Relationship between real estate and stock market during the coronavirus crises in the Czech Republic

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Abstract. This paper deals with the relationship between the residential house price index and the stock markets at the time of the coronavirus pandemic in 2020. The research focuses primarily on the real estate market in the Czech Republic and the development of the Prague Stock Exchange index. The period from 2007 to the end of 2020 is monitored. The subject of the examination is not the assessment of the severity or type of crisis, only the development of markets and their shocks. House price index (HPI) and stock market indices are used for consistent analysis. To find a broader context the mortgage interest rate and the unemployment rate are used. With the help of correlation and analysis of implemented government measures, the basic conditions for the development of indices and measures are sought. Government measures are not only aimed at local conditions, but often also affect cooperation in international trade and traveling. The aim is to evaluate the degree of dependence of the development of real estate and stock markets on measures implemented to reduce the effects of the crisis. The reason is also the fact that there are many common variables (tradable banking companies, local and international investors, etc.).

1. Introduction
The current situation in the world is increasingly proving that people can adapt to challenging conditions. This is not only due to modern technology and the pace of its development. It is primarily the ability to acquire and evaluate information. In an instant, anyone can find out what is happening in a neighbouring city or on another continent, in a variety of sectors and topics. Also for this reason, in this article, seemingly unrelated sectors and shocks in the Czech Republic for 2020 are put in context. These are house prices (House Price Index), the stock market (PX Index) and information on the progress of the fight against the COVID-19 epidemic. Data on unemployment and interest rates are also added. The data are presented for illustrative purposes, including historical developments. The impacts of the spread of historical infectious diseases are compared, and COVID-19 has a greater impact than it did for SARS [1].

Before COVID-19 became a global problem and issue, it was difficult to imagine the impact on individuals, let alone national and international economies. The change in the behavior of the basic economic actors (investors and households) in the Czech Republic is already demonstrable with the data available and presented in this paper. In 2020 and beyond, the behavior of these actors, in the context of real estate and equity investment, could primarily be guided in two basic ways:
2. Literature Review

There are many studies on COVID-19 from a medical point of view and they are still growing. On the other hand, papers dealing with the impact on economies and the real estate market have been slower in coming. Studies in 5 major cities in Australian states have presented results of a 1.26-1.77% p.a. decline in property prices when the number of infected people doubles over a period of time [2]. A possible substitution effect is also discussed. The thesis of declining real estate prices in regions with higher rates of promotion or less developed medical care is confirmed by a Chinese study [1]. The decline in residential property prices is quantified at 2.47% over the next three months, further depending on the situation [1]. One of the earliest papers dealing with COVID-19 and house prices [3] describes high liquidity constraints and credit generation as a tool to counteract the rise in house prices due to the large amount of money in the economy, due to possible quantitative easing. Based on the calculations, the relationships between different actors in the industries in China have also changed in 2020 [4]. This fact also affects the real estate market, as it is dependent on industry. Construction output is transformed by industrial output into products tradable in the real estate market. Furthermore, changes in transport, storage and production constraints are described [4]. These changes are also associated with an acceleration of development in the commercial sector and a shift of customers to the online environment. Changes in the use of existing properties and land are addressed as the impact of COVID-19 on commercial buildings is significant [5].

The COVID-19 shock has a demonstrable negative impact on the high sensitivity of long-term bond yields to index volatility in the run-up to the pandemic [6]. Increasing liquidity through quantitative easing has a greater effect on stock performance in sectors that are more constrained due to the epidemic [7]. Within [7], the performance of U.S. industries are analyzed with the conclusions that the performance impact was caused by the announcement of quantitative easing and the restoration of investor confidence.

The literature contains analyses of the real estate market and COVID-19 or financial markets and COVID-19. The link between the house price index and the stock market is presented below.

3. Methodology and Data

The research used quarterly HPI and Unemployment data from the Czech Statistical Office [8] [9]. Furthermore, monthly values of the PX index of the Prague Stock Exchange [10] and monthly average interest rate of FINCENTRUM HYPOINDEX [11], which are presented for the entire banking system in the Czech Republic. HPI values are presented as a national average. In these cases, these are hard data that can be objectively counted on. In order to illustrate the epidemiological situation, information from the official websites of the Ministry of Health [12] [13], the Ministry of Industry and Trade [14] and the Ministry of Finance [15] is further used.

The Prague Stock Exchange is not a well-known international market. However, international companies are also present here. It is possible to invest in the banking sector, the energy sector, the arms industry, IT companies or the food industry. All tradable securities are included in the PX index, which is the subject of this paper, as a representative descriptive sample of the Prague Stock Exchange. The current legal form of the exchange was established in 1993, although this year it celebrates 150 years since its foundation [10]. The volatility of stock markets is generally higher and faster than that of real estate prices, as the actual securities trades are more quickly settled. The volume per transaction tends to be higher for real estate and for many investors (households) one investment for life.
Among the government measures, the following were selected as major measures that had an impact on the behavior of economic agents. There were, of course, more measures taken. However, an analysis of the adequacy of their use in combating the epidemic is beyond the scope of this paper. The list of selected measures is recorded in Table 1.

Table 1. List of government measures taken [12]

| Date       | Description of Government intervention                                                                 |
|------------|---------------------------------------------------------------------------------------------------------|
| 24.02.2020 | 1. statement by the Minister of Health on the new situation in the world                                 |
| 12.03.2020 | Declaration of a state of emergency                                                                     |
| 16.03.2020 | Restriction of population movement - until 1 April                                                      |
| 06.04.2020 | Slight loosening of retail and outdoor sports                                                           |
| 17.05.2020 | Ending the state of emergency                                                                          |
| 17.08.2020 | All districts in the country remain free from risk of community transmission                           |
| 28.08.2020 | In Prague, there is incipient community transmission of COVID-19                                        |
| 05.10.2020 | Declaration of a state of emergency                                                                     |
| 22.10.2020 | Restricted retail and services, office activities and free movement of residents                        |
| 20.11.2020 | The government has decided to extend the state of emergency until 12 December                          |
| 10.12.2020 | The government has decided to extend the state of emergency until 23 December                          |
| 23.12.2020 | Government extends state of emergency for another 30 days                                               |

The data were analyzed using the CORREL function in MS Excel. These are the pairs of Stock vs. HPI, Interest rate vs. HPI and Unemployment vs. HPI. Correlation was first done for the period 2008 - 2020 (available data) and then for 2020 only. The change in trend of these values is compared. By combining the time series of the indices, measures and dates of government measures, the impact of the measures taken on the evolution of these markets is monitored.

4. Results
The key insight is that the uncertainty in the form of the global COVID-19 epidemic has been reflected in the decline of the PX index. Immediate action and handling of the situation by government officials and the provision of assurances of priorities on protection of the population and economic activity returned confidence to economic agents. This fact caused the declines to be no higher. The development of the PX index after the start of the epidemic is copied by foreign markets, such as the NASDAQ-100 Index [16]. However, the PX index did not return to its original level as it did abroad. However, in contrast to other studies from abroad, residential property prices have started to increase. Real estate acts as a certain investment, especially in the case of acquiring a home of one's own and storing equity as a protection against inflation. This is supported by falling mortgage interest rates and abolished the property acquisition tax (4%) of the purchase price with effect from 1 January 2021 [15].
Figure 1. Development of selected indicators [8] [9] [10] [11].

The Ministry of Finance has also granted extended tax filing deadlines to economic entities in 2020, waived advance payments to businesses in closed industries, and is preparing a subsidy program for affected industries [14] [15]. Deferment of loan repayments was also discussed [15]. The curtailment of economic activity in some sectors is reflected in rising unemployment rates. We cannot speak only of seasonal fluctuations.

House prices (HPI) have not seen a decline even with the announcement of the presence of an epidemic or a high increase in the number of infected or stricter government measures.

The relationship between house prices (HPI) and the stock market (PX index) is such that financial volumes shift from stock markets to property markets. In terms of the dependence of these two markets, the correlation coefficient over the period 2008-2020 comes out at -0.124. The value indicates independence to slight inverse dependence, which supports the thesis of a transfer of financial transaction volumes between other investment options including Real Estate Investment. The indirect dependence increases to -0.258 in the 2020 assessment, see Figure 2.

There is a high inverse dependence between Unemployment and HPI, at -0.866. However, this coefficient subsequently changes to a value of 0.965. This is due, among other things, to support from the state to prevent people from becoming insolvent.

Figure 2. Indicators with government intervention [8] [9] [10] [11].
There is a high degree of inverse dependence for Interest Rates relative to HPI. It is -0.479 for the whole period under review. This changes rapidly in 2020 as interest rates continue to fall, encouraging new loan arranging and house prices rise. The value of the correlation coefficient is at -0.958.

During states of emergency and times of restricted movement of people, property inspections were also restricted, thus delaying the processing of property transactions. However, due to this situation, virtual tours and online interviews with real estate agents’ clients flourished.

Due to the development of the number of infections in 2020, only the last quarter of the year can be considered extreme. However, the Czech health sector waited until the second quarter of 2021 for the highest extreme. Here, however, HPI data is not yet available, and therefore the graphs in Figures 1 and 2 end with December 2020.

Figure 3 shows the epidemiological waves. The initial shock in March 2020 had a much higher impact on equity markets than the subsequent three very aggressive waves. From a social point of view, it could be said that economic actors adapted to the situation and sought solutions to move their economic activities to the virtual space (e-commerce, home office, development of delivery companies, etc.).

5. Conclusion
The article dealt with the relationships between real estate prices, the value of securities on the Prague Stock Exchange and other aspects of unemployment and interest rates, all in the context of the spread of COVID-19 in the Czech Republic. The relationship between house price index and PX index has been found in the research of house prices and other related aspects. This is a correlation with an inverse relationship of -0.258 in the year 2020. Government anti-epidemic interventions during 2020 did not cause such significant fluctuations in these markets as the initial shock of the announcement of the presence of COVID-19 in the Czech Republic. However, the government intervention did not allow the PX index to return to its pre-Coronavirus form in this market. Given the degree of dependence, part of the volume of financial transactions has shifted specifically to the real estate market, namely residential real estate. Market rules of supply and demand also apply which currently corresponds to the rise in prices. Real estate prices need to be constantly monitored because of the potential for price bubbles and wider financial crises, as a large number of economic operators are involved in the real estate markets.
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