

# **Housing loan interest rates and house prices in Paris**

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## COLOFON

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## **ABSTRACT**

The decline of property transactions can have significant repercussion on the economic stability and public health of citizens in a nation. Following a sudden drop of house transaction volume in 2024 and recent rise of housing loan interest rates in France since 2022, this paper aims to understand the relationship between housing loan interest rates and house prices in Paris. The study utilizes multiple linear regression analysis on secondary data extracted from Banque de France and Demande de Valeur Foncière. Findings reveal a negative relationship between housing loan rates and house prices, implying that higher interest rates coincide with decreased house prices. This result is in line with previous theoretical expectations and empirical results, however limitations such as possible data bias and missing house characteristics warrants a tentative interpretation. The results imply that implementing interest rate specific policies may alleviate the decline of property prices.

Key words: Housing loan interest rates, house prices

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# 1. INTRODUCTION

## 1.1 Motivation

The housing market is fundamental to the economic stability and growth, significantly influencing individual financial wellbeing as well as the broader economy. Currently, there is a downturn in the housing market in France, with a significant drop in property acquisitions across the nation (FNAIM, 2024). According to Banque de France (2024), the interest rates on housing loans in France have sharply risen from close to 1.0% in 2022, to above 3.5% in 2023. This rising interest rates has occurred in tandem with the reduced property acquisition in France, therefore suggesting a relationship between housing loan interest rates and house prices.

This drop in housing sales will have crucial ramifications of the real estate asset value and economic stability in France, as well as the social and psychological well-being and public health of its citizens. Previous studies analyzed the effect that a housing decline would have on the US, stating that it leads to “reductions in consumer spending; declines in housing starts, completions and net residential investment; and to reductions in housing transactions volumes and the associated fee income from these activities” (Case and Quigley, 2008, p.179). The effects of a housing crisis can have significant negative impacts on the economic cycle of a country, with substantial reductions in production and prolonged economic downturns (Leamer, 2007). Shortage of affordable housing has been observed in the U.S, inducing a lower standard of living for families having to spend over 30% of their income on housing cost burdens (Anthony, 2022). Furthermore, this influence on the business cycle of one country due to the deterioration of its housing market has been observed to cause the same complication in other countries, such as the 2008 housing crisis (Janssen, 2009).

It is generally agreed upon that being a homeowner has positive effects on social and economic stability, and can be a source of wealth generation. The purchase of a house can have a significant influence on the spending power of a family. This spending power, in turn, plays a crucial role in shaping consumer confidence and spending behaviors in economic activities. Consequently, fluctuations in house prices exert substantial effects on the consumption trends within an economy. Housing has an important influence on health, with improvements in mental health and obesity being observed when moving from a high poverty neighborhood to a low poverty neighborhood (Gibson et al., 2011). Affordable housing plays a critical role in the economic competitiveness of a nation, and the quality of life of its population (Schwartz, 2016).

Considering the relevance of this topic, this paper investigates the relationship between housing loan interest rates and house prices, using property transaction data from Paris.

## 1.2 Academic relevance

The examination of the complex relationship between housing loan interest rates and house prices has been studied extensively in urban economics and real estate finance, bearing significance due to its profound impact on the economy, housing affordability, and household wealth.

Previous literature, as noted by Aliyev et al. (2019), predominantly deal with the theoretical dimensions of this relationship, drawing upon various economic theories such as the user cost of housing model and the asset pricing approach. Theoretical constructs posit that alterations in interest rates, which directly influence the cost of borrowing, exert noticeable effects on housing demand, consequently influencing housing prices. Empirical findings largely support this claim, evidencing a pattern where lower interest rates correspond with elevated housing prices, while higher interest rates tend to depress housing prices

(Garriga & Hedlund, 2020). However, the magnitude and persistence of this relationship show variability across different housing markets and economic contexts.

Some researchers have delved into an array of factors that serve as potential mediators or moderators of the interest rate-housing price nexus, including income levels, demographic transitions, supply constraints, and speculative activities within the housing market (Yu et al., 2021; García-Lamarca, 2022). Notable studies, such as those of Campbell and Cocco (2003), have examined the overarching association between interest rates and house prices, often concentrating on contexts outside of Europe, notably the United States. They have examined the broad effects of interest rates on housing markets, but questions remain about how these dynamics operate in the unique context of Paris. Specifically, there is a lack of detailed studies investigating how recent sharp increases in housing loan interest rates following the Covid-19 pandemic have impacted house prices in an urban setting. Though Lee and Jinbaek (2022), touch upon this subject in their investigation of the time-varying effect of interest rates on housing prices in Korea, there are still questions about this relationship in a metropolitan setting.

Although the current literature helps to understand this phenomenon, there are still some questions that remain, especially concerning the dynamics in major metropolises like Paris. The unique characteristics of such urban areas, characterized by high population density, finite land availability, and heightened international demand, may affect the sensitivities in housing price responses to interest rate fluctuations. Previous research primarily focused on aggregate market trends, overlooking the intricate impacts on specific segments or urban jurisdictions. This study endeavors to address this research gap by analyzing the interplay between housing loan interest rates and house prices within the Parisian context, aiming to increase understanding of this pivotal urban housing market. The insights gleaned from this study could help policymakers, lenders, and real estate professionals make Paris-specific housing affordability, lending, and urban development decisions.

### **1.3 Research problem statement**

This relationship between housing and the economic state of a nation, as well as well-being of its inhabitants, makes it crucial to understand the relationship between housing loan interest rates and house prices. The findings are important in understanding the housing dynamics in Paris and provide input on the association between these factors influencing the current housing crisis particularly in the Parisian urban housing market.

This paper aims to investigate the intricate relationship between housing loan interest rates and house prices, by the use of a literature review and analysis of secondary data the study aims to answer the following research question and sub questions:

- ***What is the relationship between housing loan interest rates and house prices in Paris from 2020-2023?***
- *What is the underlying mechanism between housing loan interest rates and house prices according to the academic literature?*
- *What is the strength of the relationship between housing loan interest rate and house prices in Paris from 2020-2023?*

The results of this thesis will provide better understanding of the relationship between housing loan interest rates and house price in Paris between 2020 and 2023. The may help professionals and policy makers further to understand the housing market dynamics within Paris, and can therefore alter their policy making decisions and their investment selections accordingly.

## **1.4 Thesis Structure**

This thesis is structured to logically guide the reader through the research, covering motivation, literature review, methodology, results, and conclusions. Chapter 1 introduces the research topic, motivation, significance, problem, aim, and questions. Chapter 2 reviews literature on housing loan interest rates and house prices, deriving a hypothesis from their relationship. Chapter 3 details the research design, including data collection, methodology, and descriptive statistics. Chapter 4 presents and interprets the findings, discussing them in the context of existing literature. Chapter 5 addresses the research questions, discusses societal implications, and outlines limitations and future research directions. This structure provides a comprehensive examination of the relationship between housing loan interest rates and house prices in Paris.

## **2. THEORY, LITERATURE REVIEW & HYPOTHESES**

### **2.1 House Prices**

House prices play an important role in the economy. The demand for housing is a critical determinant for house prices, with several key factors that influence this demand. According to Baffoe-Bonnie (1998), house prices, and thus the housing market are influenced by both employment growth and mortgage rates. Furthermore, higher income levels are typically associated with an increase in house prices and therefore an increase in demand (Hendershott et al., 2002). Housing characteristics that influence demand include; type of dwelling, age of property, architectural style, number of rooms and floor size (Glaeser et al., 2005; Goodman & Thibodeau, 2003). The hedonic pricing model is a method often used to estimate the value of a house by evaluating the influence such housing characteristics can have on the overall price (Malpezzi, 2003). By analyzing each of these characteristics the model helps provide a more distinct understanding of housing values.

House prices are also influenced by supply factors, that influence housing availability and affordability. The cost of building a property can directly affect the supply of housing. The increase in construction costs can limit the number of new homes built, leading to a rise of prices and constrained supply (Glaeser & Gyourko, 2003). Additionally, the study from Quigley & Rafael (2005) revealed that urban areas with stringent zoning laws had higher house prices. This is due to a subsequent reduction in land availability and thus a limited supply.

The housing market constitutes one of the most significant components of a nation's economic sector. Its impact on economic performance is substantial, particularly through its influence on household wealth and consumption patterns. Benjamin et al. (2004) explain that an increase in housing wealth leads to an escalation in consumer spending. This relationship underscores the broader economic implications of housing market fluctuations, where variations in house prices exert considerable influence on private consumption, thereby is in close inter-relationship with the business cycle (Girouard & Blöndal, 2001).

### **2.2 Housing Loan Interest Rates**

Interest rates are a fundamental aspect in economics, which can have a significant effect in various sectors. Interest rates are the cost of borrowing money, denoted as a percentage of the loan taken. Central banks, such as the European Central Bank, play a significant role in designating the benchmark interest rates by utilizing monetary policy. These rates determine the cost of borrowing money across the economy, including housing loans (Mishkin, 2007).

The determination of housing loan interest rates is a multifaceted process involving several factors, including opportunity cost, the cost of originating and servicing the loan, and potential costs associated with default (Page, 1964). Housing loan interest rates are shaped by both macroeconomic factors and individual characteristics of whomever takes the on a loan. Macroeconomic factors include central bank policies and market competition. Individual borrower factors include credit score and loan-to-value ratio (Jiang et al., 2014). La Cava (2016) identifies the reduction in mortgage interest rates as a pivotal factor contributing to the enlargement of housing capital income in the United States. For consumers lacking liquid capital to purchase property outright, housing loans are essential for property acquisition, making the interest rate an important consideration when taking on a loan.

There are two main types of housing loan interest rates, fixed-rate mortgages and adjustable-rate mortgages. Fixed-rate mortgages offer the same interest rate throughout the loan term, this provides the



borrower with stability and certainty. Adjustable-rate mortgages, on the other hand, are interest rates that can fluctuate, which can lead to differences in monthly payments (Campbell & Cocco, 2003).

### **2.3 Literature review**

Numerous studies have explored the relationship between housing loan interest rates and house prices, predominantly indicating a negative relationship. Campbell and Cocco (2003) investigated the effects of mortgage interest rates on housing prices, demonstrating that higher interest rates diminish demand and consequently reduce property values. Similarly, Lee and Jinbaek (2022), in their study on the time-varying effects of interest rates on housing prices, confirm that rising mortgage interest rates cause a decline in house prices. Englund and Ioannides (1997) also found that there is a significant negative impact of housing loan interest rates on house prices. Other studies have found not just a negative relationship but also a causal relationship between interest rates and house prices; “The persistent negative response of house prices to interest rate shocks indicates that falling interest rates have substantially contributed to the sudden increase in house prices” (Hanck and Prüser, 2016).

Previous literature has explored the trends between housing loan interest rates and house prices. According to Svensson (2013), when adding a 1% permanent increase to housing loan interest rate, house prices are observed to have a 7% decrease in value. On the other hand, a 1% increase on housing loan interest rate for one year decreases house price between 0.6% and 0.8%. Another study estimates that a 1% decrease in housing loan interest rates can lead to a reduction of house prices of up to 17% (Yu and Chen, 2018). House price data and housing loan interest rate data will be collected in order to observe their trends and confirm whether they follow a similar pattern. This provides a further argument for the existence of a negative relationship between housing loan interest rates and house prices.

However, the relationship between housing loan interest rates and housing prices is not universally straightforward. McGibany and Nourzad (2004) present evidence suggesting a lack of correlation between mortgage interest rates and house prices in the short term, although a relationship manifests in the long run. This finding introduces a temporal dimension to the interest rate-house price relationship, indicating that the effects of interest rate changes may unfold over extended periods rather than immediately. Additionally, Çalışkan et al. (2022) conducted a study in Turkey that found no causal relationship between housing loan interest rates and house prices. The authors attribute this anomaly to several factors, including the absence of actual price data, which could have influenced their findings.

In conclusion, the interplay between mortgage interest rates and housing prices is a critical area of study within the broader economic discourse on housing markets. While the predominant evidence supports a negative relationship, McGibany and Nourzad (2004) and Çalışkan et al. (2022) results stress the complexity of this topic, highlighting the importance of taking an open approach.

### **2.4 Conceptual Model**

Figure 1 portrays the simplified representation of how housing loan interest rates and house prices are to be utilized in the analysis. House prices serves as the dependent variable whose variation is assumed to be related to the variation in housing loan interest rates, which will serve as the key independent variable. Furthermore, housing characteristics number of rooms and type of dwelling are introduced as control variables. Additionally, time (years) is incorporated as a control variable. This temporal variation is

included to help analyze trends, which provides a more comprehensive and nuanced understanding of the relationship between housing loan interest rates and house prices.

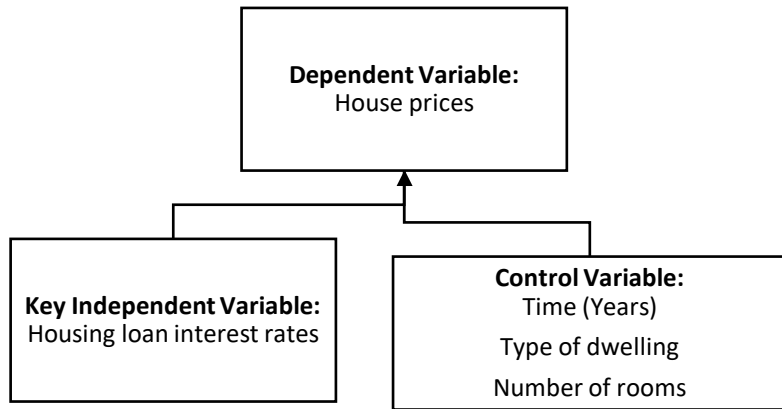


Figure 1

## 2.5 Hypothesis

The hypothesis formulated concerns itself on the type of relationship expected between housing loan interest rates and house prices. Considering existing academic literature as well as the fall of transaction costs and rise in interest rates in a similar time period, the following hypothesis is proposed:

- ***H2: Housing loan interest rates have a negative relationship with house prices in Paris from 2020-2023***

### 3. DATA & METHODS

#### 3.1 Context

The context of France is unique when investigating the recent changes of housing loan interest rates. The use of a monthly graphical representation in Figure 2 (see Appendix A), illustrates the temporal progression of interest rates associated with new housing loans in France spanning from March 2020 to May 2023. Initially, from March 2020 to around July 2021, the interest rates demonstrate a notable stability, fluctuating within the range of 1.0% to 1.5%. This period reflects a state of relative equilibrium in the economic landscape concerning housing loan interest rates. Subsequently, from July 2021 to January 2022, minor fluctuations occur, yet the rates remain within a narrow range, indicating a continuation of the previously observed stability. However, starting around January 2022, a discernible upward trend in interest rates emerges, persisting steadily throughout the entirety of 2022. Notably, a significant escalation becomes apparent from the latter part of 2022 onwards, characterized by a sharp increase in interest rates. By March 2023, this upward trend intensifies further, maintaining a steep trajectory from around 2.5% to above 3.5% at the end of 2023. It is clear to observe that from the start of 2022 the interest rate rose at a ridiculously high rate completely out of the norm from the years 2020-2021. This could be explained due to heightened inflation and tightened monetary policies following the Covid-19 pandemic.

Furthermore, France is undergoing the largest annual drop in real estate sales in more than 50 years. A recent report unveiled a significant drop in property transactions across the nation, with an estimated 875,000 sales by December 2023 – 240,000 fewer sales than the previous year (FNAIM, 2024). These recent changes in the French housing market suggest high variability in house prices between the years 2020 and 2023.

#### 3.2 Data collection

The research utilizes two sources of secondary data procured from two reputable and publicly accessible repositories. Specifically, housing loan interest rates are sourced from Banque de France and house price data are acquired from Demande de Valeur Foncière. Banque de France was chosen as it is a member of the Eurosystem, and is in charge of France's financial system. Demande de Valeur Foncière was chosen as they are public records officially released by the French government. Spanning the period from March 2020 to December 2023, these datasets are specifically selected to focus exclusively on the dynamics of the Parisian housing market, thereby providing a comprehensive analysis of relationships, trends and fluctuations within this urban housing market.

The house price transaction data is obtainable via the official public website of Demande de Valeur Foncière, provided in the form of CSV datasets for each of the 20 administrative districts that encompass Paris. With the use of this platform ([app.dvf.etalab.gouv.fr](http://app.dvf.etalab.gouv.fr), 2024), data retrieval was conducted from the dates March 1st, 2020 through December 31st, 2023. These CSV datasets were combined into a single dataset of house transaction prices, combined to a total of 288,676 transaction cases. It is important to note, that certain house type variables cases, namely "None," "Local industriel. commercial ou assimilé," and "Dépendance," were excluded, due to incompatibility with the analytical focus of this study, which exclusively concerns itself with house prices.

Additionally, further data cleansing ensued, facilitated by the usage of the software SPSS. 1130 cases provided missing values were systematically excluded, while many outliers, which were identified with

the use of boxplots, were likewise excluded from the dataset. The reason for such a numerous number of outliers is possible due to investment companies buying up residential or commercial buildings, as there were several cases within the dataset with transaction costs totaling over 100million euros. The exclusion of these cases brings the total number of house transaction values to 106,288 cases. Due to the high number of missing values of housing characteristics in the dataset, the variables used in the final dataset include; Date, house prices, type of dwelling and number of rooms, preparing the dataset for analysis.

Housing loan interest rate data was procured from the statistical repositories of Banque de France, accessible through its official website (webstat.banque-france.fr, 2024). The data retrieval was again conducted from the dates March 1st, 2020 through December 31st, 2023, and as the housing loan interest rates could be extracted on a monthly basis, the dataset was poised for analysis.

The variables derived from the initial house price dataset were integrated with the housing loan interest dataset to form the ultimate dataset for analysis. Within that dataset, dummy variables were created for the years 2020, 2022 and 2023 in order to capture and analyze the temporal variations between housing loan interest rates and house prices. Year 2021 is used as the reference category as it has the least housing loan interest rate % variation out of all years. Furthermore, dummy variables were created for number of rooms (1 room, 2 rooms, 3 rooms, 4 rooms and 5+ rooms with 0 rooms as the reference) and type of dwelling (apartment, with house as reference category). The dependent variable, House Prices, will undergo logarithmic transformation in order to capture the percentage influence the independent variables have on house prices. As all data originates from the public sources mentioned earlier, no personal data was involved or gathered for this analysis. Data security measures were strictly adhered to, with storage and analysis conducted on a secure personal laptop accessible only through authorized means, ensuring the safety of data handling practices.

### 3.3 Descriptive statistics/Analysis

Table 1 presents the central tendencies and dispersions for house prices and housing loan interest rates. The average house price is €564,818.98 with a standard deviation of €375,750.651, indicating a substantial variability in house prices across the sample. The minimum house price is €100,051 and the maximum is €1,919,022. Meanwhile, the mean housing loan interest rate is 1.5194%, with a standard deviation of 0.57455%, and ranges from 1.12% to 3.62%.

**Table 1**

	N	Minimum	Maximum	Mean	Std. Deviation
House Prices (€)	106288	100051	1919022	564818.98	375750.651
Housing loan interest rate (%)	106288	1.12	3.62	1.5194	.57455

When examining the graphical representation of the temporal progression of aggregated house prices on a monthly basis in Figure 2 (see Appendix A), through the same time period as housing loan interest rates in 3.1., similarities between these two variables can be observed. Through the period of March 2020 and July 2023, the average house prices in Paris exhibit stability, with small fluctuations, that barely cross the €600,000 to €500,000 boundary. However, in August 2023 there is a significant drop in house prices of

around 20%, with the average price settling at €400,000. Following this marked drop, the house prices stabilize once again and fluctuate between €500,000 and €400,000 respectively.

When comparing the two graphical representations, one can deduce that both variables begin with relatively stable beginnings before a relatively jarring change. Though the change is observed at a later stage in house prices than in the housing loan interest rate, meaning they do not exactly mirror each other, it can be assumed from these graphical representations that there is a possible inverse relationship between these two variables. However, it is also important to note that the months of July 2023 - December 2023, had a much lower case number (<500) provided, than the months prior (>2000). This may cause a bias in average house prices due to the smaller sample size, and may be an explanatory factor as to why the average house price experienced such a steep drop in that time period.

When examining house prices by type of dwelling in Table 2 (see Appendix B), there is a notable difference between apartments and houses. The mean price of houses (€1,191,395.48) is substantially higher than that of apartments (€562,754.82). This difference is accompanied by higher variability in house prices, as indicated by the standard deviation (€423,978.920 for houses in comparison to €373,852.320 for apartments). These statistics suggest that houses are not only priced higher but also exhibit greater price fluctuations.

In Table 3 (see Appendix B) yearly analysis of house prices from 2020 to 2023 shows slight fluctuations in the mean house prices. The mean price increased from €563,834.98 in 2020 to €573,036.86 in 2021 but saw a slight decrease in 2022 (€572,751.19) and a more pronounced dip in 2023 (€533,136.46). Despite these changes, the standard deviations remain high each year, indicating consistent price variability throughout the years.

Table 4 (see Appendix B) posits a positive relationship between the number of rooms and house prices. Properties with five or more rooms have the highest mean price (€1,258,991.04), while those with zero rooms have the lowest (€363,760.61). This pattern is consistent across all categories, with prices increasing alongside the number of rooms. Additionally, the standard deviation increases with the number of rooms, suggesting greater price variability. This trend indicates that properties with more rooms are significantly more valuable and their prices are more dispersed.

The figure and tables collectively offer a comprehensive overview of the housing market in the sample, highlighting key trends and variabilities in house prices by property sizes, years and types of dwellings. The data suggests a possible negative relationship between aggregated house prices and housing loan interest rates, notable differences of house prices between types of dwelling, high variability of house prices throughout the years and positive correlation between house prices and number of rooms.

### **3.4 Methodology**

The purpose of this study is to analyze the relationship between housing loan interest rates and house prices in Paris between 2020-2023, following the rapid rise of housing loan interest rates in that time frame. To clearly observe this relationship between house prices and housing loan interest rates in a temporal scale, this study will utilize the use of a multiple linear regression to model the relationship.

A multiple linear regression model is used to predict the value of a continuous dependent variable based on two or more independent variables. This multiple regression model will use the standard level of 95% for significance. In the case of this study using the variables house prices, housing loan interest rate and

the dummy variables, Year 2020, Year 2022, Year 2023, 1 room, 2 rooms, 3 rooms, 4 rooms, 5+ rooms and Apartment, the multiple linear regression will be utilized as follows:

$$\text{Ln(House Prices)} = \beta_0 + \beta_1(\text{Housing Loan Interest Rate}) + \beta_2(\text{Year 2020}) + \beta_3(\text{Year 2022}) + \beta_4(\text{Year 2023}) + \beta_5(\text{1 room}) + \beta_6(\text{2 rooms}) + \beta_7(\text{3 rooms}) + \beta_8(\text{4 rooms}) + \beta_9(\text{5+ rooms}) + \beta_{10}(\text{Apartment}) + \varepsilon$$

Where:

- Y is the dependent variable: Ln(House prices in €)
- X1, X2, ..., Xp are the independent variables: (Housing loan interest rate in %, Year 2020, Year 2022, Year 2023, 1 room, 2 rooms, 3 rooms, 4 rooms, 5+ rooms and Apartment)
- $\beta_0$  is the y-intercept (the value of Y when all Xs are 0)
- $\beta_1, \beta_2, \dots, \beta_p$  are the regression coefficients for each independent variable
- $\varepsilon$  is the random error term

The regression coefficients ( $\beta_1, \beta_2, \dots, \beta_p$ ) represent the change in the dependent variable Y (Ln(House Prices)) associated with a one-unit increase in the respective independent variable, holding all other independent variables constant. The error term  $\varepsilon$  accounts for the variation in Y that cannot be explained by the linear relationship with the Xs.

By adopting this formula and running the multiple linear regression in the software SPSS, this study aims to present an analysis of the relationship between housing loan interest rates and house prices in Paris between 2020-2023.

## 4. RESULTS AND DISCUSSION

### 4.1 Regression Model

Table 5: Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics		
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF	
1	(Constant)	12.912	.045		285.936	<.001	12.823	13.000						
	Housing loan interest rate	-.051	.006	-.045	-8.077	<.001	-.063	-.038	-.046	-.025	-.018	.155	6.466	
	Year 2020	.002	.004	.001	.372	.710	-.006	.009	.002	.001	.001	.720	1.389	
	Year 2022	.005	.001	.011	3.615	<.001	.002	.008	.015	.011	.008	.539	1.857	
	Year 2023	.004	.003	.008	1.326	.185	-.002	.009	-.042	.004	.003	.131	7.608	
	1 room	-.044	.037	-.030	-1.183	.237	-.116	.029	-.520	-.004	-.003	.007	133.499	
	2 rooms	.201	.019	.301	10.861	<.001	.165	.237	-.126	.033	.024	.006	156.828	
	3 rooms	.280	.012	.553	22.628	<.001	.255	.304	.282	.069	.050	.008	122.048	
	4 rooms	.298	.009	.562	32.061	<.001	.280	.317	.359	.098	.071	.016	62.942	
	5+ rooms	.283	.008	.456	37.712	<.001	.269	.298	.309	.115	.083	.033	29.984	
	Apartment	-.312	.025	-.028	-12.547	<.001	-.361	-.263	-.077	-.038	-.028	.991	1.009	

a. Dependent Variable: Ln(House Prices)

The relationship between house prices and housing loan interest rates is central to understanding the dynamics of the real estate market. Table 5 displays the regression results for the regression model. The coefficient for the housing loan interest rate is -0.051, indicating that an increase in interest rates is associated with a decrease in house prices. This negative coefficient aligns in line with earlier findings, which suggests that higher interest rates lead to a subsequent lowering of house prices. The significance level for this coefficient is less than 0.05, confirming the robustness of this relationship. Given that the coefficient for the housing loan interest rate is -0.051, it implies that a 1% increase in housing loan interest rates results in a 5.1% decrease in house prices. This relatively high elasticity indicates that house prices are quite sensitive to changes in interest rates.

Table 6 (check appendix B) displays the model fit with an R-squared value of 0.481 which is a strong fit. Therefore, approximately 48.1% of the variance in house prices is explained by the model, which includes the housing loan interest rate and the various control variables. The F-statistic of 9840.503 and a significance level of less than 0.001 further reinforce the model's overall robustness and explanatory power.

Among the control variables, the number of rooms in a house significantly affects house prices. For instance, houses with 1 room have a negative coefficient of -0.044, whereas houses with four rooms have a coefficient of 0.298. Both coefficients are statistically significant with p-values less than 0.05, indicating that the presence of more rooms generally increases house prices. Apartments, on the other hand, have a negative coefficient of -0.312, suggesting they are typically priced lower than houses.

### 4.2 Discussion

In this section, analysis results will be compared and discussed with previous existing literature. The relationship between housing loan interest rates and house prices has been extensively discussed in existing literature. McGibany and Nourzad (2004) and Çalışkan et al. (2022) found no significant relationship between housing loan interest rates and house prices, however many other studies have observed similar negative relationships between interest rates and house prices (Campbell and Cocco, 2003; Englund and Ioannides, 1997; Lee and Jinbaek, 2022). The elasticity (5.1% decrease of house prices to 1% increase of housing loan interest rates) is similar to that of the results from Svensson (2013), who observed a 7% decrease in house prices from a 1% increase of housing loan interest rates. Overall, the analysis findings are in line with the hypothesis established from the literature review, demonstrating a statistically significant and economically meaningful inverse relationship.

The coefficients derived from the covariates suggest that they can have significant influences on house prices. As established in section 3.3, apartments are lower priced compared to houses, and therefore have a significantly lower coefficient than that of houses. Furthermore, the analysis results highlight that the amount of rooms has a positive relationship with overall house prices. Type of dwelling and number of rooms are characteristics among those that were mentioned by Glaeser et al. (2005) and Goodman & Thibodeau (2003), and are often found in hedonic pricing models, supporting the notion that these factors have significant influence on house prices (Malpezzi, 2003).

The analysis findings can be summarized in a standard hedonic pricing model framework, where house prices are considered as a function of the housing loan interest rate, number of rooms, and type of dwelling. The results indicate that while interest rates have a negative impact house prices, the number of rooms and type of dwelling play significant roles in determining the price. The elasticity of house prices concerning interest rates is considerably high, underscoring the sensitivity of the real estate market to financial conditions. This comprehensive analysis not only reaffirms the theoretical underpinnings of housing economics but also provides empirical evidence that aligns with results derived from previous literature.



## 5. CONCLUSION

The dynamic relationship between housing loan interest rates and house prices in Paris is a complex phenomenon which can have profound implications for societal well-being, economic stability, and urban development. This study aimed to investigate this relationship, utilizing statistical descriptive and multiple linear regression analysis to discern patterns, correlations and the relationship between interest rates and house prices over a temporal scale, thereby shedding light on the broader implications for policy-making and professional practice.

The findings of this study provide compelling evidence for the relationship between housing loan interest rates and house prices. Based on the multiple linear regression analysis, we can deduce that there is a strong and statistically significant negative relationship between these two variables. The strength and direction of this relationship is supported by the substantial regression coefficient (-.051), and the model's R-squared value (0.493). The relationship is robust across the whole dataset from 2020 to 2023, implying that housing loan interest rates have had major influence on house prices in Paris over this period.

This analysis results goes in line with the hypothesis which insights were gained from the literature review. The rise in interest rates leads to the decrease in house prices, suggesting a negative relationship between housing loan interest rate and house prices (Campbell and Cocco, 2003; Englund and Ioannides, 1997; Lee and Jinbaek, 2022). Additionally, these results are further supported by the descriptive statistics analysis, where the sharp rise in housing loan interest rates during this period, was in tandem with the significant decrease in house prices. This indicates that the Parisian housing market has a high sensitivity to the changes in interest rate. This finding underscores the importance of understanding how changes in interest rates impact housing affordability and market dynamics, especially in densely populated urban areas like Paris.

This observed relationship between housing loan interest rates and house prices has extensive societal implications. It brings forth the sensitivity that households have to changes in interest rates, portraying that higher housing loan interest rates could potentially limit to homeownership, and therefore increase housing affordability challenges. Particularly for low-income households, this could hold a particularly disadvantageous effect, leading to a rise in socioeconomic inequalities. Furthermore, large fluctuations in house prices due to interest rate shocks can have a detrimental effect on consumer confidence and spending. This can contribute to volatility in broader economic trends. As homeownership is a key aspect in social and economic stability, such disruptions in the housing market could have ripple effects across society.

The findings of this study further highlights the importance of proactive measure that policymakers should take in order to lessen the effect that interest rates can have on housing affordability. Implementing targeted interventions such as subsidies or other incentives for affordable housing development, particularly in times of high interest rate volatility. Professionals can also play an important part is the advocacy for such policies. Additionally, by taking future interest rate expectations into account, professionals make more informed decisions when consulting investment strategies.

Despite the observations gained from this analysis, there are several limitations that should be acknowledged. Firstly, the analysis relied on publicly available secondary data sources, and though they were retrieved from reputable institutions, the data may have biases or limitations, particularly the housing price data in terms of coverage and housing characteristics. Furthermore, the difference in sample size between the months July 2023 - December 2023 and the rest of the dataset, may also have bias and be skewed to the lower end of house prices. Additionally, as the focus of the study is exclusively

on the Parisian housing market, and there is no reference on how the rest of France experiences this relationship, it is difficult to determine how sensitive Parisian house prices are to the housing loan interest rate without a reference of the whole nation.

Future research could help expand our understanding of the relationship between housing loan interest rates and house prices. Conducting the study over a longer period of time can help us gain insights into the dynamics and trends in the housing market, and can discern whether such a strong negative relationship is an anomaly. Furthermore, investigating this relationship for the whole of France and comparing it to Paris can provide understanding on the differences of the relationship in metropolitan areas and the general national urban market.

In conclusion, the findings of this study contribute to our understanding of the complex relationship between housing loan interest rates and house prices. It highlights the importance of considering how this relationship can affect the housing market, as well as its possible policy and economic implications.

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## **APPENDIX A**

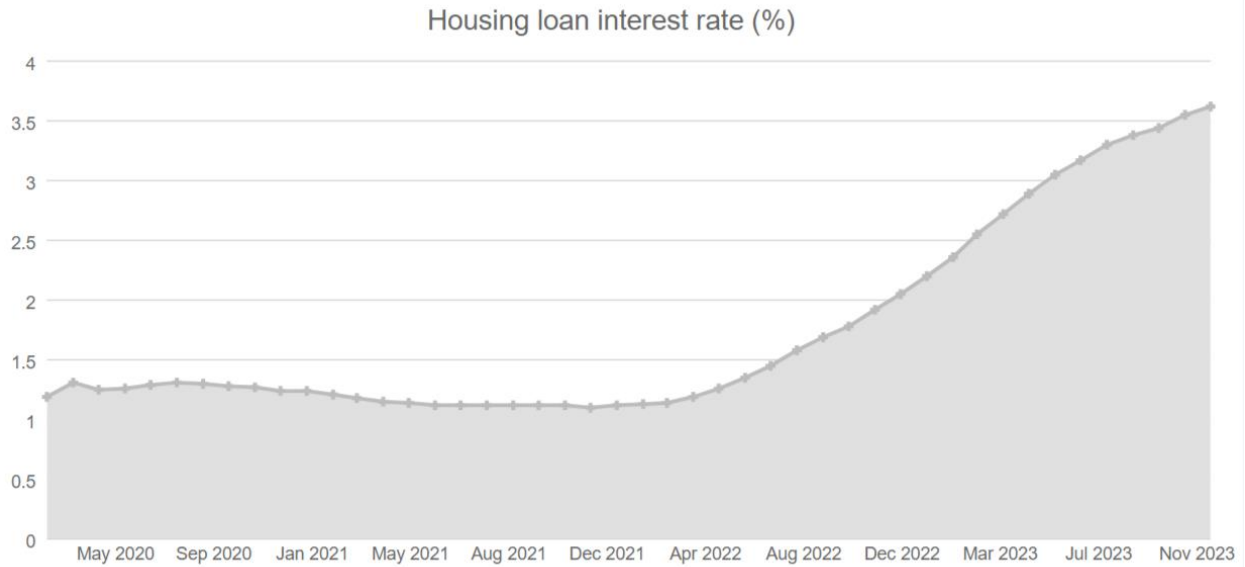


Figure 2

Note: Figure 2 maps the housing loan interest rates in % through March 2020 to December 2023.

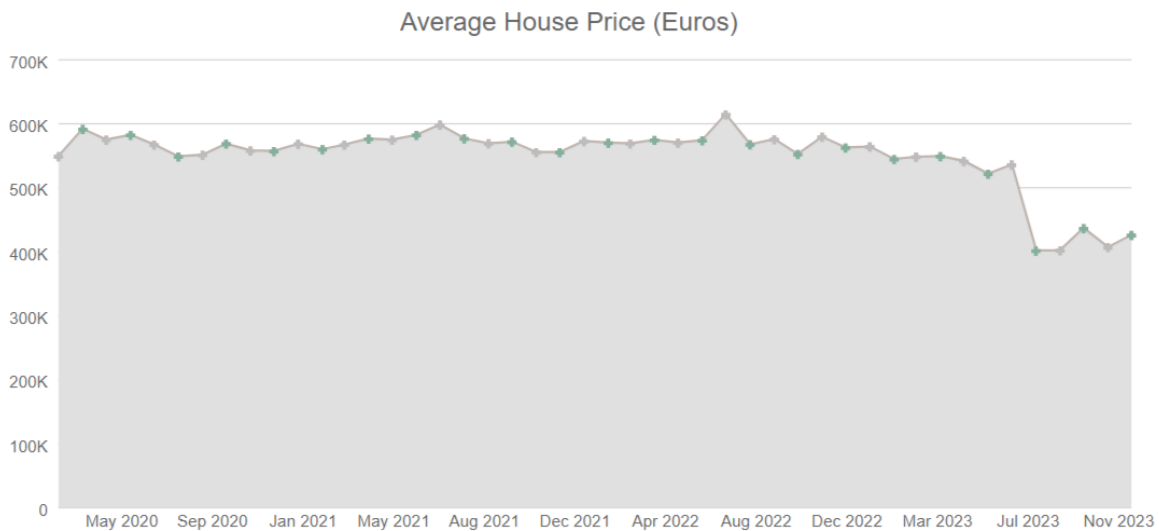


Figure 3

Note: Figure 3 maps the aggregated house prices per month (in €) through March 2020 to December 2023.

## APPENDIX B

**Table 2**

		Type of dwelling	Statistic	Std. Error
House Prices (€)	Apartment	Mean	562754.82	1148.609
		Std. Deviation	373852.320	
		Minimum	100051	
		Maximum	1919022	
	House	Mean	1191395.48	22695.071
		Std. Deviation	423978.920	
		Minimum	140000	
		Maximum	1900000	

Note: Table 2 depicts descriptive statistics of house prices (in €) by type of dwelling.

**Table 3**

		Year	Statistic	Std. Error
House Prices (€)	2020	Mean	563834.98	2454.566
		Std. Deviation	370533.744	
		Minimum	100150	
		Maximum	1913570	
	2021	Mean	573036.86	2106.485
		Std. Deviation	379061.951	
		Minimum	100700	
		Maximum	1919022	
	2022	Mean	572751.19	2039.704
		Std. Deviation	380124.358	
		Minimum	100051	
		Maximum	1918600	
2023	Mean	533136.46	2853.285	
	Std. Deviation	365253.863		
	Minimum	100230		
	Maximum	1913500		

Note: Table 3 depicts descriptive statistics of house prices (in €) by year.

**Table 4**

		Number of rooms	Statistic	Std. Error
House Prices (€)	0 rooms	Mean	363760.61	27623.919
		Std. Deviation	345022.643	
		Minimum	100800	
		Maximum	1881500	
	1 room	Mean	313258.54	1427.842
		Std. Deviation	239698.876	
		Minimum	100150	
		Maximum	1918000	
	2 rooms	Mean	459990.19	1249.428
		Std. Deviation	242984.010	
		Minimum	100051	
		Maximum	1900000	
	3 rooms	Mean	696529.37	1863.178
		Std. Deviation	292358.751	
		Minimum	101500	
		Maximum	1919022	
4 rooms	Mean	987663.32	3416.493	
	Std. Deviation	354542.389		
	Minimum	101500		
	Maximum	1919022		
5+ rooms	Mean	1258991.04	6106.412	
	Std. Deviation	420323.427		
	Minimum	100750		
	Maximum	1919022		

Note: Table 4 depicts descriptive statistics of house prices (in €) by number of rooms.

**Table 6: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.693 <sup>a</sup>	.481	.481	.46161	.481	9840.503	10	106277	<.001

a. Predictors: (Constant), Apartment, Year 2023, 3 rooms, 5+ rooms, 4 rooms, Year 2020, 1 room, Year 2022, Housing loan interest rate, 2 rooms

Note: Table 6 depicts model fit of regression analysis.