsequently coming to conclusion that time is the most dominant and consistent variable for the real estate market, specifically renting [2] claim that the rental housing market span is very small worldwide. As a result, macroeconomic damage to the market stability is reported. The authors simulate a model where macroeconomic stability is represented by reforms strengthening the rental housing market. The model´s first

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step is to discuss criteria for choosing housing. The next step is a proof of private rent attenuation. Finally, a DSGE model is introduced satisfying housing needs.

Currently, most people are looking for their new homes online. However, it is possible to come across very little known information that online housing markets provide to future tenants. [3] address the issue in the United States using American Community Survey census statistics and Craigslist geolocated advertising minilones. It was found that future tenants lack essential information about the socio-economic layout of neighbourhoods. The authors focus on describing and identifying of types of information commonly available in statements in various neighbourhoods.

A document created by [4] discusses behaviour of housing companies engaged in long-term rental housing and common rental housing and the impact of competition on these companies with the use of numerical stimulation. Their results show that if companies make strategic adjustments, even though they are only minor adjustments, it is important to maintain the system stability. Companies decentralized with long-term rental of apartments, which have a higher market share, can influence rentals of general rental use.

A similar issue is addressed by [5]. Again, the paper is related to the USA focusing on millions of Craigslist rental statements. It was revealed that differences between tenants are in demographic differences such as age, language, rent or household size. The online environment more frequently offers housing markets in larger cities. Although the Craigslist contains detailed and valuable data, it does not evenly represent all market segments. Technologies such as the Craigslist create new human interactions and have the ability of planners to track.

On the contrary, [6] primarily aims at types of properties and the dynamic link related to price and rent in Singapore. The past analyses do not take into account links between property types and are static. The authors deal with segments of the housing market that may be affected in various market cycles by shocks resulting from macroeconomics. The research found that price is determined by rent and yet the properties are interconnected. Another consequence involves shocks that affect declines in rents for non-residential housing and demand from one property type to another [7] draw their attention to European cities, specifically Krakow, and the impact of the Covid-19 pandemic on rents. Results of the research conducted by the authors showed a decrease of 6-7% in the first wave, which was in contrast with assumptions of real estate agents (about 13%). In the next wave, the subsequent decline was immediately seen (by 6.25%). Owing to the study, however, the decline in rents was precisely determined and forecast. Regardless of how much economy changes next year, rent prices will continue to fall [8] examine dynamic correlations between rent and price in the four-stage real estate markets, i.e. offices, housing, factory and retail. They focus mainly on the Hong Kong area between January 1993 and December 2008, where the Dynamic Conditional Correlation Multivariate Stochastic Volatility (DCC-MSV) model and the Bayesian Markov Chain Monte Carlo (MCMC) model are applied to capture time-varying price and volatility correlations. Throughout the period under review, the results show that rental volatility is significantly lower than price volatility in real estate markets for each type. Regarding the above mentioned stages, it was found that the correlation between rent and price in the housing market differs the most in time compared to the other three markets. In addition, the correlation in the office market is more stable than in the factory market. In 1997 and 2003, they were defined as two very unstable periods.

However, [9] study how the Covid - 19 pandemic in its first months affected the housing market in 49 largest regions of the United States. Using pandemic severity measures and a unique rental list dataset, the authors found that the Covid - 19 pandemic reduced median and average rents only in Latin Quarters. White neighbourhoods, on the other hand, are experiencing an increase in rents.

Other paper compares the static and social consequences of a simple rental housing market model and homeowners in a single framework. To examine dynamics of the comparative model, [10] generates an impulse response of rental housing prices as well as apartment and house occupancy patterns. The model forecasts an external supply of housing as opposed to realism, where the author uses the version of free entry to the supply as an extended direction [11] analyses the occurrence of housing subsidies using a Finnish panel, where the main sample included 500 000 households that received housing allowances in the 2000 – 2008 period. The results show that a significant part of the subsidies goes to rental prices. Considering subsidies, however, the demand for rental housing increased, which is not in line with the objective of subsidies. Results calculated by the author are very similar to those presented in studies that deal with the same research problem. Provided that all calculations from the studies are correct, the author recommends reviewing the housing subsidy system reform [12] looks into artificial neural networks able to create a model that will forecast the ability to survive future financial crisis in a particular company. Out of three selected neural networks, the aim is to find a specific network able to classify the company based on input data.

The main prerequisite for identifying value generators for construction companies is the use of the EVA Equity indicator, as presented by [13]. Data including financial statements of construction companies in the 2006 – 2015 period are used and arranged in a table, and based on the results, adequate methodologies and identification of generators are developed. The following variables are considered to be the most important indicator: equity, bank loans, economic growth for the current period, and others [14] also focus on construction, which is an important part of the national economy. The outcome of their research involved strong impact on construction development with a relatively small group of companies. As regards the results, the authors deduce the future development of the construction industry based on a selection of 59 companies. They also emphasize that it is necessary to verify the representation of companies over time [15] deals with life cycle cost (LCC) analysis. According to the author, the commonly used approach is used in the early phase of projects, since the greatest benefit from LCC is obtained there. In the Czech Republic, the public sector initiates applications for LCC quantification when deciding on construction. The author summarizes her experience from LCC, where benefits (and significant difficulties) of the public sector are identified and summarized [16] are concerned with processing of quantity take-off (QTO) from data generated from the BIM model. A case study and exploratory methods are employed as well as an outdated process used for quotations of 2D documents. Subsequently, the authors deal with construction pricing without lengthy calculations provided from BIM calculations.

The main goal of the paper by [17] is the use of data collection methods, particularly primary data used to determine costs of energy efficiency measures. Furthermore, the authors present results of a model that is very unique, i.e. national cost calculation, and is seen as the optimal calculation method. In selected types of buildings, a method of primary energy consumption is used.

2 Development of rental housing prices on the real estate market around the year 2019

In general, it may be argued that rent prices copy (with a certain time lag) real estate prices. The assumption in 2019 was that rent prices would soon reach their maximum. This was mainly due to the fact that such prices in the city of Brno had been growing at a very fast pace, with rental housing prices rising even more dynamically in 2019 than in 2018, which could therefore be considered a period with optimistic prospects. The economy of the Czech Republic was at its peak in 2019 and can be regarded prosperous. Thus, it was more

advantageous for the solvent part of the population to invest money so that inflation does not reduce its value. The largest demand was related to small flats, which is one of the main reasons why the average price per m^2 in Brno was the highest for small apartments (CZK 331 per m^2), as may been in the Table below. In terms of the Czech real estate terminology, the Table also includes specific abbreviations of apartments on the basis of their layout. The smallest apartments (hereafter referred to as "1+kk") consist of a single room with a kitchenette. Larger apartments contain either two rooms witch a kitchenette (hereafter referred to as "2+kk") or three rooms with a kitchenette (hereafter referred to as "3+kk"). There are also apartments including 4 rooms with a kitchenette (hereafter referred to as "4+kk").

Table 1. Average rent prices in Brno (October, 2019)

Apartment Layout	Average Rent [CZK/m²]	Total Average Rent [CZK/m²]	Average Deposit for Services
1+kk	331	10950	2200
2+kk	269	13500	2700
3+kk	221	16750	3500
4+kk (and larger)	191	19850	4000

Source: Development of real estate prices in Brno and its surroundings, 4th quarter of 2019, *remaxpro.cz* [online], Ing. Tomáš Fráňa, 01/2020 [cit. 2021-04-02] Available at: www.remaxpro.cz/vyvoj-cen-nemovitosti-v-brne-a-okoli-4-ctvrtleti-2019/.

From a global point of view, however, neither the European nor the world economy gave the impression of promising development during that period. The German economy was on the verge of recession, the United States were about to impose tariffs on European cars, and Britain was about to withdraw from the European Union. Therefore, an economic crisis onset was predicted for a number of reasons. In the Czech Republic, the Czech National Bank (CNB) sought to slow down the overly dynamic real estate market since 2016 by reducing the availability of mortgage loans and raising interest rates. The CNB strategy was functional until 2018, as from 2019 interest rates began to fall again. The downward trend did not stop until January 2020 and interest rates began to rise again. The increasing tendency of mortgage loans led to a decrease in their availability and at the same time a decrease in demand for mortgages. The important fact is that real estate prices were already very high at that time. In combination with the estimated economy development, it was therefore assumed that real estate prices in the next period would rather stagnate or grow slightly. However, the COVID-19 pandemic, which broke out in the Czech Republic in March 2020, became a key factor in the development of prices on the real estate market.

2.1 Real estate market in the city of Brno during the Covid-19 pandemic

As stated by Fráňa (2020), there are two categories of buyers in the case of buying and selling real estate. The first category comprises people who are not worried about their future (provided they have a job, business, sufficient financial background, etc.) and who have a tendency to purchase. The second category includes people who postpone purchasing of real estate, mainly due to the following reasons:

- concerns about Covid-19 (they do not want to view properties),
- uncertain future (fear of losing their job or falling income),
- fear of getting into debt or preferring to keep money in cash,

- expecting a fall in prices (speculation with the influence of pandemic prices, etc.)

Considering rental housing, Brno has a fairly stable base of residents. The number of tenants who have chosen rental housing over owning real estate is not declining, and rather an increase in rental housing preferences may be expected due to the current uncertainty. An integral part of those interested in rental housing involves people living in Brno only temporarily. Such tenants can be divided into several key groups:

The first group consists of **students** as the city of Brno has several high schools and universities. The problem with apartments rented and occupied by students can occur when high schools and universities are closed. The tenants may then tend to ask for a reduction or remission of rent. Other group of people involves tenants **living in Brno for work reasons**. In the pandemic period, the economy is weakened and the question is how long the pandemic measures will last and what the state of the economy will be after this period. So far, redundancies have been selective and only some areas of services are weakened. According to [21], however, terminations of rental housing have been minimal so far. A very specific group involves **foreign students and foreign employees**. Due to quarantine measures and border closures, this group is the only one that the Brno rental market can lose. It remains to be seen when and under what conditions they will be able to return and whether their jobs will still be available.

As reported by [19], the COVID-19 pandemic has disrupted production worldwide and is causing major GDP losses. According to available results, the year 2020 is considered to be one of the worst in economic history. According to Bloomberg, the world economy has suffered one of the worst declines since World War II, due to the pandemic and the response to it.

[20] states that the first and most affected category is related to short-term apartment rentals. A few years ago, the Airbnb phenomenon largely dominated in big cities. Many investors acquired real estate for the purpose of short-term rentals to foreigners. At the same time, however, short-term accommodation and the said platform depend on the number of visitors to the given city, its influx of visitors from abroad and tourism. In this respect, the short-term accommodation market is currently completely suspended and there is hardly any demand for this type of accommodation nowadays. Apartments for short-term rent remain empty, while the solution is to offer apartments for long-term rent. Freeing of such a large capacity of apartments will currently have a major impact on the rental market.

[21] notes that during March 2020, an accelerated change of tenants was recorded in Brno. During March to April 2020, real estate agencies registered a rapid increase in advertisements. The main influence on their rapid growth is mainly due to apartments from short-term housing platforms of the Airbnb type, which are currently without use. In Prague, the impossibility of using apartments for short-term rent poses a huge problem, with a substantial number of apartments being in the Airbnb mode. However, Brno has a significantly lower number of tourists than Prague, and for this reason there are fewer apartments and houses rented in relation to the number of apartments for long-term rent. The vast majority of Airbnb apartments are only in the historical part of Brno, or close to the city centre.

3 Material and methods

The experimental part of this paper is focused on evaluating price development on the apartment rental market in the city of Brno monitored between June 2020 and May 2021 and affected by the Covid-19 pandemic. Input data source subjected to analysing includes advertisements of apartments for rent on real estate websites, namely sreality.cz, bezrealitky.cz, as well as advertisements of individual real estate agencies. Overall, there are

4 362 advertisements used and put into different categories. The advertisements are continuously recorded and data are divided in tables taking account of individual time sequences, i.e. 06/2020, 09/2020, 12/2020, 03/2021, 05/2021. Subsequently, they are separated according to the respective city districts, and are further sub-divided on the basis of a layout into three main categories (the first category: 1+kk and 1+1 – the latter being apartments with a single room and a kitchen; the second category: 2+kk and 2+1 – the latter being apartments with two rooms and a kitchen; the third category: 3+kk and 3+1 – the latter being apartments with 3 rooms and a kitchen). The last assessed factor involves conditions of rental housing units, where apartments are classified into the above-standard category (apartments in new buildings or recently reconstructed apartments), the standard category (apartments in average conditions for regular use) and the below-standard category (apartments of older date, not reconstructed or maintained). Then, prices per m^2 and their development in the period under review in individual locations and categories are determined.

Additionally, it should be noted that the city of Brno is the second largest city in the Czech Republic and is located in the South Moravian Region in the southeast of the Czech Republic. The city consists of 29 city districts, 48 cadastral areas and, according to the Czech Statistical Office, has about 381 000 inhabitants (data from 2020) and its area is 230.18 km^2. The minimum altitude is 190 m above the sea level, while the maximum altitude is 497 m above the sea level.

To achieve a telling result, the first step in evaluating the collected data is to assess the overall situation and eliminate certain extremes (for instance, non-standard apartments with bathrooms in hallways or outside the apartments or, conversely, apartments above standard with saunas, duplex / multi-storey apartments, apartments with oversized terraces, etc.). The elimination is followed by a comparison of values for individual periods. Regarding the available statistical methods, mode, median or arithmetic mean can be used, with mode being the value that has the highest frequency. In this case, however, the data are divided into sub-categories depending on which part of the city they fall under. As some categories do not contain enough data, it is inappropriate to use mode. Median is used as the mean value of sets which are extremely different. Since extremes are excluded here, the use of median values is inappropriate as well. The following is therefore applied:

$$\bar{x} = \frac{1}{n} \cdot \sum_{i=1}^{n} x_i \tag{1}$$

Where:
n = the number of apartments for rent / advertisements.

4 Results and discussion

Particularly included are results of the Real Estate Market Analysis in the city of Brno carried out on the basis of apartment classification according to several basic characteristics, i. e. city districts, apartment layout and apartment conditions.

4.1 Development of rental housing prices on the local real estate market

Following from the experimentally analysed data, it is possible to determine certain development of the rental housing market in Brno. The first analysis is summarized in Figure 1, where the graph shows price development of individual apartments divided according to

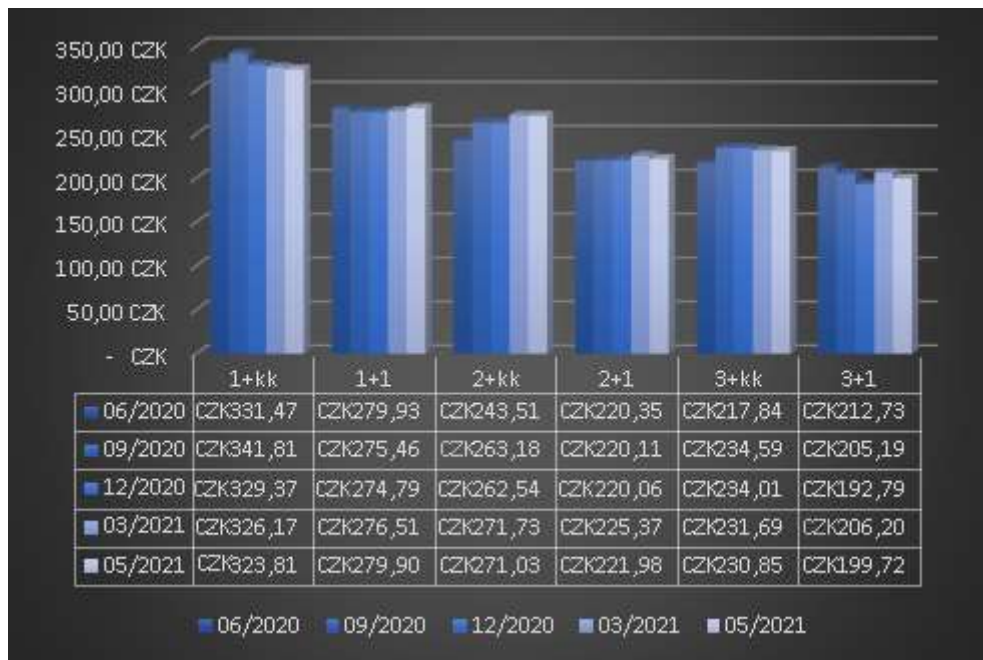their layout in the period under review without distinguishing between city districts or apartment locations.

Figure 1. Summary analysis of rental housing prices in Brno according to layout. (CZK/m^2)
Source: Own processing.

It can be stated that the price of an apartment should grow in direct proportion to its increasing layout. At the same time, however, it is observable on the market (and this fact also follows from the analysis performed) that small-size apartments are currently the most sought-after category. Apartments with the 1+kk layout are the most expensive and, as the analysis proves, the average price per m^2 decreases with an increasing layout.

4.2 Development of rental housing prices on the real estate market in relation to city districts of Brno

Based on the number of properties advertised for renting, city districts are divided into three categories. The first category includes the following districts: Bosonohy, Chrlice, Ivanovice, Jehnice, Kníničky, Ořešín, Tuřany, Útěchov and Vinohrady. No apartments for rent with sufficient informative value that could be used in the analysis were recorded here as the districts are located in the suburbs of Brno. The second category consists of the following districts: Bohunice, Černovice, Jih, Jundrov, Kohoutovice, Komín, Líšeň, Maloměřice and Obřany, Medlánky, Nový Lískovec, Slatina, Starý Lískovec and Žebětín. There are more apartments for rent here than in the first category, but the number of their advertisements is not sufficient to determine a genuine informative value. The last category comprises the following city districts with a high number of advertised properties: Bystrc, Královo Pole, Řečkovice and Mokrá Hora, Sever, Střed, Žabovřesky and Židenice. They are either located in the city centre and its immediate surroundings or development projects and intensive construction works are taking place there. Thus, there is a greater interest in them resulting

in a larger amount of apartments for rent. An overall comparison of prices in the last category of districts is shown in Figure 2.
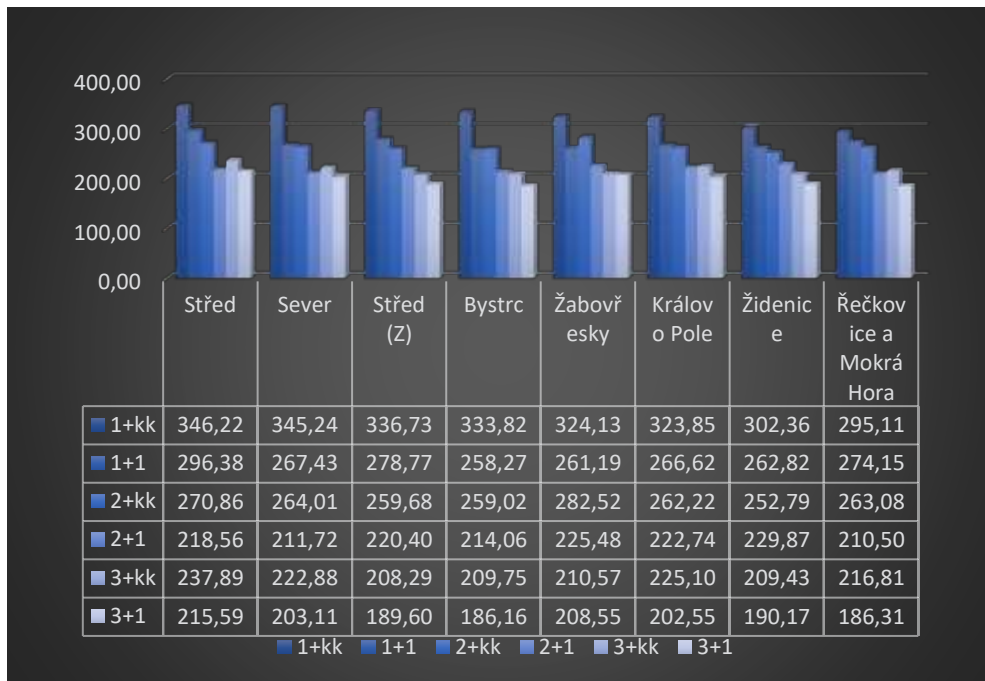
	Střed	Sever	Střed (Z)	Bystrc	Žabovřesky	Královo Pole	Židenice	Řečkovice a Mokrá Hora
1+kk	346,22	345,24	336,73	333,82	324,13	323,85	302,36	295,11
1+1	296,38	267,43	278,77	258,27	261,19	266,62	262,82	274,15
2+kk	270,86	264,01	259,68	259,02	282,52	262,22	252,79	263,08
2+1	218,56	211,72	220,40	214,06	225,48	222,74	229,87	210,50
3+kk	237,89	222,88	208,29	209,75	210,57	225,10	209,43	216,81
3+1	215,59	203,11	189,60	186,16	208,55	202,55	190,17	186,31

Figure 2. Summary analysis of rental housing prices in Brno based on city districts. (CZK/m^2) Source: Own processing.

Having categorized the collected data according to the city districts, it can be determined that the most lucrative apartments can be found in the city district of Brno - Střed (without the cadastral district of Zábrdovice). Other lucrative apartments are located in the city district of Brno - Sever. They are followed by apartments in the city district of Brno - Střed (including the cadastral district of Zábrdovice) and Bystrc with their average price being in a similar price range, and also the Žabovřesky and Královo Pole districts with only slight nuances in the average price development. The last city districts whose average price per m^2 is the lowest of the evaluated locations are Židenice and Řečkovice and Mokrá Hora.

4.3 Development of rental housing prices on the real estate market in relation to apartment standards

The last assessed factor affecting prices is related to what impact apartment conditions have on prices. In order to make the analysis and price determination as accurate as possible, the last examined quarter, i.e. 05/2021, was used along with the city district of Brno - Střed, where most advertised apartments are situated. The results are presented in Figure 3.
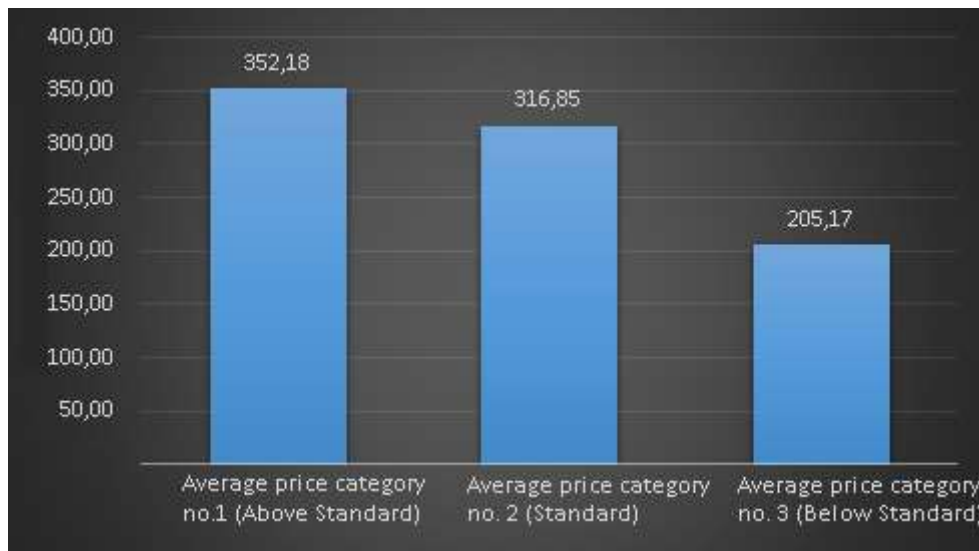
Figure 3. Development of rental housing prices depending on apartment standards and equipment
Source: Own processing. (Value in CZK)

   As can be seen from the analysis results, property conditions significantly affect rent prices. It follows that reconstructed or modernized and newly constructed (above-standard) apartments are more expensive at the price of CZK per m^2 (by 11.2%) than standard apartments, whilst the prices of below-standard apartments are more than 35.2% lower than the standard ones.

5 Discussion

Considering the analysis of rental housing development in the city of Brno, it is essential to collect a sufficient amount of data in relation to the period under review to be able to achieve an adequate informative value. The number of advertisements used in the analysis amounted to 4 362, with their given groups shown in Figure 4.
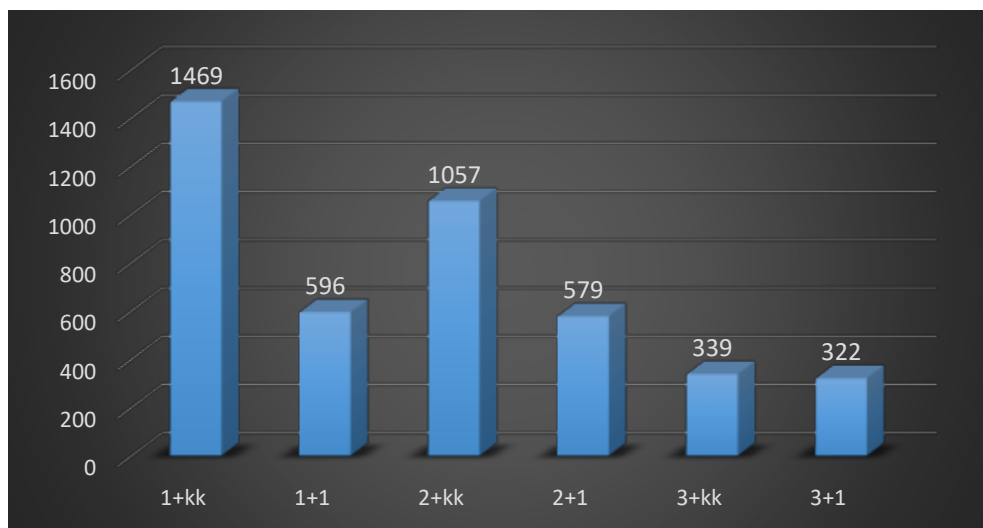

Figure 4. Number of advertisements classified on the basis of apartment layout
Source: Own processing.

Collected data from the advertisements indicate that apartments with the 1+kk layout (small apartments) are the most advertised ones for rent. This is confirmed by a 2019 survey by the Trikaya real estate agency listing purchases and rentals of small apartments as one of the most lucrative.

The lucrativeness of small apartments is also reflected in the price analysis results of rental housing in Brno. According to Trikaya, the average price of a 1+kk apartment in Brno was CZK 331 per m^2 (as of October 2019). In relation to the pandemic situation, the director of the RE/MAX Pro real estate agency, Ing. Tomáš Fráňa, informed about the rising number of apartments advertised on the real estate market in Brno in April 2020. With the pandemic being on a slight decline over the summer months, the situation stabilized and, as based on the analysis of rental housing in 06/2020, the price remained at 331 CZK per m^2 for 1+kk apartments. However, the analysis also shows that consequences of the COVID-19 pandemic become most evident for 1+kk apartments. To clearly illustrate that, below is a graph of rent price development of 1+kk apartments (Figure 5) and a trend curve of the pandemic development (Figure 6).
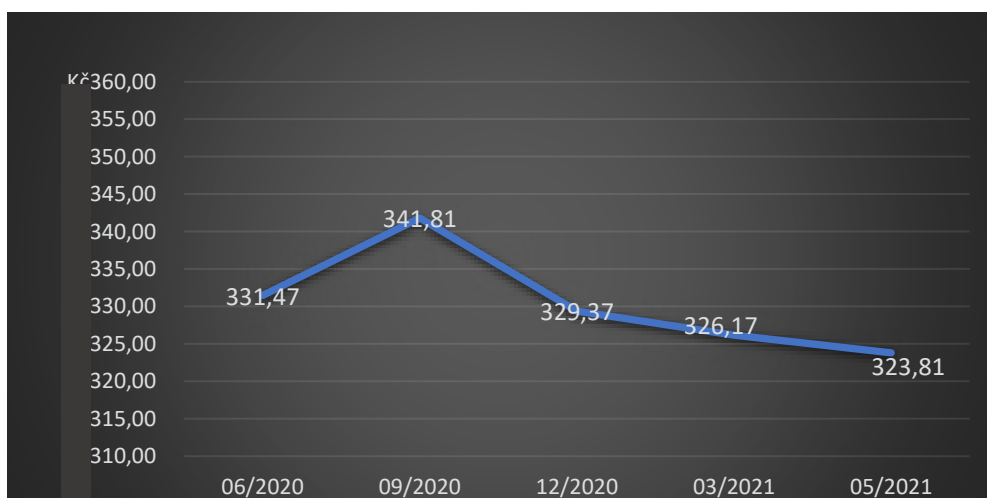

Figure 5. Price development of 1+kk apartments for rent in Brno (Value in CZK)
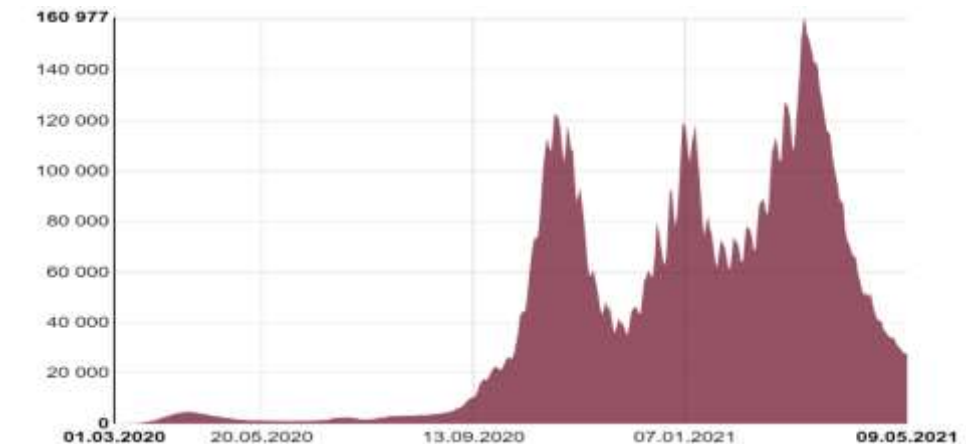Source: Own processing [22].

Figure 6. Trend development of the number of people with laboratory-proven COVID-19
Source: The Ministry of Health of the Czech Republic, 2021, available at: onemocneni-aktualne.mzcr.cz/covid-19

[23] claims that Brno has a lower number of tourists than Prague, hence there are fewer apartments rented in the form of Airbnb. It can therefore be assumed that the impact on the real estate market in Brno will not be so noticeable. However, the above analysis shows that at the turn of 09/2020 and 12/2020 there are significantly more advertisements, with the majority of them being unoccupied apartments and "hotel-type" apartments. Thus, the deteriorating COVID-19 situation and the increased number of advertisements can be considered as the cause of price decrease in small apartments between 12/2020 and 05/2021. That also corresponds to the assumption of the Association for the Development of the Real Estate Market stating that prices of properties for sale may fall in the short term, but the decline will not be long-term. This follows from the Trend Report 2020. The situation is different for apartments intended for rent, where the already mentioned short-term rentals pose the main issue.

6 Conclusion

The paper presents an experimental evaluation of the price development on the real estate market during the pandemic Covid 19. The evaluation works with data obtained from the real estate market of the statutory city of Brno in comparison with input data sources obtained from various internet portals. In the evaluation of the price development, we deliberated between the available statistical methods, but in the end, it is not possible to use any of the static methods, so our chosen formula was used.

The results of the experimental evaluation of the price development in the real estate market finally showed that as far as the apartments with 1+1 and 2+1 layout are concerned, the price has remained unchanged with only slight nuances during the period under study. However, in the case of flats with a layout of 2+kk and 3+kk, there was an increase in prices per sqm in the period 09/2020 (despite the fact that the increase in prices for 3+kk flats is not as significant as for 2+kk flats, where the price increased from CZK 243.51 per sqm to CZK 271.03 per sqm). However, according to the available Trikaya statistics, the price of 2+kk flats reached CZK 269 per sqm. Thus, this increase can be considered as a comparison of the price level after the decline that occurred in the first wave of the pandemic. Another factor for the increase may be the lower number of 2+kk and 3+kk apartments advertised and the fact that university students are returning in September to start the new semester. As a result, larger flats, which are often shared by students, will also be used.

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