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Research on changes in housing price and exploration of its influencing factors

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Abstract. With economic development, people's living standards have been gradually rising. As a necessity of life, the price of housing has been fluctuating throughout the years. By showing that, this paper aims to study the relationship between house prices and external factors such as income. Meanwhile, this paper have simply discussed their impact on micro-macroeconomics as well. In addition, this summary addresses the relationship between house prices and various economic indicators and the need for sustainable valuation methods to support informed decision-making in the housing sector. Time series and linear regression have always been the most suitable observational tools to find out the relationship between two variants. Thus, the author has actively used them in the research. Through this study, it is easy to find that house prices are strongly correlated with incomes even when the data are not so complete. With the inseparable correlation between incomes and house prices, both of them will affect economic development and their stability is significant for financial well-being. In conclusion, it is essential for people to indicate the possible risks and development of house pricing.

Keywords: House pricing, time series, linear regression, income.

1. Introduction

A house serves as essential shelter for individuals and families, fulfilling a fundamental human necessity. The aspiration to own a home is a universal life goal that many people strive towards [1]. Housing prices and rental rates are shaped by a multitude of factors, encompassing both broader macro-level influences and more specific micro-level considerations [2]. Housing prices in super large cities are notably influenced by a range of factors, including shifts in the permanent population, alterations in the money supply, fluctuations in the local currency's exchange rates, adjustments in the balance of medium and long-term resident loans, changes in per capita disposable income, and variations in loan interest rates. These elements collectively contribute to the dynamic nature of housing costs in such urban centers [3]. Other types of factors can also influence the house price, such as the housing prices and rental rates are affected by a range of factors, including construction costs, housing system approaches (such as conventional and industrialized methods), housing quality and aesthetics, material expenses, land prices, taxation policies, and transaction fees [4].

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The recent surge in housing prices and record-low interest rates in the euro area from 2015 to 2021 has prompted a renewed interest in studying the relationship between these variables, with annual residential real estate price growth reaching 9.5% in Q4 2021. This empirical inquiry into the interest rate elasticity of house prices is critical, as existing literature shows significant variations in estimates, especially in the context of rising inflation and evolving monetary policies. These estimates will offer valuable insights into potential housing market corrections in this changing economic environment [5]. In the last twenty years, there has been a notable trend in numerous advanced economies (AEs) where house prices have increased at a pace surpassing income growth. This trend has led to a pronounced upward trajectory in price-to-disposable income (PTI) ratios. The substantial price hikes have corresponded with significant growth in household debt, consequently driving up household debt-to-disposable income (DTI) ratios [6]. Within this general upward trend, there have been significant reversals in housing prices, particularly during the global financial crisis. These reversals have led households to lower debt levels, reduce consumption and, in some cases, undermine financial intermediation [7]. Meanwhile, the damage inflicted on the financial system and the economy due to real estate losses during the Global Financial Crisis (GFC) has stimulated efforts to integrate housing and finance elements into theoretical macroeconomic models. Additionally, it has spurred financial reform measures and the introduction of macro prudential policies aimed at preventing and addressing crises. As a consequence, these actions have reshaped housing activities in the post-GFC era and have given rise to new models that bridge the macroeconomy and housing dynamics [8]. In contrast, a number of other developed economies have experienced almost continuous surges in house prices. Even in the aftermath of the global financial crisis, these countries have seen significant increases in house prices, double-digit inflation rates, and historically high levels of both house prices and household debt ratios. Sweden and Norway are notable examples of this phenomenon [9]. If significant increases in house prices occur independently of the fundamental factors influencing housing supply and demand, it can render the housing market susceptible to a potential price correction. Such a correction could carry substantial risks for both macroeconomic and financial stability. This risk stems from the housing market's influence on overall demand, including residential construction and household spending, and its impact on the banking sector [10].

To sum up, the housing market has a strong connection with consumer spending. When house prices rise, it tends to boost the confidence of homeowners. Conversely, a decrease in house prices raises concerns among homeowners because of the potential loss in property value, which can lead to reduced spending and a delay in personal investments. Consequently, house prices have evolved into a key indicator of a country's economic performance.

2. Methods

2.1. Data source

The data for this literature is collected from the Kaggle website, dydata website.

2.2. Method introduction

The methods that this essay will use are time series and linear regression model. A time series is a structured arrangement of statistical data wherein data points are organized in a chronological sequence. Time series data typically undergo sampling at regular and uniform time intervals, such as on a daily, monthly, or yearly basis. Such data can encompass a diverse range of data types. The linear regression model is a statistical tool utilized to construct and analyse the linear associations among variables. Its primary purpose is to predict the relationships between one or more independent variables and a dependent variable. The central assumption of the linear regression model is the linearity of these relationships, implying that there exists a linear connection between the independent variables and the dependent variable, which can be graphically represented by a straight line.

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3. Results and discussion

This is the house price in Brazil from 2010 to 2017 and the year was taken as the independent variable, and the rate of change (%) in the first quarter was taken as the dependent variable for linear regression analysis (table 1). As can be seen from the above table, the formula of the model is: Rate of change in the first quarter (%)=1628.329-0.807* year, and the value of the model R square is 0.922, which means that the year can explain 92.2% of the change of the rate of change (%) in the first quarter It was found that the model passed the F test (F=70.865, p=0.000& lt: 0.05), which means that the year will definitely have an impact on the change rate (%) in the first quarter. The final concrete analysis shows that the regression coefficient of the year is -0.807(t=-8.418, p=0.000& lt: 0.01), which means that the year will have a significant negative impact on the change rate (%) in the first quarter. Summary analysis shows that all years will have a significant negative impact on the change rate (%) in the first quarter (table 2).

Table 1. Linear regression analysis results (n=8).

	Nonnormalized coefficient		Standard coefficient	t	p	collinearity diagnostics	
	B	standard error	Beta			VIF	XYL
constant	1628.329	193.114	-	8.432	0.000**	-	-
Year	-0.807	0.096	-0.96	-8.418	0.000**	1	1
R 2	0.922						
Adjust R 2	0.909						
F	F (1,6)=70.865,p=0.000						
D-W	2.495						
* p<0.05 ** p<0.01							

Table 2. Year impact.

Year	Rate of change in the first quarter (%)	Rate of change in the second quarter (%)(%)	Rate of change in the third quarter (%)(%)	Rate of change in the fourth quarter (%)(%)
2010	4.94	4.69	5.97	6.51
2011	5.79	7.8	6.03	4.99
2012	3.87	3.64	4.32	3.1
2013	2.62	3.25	3.72	3.66
2014	2.08	2.28	1.88	0.91
2015	1.54	0.64	0.25	0.05
2016	0.13	0.15	-0.2	0.33
2017	0.37	0.27	0.39	0.36

Taking the ratio of house price to income (%) as the independent variable and the quarterly year as the dependent variable for linear regression analysis, it can be seen from the above table that the formula of the model is: quarterly year =-127.887 1.230* ratio of house price to income (%), and the R-square value of the model is 0.842, which means that the ratio of house price to income (%) can explain 84.2% of the change of quarterly year (table 3). When F-test was carried out on the model, it was found that the model passed the F-test (F=63.955, p=0.000& lt; 0.05), which means that the ratio of house price to income (%) must have an impact on the quarterly year. The final concrete analysis shows that the regression coefficient of the ratio of house price to income (%) is 1.230(t=7.997, p=0.000< 0.01), which means that the ratio of house price to income (%) will have a significant positive impact

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on the quarter year. Summary analysis shows that: All the ratio of house price to income (%) will have a significant positive impact on the quarter year (Table 4).

Table 3. Linear regression analysis results (n=14).

	Nonnormalized coefficient		Standardization coefficient	t	p	collinearity diagnostics	
	B	standard error	Beta			VIF	XYL
constant	-127.887	16.936	-	-7.551	0.000**	-	-
Price-to-income ratio (%)	1.23	0.154	0.918	7.997	0.000**	1	1
R 2	0.842						
Adjust R 2	0.829						
F	F (1,12)=63.955,p=0.000						
D-W	1.411						
Dependent variable: quarter year							
* p<0.05 ** p<0.01							

Table 4. Year Price-to-income ratio (%).

Quarterly year	Price-to-income ratio (%)
2014 3	105.1
2014 4	105
2015 1	107.3
2015 2	108
2015 3	107.9
2015 4	108.9
2016 1	110.6
2016 2	111.1
2016 3	113.2
2016 4	113.6
2017 1	111.5
2017 2	111.6
2017 3	113.2
2017 4	114.6

4. Conclusion

Based on the above data, there is indeed a correlation between house prices and income ratios, but there is much more to house prices than that. This study collected diverse data, focusing on factors that may affect house prices. The study concluded that home prices may correlate with factors such as school district housing, income ratios, and transportation, which have often been overlooked in past studies. However, we must admit that there are some limitations to this study due to the limited amount of data, the large annual span of data sampling, and the failure to find appropriate data.

First of all, housing price is a complex phenomenon, which is affected by a variety of factors. While this study focuses on some key factors, there are many other underlying factors in the actual market, such as job market conditions, policy changes, population movements, etc., which can also have an important impact on house prices. Therefore, studies that take these factors into account will more fully explain house price fluctuations.

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Secondly, the limitation of data also needs attention. Due to the limitations of the data, this study could not obtain complete and detailed information. In addition, the sample covers a limited area, which may lead to differences in the results between different regions. Future studies could strive to increase the representativeness of the sample to better reflect the situation in different regions.

In addition, the accuracy of the model also needs to be carefully evaluated. Although a linear regression model was used in the study, this model may fail to capture the complex relationships among all the influencing factors. Further research could try to use more sophisticated statistical models or machine learning methods to more accurately predict house price changes.

In conclusion, this study provides us with some valuable insights into the volatility of house prices, but we must bear in mind that the real estate market is a complex and diverse area that requires a combination of factors. Future research should aim to fill in gaps in data and models to more fully understand and predict house price trends. This will help policy makers, investors and real estate market participants to better respond to changes in the market.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

References

[1] Zhang F 2022 Economic Policy Uncertainty and House Price Fluctuation: Evidence from 70 Large and Medium sized Cities. *Economic Research Reference*, 11.

[2] Lei W N, Mei D Z and Wen X C 2021 Stability of Exchange Rate or Protection of House Price: From the Perspective of Land Finance. *World Economic Review*, 15.

[3] Cui G C, Tian L and Gao W 2021 Research on Urban Land Transfer and Premium Based on House Price Expectations. *Modern Urban Research*, 36(5), 6.

[4] Kang J and Zhang C 2021 The Impact of Population Structure Changes on Regional Housing Prices. *Modern Urban Research*.

[5] Liu X and Zhang D D 2022 Research on the Spatial Differentiation and Influencing Factors of House Prices in Yangzhou City Based on POI Big Data. *Project Management Technology*, 4(8), 8

[6] Gao Y, et al. 2022 Spatial Differentiation of Housing Prices in Shanghai's Tourism and Accommodation Industry and Its Influencing Factors. *Geographic Science*, 42(8), 11.

[7] Li C F 2021 Basic ideas for solving the abnormally high housing prices in big cities. *China Circulation Economy Editorial Department*, 4-7.

[8] He S Q, Jin S P and Chen J Q 2023 Construction and application of panel data model for new ordinary residential housing price index. *Statistics and Decision*, 63-67.

[9] Chen R 2021 Research on the Interaction between Urbanization, Tertiary Industry, and Housing Prices. *Journal of Shenyang University of Technology*, 14 (1), 65-72.

[10] Jia T and Zhang L Y 2021 The impact of investor sentiment on housing price fluctuations based on sentiment analysis. *Journal of Engineering Management*, 35(3), 6.