
MULTIDIMENSIONAL COMPARATIVE ANALYSIS OF THE HOUSE PRICE INDEX
IN EUROPE BETWEEN 2021-2022 IN THE ASPECT OF ECONOMIC SECURITY

Bartosz Kozicki¹, Aleksandra Tomaszewska², Paweł Jaśkiewicz³,
Oktawia Jurgilewicz⁴, Przemysław Przybylski⁵

^{1,3} Military University of Technology, gen. Sylwestra Kaliskiego 2, 00-908 Warszawa, Poland

² University of Edinburgh, Old College, South Bridge, Edinburgh EH8 9YL, United Kingdom

⁴ Rzeszów University of Technology, Aleja Powstańców Warszawy 12, 35-959, Rzeszów, Poland

⁵ Instytut Copernicanum w Toruniu, Gagarina 11 street, 87 100 T, Toruń, Poland

Emails: ¹bartosz.kozicki@wat.edu.pl; ²aleksandra.tomaszewska1405@gmail.com;

³pawel.jaskiewicz@wat.edu.pl; ⁴niemieco@prz.edu.pl; ⁵metodykppp@interia.pl

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Abstract. The article presents a multidimensional comparative analysis of the impact of crude oil and liquefied petroleum gases (LPG) prices on the housing price index in 28 European countries. Research shows that the COVID-19 pandemic and the attack of Russia on Ukraine have led to similar large fluctuations in crude oil and LPG prices. This, in turn, contributed to an increase in inflation and house price indices in the 28 analyzed European countries. Such an increase was driven by higher total construction costs, including higher prices for materials, energy and charges for building services. Housing prices in respective European countries vary. The study examines the dynamics of their changes and compares them with the use of ranking.

Keywords: House price index; crude oil and natural gas prices; crisis cascade situations; multidimensional comparative analysis; economic security

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1. Introduction

At the time of crises, the study of the security systems of respective countries requires a continuous cause-and-effect analysis of factors influencing the functioning of respective economies by identifying deviations in dependent variables which become a premise for further increases and decreases in other variables dynamically (Beshir, 2022; Besenyő, Málnássy, 2022; Chehabeddine, Grabowska, Adekola, 2022).

The study attempts to conduct multidimensional comparative analyzes of three groups of dependent variables: crude oil prices, LPG and the house price index in 28 European countries.

The price is one of the economic categories that determines the size of the purchase and sale transactions on the stock exchanges and markets of respective countries. It means the value of goods, service, currency or production factor expressed in money (Owsiak, 2015, p. 344; Omelchuk, 2018; Napiórkowska-Baryła, Świdzińska, 2021). Strong and long-lasting increases in dependent variables - crude oil and LPG prices - expand standard

deviations of other dependent variables.

This became a premise for the formulation of the research problem of the study, which is: To what extent will long-term fluctuations in crude oil and LPG prices affect the house price index in European countries in 2021 and 2022?

The aim of the study is to conduct a multidimensional comparative analysis of two dependent variables: crude oil and LPG prices in terms of their impact on fluctuations in dynamics indices on a fixed base of house price index in 28 European countries. A research hypothesis was outlined for the research problem and the aim of the study: The use of a multidimensional comparative analysis will allow to study the impact of fluctuations in crude oil and LPG prices on the house price index in 28 European countries between 2021-2022. The research method used in the article is a multidimensional comparative analysis.

2. Analysis of the literature on the research subject

The House Price Index (HPI) is considered to be an index for the comparison of the residential property prices purchased by households - both new and existing ones, irrespective of their final destination and previous owners (House Price Index - quarterly data, as of 14/10/2020). The data collected in Eurostat and used in the research in this study refer only to market prices, so self-built houses are excluded. The base year is 2015 (HPI = 100). The emergence of the COVID-19 infectious disease has highlighted the importance of research into crisis cascade situations (More Jurgilewicz et al., 2021). The concept of a crisis refers to a situation that threatens with the outbreak of war, a change of government or other radical changes, as well as the collapse of the economic growth process and a regression in the economic development of the state (Polish language dictionary <https://sjp.pwn.pl/sjp/kryzys;2565070.html>).

In turn, the cascade in the Dictionary of the Polish Language is interpreted as a large number of successive phenomena (Polish language dictionary <https://sjp.pwn.pl/szukaj/kaskadowe.html>). The cascade crisis should be understood as a sequence of dependent variables, in which, dynamically, there is an increase in the deviations of the analyzed data, they may cause the collapse of respective sectors of the economy, and the final effect is a decline in economic growth of countries, as well as, for example, the outbreak of war or a change of government. The infectious disease COVID-19 and the attack of Russia on Ukraine have brought about changes in the functioning of respective sectors of the economies of the world. They led to an increase in the fluctuations of many dependent variables, including crude oil and LPG prices dynamically. This resulted in a strong increase in the prices of consumer goods in European countries, as well as the house price index. The infectious disease COVID-19 was first observed in Wuhan, China (Zhu, Zhang et al., 2020). The disease was threatening the life and health of people and spread rapidly. As a result, on March 11, 2020, the World Health Organization declared the COVID-19 pandemic (Satomi, et al., 2020). The fear of a large number of infections and deaths has resulted in the introduction of restrictions around the world regarding, among others, travel restrictions or the obligatory facemasks (Matuka, 2020). This led to huge decreases in the number of passengers travelling by air (Kozicki, Bryczek-Wróbel, 2020). This, in turn, contributed to a reduction in the global demand for power raw materials and a long-lasting decline in their prices. An increase in unemployment was also observed, including the largest economy in the world which is the United States (Kozicki, Górnikiewicz, 2020). Then, starting from 2021, prices of the raw materials began to increase drastically (*Rekordowa inflacja. GUS opublikował wstępne dane...*, stan na 21.07.2022). Then there was an increase in inflation (*Inflacja w czerwcu 2022 r. – 15,6 proc. (rdr)...*, stan na 21.07.2022; Redzik, 2022). The rise in the prices of power raw materials was influenced by the attack of Russia on Ukraine on February 22, 2022. Since the beginning of the 21st century, the divergence of interests of Russia, European countries and the United States has been clearly visible. Undoubtedly, the Russian-Ukrainian war is an example of this. The above-mentioned situation has a negative impact on the economic security of respective European countries, including Poland. In the Dictionary of the Polish language, the term security is defined as a state of non-threatening, peace and certainty (Szymczak, 1981, p. 147). This should be read as a guarantee of the maintenance of an appropriate level, identical with the states of non-threatening, peace and certainty. Security is interdisciplinary and utilitarian, as it is a means to achieve other values such as life, health, property and others (Tyrała, 2000, p. 48).

One of the types of security is an economic one, identified with certainty of the survival and development of the economic system of the state and international economic organizations, it guarantees the maintenance of an appropriate position in economic relations and a proper standard of living for citizens (Nurzyńska, 2016, p. 22). According to W. Kitler, it is to ensure the economic conditions necessary for the survival, prosperity and sustainable development of society and the efficient functioning of the state and its institutions (Kitler, 2011, p. 49).

The multidimensional comparative analysis was used in the study to evaluate the similarities of two dependent variables - data on crude oil and natural gas prices in terms of the analysis of their fluctuations in relation to their impact on the house price index in 28 European countries. The multidimensional comparative analysis makes it possible to explain the structure of relations between the observed characteristics of objects (Panek, Zwierzchowski, 2013, p. 15). It belongs to the group of statistical methods which allow simultaneous analysis of at least two variables describing each object (Łuniewska, Tarczyński, 2006, p. 9).

3. The multidimensional comparative analysis of the causes of the increase in the prices of consumer goods in Europe between 2021-2022

The research in the article concerned the impact of the increase in the prices of power raw materials (crude oil and LPG) from January 2020 to July 2022 on the increase in the house price index in 28 European countries in 2021 and 2022 quarterly. The analysis began with the compilation of data on the listing of prices of one barrel of crude oil in dollars from January 2, 2020 to July 25, 2022 in Figure 1.

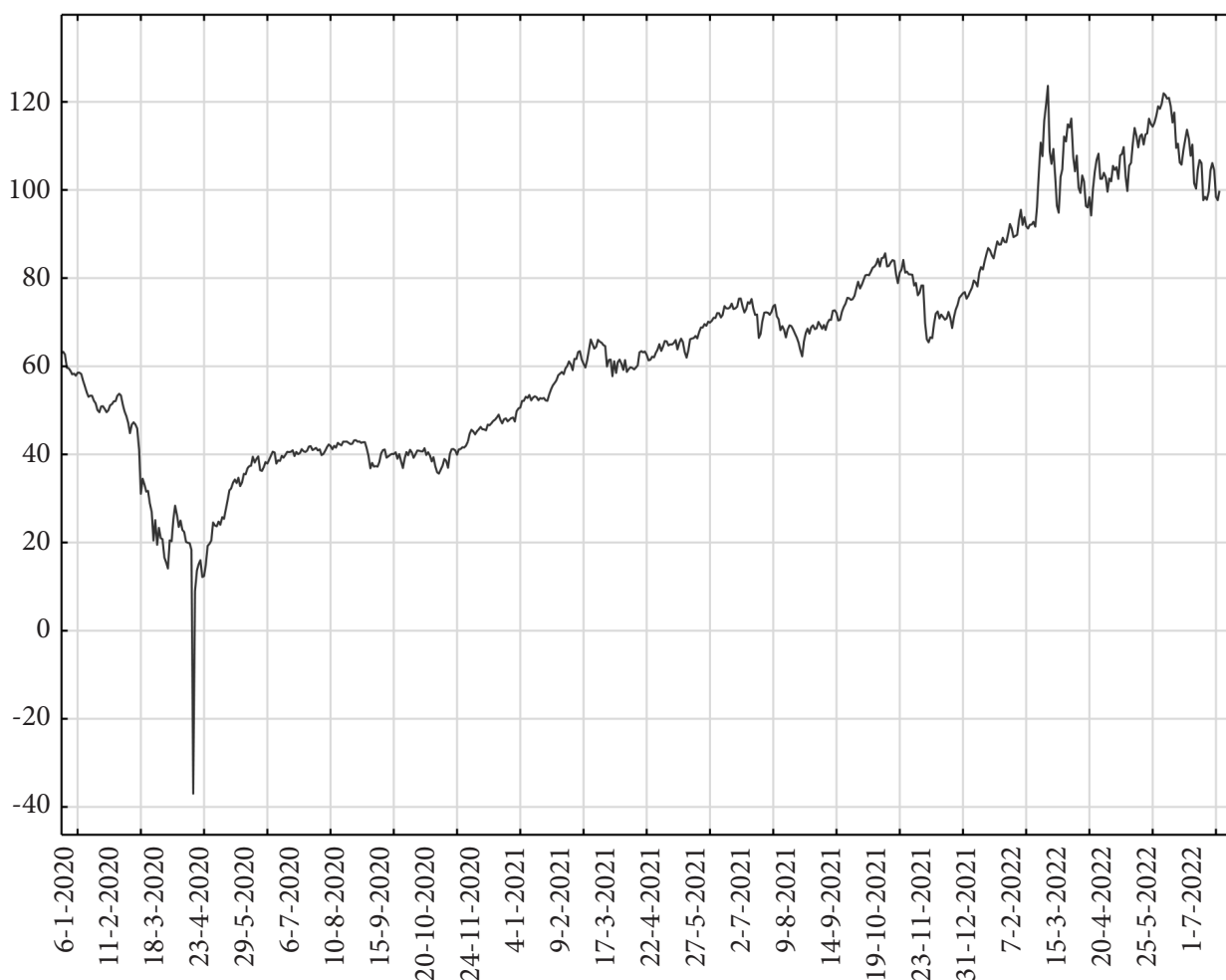


Figure 1. Line chart of the listing of prices of 1 barrel of crude oil in dollars from January 2, 2019 to July 25, 2022

Source: own study based on data obtained from the website of Federal Reserve Bank (FRED) (as of 21.07.2022)

The data outlined in Figure 1 shows that from December 27, 2019, the price of a barrel of crude oil (\$ 61,17 for 1 barrel) began to decline. The downward trend was intensified by the introduction of the COVID-19 pandemic on March 11, 2020 - the price of 1 barrel of crude oil at that time was \$ 33,13. This, in turn, led to a reduction in world demand for crude oil, which resulted in low prices until the end of January 2020, hovering around the arithmetic mean of \$ 40 per barrel of crude oil. On April 20, 2020, the stock market price hit a negative level of \$ - 36,98 per barrel of crude oil. On January 4, 2021, the price of one barrel was \$ 47,47, then the global increase in crude oil prices to \$ 75,33 per barrel was visible on December 31, 2021. In 2022, a strong increase in oil prices continued, triggered, among other things, by the attack of Russia on Ukraine on February 22. From March 25, 2022, the price of a barrel of crude oil began to decline from \$ 116,20 to \$ 99,83 on July 25, 2022. Throughout the period under consideration (Fig. 1), a wide range of prices per barrel of crude oil can be observed: from a negative price of USD - 36,98 per barrel to USD 123,64 per barrel on March 8, 2022. The fluctuations in oil prices were primarily influenced by two events: the COVID-19 pandemic and the attack of Russia on Ukraine. They also caused similar trends in changes in natural gas prices, as shown in Figure 2.

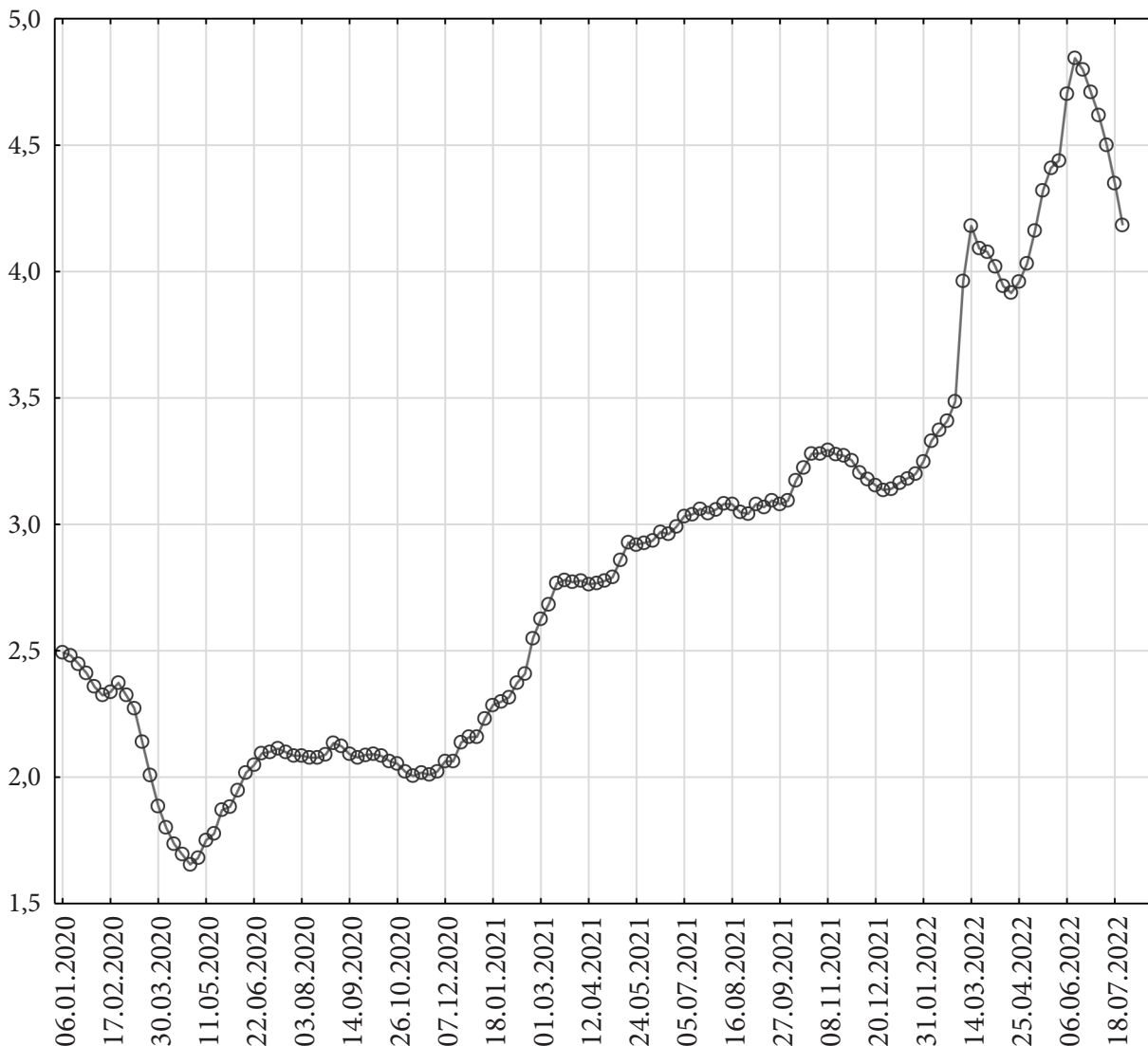


Figure 2. Price listings of 1 gallon of LPG in the United States in dollars from January 6, 2020 to July 25, 2022

Source: own study based on data obtained from the website of Federal Reserve Bank (FRED) (as of 21.07.2022)

From January 6, 2020, when the price of one gallon of LPG was \$ 2,494, it dropped to \$ 1,694 per gallon on April 20, 2020. From April 20, 2020, the price increased to \$ 2,113 per gallon of LPG on July 13, 2020. Then, from July 13, 2020 to January 4, 2021, the price hovered around the arithmetic mean of \$ 2,08 per gallon of LPG. From January 2021 to June 13, 2022, an upward trend in LPG prices was visible. The increase in LPG prices took place after February 22, 2022, i.e. after the attack of Russia on Ukraine.

The above-mentioned large fluctuations in the prices of raw materials (crude oil and LPG) influenced the increase in the prices of consumer goods and the house price index in all European countries from 2021 to 2022 (Fig. 3). The increase in the prices of power raw materials influenced the increase in the costs of transport, production of future sold goods, and this in turn resulted in an increase in the prices of goods, i.e. future consumer goods.

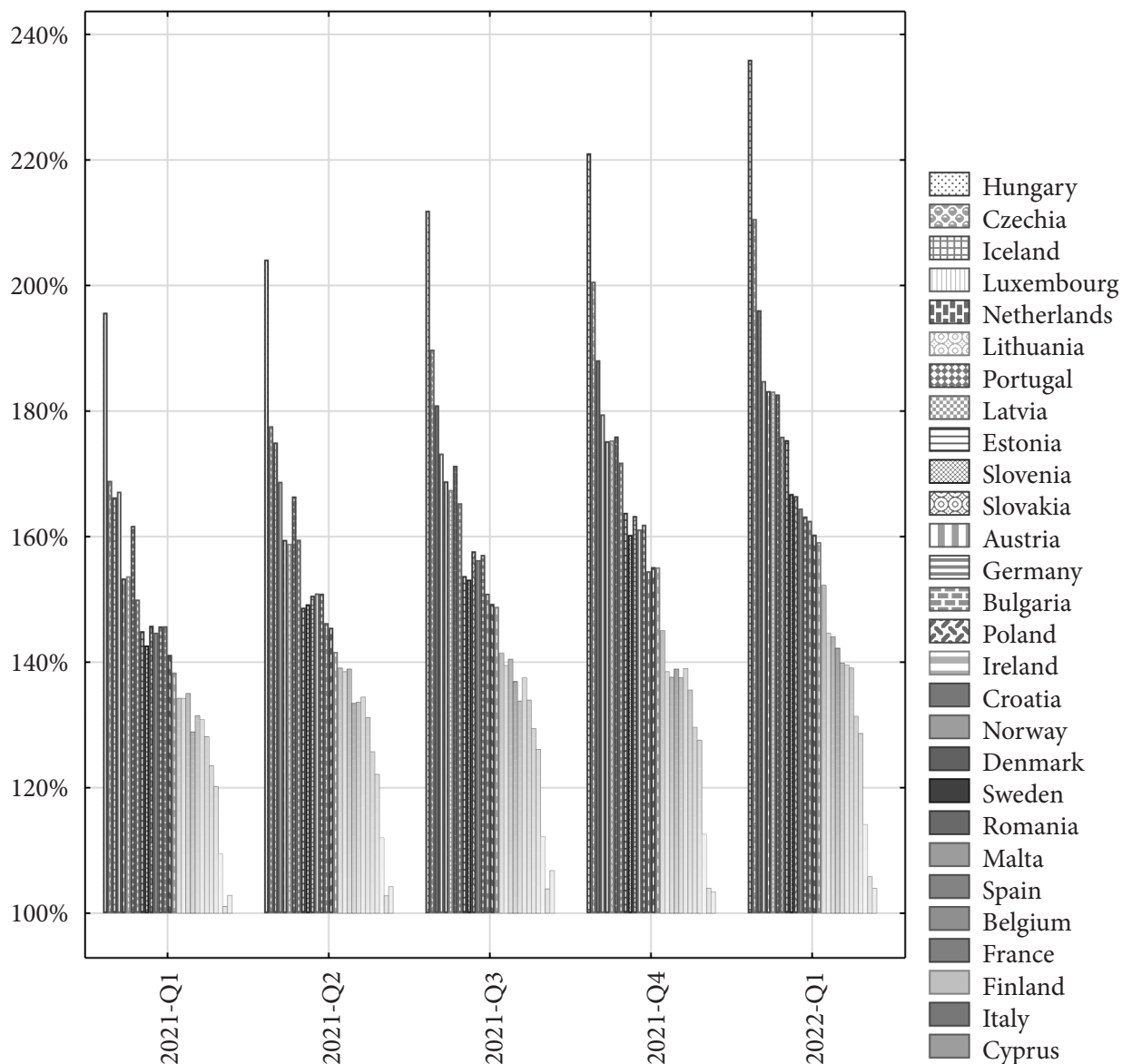


Figure 3. Categorized house price index charts from the first quarter of 2021 to the first quarter of 2022 in 28 European countries (constant – the price of flats in respective European countries under consideration in 2015)

Source: own study based on data obtained from the website of Eurostat
<http://appsso.eurostat.ec.europa.eu/> (as of 21.07.2022)

The data presented in Figure 3 shows that the house price index increased in all analyzed European countries. In the legend of Figure 3, the countries of Europe considered in the research were compared using the ranking from the highest to the lowest house price index in the first quarter of 2022. The data on the house price index in Figure 3 (constant: the price of consumer goods in respective European countries in 2015) shows that the highest increases in Europe were recorded in Hungary: from 195,7% in the first quarter of 2021 to 236% in in the first quarter of 2022. The Czech Republic was second in the ranking. The house price index increased by 41,7% from the same first quarter from 2021 to 2022. Iceland was third - the house price index increased by 29,8% in the analyzed period. Poland was ranked fifteenth in the ranking with an increase of 19,1%. The lowest in the ranking was Cyprus with an increase in the analyzed period by 1,2% and Italy with an increase of 4,7%.

For illustrative purposes, Figure 4 summarizes the calculated standard deviations of the house price index quarterly from the first quarter of 2021 to the first quarter of 2022, ranking them from the largest to the smallest.

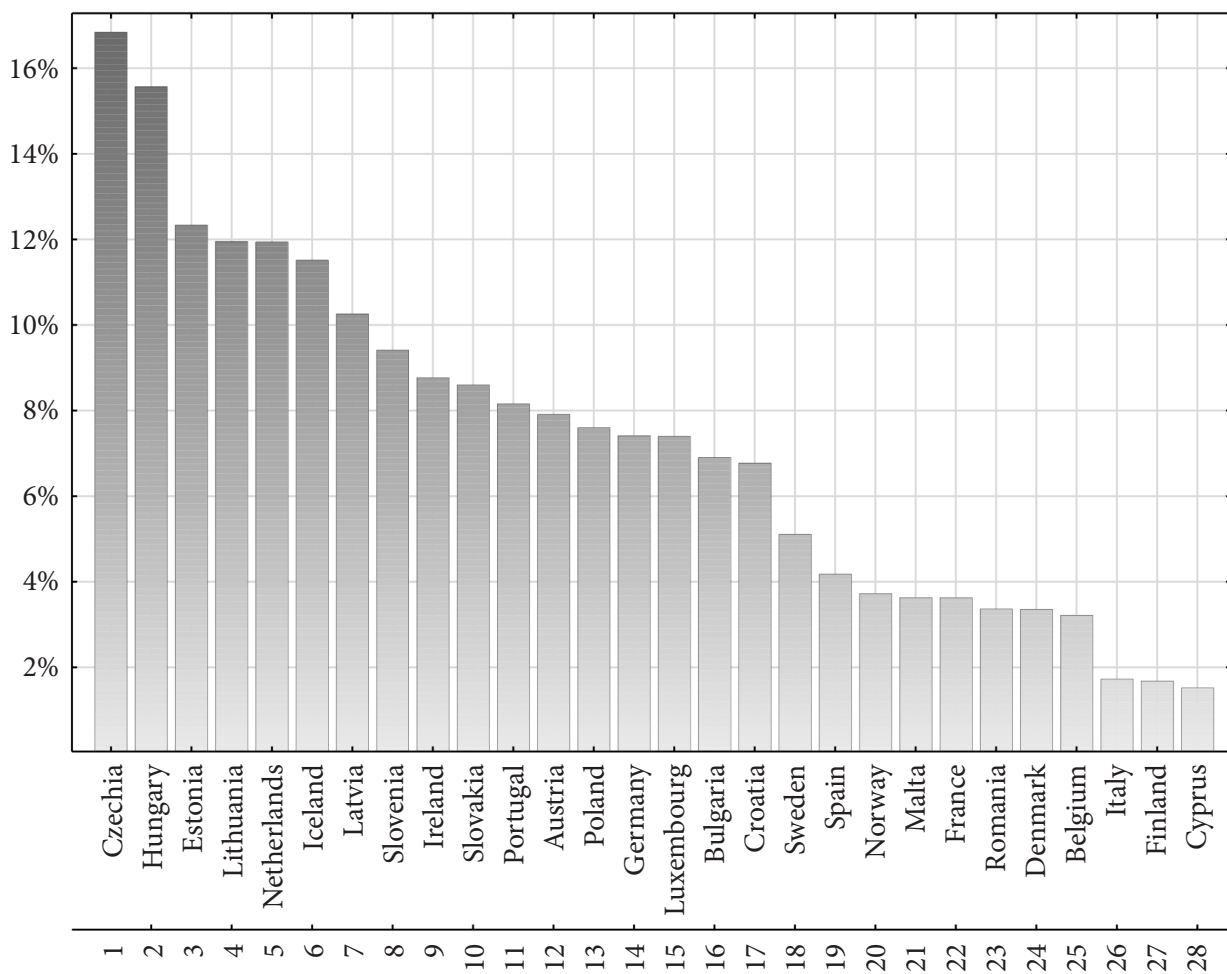


Figure 4. Bar chart of the standard deviation of the house price index from the first quarter of 2021 to the first quarter of 2022 in 28 European countries (constant: the price of flats in respective European countries under consideration in 2015).

Source: own study based on data obtained from the website of Eurostat:
<http://appsso.eurostat.ec.europa.eu/> (as of 21.07.2022)

The largest fluctuations in the house price index were recorded in the Czech Republic in the analyzed period. The standard deviation here was 16,8%. Hungary was second with a standard deviation of 15,6%. Third place in the ranking in terms of the largest price fluctuations was taken by Estonia, where the standard deviation was at the level of 12,3%. In terms of price fluctuations, Poland came thirteenth with a standard deviation of 7,6%. The lowest in the ranking is Cyprus with a standard deviation of 1,5%.

4. Summary and conclusions

The research shows that the COVID-19 pandemic has led to strong fluctuations in the price of one barrel of crude oil. From March 11 to the end of December 2020, the price hovered around \$ 40 a barrel. From January 4, 2021, when the price of a barrel of crude oil was \$ 47,47, the global increase in crude oil prices to \$ 75,33 per barrel in dollars on December 31, 2021 was visible. In 2022, a further strong increase in oil prices could be noticed, caused, among others, by the attack of Russia on Ukraine on February 22, 2022 (See Jurgilewicz et al. 2022). Similar price fluctuations were observed for LPG. From January 6, 2020, when the price of 1 gallon of LPG was \$ 2,494, there was a decrease to \$ 1,694 for one gallon of LPG on April 20, 2020. From that day forth, LPG prices began to rise to \$ 2,113 per gallon on July 13, 2020. Then, from July 13, 2020 to January 4, 2021, the price hovered around the arithmetic mean of \$ 2,08 per gallon of LPG. From January 2021 to June 13, 2022, an upward trend in LPG prices is visible. The increase in LPG prices took place after February 22, 2022, i.e. after the attack of Russia on Ukraine. Large fluctuations in the prices of raw materials (crude oil and LPG) influenced the house price index in all European countries from 2021 to 2022. The increase in the prices of power raw materials contributed to an increase in the costs of transport and production of future goods sold, which in turn had an impact on the increase in the prices of goods and real estates. Real estate prices increased in all 28 European countries analyzed. The highest was recorded in Hungary: from 195,7% in the first quarter of 2021 to 236% in the first quarter of 2022. The Czech Republic was second in the ranking. The house price index increased by 41,7% from the same first quarter of 2021 to 2022. Iceland came third with an increase in the house price index in the analyzed period at the level of 29,8%. Poland was ranked fifteenth in the ranking with an increase of 19,1%. The lowest one was Cyprus with an increase of 1,2% and Italy with an increase of 4,7%. The largest fluctuations in the house price index in the analyzed period were recorded in the Czech Republic. The standard deviation here was 16,8%. Hungary was second with a standard deviation of 15,6%. The third place in the ranking in terms of the largest fluctuations in real estate prices was in Estonia, where the standard deviation was at the level of 12,3%. In terms of fluctuations in real estate prices, Poland took thirteenth place with a standard deviation of 7,6%. The lowest in the ranking is Cyprus with a standard deviation of 1,5%.

The conducted research clearly shows a substantial increase in inflation and real estate prices in 28 European countries, caused, inter alia, by long-term increases in oil and LPG prices and the associated higher prices of building materials and fees for provided construction services. The strong inflation noticeable in Europe and the continuing high increase in real estate prices may result in a lower number of purchases in the future. A further increase in real estate prices will result in the rising fees related to the rental of apartments and broadly understood fees for services provided by the tourism industry.

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Bartosz KOZICKI - Military University of Technology, PL. Research interests: national security, internal security.
ORCID ID: 0000-0001-6089-952x.

Aleksandra TOMASZEWSKA - University of Edinburgh, Edinburgh, UK. Research interests: international security.
ORCID ID: 0000-0002-1084-064X

Paweł JAŚKIEWICZ - Military University of Technology, PL. Research interests: national security, internal security.
ORCID ID: 0000-0002-8863-6948.

Oktawia JURGILEWICZ - Rzeszów University of Technology, PL. Research interests: internal security, environmental protection, criminal law.
ORCID ID: 0000-0003-1293-6933.

Przemysław PRZYBYLSKI – Instytut Copernicanum w Toruniu. Research interests: internal security, education for security, sociology.
ORCID ID: 0000-0003-0923-2409.