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Housing Market Behaviour and the Effect of Immigration Booms in the Case of Spain

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1. Sumary of the paper

The housing market is a complex sector of the economy and plays a key role due to the importance it has on society. In this paper we deeply study the housing market, how does it behave according to its characteristics and the main factors that affect and determine its evolution. We focus on the Spanish housing market of the period between 1998 and 2011, observing the evolution of its prices and stock among these years and also relating it to the 2007 world economic crisis, which in the case of Spain specially affected the real-estate market. Our descriptive statistics show that new construction activity increased housing stock units in 2 log-points in annual average, while the increase in housing prices was of 6 log points per year and population changes were around 1,3 annual log-points. We set as the main determinant of this housing market behaviour the immigration boom that took place in Spain since the end of the nineties until de crisis burst. We provide OLS estimations of the effect of immigration on housing prices and construction activity in Spain between 2000 and 2011. In these estimations we observe a price-population elasticity of 0,48 and a stock-population elasticity of 0,53, results which verify our hypothesis that sets immigration boom of that decade as a key determinant of the specific housing market behaviour. In the last part we use marginal effects of each years' population inflows in order to see how persistent they are as we move backward in time.

El mercado de la vivienda es un sector complejo de la economía que tiene un papel muy importante debido al efecto que tiene sobre la sociedad. En este estudio analizamos en profundidad el mercado de la vivienda, como se comporta de acuerdo con sus características y los principales factores que determinan su evolución. Nos centramos en el mercado de la vivienda de España en el periodo comprendido entre 1998 y 2011, observando la evolución de los precios y el stock a lo largo de esos años y a la vez relacionándolo con el contexto de crisis económica mundial que tuvo lugar desde el 2007 y que, en el caso de España, afecto especialmente al sector inmobiliario. La estadística descriptiva llevada a cabo muestra que la construcción de vivienda incrementó el stock en 2 puntos logarítmicos medios por año, mientras que el incremento en los precios de la vivienda fue de 6 puntos logarítmicos y los cambios en la población fueron de 1,3 puntos logarítmicos medios anuales. Fijamos como principal determinante de este comportamiento del mercado de la vivienda el boom migratorio que tuvo lugar en España desde finales de los noventa hasta el estallido de la crisis. Proporcionamos estimaciones de los MCO de los efectos de la inmigración en los precios y en la actividad de la construcción de vivienda en España entre el 2000 y el 2011. En estas estimaciones se observa una elasticidad precio-población de 0,48 y una elasticidad stock-población de 0,53, resultados que verifican nuestra hipótesis que presenta el boom migratorio de la década como determinante clave del comportamiento del mercado de la vivienda. En el último apartado utilizamos los efectos marginales de los niveles de población de cada año para ver cómo de persistentes son a medida que nos movemos hacia atrás en el tiempo.

2. Introduction to the topic and the main purpose of the paper

The main objective of this paper is providing a clear explanation of the end of the 20th century and the beginning of the 21st housing market behaviour in order to allow a proper understanding of this subject of study which has a key role in Spanish economy.

It is very important to study the environment that affects the housing market and also the determinants that generate complexity in the situation. In this paper we analyse the factors that could have played an important role and we set as the key determinant the demographic boom, more precisely the migration inflows that boosted housing demand and prices. What we expect to obtain with this study is the justification of the main hypothesis that sets immigration inflows that characterized Spain's demography of the period between 1998 and 2008 as an exacerbating factor of the housing bubble generation. We want to demonstrate that a great part of housing prices and stock increases happened due to the foreign-born population inflows that experienced Spain during that decade. Furthermore, we also try to understand how does the real estate market behave, analysing step by step its structure through the stock-flow model, its comparative statics when a demographic boom happens and the adjustment procedure. Then, we implement a deep analysis of the Spanish housing market in order to understand why immigration chose Spain as a new potential destination. We go through the improvement in the economic conjuncture (GDP, unemployment rate etc.) and also through financial facilities (low interest rates, easier and cheaper access to credit etc.). Once we have understood the Spanish housing market and why its determinants have made it as it is, we proceed with our study. We present a table with the descriptive statistics in which we can observe the 6,4 log points average increase in housing prices per year, a 2 log-points average increase in housing stock and a 1,3 log-point average annual increase in population. Then we implement OLS estimations, which show how population inflows affected housing prices and stock, obtaining results 0,48 price-population elasticity and 0,53 stock-population elasticity and verifying the fact that population booms have important effects on housing market. At the end of the paper we develop the study of the multiplier effect for both housing prices and stock in order to see what happens over the years with the demographic effect.

We also dedicate a part of our paper to observe the housing market differences among Spanish regions. In some Spanish autonomous communities, especially in those which have an intense touristic activity or those which are economic centre metropolis, housing prices have presented soaring trends during the las years. At the same time, in other regions prices have remained lower or their variation hasn't been such significant. It is also a very interesting part of the study to compare effects between different Spanish regions, fixing our attention in finding the causality relation between those which have had higher prices and also those which have experienced the most important immigration inflows and see the relation between these both occurrences.

This paper is closely related to the literature of Gonzalez and Ortega (2012), we implement our analysis following the same line although they develop a deeper methodological coefficients analysis like the instrumental variables approach. We differentiate our paper by introducing the stock-flow model analysis, a deeper study of the Spanish conjuncture including the main attractions for immigration and at the end we also analyse the marginal annual multiplier and total multiplier effect. At the beginning, the first inspiration was taken from Mankiw and Weil (1989), and then it was translated from baby boom to immigration boom. It has also been very useful the methodology and arguments of Garcia Montalvo (2001), from which lots of housing market arguments and ideas have been very useful to understand and define a more profound object of study. Poterba (1992) has also been a key reference for his original model and his basic findings in the housing context that have given a background knowledge to start working in this complex field of study.

3. The housing market

Contextualization and evolution in history

During the last years of the 20th century and the beginning of the 21st many economies around the world have experienced a strange behaviour on their housing markets. There has been a drastic increase in housing prices identified as a sign of one of the most important booms ever experienced. Furthermore, at the same time, housing stock has been significantly incremented due to an increase in construction activity. These both phenomena apparently seemed to be a signal of growth and welfare in economy, but in fact, it was an unsustainable situation characterized by the accumulation of imbalances which generated a housing bubble that exploded in 2007, leaving one of the most important financial crisis in the world.

During the period between 1995-2006, real housing prices increased in most of the OECD countries reaching surprising figures: in U.S.A prices increased by 69 percent, in Australia by 90 percent and in Great Britain by 133 percent.

The housing bubble affected the economies of many countries, but some of them had to face harder troubles given the way in which the housing boom took place and the country's context in which the country was located. Spain is an example of country that had to face one of its most important bubbles and housing boom ever experienced. It is very important to contextualize and identify the situation and factors that characterized each country during that period and made prices to experience that exuberant behaviour.

If we look at the determinants that brought the Spanish housing market to that extreme situation we can enumerate many factors that seem to have played a role: economic welfare, low interest rates, favourable mortgage market conditions, expectations etcetera. In our study we have set the demographic boom that took place during the last years of the nineties and the pre-crisis years as one of the most important detonator of the specific behaviour observed in the housing market. In this paper we also justify what does this population growth represent and its main cause, which is attributed to the large increase in foreign-born population in Spain during that period of time.

Characteristics of the housing market

Housing goods form an indivisible and durable market with a high degree of heterogeneity. It is considered one of the most important components of household's consumption patterns due to its role in consumers' wealth and it has also been considered a basic right included in the "*Universal Declaration of Human Rights*".

The housing market has been considered an important contributor to economic development. Due to this, it is very important to analyse the interaction between housing market and macroeconomics. Before proceeding with this analysis we have to understand what is the housing market and how does it work. Here we present some of the most important characteristics of the housing market:

- Durability: buildings can last many years (even centuries). Due to this we use the stock-flow model to describe the behavior of this market. This methodology differentiates stock of existing houses and flow of new developments and allows observing the effect of changes in specific variables that are captured by the curves in this model.

- Immobility: houses are characterized by spatial fixity; they cannot be moved from one place to another. Consumers have to look for the place they want to live in and find or build their house there; but they can also find the house they want and accept the place

it is. This characteristic combined with close proximity of housing units in urban areas supposes externalities inherent in a given location.

- Heterogeneity: each component of housing market is unique and not only for the specific house features but also for the location and the way it is financed. Two similar houses can perform in a different way depending on the country, region, city or even depending on the neighborhood within the same city they are located. It is very important to consider these differences when someone is going to invest in this market because the choice has a great impact on consumers' future returns. This is what makes difficult setting prices in this market, contributing to increase search costs, generating problems of asymmetric information and restricting substitutability. Furthermore, it is important to bear in mind the phenomenon known as depreciation which supposes important qualitative differences between new and old buildings (even if they have exactly de same features).

- Inefficient market: in this market asymmetric information exists among participants. This supposes that there are some individuals with special information, more experience or with resources to obtain greater profits. Information is essential in this market because it allows profit opportunities that would not exist in more efficient markets.

- Investment and consumption goods: when someone purchases a house it can be done with different objectives; with intention of attaining returns (investment good), with intention of staying in it (consumption good), or even a combination of both. This is the main reason why it is attractive for people to overinvest in housing assets.

- High transaction costs: acquiring or moving into a new home supposes higher costs than the ones observed in other transactions. These costs include different expenses: search costs, moving costs, intermediates costs, commissions, fees, taxes etc.

- Long time development process: the transactions done in this market can be subject to delays due to the steps that have to be followed: financing, designing, constructing, regulation etc. This slowness generates short run disequilibrium and difficulties in the adjustment mechanism in comparison to other more fluid markets. This is an important point that has to be considered because this market is not characterized by perfect competition; it adjusts prices in the short term and quantities in the long term (González Tejeda, 2006).

4. The stock-flow model

As the housing market is characterized by the dynamics of durable goods we need to use the stock-flow model to explain its behaviour. A stock-flow model makes a distinction between the stock of housing, which is rigid in the short run, and the flow of residential investment, which can react quicker to changes in macroeconomic conditions (Steiner, 2010).

The housing stock and the flow of investment in new residence are linked together through two channels. The first one defines residential capital stock as the accumulation of residential investment over time, so the increase in the stock depends on the amount of gross residential investment. The residential capital stock does not experience drastic changes when shocks occur. On the other side, the flow of residential investment also reacts relatively slowly to shocks due to the characteristics already mentioned above of housing market as an inefficient market, a long time developing process and the high transaction costs it supposes. The second channel is generated through housing prices. Housing prices are determined by the level of stock and at the same time determine the flow of new residential investment. As it has already been mentioned above, an essential

feature of housing market is the specific adjustment of its components against a shock: housing prices and investment react quicker than stock.
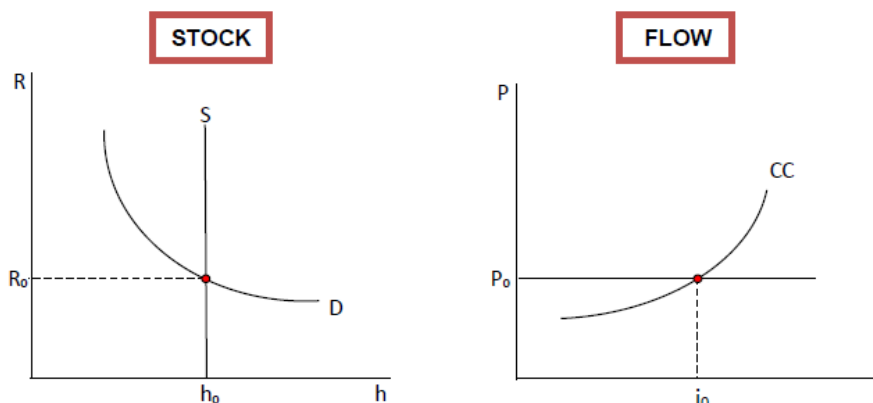
Source: own elaboration

In these both graphics we show the two different parts of the model, each one with its own macroeconomic variables shaped in a graphical representation. In the following points each part is going to be explained and developed.

Stock part

1) Demand

The demand of housing shows the quantity of housing services that individuals are willing to obtain given the different prices in the economy. The behavior of this demand depends on some specific factors which are going to be listed below:

- Price of housing: it is a determinant factor of households' demand of housing services. A measure that shows the effect of a change in prices in consumers' demand is the price elasticity of demand for housing. This measure is calculated as the ratio of the percent change in quantity demanded if there is a percent change in prices, i.e. it shows the percentage decrease that will be observed in demand if prices increase by 1%.

Depending on the results we obtain from the coefficient we can say that our demand is price elastic if it is greater than one, inelastic if it is smaller than one and unit elastic if it is equal to one.

There are also some main non-price exogenous determinants of housing demand:

- Demographic: total demand of housing is determined by population size, population growth and changes in the structure of population caused by migration and long-term changes in birth and death rates. If a society is characterized by having an ageing population or suddenly suffers an immigration boom, its housing demand is going to increase. Demography is one of the most important determinants because it has a peculiarity; it is a variable not entirely exogenous in the sense that not only an increase of demography supposes an increase of housing demand. In this paper demography is a key factor for the development and explanation of the evolution of housing market.

- Income/wealth: changes in the level of national income and its distribution can have an important effect on housing demand. An important indicator that shows this is the income elasticity of demand, which measures the percentage of change in the quantity demanded of a good due to a percentage change in real income. Depending on the coefficient obtained we can classify the different types of goods we can find:

$$|\varepsilon_d^i| > 0 \quad \rightarrow \text{normal good}$$
$$0 < |\varepsilon_d^i| < 1 \quad \rightarrow \text{necessity good}$$
$$|\varepsilon_d^i| > 1 \quad \rightarrow \text{luxury good}$$
$$|\varepsilon_d^i| < 0 \quad \rightarrow \text{inferior good}$$

Standard houses can be considered normal goods with high income elasticity of demand, so an increase of 1% in income supposes a larger percentage increase in demand. As households see their incomes rise they opt for buying a house; therefore, increases in real income or wealth should be associated with an increase of investment in housing. Many individuals switch from renting to home ownership or they move to a bigger property or they buy a second property as holiday home or to rent it out. An increase of income or wealth would suppose a shift of demand to the right.

- Cost and availability of credit: the availability of credit was not a problem before the crisis, conditions that had to be fulfilled in order to be financed where not strict and this made the option of buying houses more affordable and people begun to buy assets above their own possibilities. The number of mortgages granted to allow housing acquisition kept an upward trend until 2006 in Spain. Once the crisis broke out, interest rates were increased in 2007 in order to soften the crisis effects. Fear and panic contributed to worsen the situation and during 2008 average variable rate mortgages fell; banks had to become stricter and established harder conditions when had to finance households.

The willingness of banks to lend mortgages has a significant effect. If banks give mortgages with better conditions, the effective demand of houses will be bigger. The willingness of banks to lend mortgage finance can vary depending on the strength of the interbank lending sector. With the crisis of 2008 costs of interbank lending have been raised sharply and due to this there has been a fall in availability of mortgage finance.

- Households expectations: there is an important speculative determinant in the housing demand. It is very common to observe that households base their current demand for property on expectations of future price changes. If house prices or rents are expected to increase in the future, speculation is encouraged and housing demand increases before it should. If housing prices or rents fall, speculative buying is discouraged. This phenomenon induces shifts in demand.

2) Supply

Housing supply is generated in order to satisfy consumers' demand. It is produced using a sort of inputs such as land, labor, electricity, infrastructures, building materials, technology etc. All these inputs are reorganized and combined in a production process in order to create new housing supply. The quantity of new supply is determined by the costs of these inputs, the price of existing stock of houses and technology of production.

Once optimum quantities of new buildings are produced, prices are set according to all different determinants that affect them. Then, households who are interested in buying a house have to decide according to the market situation if it is worth or not. As we have mentioned before, new housing can have different consumption uses: it can be used as first residence, it can also be used as holiday's residence, it can be used as an inversion good and then it can be rented etc. Depending on the use that households give to the property, they satisfy different types of demand.

It is very important to take into account that short run housing supply is inelastic (vertical slope). In case there is a large increase in housing demand, supply cannot be increased

suddenly in the short run. Housing construction procedure needs months or even years and it is not possible to make fast short run adjustments to satisfy demand increases. If we think about long run supply, it is easier to observe the proper supply-demand adjustment because there is time enough to adjust the new equilibrium.

Housing supply is patterned by different factors. As happens with demand, supply is also determined by housing prices and by other non-price factors that are going to be explained in this section:

- Prices: house prices are an important determinant of housing supply. The relationship between supply and prices is positive, the higher are house prices the higher is the willingness of supplying. High prices encourage house builders to construct more; the supply of housing is positively correlated to house prices and the supply curve is upward sloping. However, short run supply is frequently inelastic due to time needed to construct, limited spare capacity, low stock levels and also difficulties in legal procedures.

The price elasticity of supply shows us the percent responsiveness of the quantity supplied of housing given the percent change in prices. According to the result of the coefficient, our supply is price elastic if it is greater than one, price inelastic if it is smaller than one and unit elastic if it is equal to one.

There are also other non-price determinants that affect housing supply: availability of production factors (land, labor hand etc.), costs of production, government legislation and available technology.

3) Equilibrium

STOCK PART VARIABLES:
R – Renting prices in the market
H – Stock of housing
h – Stock of housing per capita
S – Supply of housing
D – Demand of housing

In this part of the model we observe the relation between supply and demand; i.e. the equilibrium between housing renting prices and a certain amount of units of stock per individual:

$$HS^S = f(H) \quad \rightarrow \quad f' > 0$$
$$HS^D = h(R) \quad \rightarrow \quad h' < 0$$

The housing services supply curve presents a positive slope (although here it is represented as a vertical curve to emphasize its inelasticity property). This means that, as higher are renting prices, higher will be the amount of stock supplied. The housing services supply curve presents a negative slope; this means that as renting prices increase, lower housing stock is demanded. When we are in the equilibrium we have:

$$HS^S = HS^D$$
$$f(H) = h(R)$$
$$R = R(f(H))$$
$$R = h^{-1}(f(H)) = R(H) \quad \rightarrow \quad R' < 0$$

This means that, in the equilibrium, as housing stock is increased and there are more dwellings in the economy, renting prices are going to be decreased.

Flow part

This is the other part of the stock-flow model which integrates the evolution of housing stock experimented over a certain period of time thanks to inversion done by households in the market given certain housing prices and costs.

The stock-flow model relates the stock variable, which represents the result of gradual housing construction accumulation and the flow variable, with the rate of change of housing stock. The rate of change of stock is the net sum of its flows (Birnus, Onur, & Yamam, 2014). Regarding the contribution of this part of the model, it is smaller than the one that supposes the stock part. Due to all factors we have already seen, new stock is not so easy to generate; this is why new stock contributions are insignificant in comparison to the already existing market stock.

1) *Curves and equilibrium*

FLOW PART VARIABLES:
P – Price of housing
I – Flow of investment on housing
i – flow of investment on housing per individual
CC – Costs curve

In this part of the model we observe the relationship between housing stock prices and investment done in this stock. The two curves observed in this part represent the price payed by home-owners and the construction costs that have been incurred in order to construct new stock. The curve which represents the costs curve has a positive slope, this means that, as housing investment is increased, housing prices should also be higher. Housing investment will depend on the costs of constructing; if they are high, there will be less investment in housing construction, while if they are low, there is going to be more investment in construction.

Adjustment mechanism between stock and flow

In this part the four different steps of the housing market adjustment mechanism are going to be enumerated:

1. Initial stock market equilibrium: at a certain moment in the time horizon, there is a fixed stock (supply) that has to satisfy a certain demand. According to de levels of both of them a rent of housing is set.
2. This rent that has been set is the housing price determinant. It is translated via cash flows discounts.

EQUILIBRIUM PRICE DETERMINATION:

First of all, it is important to differentiate the two regimes in which people can inhabit a house: renting and owning. Someone who purchases a house can live there or use it for personal activities (owner-user) or can also consider it as an investment asset (pure owner) that is going to be offered as a renting property for other individuals, the renters, in the housing market in exchange for the rent.

Once this identification is made, we can find the two parts that determine the price:

- If you live in a rented house, you have to pay the renting = R

- If you are the owner-user and you buy a house, in order to proceed you have to incur in some specific expenses; for example, the interests of the mortgage you use to

finance yourself (among others). We represent this like a cost that has to be assumed according to the price of the house you are obtaining $= c \cdot P$

In the equilibrium, what we have is perfect situation in housing market; everyone has somewhere to stay (renting or owning), so this means the following condition is satisfied:

$$R = c \cdot P$$

This can be reorganized in order to finally have the equilibrium price in the stationary state:

$$P = R/c \quad \rightarrow \quad P_0 = R_0/c$$

3. In this step housing price (P) is compared with construction costs (cc) in order to determine if profitable opportunities exist for investors:

How does the housing stock flow behave against the different positions that prices can reach against construction costs?

Figure 2: Investment in housing according to the level of costs
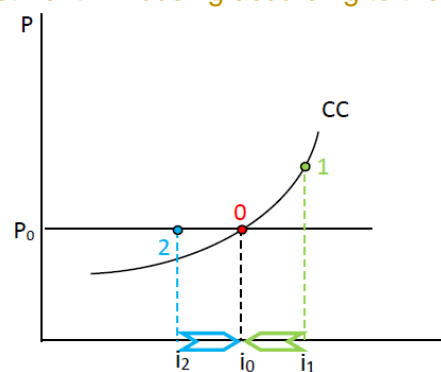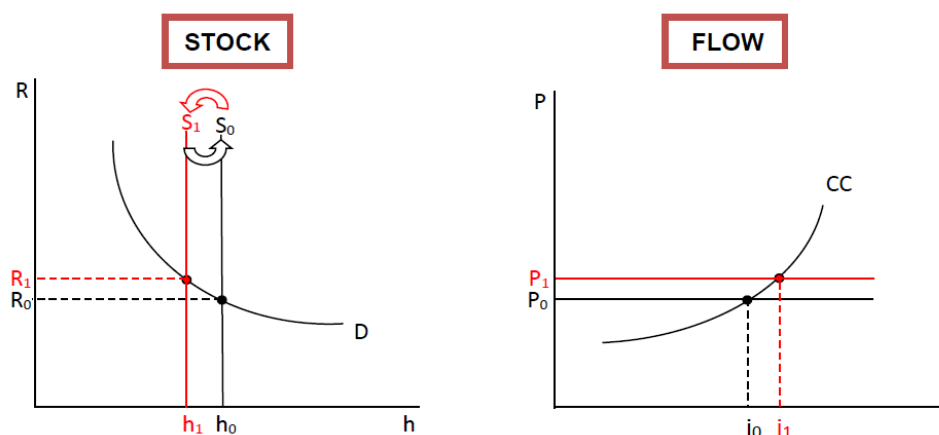

Source: own elaboration

- Situation 1: P_0 < costs → no production of new housing stock with these costs, there is not more demand because there are not profitable opportunities.

- Situation 2: P_0 > costs → there is production of new housing stock with these costs because there are profitable opportunities and it is worth to invest.

- Situation 0: P_0=costs → equilibrium point. When housing market is located out of its optimum allocation (situation 1 and 2) adjustment mechanisms act and finally we go back to the equilibrium point 0.

4. The intersection between costs of construction curve and price of housing (cc+P_0) determines the maximum level of new housing achieved thanks to investment (I_0). This new stock is added in the following period in the housing supply (new stock) and the supply curve is going to be shifted to the right.

Adjustment with depreciation

When we talk about durable goods it is important to think about the effect that time can have on them. Here we introduce the concept of depreciation, which represents an accounting method of allocating the cost of a tangible asset over its useful life (Investopedia, n.d.). Residential capital stock is affected by depreciation, which is considered to be constant year over year.

Residential stock in any period is determined by existing stock in the previous period, by the depreciation that this stock has suffered and by the flow of new residential construction investment.

Figure 3: Adjustment stock-flow model with depreciation

Source: own elaboration

If we introduce depreciation in our stock-flow model, as can be seen in figure 3, we are internalizing the existing housing deterioration over time. In this paragraph we can observe how this phenomenon affects our model and the chain effect to which entails.

First of all, depreciation directly affects supply of housing (current economy's stock). It shifts this curve to the left due to deterioration (decrease in stocks' value). This supposes a change in rents because here we have the same demand with less valuable stock. Then, this over-sized demand generated by the stock reduction supposes increases in rents and prices in order to equate the new lower amount of stock with demand. Due to the increase experimented by housing rents (R), there is an upward shift of the curve of housing prices (P). This makes housing investment to be more profitable and flow of investment in housing per individual is increased ($i_0 \rightarrow i_1$).

Finally, as new inversion brings new housing stock for the next period, supply housing curve (housing stock) goes back to its initial position (h_0).


Demographic boom

This paper it is going to be focused on the effect that the demographic boom between 1990 and 2008 has had on housing prices and stock. Due to this, it is important to develop the comparative statics of the migratory boom, see what happens with the curves and the variables and also note the effects it leaves in the market.

If we take a look at the results of a demographic boom in Spain, we have to think about the different effects in different moments in time that are going to be observed because housing market is explained by the stock-flow model, in which adjustments are not automatic, but they change over time. Figure 4 represents the different steps by which housing market adjusts its levels after a demographic boom. First of all, we have to think that, when more people arrive to a country in order to become permanent inhabitants, housing demand is going to be increased. After observing this first boom's sign, as our economy is initially close to the equilibrium, there are not enough empty dwellings to satisfy this new demand, so an over-demand situation is generated and housing prices rise. While this is happening in the immediate short-run in the stock part of the housing market, the construction activity companies start building new dwellings in order to satisfy this new demand and take advantage of this new opportunity of business. The problem

with this sector is that, as we have mentioned previously, there is a very important restriction, time. Housing supply is characterized by rigidity because to increase the available stock in the market, a reasonable amount of time is needed. This is why in the short-run we have an inelastic-vertical supply slope, while then in the long run supply is less inelastic and we need to add a new graph in figure 4. After some years, in the long-run, new dwellings are built and housing supply is increased. Depending on the amount it grows, we are going to observe different results in housing market indicators. In the Spanish housing market, the increase of stock was not enough to satisfy the continuous increase in demand. This made rents and prices keep rising along years and at the same time stock was growing, generating one of the most important bubbles ever seen in the Spanish real estate market.

Figure 4: Demographic Boom in Stock-flow Model
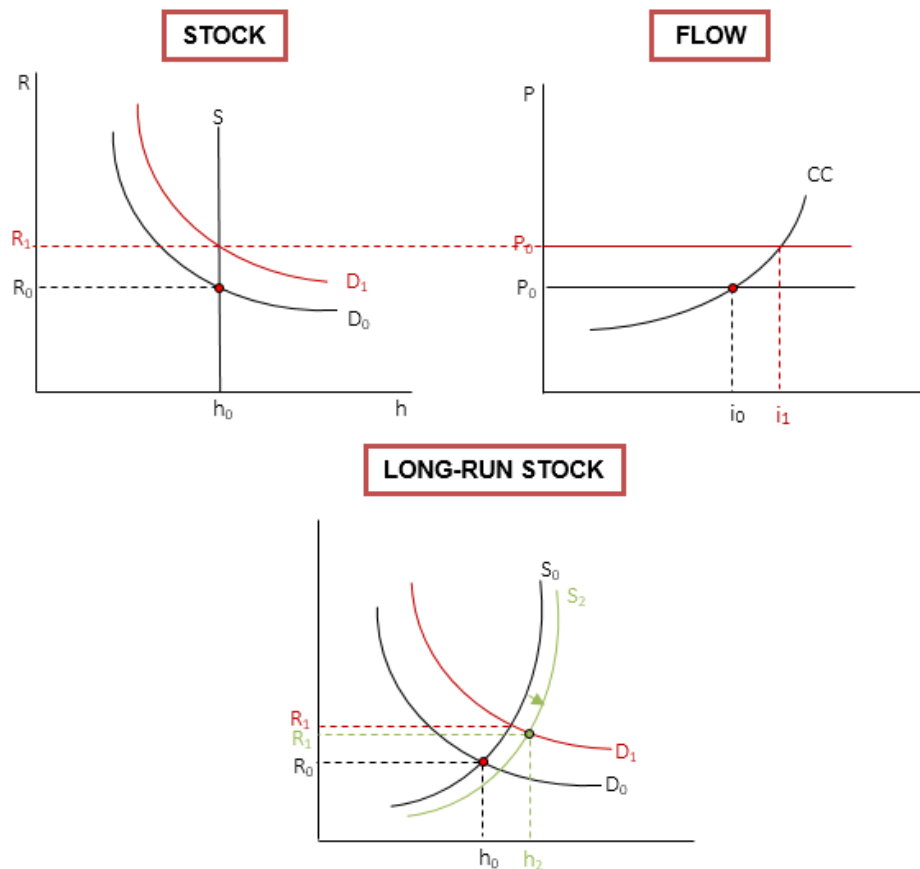
Source: own elaboration

As a result, in the new equilibrium we can observe: an increase in housing rents, an increase in housing prices, an increase in investment in housing construction and after a specific period of time, an increase in housing stock. Depending on the magnitude of the housing stock increase, rents and housing prices could return to their original levels before the shock (in figure 4, the green line should have been shifted downwards at the same level of the initial equilibrium). But in the Spanish case this was not what happened and the process of adjustment to the new equilibrium was repeated during many years while population was increasing and in the short-run stock was not enough to satisfy that new demand. In the following points of the paper we are trying to analyse why was there a migratory boom in Spain, the effects it had in housing market and at the same time trying to fit in reality with the theoretical explanation.

5. Spanish housing market

The Spanish housing market has faced one of the most important bubbles in history. From 1997 until 2008 housing prices have undergone a drastic upward trend due to different causes: demographic changes, low interest rates, deregulation in mortgage market, economic prosperity, irrational behaviour, speculation etcetera.

The unnatural housing prices evolution during the period between 1998 and 2001 is one of the key points that are going to be deeply analysed in order to properly understand what brought this behaviour, specially focusing on the point of view that sets immigration as the main trigger. The most important bubble symptom was that housing prices were growing above salaries and CPI.

Figure 5: Housing prices evolution, salaries and inflation
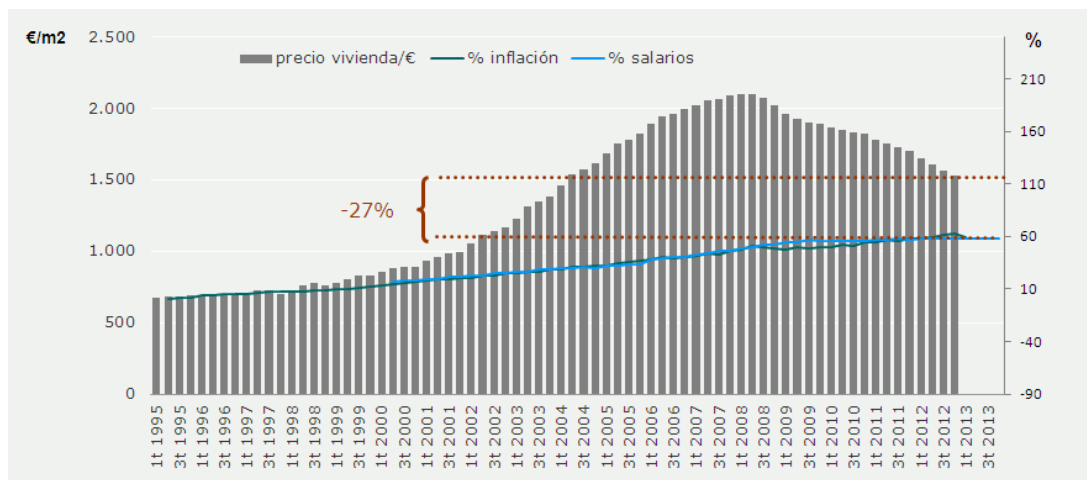
Source: Spanish Ministry of Development, CCOO and INE

Between 1998 and 2008, the peak year of the boom, housing prices increased by 175%. In 1998, prices were 753 euros per square meter, while during 2008 they reached their maximum level during the first quarter of the year 2.101 euros per square meter. Over the same period, the total percentage increase in the consumer price index in Spain was 61,5 percent or an average annual inflation rate of 4,9 percent (Gonzalez & Ortega, 2012). This data verifies that the experienced increase in housing prices does not correlate with the evolution of other economic indicators. This indicates that there is a bubble, which is being stimulated through the behavior of agents in the context of increased economic prosperity.

*Figure 6*: Free housing prices evolution 1998-2011
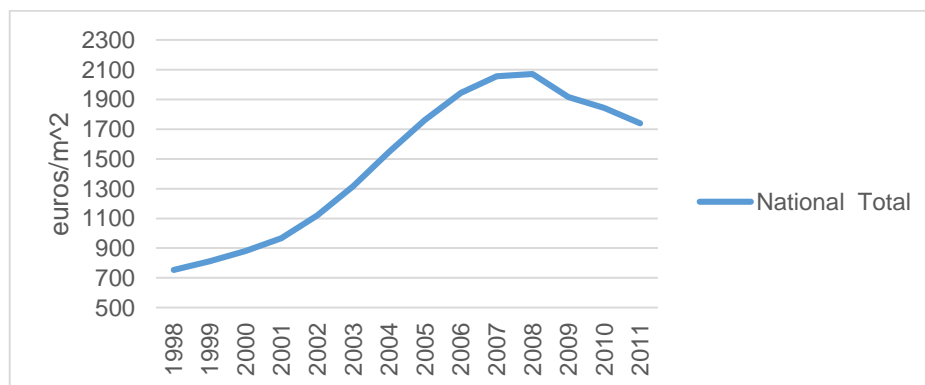
Source: own elaboration- data Spanish Ministry of Development

Due to the fact that housing supply is inelastic in the short-run and it is not possible to satisfy new demand at the same speed as it is increased due to a lack of stock, we could think that this drastic increase in housing prices may be driven by a sudden-drastic increase in housing demand.

What is surprising is that when we look at the residential construction activity we observe that it is also following an upward trend during this same period. The number of new units of housing already finished in 1998 was under 250.000, while in 2006 it reached an amount of 600.000 units (figure 7). In seven years, the number of new units of stock was increased in a 164 percent. If we consider the effect of the increase in demand of new-constructions every year (not finished at the end of the same year) we can also observe important increases during the years between1998 and 2008. This indicator evolves from more than 350.000 units in 1998 to 665.000 units, peak amount reached in 2006, supposing a total 90 percent increase. Since 2006 we have observed a change in this upward trend and during 2007 the total amount of new free housing units started to become smaller than the total amount of free housing units finished. This is a representation of the reality; the first signs of the broken-bubble came to light during 2007 when agents become aware of the extreme situation they had generated.

Figure 7: Evolution of the number of new housing started and finished 1998-2008
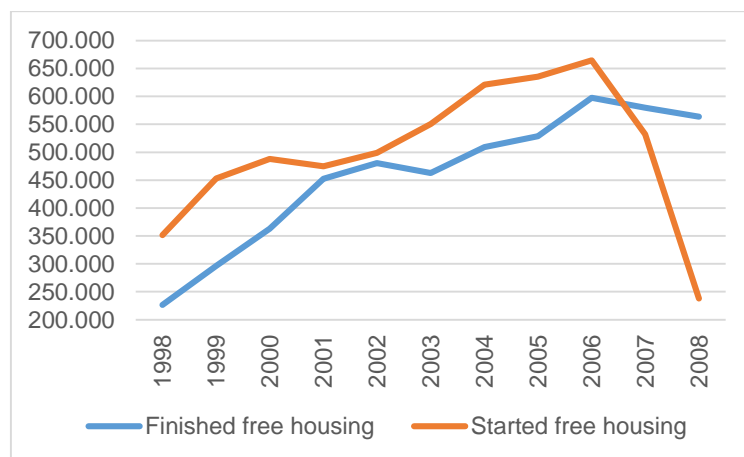
Source: own elaboration – data Spanish Ministry of Development

Analyzing these data we conclude that the increase in housing supply is not fast enough to satisfy the increase in housing demand and due to this, housing prices soar reaching historical levels.

Causes of Spanish housing boom: migration in the spotlight

When we take a look to the Spanish contextualization, it is very important to identify what was taking place in our society. There are different important causes that have been listed during the recent post-crisis years about which factors made prices follow the drastic upward trend they followed. The most important ones that could be considered are demographic changes, low interest rates, deregulation in mortgage market, economic prosperity, irrational behaviour and speculation (among others).

In this document, the migration boom is going to be set as the central factor that contributed housing market's behaviour during the bubble period, boosting housing demand and prices in Spain. Spanish immigration has experienced a shocking evolution during the 20th and 21st century due to both aspects, the magnitude and the timing in

which they have occurred. During the last years of the 90's and the beginning of the 21st century, Spain received an important amount of immigrants in comparison to its own population. Inflows increased from under 30 thousand per year in 1996 to 958 thousand per year in 2007. Foreign nationals amounted more than 2 percent of the total population in Spain during 2007 (Izquierdo, Jimeno, & Lacuesta, 2015). It is very important to analyse the Spanish Economy conjuncture that attracted such important inflow of foreign-born population to Spain.

The Spanish conjuncture

Until the mid-nineties, Spain had been a country characterized by emigrant population flows. However, in 1985 Spain signed the Treaty of Adherence to join European Community and since then the tendency changed; Spain became an immigrant-receiver country (Martí Romero, 2015). During the last years of the 20th century and early-beginnings of the 21st, Spain's economy was doted by several economic prosperity indicators which became a potential explanation of the increase in migratory inflows. In this section these important indicators are explained and related to the behaviour population inflows.

Economic development

Economic development experienced in Spanish economy since the beginning of the nineties has been the most important reason why foreign-born population chose Spain as their new destination. During the end of the 20th century, Spain continued with all its objectives to become part of the Monetary European Union. By the 1st of January of 1999, Spain fulfilled all the requirements settled by the convergence criteria of the Maastricht Treaty and became part of the Monetary European Union. This important integration brought the Euro, and came preceded with many other favourable economic indicators:

*Figure 8:* Annual GDP and Unemployment (%)

Source: IMF - (Delmedo, 2011)

GDP increase: during 1998 and 1999, there was an annual increase in Spain's GDP of 4,5 percent per year. As it can be seen in figure 8, since the 21st century annual growth was around 4 percent until 2007, the year when the bubble exploded and the crisis arrived.

Unemployment rate: this indicator has showed a favourable and attractive trend during the pre-crisis years. Low unemployment rates supposed an important attraction for immigrants willing to move from their born-countries in order to find new opportunities and higher quality employment. Furthermore, the touristic boom made the demand of low-skilled labour hand increase significantly. Services and Construction sectors have given lots of job opportunities, not only to Spanish population, but also to foreign-born population.

The construction industry is characterized by allowing increases in housing supply in order to satisfy increases in housing demand. Its evolution has been a key factor in the economic development observed in Spain. Between 1998 and 2008, it has had an average weight around 10% on total Spanish GDP as it can be seen in figure 9. The increase in construction activity helped to pull unemployment down; it went from 24 percent in 1994 to 8,3 percent in 2007. In 2008, about 600.000 foreign-born individuals were employed in the construction, amounting the 25% of the total amount of employees in this sector (Labor Force Survey, 2008). During the same year, employment in construction was 12% of total employment in the economy (Gonzalez & Ortega, 2012).

Figure 9: Average % Structure of GDP 1998-2008
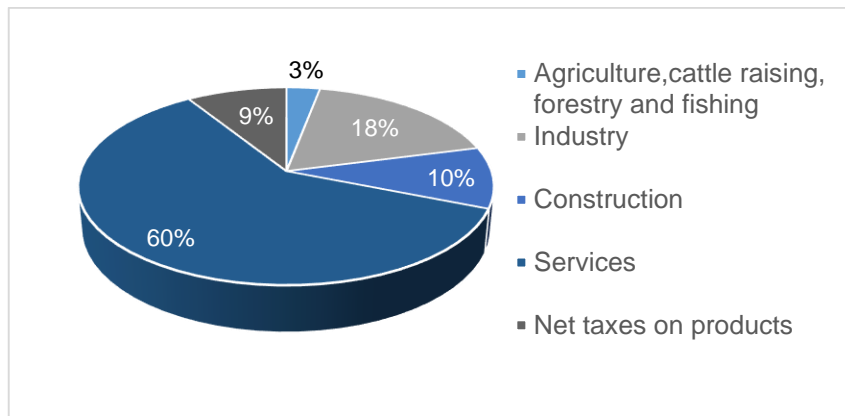
Source: own elaboration – Data: INE

Household real disposable income: this indicator determines the affordability of housing. Aggregate income is the product of average income of workers and the level of employment (André, 2010). During the expansion period there was a significant growth in steady income which combined with the decrease in unemployment rate supposed important housing demand increases, especially in Spain with a real disposable income above the Euro Area average during the early-2000s as it can be seen in figure 10. Due to the good income and job conditions, little by little Spanish society became one of the most important host countries for immigrants.

Figure 10: Real Disposable Income Spain vs Euro Area
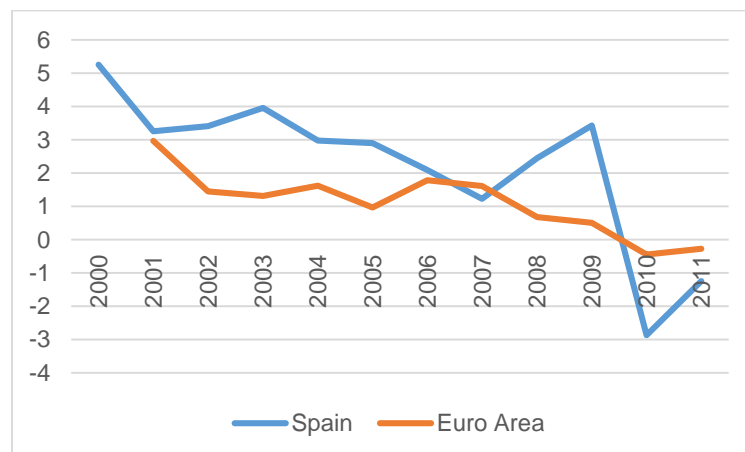
Source: own elaboration – Data: OECD

Financial factors

Low interest rates: if we try to extract which effect had interest rates during the expansion period we can observe that there were significant low real interest rates characterizing the Spanish economy; this made investment more attractive and at the same time drove housing prices upwards. The Taylor Rule allows Central Banks setting the proper nominal interest rate according to each country's inflation levels in order to have the proper real interest rate in each country. The problem has appeared when many Central Banks have kept nominal interest rates too low and caused housing prices to soar, like for example in Spain. In some important researches, there has been found a strong relation between too low interest rates and housing bubbles. When the "too low" interest rate is kept for "too long", the housing bubble becomes even worse and prices increase more (Hott & Jokipii, 2012).

Easier and cheaper access to credit: real mortgage interest rate followed a downward trend in Spain since 1993 reaching the lowest levels during the early-2000's. This made more attractive becoming homeowner and investing in Spanish housing market. Due to this, there was an important increase in total amount of mortgage credits. It is important to note that more people were willing to become homeowners, especially those whose acquisition level was not very high and never before had had the opportunity of buying a house. Between 2002 and 2007 the Spanish economy kept developing, employment rate was improving and this attracted immigration. Due to the exceptional credit conditions and low control everyone could have the opportunity of becoming homeowner through mortgages. In 2002 the total amount of mortgages was 800.000, while in 2007 it reached 1,06 million (Letón, 2015).

Mortgage favourable conditions: The credit facilities which have characterized the Spanish Credit Market during the pre-crisis period have been a key factor in the housing market development. The increase in the repayment terms, the reduction of the Euribor differential, the flexibility in the return of borrowed capital, the amount of credit grants close to the total value of the dwelling and many other favourable conditions facilitated the acquisition of housing for immigrants and become members of our society, participating in labour market and contributing to our economy.
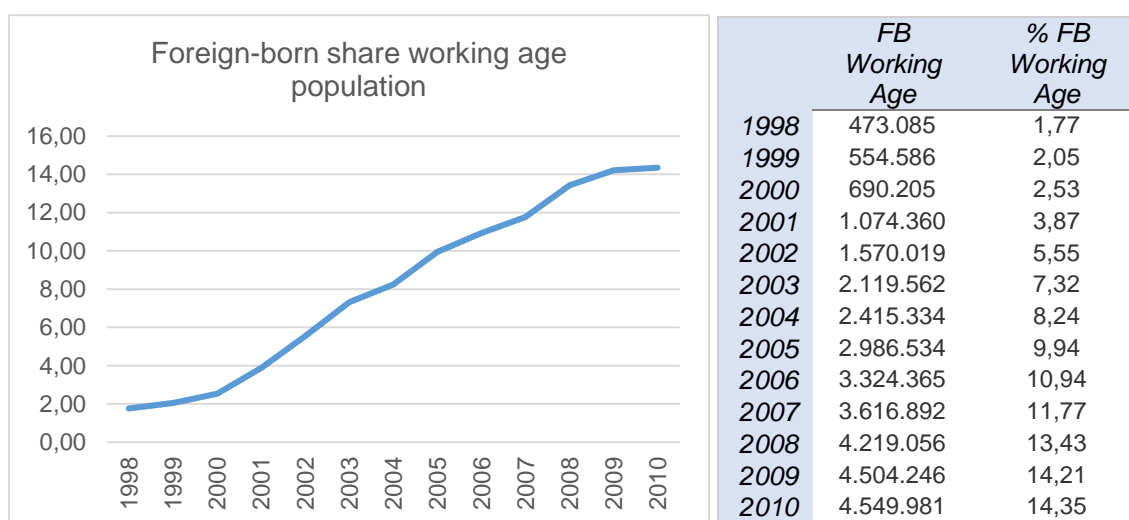
Subsidies and favourable tax conditions: housing market has hold, not only in Spain, but also in many other worldwide, a favourable tax treatment that has stimulated home-ownership. Poterba (1992), measured the effect of tax policies on housing market. A favourable tax treatment makes ownership user costs to become smaller and makes acquisition of new dwellings to become a tendency. The non-taxation of imputed rents, the basically untaxed capital gains and the mortgage interest payments deductions (MID) are common features in many tax systems. In the case of Spain, payments of the principal were also deductible from the Personal Income Tax (known as IRPF in Spain) (Meliveo, 2014). All these favourable tax-treatment conditions were expected to reduce housing prices when new dwellings are acquired, but at the end it contributed to the housing demand increase and inevitably, it supposed an indirect contribution to housing prices' growth and to the bubble generation.

All these circumstantial features made Spain an attractive destination where people and families around the world desired to move in order to find new job opportunities and better living conditions.

Immigration as the main trigger of Spanish housing market boom

In this paper we present the hypothesis that sets the immigration wave that took place between 1998 and 2008 in Spain as the main trigger of the larger Spanish housing market boom. During this period, foreign-born share of working age population increased from almost 2 to almost 15 percent as it can be seen in figure 8. In absolute terms, the foreign born population increased from 0,5 million to almost 5 million over the course of the decade (Gonzalez & Ortega, 2012).

Figure 11: Foreign-born share of working age population in relative and absolute terms

	FB Working Age	% FB Working Age
1998	473.085	1,77
1999	554.586	2,05
2000	690.205	2,53
2001	1.074.360	3,87
2002	1.570.019	5,55
2003	2.119.562	7,32
2004	2.415.334	8,24
2005	2.986.534	9,94
2006	3.324.365	10,94
2007	3.616.892	11,77
2008	4.219.056	13,43
2009	4.504.246	14,21
2010	4.549.981	14,35

Source: own elaboration- data INE

This important increase in foreign-born share population has been translated in the Spanish annual population growth. Figure 11 shows us clearly the takeover of the foreign-born population growth as the determinant of the total annual Spanish population growth. Since the beginning of the nineties it was the migratory boom what allowed increasing annual growth until reaching the peak in 2005 and ranging a growth rate between 1,5 and 2 percent between 1998-2008, the expansion period. The orange line represents national population natural growth and it shows its insignificant contribution to population growth during the pre-crisis period. Since 2008 foreign-born share begins to stagnate and annual population growth plummeted due to the burst of the crisis.

Figure 12: Annual Population Growth
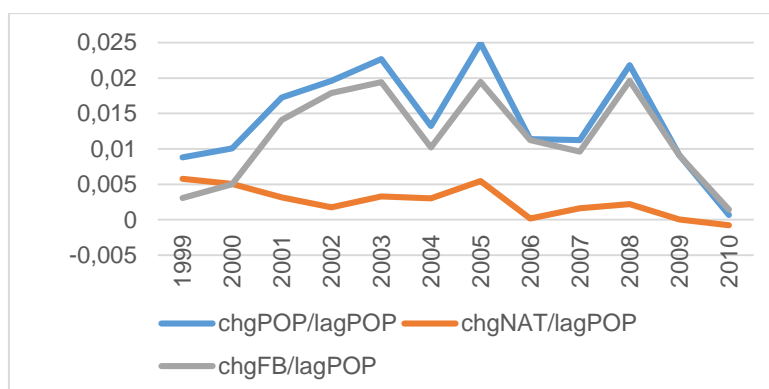
Source: own elaboration- data INE[1]

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[1]Data used to generate this figure corresponds to working-age population.

Against these results, this paper sets the migratory boom that took place between 1998 and 2008 as the main cause of the specific housing market behaviour due to the increase in working-age population and the effect it had in housing market.

6. Analysis

Methodology and development of the procedure

In this part we develop and explain the procedure followed in order to obtain results that correspond to the hypothesis presented above: immigration inflows as the main determinant of the specific housing prices and stock behaviour. We analyse outcomes of housing prices and residential housing units and then we estimate the impact of immigration on them[2]. We include as a potential point the regional variation in immigration inflows, changes in housing prices and stock and many other different characteristics that make each region or each province in Spain different from the others and allow observing heterogeneous results.

There are two dependent variables that generate two separate studies: the logarithm of the price per square meter of housing (in euros) $\ln P_{rt}$ and the logarithm of the stock of housing units $\ln Q_{rt}$, which give us results for province r in year t. In both analysis we have one main explanatory variable, the logarithm of emancipated-age population $\ln Pop_{rt}$[3]. There are other explanatory variables used in different specifications of the analysis, like for example foreign-born population relative to total population M_{rt}/Pop_{rt}.

When we start with our analysis we implement a basic model and then more specifications are included, generating new cases of study. At the end, we obtain eight different cases of estimations for each dependent variable, housing prices and stock. Our basic regression model estimated with first differences has the following format:

(1) $\Delta Y_{r,t} = \alpha_t + \beta_0 \Delta \ln Pop_{r,t} + e_{r,t}$

$Y_{r,t}$ represents both prices ($P_{r,t}$) or quantities ($Q_{r,t}$), α_t are the temporal dummies which are included in all the different cases of analysis.

(2) $\Delta Y_{r,t} = \alpha_t + \beta_0 \Delta \ln Pop_{r,t} + \beta_1 \Delta \ln(L/Pop)_{r,t} + \beta_2 \ln Y_{r,t-1} + e_{r,t}$

In the second analysis control variables $\Psi_{r,t}$ are included: the first difference of the log of employment rate $\Delta \ln(L/Pop)_{r,t}$ and the log of the dependent variable, P or Q, lagged one period $\ln Y_{r,t-1}$.

(3) $\Delta Y_{r,t} = \alpha_t + \beta_0 \Delta \ln Pop_{r,t} + \beta_1 \Delta \ln(L/Pop)_{r,t} + \beta_2 \ln Y_{r,t-1} + \Psi_{r,t} + e_{r,t}$

In the third analysis regional dummies $\Psi_{r,t}$ are included, which allow withdrawing autonomous communities geographical unobservable and uncaptured trend effects, like for example political or regulatory changes.

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[2]This analysis is very similar (but more simple) to the one made by Libertad Gonzalez and Francesc Ortega in the paper "Immigration and Housing Booms: Evidence from Spain".
[3]Emancipated age population (between 25 and 39 years old) is used in this analysis because it has been showed that housing acquisition is mainly conducted in that age range and also due to the facility it supposed when we had to recollect the disaggregate data by provinces or regions.

(4) $\Delta Y_{r,t} = \alpha_t + \beta_0 \Delta \ln Pop_{r,t} + \beta_1 \Delta \ln(L/Pop)_{r,t} + \beta_2 \ln Y_{r,t-1} + \theta_{r,t} + e_{r,t}$

In this fourth analysis instead of regional dummies, province dummies $\theta_{r,t}$ are included. Their task is the same that regional dummies have but with a deeper and more detailed specification because they better capture the heterogeneous trends among the different Spanish provinces.

(5) $\Delta Y_{r,t} = \alpha_t + \beta_0 \Delta \ln Pop_{r,t} + \beta_1 \Delta \ln(L/Pop)_{r,t} + \beta_2 \ln Y_{r,t-1} + \Psi_{r,t} + \varphi_{r,t} + e_{r,t}$

In the fifth analysis regional dummies are included again and also a regional trend $\varphi_{r,t}$ is added. This trend allows absorbing additional effects; this means that if there is some behaviour that is not explained through the exogenous effect of the variable $\Delta \ln Pop_{r,t}$, it could generate biased estimations. This regional trend is in charge of eliminating them.

The analysis six, seven and eight are obtained by repeating analysis (3), (4) and (5) but changing the year's period of study: rather than from 2001 to 2011 we use data from 2001 to 2008, i.e. we only use pre-crisis years. The results in which we are interested do not really present significant differences between one period analysis and the other, but it can also be an interesting point to take into account regarding some specific coefficient variations.

Data used in our analysis

In this analysis the main variables are housing prices and housing stock at each province and year level. These two data series are obtained from the official data made available by the Spanish Ministry of Development ("*Ministerio de Formento*"). The housing prices data is provided at the quarterly level and we have just made an average of the four quarters and used that average price to represent the one at the yearly level. House prices are published in euros per square meter and with the name of *"Valor Tasado de la Vivienda Libre"*. Here are included both prices of new and old dwellings. The stock of housing represents the quantity of houses and it is published with the name of *"Estimación del Parque de Viviendas: total del parque de viviendas por comunidad autónoma y provincia".* In this quantity variable there are also included both new completed dwellings and housing stock accumulation year over year. We introduce change in logarithm of both of these variables in our estimations.

Some data related to population and employment ($L_{t,i}$) have also been collected from the National Statistics Institute ("*Instituto Nacional de Estadística*"), a website in which a huge amount of official statistical free-access information of Spain can be found.

The rest of the variables are obtained from the "*Registro del Notariado*" and have been collected by province and year. Total Population ($Pop_{t,i}$) is measured as the aggregation of foreign-born population ($M_{t,i}$) and native population ($N_{t,i}$), which are only available from 1998 onward. Our analysis is focused on the period 2000-2010 because data presented some abnormal behaviour during 1998 and 1999[4] and that supposed non-representative results. When we are calculating $(M/Pop)_{t,i}$ and $(N/Pop)_{t,i}$, we are calculating the change in immigrant or national share according to total Spanish population.

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[4] In the paper of Libertad Gonzalez and Francesc Ortega "Immigration and Housing Booms: Evidence from Spain" it is explained why are 1998 and 1999 data are excluded: there was a change in the design of the Local Population Registry provided by the National Statistical Institute. As a result, the reported 1999-2000 population increase is abnormally high (Gonzalez & Ortega, 2012)

In our further analysis we include variables of control by province and year: the employment rate $(L/Pop)_{t,i}$, which is obtained from the ratio of total employed population divided by total population, and we also use the lagged population $Pop_{t-1,i}$.

Descriptive statistics

Variable	Mean	St. Dev.	Min.	Max.
Change in log of house price ΔlnP	0,0638	0,0798	-0,144	0,254
Change in log of house stock ΔlnQ	0,0199	0,01	0,0004	0,0715
Change in log of population $\Delta lnPop$	0,0126	0,0144	-0,0101	0,1012
Change in immigrant share $\Delta ln(M/Pop)$	0,009	0,0068	-0,0042	0,0366
Change in national population share $\Delta ln(N/Pop)$	-0,009	0,0068	-0,0366	0,0042

Source: own elaboration – data: Spanish Ministry of Development and INE

In this analysis there are 500 observations (50 provinces, excluding Ceuta and Melilla, and annual changes from 2001 to 2010). "P" is measured in euros per square meter and "Q" is measured in units of housing. "M", the foreign-born population is represented as the share of foreign population on total population in Spain and "N" is the native population, which is also represented as the share of national population according to the total population in Spain.

Data has been organized by provinces in order to have the data series for each variable during the period between 2001 and 2010. Then we have summarized all the information obtained with our descriptive statistics analysis showed in table 1. There are 500 observations, disaggregated in 50 Spanish provinces times 10 years of data for each variable from 2000 to 2010. There are 50 Provinces because Ceuta and Melilla are omitted due to a lack of data and also due to the outlying foreign-born share they present (Gonzalez & Ortega, 2012).

Housing Prices Evolution			
1998	5,485%		
1999	7,663%		
2000	8,583%		
2001	9,858%		
2002	15,729%	Boom Years: Average Increase	10,29%
2003	17,619%		
2004	17,449%		
2005	13,911%		
2006	10,407%		
2007	5,764%		
2008	0,716%		
2009	-7,438%		
2010	-3,860%		
2011	-5,579%		

Source: own elaboration – Data: Spanish Ministry of Development

As table 1 shows, there is an average increase in housing prices across provinces and years of 6,38 log-points. In the first part of this paper it has been seen that housing prices levels have experienced a drastic increase from 753 euros per square meter in 1998 to 2.101 euros per square meter in 2008. Trying to extrapolate the total average increase that housing prices have suffered, we observe a 175 percent increase from 1998 to 2018. If this increase in housing prices is disaggregated as it is done in table 2, it can be noticed that during de boom years between 1998 and 2007, there was an annual average growth in housing prices of 10,3 percent. It started at 5,5 percent in 1998 and reached its maximum percentage growth during 2003 with almost 18 percent. Since 2008 the evolution of the percentage change in housing prices has changed and it has been showing a downward trend.

Stock of housing was increased in 2 log-points each year due to the fact that new construction activity started in order to satisfy the increase in housing demand. Figure 7 presented above shows this important increase in construction of new dwellings during the years of the boom (orange line represents started free housing units). The total amount of new dwellings built went from 226.631 in 1998 and reached its peak in 2006 with almost 600.000 new ones built during that year. During the years between 1998 and 2008, the average increase in construction of new dwellings was of 165 percent. When the bubble burst, new construction was drastically decreased, especially in 2009.

Looking at the evolution in population changes it is possible to observe a change of 1,3 log-points per year. This is the strong point of this paper, explaining the effect of change in population (main explanatory variable), more precisely the change in immigrant population, in the variation of prices/stock of housing. If we observe the immigrant share population we note a change of 0,9 percentage points across provinces and years. The foreign born-share working age population increased from 1,77 to 14,5 between 1998 and 2008 as we have already seen in figure 11. Comparing levels, during this ten-years period, foreign-born population increased from 0,5 to 4,3 million while national population only increased from 26,3 to 27,2 million. This shows that the immigration boom was responsible for the majority of the population growth experienced during this period and that natural national population growth had nothing to do as we have seen in figure 11.

Going back to the results collected in table 1, it can be observed a negative mean for the share of national population in Spain, i.e. a decrease of 0,9 log points. Here there is another fact that contributes to the verification of the hypothesis that national population evolution does not contribute to total population growth, and instead of increasing housing prices or stock it has a negative-decreasing effect on them.

Comparing Provinces

In this part of the paper a comparison between housing prices and stock levels is made among different Spanish provinces.

If we check housing prices evolution, it is possible to observe that there was a great variation across provinces in both initial levels and total percentage change in prices between 1998 and 2008. According to our data, in 1998 housing prices ranged from 405 euros per square meter in Jaén to 1.151 euros per square meter in Álaba, with an average of 637 euros per square meter. In 2008 the prices ranged from 982,5 euros per square meter in Cáceres to 3.046 euros per square meter in Bizkaia, with an average of 1.705 euros per square meter. As we can see reflected in these prices mentioned, not only there is an important increase in the lowest and highest housing prices between 1998 and 2008, but also an important increase in the dispersion between prices of the different Spanish provinces. Housing prices show an average increase of 170 percent from 1998 to 2008; the highest increase is observed in the province of Málaga, which

increase in almost 300 percent during the decade. Madrid and Barcelona, the two metropolitan areas with higher population also show one of the most drastic increases in their housing prices.

The variation in housing stock due to the construction activity during the decade also presents important variations across provinces. Between 1998 and 2008 the number of new dwellings built increased significantly, especially in the provinces of Madrid, Barcelona and those located in the Mediterranean coast.

Figure 13: Percentage of foreign-born population on total population 2001 vs 2007
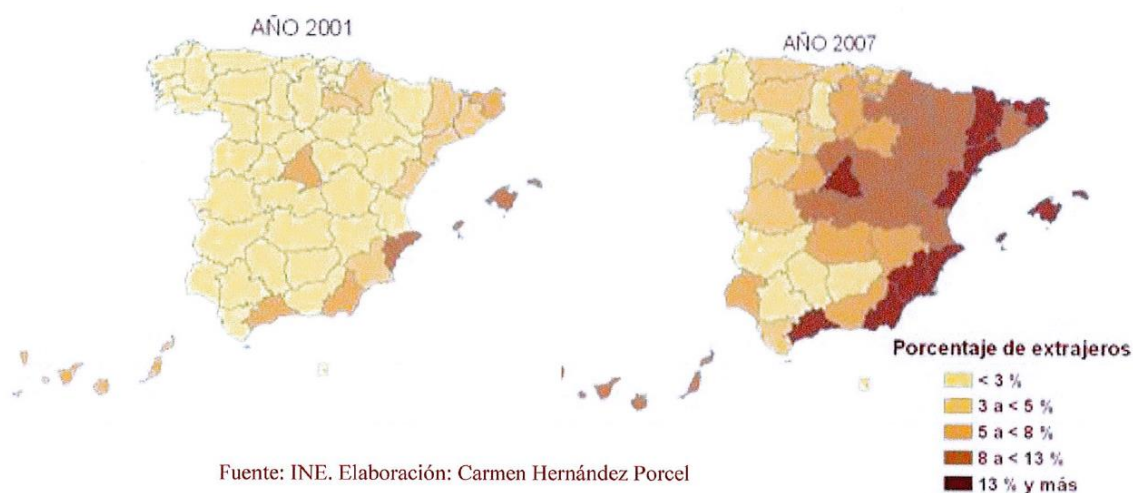
Source: Made by: (Hernández, n.d.) - INE

If we take a look to what happens with population changes among the different provinces it can be seen that immigrants do not stablish themselves equally among all the Spanish provinces. As it can be seen there has been a remarkable tendency of concentrating in certain zones depending on the year we are studying. During 2007, immigration boom was in its full swing and the percentage of immigrants over total population had reached its highest levels all over the country. We can highlight the spectacular growth experienced by the Mediterranean regions and the Islands, where foreign born share population overcame the 10 percent of the total population. Furthermore, provinces like Barcelona, Madrid or Valencia also have experienced important population inflows due to its metropolitan importance. During the boom, immigrants started to choose areas like the surroundings of Madrid, also known as *Meseta Central* and the area of Aragón.

OLS Estimates

In this section of the paper it is presented a summary of the results obtained in each of our eight different analysis explained before. Each group is represented in columns from 1 to 8 and includes different variables and show different estimations depending on the determinants included:

- Column 1: basic specification which includes the main explanatory variable (change in log of population) and also year dummies, which are included in all the cases.
- Column 2: specification which adds the control variables change in employment-population ratio and one year lagged housing prices.

- Column 3: this specification adds regional dummies. In this analysis, each region is considered one autonomous community, in the case of Spain 17: (1) Andalucía, (2) Aragón, (3) Principado de Asturias, (4) Islas Baleares, (5) Canarias, (6) Cantabria, (7) Castilla y León, (8) Castilla-La Mancha, (9) Cataluña, (10) Comunidad Valenciana, (11) Extremadura, (12) Galicia, (13) Comunidad de Madrid, (14) Región de Murcia, (15) Comunidad Foral de Navarra, (16) País Vasco and (17) La Rioja. This regional dummies pretend to capture unobservable geographical differences in trends, like changes in policies or regulations across different regional governments (Gonzalez & Ortega, 2012).
- Column 4: this specification in which, rather than region dummies province dummies are included; for each of the 50 provinces used in the analysis, there is one dummy in charge of each province-fixed effect with the aim of absorbing additional unobservable behaviours.
- Column 5: specification which adds regional specific linear trends with the aim of capturing changes in housing prices or quantities which are not caused by changes in population and grow explaining a tendency. With this we are avoiding biases in our estimations and we obtain more representative results. What we obtain here is a β coefficient for each autonomous community (from 1 to 17) and for each of these autonomous communities we have a coefficient for each year, from 2001 to 2010.
- Columns 6,7 and 8: these three columns represent exactly the same as 3, 4 and 5 but for a more concrete period, between 2000-2008, only during the boom years and eliminating the boost years in which net foreign migration became zero or negative in many provinces.

This procedure is implemented for both dependent variables: annual change in the logarithm price of housing per square meter and annual change in the logarithm of stock of housing. As it has been explained, due to the main hypothesis that sets population changes as one of the most important determinants in housing prices and quantities, our main explanatory variable is the change in logarithm of population. Now OLS estimates for each dependent variable are presented and explained.

Table 3: OLS estimation results

	Coefficients reported for Main Explanatory Variable: Change in Log Total Population							
	1	2	3	4	5	6	7	8
Change in log price	**0,583***	**0,798***	**0,946***	**1,281***	**0,484***	**0,812**	**0,911***	**0,511****
	[0,143]	[0,179]	[0,243]	[0,266]	[0,219]	[0,228]	[0,322]	[0,237]
Change in log stock	**0,348***	**0,376***	**0,467***	**0,271****	**0,528***	**0,478***	0,194	**0,544***
	[0,064]	[0,062]	[0,063]	[0,115]	[0,076]	[0,072]	[0,148]	[0,080]
N(ΔlogP)	500	500	500	500	500	400	400	400
N(ΔlogQ)	450	450	450	450	450	350	350	350
Years	2001-2010	2001-2010	2001-2010	2001-2010	2001-2010	2001-2008	2001-2008	2001-2008
Region D.	N	N	Y	N	Y	Y	N	Y
Province D.	N	N	N	Y	N	N	Y	N
Region Trends	N	N	N	N	Y	N	N	Y
Controls	N	Y	Y	Y	Y	Y	Y	Y

Source: own elaboration – data: Spanish Ministry of Development and INE

Notes: all specifications include year dummies. Variables' significance is measured by one asterisk (*) if they are significant at the 90 percent level, two asterisks (**) if they are significant at the 95 percent and three asterisks (***) if they are significant at the 99 percent. As we have commented, control variables include the change in employment ratio in each province and the lagged log price or lagged log quantity (depending on the dependent variable we analyse).

Housing prices

When our dependent variable is the annual change in the logarithm of the housing price per province, represented in the first row of table 3, and our main explanatory variable is the change in log population, we can observe each group's estimation coefficient in the different columns of this row. Column 1 shows the basic specification with a highly significant coefficient of 0,58. If we introduce control variables, we observe that this coefficient is increased until it reaches a value of almost 0,8 in column 2. If regional dummies are added, we obtain the result presented in column 3 which shows an important increase with a price-population elasticity of 0,95 that can seem to be too high. If we decide to add province dummies rather than regional dummies in order to be more specific as it is done in column 4, we observe an abnormal high coefficient greater than one which amounts 1,28. If we try to analyse the reason of this strange behaviour we can extract that, as provincial dummies include more variability and heterogeneity than regional dummies, the fix effect of the perturbation term (regional dummies) and the fix effect of the variable studied (increase in logarithm of population) both are increasing and generates this drastic soar in our coefficient. Another point that can be extracted from this coefficient is that there is some correlation between the perturbation term and the independent variable $\Delta lnPop_{t,i}$, which make the fix effect of both of them increase each other and observe a higher coefficient effect. If we move to column 5 we observe that it includes regional trends and gives us a smaller coefficient of 0,48, more representative and realistic. Columns 6 and 7 show us again high results like columns 3 and 4, with estimations of 0,81 significant at the 95 percent level and 0,91 at the 90 percent level respectively. In turn, if we observe column 8 we find an estimated coefficient of 0,51, similar to the one of column 5.

Apparently, the estimation that better represents reality is case number 5, which adds regional dummies and also linear specific trends in order to eliminate biases and correlations among our variables. The coefficient 0,484 seems to better represent the reality because it means that a significant part of the change in log housing prices is explained by the change in log total population. Other coefficients like the ones in estimations 3 or 4 seem to be too high to have sense in this context.

Housing stock

The change in the log of stock of housing in a province is in this case the dependent variable, represented in the second row of table 3, while we keep the same main explanatory variable (change in log population). The coefficients of each case are represented in the different columns of the row. In column 1 it can be observed the basic specification with a 0,35 coefficient with significance at 99 percent level. In column 2, control variables are included and a slight increase in the coefficient can be observed, reaching a value of 0,38. When regional dummies are included, the coefficient is increased until 0,47 as it is showed it column 3, while when province dummies are included in column 4 it is decreased until 0,27. With the introduction of regional trends the coefficient reaches a stock-population elasticity of 0,53 in column 5.

This one is our preferred estimation because we eliminate biases with regional dummies and also other tendency effects on housing stock coefficient that come from certain events in the economy. If these effects were not eliminated through the inclusion of regional trends, they would have biased our coefficient. Furthermore, in housing stock analysis we also have chosen case 5 as our preferred estimation because the total amount of the coefficient represents that 0,52 log points of the housing stock increase is explained by the population increase of the nineties that the immigration boom brought to Spain. Columns 6, 7 and 8 which use the same specifications but excluding the bust years deliver similar results to columns 3,4 and 5.

7. Multiplier effect

When the effect of a population boom is analysed it is important to take into account that today's housing prices and stock are not only going to be affected by today's or last year's population boom, but also by population remittances from years and years ago. Here, in this part of the study, the accumulation of population increases experimented during the period between 1990 and 2008 is stated in order to see the effect that each year's immigration levels have in the present housing prices and stock. It is also studied how does the demographic effect of the past years remain on today's housing market and also how many years do we have to go backward in time in order to find out when past immigration flows cease to have an effect on today's housing market.

In this part of the paper the accumulated effect of immigrant population boom from some years ago is going to be reflected in order to disaggregate how each year's demographic evolution affects today's housing prices and stock. To represent this effect, it is used a macroeconomic procedure for dynamic models which develops through lags in the dependent variable (housing prices or stock) and some other mathematic transformations the marginal effects of the main independent variable (change in population). The main interest of this point is the *marginal annual effect*, also known as *dynamic multiplier* or *lagged "j" multiplier*. This procedure quantifies the effect of an unitary variation in the exogenous variable (population changes) in the period of time "t-j", on the endogenous variable (in this case housing prices or stock), in the period of time t ($Y_{t,i}$).

The following procedure starts with our basic model with first order differences and includes the dependent variable lagged one period, which is representing one independent variable in the model. Here we have used $Y_{t,i}$ as a representative term of both $P_{t,i}$ (housing prices) and $Q_{t,i}$ (housing stock):

(1) $\Delta \ln Y_{t,i} = \alpha \ln Y_{t-1,i} + \beta \Delta \ln Pop_{t,i} + e_{t,i}$

Then we rewrite this equation changing the term $\Delta \ln Y_{t,i}$ by $(nY_{t,i} - \ln Y_{t-1,i})$:

(2) $\ln Y_{t,i} - \ln Y_{t-1,i} = \alpha \ln Y_{t-1,i} + \beta \Delta \ln Pop_{t,i} + e_{t,i}$

And now we reorganize the terms joining both $Y_{t-1,i}$ and extract it as common factor:

(3) $\ln Y_{t,i} - \ln Y_{t-1,i} - \alpha \ln Y_{t-1,i} = \beta \Delta \ln Pop_{t,i} + e_{t,i}$

(4) $\ln Y_{t,i} - (1 + \alpha) \ln Y_{t-1,i} = \beta \Delta \ln Pop_{t,i} + e_{t,i}$

Now, we rewrite the equation representing the lag in housing prices or stock with an L rather than differentiating between $Y_{t,i}$ and $Y_{t-1,i}$:

(5) $(1 - (1 + \alpha)L) \ln Y_{t,i} = \beta \Delta \ln Pop_{t,i} + e_{t,i}$

The next step is isolating the term $\ln Y_{t,i}$ and moving $(1 - (1+\alpha)L)$ as a coefficient to the other side of the equation:

(6) $\ln Y_{t,i} = (\beta \Delta \ln Pop_{t,i} / (1 - (1+\alpha)L)) + (e_{t,i} / (1 - (1+\alpha)L))$

(7) $\ln Y_{t,i} = (\beta \Delta \ln Pop_{t,i} / (1 - (1+\alpha)L)) + e_{t,i}^{*}$[5]

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[5] We leave et as $e_t^{*} = (1/(1 - (1+\alpha)L))^{*}et$ because we do not exactly know what does this perturbation term contain, so we just leave it as a new perturbation term.

When we have $1/(1-(1+\alpha)L)$ it is the same as $[1+(1+\alpha)+(1+\alpha)^2+(1+\alpha)^3+(1+\alpha)^4+\ldots]$, so we can rewrite the expression:

(8) $\ln Y_{t,i}= \beta[1+(1+\alpha)+(1+\alpha)^2+(1+\alpha)^3+(1+\alpha)^4+\ldots]\Delta\ln Pop_{t,i} + e_{t,i'}$

Now this new expression has to be developed and solved multiplying β by each parameter of the geometric progression and then equalizing it to the change observed in today's housing stock or prices given the change in past year's population levels ($\partial\ln Y_{t,i}/\partial\ln Pop_{t-j,i}$). This procedure allows us finding each year's β coefficient that represent the marginal effect of the change in population of every year on today's housing prices or stock:

(9) MARGINAL EFFECTS:

- $\partial\ln Y_{t,i}/\partial\ln Pop_{t,i} = \beta$

- $\partial\ln Y_{t,i}/\partial\ln Pop_{t-1,i} = \beta(1+\alpha)$

- $\partial\ln Y_{t,i}/\partial\ln Pop_{t-2,i} = \beta(1+\alpha)^2$

- $\partial\ln Y_{t,i}/\partial\ln Pop_{t-3,i} = \beta(1+\alpha)^3$

- $\partial\ln Y_{t,i}/\partial\ln Pop_{t-4,i} = \beta(1+\alpha)^4$

- $\partial\ln Y_{t,i}/\partial\ln Pop_{t-5,i} = \beta(1+\alpha)^5$

- $\partial\ln Y_{t,i}/\partial\ln Pop_{t-6,i} = \beta(1+\alpha)^6$

If we want to see the total effect these coefficients have, i.e. the total impact of population growth on housing prices or stock, we only need to calculate the *total multiplier effect* (*TME*), a formula that gives us the aggregation of all the population effects:

(10) $TME = \beta / 1 - \phi^6 = \beta / 1 - (1+\alpha) = \beta / -\alpha$

Multiplier effect on housing prices

This part of the paper tries to demonstrate the effect of changes in population since the 90's on today's housing prices. We have used the procedure explained above and the β and α coefficients found in our OLS estimations in order to obtain each year's corresponding marginal effect. There is also a graphical representation of the evolution followed.

We have used the estimations of cases 4 and 7 (both include same specifications, it is only changed the period contained in each case) because the OLS estimations of these cases give β and α coefficients that allow a clearer development to understand what we are trying to show in this part of the study. Cases 4 and 7 add to the basic specification control variables and provincial dummies; in our analysis we got β coefficients of 1,28 and 0,91 and α coefficients of -0.24 and -0,22 respectively. As it is mentioned above, these coefficients could be too high to represent population effect on housing prices, but they are the ones who allow a better understanding of the idea of the multiplier effect represented in this part of the study.

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[6] $\phi=(1+\alpha)$

As it has been mentioned in the development of the marginal effects equations, it is possible to take, prepare and solve them while we get results with our coefficient values. Equation (8) of the procedure allows developing the marginal effects, which would have the following form in the analysis with the β coefficients of cases 4 and 7:

(8*4) $\ln P_{t,i} = 1,28[1+(1-0,24)+(1-0,24)^2+(1-0,24)^3+(1-0,24)^4+ \ldots]\Delta\ln Pop_{t,i} + e_{t,i}'$

(8*7) $\ln P_{t,i} = 0,9[1+(1-0,22)+(1-0,22)^2+(1-0,22)^3+(1-0,22)^4+ \ldots]\Delta\ln Pop_{t,i} + e_{t,i}'$

If coefficients of the equations are multiplied, we reach point (9) explained above that allows obtaining the marginal effect of each year's population growth in today's housing prices for cases of study 4 and 7. The following numbers presented in table 4 are the results of this procedure and they represent the marginal effect of increase in population due to an immigration boom in housing prices.

Table 4: Marginal Effect of Changes in Population on Housing Prices (Cases 4 and 7[7])

|		CASE4	CASE7
	β	1,2809	0,9112
	α	-0,2425	-0,2161
2011	$\partial\ln P_{t,i}/\partial\ln Pop_{t,i} = \beta$	1,2809	
2010	$\partial\ln P_{t,i}/\partial\ln Pop_{t-1,i} = \beta(1+\alpha)$	0,9702	
2009	$\partial\ln P_{t,i}/\partial\ln Pop_{t-2,i} = \beta(1+\alpha)^2$	0,7349	
2008	$\partial\ln P_{t,i}/\partial\ln Pop_{t-3,i} = \beta(1+\alpha)^3$	0,5567	0,9112
2007	$\partial\ln P_{t,i}/\partial\ln Pop_{t-4,i} = \beta(1+\alpha)^4$	0,4217	0,7142
2006	$\partial\ln P_{t,i}/\partial\ln Pop_{t-5,i} = \beta(1+\alpha)^5$	0,3194	0,5598
2005	$\partial\ln P_{t,i}/\partial\ln Pop_{t-6,i} = \beta(1+\alpha)^6$	0,2420	0,4388
2004	$\partial\ln P_{t,i}/\partial\ln Pop_{t-7,i} = \beta(1+\alpha)^7$	0,1833	0,3440
2003	$\partial\ln P_{t,i}/\partial\ln Pop_{t-8,i} = \beta(1+\alpha)^8$	0,1388	0,2696
2002	$\partial\ln P_{t,i}/\partial\ln Pop_{t-9,i} = \beta(1+\alpha)^9$	0,1052	0,2113
2001	$\partial\ln P_{t,i}/\partial\ln Pop_{t-10,i} = \beta(1+\alpha)^{10}$	0,0797	0,1657
2000	$\partial\ln P_{t,i}/\partial\ln Pop_{t-11,i} = \beta(1+\alpha)^{11}$	0,0603	0,1299
1999	$\partial\ln P_{t,i}/\partial\ln Pop_{t-12,i} = \beta(1+\alpha)^{12}$	0,0457	0,1018
1998	$\partial\ln P_{t,i}/\partial\ln Pop_{t-13,i} = \beta(1+\alpha)^{13}$	0,0346	0,0798
1997	$\partial\ln P_{t,i}/\partial\ln Pop_{t-14,i} = \beta(1+\alpha)^{14}$	0,0262	0,0625
1996	$\partial\ln P_{t,i}/\partial\ln Pop_{t-15,i} = \beta(1+\alpha)^{15}$	0,0199	0,0490
1995	$\partial\ln P_{t,i}/\partial\ln Pop_{t-16,i} = \beta(1+\alpha)^{16}$	0,0150	0,0384
1994	$\partial\ln P_{t,i}/\partial\ln Pop_{t-17,i} = \beta(1+\alpha)^{17}$	0,0114	0,0301
1993	$\partial\ln P_{t,i}/\partial\ln Pop_{t-18,i} = \beta(1+\alpha)^{18}$	0,0086	0,0236
1992	$\partial\ln P_{t,i}/\partial\ln Pop_{t-19,i} = \beta(1+\alpha)^{19}$	0,0065	0,0185
1991	$\partial\ln P_{t,i}/\partial\ln Pop_{t-20,i} = \beta(1+\alpha)^{20}$	0,0050	0,0145
1990	$\partial\ln P_{t,i}/\partial\ln Pop_{t-21,i} = \beta(1+\alpha)^{21}$	0,0038	0,0114

Source: own elaboration

Both cases 4 and 7 show similar behaviours. Marginal effect of population growth on housing prices (2011 in case 4 or 2008 in case 7) decreases as we go back in time. This fits with our expectations because recent year's population growth should have a more significant effect on today's housing prices than the one of earlier years. If there was a

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[7] In case 7 we have done our study since 2000 until 2008, so only pre-crisis years are included. Due to this, all the analysis developed in this part of the paper take as the "present year" 2008 rather than 2011 as it is assumed in case 4.

demographic boom twenty years ago, it is going to affect less today's housing prices than a population boom occurred in 2011. If we look to our results, in case 4, today's population increase is going to have an effect on today's housing prices of 1,28, while the population increase of 1991 only affects today's housing prices in a magnitude of 0,005. From these numbers we can extract one idea: last years' change in population, in this case an increases due to an immigration boom, not only have an effect on the present year's housing prices, but they also affect future housing prices and until their effect is going to be zero many years can be needed to elapse.

Figure 14: Marginal Effect of Changes in Population on Housing Prices (Cases 4, 7)
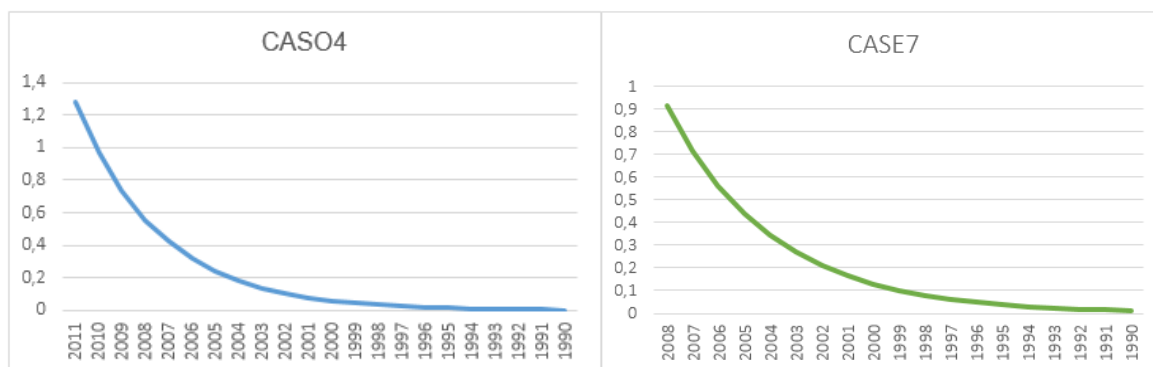
Source: own elaboration

In Figure 14 it is possible to observe this decreasing marginal effect that the immigration boom has had on present housing prices as we go backwards in time. The effect of the first three previous years to 2011 in case 4 and 2008 in case 7 is much more significant than the effect of changes in population observed during the former ones. In case 4 it can be observed that since 1993 the demographic effect is almost 0, so population increases or decreases of 1993 have an insignificant effect on present (2011) housing prices. A similar behaviour is observed in case 7, in which the 1990 effect is not as close to 0 as in case 4 because the coefficient represents the effect since 2008 rather than 2011, but despite of this we can see a clearly the tendency to zero.

Housing prices have presented this behaviour against population changes given the type of market it is. Demography is one of the most important exogenous determinants for housing that affects not only by the side of demand, but also by the side of supply, especially in the case of an increase in foreign-born population that contribute as labour hand in new dwellings construction. The importance of demography in housing market is the main reason of their significant effect on housing prices.

Total multiplier:

After all the periods of time with a marginal effect on present housing prices we can aggregate them and obtain the total multiplier, which represents the accumulative change in the endogenous variable (housing prices in this case), when it suffers an increase of the explanatory variable (population). The procedure requires to put together all the years in which β population coefficients have had values different to zero. If we take equation (10) and substitute our coefficients we are going to have this total multiplier effect for each cases 4 and 7:

(10^{*4}) TME= β / - α = 1,28/ -(-0,245) = 5,28

(10^{*7}) TME= β / - α = 0,91/ -(-0,216) = 4,21

Interpreting these results, it is possible to extract that in case 4, for each log-point unit in which population is increased during past years, there is an increase of 5,28 percentage points in housing prices. In case 7 the magnitude of the effect has been of 4,21 percentage points increase.

Multiplier effect on housing stock

In the following part of the paper it is developed the analysis of the effect that changes in population since the 90's have had on recent year's housing stock. What we do is, through the same procedure we obtained the effect of population changes on housing prices, obtain the effect that population changes have on housing stock. The analysis consists in identifying each year's corresponding marginal effect, the total multiplier and giving graphical representations.

When we proceed with the housing stock analysis we also obtain that cases 4 and 7 are the ones which better represent how do marginal effects of population changes influence housing stock. Both of them add to the basic specification control variables and provincial dummies. The OLS estimations give β coefficients of 0,27 and 0,19 and α coefficients of -0,046 and -0,023 for cases 4 and 7 respectively.

As it has been mentioned in the development of the marginal effects equations, it is possible to prepare, solve and get results from them substituting our coefficient values. Equation (8) of the procedure allows developing the explanation of the marginal effects which would have the following form in the analysis with each case's β coefficients:

$$(8^{*4}) \ \ln H_t = 0,27[1+(1-0,046)+(1-0,046)^2+(1-0,046)^3+(1-0,046)^4+\ldots]\Delta\ln Pop_t + e't$$

$$(8^{*7}) \ \ln H_t = 0,19[1+(1-0,023)+(1-0,023)^2+(1-0,023)^3+(1-0,023)^4+\ldots]\Delta\ln Pop_t + e't$$

If the equations are developed by multiplying coefficients, we reach point number (9) explained above that allows obtaining the marginal effect of each year's population growth in today's housing stock for cases of study 4 and 7. The numbers presented in table 5 are the results of this procedure.

Both cases 4 and 7 show similar results. Marginal effect of population growth on housing stock (2011 in case 4 or 2008 in case 7) decreases as we go back in time. This behaviour fulfils our expectations because last year's population growth should have a more significant effect on today's housing stock than population growths observed twenty years ago. From these numbers we can extract a similar idea to the one already commented in the case of marginal effect in housing prices: changes in population, in this case increases due to an immigration boom, not only have an effect on the same year's housing stock, but also affect future dwellings' levels and until this effect is zero many years can be needed to elapse.

In Figure 15 it is possible to observe the decreasing marginal effect that the increases in population have had on present housing stock. The effect of the first three previous years to 2011 (in case 4) or 2008 (in case 7) is more significant than the effect of the former ones. The slope of the curve in this case is not as deep as in the case of housing prices because the evolution of the marginal effect on housing stock has a slower speed in the decrease of the marginal effect over time than the one observed in housing prices study. In case 4, the decrease is more significant than in case 7, but any of them reaches the zero value in the period of time analysed. The main reason why this is happening is

because there will always be some effect generated by population increases in housing stock remaining from the past while people are alive and participate in this durable goods' market.

Table 5: Marginal Effect of Changes in Population on Housing Stock (Cases 4 and 7[8])

		CASE4	CASE7
	β	0,2712	0,1944
	α	-0,0462	-0,0233
2011	$\partial lnH_t/\partial lnPop_t = \beta$	0,2712	
2010	$\partial lnH_t/\partial lnPop_{t-1} = \beta(1+\alpha)$	0,2587	
2009	$\partial lnH_t/\partial lnPop_{t-2} = \beta(1+\alpha)^2$	0,2467	
2008	$\partial lnH_t/\partial lnPop_{t-3} = \beta(1+\alpha)^3$	0,2353	0,1944
2007	$\partial lnH_t/\partial lnPop_{t-4} = \beta(1+\alpha)^4$	0,2245	0,1899
2006	$\partial lnH_t/\partial lnPop_{t-5} = \beta(1+\alpha)^5$	0,2141	0,1854
2005	$\partial lnH_t/\partial lnPop_{t-6} = \beta(1+\alpha)^6$	0,2042	0,1811
2004	$\partial lnH_t/\partial lnPop_{t-7} = \beta(1+\alpha)^7$	0,1948	0,1769
2003	$\partial lnH_t/\partial lnPop_{t-8} = \beta(1+\alpha)^8$	0,1858	0,1728
2002	$\partial lnH_t/\partial lnPop_{t-9} = \beta(1+\alpha)^9$	0,1772	0,1688
2001	$\partial lnH_t/\partial lnPop_{t-10} = \beta(1+\alpha)^{10}$	0,1690	0,1648
2000	$\partial lnH_t/\partial lnPop_{t-11} = \beta(1+\alpha)^{11}$	0,1612	0,1610
1999	$\partial lnH_t/\partial lnPop_{t-12} = \beta(1+\alpha)^{12}$	0,1538	0,1572
1998	$\partial lnH_t/\partial lnPop_{t-13} = \beta(1+\alpha)^{13}$	0,1467	0,1536
1997	$\partial lnH_t/\partial lnPop_{t-14} = \beta(1+\alpha)^{14}$	0,1399	0,1500
1996	$\partial lnH_t/\partial lnPop_{t-15} = \beta(1+\alpha)^{15}$	0,1334	0,1465
1995	$\partial lnH_t/\partial lnPop_{t-16} = \beta(1+\alpha)^{16}$	0,1273	0,1431
1994	$\partial lnP_t/\partial lnPop_{t-17} = \beta(1+\alpha)^{17}$	0,1214	0,1398
1993	$\partial lnP_t/\partial lnPop_{t-18} = \beta(1+\alpha)^{18}$	0,1158	0,1365
1992	$\partial lnP_t/\partial lnPop_{t-19} = \beta(1+\alpha)^{19}$	0,1104	0,1333
1991	$\partial lnP_t/\partial lnPop_{t-20} = \beta(1+\alpha)^{20}$	0,1053	0,1302
1990	$\partial lnP_t/\partial lnPop_{t-21} = \beta(1+\alpha)^{21}$	0,1005	0,1272

Source: own elaboration

Figure 15: Marginal Effect of Changes in Population on Housing Stock (Cases 4 and 7)
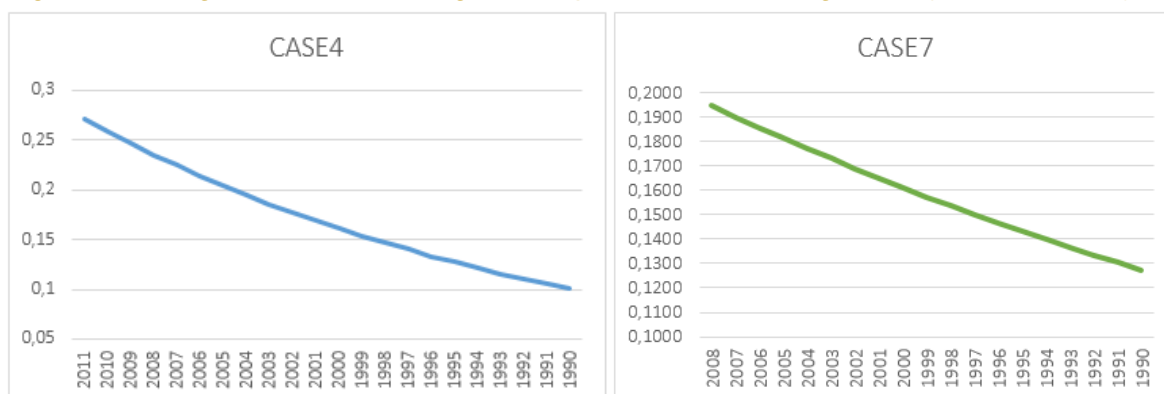
Source: own elaboration

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[8] In case 7 we have done our study since 2000 until 2008, so only pre-crisis years are included. Due to this, all the analysis developed in this part of the paper take as the "present year" 2008 rather than 2011 as it is assumed in case 4.

Total multiplier:

If the total multiplier effect is calculated, we obtain the aggregated impact of the population evolution on housing stock. What we do is represent through it the accumulative change in the endogenous variable (housing stock) when there is an increase of the explanatory variable (population). In this case, the population boom is the main reason that made housing stock significantly increase. If we take equation (10) and substitute our coefficients, we are going to have this total multiplier effect for each cases 4 and 7:

(10^{*4}) TME= β / - α = 0,27/ -(-0,046) = 5,87

(10^{*7}) TME= β / - α = 0,19/ -(-0,023) = 8,35

Interpreting these results, it is possible to extract that in case 4, for each log-point unit in which population was increased during the past years, there is an increase of 5,87 percentage points in housing stock. In case 7 the magnitude of the effect has been of 8,35 percentage points. This indicator aggregates the external effect of population increases generated by immigration in Spain year over year and shows their total contribution to housing stock. As it can be observed, in case 7 the coefficient is higher than in case 4 because in the former one we do not study crisis years which reduce the increasing effect. After 2008 immigration inflows were reduced and housing prices did not present that soaring upward trend they had during the boom years anymore.

8. Conclusions

The results obtained from our study suggest that the Spain's immigration wave observed during the decade between 1998 and 2008 has had a large effect on the housing market behaviour, more specifically in housing prices and stock. Construction has drastically been incremented, not only by the demand side, but also by the supply side because new foreign-born population became employed in the construction sector and this contributed to the increase of the absolute amount of new dwellings; at the same time housing prices have been soared. Our descriptive statistics represents an average annual increase of 2 log-points in housing stock, of 6,5 log-points in housing prices against the population growth of 1,3 log-points. These levels really represent significant growth in the Spanish indicators and at the same time, all these determinants clearly represent the generation of a housing bubble which ended with its bust in 2008. Taking a look to our OLS estimations which set housing prices and stock as dependent variables and population as explanatory variable, our coefficients show a 0,48 price-population elasticity and a 0,53 stock-population elasticity. From this we can extract that housing prices and housing stock both are significantly affected by the demography evolution suffered in the decade.

Furthermore, we can also review what happens with the immigration effect's persistence over time. In our study we observe that yesterday's demographic increases do not only affect today's housing market, otherwise they also affect future levels for many years. In our analysis we have seen that if there is a demographic shock in a certain moment, it keeps affecting housing prices and stock for a long period of time, especially in the case of demographic marginal effect on housing stock.

After these conclusions obtained along the study, we can confirm our hypothesis and say that the Spanish Housing Boom and hence the severity of the consequences that the bubble bust left, were exacerbated by the larger immigration inflows that took place during the same period and contributed to the economic structure imbalances of Spain.

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