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Impact of Macroeconomic Factors on Real Estate Prices

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Abstract (German)

Der Immobilienmarkt stellt einen wichtigen Markt in modernen marktwirtschaftlich orientierten Volkswirtschaften dar. Die Stabilität des Immobilienmarktes beeinflusst den Zustand der nationalen Wirtschaft, während makroökonomische Entwicklungen wiederum einen erheblichen Einfluss auf die Stabilität des Immobilienmarktes haben. Der Immobilienmarkt ist somit ein wesentlicher Faktor für den wirtschaftlichen Wohlstand eines Landes.

Diese Studie untersucht die Auswirkungen ausgewählter makroökonomischer Indikatoren auf Immobilienpreise anhand eines umfangreichen Datensatzes, der den Zeitraum von Q1 1970 bis Q4 2021 umfasst. Zur Quantifizierung dieser Zusammenhänge wurden die Faktorenanalyse sowie multiple lineare Regressionsmodelle eingesetzt. Die meisten im Modell definierten Prädiktorvariablen erweisen sich hinsichtlich ihres Einflusses auf die Immobilienpreise und den Immobilienmarkt als statistisch signifikant.

Es gibt jedoch kein einheitliches Set makroökonomischer Faktoren, das deren Einfluss und Bedeutung für Immobilienpreise vollständig beschreibt. Zwar lassen sich bestimmte gemeinsame Merkmale bzw. Einflussfaktoren identifizieren, die Auswahl der makroökonomischen Variablen bleibt jedoch bis zu einem gewissen Grad eine subjektive Entscheidung der Forschenden. Diese Subjektivität kann durch den Einsatz leistungsfähiger statistischer Software wie STATA, die auch in dieser Studie verwendet wurde, deutlich reduziert werden.

Unter Anwendung eines schrittweisen Regressionsmodells, bei dem jeweils eine zusätzliche erklärende Variable in das Modell aufgenommen wird, ergeben sich folgende wesentliche Erkenntnisse: Die wirtschaftliche Aktivität steht in einem positiven Zusammenhang mit den Immobilienpreisen, wobei dieser Zusammenhang durch die Einbeziehung weiterer unabhängiger Variablen noch stärker wird. Wie erwartet weist der langfristige Zinssatz eine negative Korrelation mit den Immobilienpreisen auf; dieser Zusammenhang verstärkt sich zusätzlich, wenn das gesamte Haushaltskreditvolumen in das Modell aufgenommen wird. Das gesamte Kreditvolumen der privaten Haushalte steht wiederum in einem positiven Zusammenhang mit den Immobilienpreisen, was mit den Ergebnissen der bestehenden Fachliteratur übereinstimmt.

Abstract (English)

The real estate market represents an important market in modern market-oriented economies. The stability of the real estate market influences the state of the national economy, while macroeconomic trends, on the other hand, significantly affect the stability of the real estate market. The real estate market determines the economic well-being of a particular country.

This study evaluates the effects of selected macroeconomic indicators on property prices, using the large data sample spanning from 1970Q1 to 2021Q4. To quantify these relationships, Factor Analysis and Multiple Linear Regression models were used. Most predictor variables defined in the model are significant in terms of their impact on property prices and the real estate market. There is no unique set of macroeconomic factors that describe their impact and importance on property prices. Some common characteristics or common factors that influence property prices can be identified, but the choice of macroeconomic factors is a subjective matter for researchers dealing with this issue. Significantly reducing subjectivity can be achieved by using "powerful" statistical software, such as STATA, as used in this study.

Using the step-wise model by including the additional explanatory variable to the model each time, the main conclusions reached in the analysis are the following: economic activity variable has a positive relation with real estate prices, and the relation is even stronger if we include additional independent variables; as expected, the long term interest rate is negatively correlated, and the relation is even stronger when the total credit to households is included; total credit to households is positively related to the real estate prices, in accordance with the literature.

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1. INTRODUCTION

1.1. Background of Study

The real estate market is a very important part of a country's economy and is rather an interesting field for research both from a micro and macro perspective. Real estate is one of the most volatile parts of the economy, so researchers and policymakers have spent a lot of time looking at how property prices move in relation to broader economic factors. The real estate market is an integral part of the economic development of each country and contributes to the promotion of investment, production, increase of income and socio-economic stability. On the other hand, on micro level, real estate can be viewed in the framework of consumer behavior analysis (Mavrodiy, 2005), given that real estate purchased constitutes a considerable part of consumption expenditures, and that real estate serves as a store of value and a source of income for households.

Housing assets represent a substantial share of a country's wealth, overall welfare and GDP, and therefore play a crucial role in shaping long-term economic development. The motivation for this thesis is found in the research done at the macro level which analyzes core macroeconomic determinants of the real estate prices. The extensive literature overview will be discussed in the next chapter. For now, the following introductory subsections will briefly outline the definition of real estate (concept, types, advantages and disadvantages), factors influencing supply and demand for real estate, property prices, the purpose of the study (subject, problem and research objectives), the significance and contribution of the research questions.

1.2. Definition of Real Estate

Real estate (also known as real property) represents all immovable property consisting of land and everything erected on a specific parcel. Starting from basic human needs (the five primary levels of Maslow's hierarchy of needs, Figure 1), Maslow originally believed that a person needs to completely satisfy one level of needs before pursuing higher-level needs. Among the first of these needs are physiological needs, which are the most essential things a person requires to survive, with shelter (housing), water, food, warmth, rest, and health being the most important. Accordingly, this underscores the significance of real estate (housing) in ensuring the security of individuals. It is considered one of the greatest achievements of human society that housing is defined as a human right. Housing is one of the fundamental existential needs of human beings.



Maslow's hierarchy of needs

Figure 1: Maslow's Hierarchy of Needs Pyramid

Housing is always present in the market and differs from other goods in the market. The real estate market has its own characteristics that are not identical to other commodities. Specifically, the real estate market does not exist at a general level as a compact structure; instead, it consists of a larger number of individual (local) markets. This means that demand in one place cannot be substituted by the supply of housing in another place because housing is closely tied to a specific location (housing is an immovable property).

There are different types of real estate. We can categorize them as residential, commercial, industrial, land and special-purpose real estate. Residential real estate encompasses every property used for residential purposes, such as single-family homes, apartments, duplexes and multi-family residences. Commercial real estate includes any property used exclusively for business purposes, such as apartment complexes, gas stations, general merchandise stores, hospitals, hotels, offices, parking lots, restaurants, shopping centers, stores, cultural facilities (opera, theater). Industrial real estate includes properties used for production, services, distribution, storage, research and development. Land encompasses undeveloped property, vacant land and agricultural land, such as farms, orchards, ranches and forests. Special-purpose real estate includes property used by everyone, such as cemeteries, government buildings, libraries, parks, religious facilities and schools.

Furthermore, real estate as a commodity in the market has its advantages and disadvantages. In the following text, some of the advantages and disadvantages will be mentioned. Advantages of real estate that make them attractive compared to other forms of investment can be observed through the following characteristics:

- Real estate can offer absolute returns.
- Real estate represents a form of secure investment (protection against inflationary disturbances).
- Real estate can provide diversification of investments compared to stocks and bonds (higher returns are achieved than with securities investments).

- Real estate can provide stable cash flows.
- Owning a part or all of a property (for residential or business purposes) is considered a symbol of status, prestige, the so-called "trophy property". Owning real estate gives the owner a recognizable image and prestige.

In addition to the advantages, real estate also has disadvantages. Some of them are mentioned below:

- Heterogeneity of real estate. Tracking real estate price movements analytically is challenging because, unlike financial assets, they are heterogeneous categories. Physical characteristics (location, use, design, etc.) and different lease structures lead to different property prices and income.
- Indivisibility of ownership. Due to indivisibility, real estate cannot be bought and sold quickly and easily as buyers and sellers would desire.
- Centralized market. Real estate is rarely traded (if it is traded, it is done with a small real estate fund and it may be traded several times), the market is rather small, and there is no centralized market for it.
- Real estate liquidity. Compared to securities, real estate can be very illiquid.

1.3. Supply and Demand for Real Estate

Contemporary society pays significant attention to housing development. Housing reflects social and economic power, as well as the national income, personal earnings and living standards. Like all commodities in the market, real estate behaves in accordance with market principles. The price of real estate is largely influenced by general circumstances (the prosperity of the nation and individuals), supply and demand for real estate, tax policies, as well as the property's location quality. Internationalization and globalization, as well as economic (in) stability, have a strong impact on the real estate market. Of course, there are many other factors that influence the real estate market. Each country has its own specific characteristics in terms of geographical location, level of development, political structure, religious and cultural differences, and resources, all of which affect property prices. There are some generally accepted factors that influence real estate prices. We can consider them as real estate supply, real estate demand and external effects on the real estate market. One of the specific features of real estate as a commodity in the market is that some factors that determine supply can also be interpreted as factors that determine demand (price, income, population, location, etc.).

Real Estate Supply. Supply in the real estate markets mostly refers to land and properties (apartments, commercial spaces, etc.) that are offered in large numbers on these markets. The price of real estate is the most important factor determining supply. In addition to the price of real estate, many factors influence real estate supply, such as construction costs, new technologies, investor motives (public-private, domestic-foreign), as well as seasonal factors.

Investments in real estate have significantly increased in many countries but have remained below demographic needs. Inflationary disturbances affect real estate supply. Institutional and structural factors influence supply through local land-use regulations, cumbersome construction permit processes, and limited capacities in the construction sector (labor shortage). Similarly, tax incentives for mortgage financing and property ownership reduce user costs, affecting real estate supply. Many countries grant tax incentives for mortgage interest payments, stimulating households to borrow more and buy real estate.

Real Estate Demand. Similarly, many factors influence demand for real estate. In addition to the price of real estate as the most important factor, let's mention some other factors that determine real estate demand, such as increased economic prosperity of the country and individuals, demographic trends (population growth, migration), location characteristics, sources and methods of financing, economic restructuring (conversion of industrial zones and facilities into urban land and residential properties). Disposable income of the population plays a crucial role in shaping real estate demand. The higher the real disposable income per capita, the more the population can spend on buying real estate or servicing a mortgage, leading to rising real estate prices. Demand for real estate is also stimulated by a decline in interest rates. A decrease in interest rates reduces housing costs through financing cost savings. This decline encourages real estate purchases for investment purposes. Demographic trends can also influence real estate demand. Population growth, including migration, along with an increasing share of the young population forming households, stimulates demand for real estate.

External Effects on the Real Estate Market. We live in a world of significant changes, and these changes are happening in the real estate sector as well. Cities are becoming overcrowded for living conditions, and they are becoming symbols of car noise, air pollution, and traffic congestion, hindering the normal life of the population. Despite all these negative aspects of urban life, real estate prices in such conditions are higher compared to properties in suburbs or the outskirts of these urban areas. Among external factors, a particularly significant group is external effects - agglomeration effects. The expansion of cities and the high concentration of population in a small area lead to the intensification of agglomeration effects. Agglomeration effects manifest themselves in the way that changes in the size of a city lead to changes in the convenience of consumption. Health services at a higher level, better educational, cultural, and sports services are located in large cities, and they provide the highest quality of these services. The state, through its regulations and policies, creates these conveniences. The existence of these institutions (services) in large cities and their accessibility to the population significantly affects the real estate market.

1.4. Real Estate Prices and Economic Stability

The real estate market is a significant sector in market-oriented economies. Greater demand disruptions or increased real estate supply automatically lead to price declines, and vice versa. The most important indicator of real estate market stability is their prices. The fiscal aspect is also important because national and local fiscal revenues depend on real estate market transactions. Real estate prices are crucial for the overall well-being of a country and its residents. They also impact the banking sector (through mortgages, property sales, etc.), making it extremely important to stabilize real estate prices. The construction sector, especially residential construction, and a developed real estate market are the backbone of any economy. A country with a developed real estate market is considered a developed nation. The ancient Greek saying that no one has ever lost money by buying real estate still holds true today. It can even be added that buying real estate can be very profitable. Even during crisis periods, their prices consistently rise. Buying real estate is considered a form of savings during crises. In macroeconomic terms, real estate prices depend on a variety of factors, but the most important ones are individual wealth and overall economic well-being. In all situations, real estate prices depend on the supply and demand relationship; both in the short and long term, they move in accordance with economic principles and laws. Suppliers react quickly to changes in demand, with timing, i.e., the speed of response to changes in demand, being crucial for analysis. In the real estate and land supply market, adjusting supply is not possible in a very short time. It is less realistic to adapt in a shorter period and more realistic to adapt over a longer period.

This thesis emphasizes that real estate prices are not determined in isolation, but rather through the interaction of supply and demand, influenced by a broad set of macroeconomic and structural factors, as illustrated in Figure 2.

Factors such as monetary and fiscal policy, demographic trends and financing conditions affect both sides of the market, while real estate prices themselves feed back into the broader economy. This suggests that the relationship between housing prices and macroeconomic variables is not one-directional, but interdependent. The relationship between macroeconomic factors and residential property prices may be characterized by a simultaneity problem, as macroeconomic variables may influence real estate prices, while changes in real estate prices may, in turn, affect macroeconomic indicators. In the context of the housing market, this interdependence becomes particularly evident, as many key variables are determined simultaneously and influence each other. For example, while inflation and interest rates are often used to explain movements in real estate prices, changes in housing prices can also affect inflation through rent levels, construction costs and wealth effects. Similarly, easier access to credit may increase housing demand and push prices up, but rising property prices can also affect lending behavior and financial stability. Such interdependence gives rise to the simultaneity problem, where variables like inflation or interest rates both influence and are influenced by real estate prices. As Wooldridge (2016) points out, simultaneity occurs when explanatory variables are jointly determined with the

dependent variable, making it difficult to clearly distinguish cause and effect. This makes the empirical analysis more challenging, as it is not always clear which variable is driving the change. In this study, this implies that the estimated effects of macroeconomic factors on real estate prices may be biased, as part of the observed relationships may reflect this two-way interaction rather than a purely causal influence.

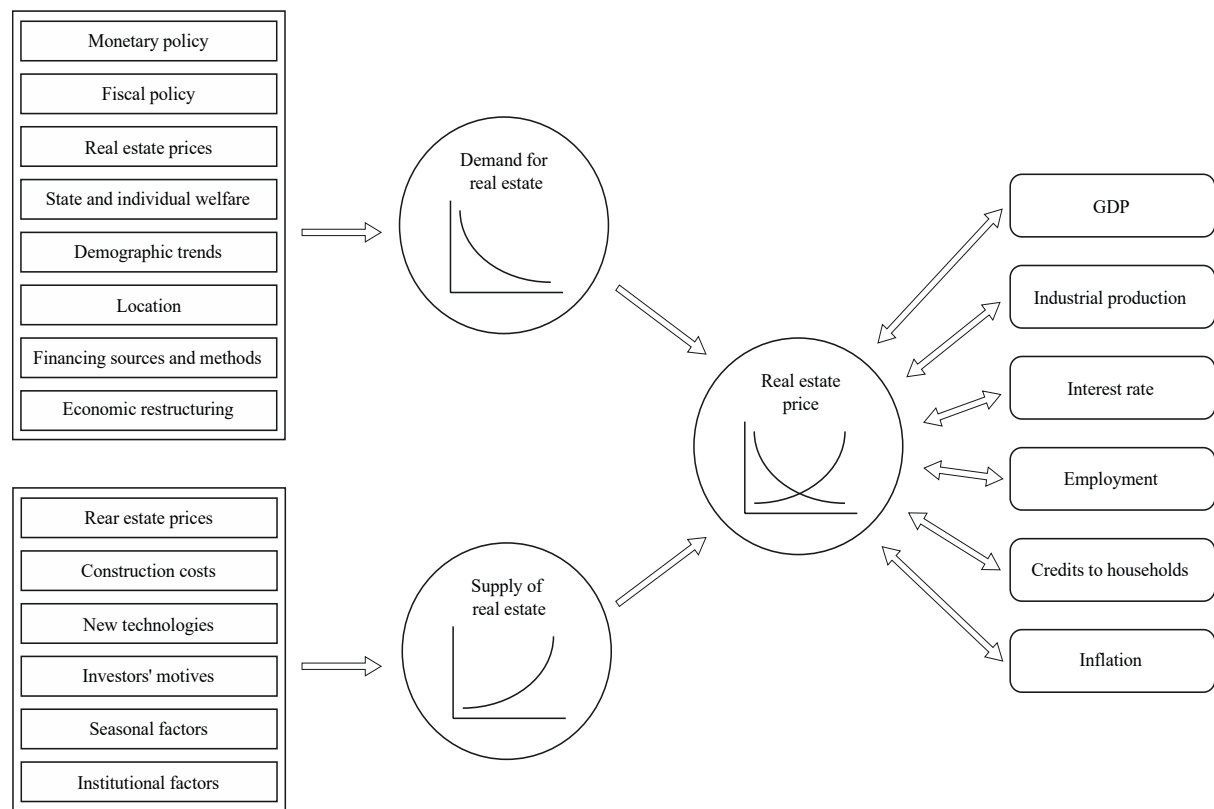


Figure 2: Supply and Demand Factors, Interdependence of Real Estate Prices and Macroeconomic Factors

The rental market is important and complementary to the real estate market. This topic was researched by Carlos Cuerpo, Peter Pontuch and Sona Kalantaryan (2014). Rental markets, as an alternative to ownership, stand out as particularly relevant institutional factors shaping the real estate market. Rental markets balance and alleviate pressure on apartment or house prices. This is especially the case when it proves to be an affordable platform for young households and low-income households, providing them with a sustainable alternative. The results also show that an efficient, fair and swift legal system is crucial for the development of the rental market.

Problems and crises promptly affect the real estate market. Crises have a significant impact on real estate prices. The mortgage crisis in the USA prompted many researchers to take a more serious look at the real estate market. The decline in the market for mortgage-backed financial derivatives (starting in 2007 and comparable to the Great Depression of 1929) directed the entire world towards a recession, the consequences of which we still feel today.

Unlike the financial crisis of that period, the real estate market behaved differently during the COVID-19 pandemic. The financial system of modern states, through economic policy measures (such as reducing interest rates and subsidies), managed to neutralize the initial shocks, and the market reacted in such a way that the real estate market continued to grow. This was also contributed to by the fact that the population was not as heavily indebted as during the financial crisis (Duca, J., Muellbauer, J., Murphy, 2021).

Macroeconomic problems and crisis situations have a strong impact on the real estate market; crises have the greatest effect on property prices. Supply, demand, prices and crisis situations are not the only factors that determine real estate markets. Fiscal factors also matter, since government revenues (both national and local) depend on real estate market transactions. Property prices also affect the overall well-being of citizens and influence how banks operate (through mortgages, buying and selling, etc.). Therefore, it is very important to keep property prices stable. Only in this way can policies and macroeconomic measures be applied to make the real estate market an efficient part of the overall socio-economic system.

1.5. Purpose of the Study (Subject, Problem and Research Objective)

The subject and problem of this research involve analyzing the long-term trends of selected macroeconomic factors, in the context of their impact on real estate prices in the global market. In the broadest sense, the subject of the research pertains to determining the impact of key macroeconomic, institutional and other factors on the stability of the real estate market in the defined set of countries. In a narrower sense, the objective of this work is to determine the influence of Real GDP, employment rate, industrial production, (long-term) interest rate, total credit to households (core debt) on residential property prices, expressed through Residential Property Prices, for selected countries (Austria, Australia, Belgium, Canada, Chile, Colombia, Czech Republic, Denmark, Finland, France, Germany, Greece, Great Britain, Hungary, Ireland, Israel, Italy, Japan, Korea, Luxemburg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, United States of America). In addition to the aforementioned factors, the existing literature also points to the importance of other economic and institutional variables, such as inflation, construction costs, population, migration and foreign investment, in shaping developments in the real estate market within the context of regional integration.

Essentially, this research involves analyzing theoretical and practical aspects that determine the real estate sector, primarily focusing on the influence of macroeconomic factors on real estate prices. The study will uncover specific economic interconnections among different economic factors that affect the stability of the real estate market in the selected countries worldwide, with a priority on analyzing the influence of macroeconomic factors on real estate prices. The research requires the use of econometric and statistical methods and techniques to establish the relationship between GDP, employment, industrial production, interest rates,

household credit and real estate price trends for selected countries, thereby assessing the stability of the real estate market.

The primary objective of this research is to determine the intensity and direction of the impact of key selected factors on the stability of the real estate market, particularly on real estate prices. The level and stability of prices are crucial determinants of the stability of the global real estate market.

The results of this research should demonstrate that countries effectively managing the real estate market can achieve comparative advantages. The analysis is based on statistical methods, primarily regression analysis, along with other relevant techniques such as factor analysis and extrapolation methods. These methods are used to test the proposed hypotheses and determine the most appropriate model through different statistical tests. Regression analysis will be applied to examine how selected explanatory (independent) variables influence the dependent variable. In this study, a linear model is used, where the constant term changes simultaneously with each new observation unit. This approach makes it possible to analyse both the individual effects of variables and their combined impact. The selected methodology enables forecasting of future trends in the observed variables, which represents one of the key contributions of this research.

The questions to be investigated and analyzed are as follows:

- Does Real GDP influence, and to what extent, the Residential Property Prices?
- Does the employment rate influence, and to what extent, the Residential Property Prices?
- Does industrial production influence, and to what extent, the Residential Property Prices?
- Does the long-term interest rate influence, and to what extent, the Residential Property Prices?
- Does total credit to households influence, and to what extent, the Residential Property Prices?

Numerous studies such as Hon-Chung (2009), Ludwig and Slok (2004), Case et al. (2005), Bardham et al. (2007), Goodhard and Hofmann (2007) and Zhang and Wu (2008) showed that among various macroeconomic factors linked to the real estate prices, the key ones were gross domestic product (GDP), unemployment, share index, current account of a country, demographic factors, household income, interest rate, industrial production and consumption of households. Therefore, the independent variables of this thesis' regression model will be selected according to most frequently suggested macroeconomic factors impacting housing prices. All data on independent and dependent and control variables will stem from the officially collected and publicly available range of data. The analysis will be conducted in the statistical software for data analysis and visualization of results, Stata. The

results of the research should confirm the impact as well as the existence of a positive or negative relationship between the analyzed factors and the price of real estate.

1.6. Chapters Overview

The paper is divided into 5 chapters. The first chapter provides introductory considerations, the subject, problem and research objectives, as well as defined research questions. The second chapter deals with a review of relevant literature, i.e. previous research related to the topic of the paper. It analyzes the factors influencing property prices and the methods applied in those studies. The third chapter presents the model and methods used in the analysis. It introduces the model variables and provides an explanation of whether the chosen variables are appropriate for answering the research questions and testing the hypotheses. The fourth chapter presents the results and discusses the findings of the research. The fifth (final) chapter provides the conclusion and recommendations.

2. PRIOR RESEARCH - Existing Literature

The real estate market is a crucial part of a country's economy and a fascinating field of study from both micro and macro perspectives. As the real estate market represents one of the most volatile sectors in a country's economy, the link between property prices and macroeconomic factors has attracted significant attention from researchers and policymakers over the past decades. The real estate market is an integral part of the economic development of any country and contributes to investment stimulation, production, income growth and socio-economic stability. Given that real estate constitutes a significant part of a country's wealth and GDP, it significantly shapes long-term economic development. Therefore, numerous authors have explored the impact of macroeconomic variables on property prices from various perspectives, using different approaches and methods in various real estate markets.

In this section of the paper, the focus is on an overview of previous research related to the subject of this study. Sections 2.1 to 2.4 cover works (literature) related to the real estate market in the USA, BRICS, Europe, as well as the phenomenon of housing bubbles in the real estate market. Section 2.5 explains the macroeconomic factors of the real estate market and their impact on property prices.

Yingying (2020) analyzed the impact of per capita disposable income and real estate planned investment on apartment prices. The model including data from 2000 to 2018 in Anhui Province found a significant positive correlation between house prices and income. Grum and Govekar (2015) used a multiple linear regression model to examine which among the observed macroeconomic factors: the unemployment rate, the current account of the

country stock index, gross domestic product and industrial production are significantly related to property prices in Greece, France, Poland and Norway. They found that there are statistically significant correlations between the prices of residential real estate and selected macroeconomic factors. Similarly, research results by Trung et al. (2019) examining influence of factors on real estate prices, such as: natural, economic (profitability from the point of view of renting or selling), legal, political, market (supply-demand, labor market, financial market), macroeconomic factors, based on multiple regression analysis, also show a positive impact. Results revealed that macroeconomic factors have the greatest influence on the price of real estate, followed by legal factors, then market, political, economic and finally natural factors. Mavrodiy (2005) analyzed the micro and macro level of influence of factors on real estate prices. Regarding the macro level, the author investigated the impact of real GDP, population level in Kiev, average wages and interest rate on the average residential housing price per square meter. Results confirmed that macro factors indeed influence real estate market. Increase in GDP, average wage and population level are shown to have a positive effect on real estate prices, while increase in interest rate has a negative impact on prices. Adams and Füss (2010) examined the long-term impact and short-term dynamics of macroeconomic variables on international housing prices. Their results showed that a 1% increase in economic activity lead to a 0.6% rise in the demand for houses, and thus in the house prices, in the long run. An increase in construction costs has a similar long-term effect of about 0.6% on house prices, as it reduces housing supply, which then drives up rents and, in turn, house prices. Finally, a rise in the long-term interest rate makes other fixed-income assets more attractive compared to residential property investments, reducing the demand for this kind of investment and leading to a 0.3% decrease in prices in the long run. Gustafsson et al. (2016), on the other hand, examined the effects of changes in housing prices themselves and found that a 20% decrease in housing prices would have recession-like effects on household consumption and unemployment. If such a decline were to happen, more expansionary stabilization policies would be needed in order to lessen the effects on the real economy.

2.1. Real Estate Market in the USA

Taking a look at the real estate market in the United States, we can observe that the residential real estate is the largest property market there. According to the Financial Stability Report (the assessment of the Federal Reserve Board on the stability of the US financial system, May 2023), the annual growth and average annual growth of residential and commercial real estate prices, as well as price growth (real), are shown in Table 1.

	Outstanding (billions of dollars)	Growth, 2021: Q4– 2022: Q4 (percent)	Average annual growth, 1997–2022: Q4 (percent)
Residential real estate	55,670	10.4	6.4
Commercial real estate	23,796	–1.4	6.8

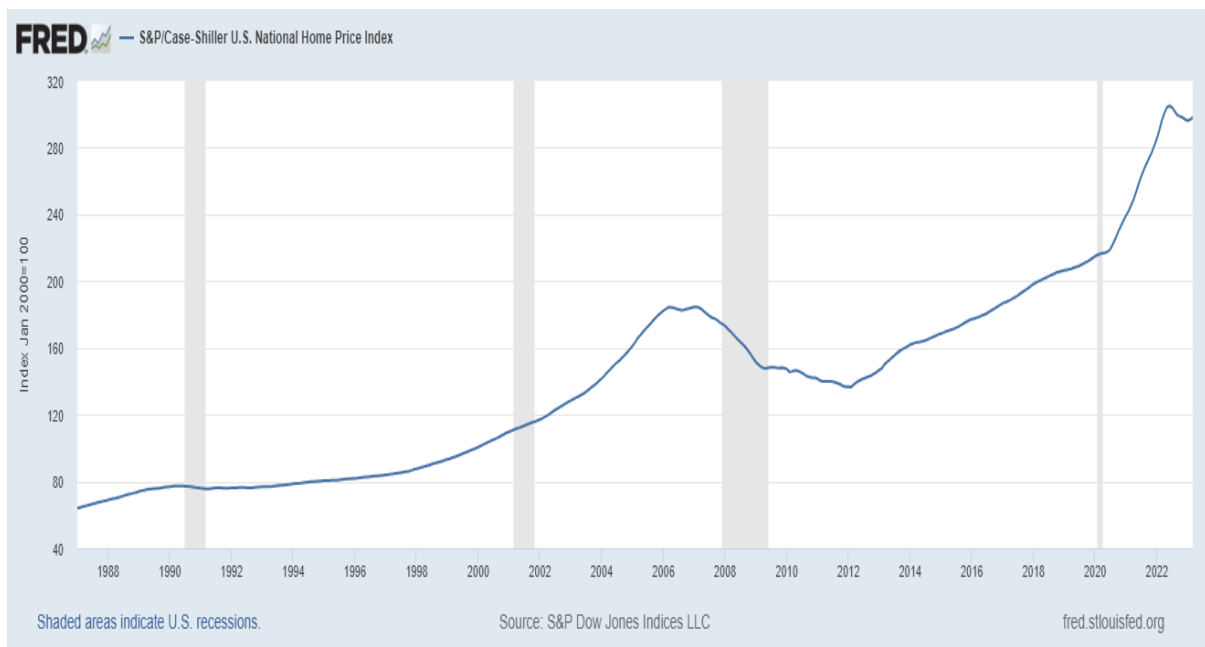
Price growth (real)			
Residential real estate		0,3	2,5
Commercial real estate		-1,9	3,1

Source: Adapted from the Board of Governors of the Federal Reserve System, USA. *Financial Stability Report* 2023.

Table 1: Size of selected asset markets

We observe a slight increase in residential property prices by 0.3% from December 2021 to December 2022 and a decline in commercial property prices by approximately 2%. Following the COVID-19 pandemic (officially ending in 2023), the trend of remote work continued in many sectors of the economy, leading to reduced demand for commercial spaces (offices, commercial buildings), and subsequently, a decrease in commercial property prices.

Figure 3 illustrates the trend of property prices from January 1, 1987 to March 1, 2023, in the USA.



Source: S&P Dow Jones Indices LLC, S&P/Case-Shiller U.S. National Home Price Index [CSUSHPIA], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/CSUSHPIA>, June 14, 2023.

Figure 3: Property Price Trend in the USA

In Figure 3, we can see that property prices have been consistently rising since 1987. A significant drop in property prices occurred in 2007 and 2008, influenced by the financial crisis, which continued in a milder form from 2009 onwards. Recovery only took place in 2012, followed by a gradual increase until the onset of the COVID-19 pandemic, which led to a substantial surge in property prices.

The study conducted by Xinying Ding in 2022 analyzes the macroeconomic factors affecting property prices and how changes in these factors influence property price fluctuations. Housing price index is used as a proxy for property prices, and the macroeconomic factors

affecting them include stock growth, economic growth, mortgage rates, unemployment rates and population growth. The data used consists of time series from a sample of 191 observations in the USA (FRED data) from 2005 to 2020, encompassing periods of crises such as the Great Depression and COVID-19. The study employs a multiple linear regression model using Stata. The results of the analysis show that stock growth and economic growth are positively correlated with the rise of the housing price index, whereas mortgage rates and unemployment rates have a negative impact on housing prices. Additionally, it is worth noting that population growth, as a determinant, is not statistically significant.

Although the real estate market has contributed to economic growth, it has also resulted in a situation where, in 2018, as much as 35% of the population in the USA did not own any property¹.

The mortgage crisis in the USA in 2008 demonstrated how the real estate market can impact a country's financial stability. Low-interest rates led to increased borrowing for property purchases, resulting in a growing number of mortgages and few or minimal outstanding loan obligations. Consequently, property prices surged, and banks heavily invested in the real estate market, leading to a speculative real estate bubble. Eventually, this bubble burst, and banks that had heavily invested in real estate were unable to collect on their loans. With increasing outstanding loan obligations and a decline in property demand due to rising foreclosures, property prices fell. This situation also led to a rise in nonperforming loans (NPLs), which are loans that are 90 days or more overdue and still accruing interest, including loans in nonaccrual status. All these factors had a significantly negative impact on the country's economy.

A study that focuses on the determinants of NPLs and changes in property prices is "House prices and credit risk: Evidence from the United States" by Tajik, M., Aliakbari, S., Ghali, T., Kaffash, S. (2015). This study analyzes how changes in property prices affect NPL dynamics, considering different categories of loans (property loans compared to other types of loans) and various types of banks. The results of the analysis show that changes in property prices significantly impact NPLs, with property loans being more susceptible to negative property price changes (as they are secured by the properties themselves) compared to other types of loans. Moreover, changes in property prices do not have the same impact on different types of banks.

¹ The statistics is sourced from <https://www.statista.com/statistics/184902/homeownership-rate-in-the-us-since2003/>, retrieved on 11th November 2019.

2.2. Real Estate Market in BRICS countries

When we mention BRICS (Brazil, Russia, India, China, and South Africa), we are referring to countries that have become an economic (and political) interest group due to their growth. It is believed that by 2050, BRICS will dominate the global economy. Brazil, Russia, India, China, and South Africa have been among the fastest-growing emerging market economies for many years. Comparative advantages have been achieved thanks to low labor costs, demographic population structures, and vast natural resources. The economic growth of these countries is impressive and warrants the attention of researchers. Many studies have focused on researching the economic growth of these countries and the factors influencing it. There are some common macroeconomic factors that affect the economic growth of the BRICS group of countries. These factors often include GDP per capita, foreign direct investment (FDI), exports of goods and services, and bank credit to bank deposits. Every country has a need for financial development and economic growth. Numerous scientific studies in the past two decades have analyzed the relationship between the development of the financial sector and economic growth in BRICS countries. Most authors believe that a developed financial sector significantly positively influences economic growth. For example, Stiglingh & Vijloen (2018) examine the relationship between the financial sector and economic growth in BRICS countries from 1996 to 2016 using panel analysis. The variables used in the model include GDP growth, foreign direct investment, population, real interest rates, gross fixed capital formation and credit to the private sector. The level of financial sector development is measured based on indicators of banking sector development, net inflows of foreign direct investment and the level of real interest rates. The findings of the study suggest that there is both a long-term and short-term relationship between economic growth and financial development. The research results show that, although foreign direct investment represents a significant factor in long-term economic growth, in the short term, economic growth is not primarily influenced by foreign direct investment. On the other hand, the real interest rate has a significant positive impact on long-term economic growth. It is recommended that countries regulate and stimulate domestic credit to the private sector.

The paper from Khaled and Sanzida (2018) analyzes the macroeconomic factors determining the real estate prices in three major Asian countries: Russia, China and India, from 2003 to 2017, using a linear regression model. The selected macroeconomic factors, including GDP, interest rate, inflation, population density per square meter and unemployment (independent variables), are significantly associated with property prices (dependent variable) in the context of different cultural characteristics in Russia, China and India. The study results demonstrate that all independent variables provide a very good explanation for the dependent variable. The coefficient of determination shows that GDP, interest rate, inflation, price, population density per square meter and unemployment, at a 95% confidence level, explain property prices in India by 95%, in Russia by 89%, and in China by 77%, which is an excellent result. This indicates that the chosen macroeconomic factors have a significant impact on property prices. Other factors only account for 5% in India, 11% in Russia and 23%

in China. Nevertheless, one factor stands out as the most important: population density is the most common factor influencing property prices in Russia, China and India.

Brazil. The paper from Vartanian, Santos, Silva and Fronzaglia (2022) analyzes the impact of macroeconomic factors such as interest rates, inflation, industrial production and the exchange rate, as well as financial indicators such as the S&P 500 and oil prices, on the Ibovespa and the Index of real estate funds (IFIX) in the stock and real estate markets. The research period spans from 2015 to 2020, using a vector with error correction (VEC) econometric model. The results indicated that the Ibovespa and the IFIX exhibit relatively similar behavior in response to macroeconomic and financial shocks. Shocks in inflation, exchange rates (devaluation of the real) and interest rates promoted a negative trend in the dynamics of the Ibovespa and the IFIX, while shocks in industrial production resulted in a positive trend in both the IFIX and the Ibovespa.

Russia. In the analysis of the potential real estate "Bubble" in the Russian market (Drobyshevsky and Elena Pikulina, 2009), concerns arose due to the rapid growth of the real estate market in Russia. Real estate prices had been consistently rising since the early 2000s, with the most significant price increases occurring in the major cities of Moscow and St. Petersburg. For example, from 2005 to 2008, the real estate price index increased by 3 to 3.5 times compared to the previous period. The growth in real estate prices was influenced by an increase in demand, rising real incomes, economic stability, limited housing supply, extended construction periods, a lack of land parcels for development and insufficient infrastructure facilities.

We have an identical case, although in different time periods, in the real estate markets of the USA, the United Kingdom, Japan and some European countries (Spain, Germany, Austria). Although fundamentally the same, they have different origins and causes (consequences) that significantly differ from Russia. In the USA, the rise in property prices (in the 1990s) was driven by changes in fiscal policy and tax incentives. In Japan, the real estate market was influenced and regulated through monetary policy instruments. In the Russian real estate market, demand and supply are the factors determining property prices. Demand is observed as household demand (consumer good) and investor demand (investment good). Furthermore, demand has two components: fundamental and speculative, thus referred to as fundamental and speculative demand. Speculative factors can include the accessibility of loans (increasing investor demand) and the RTS index change rate (reducing investor demand). It is estimated that speculative (investment) demand contributed to up to 30% of the rise in property prices. An increase in the supply of properties leads to a decrease in property prices. Because of all the aforementioned factors, we can speak of the existence of a "Bubble" in the Russian real estate market during the analyzed period.

India. India is the second most populous country in the world, so there is a very high demand for real estate. For some, buying a house is a lifelong dream (consumer goods), while for others, it is an investment that can yield a good return. The real estate market in India has

been growing at an incredible rate of 30% annually (Madan, Shukla 2015), with a value of \$15 billion. Foreign investments in the real estate sector and the real estate market itself have a significant share in India's GDP. With the increasing demand for properties, property prices also rise. The population further incurs debt from banks, which affects the reduced purchasing power of the population. On the other hand, speculative behavior is also on the rise, leading to an even greater disparity between supply and demand for real estate. As investments in real estate increase, so does speculative behavior.

The real estate market in India, as is characteristic of all BRICS countries, is complex, influenced by various factors such as demographic, political, social and economic aspects. The study titled "The Impact of Macroeconomic Factors on Housing Prices in India: An Empirical Investigation" (Parrikar, 2019) examines the influence of macroeconomic factors on property prices in India from 2010 to 2018. This investigation employs multiple regression analysis, the Johansen cointegration test and the Vector Error Correction Model (VECM) to explore both short-term and long-term relationships between macroeconomic factors and property prices. Specifically, the research seeks to establish connections between GDP, interest rates, housing loans, exchange rates and inflation with the Property Price Index in India. The findings reveal that approximately 98.75% of property price variations can be explained by GDP, interest rates, housing loans, exchange rates and inflation. Conversely, utilizing the Vector Error Correction Model (VECM), it is observed that there is an unstable long-term relationship between macroeconomic variables and the housing price index. In the short term, there is a weak (random) connection between GDP, housing loans, and interest rates with property prices in India. If GDP does not significantly impact property prices, this creates room for speculative and irrational expectations in the real estate market.

India, like many countries worldwide, was severely impacted by the COVID-19 pandemic. As the pandemic spread, the growth rate declined, employment decreased, and people's incomes were either reduced or non-existent. All of this had an impact on the real estate market and India's GDP. The drop in housing prices weakened the GDP, which, in turn, affected all economic activities within the country. The first study in India that analyzed and measured the impact of COVID-19 shocks on property prices during the COVID-19 era was titled "House Prices and COVID-19 Pandemic Shocks in India: A Nonlinear ARDL Analysis" (Mehta, Gupta, Maitra, 2023). The aim of this research was to measure the asymmetric impact of COVID-19 shocks on property prices in India, using a nonlinear autoregressive distributed lag model and to test the existence of short- and long-term asymmetry. The research results show that in India, during the initial phase and peak of the COVID-19 pandemic, property prices experienced a decline. Prices gradually normalize at a rate of 0.978% with a decrease in the number of COVID-19 cases.

India's real estate market, similar to Russia's real estate market, is not as heavily dependent on conventional macroeconomic factors (nor monetary policies). Property prices are primarily influenced in the long term by demand and expectations within the real estate market. Any

negative impact on the real estate market (such as crises) can jeopardize financial stability, as the government lacks means of intervention (e.g. through monetary policy).

China. The disposable income of residents has a significant impact on the demand for real estate. However, there is not much research analyzing the impact of disposable income and investments on real estate. To investigate the relationship between property prices, disposable income per capita, and real estate investments, a study by Yingying Zhang in 2020 uses data on average property selling prices in Anhui Province, China, from 2000 to 2018, applying a multiple linear regression model. The econometric model's results demonstrate a clear positive correlation between property prices, personal disposable incomes, planned real estate investments and that these analyzed factors significantly influence changes in property prices.

In China, there are six different stock markets and a well-developed real estate market. The interaction between these two markets (stock and real estate) is influenced by domestic and foreign investors. What makes the study from Di, Heshmati and Liu (2022) interesting is that it examines the (short-term and long-term) relationship between the stock market and the real estate market in different provinces (31 provinces) in China. A panel regression analysis was conducted on the 31 provinces from 2000 to 2016. The research findings show the existence of a long-term relationship and significant connection between the stock market and the real estate market. Furthermore, the study reveals that the short-term relationship varies from province to province and is influenced by major industries as well as domestic and foreign investors.

The rapid development of the real estate market can lead to significant disruptions and instability in the banking sector. The banking sector finds it challenging to keep up with the ups and downs of the real estate market because supply and demand are unpredictable. In the short term, the banking sector can monitor real estate market developments, but it struggles to do so in the long run. This is especially evident in economically strong (emerging) countries like China. Lending to the real estate market in commercial banks in China carries the risk of banks increasing non-performing loans (NPLs). The study titled "Real Estate Investments and Financial Stability: Evidence from Regional Commercial Banks in China" by Zhang, Cai and Liu Kutan (2016) examines the relationship between the real estate market and banking stability, measured by NPLs. The results demonstrate a strong connection between increased real estate investments and non-performing (problematic) loans and their sensitivity to real estate market fluctuations. The banking sector can face significant issues if banks invest in only one type of real estate. Diversification of investments into multiple asset types is necessary to reduce investment risk.

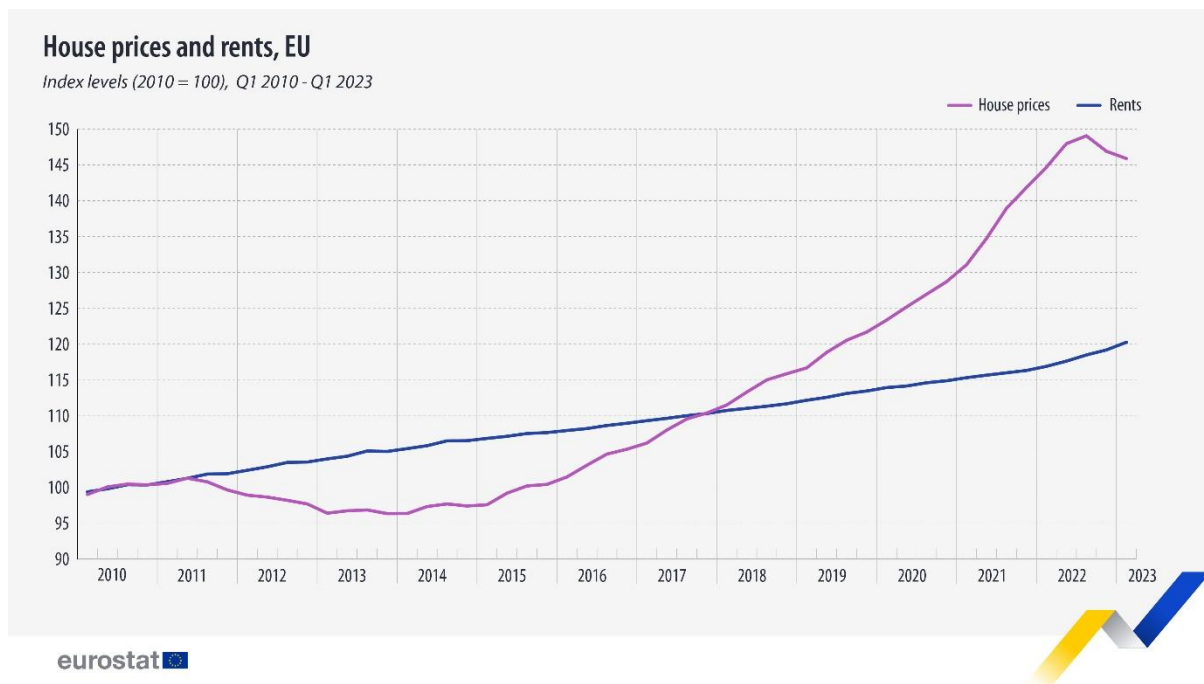
South Africa. The aim of this section is to provide basic characteristics of the South African residential real estate market. In his work "The Absa Residential Property Market Database for South Africa - Key Data Trends and Implications," Christo (2005) analyzes the real estate market in South Africa. There are numerous factors that influence the real estate market, and

they can be divided into macroeconomic factors and South Africa-specific factors that affect property prices. Macroeconomic factors include GDP (with a small budget deficit averaging only 1.9% since 1998), the inflation rate and a high-interest rate (ranging between 13% and 24%). Specific factors influencing the real estate market are population migrations, the economic empowerment of black people (the "black middle class"), the creation of secure areas with constant security control (known as "secure villages"), an undervalued currency, foreign investments in real estate in coastal regions. The influence of these factors has increased the demand for properties and led to rising property prices.

2.3. Real Estate Markets in Some European Union Countries

Real estate prices in the EU have shown a long-term positive trend. This positive trend began in the mid-1990s, led by countries such as Ireland, the Netherlands, Norway, the UK and Spain, and ended in 2007 when the real estate market became overvalued, leading to the emergence of a "price bubble". Governments of these countries had to prevent a complete collapse of the real estate market by using Central Banks and monetary policy instruments, especially through interest rates. Some EU countries experienced a "bubble" in their real estate markets, which burst in 2008, causing a downturn in all economic activities and a slowdown in economic growth.

After 2010, rapid fluctuations (both upward and downward) in real estate prices were observed in most European real estate markets. These price fluctuations can be attributed to changes in economic and social factors, as well as crises (such as the pandemic and the conflict in Ukraine) that impact the real estate market. Figure 4 illustrates the trends in house prices and rents in the EU from the beginning of 2010 to Q1 2023.



Source: Eurostat, July 2023
Figure 4: House prices and rents, EU territory

In the above figure, we can observe the growth of house prices after the 2008 financial crisis. Subsequently, there is a decline in prices until 2014, followed by a significant increase in property prices starting from 2015. The most significant growth is observed in 2021/2022, followed by a decline in house prices after 2022. House rents show a consistent mild increase throughout the period displayed.

The real estate market in Germany represents the most stable real estate market globally. The stability of the real estate market in Germany is attributed to the fixed interest rate calculation for residential mortgages. This ensures that the rise or fall in economic activities does not affect the real estate market as it does in other countries worldwide. Additionally, the population has been decreasing at an average rate of about 50,000 annually since 2002. This contributes to the prevention of excessive demand for real estate and thus prevents a steep rise in property prices.

According to estimates from the German Federal Statistical Office (Destatis) and the Global Property Guide in 2023, after many years of significant growth in property prices, there has been a slowdown in their growth. Unlike property prices in other countries, property prices in Germany continued to rise (52% or 38.1% adjusted for inflation) after the 2008 and 2009 financial crisis, as well as after the Covid-19 pandemic. Table 2 shows the percentage annual changes in the House Price Index.

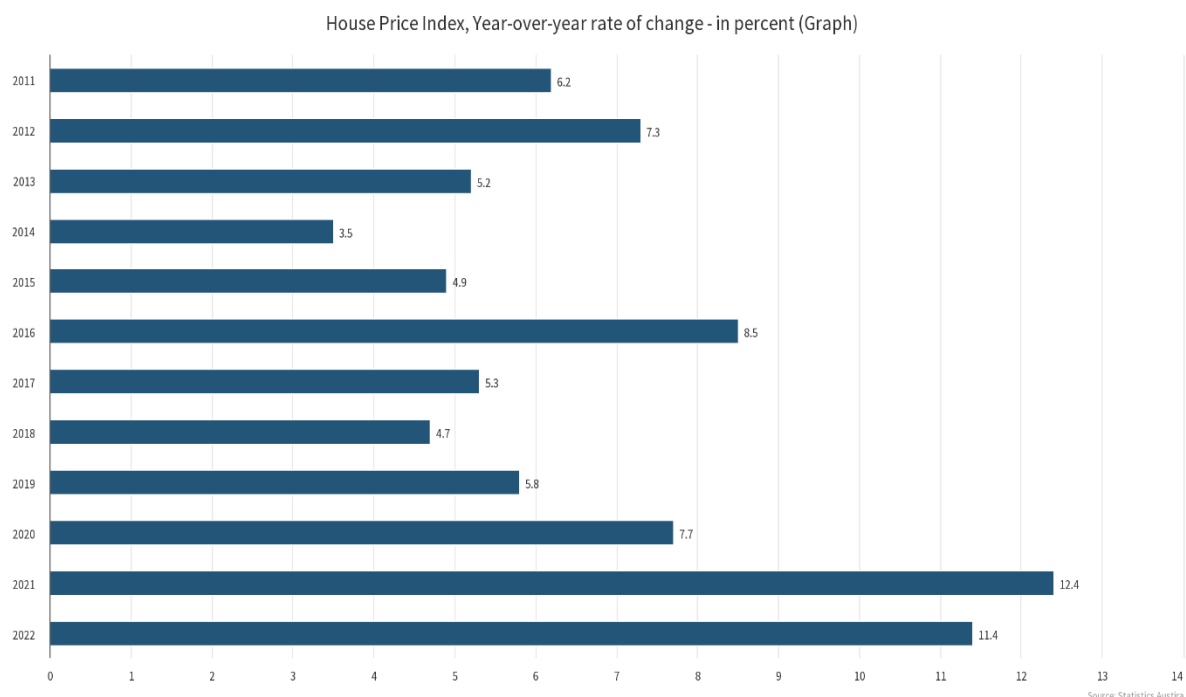
HOUSE PRICE INDEX, ANNUAL CHANGE (%)		
Year	Nominal	Inflation-adjusted
2009	2.93	2.52
2010	-0.48	-1.83
2011	4.18	1.91
2012	4.93	2.86
2013	1.53	0.19
2014	3.44	2.92
2015	5.82	5.49
2016	8.45	7.25
2017	6.25	4.51
2018	6.22	4.69
2019	6.50	5.19
2020	8.74	9.02
2021	12.61	7.22
2022	-3.57	-12.06

Sources: Destatis, Global Property Guide 2023

Table 2: House price index

In 2022, the House Price Index fell by 3.57% (-12.6% adjusted for inflation) compared to 2021. Similarly, the estimated population in 2022, according to Destatis and the Global Property Guide 2022, amounts to 84.3 million people, which is an increase of 1.1 million people compared to 2021. This population increase is believed to be primarily due to migration. Crisis situations in Syria and Ukraine have led to significant population migration to European countries, especially Germany.

When discussing the real estate market in Austria, due to increased demand and limited supply (stagnation in housing construction), property prices experienced a significant surge. As seen in Figure 5, at the end of 2021, the residential property price index increased by a substantial 12.36%. Expectations for 2023 are that the real estate market will continue to grow because the population is investing in real estate to reduce the risk and uncertainty of inflation and crisis situations.



Source: Statistics Austria, House Price Index. Created on 23 June 2023

Image 5: House price index

The mortgage market in Austria increased to 33.75% of GDP in 2021, compared to the increase of 17.1% of GDP in 2003. According to the Global Property Guide, Austria is relatively low on mortgages: the EU average is 50% of GDP. Regarding rental properties, Vienna, with approximately 75% of rented properties, is the city with the highest rental percentage in the world. The average homeownership rate in the EU-27 is over 70%.

Despite economic difficulties due to the Covid-19 crisis, it seems that property prices in Austria are not declining, quite the opposite. According to real estate agents, this is because the demand is stable and even expected to continue growing. People view investing in real estate (residential properties) as a safeguard against economic uncertainty and risks. Adams and Füss (2010) point out that unlike other assets in the capital market, real estate prices do not change immediately after economic news releases and generally show low price fluctuations. The financial system of modern, developed countries like Austria has been able to neutralize initial shocks through economic policy measures (reducing interest rates, subsidies, etc.), and the market has responded by continued real estate growth. The Austrian real estate industry has proven to be resilient in times of crisis and to be a stabilizing factor in the Austrian economy².

The real estate market in Italy is one of the more stable real estate markets in developed countries worldwide. Although Italy is considered one of the top economies in the European Union, the credit market is underdeveloped (due to the time and cost of credit repayment)

² <https://practiceguides.chambers.com/practice-guides/real-estate-2021/austria/trends-and-developments>

and accounts for 20% of GDP, which is below the EU average of 50% of GDP. The underdeveloped credit market has protected the real estate market from non-repayable loans, unlike most European countries, such as Spain, Ireland and the United Kingdom. The banking credit policy has prevented the formation of a real estate bubble. However, a high GDP has an impact on economic growth, increased demand and an increase in real estate demand, leading to rising property prices.

The real estate market in different European countries is characterized by the fact that the specifics of the "welfare state" also affect the regulation of the housing system (housing policy, housing outcomes and housing market movements). There are significant differences between various European housing systems. Particularly, Southern European countries have a pronounced Mediterranean housing system. Let's take Spain as a typical Mediterranean country, for example. In recent decades, especially after 2000, the real estate market has been characterized by high property prices. This growth was spectacular. The increase in housing construction (a housing boom) resulted in an oversupply of apartments. This meant that apartments remained vacant for a certain period and were not included in the real estate market's property supply. This is a clear indication of speculative tendencies in the real estate market. An oversupply of apartments for living or renting led to a decline in property prices, which had an impact not only on housing policy but also on the country's overall economic policy (the 2008 crisis). This phenomenon is referred to in the literature as the "Spanish paradox" (Hoekstra, 2010). A similar phenomenon can be observed in the real estate market in Ireland, which, like Spain, had a higher growth rate in housing construction than the population growth rate. One characteristic observed in the Irish real estate market is known as "buy-to-let" activities (buying for renting). This means that residents of Ireland were not buying and/or building new homes for living but for investment purposes, i.e. renting out these properties. The same situation could be applied to any country where residents have a strong preference for property ownership, high demand for real estate investment and relatively little government intervention in the real estate market.

In addition to analyzing the real estate market conditions in individual EU countries, many authors have explored the impact of macroeconomic factors on property prices in the EU. For example, Grum and Govekar (2015), based on a multiple linear regression model, investigated which of the analyzed macroeconomic factors: unemployment rate, the current account of the country stock index, GDP and industrial production, are significantly correlated with property prices in various (economic, cultural, and societal) environments, such as Slovenia, Greece (as southern EU members), France (as a western EU member), Poland (as an eastern EU member) and Norway (as a northern and Scandinavian country; not an EU member). They found statistically significant correlations between property prices and selected macroeconomic factors.

Mavrodiy (2005) analyzed the micro and macro-level influences on property prices. Regarding the macro-level, the author examined the impact of real GDP, the population of Kiev, average

wages and interest rates on the average price of residential space per square meter. The results confirmed that macro factors indeed affect the real estate market. It was shown that an increase in GDP, average wages and population positively influences property prices, while an increase in interest rates has a negative effect on prices.

In today's world, it is essential to understand the relationship between the stock market and the real estate market, including GDP, inflation and interest rates. In the study by Aydogan and Gatjetjiladze (2019), the short-term and long-term relationship between stock prices and property prices, including GDP, inflation and interest rates (as control variables), in Sweden, specifically in the three largest cities in Sweden (Stockholm, Malmo, and Gothenburg) from 1994 to 2018, was analyzed. A Vector Autoregressive (VAR) model was applied to investigate possible long-term equilibrium. The authors explore whether the relationship between the stock market and the real estate market differs in Stockholm, Malmo and Gothenburg, as well as in Sweden as a whole. The results show that in Stockholm and Malmo, a positive long-term relationship was established, where the stock market influences the real estate market (increasing property prices lead to higher stock prices), while a negative long-term relationship was identified for Gothenburg (as well as for Sweden as a whole) where increasing property prices lead to lower stock prices.

Analyzing the works of these authors, we can conclude that time series data on the pandemic and (post-pandemic) fluctuations in property prices were relatively short and might not be considered a representative sample since the available data was unreliable. Accordingly, future research could provide more comprehensive insights into the phenomenon of stable and rising real estate prices based on longer time series data availability for a larger number of EU countries and beyond.

In the Global Property Guide Report for the year 2023, we find data on property prices in Europe. Table 3 provides an overview of property prices in Europe.

Country	Value
Monaco	€ 51,900
UK	€ 13,750
France	€ 13,462
Luxembourg	€ 8,933
Switzerland	€ 8,872
Netherlands	€ 8,250
Norway	€ 7,862
Sweden	€ 7,740
Denmark	€ 7,378
Ireland	€ 7,312
Italy	€ 7,300
Austria	€ 5,788
Finland	€ 5,340
Germany	€ 5,077

Portugal	€ 4,800
Czech Rep.	€ 4,752
Russia	€ 3,608
Belgium	€ 3,477
Croatia	€ 3,440
Hungary	€ 3,424
Slovak Rep.	€ 3,320
Estonia	€ 3,162
Slovenia	€ 3,100
Andorra	€ 3,020
Spain	€ 2,920
Poland	€ 2,570
Lithuania	€ 2,546
Malta	€ 2,322
Greece	€ 2,227
Serbia	€ 2,050
Romania	€ 1,900
Cyprus	€ 1,850
Turkey	€ 1,777
Bulgaria	€ 1,425
Montenegro	€ 1,400
North Macedonia	€ 1,134
Moldova	€ 1,050
Ukraine	€ 1,030
Latvia	€ 967

Source: Global Property Guide 2023

Table 3: Property Prices EUR/m2 in Europe

From Table 3, we can see that properties in Monaco are extremely expensive (€51,900), followed by the UK and France. Next in line are Luxembourg, the Scandinavian countries (Norway, Sweden, Denmark), followed by Ireland, Italy and Austria. The last positions are occupied by Montenegro, North Macedonia, Moldova, Ukraine and Latvia (€967).

2.4. The Phenomenon of Real Estate Bubbles in the Property Market

The detection of real estate bubbles has long been a subject of interest for researchers. Although there is no consensus in the literature on what exactly constitutes a bubble in the real estate market, authors believe that it can be accepted that a bubble occurs when property prices exceed their true value. This is a situation where buyers are willing to pay a higher price for a property because they expect property prices to rise in the future. Property prices increase rapidly, sometimes by 20%, 30% or 40% annually over a period of three years, followed by a sudden decline.

There are many reasons for the emergence of bubbles in the real estate market. We can mention several main reasons, such as low interest rates, an inflow of available funds, excessive household indebtedness, speculative investment in real estate (similar to stocks because it is believed that property prices will never decrease once they rise). These reasons lead to a situation where the population cannot meet their financial obligations (loans) used to finance the purchase of properties, and such circumstances lead to the emergence of real estate bubbles and crises.

There are different schools of thought on the existence of housing bubbles. The Austrian School sees the formation of bubbles as a combination of psychological and real factors primarily caused by manipulations in monetary policy (Holcombe & Powell, 2009). For Austrian economists, the bubble develops as a result of the failure of monetary policy. Pitros (2016) also shares this view, stating that the Austrian School believes that the real estate price bubble exists and will continue to grow due to governments' failure to manage money and interest rates rationally. The emergence of a bubble depends on the control of the interest rate approved by the central banks of individual countries.

Austrian economic theory also suggests that in the presence of a real estate bubble, rising property prices will increase demand for real estate, which can lead to oversupply in the construction sector (Holcombe & Powell, 2009; Kennard & Hanne, 2015; French, 2009). The best explanation of how the bubbles emerge, development and eventually burst can be found in the research of authors Allen and Gale (2000). They claim that housing bubbles consist of three different phases, as follows. The first phase is characterized by financial liberalization and monetary easing and credit expansion, which is followed by rising property prices, often creating the illusion that housing remains affordable (Barlevy, 2007). This first phase lasts for some time, perhaps several years, as the bubble inflates, leading to the second phase, the bursting phase. When this occurs, property prices tend to fall rapidly over a short period, although in some cases the decline can be more prolonged. The final phase is characterized by credit delays and a banking crisis, often leading to problems in the real sector of the economy. The link between housing bubbles and lending is strongly emphasized by Zhou and Sornette (2003). They claim that the real estate bubble is part of a credit bubble and cannot exist without the existence of a credit bubble. Ermisch (1990) similarly points out that developments in mortgage markets can help explain increases in house prices. Furthermore, Allen and Carletti (2010) and Agnello and Schuknecht (2011) note that loose monetary policy can contribute to the formation of the real estate bubbles, while Gouldey and Thies (2012) and Muller et al. (2009), claim that asset bubbles are usually closely linked to money and credit expansion. This view is supported by Hubbard and Mayer (2009), who find a negative relationship between house prices and real interest rates. Finally, Alan Greenspan noted that the rise in house prices in the United States in the 2000s was largely driven by low mortgage interest rates (Zhou & Sornette, 2003).

The two most significant real estate bubble phenomena occurred in the United States. The first is known as the "dot-com bubble" and arose in the late 1990s due to excessive speculation in internet companies during the mass adoption of the internet. The second real estate bubble phenomenon occurred in late 2007 and was caused by the high-risk mortgage crisis (loans were approved at high interest rates with poor customer credit ratings, leading to an inability to repay the loans).

We can also mention the occurrence of a real estate bubble in Spain. From 1995 to 2008, Spain experienced an economic boom, with real GDP averaging a 3.8% annual increase. The banking sector and construction companies financed the construction of new properties for the younger population. As a result, property prices tripled. After this period (in 2008), property prices declined, leading to a collapse caused by a financial crisis. It can also be observed that the bursting of the real estate bubble led to a decrease in GDP, which took five years to recover, along with the trend of rising property prices.

Studying the movement of property prices, we can conclude that a reduction in interest rates affects the rise in property prices, which in most cases leads to a financial crisis and the bursting of the real estate bubble. Therefore, it is important for property prices to remain stable to prevent the emergence of a new bubble and financial crisis.

2.5. Macroeconomic Factors Affecting Property Prices

There is no single set of macroeconomic factors that describe the impact and importance on property prices. Some common characteristics or shared factors influencing property prices can be identified, but the choice of macroeconomic factors is a subjective matter for researchers studying this issue. When it comes to determining property prices and the factors affecting property prices, we can discuss three approaches:

Macroeconomic Approach. Property prices are formed based on macroeconomic factors such as GDP, GDP growth rate, FDI (Foreign Direct Investment), inflation, employment, net wages, credit availability, interest rates, consumer spending and household deposits.

Hedonistic Approach. Property prices are determined based on a specific set of factors specific to a narrow geographical area. It analyzes the specific market where the property is located and describes it using a specific set of factors. Property prices are formed using a specific set of factors related to that specific market. These factors typically fall into two groups: location and property characteristics such as the year of construction, property size, number of rooms, floors and the presence of an elevator.

Combined Approach. As the name suggests, this approach combines both macroeconomic and hedonistic approaches, and property prices are influenced by both macroeconomic factors and specific factors for the narrow geographical area.

In this study, a macroeconomic approach is applied.

When discussing the macroenvironment, it is possible to define its basic components. Six components of the macroenvironment are: demographic, economic, natural, technological, political and cultural environments. Since property prices are influenced by factors that are inherently global in nature and are therefore used by all countries worldwide, it is not surprising that property prices in a group of countries (developed, developing, transitional, interest groups such as EU, BRICS, OECD, etc.) are closely correlated. Macroeconomic factors that affect a country's economy can be viewed as GDP growth, interest rates, inflation, fiscal policy, employment, economic growth rate and industrial production. Governments and institutions create strategies based on these factors. The importance of these factors varies from country to country.

The real estate market represents a crucial segment of development for any country and plays a leading role in achieving the stability of the national economy. Consequently, there is a significant body of research by various authors in the field of analyzing the impact of macroeconomic factors on property prices. The selection of key macroeconomic factors is a subjective matter for individual authors. Some authors believe that certain factors are more important while others are less important. Different authors employ various methods and methodologies. When considering different countries, their regulations, population sizes, migrations, crises and other contemporary phenomena and processes, the task is by no means easy. There is no general consensus on which factors and which method should be used for this type of analysis. As a compromise, the most significant research and authors who have addressed this issue are presented. Let's mention some authors and studies they have conducted.

Authors (Trung, Quan, 2019) investigate the factors influencing property prices in Ho Chi Minh City, China. The research involved 250 real estate investors, utilizing exploratory factor analysis (EFA) and multiple regression analysis. Natural factors (location of real estate; size, area, shape of the land; terrain; form of construction; soil characteristics; environmental factors and natural disasters; and zone), Economic factors (real estate profitability; the amenities of real estate: electricity, water, sanitation, air conditioning, communication, etc.), Legal factors (red books, pink books, ownership certificates), Market factors (supply and demand, labor market, financial market), Political factors (changes in policies of the State and local authorities), and Macroeconomic factors (annual GDP growth rate of the region; average annual income of people in the area; general inflation level; labor market conditions; credit market; tax rates; stock market; neighborhood, etc.) all show a positive influence on selected variables affecting property prices. Among these factors, macroeconomic factors have the greatest impact on property prices, followed by legal factors, market factors, political factors, economic factors, and finally, natural factors.

Analyzing the impact of macroeconomic variables on property prices, we can identify the GDP growth rates, unemployment rates, nominal short-term and long-term interest rates and

inflation rates as key factors. These variables can also be represented as economic factors³, employment factors⁴ and monetary policy factors. Adams and Füss (2010) examined the long-term influence and short-term dynamics of macroeconomic variables on international property prices. The macroeconomic factors they considered included economic activity (comprising real GDP, employment, real industrial production, real consumption, real money supply), construction costs and long-term interest rates. International housing prices were the dependent variable in the model. The analysis used Panel cointegration analysis consisting of 15 OECD countries over a 30-year period. The research results showed that a 1% increase in economic activity leads to a long-term 0.6% increase in housing demand and, consequently, housing prices. An increase in construction costs has an average long-term impact of 0.6% on housing prices by reducing the supply of apartments, leading to higher rents and, in turn, higher housing prices. Finally, an increase in long-term interest rates makes other fixed-income assets more attractive compared to investments in residential real estate, reducing the demand for this type of investment, which in the long-term lowers housing prices by 0.3%.

Egert and Mihaljek (2007) examined the relationship between macroeconomic factors and property prices in 8 transitional economies from Central and Eastern Europe (CEE⁵) and 19 countries from the Organization for Economic Co-operation and Development (OECD⁶), which the authors consider as large, small and catching-up OECD countries. Using a panel Dynamic Ordinary Least Squares (DOLS) approach, the authors focus on whether standard fundamental variables, such as GDP per capita, real interest rates, housing credit and demographic developments, can explain movements in property prices in CEE and OECD. On the other hand, the study explores how, to what extent and on which groups of countries (CEE and OECD), macroeconomic factors affect property prices. Despite some data quality issues in the analysis regarding property prices and the macroeconomic factors affecting them, it can be concluded that the fundamental macroeconomic factors (and some transition-specific factors, especially the institutional development of housing markets) played a significant and important role in explaining property prices and their variability in CEE and OECD countries.

The results show the following relationships and impacts of macroeconomic factors on property prices in CEE and OECD countries:

- 1) A very strong positive relationship between GDP per capita and property prices.

³ Adams, Z.; Füss, R. Macroeconomic determinants of international housing markets. *J. Hous. Econ.* 2010, 19, 38–50.

⁴ Tzeremes, P. The Asymmetric Effects of Regional House Prices in the UK: New Evidence from Panel Quantile Regression. *Stud. Microecon.* 2022, 10, 7–22. [CrossRef]

⁵ CEE countries that are members of the OECD are included only in the transition economies sample.

⁶ The large OECD sample comprises France, Germany, Japan, the United Kingdom and the United States. The small OECD sample comprises Austria, Belgium, Finland, Greece, Ireland, the Netherlands, Portugal and Spain from the euro area, plus Denmark, Norway, Sweden, Australia, Canada and New Zealand. The catching-up sample includes Greece, Ireland, Portugal and Spain.

- 2) A strong relationship between real interest rates and property prices. Property prices in CEE tend to rise twice as fast compared to an equivalent real decline in interest rates compared to OECD countries.
- 3) A strong relationship between credit and property prices. Property prices in OECD countries react about twice as strongly to credit growth compared to CEE countries.
- 4) A strong relationship between demographic factors and property prices. Demographic factors have a stronger influence on property prices in CEE countries than in OECD countries.
- 5) The development of the housing market and housing finance institutions⁷ have a fairly strong impact on the dynamics of real house prices in Central and Eastern Europe compared to OECD countries.

An interesting study and experience from Malaysia can be found in the paper titled "Impact of Macroeconomic Attributes on High-rise House Prices in Malaysia using Auto-Regressive Distributed Lag Approach" (Tihah Fikah, 2020). In this paper, the author aimed to determine the (short-term and long-term) relationships between selected macroeconomic factors (interest rate, gross domestic product, stock of houses sold, population rate and unemployment rate) and high-rise house prices in Malaysia from Q1 2009 to Q4 2019. Additionally, the goal was to ascertain the influence of these macroeconomic factors on high-rise house prices. The Cointegrations Test of Auto-Regressive Distributed Lag model and Error Correction Model was used to establish the relationships between the macroeconomic factors, while the Granger Causality Test was employed to investigate the impact of these factors on high house prices.

The study found that interest rates, gross domestic product, the stock of houses sold and the population rate exhibited a long-run relationship with high-rise house prices. In the short run, the population rate and inflation rate had a positive and statistically significant relationship with high-rise house prices. The author concludes that 71.31% of the short disequilibrium needs to be corrected to achieve the long-run equilibrium and that the factor "stock of houses sold" has the most significant influence on high-rise house prices.

Another paper (Ahamba, Osigwe, Onoja, Agbanike, 2018) assesses the impact of real gross domestic product, money supply, exchange rate, nominal interest rate, government expenditure, domestic credit and the openness of the economy on the price level in Nigeria using a Vector Error Correction Model. The Johansen cointegration test confirmed a long-term relationship among the selected macroeconomic factors. The analysis results are as follows:

- Real gross domestic product had a positive and highly significant impact on the price level.
- The current exchange rate had a negative and significant impact on the price level.

⁷ EBRD indicators of reform in banking and non-banking financial institutions

- Domestic credit had a positive and significant influence on the price level.
- The openness of the economy had significant and positive effects on the price level.
- Money supply, government expenditure and nominal interest rate did not have a significant impact on the price level.

In addition to this study, other key macroeconomic factors related to real estate prices include gross domestic product (GDP), unemployment, share index, current account of a country, demographic factors, household income, interest rate, industrial production and household consumption, as indicated by various authors such as Hon-Chung, H. (2009), Ludwig, A., & Slok, T. (2004), Bardhan, A., Edelstein, R., & Tsang, D. (2007), Zhang, Y.L., & Wu, J. (2008), Goodhart, C., & Hofmann, B. (2007).

Authors Lovrinčević and Vizek (2008) analyze the factors influencing real estate prices in selected EU countries and Croatia from 1995 to 2006 using the Johansen cointegration method. The aim of the study is also to determine the short-term and long-term impacts of the analyzed factors on real estate prices in Croatia. The following macroeconomic factors were used for this research: real long-term interest rate, construction works volume index, real net average wage per employee, consumer price index (inflation rate), real gross domestic product, real total loans to households, gross domestic product gap (the gap GDP was obtained by subtracting the value of potential GDP from the actual real GDP value) and the number of marriages contracted. The Average real price per square meter of a newly built apartment was used as the real estate price. Using the Wald test (excluding certain factors and transforming them) and the Lagrange multiplier test (to test if some important factor is missing from the model), the total number of factors was reduced to five factors that influence real estate prices in both the short and long term. The research results show that in the short term, an increase in loans to households, an increase in the number of marriages contracted and an increase in the general price level (inflation) lead to an increase in real estate prices. In the long term, a 1% increase in the volume of construction works reduces real estate prices by only 1.75%, similarly, if interest rates increase by 1%, real estate prices decrease by 0.28%, and finally, an increase in the price level is positively associated with an increase in real estate prices (hence, real estate investment serves as protection against inflation).

Another noteworthy research (due to the number of factors and countries analyzed) is the study "Macroeconomic Determinants of Housing Prices: A Cross Country Level Analysis" by Tripathi and Sabyasachi in 2019. The selection of macroeconomic factors was based on their significance in each country. The study analyzes the impact of macroeconomic factors on housing prices in 43 countries, including Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, England, United States, Brazil, Chile, China, Colombia, Estonia, India, Indonesia, Israel, Latvia, Lithuania, Russia, Slovenia, South Africa. The selected

macroeconomic factors include rent, price-to-income ratio, price-to-rent ratio, urbanization, per-capita GDP, inflation, the share of the population aged 15-64, GDP growth rate, broad money, real exchange rate, percentage share of employment in services and employment. The research covers the period from 1970 to 2017, and panel data regression models are used for data processing and analysis. Data sources include databases from the World Bank and the OECD. The research results show that rent, price-to-income ratio, price-to-rent ratio, urbanization, per-capita GDP, inflation, the share of the population aged 15-64, GDP growth rate, broad money, and real exchange rate have a positive and significant impact on real estate prices. On the other hand, the percentage share of employment in services has a negative impact on real estate prices. Surprisingly, the analysis shows that the interest rate has no impact on real estate prices in the analyzed countries.

Based on commonly accepted understandings of the significance of macroeconomic factors, in this study, GDP, employment rate, industrial production, interest rate and household loans have been selected as factors that significantly determine real estate prices (independent variables in the model). The variable "Housing prices" is analyzed as the real estate price (dependent variable). In the following text, we will explain these variables and their roles in the research.

3. MODEL AND METHODOLOGY

3.1. Variables in the model

This study is based on a dataset constructed from internationally recognized databases, namely the Bank for International Settlements (BIS) and the OECD. These sources provide consistent and comparable macroeconomic and housing market indicators across countries, which makes them particularly suitable for cross-country empirical analysis.

The dataset covers a quarterly period from 1970Q1 to 2021Q4 and includes 31 countries, comprising both advanced and emerging economies. Given the cross-country nature of the analysis and differences in data availability, the dataset was unbalanced, meaning that the number of observations varies across countries and time periods. To account for this heterogeneity, the empirical model incorporates both country and time (year) fixed effects, ensuring that unobserved country-specific characteristics and global shocks are properly controlled for.

All data processing, transformation, and econometric analysis were conducted using STATA statistical software. The empirical approach consists of three main steps: data cleaning and preparation, factor analysis and regression analysis.

3.1.1. Dependent Variable - Housing Prices

The dependent variable in the model is residential property prices, which serve as a proxy for developments in the real estate market. The analysis focuses on real property price indices, capturing changes in residential property values over time.

Given the skewed distribution commonly observed in macroeconomic and financial time series, the dependent variable is expressed in logarithmic form. The log transformation is applied to reduce skewness, improve normality, and ensure a more linear relationship between dependent and independent variables. In addition, the use of logarithms allows the estimated coefficients to be interpreted as elasticities, which facilitates economic interpretation.

Housing prices encompass indices of residential rent prices, real and nominal house prices indices, as well as price-to-rent and price-to-income ratios. In most cases, the nominal house price index reflects the sales of newly constructed and existing dwellings, in line with the guidelines set out in the Residential Property Prices Indices (RPPI) manual. The real house price index is calculated as the nominal house price index divided by the customer expenditure deflator for each country, based on data from the OECD national accounts. Both indices are seasonally adjusted. The price-to-income ratio is calculated as the nominal house price index divided by the nominal disposable income per capita and can be considered an indicator of affordability. The price-to-rent ratio is obtained by dividing the nominal house price index by the residential rent price index and can be seen as a measure of the profitability of homeownership. Both the price-to-income and price-to-rent ratios are indexed with a base year set to 2015.

The analysis of the impact of various factors on real estate prices can be explored through the influence of related economic and institutional selected independent variables.

3.1.2. Independent variables

The selection of independent variables is based on both theoretical considerations and empirical findings from the literature on macroeconomic determinants of housing prices.

3.1.2.1 Real GDP

Gross Domestic Product (GDP) is the aggregate most commonly used in macroeconomic analyses⁸. The main independent variable pertains to Real Gross Domestic Product, which is the most crucial factor in economic well-being. Its significance lies in the fact that the amount of Real GDP identifies the size or strength of the national economy, while GDP per capita serves as a measure of national prosperity. This means that some countries may have a high

⁸ Majkl Burda i Čarls Viploš, Makroekonomija, CLDS, 2004, str. 20-21.

GDP but not on a per capita basis, indicating significant markets with relatively low personal consumption (e.g., India). Furthermore, the distribution of the achieved GDP (or wealth) across economic factors is significant. Even a higher GDP per capita, if unfairly distributed, may not guarantee high and widespread personal consumption.

Gross domestic product (GDP) is a commonly used indicator that measures the value of goods and services produced in a country over a certain period. It can also be interpreted as the total income generated in the economy or the total spending on final goods and services, excluding imports. Although GDP is the main indicator of economic activity, it does not fully capture how well people actually live. Because of this, additional indicators from the System of National Accounts (SNA) are used to better understand the economic situation of households. The OECD Household Dashboard therefore combines this data with other variables, such as unemployment and consumer confidence, in order to provide a broader view.

Overall, these indicators give a more realistic picture of living standards from the perspective of households, compared to relying only on GDP. Most of the data is based on the 2008 SNA framework, while for some countries older data based on the 1993 SNA is still used.

GDP, both aggregate and GDP per capita, as well as equitable distribution of national wealth, have an impact on real estate markets. Generally, real estate markets are more developed in wealthier countries. The turnover and demand for real estate in a country depend most on the achieved income and the level of economic prosperity.

Due to its connection with GDP, the real estate market can be considered an indicator of economic growth and development. Economic growth is defined as an increase in GDP, which can be measured in nominal and real terms. However, using GDP as an indicator of economic growth has its drawbacks; GDP does not provide enough information about the distribution of goods. Therefore, a country may have a high GDP, but its population may have a low standard of living (if foreign factory owners generate high profits while paying low wages to the local population).

The three most important microeconomic factors influencing real estate prices are often summarized as "location, location, location." Similarly, we can say that the most significant macroeconomic factor influencing real estate prices is Real GDP.

Although we mentioned GDP in the context of the impact of macroeconomic factors on real estate prices in the previous section, we believe it deserves a special place in the analysis of the real estate price phenomenon. We also want to show how GDP is the most significant factor determining property prices in many countries.

For example, in the study by Sivitanides, Petros (2015), the question of which factors influence the House Price Index is posed. Based on official data from the Central Bank of Cyprus from 2006 to 2014, using a regression model, Sivitanides suggests that nominal GDP per capita

(alternatively, nominal GDP) has the most significant impact on the House Price Index. Construction costs and the number of households have less significance and influence, while interest rates have the least impact on the House Price Index.

Cohen, V., and L. Karpaviciute (2017), analyzed the real estate market in Lithuania (from 2001 to 2015) using a multiple linear regression model. They examined the impact of GDP, unemployment, inflation, interest rates, emigration, and the introduction of macroprudential policy on housing prices. The research results indicate that these macroeconomic factors explain as much as 98.76% of the variability in housing prices. Among them, GDP, unemployment, and the introduction of macroprudential policy have the most significant influence, while inflation, interest rates, and emigration have little to no impact on housing prices.

According to Bardhan et al. (2007), the key factor affecting the demand for real estate is GDP. A study on the impact of GDP on house prices in the United States before, during, and after 2007 can be found in the work "The Housing Bubble and the GDP: a correlation perspective" (Valadez, 2010). The research results show that GDP significantly affects the housing price index.

Zull Kepili Izati and Masron (2011) also investigated the relationship between real estate prices and GDP. In their research, they examined real estate prices, GDP, and foreign investment growth in Malaysia and South Korea. They concluded that GDP significantly influences real estate prices and that the growth of GDP and real estate prices is higher in South Korea due to greater foreign investment growth.

The study by Hossain and Latif (2009) analyzes the macroeconomic factors contributing to the instability of real estate prices and investigates the dynamic effects of these macroeconomic factors on price instability in Canada using a vector autoregressive (VAR) model. The analysis results show that price instability is significantly influenced by the GDP growth rate, housing price appreciation rate, and inflation. On the other hand, price instability also affects the GDP growth rate, housing price appreciation rate, and inflation. The analysis reveals asymmetry in response to positive and negative shocks. The findings of this article have important implications, particularly for those interested in developing derivatives for real estate markets.

The authors (Radonjić, M., Đurišić, V., Rogić, S., Đurović, A. 2019) in Montenegro (a Western Balkan country with access to the Adriatic Sea where demand for real estate is consistently high) conducted an analysis to determine which factors influence real estate prices and which of these factors have the most significant impact on real estate prices. They examined macroeconomic factors: GDP, the inflation rate, interest rates on mortgages, take-up of mortgages, the unemployment rate, the average net salary, the current account deficit, and construction activity using a model averaging technique. The research results indicate that the most crucial macroeconomic factor that significantly affects real estate prices and best

describes them is GDP, followed by the average net salary, the unemployment rate, the take-up of mortgages, and their interest rates.

According to a study by Aizenman et al. (2016), changes in real estate prices have a positive impact on GDP growth (reflected in consumption, investment, employment, credit allocation), GDP per capita and total productivity in 17 out of 19 countries analyzed. A 10% increase in real estate prices corresponds to an average GDP growth of 0.2%. The highest GDP growth is observed in Hong Kong (0.67%), followed by Ireland (0.41%) and Denmark (0.40%), while the lowest are Austria (0.04%) and France (0.10%). The two countries that showed a negative impact of changes in real estate prices on GDP are Japan (-0.05%) and Germany (-0.13%).

Analyzing the significance of GDP for real estate prices, it can be concluded that in all analyzed countries, GDP influences changes in real estate prices, and real estate prices also affect GDP.

3.1.2.2. Employment Rate

The employment rate⁹ is the percentage of employed individuals relative to the total population. In 2017, the European Commission, European Parliament, and Council of Europe set three goals for 2030, one of which is achieving an employment rate of 78%. In 2022, the number of employed individuals aged 20 to 64 in the EU amounted to 193,458,000, which represents 74.6% of all individuals in the corresponding age group. Employment rates in five EU member states exceeded 81%. The Netherlands leads with 82.9%, followed by Sweden (82.2%), Estonia (81.9%), Czech Republic (81.3%), and Malta (81.1%). Similar rates were recorded in EFTA countries with available data - Iceland (84.8%), Switzerland (81.9%), and Norway (80.9%). In contrast, Croatia (69.7%), Spain (69.5%), Romania (68.5%), Greece (66.3%), and Italy (64.8%) had employment rates below 70%.

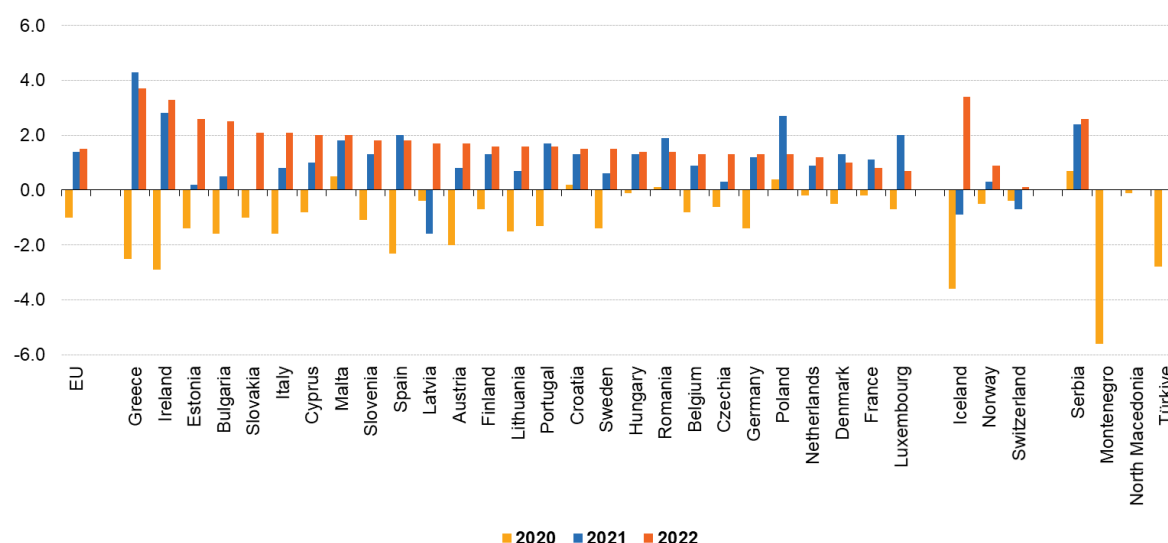
Figure 6¹⁰ illustrates the annual change in employment rates from 2020 to 2022. In the figure, we can observe that in 2020, the COVID-19 pandemic led to a decrease in employment rates for 23 EU member states compared to the previous year, 2019. In 2021 and 2022, there was an increase in employment rates in almost all EU member countries. Greece recorded the highest growth between 2021 and 2022, with a 3.7% increase, followed by Ireland with 3.3%, Estonia with 2.6%, and Bulgaria with 2.5%.

⁹ https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Employment_rate

¹⁰ https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Employment_-_annual_statistics#Employment_in_2022_compared_with_the_EU_target

Annual change in employment rate, 2020-2022

(age group 20-64, percentage points difference - each year compared with the previous one)



Germany and Iceland: break in time series in 2020

Source: Eurostat (dataset code lfsi_emp_a)

eurostat

Image 6: Annual change in employment rate

Many authors have examined fluctuations in property prices in the United Kingdom and the factors influencing them. Property prices are determined based on property prices in all neighboring regions. Any increase or decrease in prices in one region reflects prices in all other regions and all types of properties (new and old). The fluctuation of property prices is defined as the 'ripple effect'. The ripple effect occurs when property prices first increase in one region (southeast regions), and then this increase in property prices spreads to other regions of the UK. In their study (Tzeremes, 2022), they prove that there is a strong heterogeneity among regions of the United Kingdom, and that asymmetry may be one of the keys to the ripple effect. The study examines the impact of employment rate, real personal disposable income per capita, and private sector housing starts on property prices in the United Kingdom (twelve regions) from 1992Q1 to 2017Q4, using a fixed-effects panel regression model. The results of the panel analysis show that property prices are strongly influenced by the employment rate and real personal disposable income per capita, with the presence of the ripple effect on property prices. Although there is significant heterogeneity between individual regions in the United Kingdom and heterogeneity in terms of employment and income prices, a statistically significant impact of the employment rate on property prices in the United Kingdom has been observed.

The results of the study show that changes in housing prices have a stronger impact on employment in non-tradable (locally oriented service) sectors than in tradable (industrial and export-oriented) sectors, indicating that housing market shocks primarily operate through local consumption and economic activity, with house prices playing a more pronounced role in shaping employment in sectors directly linked to domestic demand.

3.1.2.3. Industrial Production

The industrial production rate represents the ratio of annual production and sales (the value of sales of each individual product according to the valid Nomenclature of Industrial Products) to the total value added. The index of the physical volume of industrial production is defined by the Nomenclature of Industrial Products (NIPUM 2019). The industrial production index shows the output and activity of the industrial sector. It serves as a short-term business indicator for the industry and is used to gauge the development of the market for industrial products and services produced within the industry. The development of the industry (industrial production) implies stable business conditions, production growth, reduced unemployment (increased employment), a trade surplus, and a higher number of products with high added value.

Katrakilidis and Trachanas (2012), using a nonlinear cointegration model in Greece for the period from 1999 to 2011, found a long-term relationship and significant influence of industrial production and the Consumer Price Index (as a measure of inflation) on housing prices.

We also include Turkey in the analysis for several reasons. Turkey is chosen as a country that is attractive to both foreign and domestic investors and has a significant industrial production. A large population and a high GDP have led to significant investments in the real estate market over the last 15 years. The real estate sector has played a crucial role in the economic recession, generating significant interest in the real estate market. Let's look at the state of foreign investments in 2019 and 2020. Foreign investments in the real estate sector in 2019 increased by as much as 78% compared to 2018 or, in terms of residential units, this corresponds to the purchase of 40,000 residential units (AREREIT 2019a). Sales of apartments to foreigners, by the end of the first quarter of 2020, increased to 10,948 units, marking a 13.8% increase compared to 2019 (AREREIT 2020b).

Recent research on the impact of industrial production on real estate prices can be found in the study "Predicting House Prices Using DMA Method: Evidence from Turkey," authored by Hacıevliyagil, Krzysztof, and Ibrahim (2022). The authors analyze the influence of 12 macroeconomic factors on real estate prices using the dynamic model averaging (DMA) methodology to predict monthly house price growth in Turkey from January 2010 to December 2019. Variables commonly used to measure the impact on real estate prices, such as GDP (as well as household income), were not included in the model due to their limited publication frequency. The results of this research show that some of the analyzed variables, such as industrial production, foreign direct investment, unemployment, bond yields, mortgages, and exchange rates, are the most significant determinants affecting real estate prices in Turkey.

3.1.2.4. Long-term interest rate

The interest rate is the percentage that the lender charges for the use of their money. The principal is the amount of money borrowed. The study utilizes the long-term interest rate. The long-term interest rate is more relevant to real estate markets as it is determined by the market and represents market expectations. It is well-known that governments use monetary policy instruments to achieve their economic and financial goals. Studies have shown that monetary policy significantly influences property prices. Numerous empirical pieces of evidence have demonstrated a connection between monetary policy, especially interest rates, and property prices.

Monetary policy influences property prices and, in turn, financial stability. Why is there so much interest in the impact of monetary policy on property prices? There are several reasons. The real estate market represents a significant sector in every country, and through it, the government regulates many economic and social issues. On the other hand, the global economic and financial crisis demonstrated the potentially catastrophic effects of a housing market crash or bubble, fueled by excessive borrowing in the banking sector. Furthermore, property financing is on the rise in most countries worldwide, posing a risk to financial stability. The laws of supply and demand dictate that interest rate policy has a direct impact on the real estate market. An increase in interest rates reduces demand for loans (borrowing) and lowers property prices, and conversely, a decrease in interest rates leads to greater demand for loans, implying higher property prices.

Monetary policy influences financial stability, but the challenge lies in achieving this at the expense of other macroeconomic factors, such as inflation and employment. The objectives of macroeconomic and financial stability must be harmonized. It is the role of the government to align these objectives or, at the very least, find compromise solutions. The assessment of the effects of monetary policy on property prices is conducted through an analysis of the interest rate's impact on property prices.

According to OECD data¹¹, housing wealth typically represents 50.4% of households' total wealth, with mortgage debt constituting the largest portion (an average of 68.6%) of household debt. As a result, housing and monetary policies have implications for wealth distribution.

In earlier research, Reichert (1990), Ahearne et al. (2005), Jacobsen and Bjorn (2005), and Liang and Gao (2007) explored the impact of interest rates on real estate prices. Reichert (1990) studied the influence of interest rates, household income, employment, and migration on national and regional housing prices. He found that interest rates on mortgage loans had the most significant impact on national housing prices, while regional housing prices were more influenced by population migration, employment, and household incomes. Ahearne et

¹¹ OECD Measuring the Role of Housing in Wealth Distribution. 2022. Available online: <https://www.oecd.org/housing/policytoolkit/data-dashboard/wealth-distribution/> (accessed on 20 December 2022)

al. (2005) confirmed these findings when investigating real estate prices in 18 industrialized countries, discovering a strong connection between monetary policy and property prices. They concluded that interest rates were the main factor affecting housing demand. Jacobsen and Bjorn (2005) reached similar conclusions in their study, identifying interest rates, unemployment rates, household income, and the volume of residential construction as the most important factors significantly correlated with housing prices in Norway. Liang and Gao (2007) also found a link between monetary policy and real estate prices.

In the study by Tsatsaronis and Zhu (2004), the influence of macroeconomic factors on real estate prices in 17 industrialized countries worldwide, including Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States, was analyzed. They examined factors such as GDP and interest rates, inflation rates, and bank lending using Vector Autoregression (VAR) models for the period from 1970 to 2003. The analysis results showed that housing prices are dependent on inflation and credit and are strongly correlated with short-term interest rates. A decrease in interest rates directly leads to an increase in real estate prices.

A strong influence of the interest rate as a macroeconomic factor on property prices can also be found in the study "Housing Prices and Macroeconomic Factors in Greece: Prospects within the EMU" (Apergis, Rezitis, 2010). The authors analyze the impact of selected macroeconomic factors (interest rate, inflation, employment, and money supply) on the prices of newly sold houses in Greece, using an Error Correction Vector Autoregressive (ECVAR) model. The analysis results demonstrate that the housing loan interest rate (along with inflation and employment) has the most significant influence (explains) the dependent variable, which is the property prices in Greece, whereas the money supply shows little to no significant impact (weakly affects property prices).

Research (Williams, 2016) indicates that an increase in interest rates leads to a decrease in property prices, resulting in reduced GDP and inflation. The research results demonstrate that a 4% decrease in property prices leads to a 1% reduction in GDP.

The author (Chung Yim Yiu, 2023) utilizes two global interest rate shocks to test the influence and causality of monetary policy (taking the real interest rate as an influencing factor) on real estate prices, using panel regression analysis. The globally synchronized reduction in central bank interest rates following the outbreak of the COVID-19 pandemic in 2020, followed by an increase in interest rates due to the global inflation crisis in 2022, provided enough evidence to test the hypothesis regarding the impact of monetary policy on real estate prices. The study employs two analysis periods. The first analysis period corresponds to the onset of the pandemic in 2020 when central banks lowered interest rates to support economic activities. In 2020, following the emergence of the COVID-19 pandemic, central banks reduced interest rates by 207 times (Sahin, Girgin 2021). In the first quarter of 2020 alone, 54 central banks lowered interest rates 73 times to bolster the economy, with some even reaching historically

low levels. The second period corresponds to the global inflation crisis of 2022 caused by the outbreak of the Russia-Ukraine conflict in February 2022, leading to increases in fuel and food prices. Central banks raised interest rates to counteract the effects of global inflation. In the second quarter of 2022, 55 central banks worldwide increased interest rates 62 times, each time by no less than 50 basis points (Romei, Stubbington 2022). In the first three quarters of 2022, the world witnessed a total of 8190 basis points increase in central bank interest rates, and considering only the G10 countries, their central banks raised interest rates by a total of 1850 basis points (Stohecker, Flasseur, Bonanza 2022). The facts reveal a negative correlation between changes in interest rates and changes in real estate prices in many countries. The results confirmed that, after controlling for GDP growth and unemployment factors, changes in the real interest rate had a negative impact on real estate price growth rates.

The consequence of these two recent global interest rate shocks has been a change in real estate prices in many countries, with strong increases in 2021 followed by a decline in 2022. Based on Knight Frank's (2021-2022) Global Real Estate Price Index, annual growth rates of real estate prices in ten countries indicate either a reduced growth rate or even a negative figure in the annual growth rate in 2022¹².

Among the various instruments used by the governments of many countries (central banks of those countries) to conduct monetary policy, interest rates play a crucial role in real estate markets. The latest research (Joël Vonlanthen, 2023) on the impact of interest rates on real estate prices can be found in the study: "Interest rates and real estate prices: a panel study in Switzerland." The author explores the relationship between interest rates and real estate prices (defined as groups of properties: rental apartments, owner-occupied apartments, houses, commercial properties, industrial properties) in Switzerland (106 regions) from 2005 to 2019. The research results not only show how groups of properties react to changes in interest rates (both fixed and variable) but also how this effect varies among Swiss regions.

The analysis results using a Panel Regression model with fixed effects demonstrate a strong connection between interest rates and real estate prices. A 1 percentage point decrease in variable interest rates increases apartment prices by 2.3%. Similarly, a 1 percentage point reduction in fixed mortgage interest rates raises apartment prices by 1.8%. Rental apartment prices are less sensitive to interest rate changes, increasing by about 0.4% in response to a 1 percentage point increase in interest rates. For commercial real estate in Switzerland, a less significant relationship with interest rates was identified. On the other hand, when analyzing conditions in individual regions, which consist of major urban cities, a higher sensitivity of real estate prices to interest rates was observed.

¹² Knight Frank. Global House Price Index, Research, Q1 2021 and Q3 2022, Knight Frank. 2021. 2022. Available online: <https://content.knightfrank.com/research/84/documents/en/global-house-price-index-q2-2022-9334.pdf> (accessed on 16 December 2022).

3.1.2.5. Total Household Loans

Household loans are loans intended for individuals, often with little or low collateral, for personal purposes. These loans have significant economic importance because they enable consumer spending beyond their means, resulting in increased domestic demand.

We believe that there is a two-way interaction between real estate prices and household lending. We will illustrate these mutual influences using several examples.

Why do we start the analysis of the impact of loans on real estate prices with Chinese authors and their research? The answer lies in the fact that China is one of the economic powerhouses in the world today and one of the largest economic potentials globally. According to data from CEIC and the National Bureau of Statistics of China (NBSC), China's GDP increased at a phenomenal rate of 479% between 1999 and 2012, while real estate prices increased by 200%. An important fact is that the volume of realized loans increased tenfold. In 2009 alone, banks issued loans worth 10 trillion RMB, which was equivalent to almost one-third of China's GDP that year.

Zhang et al. (2006) confirmed a statistically significant and positive relationship between real estate prices and bank loans in their study conducted on Chinese real estate.

Analyzing the relationship between loans and real estate prices in China from 1999 to 2012, authors Huang, Leung, and Baozhi (2015) believe that loans have a significant role in increasing real estate prices after 2008 (the period of the financial crisis or the Great Recession), while real estate prices influence bank loans only before 2008. The research showed that loans have a positive and significant impact on real estate prices after 2008, so a 1% increase in loans leads to a 16.1 basis point increase in real estate prices the following year. Similarly, before 2008, with a 1% increase in real estate prices, bank loans increased by 49.3 basis points in the following year. They also concluded that local amenities (education, infrastructure, favorable climate) positively affect real estate prices. Their recommendation is that in the future, it is necessary to jointly (in interaction, not separately) consider macroeconomic and urban economic data in real estate price research.

In the paper "Interaction between Housing Prices and Household Borrowing – the Finnish Case" (Oikarinen, 2008), the impact of real GDP, credit, and interest rates is analyzed using Vector Error-Correction Models (VECM) from 1975 to 2006 in Finland. The author demonstrates the existence of a strong two-way interaction between real estate prices and loans, and this strong two-way interaction significantly increased after deregulation in the late 1980s.

3.2. Metodology

Following the specification of the variables, the empirical analysis combines factor analysis and panel regression techniques in order to examine the relationship between macroeconomic factors and residential property prices.

As mentioned in the previous subsection, the model among others includes several macroeconomic indicators, namely real GDP, employment rate and industrial production, which capture closely related aspects of economic performance. These variables are expected to influence property prices in a similar manner, as higher levels of economic activity generally lead to increased income, stronger labor market conditions, and higher demand for housing, ultimately resulting in rising real estate prices.

However, since these variables tend to move together over time, including them simultaneously in a regression model may lead to multicollinearity, which can distort the estimated coefficients and reduce the reliability of the results. In order to address this issue, factor analysis is applied. This approach allows the three variables to be combined into a single indicator of economic activity, capturing their common variation while reducing the dimensionality of the model.

The constructed Economic Activity factor is then used as a key explanatory variable in this empirical analysis. The relationship between macroeconomic factors and residential property prices is estimated using a regression model with country and year fixed effects, which control for unobserved heterogeneity across countries as well as global time-specific shocks.

The guiding hypothesis of this research is that macroeconomic conditions have a significant impact on real estate prices. More specifically, it is expected that economic activity has a positive effect on property prices, while the long-term interest rate is negatively related to housing prices due to higher borrowing costs. In contrast, credit to households is expected to have a positive influence, as greater availability of financing stimulates demand for real estate.

Based on the selected variables and following the process of data cleaning and factor construction, a consistent and ready-to-use dataset is obtained. On this basis, regression analysis is conducted in order to examine the relationships between the variables and to evaluate the explanatory power of the model, particularly through the coefficient of determination (R^2), which indicates how well the model explains variations in residential property prices. To assess the robustness of the results and the incremental contribution of each explanatory variable, the analysis follows a stepwise estimation approach: model (1) includes only the economic activity factor, model (2) adds the long-term interest rate, and model (3) further includes total credit to households. This approach allows for a gradual evaluation of how the inclusion of additional variables affects both the magnitude and

significance of coefficients, as well as the overall explanatory power of the model (measured by R²).

The equation of the suggested model can be written in the following simple way:

$$\begin{aligned} \ln(\text{Residential_Property_Prices}_{it}) \\ = \alpha + \beta_1 \text{Economic_Activity}_{it} + \beta_2 \ln(1 + \text{Interest_rate}_{it}) \\ + \beta_3 \ln(\text{Total_Credit_to_Households}_{it}) + \mu_i + \lambda_t + \varepsilon_{it} \end{aligned}$$

where i denotes the country and t denotes time. $\text{Residential_Property_Prices}_{it}$ represents residential property prices as a dependent variable, whereas $\text{Economic_Activity}_{it}$ (constructed economic activity factor), $\text{Interest_Rate}_{it}$ and $\text{Total_Credit_to_Households}_{it}$ are the selected independent variables in the model. Furthermore, μ_i captures country-specific fixed effects, λ_t represents time-specific effects common to all countries, and ε_{it} is the error term.

4. RESULTS

The empirical analysis was based on the main hypothesis that macroeconomic factors have a significant influence on residential property prices. In particular, it was expected that stronger economic activity would lead to an increase in property prices, while higher interest rates would have a negative effect due to higher borrowing costs. At the same time, a higher level of credit to households was expected to support housing demand and therefore positively affect real estate prices.

In order to test these relationships, the regression analysis was performed using a stepwise approach. This means that variables were gradually added to the model, allowing for a clearer understanding of how each variable contributed to explaining movements in property prices.

The sample used in the analysis included a large number of countries over the period from 1970Q1 to 2021Q4. The total number of countries was 31 and the total number of observations was 2 776. The number of observations was relatively high, although it slightly varied between specifications due to data availability. The model also included country fixed effects, which meant that a dummy variable was included for each country (except for one reference category). In this way, country-specific characteristics were captured through a constant term that did not change over time. This was important because countries differed significantly in terms of institutions, economic structure, and housing markets, and these differences could otherwise affect the results.

The results of the regression analysis are presented in Image 7 and can be interpreted step by step because the analysis followed a stepwise approach, where were gradually added to the model in order to evaluate their contribution.

VARIABLES	(1) Real Prices	(2) Real Prices	(3) Real Prices
Log Economic Activity	0.0931*** (0.00605)	0.0916*** (0.00603)	0.116*** (0.00525)
Log (1 + Long-Term Interest Rate)		-0.0677*** (0.0131)	-0.148*** (0.0116)
Log Total Credit to Households			0.569*** (0.0185)
Constant	3.646*** (0.0843)	3.786*** (0.0881)	2.305*** (0.0900)
Year Fixed Effect	Yes	Yes	Yes
Number of countries	31	31	31
Observations	2,776	2,776	2,776
R-squared	0.661	0.664	0.751

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
All models control for country and year fixed effects.

Image 7. Regression analysis summary table

In the first iteration (model (1)), only the economic activity variable was included. This variable combined real GDP, employment rate and industrial production into a single indicator. The estimated coefficient was positive, confirming the expected relationship: higher economic activity was associated with higher property prices. This result was in line with the literature and suggested that improvements in overall economic conditions led to increased demand for housing.

At this stage, the explanatory power of the model, measured by the R-squared, was relatively limited, with an R-squared of 0.661. This was expected, as the model included only one explanatory variable. However, the fact that the coefficient was already meaningful indicated that economic activity alone captured an important part of the variation in property prices.

In the second iteration (model (2)), the long-term interest rate was added to the model. The results showed a negative relationship between interest rates and property prices, which was consistent with economic theory. As interest rates increased, borrowing became more expensive, which reduced demand for housing and slowed down price growth. An important point was that the R-squared increased compared to the model (1). This indicated that including the interest rate improved the model and allowed it to explain a larger share of the variation in property prices. In other words, monetary conditions added explanatory power beyond general economic activity.

In the third iteration (model (3)), total credit to households was included. The coefficient of this variable was positive, indicating that higher levels of credit were associated with higher property prices. This result reflected the important role of financing conditions in the housing market, as easier access to credit enabled households to purchase property more easily. Again, the R-squared increased further in this model, reaching its highest value across all models (from 0.661 in model (1) to 0.751 in model (3)). This step-by-step increase in R-squared clearly showed that the model became more complete as additional variables were included.

Overall, the results confirmed the initial expectations: economic activity and credit had a positive effect on property prices, while interest rates had a negative effect. These findings were consistent with previous empirical studies and supported the validity of the chosen model.

In addition to the regression results, the analysis also included graphical representations of property price developments across sampled countries (Image 8 and 9). From these graphs, it could be observed that property prices generally showed an upward trend over time in most countries. This reflected long-term economic growth, increasing demand for housing and expansion of financial markets. At the same time, the graphs also showed that there were clear differences between countries. Some countries experienced more stable and gradual increases in property prices, while others showed stronger fluctuations. These fluctuations were often associated with economic crises or changes in financial conditions.

When comparing these graphical patterns with the regression results, a consistent picture emerged. Periods of strong economic activity and favorable credit conditions were associated with increasing property prices, while periods of higher interest rates or economic slowdown were linked to weaker price dynamics.

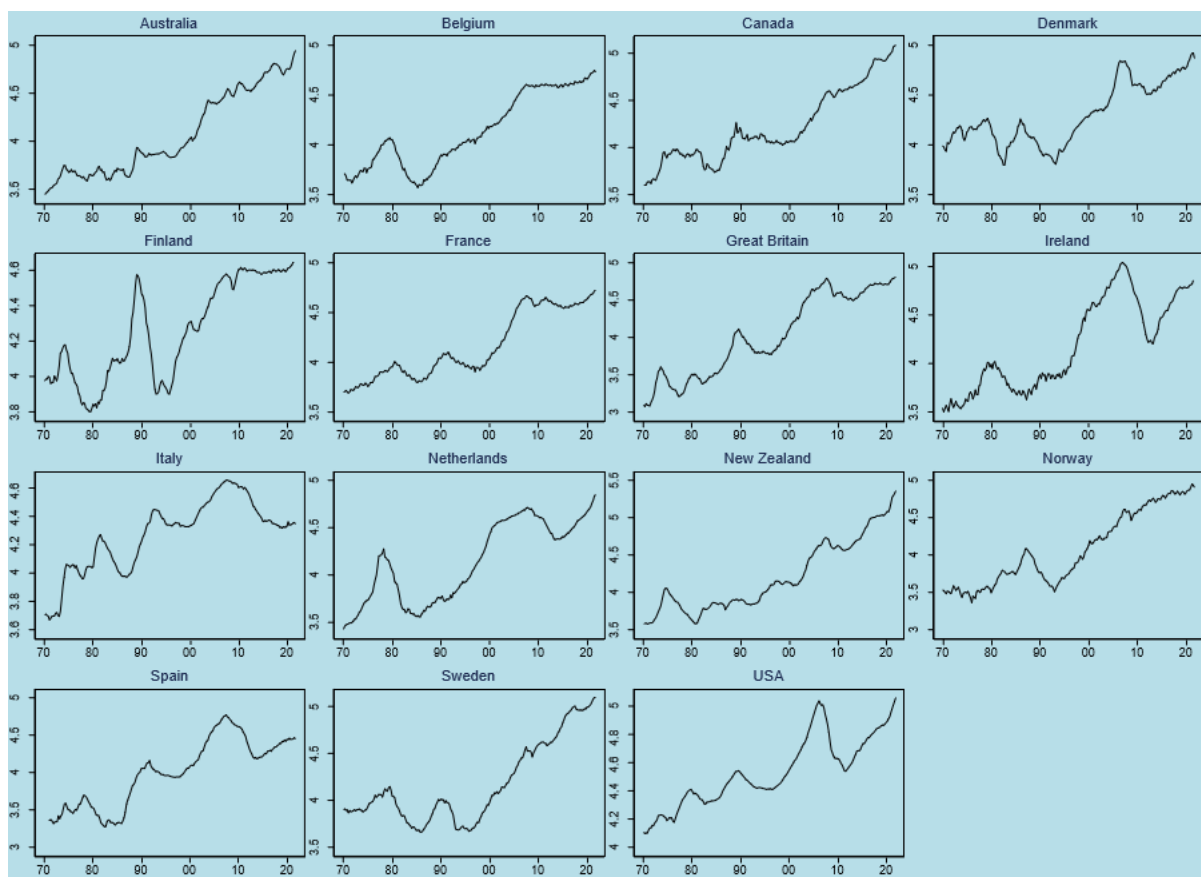


Image 8. Residential property price developments across countries

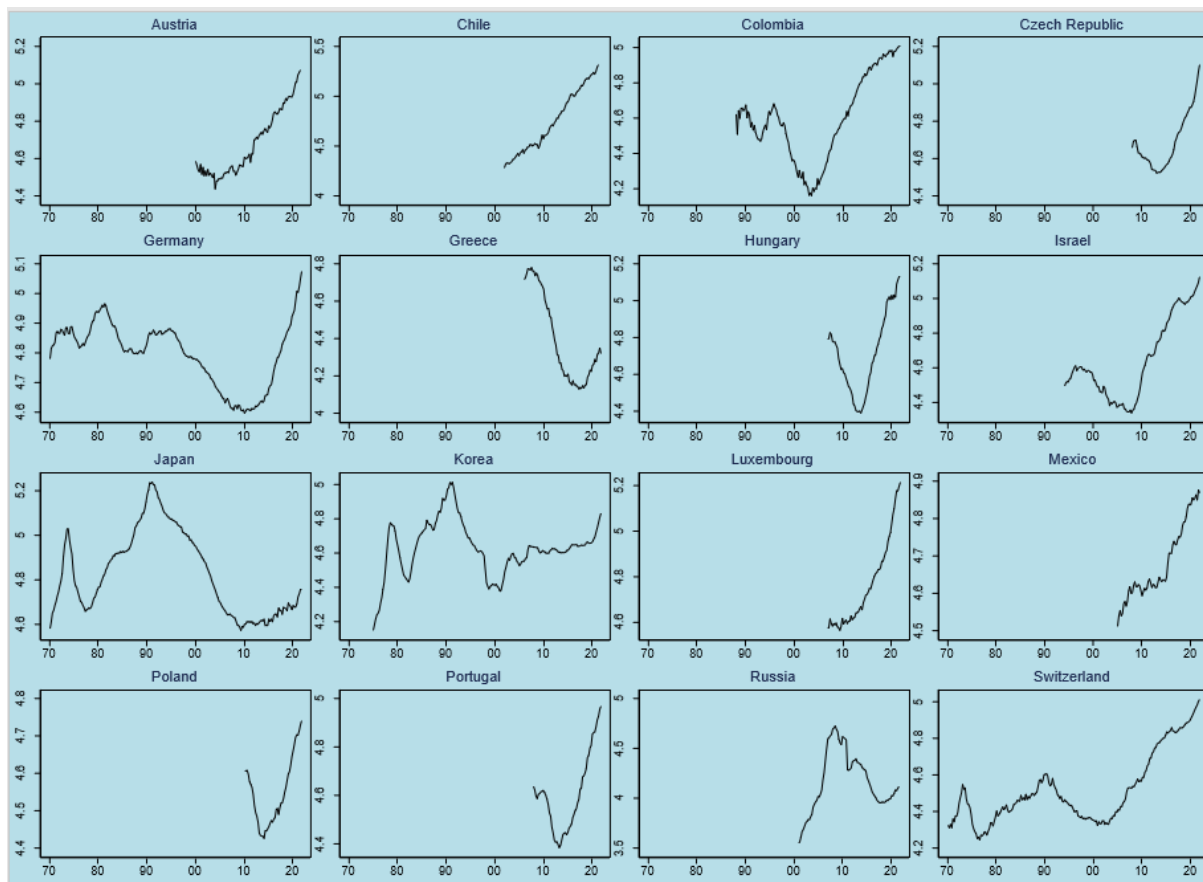


Image 9. Residential property price developments across countries (continued)

5. CONCLUSION

5.1. Implications

The results of this study have several important implications for understanding the dynamics of real estate markets from a macroeconomic perspective. First, the findings confirm that residential property prices are closely linked to overall economic performance. The positive relationship between economic activity and housing prices suggests that periods of economic growth are typically associated with increased demand for housing and rising property values. This has direct implications for policymakers, as it highlights the importance of maintaining stable macroeconomic conditions in order to support a well-functioning real estate market. Furthermore, the negative relationship between long-term interest rates and property prices emphasizes the role of monetary policy in shaping housing market developments. Lower interest rates reduce borrowing costs and stimulate demand for real estate, while higher rates

have the opposite effect. This indicates that central bank policies can have a significant indirect impact on housing affordability and investment decisions in the real estate sector.

The positive effect of credit to households further underlines the importance of financial conditions. Easier access to credit enables households to finance real estate purchases, thereby increasing demand and pushing prices upwards. This finding is particularly relevant in the context of financial stability, as excessive credit growth may contribute to housing price imbalances and potential market overheating.

Overall, the results suggest that real estate markets should not be analysed in isolation, but rather as an integral part of the broader macroeconomic and financial system. The interaction between economic activity, monetary policy, and credit conditions plays a key role in shaping property price dynamics across countries.

5.2. Limitations

Despite the robustness of the empirical analysis, several limitations should be acknowledged. One of the main limitations of this study is the potential presence of simultaneity between the variables. As discussed earlier, macroeconomic factors such as economic activity, interest rates and credit conditions influence real estate prices, but the reverse relationship may also hold. For example, rising property prices can increase household wealth, stimulate consumption and affect economic growth. Similarly, developments in the housing market may influence lending behaviour and financial stability. This two-way relationship makes it difficult to clearly distinguish cause and effect and may lead to biased estimates in the regression results.

Another limitation relates to data availability and comparability across countries. Although the dataset covers a large number of countries over a long time period, not all variables are available for all countries and time periods. As a result, the dataset is unbalanced, which may affect the consistency of the results. In addition, differences in national statistical methodologies and data quality may introduce measurement errors.

A further limitation of the model is that it simplifies quite complex relationships. By combining several variables into one economic activity indicator, the model becomes easier to work with, but at the same time it makes it harder to see how each individual variable (like GDP, employment, or industrial production) affects property prices on its own. Similarly, the model

includes only a limited number of explanatory variables, which means that other potentially important determinants of property prices are not explicitly captured.

Finally, although using fixed effects makes the results more reliable by controlling for differences between countries, it does not completely remove all possible biases, especially those caused by variables that change over time and are not included in the model.

5.3. Recommendations for future analysis

Based on the results, several directions for future research can be suggested. At the same time, it is important to highlight that the current model already provides a solid explanation of residential property price movements, as shown by the consistent results and relatively strong explanatory power.

One possible improvement would be to include additional variables such as construction costs, population growth, migration and foreign investment, which could further enhance the model. These factors capture both supply and demand aspects of the housing market and may provide a more detailed understanding of price dynamics. However, even without these variables, the model already captures the main macroeconomic drivers.

Future research could also benefit from using more recent data, allowing the analysis to reflect the latest developments in global real estate markets. While this could improve precision, the current dataset already covers a long period and a large number of countries, which makes the results reliable and meaningful.

Finally, more advanced econometric methods could be used to address issues such as simultaneity. However, despite these limitations, the current model still offers a clear and consistent indication of the relationship between macroeconomic factors and property prices.

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