

# RESIDENTIAL REAL ESTATE AS A POTENTIAL HEDGE OF CAPITAL AGAINST INFLATION

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| ARTICLE INFO                                                                                                                                                                                                                                            | ABSTRACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| <b>Keywords:</b><br>real estate market, inflation, cointegration test, inflation headgining                                                                                                                                                             | There is a belief among investors that real estate is an excellent way to protect capital from depreciation due to inflation. Research does not provide a clear answer as to whether this investors' belief is correct, but some approaches indicate that simple econometric methods are not able, especially in the short term, to clearly indicate the existence of a relationship between inflation and property prices (Fogler, 1984). The purpose of the study –was to find the relationship between residential real estate prices and inflation in the Polish economic conditions. Methodology of the study - the study used cointegration analysis with the Engle - Granger test. The research was carried out in the period from the first quarter of 2009 to the fourth quarter of 2021. The real estate hedonic indices calculated by NBP (National Bank of Poland) and the actual and forecasted inflation rates published by the GUS (Central Statistical Office) and the NBP (National Bank of Poland) were used in the research. The result - the analysis led to a negative verification of the research hypothesis, as it could not be proved that real estate prices were related to the level of inflation during the researched period. Originality/value - the study fills a gap in the Polish market regarding the analysis of the possibility of using real estate as a hedge against inflation. The research concerned only the Polish market, but this issue has not been taken up for years, also in mature economies. |
| <b>JEL Classification:</b><br>G11, R30, R31, R39                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Citation:</b>                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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## 1. Introduction

In recent years, Poland has seen both a significant increase in property prices and the consumer price index - inflation. The common belief of investors is that real estate is an effective hedge against the negative effects of accelerating inflation. However, research conducted in other markets shows that this is not always true. Some researchers point out that real estate is not so much a hedge against rising prices, as it may be the cause (Muellbauer, 2015). The topic of rampant inflation is currently one of the most important issues being discussed by economists. Therefore, it is worth taking a look at the relation of real estate prices to the rising inflation rate in Poland. The research will be carried out on quarterly data including real estate market indices and quarterly inflation data. Both actual and expected inflation data have been obtained for the study. The study will use cointegration analysis using the Engle - Granger test

(Engle & Granger, 1987). The author set as the aim of the study to find the relationship between residential real estate prices and inflation in the Polish economic conditions. In order to achieve the goal, the research hypothesis was set that residential real estate effectively protects the value of capital from the effects of inflationary processes.

## 2. Literature overview

Economic and political turmoil makes investors look more actively for opportunities for diversified asset allocation. Periods of high inflation also mean that the most popular investments are those that are commonly associated with capital protection against the negative impact of inflationary processes. Such assets include real estate. The possibilities of investing in real estate are quite wide. However, the research shows that the possibility of capital protection with investments in the real estate market depends on many factors, including the research method chosen

to analyze the problem of the relationship between real estate prices and inflation. The literature review conducted is selective in nature. The author decided to cite only some of the very many works to show how different results can be obtained depending on the market, method or period of study.

One of the first research papers on the topic of the relationship between house prices and inflation was a study by Fama and Schwert (1977) showing that U.S. residential real estate allows capital to be protected from inflation. The researchers examined the relationship of house prices to both expected and unexpected inflation. The period from 1953 to 1971 was considered, using both quarterly and monthly data. The results found that residential real estate investments hedge against expected inflation, but not against the unexpected part of inflation. Slightly different results were obtained by Matysiak et al. (1996). The authors found that commercial real estate does not hedge capital in the short run, but that, in the long run, there is a positive relationship between real estate returns and expected and unexpected inflation. The study was conducted on the indirect and direct real estate market in the United Kingdom from 1964 to 1993. The analysis was done with the help of cointegration by Engle - Granger and Johansen tests. Stevenson and Murray (1999) conducted a study on the market in Ireland. The study used data from 1985 to 1996. Regression and cointegration analysis were used. Changes in the direct property market were measured by the Irish Property Index, while CPI was taken as inflation. The database contained semi-annual quotations. The authors found no relationship between the property market index and the CPI, and this in both the short and long term. Additionally, it was shown that an increase in real estate market prices can lead to an increase in inflation. Yongqiang and Tien (2004) conducted a study in the Chinese real estate market testing the chances of protecting money from inflation by investing in real estate markets. The study was conducted in four major cities, i.e. in China, Beijing, Chengdu, Shanghai and Shenzhen, using Autoregressive Integrated Moving Average models (ARIMA). The results do not indicate the long-term capital preservation ability of real estate investment, but the causality test shows that there is significant unidirectional causality from inflation to real estate returns. The study used both OLS linear regression and cointegration analysis. The quarterly data covered the period from 1996 to 2002. Trojanek (2007) analyzed the relationship of residential real

estate prices in Poznań from 1996 to 2004 by examining the relationship in relation to expected and unexpected inflation. The research showed that real estate can effectively hedge capital against inflation. Le Moigne and La (2008) examined the Canadian market to protect capital from the impact of inflation (the paper takes CPI as inflation) by investing in the direct real estate market from which quarterly returns were calculated using Appraisal-based indices. The study was performed from 1973 to 2007. The results for the entire period show that real estate hedges against inflation, both expected and unexpected. However, from 1985 to 2007 in a low inflation environment, only real estate investments in British Columbia and Quebec hedged against expected inflation. Obereiner and Kurzrock (2012) conducted a study using cointegration analysis with Engle - Granger and Johansen tests on the German market from 1992 to 2009. The study showed that real estate investments hedge capital against inflation in the long run, but no relationship was found in the short run. The real estate market, in the study represented by real estate stocks and real estate investment trusts, provided a hedge against inflation in the long run. Lee (2013) used regression analysis and cointegration analysis to examine the relationship between returns in Hong Kong's direct investment market and inflation. Lee showed that residential property market returns and inflation are cointegrated. He also showed that changes in inflation precede changes in property returns. Data from the real estate market, stock market, and bank deposits from 1980 to 2008 were considered. Yeap and Lean (2017) conducted a study in the Malaysian market examining the asymmetric ability of real estate investments to protect the value of capital from the impact of inflation. The study was performed on the residential (real estate) market using the Nonlinear Autoregressive Distributed Lags (NADRL) approach. The authors found that investments in terraced housing hedge against consumer inflation in the long run, while no investment hedges against energy price inflation. In the short run, none of the real estate investments are able to hedge against consumer inflation and energy inflation. The study was conducted using local real estate price indexes, CPI, and the benchmark West Texas Instrument (WTI) crude oil price as an indicator of energy inflation. The study was conducted from Q1 1999 to Q4 2015, resulting in a total of 68 observations. The Malaysian market was also studied by Lee and Isa (2019) however extending their study

to other asset classes such as stocks, bonds and gold. They obtained results that, while stocks and government bonds provide a hedge against inflation, real estate provides only a partial hedge. The study was done from 1980 to 2016, using The Autoregressive Distributed Lag (ARDL) approach for studying the relationship over the long term. The house price index came from the National Property Information Centre (NAPIC). Taderera and Akinsomi (2020) conducted a study in the South African market. The authors analyzed the ability of commercial real estate (CRE) to hedge against inflation. The study used a Vector Error Correction (VEC) model for integrated time series. The long-run relationship between commercial real estate returns and inflation was analyzed. The properties were divided into office, retail and industrial. This study shows that, in the short run, investment in commercial real estate does not provide a hedge against inflation. In the long run, commercial and industrial properties hedge capital against inflation, while the relationship between inflation and office property prices was not statistically significant. Commercial real estate yields do not respond immediately to changes in inflation, taking time to adjust to economic conditions. The database included the CPI for inflation and commercial property prices provided by the Investment Property Databank. The research period covered 1995 to 2016, and the data was analyzed on an annual basis.

The Polish market lacks research on the impact of inflation on the level of property prices. This is not particularly surprising, as for the last twenty years, inflation has been within the inflation target and has not been of interest to the wider public. Exactly the same gap is observed in developed economies, where recent research on the phenomenon is hard to find. Apart from the work of Trojanek (2017), other studies of a similar nature can be found on the Polish market, except that they address the issues of the relationship of property prices with selected economic factors, market equilibrium, or the impact of certain factors on property prices. (e.g. Żelazowski, 2011; Bełej & Kulesza, 2015; Batóg, 2016; Dittmann, 2016; Kubus, 2016; Foryś & Tarczyńska-Łuniewska, 2017; Brzezicka et.al., 2018; Wolski, 2020; Trojanek, 2021).

### 3. Evidence on real estate and inflation

Although research on the relationship between real estate prices and inflation is widespread around the world, it is difficult to find a similar work for the Polish market. Filling this gap, the author decided to use the

analysis of cointegration with the Engle - Granger test in order to achieve the aim of the paper: to show the relationship between real estate prices and inflation. The research hypothesis was formulated in order to achieve the goal: housing properties effectively protect the value of capital from the effects of inflationary processes.

#### 3.1. Data

The analysis was based on hedonic indices of residential real estate prices calculated on the secondary market for 7 cities (Gdańsk, Gdynia, Łódź, Kraków, Poznań, Warsaw, Wrocław) - denoted in the study by CitiesIndex7, for 10 cities (Białystok, Bydgoszcz, Katowice, Kielce, Lublin, Olsztyn, Opole, Rzeszów, Szczecin, Zielona Góra) - denoted in the study as CitiesIndex10, and for 6 cities of Poland (Gdańsk, Gdynia, Łódź, Kraków, Poznań, Wrocław) - denoted in the study as CitiesIndex6. The choice of indices was determined by the availability of data. NBP (the Polish central bank) counts hedonic indices only for those groups of cities. The author decided to choose hedonic indices, not average prices, being convinced that they reflect the state of the market much better. Hedonic indices adjust price changes to changes in qualitative features of properties which allows measuring "pure" price change not resulting from qualitative differences (Widłak 2010; Foryś, 2016; Trojanek, 2018). Inflation indicators were also used in the analysis. The CPI was taken from data published by the Central Statistical Office (Statistics Poland). The expected inflation rate, denoted in the study by the abbreviation ExpCPI, was estimated on the basis of NBP publications: projected inflation levels four quarters ahead. The inflation projection is prepared by the Department of Economic Analysis (DAE) of the National Bank of Poland and the reports on this projection are published three times a year on the NBP website. The constructed database covered the period from the third quarter of 2006 to the fourth quarter of 2021 in the case of hedonic indices of house prices and CPI. The ExpCPI expected inflation index, on the other hand, covered data from the first quarter of 2008 to the fourth quarter of 2021. A thorough analysis of the data, however, led to a limitation of the research period. The author chose the research period from the first quarter of 2009 to the fourth quarter of 2021 due to the price developments in the property market. This excluded the period of the financial crisis, which was also reflected in the property market, from the research.

The variable CPI4 was also introduced into the database. This is the CPI inflation rate shifted back four quarters. Thus, something like a predicted inflation was obtained. This time, however, NBP models and calculations were not used. It was

considered that the next year's realization is the current expectations. This procedure limited the research period from the first quarter of 2009 to the fourth quarter of 2020.

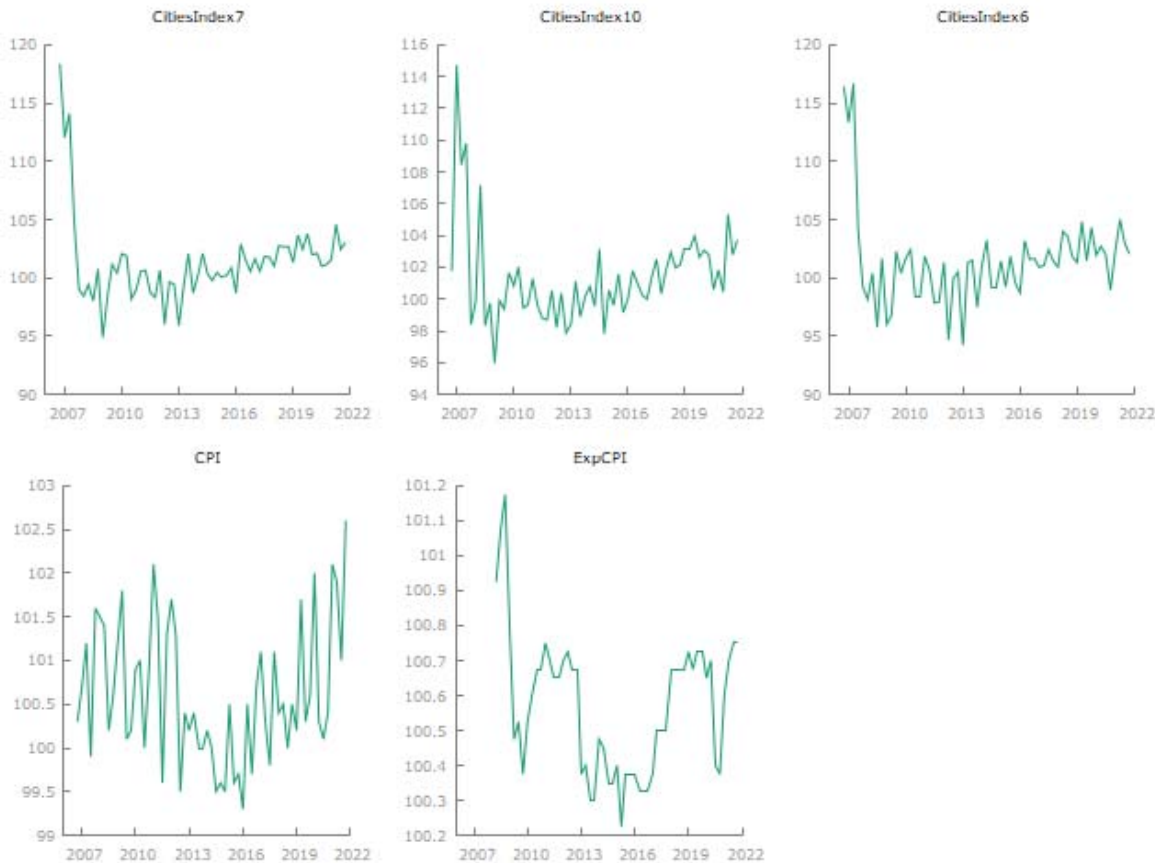


**Fig. 1.** Analyzed quotations from 1Q 2009 to 4Q 2021. *Source:* own study.

### 3.2. Methodology

The study used cointegration analysis with the Engle - Granger test (Engle & Granger, 1987). Cointegration was tested between successive hedonic indices and the CPI, CPI4 and the ExpCPI inflation forecast index. The cointegration equations tested used a lag of four quarters for the explanatory variables: real estate market indices. The explanatory variables in these equations were consecutive hedonic indices of residential real estate prices on the secondary market in Poland. Thus all hedonic indices calculated by NBP were analyzed. In the first step, a unit root test was performed for the successive variables. The model with a constant was tested:  $(1 - L)y = b_0 + (a - 1) * y(-1) + \dots + e$  and 4lags. The time series of levels of successive variables were expected to be non-stationary, thus the null hypothesis of a unit root

is not rejected. In the next step, the unit root was tested for the residual process (uhat) (residuals) using a model without a constant:  $(1 - L)y = (a - 1) * y(-1) + \dots + e$ , with 4 lags. This time the residual (uhat) process from the cointegrating equation was expected to be the process for which the null hypothesis of a unit root is rejected. A similar methodological approach was used by Lee (2013) in his work. Gretl software was used to perform all the presented calculations.

### 3.3. Research results

Searching for the relationship between real estate prices and inflation indices, the author decided to conduct a cointegration analysis. It was decided to use the Engle - Granger test, with ADF test with constant. According to the methodology of this test, cointegration occurs if, for each process used, the null

hypothesis of a unit root is not rejected and the residual process (uhat) from the cointegrating equation is not integrated - that is, the null hypothesis of a unit root is rejected.

In order to demonstrate the existence of cointegration, the condition in which the null hypothesis failed to be rejected for each variable must be met, while for the residuals, the null hypothesis was rejected in favor of the alternative hypothesis.

Table 1

**Cointegration test for real estate indices and CPIs**

Augmented Dickey-Fuller test for unit-root null hypothesis:  $a = 1$ ; test with constant; model:  $(1 - L)y = b_0 + (a - 1) * y(-1) + \dots + e$

| including 4 lags of (1-L)    | CitiesInd ex7 | CitiesInde x10 | CitiesIndex 6 | CitiesInde x7 | CitiesInde x10 | CitiesInde x6 | CPI     | ExpCPI  | CPI4    |
|------------------------------|---------------|----------------|---------------|---------------|----------------|---------------|---------|---------|---------|
| No. Of observations          | 47            | 47             | 47            | 43            | 43             | 43            | 47      | 47      | 43      |
| Test statistic $\tau_c(1)$ : | -0.860        | -0.520         | -0.917        | -1.281        | -0.958         | -1.237        | -0.540  | -1.587  | -0.557  |
| Asymptotic p-value:          | 0.801         | 0.885          | 0.783         | 0.640         | 0.770          | 0.661         | 0.881   | 0.489   | 0.877   |
| 1st-order autocorrelation    | -0.023        | -0.020         | -0.052        | -0.021        | -0.033         | -0.043        | -0.010  | -0.031  | -0.037  |
| coeff. for e:                |               |                |               |               |                |               |         |         |         |
| Lagged differences:          | 4.050         | 4.657          | 6.042         |               |                |               | 3.579   | 0.288   |         |
| F(4, 41) =                   | [0.007]       | [0.003]        | [0.001]       | X             | X              | X             | [0.014] | [0.884] | X       |
| Lagged differences:          | x             | x              | x             | 4.092         | 4.206          | 5.907         | x       | x       | 2.820   |
| F(4, 37) =                   |               |                |               | [0.008]       | [0.007]        | [0.001]       |         |         | [0.039] |

Augmented Dickey-Fuller test for uhat including 4 lags of  $(1-L)uhat$ ; unit-root null hypothesis:  $a = 1$ ; test without constant; model:  $(1 - L)y = (a - 1) * y(-1) + \dots + e$

|                               | 47      | 47      | 47      | 47      | 47      | 47      | 43      | 43      | 43      |
|-------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| No. Of observations           | 47      | 47      | 47      | 47      | 47      | 47      | 43      | 43      | 43      |
| Test statistic: $\tau_c(2)$ = | -1.033  | -0.790  | -1.063  | -0.958  | -0.624  | -1.066  | -1.474  | -1.372  | -1.355  |
| Asymptotic p-value:           | 0.895   | 0.933   | 0.890   | 0.909   | 0.952   | 0.889   | 0.773   | 0.809   | 0.814   |
| 1st-order autocorrelation     | -0.019  | -0.021  | -0.045  | -0.018  | -0.028  | -0.045  | -0.005  | -0.003  | -0.025  |
| coeff. for e:                 |         |         |         |         |         |         |         |         |         |
| Lagged differences:           | 4.000   | 5.151   | 6.170   | 3.973   | 5.066   | 6.033   | X       | x       | X       |
| F(4, 42) =                    | [0.008] | [0.002] | [0.000] | [0.008] | [0.002] | [0.001] |         |         |         |
| Lagged differences:           | X       | x       | x       | x       | X       | x       | 3.572   | 3.660   | 5.526   |
| F(4, 38) =                    |         |         |         |         |         |         | [0.014] | [0.013] | [0.001] |

There is evidence for a cointegrating relationship if:

- (a) The unit-root hypothesis is not rejected for the individual variables, and
- (b) the unit-root hypothesis is rejected for the residuals (uhat) from the cointegrating regression.

Source: own study.

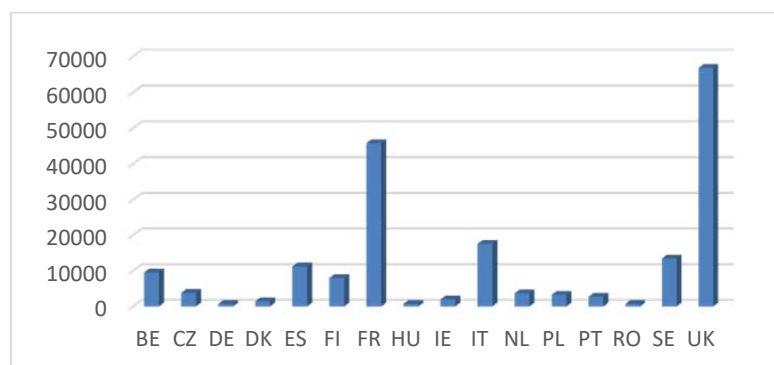


Fig. 2. Gross residential mortgage lending (million eur). Source: Diaz and Westig (2020).

#### 4. Discussion

In the study conducted, the existence of cointegration could not be confirmed in any case. Thus, one can

venture to say that residential property prices, as measured by hedonic indices, and inflation rates, actual and expected, are not cointegrated. The results of these studies contradict the common belief in the

potential of real estate to hedge against inflation, but confirm some of the research conducted in other economies, such as Ireland (Stevenson & Murray, 1999). Stevenson and Murray explained this phenomenon, among others, by a too shallow real estate market, which does not allow prices to follow market trends. The lack of correlation was also observed in situations when inflation was stabilized. If we take into account the volume of mortgages granted per person in Poland and Ireland (EUR 86.09 per person in Poland and EUR 394.20 per person in Ireland)<sup>1</sup>, the Polish market seems even shallower than the Irish one. This may compound the effect of the insensitivity of house prices to inflation. Gross residential mortgage lending is shown in Figure 2.

Insufficient market development may be one of the factors, not excluding others, like the nature of real estate as a capital-intensive, low liquidity, indivisible good, but also low market transparency, affecting inefficiency (Clayton et al., 2007; Wolski & Zaleczna, 2013). Other factors limiting real estate trade are attachment to a specific place (Kucharska-Stasiak, 2009; Hoesli & MacGregor, 2000). The characteristics of real estate mean that it cannot be treated as just another financial asset in a portfolio. The lack of correlation between residential real estate prices and inflation may also be due to the fact that a sharp increase in inflation has been observed recently.

Summarizing the results, it should be assumed that the research hypothesis "residential real estate effectively protects the value of capital against the effects of inflationary processes" was verified negatively. However, the results should be approached with caution as the results of other researchers indicate that the results of research on the same data vary depending on the choice of research method (Bond & Seiler, 1998).

## 5. Conclusions

In this paper, the author conducted a study of the relationship between residential real estate prices represented by three hedonic indices and inflation indicators, including expected inflation. Cointegration analysis allows to show the relationship between two time series of data. To analyze these relationships, a cointegration analysis was performed using the Engle - Granger test, with the ADF test. The study used three hedonic indices of residential real estate prices: the indices for 7, 10 and 6 cities calculated by the National

Bank of Poland, the CPI inflation index calculated by the Central Statistical Office and the expected inflation index calculated by the National Bank of Poland. The period from Q1 2009 to Q4 2021 was examined. The results indicate that, as in the Irish market, property prices are not in any way related to inflation indices (Stevenson & Murray 1999). The lack of correlation between residential property prices and inflation is explained, among other things, by the fact that the Polish property market is too shallow and the period of high inflation is too short. To these factors, one can certainly add the rising interest rates that significantly limit the availability of mortgage loans. The question of whether the occurrence of possible cointegration is sufficient to conclude that an investment is inflation-proof is also open, though the authors of many of the papers cited above have indicated that this might be the case. However, there are also other approaches to the subject, such as the Polish study by Trojanek (2007). Still, it is difficult to relate the results obtained in the present article to the work of Trojanek, mainly due to a completely different research period taken into account, but also the very different social and economic situation in Poland at that time.

The research has the limitations of a short period of elevated inflation and a relatively short research period of 12 years. In further research it is worth considering dividing the research period depending on the behavior of the CPI. By the way, we may risk a statement that, taking into account the practical implications of the conducted research, investors should be sensitized to the risks associated with the economic situation on the real estate market. Drawing conclusions for the near future - and only such are legitimate given the short period of occurrence of inflation growth - one can risk a statement that, in the near future, real estate will not protect the investor against depreciation of the value of money, and it might be better to invest, for example, in inflation-indexed bonds.

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<sup>1</sup> Data based on Diaz, Westig 2020 and EUROSTAT: Population on 1 January 2020.

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