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THE EFFECT OF THE MAIN SOCIOECONOMIC FACTORS ON THE HOUSING PRICE IN SPAIN

ABSTRACT

The purpose of this paper is to analyse and understand the behaviour of the price of housing in Spain to be affected by a variation in some of the most important socioeconomic factors in our country. This study of the price of housing is carried out through an econometric model estimated by vectors autoregressive (VAR) and drawing impulse response graphs, which allow to visualize more clearly the response of the house price, compared to a shock in some the variables used. In addition, it can be seen that a variation in some of the variables included in the model does not cause the expected effect on the price of Spanish housing. So, this work is an interesting option for the study of the price of housing in Spain, due to the little literature that there is on this issue in our country in recent years.

Key words: Housing prices, Spain, VAR, Econometric model

JEL Classification: C01, C32, L74, R31

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EC 1049- Bachelor's Thesis

Economics Degree

Academic year: 2018/2019

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1. INTRODUCTION

The objective of this paper is to analyse how a variation of some of the most important economic, demographic and social indicators affects the price of housing, valued in euros per square meter in Spain.

The main reason that led to this study is precisely this variation in the price of housing, during the great real estate and financial crisis suffered by Spain in 2008 and that lasted until 2014, the year in which it ended supposedly the crisis, although at present its effects are still noticeable. This crisis was caused mainly by an inflationary bubble in the price of the houses that caused that the prices were exorbitant, in addition to the great stock of houses recently constructed and without inhabiting that abounded in the Spanish territory.

However, it should be taken into account that this great bubble started a few years before, with the beginning of the housing bubble, as a result of the massive housing construction. This real estate bubble is considered to have started to appear during the second and final legislature (2000-2004) of José María Aznar's Government, which dragged its effects to lead to the great crisis that began in 2008 (Euribor.us, 2012).

Historically, Spain has always been considered a country dependent on energy resources, and this lack of resources is mainly based on the need to import oil. Around the year 2000 there was an energy crisis in our country that caused a clear inflationary trend in the Spanish economy. In June 2008, the inflation that had accumulated the Spanish economy in the last thirteen years, was about 5%. Therefore, the fall in oil prices between 2003 and 2008, and the coincidence in time with the bursting of the bubble, caused the fear of entering in a clearly deflationary period, a fact that eventually it did. In Spain, during 2009, the inflation rate registered historical lows, which had not been seen for 40 years, even arriving in March 2009 to have a deflationary period, a fact that had not been recorded since there are records of inflation data (El País, 2009).

On the other hand, in addition to suffering a major housing crisis, Spain also suffered a serious crisis in the banking sector. At the beginning of this millennium, according to many experts in the banking sector, the Spanish banking system was considered one of the most solid to withstand a liquidity crisis. All this was thanks to a restrictive policy aimed at banking. However, this situation changed during the years of the housing

bubble, being laxer when it comes to legislating on banking, and even when the Bank of Spain had to apply sanctions.

In addition, Spain had the densest bank office network in the entire European territory, therefore, when the banking crisis broke out, it caused many of the employees in this network of offices to be fired, and many bank offices were closed, causing an important increase in unemployment in Spain, adding an additional effect to the crisis that affected our country. This increase in the unemployment rate, together with the drop in the price of housing after the bubble that had been created since the beginning of 2000, finally broke out in 2008, causing many people to have no resources to pay their mortgage loans, not even getting to sell their homes.

Thus began the decline of the Spanish economy, which still suffers its effects today: high unemployment rate, many new unoccupied homes, buildings under construction and unfinished, decreased purchasing power of families, increased evictions of families whose home is owned by the bank, with the consequent increase in the number of homes or premises owned by banks, and thus a long list of disastrous consequences that led Spain to plunge into one of the most important crises in its history and which is still trying to leave.

For all the above, it has been considered interesting to carry out a study on the variation of the price of housing in Spain in the period 2000-2018, which is the interval of years in which the real estate bubble was mainly noticed, as well as the subsequent economic crisis, applying an econometric model estimated through vectors autoregressive (VAR), and obtaining a result captured in the impulse response graphs, which shows how a shock in each of the variables used affects the price of Spanish homes.

2. REVIEW OF THE LITERATURE

After a brief review of the literature and analysed the assignments of different experts in the field, it could be possible to extract several ideas to carry out a more precise analysis in the housing and credit market.

Most authors consulted, use vector error correction models (VECM) or vector autoregressive models (VAR). In order to carry out this work, a model of VARs have been used, according to the idea of Sims (1980) that this type of model is better for a series of macroeconomic variables and thus be able to focus the analysis in a short-term period.

Therefore, according to the idea of Aspachs-Bracons (2009), an econometric model must be carried out to analyse the real estate cycle, that is, a tool that allows us to study the

relevant increases and decreases in house prices in a determined period, since these affect the wealth and indebtedness capacity of natural and legal entity.

This study has focused on the Spanish national territory, although historically it has been complicated to carry out an analysis of house prices in Spain, due to the absence of exhaustive historical series of housing prices both nationally and regionally (López, 2002).

This literature review has also been useful to a better use of the variables used in the econometric model that has been chosen. The variable that has been analysed is the price of housing in Spanish territory, but due to the little literature that has been done on this field historically in Spain, it has also resorted to articles of international scope (European, American or even world level).

Some of these international authors, such as Case and Shiller (1989), state that there is a greater influence on the evolution of the real estate sector due to the expectations generated by the movements of prices in previous periods and therefore, it is not due to the extent that it was believed, to the knowledge of the investors.

In addition, Shiller (2003) also defends the use of psychological variables to develop a model that explains the real estate market. These variables are necessary since economic cycles such as bubbles or crashes are caused by irrational decision making, therefore, this is one of the reasons why, in the econometric model that has been used in this work, has included a variable that reflects consumer confidence regarding the economic expectations of the country.

On the other hand, authors such as Goodhart and Hofmann (2008) affirm that the increase in the supply of mortgage loans causes interest rates to fall, in addition to expectations of greater economic activity. Therefore, the expected return on the value of the home will increase, causing a greater demand for it. Thanks to the elasticity of housing supply, it can be determined to what extent the effect of higher demand will cause higher housing prices. According to these ideas we also find authors such as Piazzesi and Schneider (2016), who defend the idea that an increase in housing prices causes the expected return to increase and the demand for residual investment, which finally causes a boom in the demand for housing loans.

The econometric model done in this work also takes into account a variable that includes the Euribor in Spain, according to the ideas of some authors such as Agnello and Schuknecht (2011) or Kasparova and White (2001), who affirm and defend that the use of variables such as the interest rate or the Euribor is correct in the econometric models

since a great influence of these two indicators has been found in the mortgage market and the real estate sector.

Another factor to take into account in order to explain the variation in housing prices is the inflation rate in the Spanish economy, as affirmed by Goodhart and Hofmann (2008), who recommend including a variable in the model that reflects the inflation, since it has been proved that it has had a great relationship with the price of housing in the period between 1985 and 2006.

Moreover, it has also been possible to demonstrate how shocks in a country's inflation rate or shocks in GDP affect the final price of homes. However, another factor to take into account is the existing real estate offer in the market, an idea supported by some authors such as Malpazzi and Wachert (2005); and according to these statements, this factor has been used in the present study, including in the econometric model the supply of new dwellings in the Spanish territory. In addition, following the ideas of these authors, in the econometric model has been used a macroeconomic variable that also takes into account demographic factors such as GDP per capita in Spain.

However, despite the fact that the variable that collects per capita income or GDP per capita has a relevant effect on the variation of prices in Spain, some Spanish authors affirm that these conclusions are conditioned by the short period of time that we have been able to use (López, 2002).

Among the many researches that have been carried out in the real estate market, two types of studies can be differentiated, those that analyse the houses for private use and, on the other hand, the houses that are considered only patrimonial instruments used for investment and speculation (Agnello and Schuknecht, 2011).

If housing is considered as an investment object, there are many models of analysis and prediction of the real estate market that allow to make objective forecasts of the sector and predict the changes of tendency to be able to advance and elaborate optimal investment strategies, such as during periods of crisis, being able to develop patrimonial management activities that guarantee stable Cash Flow to companies (Hewlett and Kaufmann, 2005).

On the other hand, Oikarinen (2009) states that there is currently a strong relationship between housing prices and the stock of housing loans. Probably, this interaction increases the cyclical behaviour of this sector, causing booms and falls in the economy and increasing the fragility of the financial sector. In addition, this Finnish author, in the same study, concluded that the variation in house prices has an effect on the level of

consumption in the country, an idea that was also joined by authors such as Mishkin (2007) and Carroll et al. (2006).

There are also studies that analyse the relationship between housing prices and mortgage loans, stating that in a short-term analysis there is clear empirical evidence of a bidirectional dependence in the same period of time for these two variables. However, there is no long-term causality, that is, there are other exogenous factors that allow explaining the relationship between the price of housing and mortgage loans (Brissimis and Vlassopoulos, 2009).

Analysing in depth the literature that has been made in our country, it can be seen how some studies, which mainly focus their study on Spanish territory, both nationally and regionally or even extrapolating to important cities, have been based on the model of the housing market proposed by Poterba (1991). This model has been used by experts to detect a possible overvaluation in the price of housing and find its value in the market equilibrium (Balmaseda et al., 2002). However, the study of real estate bubbles in Spain has been limited to a simple measurement of a possible deviation of the real price from the equilibrium price, as Bellod-Redondo (2011) points out, it is difficult to find in the literature, analysis on specific tests for detecting bubbles in the Spanish real estate sector.

Although many of the works of these Spanish experts do not allow to assure the cause of the imbalances in housing prices, they blame the lack of precision in the model on a possible presence of a bubble in the real estate sector, a significant transitory alteration of prices or a poor specification of the econometric models used.

Due to the financial crisis of 2008, Spain became one of the countries, together with Ireland and the USA, more thoroughly analysed in the economic and financial field. Cuestas (2017), acknowledged that the prices of homes in Spain were influenced by external agents, and that if this claim was recognized by the corresponding institutions it would help to avoid a possible future bubble in the real estate market. In this author's study, there is also a relationship between house prices and foreign capital flows, which affect the price of housing in a positive way, while a variation in interest rates caused a decrease in the price of housing.

On the other hand, the present work has also been based on studies focused on the international field. Many of these researches use the term *intrinsic bubble* to explain the behaviour of stock exchange assets in the USA, and it could be able to apply it in the same way, in the real estate market, and thus be able to analyse the behaviour of the house price (Froot and Obstfeld, 1991). Following these ideas, Hott (2009) concluded

that the hypothesis of the *intrinsic bubble* helps to explain the evolution of housing prices in countries such as Switzerland and the United Kingdom, while Nneji et al. (2011) found this relationship between the stock market and real estate in the case of the United States of America.

On the one hand, caution must be exercised when analysing the results extracted with this type of assumption, since historically they have been used for the study of financial markets and, therefore, tend to be assumptions that oversimplify the nature of a good that is considered quite complicated, as is the case of dwellings. On the other hand, the capacity they have shown to reflect the recent behaviour of the real estate market, could justify its use in these studies (Abad, 2013).

A great part of American literature dealing with the study of the price of housing, also investigates what are the consequences of persistent deregulation of American banking. These deregulatory measures are usually motivated by political reasons and not for economic reasons. This lack of relationship between banking measures and economic factors makes it possible to identify this variable of regulation as an exogenous agent to the housing market (Favara and Imbs, 2014).

Following in American territory, Bian et al. (2018) affirm that housing prices are traditionally accorded through negotiation and finally they end up being financed through a mortgage loan. In addition, they affirm that if the price of the house is financed through a mortgage formalized after a negotiation period, the final price paid by the buyer not only shows the real value of the property, it also reflects the value that was created after the financing of the property. This negotiation, together with the financing of the total cost of housing, produces an inflationary effect on housing prices. These authors also question the use of the total price of the transaction to calculate the value of the guarantees and some doubts are raised about the control exercised over these operations, in addition to the great risk of the mortgage companies.

Since the beginning of this century, and following the American model, both the mortgage market and the housing market are undergoing some important changes. The interest rates related to mortgages have been reduced continuously, reaching historical lows. In addition, the real estate market in the United States experienced a cycle of constant booms and falls over the price of housing. Therefore, a mortgage risk control strategy should include specific clauses that can be modified during the entire amortization period. Another very common type of transaction in the USA, occurs in the so-called *hot housing market*, where sellers have a greater bargaining power in front of buyers, because it can even produce a kind of bidding to buy the house, consequently, the loans

originated in this type of transactions should be regulated in a more strict way or charge a higher risk premium, due to the bias that may have occurred when agreeing a price.

At a European level, authors such as Ioannou (2018), have studied the housing market in Lithuania and the Baltic and Nordic countries, after completing this study concluded that there is a strong relationship between the upturns in mortgage credit and the existence of some upturns in the prices of houses. Another aspect that he managed to identify is the influence of the disturbances of internal agents of this country on the price of Lithuanian housing.

After this brief literature review with the objective of analysing the price of housing, some of the variables that the aforementioned experts have used in their econometric models have been chosen demonstrating that these factors are relevant and have an influence in housing prices. Although many of these authors have not studied the case of the Spanish housing market, this study extrapolates the variables used by these authors, into Spanish territory, in order to check whether they are relevant in the real estate sector in this country or not.

3. EMPIRICAL METHODOLOGY

3.1 VARIABLES AND DATA DESCRIPTION

After analysing the extensive literature which investigates the factors that affect the price of housing, it has been decided to create an econometric model with a series of variables drawn from the ideas of some authors. This paper analyses the price of housing per square meter in the Spanish state, without breaking it down into autonomous regions or provinces. In addition, the time interval in which this study focuses is from the year 2000 until the year 2018, divided into quarterly periods, that is, a total of 76 periods. This period of time has been chosen as it seeks to understand and analyse what factors influenced the prices of homes before, during and after the crisis period, therefore, an econometric model that uses a time series is estimated.

The variable, which is the object of study, includes the variation of the price of the house valued in euros per square meter with respect to the previous period. The data of this variable has been calculated through a report by TINSA, a housing appraisal company approved by the Bank of Spain (*Banco de España*).

Once the variable that you want to study has been selected, you must choose which variables can influence the price of the home.

In the first place, it has been considered appropriate to include in the econometric model the variation of GDP per capita with respect to the previous period, an idea supported by authors such as Malpazzi and Wachert (2005). These data have been obtained through *Datosmacro (Expansión)*.

Another variable included in the econometric model is the inflation, this variable includes inflation for each period and is expressed over one. The decision to include this variable is based on the analysis of the price of houses made by Goodhart and Hofmann (2008). These data have been extracted from the database of the National Institute of Statistics (*Instituto Nacional de Estadística*).

In addition, it has sought to include a variable that collects psychological aspects that can affect the price of housing. This is the case of the variable that reflects consumer confidence in Spain based on future expectations it has on the national economy. This factor was already collected in the study of Shiller (2003), having an important relevance in his results. This variable is created with EUROSTAT database.

The variable that collects the Euribor values for each period of the study, is expressed over one, has also been included. The Euribor can be defined as the interest rate by which banks accept loans between them. This variable has been decided to be included in the econometric model following authors such as Agnello and Schuknecht (2011) who used it in their studies. These data have been extracted from historical data from Bank of Spain (*Banco de España*).

And finally it has been decided to include a variable that takes into account the number of new homes that have been built in Spain in each period, in this case we have included this variable based on this study in an analysis that has already been previously cited as that of the authors Malpazzi and Wachert (2005). These data can be found in a report from Ministry of Development of the Government of Spain (*Ministerio de Fomento del Gobierno de España*).

Once all these data have been collected and all the variables mentioned have been included, an econometric model has been carried out to study the impact of these variables on the price of housing in Spain in a given period of time. The use of different variables, in the authors and studies consulted, shows us how these variables have been modified as the years go on, and so, taking into account how they are influenced by the political and social context of each moment and area, and therefore the choice of the variables must be adapted to the situation at that moment and to the object which the study is focused on.

3.2 THE ECONOMETRIC MODEL

Once the variables that are going to be incorporated into the econometric model have been chosen, it should be checked if the variable that is the subject of the study, the price of the house valued in euros per square meter, is a correct proxy variable to analyse the Spanish real estate market.

From a more theoretical point of view, the authors Roig et al. (2015), take into account several hypotheses when carrying out their analysis. The first of the hypotheses is to consider the variable that will be studied, as an indicator that takes into account the real estate cycle in Spain. Another hypothesis, maintained by these authors, is to consider that although this real estate cycle may be influenced by variables that change over time, it can be observed that this cycle has a structural behaviour over time. The last hypothesis that should be taken into account is the behavioural theory, which considers that investors behave irrationally, since they are influenced by their feelings and beliefs and, therefore, operate in the market in a constant manner and not randomly (DeLong et al., 1990).

The estimation and analysis models to be used in this study are VARs. That is, an estimation system that allows analysing the effect of a variation of the variables chosen on the price of the home in a short period of time. In addition, vectors autoregressive are a good system to use if a series of macroeconomic variables are being studied (Sims, 1980).

This type of system allows specifying a model of equations, where it is not necessary to differentiate the endogenous from the exogenous variables. In this type of estimation, it should be assumed that the random perturbations or error term behave as white noise, that is, there is homoscedasticity in the model and absence of autocorrelation. In addition, to be able to estimate a model of vectors autoregressive, data of a stationary character must be used in all the variables, for this, it is checked if in each of the variables used in the model the existence of a unit root is found or not, through the Augmented Dickey-Fuller test (Oikarinen, 2009), if it is dealt with this case of non-stationary variables, first differences are applied to transform those variables that are not stationary in a stationary series.

On the other hand, if the results of the extensive literature on this subject are analysed, a series of results and conclusions can be expected, that is, it can be assumed that the variations of the different factors included in the model will affect the price of the dwellings. It is expected that, if there is a variation in GDP per capita as well as short-

term consumer confidence or a variation of the inflation, this could cause the price of housing to increase.

In the case of a variation of GDP per capita, the increase in the price of homes could be caused because this indicator can be used as if it showed the income of families. Therefore, the increase in GDP per capita would entail an increase in the purchasing power of consumers, thus causing an increase in the demand for houses and their price in the market. Faced with a change in consumer confidence, the increase in the price of houses would be caused, thanks to the fact that the economic expectations of the inhabitants in Spain would increase and, therefore, they would be willing to pay a higher price than before for the same good. Moreover, if there is an increase in the inflation in Spain, the builders will suffer an increase in production costs, due to an increase in the price of raw materials and, therefore, there will be an increase in the price of houses.

Opposite to these assumptions of rising housing prices, we can find the variables of the Euribor and the number of new homes built in Spain, which theoretically should cause a decline in the price of houses. Faced with a change in the values of the Euribor, consumers will suffer an increase in the cost of mortgage loans, which would lead to a lower demand for these and entail a reduction in the price of homes. And, finally, before a variation in the number of new homes built in a given period, a greater supply of these would be caused, which would lead to a decrease in the prices of houses.

Once analysed the theory on which econometric processes should be followed and what results are expected before estimating the econometric model, we proceed to analyse in an empirical framework the econometrics performed to get to study the price in euros of the square meter of housing in Spanish territory. In order to estimate the VAR used in this study, the Gretl software has been used.

In the first place, it has been verified that the variables used meet the assumption of being stationary. In this sense, it has been possible to verify through the Augmented Test of Dickey-Fuller, as the variables that collect inflation and the Euribor are stationary, therefore, they should not be modified. While the rest of the variables are not stationary and, therefore, first differences have been applied to obtain a series of stationary data. However, in the case of GDP per capita, first seasonal differences have been applied, since there is also a clear cyclical behaviour with the passage of the periods analysed.

After getting rid of the seasonality of the variables and converting them into stationary variables, we have proceeded to determine what should be the number of delays included in VAR. For this, a contrast is applied, in order to determine the order of the VAR model. This contrast is subject to a maximum of 8 delays, that is, the price of the

home may be influenced by the last 8 quarters or 2 years. After making this contrast, we can observe how there is a contradiction between the results that show the different criteria. On the one hand, the Akaike information criterion and the Hannan-Quinn criterion indicate that 8 delays must be included in the model, while the Schwarz Bayes criterion indicates that only 1 delay must be included. After analysing how many delays should be included in the model against the contradictions between the different criteria, it has been decided to include only one delay in the model, following the results of the Schwarz Bayesian criterion, since in the case that it was decided to include 8 delays in the model, we would suffer a loss of degrees of freedom that would cause a lower accuracy in the results and a lower reliability at the time of the interpretations that can be made.

Once all these steps have been completed, we can estimate the econometric model through vectors autoregressive. This method does not allow us to interpret the estimators that are obtained, and therefore, the Cholesky method has been used to obtain the graphs that will later be analysed and, thus, be able to interpret the response of the price of the houses against a variation of each one of the variables. This method requires that the variables of the model, when introducing them into the program, follow a specific order of causality, since a possible variation of the order would cause a modification of the results.

The Cholesky arrangement has remained this way: GDP per capita, consumer confidence, Euribor, inflation, the number of new homes built in Spain and the price of homes priced in euros per square meter. This order has been followed since GDP per capita clearly affects consumer confidence, modifying consumer expectations. Consumer confidence influences the value of the Euribor, because the expectations of the future of consumers influence the flow of capital between banks and their business expectations. While, the Euribor affects Spanish inflation, since it is set based on the expectations of the big banks and the monetary policies put in place by the European central bank, therefore, these decisions influence the economy producing the effects that were expected. In addition, inflation affects the number of new homes built in the Spanish territory, since inflation will produce a variation in the price of products in the construction process, and therefore, will modify the amount of homes that will be built in Spain. Finally, and as it is obvious, the number of homes built in a specific period conditions the price of homes in Spain.

To sum up, it has been considered that the variables which show inflation and Euribor are stationary. While first differences have been applied in the variables of house prices,

consumer confidence and the number of new homes built in Spain, to convert all of them, into stationary variables. However, it has been observed that the GDP per capita variable, in addition to not being stationary, had a remarkable seasonality, therefore, first seasonal differences have been applied, and thus it becomes a stationary variable and does not suffer seasonality, both assumptions necessary to estimate by vectors autoregressive. In addition, after justifying the order of the variables that have been introduced in the Gretl software, and under the order of Cholesky, graphs have been obtained to analyse and interpret the final results of this study that will be explained in more detail in the following pulled apart.

4. GRAPHICS AND RESULTS ANALYSIS

Once explained the econometric process that has been followed to be able to estimate the model and extract a series of results, we proceed to its analysis and comment.

In this section it will be analysed the short-term effect of each of the variables included in the econometric model. This influence will be analysed in a range that contains the 20 quarters following the period of time used in the model, that is, the influence of the variables used in the evolution of the house price, valued in euros per square meter, in a period of 5 years after the time interval included in the study.

In order to obtain the final results of this econometric model, a series of tests have had to be applied in order to obtain a correct specification. The first of the contrasts applied is the Augmented Test of Dickey-Fuller, a test that is used to check whether a unit root is found in each of the variables used in the econometric model. The presence of a unitary root, implies that the variable contains a series of data with non-stationary character, therefore, first differences have had to be applied to turn these variables into stationary and thus meet one of the assumptions to be able to estimate the econometric model using VARs. On the other hand, there has also been a case of a variable that, in addition to being non-stationary, suffered from a seasonality problem, therefore, it has had to apply first seasonal differences.

Table 1. *Results of the Test ADF*

	price_m2	gdp_capita	infl	conf_cons	new_dwellings	Euribor
p-valor	0.482	0.540	0.027	0.134	0.770	0.032
Results	First differences	First seasonal differences	Stationary	First differences	First differences	Stationary

Source: Self elaboration (Gretl)

Moreover, when estimating an econometric model, based on vectors autoregressive, one must also adjust which will be the number of optimal delays that will be included in the model. After obtaining the results of the Akaike information criterion, the Hannan Quinn criterion and the Schwarz Bayesian criterion, it has been decided to include only one delay, as indicated by the Bayesian criterion of Schwarz. This decision is attributed to the fact that in the case of including the 8 delays indicated by the other two information criteria, the econometric model and its estimates would suffer a significant loss of degrees of freedom, and therefore an accuracy lose and reliability in their results.

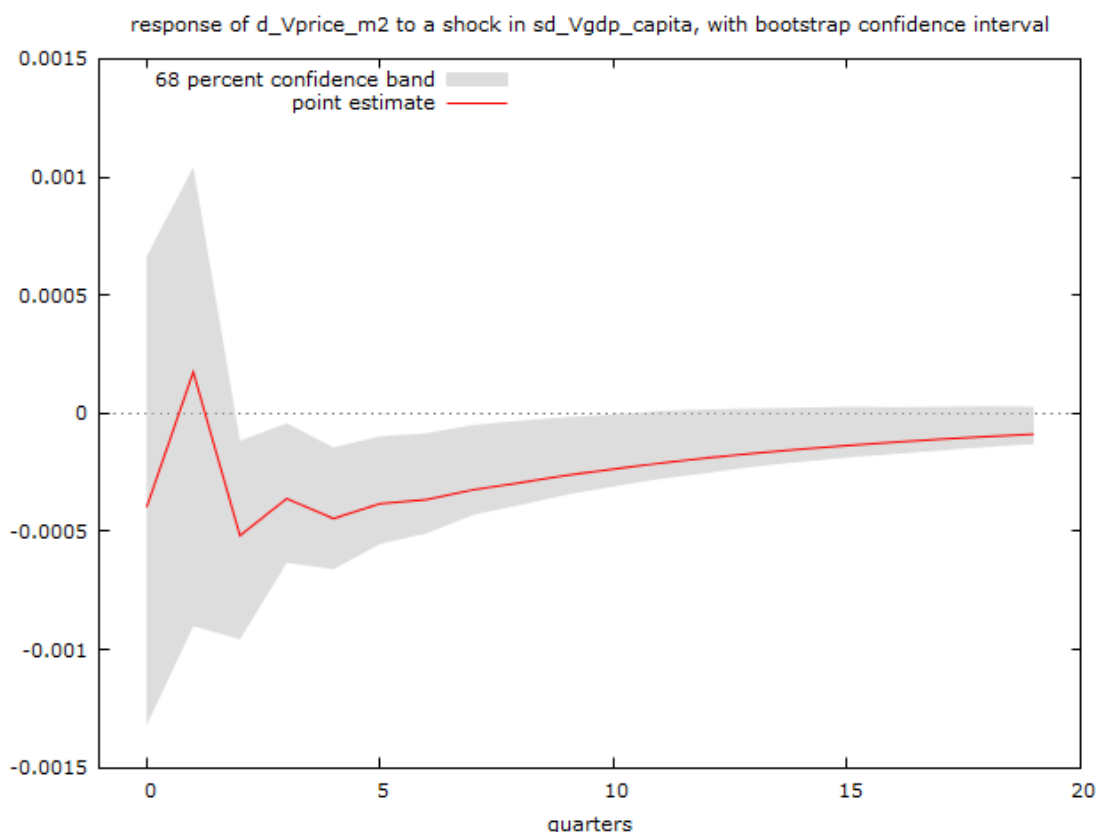
Once all these aspects are clear, we proceed to elaborate the econometric model by means of vectors autoregressive, and thus be able to produce impulse response graphs by means of Cholesky's ordering.

$$\begin{array}{l}
 price_m2_t \\
 gdp_capita_t \\
 infl_t \\
 conf_cons_t \\
 new_dwellings_t \\
 Euribor_t
 \end{array}
 = \beta_0 + \beta_1 price_m2_{t-1} + \beta_2 gdp_capita_{t-1} + \beta_3 infl_{t-1} + \beta_4 conf_cons_{t-1} \\
 + \beta_5 new_dwellings_{t-1} + \beta_6 Euribor_{t-1} + \varepsilon
 \tag{1}$$

The order of the variables introduced to generate the graphics is done under the Cholesky ordering system, so the order of the introduced variables has been as follows: GDP per capita, consumer confidence, Euribor, inflation , the offer of new housing in Spain and, finally, the price of housing in Spain, priced in euros per square meter.

Once it has been chosen what is the order of the variables to obtain the graphics that must be interpreted, you must set the level of confidence to which our model is submitted. It is then, necessary to establish a confidence band of 68%, this is equivalent to the value of one standard deviation of each variable. This decision has been taken according to various authors such as Uhlig (2005), who defend the use of a confidence band of 68% instead of 95%, or what is the same, the use of a standard deviation against the use of two standard deviations. It has been ruled out to use a 95% confidence band since, at this level of confidence, problems arise with the significance of the results obtained, therefore, it has been decided to calculate the graphics subject to a confidence band of 68%. In addition, the graphs have been obtained in a future period of 20 quarters, that is, 5 years, and this allows the graph to be analysed in the near horizon of 5 years.

Graphic 1. *Response of housing price to a shock in GDP per capita*

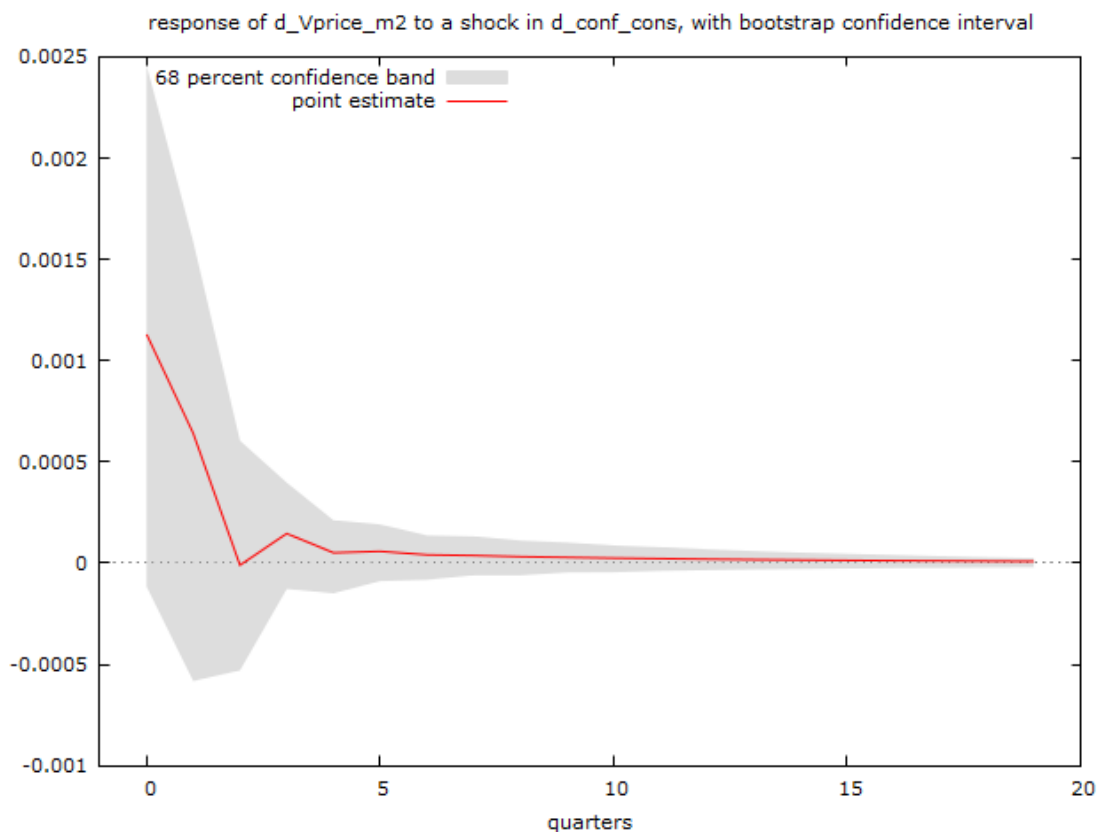


Source: Self elaboration (Gretl)

As shown in Graphic 1, it is analysed what happens with the price of housing in Spain when a shock occurs in GDP per capita. As it can be seen, given the shock of GDP per capita, the price of housing in Spain will suffer an immediate growth in the following three quarters, however, this effect disappears in the following quarters, causing a drop in home prices. This price decrease is considered empirically significant, since the 68% confidence bands do not include the value of zero. However, the rise in housing prices in front of a shock in GDP per capita cannot be considered empirically significant, since the 68% confidence bands, this time, include the value of zero and, Therefore, in this case, we could not guarantee this response to the price of housing in the face of a shock in GDP per capita.

Thus, thanks to this graphic it can be concluded that, in front of a shock in GDP per capita, the price response of Spanish houses valued in euros per square meter is that an immediate overshooting is suffered, and after this effect, the price of the houses is reduced enough, until the moment in which this effect is mitigated and it is finally observed as a constant price decrease is maintained in the following periods.

Graphic 2. *Response of housing price to a shock in Consumer confidence*



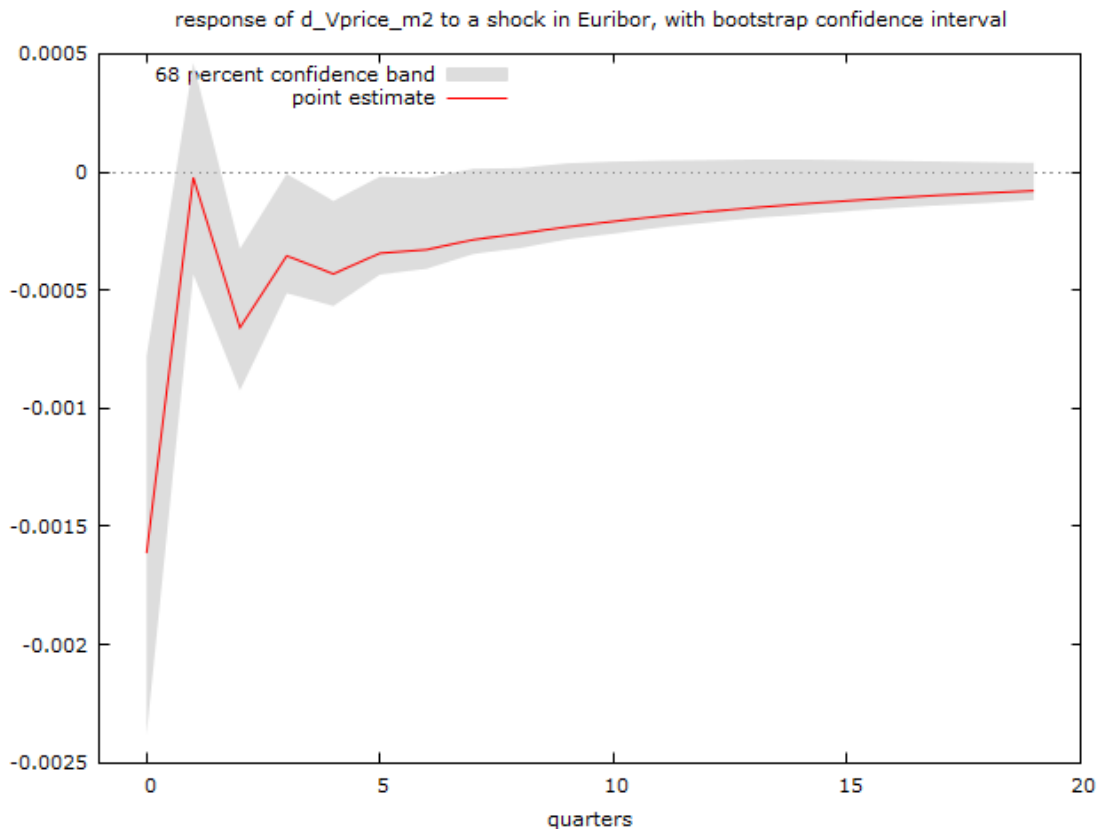
Source: Self elaboration (Gretl)

In this second graphic, we analyse what is the response of housing prices facing it to the shock in consumer confidence. As it can be seen, in front of this shock, the price of housing would increase, although as the quarters pass, this price growth will be reduced until it stabilizes at a value close to zero in recent periods.

However, in this graph it can also be seen how the confidence bands at 68%, at all times include within the range the value of zero. This causes these results and their interpretations to be empirically insignificant and, therefore, it can be stated that, with the data previously collected, a shock in consumer confidence would not cause a statistically significant change in prices.

Therefore, if there is a shock in consumer confidence, we cannot state categorically what response the variation in the price of Spanish homes will have, since the results obtained in this graph do not reflect any statistically significant behaviour of this variable.

Graphic 3. *Response of housing price to a shock in Euribor*

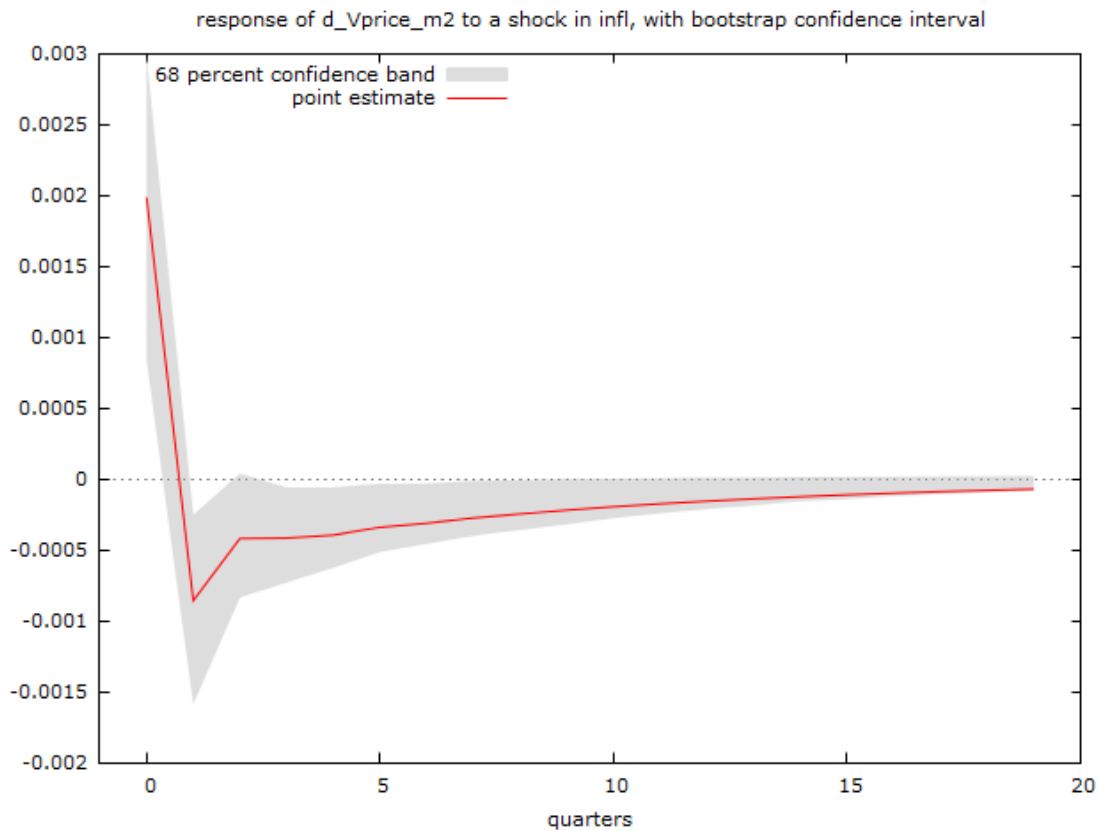


Source: Self elaboration (Gretl)

This third graphic analyses the response of the price of homes if there is a shock in the value of the Euribor. In this graph you can see housing behaviours that are statistically significant. At first, the price of housing would decrease less and less, even reaching a peak where it would remain almost stable, this would occur approximately in the third quarter. However, with the passage of the quarters, the fall in house prices would be confirmed in front of a shock in the Euribor. In addition, this decrease is considered statistically significant since approximately the first 7 or 8 quarters, the confidence bands fixed with a value of 68%, do not usually include the value of zero within this interval.

Therefore, it can be stated that, with the data included in this study, the response of housing prices to a shock in the value of the Euribor, is statistically significant and, therefore, it can be affirmed that the price of housing would fall over the following quarterly periods.

Graphic 4. *Response of housing price to a shock in Inflation*

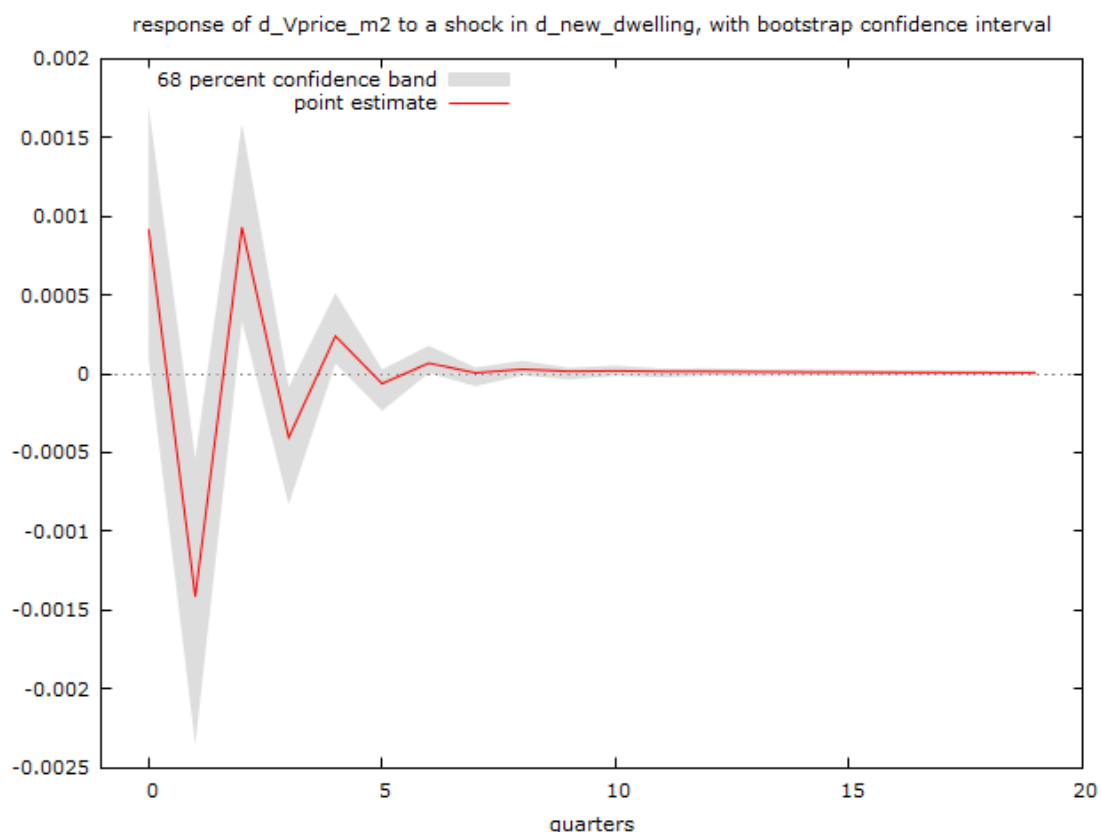


Source: Self elaboration (Gretl)

In the fourth graph, the response of the house price is shown against a shock in the value of Spanish inflation. It can be seen how the price of the house is increasing, but each time more reduced, reaching, approximately, in the second quarter to begin to be reduced the price of houses, and from this period, stabilizes this effect and a constant decrease in house prices is maintained throughout the periods.

With this graph, you can see how the results are statistically significant, so, we can say that the price of homes would grow in the first two periods, but this rise would be less, however, from the second period, the price it would begin to fall, stabilizing this descent to a constant value throughout the rest of periods.

Graphic 5. *Response of housing price to a shock in New dwellings*



Source: Self elaboration (Gretl)

In the fifth and last graphic, we seek to analyse how the price response of Spanish homes, priced in euros per square meter, would be compared to a shock in the number of new homes in the Spanish territory.

As it can be seen, the effects of a shock on the number of new homes are somewhat irregular. At first, this shock causes a reduction in housing prices, however, from the first quarter, the shock would lead to an increase in housing prices. Nevertheless, this oscillation softens as the periods pass, with a clear tendency that a shock in the number of new homes in Spain may cause the price of homes to end up increasing, but always touching the value of zero.

Thus, it can be said that this response to the price of Spanish homes in front of a shock in the number of new dwellings is statistically relevant. Despite the clear zigzag that can be seen in the graph, over time this behaviour softens, reflecting the small increase in the price of Spanish homes.

Once all the impulse response graphs based on the vector autoregressive model (VAR) have been analysed, and obtained using the Gretl software, the conclusions obtained can be compared with the expected results prior to the estimation of the model.

In the case of GDP per capita, the initial assumption was that the price of houses would increase because GDP per capita is a variable equivalent to per capita income, and, therefore, increase the purchasing power of families. They would be willing to pay a higher price for housing. However, thanks to the results of Graph 1, it can be affirmed that the price of Spanish homes would be reduced if the GDP per capita suffered a shock at a certain moment. This effect could have an explanation, since the increase in GDP per capita could be conditioned to only the national increase in GDP, thus, this would indicate that the economic activity of the country would have increased and, therefore, the building industry could have increased its production, causing a situation where there would be an increase in the supply of Spanish homes that would lead to a reduction in the price of houses.

However, the variable that gathers the consumer's confidence regarding the expectations that it has of the Spanish economy, has followed the initial hypothesis that at the moment that a consumer confidence shock occurred, the response that would have the price of housing in Spain, would be an upward behaviour of the prices of these, as it has been shown in Graphic 2. Therefore, the reason for this increase in housing prices, is explained in another section of this work, which can be summarized as a situation where consumer confidence increases, due to better expectations about the Spanish economy, it would cause society to be willing to pay a higher price for the same good.

Another of the variables that has met the result that was expected at first, is the variable that reflects the value of the Euribor, as reflected in Graphic 3. Thus, following the initial reasoning, it can be said that, a Euribor shock, at a certain time, would cause the prices of homes in Spain to fall, this could be because an increase in the values of the Euribor, would make the loans in Spain more expensive, and therefore, would make difficult the access of the consumers to these credits. This difficulty to get into debt, would cause many potential consumers to give up buying a house, causing the demand of Spanish houses to fall, and therefore its sale price to fall.

Regarding the variable that collects the values of inflation in Spain, the expected effect, before the econometric estimation, was that a shock in Spanish inflation would cause an increase in house prices. However, after estimating the model by means of vectors autoregressive, and making the impulse response graphs, it has been possible to verify how the effect of a shock on the variable that collects the inflation of the Spanish economy, would cause the prices of homes they were reduced.

Although this effect could also cause, as seen in Graphic 4, the price of all goods to rise due to the increase in inflation, and this would lead to an increase in the building process, and then the prices of the homes would also go up. This effect occurs approximately in the first two quarters. However, in front of this situation, real wages could fall, due to the fact that the country's wages were not regulated correctly with respect to the inflation of the period, this would cause the purchasing power of society to decrease, causing the demand of the houses to fall, and so, lowering the final price of the same. If the reduction in the demand for housing was greater than the reduction of the supply that had initially been assumed, the inflation shock would eventually cause the price of Spanish housing to fall.

Finally, in front of a shock in the number of new homes in Spain, the response of the price of housing would cause, as it can be seen in Graphic 5, that the price of houses increases. However, this result contradicts the initial hypothesis, which stated that, faced with an increase in the supply of housing or the number of homes built, the price of Spanish houses would fall as their supply increased. However, with the data used, this result is not obtained, this is due to the fact that, in the Spanish real estate market, between 2000 and 2018, there was an inflationary period in the price of housing, known as the real estate bubble, therefore, in these years, although the number of new homes in Spain increased considerably, the price of these grew exponentially. Therefore, the result obtained in Graphic 5, may be due to this inflationary phenomenon in the real estate market.

Thus, after analysing all the responses to the shocks that the price of Spanish housing has, in front of a shock in each of the variables included in the econometric model, it has finally been observed, as a shock in the variables that they collect consumer confidence and the supply of new homes have caused an increase in the price of homes. Faced with this effect, it has been possible to see how a shock in the variables that collect the GDP per capita, the Euribor and the inflation, cause a decrease in the level of housing prices in Spain.

Finally, we have also seen how some of the responses to the price of Spanish homes have not been as expected when there was a shock in one of the variables included in VARs. One of these cases has been the increase in the price of houses in Spain, in front of a shock in housing supply, since theoretically there is a tendency to think that a variation in the housing supply shock would produce a decrease in housing prices. While the shock in GDP per capita and inflation would cause a reduction in the price level,

compared to the initial hypothesis, which concluded that a shock of any of the two previous variables, would lead to an increase in the price of Spanish homes.

5. CONCLUSION

In summary and concluding this research, it can be affirmed that some results have been obtained extracted from the econometric model based on vectors autoregressive and a thorough analysis and a detailed interpretation of these has been carried out. Thus, a series of conclusions and reflections can be drawn after preparing this work, which are briefly explained below.

As it has been observed, the analysis of the price of the house has been made through the estimation of VARs and this has allowed the elaboration of impulse response graphs that help to interpret the obtained results and allows to see clearly, what is the response of the price of Spanish housing against a shock of each of the variables that has been decided to include in this model.

The results that have been extracted from these graphs, show how the response of the prices of the houses causes that these increases, before a shock in the level of confidence of the consumer in Spain and before a variation in the offer of new houses. However, it has been seen as in the case of a shock, in each of the three following variables included in the model, such as GDP per capita, the value of the Euribor and the value of inflation, the response of the price of Spanish homes is that it is reduced compared to the initial levels.

On the other hand, there are some variables, which although initially, it was thought that they could be included in this model, it was finally decided to dispense with them in order not to overspecify the model used. One of the variables not included, is the case of the divorce rate in Spain; if it increased the value of this rate, it would cause an increase in the demand for housing and, therefore, would have an upward effect on the price of housing. Another factor, which has not been included in the model, is the variable that includes the IBEX 35 price in the periods studied. The purpose of the inclusion of this variable would be to look for a relationship, in the period of the years of the real estate bubble, between investment in the stock market and investment in the real estate market. These factors, among others, could be included in future works to be able to analyse in a more exhaustive way, the influence of more components on the price of homes in Spain.

Finally, during the elaboration of this work, the idea of carrying out an analysis on the price of rents in Spain was also taken into account, since it is an issue that is nowadays

very common and it is almost daily discussed in gatherings, debates and news or any other information forum, because there may be a case of a bubble in the price of rents in large Spanish cities. This would be a good topic of study in the future, since, above all, it is an issue that affects young people, who are looking for their first residence, and who currently seems to become the most common form in Spain to get a home, instead of buying it. This situation contradicts the way of buying a home that was used a long time ago, where the main objective of the families was to acquire a property. However, this situation has changed lately, where a high percentage, and each time more, seems that the decision to get rental housing increases, although there is also the modality of renting with the option of later purchase, which is also being extended in our society.

In short, it can be deduced from this work that the price of housing in Spain fluctuates according to the variables that apply to the model, such as GDP per capita, consumer confidence, Euribor, inflation or supply of new homes in Spain, since each one of these variables can affect both the rise and the fall, or simply stabilizing and not affecting, the price of housing.

6. LITERATURE CONSULTED

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7. APPENDIX

Table A2. Variable definitions and sources

Variable	Author	Description	Source
price_m2	Aspachs-Bracons (2009)	Variation in the price of housing in Spain priced in euros per square meter	TINSA
gdp_capita	Malpazzi y Wachert (2005)	Variation in GDP per capita in Spain	<i>Datosmacro (Expansión)</i>
infl	Goodhart y Hofmann (2008)	Value of inflation in Spain	INE
conf_cons	Shiller (2003)	Consumer confidence regarding the future expectations of the Spanish economy	EUROSTAT database
new_dwellings	Malpazzi y Wachert (2005)	Offer of new housing in Spain	<i>Ministerio de Fomento del Gobierno de España</i>
Euribor	Agnello y Schuknecht (2011)	Value of the Euribor	<i>Banco de España</i>

Note: The names of the variables refer to the acronyms used in Table 1 and Equation 1.

Graphics A1. Main variables, Spain

