

## House Price Shock and Business Cycle: The French Case

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### Abstract

This study examined the relationship between house prices and the business cycle. Specifically, we examined the effect of house price and stock price in the French business cycle. After presenting the transmission channels from house price to the business cycle, we analyzed the cyclical properties of house prices and compared them with the Gross Domestic Product (GDP) cycle. The question arises: are fluctuations in economic activity more sensitive to a real estate price shock (property wealth effect) or a stock price shock (stock market wealth effect)? We collected the data over the 1980Q1-2015Q4 period and investigated the effects of house price and stock price shocks on French GDP by employing the Structural VAR model. We found the evidence that house price strongly affects the GDP cycle. Indeed, their response is significantly more important than the stock price, suggesting that the housing market might contribute to the persistent propagation of the shocks hitting the economic system. The study has important implications for both academia and policymakers and offers new insights into the French experience.

**Keywords:** house price; business cycle; var model; economic activity; stock price.

**JEL classification:** A10; B4.

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### 1. INTRODUCTION

The world has witnessed many crises (such as stock market crash, banking crises, currency crises, and real estate crises)<sup>1</sup> that have marked economic history. However, the magnitude of the latter is often more harmful. We have noticed the real estate crises that happened in many countries including 1990 Japan crisis, 2007 United States crisis, and 2009 Spain crisis. The bursting of these real estate crises has left its marks to date. Therefore, it is crucial to monitor the real estate market, especially the evolution of prices and residential investments.

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Since the bursting of the housing bubble in the United States, several scientific researchers and the academicians have evaluated and highlighted the importance of real estate sector in the economic growth (Ahearne *et al.*, 2005; Borge *et al.*, 2010; Jorda *et al.*, 2016). Scholars found the continuous increase in property prices for nearly two decades in France as well as in the majority of OECD countries (Christensen *et al.*, 2016) that has attracted the interests of economists in the property market. Moghadasi and Rad (2019) documented a dynamic relationship between prices and risk in absence or presence of financial crises.

Given the importance of the real estate sector in the dynamics of economic activity of several developed countries, we intended to assess the impact of a shock in property prices in France on the evolution of the country's gross domestic product (GDP). The question arises: Are fluctuations in economic activity rather sensitive to a real estate price shock (property wealth effect) or to a stock price shock (stock market wealth effect)? To measure the response of real GDP shock, we employed the structural vector auto regression SVAR model (Goodhart and Hofmann, 2008; Blot *et al.*, 2009). We compared the effects of two types of shocks on the French economy, namely the real shock (real price) and the equity price shock. In recent years, many countries have initiated housing projects to help poor families. Karshenasan and Beiranvand (2013) conducted a study in Iran where they studied the Mehrhousing project that aimed to provide cheap housing facilities to needy people. Alvarez *et al.* (2010) examined the house prices and output co-movement for Germany, Spain, France, and Italy and found higher co-movement compared to house prices among the four countries. In similar vein, Alvarez *et al.* (2010) examined the housing markets of the same four countries using unobserved components models. They found more evidence of business cycle, rather than housing cycle co-movement. Selmi and Hachicha (2015) tested the house price index and mortgage market rate in US and found persistent results in the presence of d estimates on the Shimotsu method than on the one of Künsch (1987); Kunsch (2020). Bui (2020) conducted a study in Vietnam to determine the factors influencing the apartment prices. He found that apartment prices were positively influenced by size of apartment, presence of balcony, presence of swimming pool, presence of shopping malls, and periodic rental income or value.

## 2. TRANSMISSION CHANNEL FROM HOUSING PRICE TO THE BUSINESS CYCLE

There are three channels through which property prices can be considered to affect activity: wealth channel, Tobin Q ratio, and the broad credit channel.

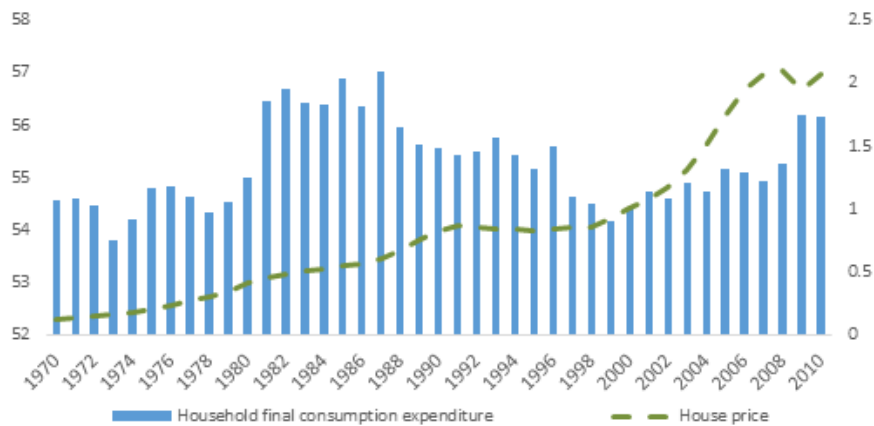
### 2.1 Wealth Channel

The real estate wealth is a very important component of overall wealth (Mishkin, 1996). According to the INSEE report, the total wealth of French households has increased considerably since the 2000s (Aviat *et al.*, 2007). This increase is mainly due to the increase in household property assets (Aviat *et al.*, 2007).

The housing wealth effect occurs when an increase (decrease) in real estate prices, synonymous with an increase (decrease) in the value of real estate, usually results in an increase (decrease) in household consumption (Lecat and Mésonnier, 2005; André *et al.*, 2012; Aßmann *et al.*, 2013). In other words, rising house prices allow households to spend

more. [Nocera and Roma \(2017\)](#) found a comparatively stronger housing wealth effect on consumption in Ireland and Spain.

When the real estate market is booming, high prices positively impact homeowner's consumption. On the one hand, we have those who benefit from the sale of their former property to increase their consumption ([Timbeau, 2014](#)). The rise in property prices allows households, as soon as a property is sold, to acquire either a smaller dwelling or a dwelling of the same size, however in cities where the price per square meter is cheaper. On the other hand, we have new owners who will generally equip their new homes and increase their consumption of furniture and equipment. Therefore, this increase in consumption is profitable to economic activity in general because it increases the production of manufacturers, contributes to reduce unemployment, and increases in GDP. However, [Nocera and Roma \(2017\)](#) reported that housing demand shocks may exercise upward pressure on inflation directly through higher rents and indirectly through consumption.



Source: The World Bank, General Council for the Environment and Sustainable Development  
 Note: Housing price index in euros (€) with base value of 2000 (right scale); Household final consumption expenditure as a percentage of GDP (left scale)

**Figure no. 1 – Household Consumption and Residential Property Prices in France**

## 2.2 Tobin's Q Ratio

[Musso et al. \(2011\)](#) contended a significant positive correlation between GDP and residential investment. They also found a strong link between economic fluctuations and the French real estate market. This study also finds a high correlation between residential investment and GDP that is equal to 0.79.

When the price of the old real estate increases relative to the cost of construction, it becomes interesting (profitable) to build new homes. In fact, when the purchase of an old home is more expensive than a new home, investment in real estate becomes interesting. Following model is consistent with Tobin's Q theory: 
$$Q = \frac{\text{Price of the old real-estate}}{\text{Cost of construction}}$$

Therefore, the Q ratio is used to arbitrate between the construction of new dwellings and purchase of old (Jud and Winkler, 2003; Baugnet *et al.*, 2011). When the price of old houses increases, the ratio Q increases and the investment in new homes increases. This ratio reflects the dynamics of the real estate market.

This shows that real estate prices play an important role in stimulating economic conditions in general and the construction sector in particular. A positive shock of real estate prices in old housing is favorable to the construction of new housing.

### 2.3 Broad Credit Channel (Financial Accelerator)

The rise in real estate prices allows to reduce the information asymmetry between creditors and borrowers (limiting market imperfections) in the credit market. As a result, banking activity and real estate activity are boosted (increase in credit granting and residential investment).

Since the value of the property represents the guarantee of a loan, therefore any increase (decrease) in prices means that the guarantee of a credit is more (less) important than warrant the quality of the investment, called “*collateral effect*” (Cloyne *et al.*, 2019). This will allow the reduction of external financing premium that will allow banks to distribute more credit. The rise in prices is amplified by the increase in loans when the lending criteria are relaxed. On one side, there is a strong positive correlation between credit supply and housing prices and a causal link where the supply of credit depends on the evolution of real estate prices while house prices depend on conditions of access to credits on the other side (Favara and Imbs, 2015).

The credit channel is an indirect channel for transmitting positive shocks from housing prices to economic activity (Cesa-Bianchi, 2013). Indeed, a rise in prices affects demand and supply of credit on the one hand and also encourages households to borrow more while it pushes financial institutions to grant more loans on the other hand.

In the end, rising real estate prices value collateral deposited with banks, thus allowing in reducing the asymmetric information and increasing the distribution of loans. In turn, these increase real estate prices.

## 3. RELATIONSHIP BETWEEN REAL ESTATE PRICES AND THE BUSINESS CYCLE

Table no. 1 shows French Dating Cycles namely the real price cycles and the business cycle (GDP cycle)<sup>2</sup>. We analyzed the peaks and troughs of each series by focusing only on the cyclical fluctuations of the two series. The latter represents the deviation of the series from the trend (long term component). Using the Hodrick-Prescott (HP) filter with a smoothing parameter of 1600, we extracted the trend of all our variables. The dating cycles were detected by the BBQ algorithm. We used seasonally adjusted quarterly data and corrected it for working days. The study period starts from the first quarter of 1980 to the last quarter of 2015. The GDP (in billion Euro) is extracted from the database INSEE<sup>3</sup>, and the real estate price index is collected from the Federal Reserve Bank of Dallas (index 100 in 2005).

For our study period from 1975Q1 to 2015Q4, we found eight real estate price cycles. Peak dates were 1977Q1, 1980Q1, 1991Q1, 1994Q1, 1996Q3, 1999Q3, 2006Q4 and 2011Q3<sup>4</sup>.

**Table no. 1 – French Property Prices and Business Cycles**

	1975Q1-1985Q4		1986Q1-1995Q4		1996Q1-2005Q4		2006Q1-2015Q4	
	PEAKS	TROUGHS	PEAKS	TROUGHS	PEAKS	TROUGHS	PEAKS	TROUGHS
GDP	1980Q1	1981Q1	1990Q1	1991Q1	2001Q1	1997Q1	2008Q1	2009Q2
	1982Q2	1987Q1	1992Q1	1993Q4	2004Q4	2003Q2	2011Q1	2014Q2
			1995Q2		2005Q2			
Property prices	1977Q1	1979Q1	1991Q1	1993Q3	1996Q3	1998Q1	2006Q4	2009Q2
	1980Q4	1985Q3	1994Q1	1995Q3	1999Q3	2003Q1	2011Q3	

Referring to the dating cycles, we noticed in [Table no. 1](#) that the real estate prices precede (or coincide) generally with the evolution of the GDP. As a result, there may be a link between housing market and the business cycle. However, this relation does not imply any causality at this stage of the study, and we cannot identify which variable affected the other.

On the one hand, a prosperous (or struggling) economy will likely affect the upward (downward) movement of property prices. When the economic situation is favorable, credit conditions are often relaxed. As a result, residential real estate market activity (transaction and construction) is generally become more dynamic, consequently the real estate prices will rise. On the other hand, the increase in real estate prices generally attracts investors, thus boosting the sector of new housing construction and economic activity.

#### 4. THE SVAR MODEL

##### 4.1 Descriptive Analysis

[Table no. 2](#) reveals that the correlation between French GDP and inflation between 1980 and 2015 is significantly negative indicating that the two variables do not evolve in the same direction. Regarding the link between real estate prices and GDP, the correlation between these two variables is significantly positive and higher in magnitude (0.68). This specifies a strong relationship between these two variables. The relationship between the stock price and the French GDP is significantly positive, however it has smaller coefficient (0.45) as compared to GDP and real estate prices.

**Table no. 2 – Correlation<sup>5</sup>**

	$PIB_t$	$IPC_t$	$PL_t$	$PA_t$
$PIB_t$	1.0000			
$IPC_t$	-0.3166*	1.0000		
$PL_t$	0.6857*	0.0003	1.0000	
$PA_t$	0.4520*	-0.1589*	0.3482*	1.0000

Note: \* represents the 5% level of significance.

##### 4.2 Stationary and the Order of Variable in SVAR Model

We employed Dickey-Fuller test to examine the stationarity of our cyclical components. Comparing the p-value of each of our variables to the decision rule at the 5% threshold, we rejected H0 and confirmed that all our variables are stationary. These results allowed us to proceed further and employ the SVAR model.

Using the structural VAR model for a period from 1972 until 1998, [Goodhart and Hofmann \(2001\)](#) used Cholesky decomposition. The orthogonalized shocks in European countries (including France) are GDP, inflation, housing prices, the exchange rate, short-term rates, and ultimately stock prices. [Iacoviello \(2005\)](#) studied the case of the US economy and adopt a different classification of variables. He found the key interest rates of the central bank at first place, followed by inflation rates in the second place. He also found real price in the third place while GDP at the fourth place. In contrast, [Bjørnland and Jacobsen \(2013\)](#) put the GDP at the beginning of the ranking followed by inflation, property prices and equity prices and finally the key rate.

We classified our four variables for the implementation of the Cholesky decomposition as GDP (PIB) at the first place, and the consumer price index (IPC) at second place then housing prices (PL) and finally share price (PA).

We put that variable at first place which is not contemporaneously affected by the shocks of the other variables. Therefore, it is the most exogenous variable, and these restrictions are based on economic theory.

GDP may affect inflation contemporaneously but has not an immediate effect on the other variables. However, we noticed that inflation is not immediately affected by a shock in property prices or share prices. We also found that real estate prices are affected immediately by a GDP and inflation shocks while it takes some time to react to stock price shocks. On the other side, stock prices react immediately to shocks of all other variables (i.e., GDP, inflation, real estate).

#### 4.2.1 The SVAR Model Results

In order to identify the shocks, we used Cholesky decomposition as follows:

$$A_{\varepsilon_t} = B_{\varepsilon_t}$$

We have the matrix representation as follows:

$$\begin{pmatrix} \varepsilon_{PIB} \\ \varepsilon_{IPC} \\ \varepsilon_{PL} \\ \varepsilon_{PA} \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 \\ a_{41} & a_{42} & a_{43} & 1 \end{pmatrix} = \begin{pmatrix} \varepsilon_{PIB} \\ \varepsilon_{PIC} \\ \varepsilon_{PL} \\ \varepsilon_{PA} \end{pmatrix} \begin{pmatrix} b_{11} & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 \\ 0 & 0 & b_{33} & 0 \\ 0 & 0 & 0 & b_{44} \end{pmatrix}$$

With  $\varepsilon = (\varepsilon_{PIB}, \varepsilon_{IPC}, \varepsilon_{PL}, \varepsilon_{PA})$  vector shocks GDP, inflation, property prices and equity prices respectively; 'A' and 'B' are two square matrices where A is a triangular matrix and B is a diagonal matrix;  $\varepsilon_t$  is the vector of shocks and  $\varepsilon_t$  is the vector orthogonal structural shocks. This shock matrix represents that each shock has a separate effect of the other shock.

After classifying our four variables, we obtain the following SVAR model:

$$y_{PIB,t} = a_1 y_{PIB,t-1} + a_2 y_{IPC,t-1} + a_3 y_{PL,t-1} + a_4 y_{PA,t-1} + \varepsilon_{PIB,t} \quad (1)$$

$$y_{IPC,t} = b_1 y_{PIB,t} + c_1 y_{PIB,t-1} + c_2 y_{IPC,t-1} + c_3 y_{PL,t-1} + c_4 y_{PA,t-1} + \varepsilon_{IPC,t} \quad (2)$$

$$y_{PL,t} = d_1 y_{PIB,t} + d_2 y_{IPC,t} + h_1 y_{PIB,t-1} + h_2 y_{IPC,t-1} + h_3 y_{PL,t-1} + h_4 y_{PA,t-1} + \varepsilon_{PL,t} \quad (3)$$

$$y_{PA,t} = e_1 y_{PIB,t} + e_2 y_{IPC,t} + e_3 y_{PA,t} + f_1 y_{PIB,t-1} + f_2 y_{IPC,t-1} + f_3 y_{PL,t-1} + f_4 y_{PA,t-1} + \varepsilon_{PA,t} \quad (4)$$

**Table no. 3 – SVAR Model**

	<b>Coef.</b>	<b>Std. Err.</b>	<b>z</b>	<b>P&gt;z</b>	<b>[95% Conf.</b>	<b>Interval]</b>
a_1_1	1	.	.	.	.	.
a_2_1	.351	.322	1.09	0.277	-.282	.984
a_2_2	1	.	.	.	.	.
a_3_1	-.258	.127	-2.03	0.042	-.506	-.009
a_3_2	-.0315	.0338	-0.93	0.351	-.0977	.0347
a_3_3	1	.	.	.	.	.
a_4_1	-1.774	2.045	-0.87	0.386	-5.782	2.233
a_4_2	.743	.538	1.38	0.168	-.312	1.798
a_4_3	.952	1.372	0.69	0.488	-1.737	3.641
a_4_4	1	.	.	.	.	.
b_1_1	.003	.000	16.37	0.000	.003	.003
b_2_2	.012	.000	16.37	0.000	.010	.013
b_3_3	.005	.000	16.37	0.000	.003	.005
b_4_4	.072	.004	16.37	0.000	.063	.080

Source: Authors own calculation. Values are rounded up to three decimal points.

According to the Cholesky matrix, a 10% rise in inflation is that on one hand, the real estate prices immediately increase by 0.3%, and on the other, reduces the share price by 0.8%. However, a 10% increase in property prices contributes to a 0.4% increase in stock prices. An increase of GDP to 10% results in the immediate rise of 0.7% in property prices and 0.5% in share prices.

**Table no. 4 – Cholesky Decomposition Matrix**

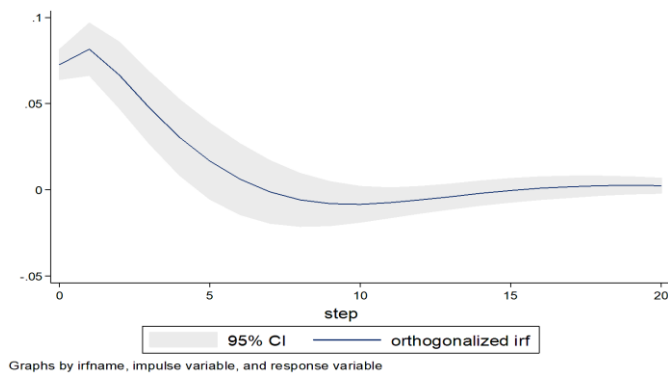
	<b><math>PIB_t</math></b>	<b><math>IPC_t</math></b>	<b><math>PL_t</math></b>	<b><math>PA_t</math></b>
<b><math>PIB_t</math></b>	.00309266	0	0	0
<b><math>IPC_t</math></b>	-.00108597	.01155718	0	0
<b><math>PL_t</math></b>	.00076281	.00036374	.00451894	0
<b><math>PA_t</math></b>	.00556823	-.00892988	-.0043004	.07178331

Source: Authors own calculations

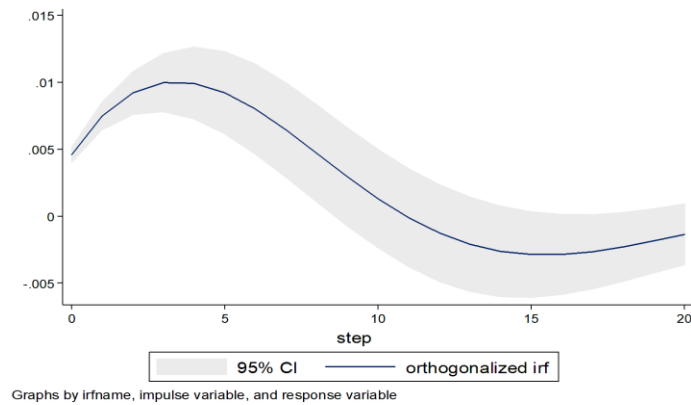
After the estimation of the SVAR model, we were interested to examine the impact of shocks over time. Initially, we focused on the impulse responses of GDP to shock in the real estate prices and secondly we evaluated the response of GDP to shock in equity prices. Afterwards, we interpreted the error variance decomposition.

We applied the impulse response function to examine the impact of shocks in real estate prices and equity prices on GDP. Later, we applied the Forecast Error Variance Decomposition to measure the share of each shock for the change in a variable.

In Figure no. 2 and no. 3, we evaluated the impact of a positive shock in real estate prices and equity prices on the evolution of French GDP. Irf stands for impulse response function. An impulse response is the reaction of any dynamic system in response to some external change (Cummins, 1962).



**Figure no. 2 – Shocks in Real Estate**



**Figure no. 3 – Shocks in Equity Prices**

Figure no. 4 represents the impulse response function of the GDP impact of property prices in 20 quarters. We found a positive shock in real estate prices causes a rise in GDP, confirming the theoretical predictions. Indeed, a rise in house prices increases household consumption by wealth (income) effect as well as residential investment. The increase in consumption stimulates investment and increases the overall global production.

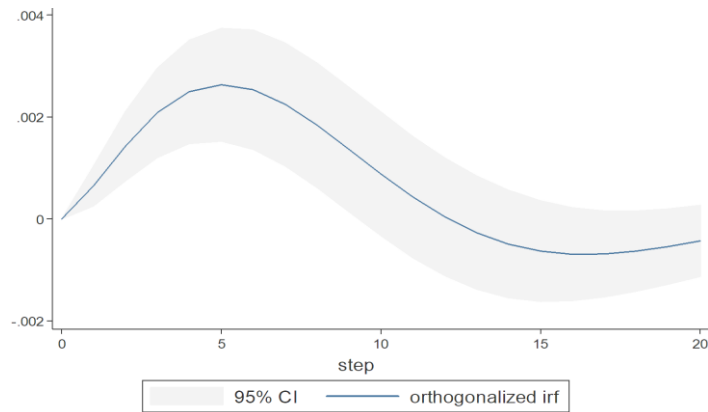
We noted that the impact of a shock in property prices intensifies over time to reach the top in the fifth quarter. This outcome is very similar to that found by [Blot \*et al.\* \(2009\)](#) who reported that the scale of French real shock peaked in the fourth quarter. However, our findings reveal that from the tenth quarter, the GDP response to a shock in property prices is not significant. From the third quarter until the seventh quarter, the GDP response exceeds around more than 0.2%. [Demary \(2009\)](#) reported that the response of French GDP to real shocks was 1% in the fourth quarter then became insignificant.

We noted that the response of the French GDP is considerably lower in comparison to the response of the GDP of other countries facing a real shock. [Demary \(2009\)](#) reported that the impulse response of Japanese GDP to a price shock was significantly positive and it was 10% in the fourth quarter and 3% in the sixteenth quarter. He also reported that Denmark's GDP response was 34% in the first quarter and 10% sixteenth quarter while Spain's response was around 35% in the fourth quarter and 6% in the twelfth quarter.

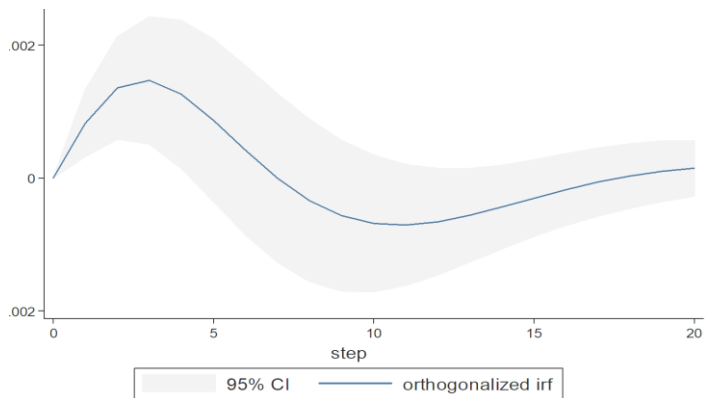


The response of the GDP impact on share price is represented by [Figure no. 5](#). We noted that it had a lower magnitude than that of property prices shock. The impulse response of GDP to a shock equity prices peaked in the third quarter with a response of 0.14%. The impact of stock prices is short-lived compared to the impact of property prices. It became insignificant from the fifth quarter. Following these results, we concluded that a shock in real estate prices affects GDP more than that of stock prices shock.

[Helbling and Terrones \(2003\)](#) found similar results in their study on French property market. [Blot et al. \(2009\)](#) also found similar findings and contended that the effect of a real estate shock lasts longer than the stock prices shock. According to our results, the length of a real estate shock is 27 months against 12 months only for the duration of a shock in equity prices. Existing literature supports the notion that duration of real shock is usually longer than that of a clash of share prices. The study of [Bjornland and Jacobsen \(2013\)](#) in the US market showed that the effect of a real shock to GDP lasts longer than a stock market shock.



**Figure no. 4 – Impulse Response Function (irf) of GDP to Real Estate Prices Shock**



**Figure no. 5 – Impulse Response of GDP to Equity Prices Shock**

Later, we proceeded to measure the magnitude of each shock (i.e., real estate prices and stock prices) in the evolution of GDP. Therefore, we applied the Forecast Error Variance Decomposition (FEVD).

The Forecast Error Variance Decomposition can measure the change in a variable due to fluctuations in another variable. More specifically, it is used more narrowly for a specific tool for interpreting the relations between variables described by vector autoregressive (VAR) models (Lutkepohl, 2010). In our study, this allowed us to determine the magnitude of the impact of house prices and stock prices on French GDP.

**Table no. 5 – Forecast Error Variance Decomposition**

step	fevd (PL)	S.E (PL)	fevd (PA)	S.E (PA)
0	0	0	0	0
1	0	0	0	0
2	.018022	.011441	.029176	.018225
3	.067051	.03423	.06807	.038816
4	.136959	.058752	.093542	.053738
5	.212084	.079484	.101635	.062803
6	.280674	.095071	.098459	.066558
7	.336082	.105729	.091467	.06587
8	.375483	.112239	.085788	.062281
9	.399064	.115687	.083656	.057918
10	.409427	.117096	.085037	.054811
11	.410664	.117106	.088637	.05391
12	.407185	.116057	.092858	.054766
13	.402653	.114341	.096462	.056302
14	.399379	.11256	.098835	.057677
15	.398266	.111325	.099936	.058531
16	.399155	.110968	.10008	.058858
17	.401318	.111432	.099699	.058822
18	.403912	.112409	.099175	.058624
19	.406261	.113533	.098754	.05843
20	.40798	.11452	.098542	.058332

*Note:* FEVD is Forecast Error Variance Decomposition, S.E. is Standard Error. PL represents the effect of property price on GDP, PA represents the effect of stock price on GDP

Table no. 5 reveals that property prices better explain the change in GDP in twenty quarters. However, property prices explain the change in GDP increases with each quarter and it reached to nearly 40% in the ninth quarter. In contrast, stock prices explain only 10% of the variation in GDP in the fifth quarter (which is its maximum value).

## 5. CONCLUSION

Given the importance and consequences of the bursting of bubbles in property prices on economic conditions, we investigated the link between real estate prices and French GDP. We empirically examined the effects of shocks of real estate prices on the French GDP. For this, we adopted the structural SVAR model to measure the impulse response of GDP due to a shock of real estate prices (not financial assets) and a stock price shock (financial wealth).

The findings highlighted two main points. Firstly, the impulse response function showed that the magnitude of the shocks of real estate prices is more important than the stock prices. Secondly, the response of GDP to a shock in property prices continues longer than the response to a shock in stock prices. In light of these results, we can conclude that the impact of a positive shock in real estate prices on GDP is larger than the impact of stock prices. The rise in house prices, therefore, promotes the growth of GDP in France.

This study has some important implications. The study extends the existing empirical literature on the role of housing markets in macroeconomic fluctuations, by offering new insights into the French experience. The study highlights the importance of property prices on French GDP. House price shocks have a positive impact on GDP through higher consumption since an increase in house prices implies a higher value of the collateral which can be used by a borrowing-constrained household to obtain more credit. It is recommended that policymakers and regulators need to understand the causes and consequences of house price bubbles before, rather than after, they have unwound. Interest rate adjustments can be made in response to the housing market. The study has some limitations and directions for future research. This study only collected the data from 1980Q1 to 2015Q, the future studies may collect data for a longer period especially including the pandemic data. Many countries have reduced the interest rate to soften the effects of Covid-19 while housing demand has surged.

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### Notes

- <sup>1</sup> The Real estate prices and/or property price are used interchangeably throughout the paper.
- <sup>2</sup> The dating of cycles and the information it can contain, has aroused the interest of many researchers. Among those who have studied the fluctuation of real estate prices we quote: *see Girouard et al. (2006)*, and *Goodhart and Hofmann (2008)*. The study by *Girouard et al. (2006)*, prepared between 1970 and 2000 shows that real estate prices in France record two cycles. These represented by three peaks recorded in 1981T1, 1991T2 and 2005T2 and two lows in 1984T3 and 1997T1. *Van den Noord (2006)* analyzing the French real estate market from 1970 to 2005, found that real estate prices experienced a first peak in the first quarter of 1981 and a second peak ten years later. *Goodhart and Hofmann (2008)* studied the real estate market over a shorter period than the previous studies (1985-2006). During these twenty years, he detected four peaks for French real estate prices: in 1988T1, 1991T2, 2006T4 and 2000Q1.
- <sup>3</sup> L'Institut national de la statistique et des études économiques. See [www.insee.fr](http://www.insee.fr).
- <sup>4</sup> I record a dating difference ranging from a quarter to four quarters compared to the studies mentioned above, this is due to our choice of parameters.
- <sup>5</sup> The data source of index of share prices and the consumer price index is OECD. The base of these two variables is index in 100 in 2010. Using the Hodrick-Prescott (HP) filter with a smoothing parameter of 1600, we will extract the trend of all our variables except the interest rates. The variables are transformed in logarithms.

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