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Abstract

House prices in Spain have shown one of the biggest cumulative growth rates among the OECD countries over the past five years and, indeed, over a more extensive period. This paper focuses on analysing this development and its possible determinants. The evidence provided suggests income and nominal interest rates are pivotal explanatory factors, although equity returns may also have been influential in the final years of the sample. According to the estimated models, house prices are currently above their long-term equilibrium level by an amount not unlike other times in the past. Therefore, something of a correction –of an intensity difficult to estimate but not necessarily sharper than in past episodes– may be expected in the future.

1. INTRODUCTION

Housing is an essential component of household wealth and, therefore, one of the factors that contribute to explaining household spending, which accounts for around 60% of GDP in the developed countries as a whole (55% corresponding to consumption, and 5% to residential investment). As a result, house prices are a salient indicator in any analysis of a country's macroeconomic or financial stability. Indeed, there is some evidence internationally of episodes in which strong increases in house prices and in credit for construction and house purchases have tended to fuel one another, being followed by a more or less sharp correction of the resulting disequilibria, with highly adverse consequences occasionally for the banking system and the economy in general. It is thus very important to identify the factors behind changes in house prices and to detect in good time the risks that may ensue.

This paper focuses on the study of house prices in Spain. In our country, the value of housing accounts for around two-thirds of total household wealth and acts as a guarantee for almost one-third of Spanish credit institutions' total assets. In turn, household consumption and residential investment represent 58% and 7% of Spanish GDP, respectively. The analysis of housing in Spain has acquired even greater significance owing to the behaviour of prices in recent years. Since 1976, average Spanish house prices have risen sixteen-fold in nominal terms and have doubled in real terms. Relative to average household gross disposable income, the price of a typical house has increased from a multiple of 2 to one of 3.5 over the same period. In terms of international comparison, Spain would be among the three or four OECD countries evidencing the highest long-term real growth in house prices. Focusing on the recent period, the trend of house prices in Spain is also notable. In real terms they have grown by 55% in the past five years, taking them to almost 30% above the 1991 peak. All these figures warrant a detailed analysis of house prices in Spain. The aim of this paper is to contribute to this analysis by exploring the historical determinants of house prices in Spain, price dynamics and the possible existence of bubbles in respect of their valuation.

The following section analyses the historical trend of house prices in Spain. A distinction is drawn between houses with different characteristics, inasmuch as the information available allows, and these developments are then compared with those in other European and non-European countries. Section 3 reviews the theoretical determinants of house prices. Section 4 offers an initial descriptive analysis of changes in these determinants in Spain, which is complemented with some simple empirical estimates outlined in section 5. Finally, the main conclusions of the paper are drawn in section 6.

2. HOUSE PRICE TRENDS IN SPAIN

The first problem to be addressed on analysing the price of housing is how this may be defined. Housing is not a homogenous good but varies on the basis of its location, size, structure (one-family houses, blocks of flats, etc.), quality of construction, etc. Moreover, the characteristics of existing housing change over time. Consequently, merely plotting the average price of houses bought and sold in each period would not be a suitable indicator. The statistical series available resort in most cases to adjusting for the most obvious differential factors –size, for instance– by means of measuring either the average price per square metre of housing or the average price of houses of a specific size (number of bedrooms) and structure. However, this adjustment is only partly valid. The relationship between house surface area and price is not linear, and nor is the number of bedrooms an unequivocal indicator of the size of the house. And there remain, moreover, differences linked to quality factors, etc.[1]. Nonetheless, these indicators may be expected to reflect reasonably the main house price trends over time.

This paper uses two sources of information to analyse house price trends in Spain. The first is the average price per square metre statistic, produced by the Ministerio de Fomento on the basis of valuations performed by various appraisal companies throughout Spanish territory[2]. This statistic includes quarterly data from 1987 Q1, and distinguishes between houses on the basis of age, location and the size of the municipality where they have been built. The number of total valuations considered has been on the increase over time, as has the number of appraisal companies providing information. Thus, compared with the 19,759 valuations for the year 1987 (relating to two companies), in 1994 this figure had risen to 215,974 (seven companies), exceeding 450,000 (13 companies) in 2000. This might affect the relative reliability of the estimates for the initial years of the sample, especially for specific disaggregations. In any event, what is provided is the fullest information available on prices in the Spanish house market.

The second source of information is the data on average prices per square metre of the new housing for sale in the city of Madrid, compiled by the company Tecnigrama[3]. In this case the information available refers exclusively to the city of Madrid, but its advantage is that the figures go back to 1976, allowing a much longer period to be analysed, albeit with a lesser periodicity (annual data to 1990 and half-yearly data thereafter).

[1] See Bover and Velilla (2001) for an estimate of the impact of changes in quality on house prices in Spain.

[2] See Ministerio de Fomento (2000).

[3] See Tecnigrama (2002).

Both series are depicted in Chart 1. It can be seen how the series differ in level but not in trend, with both moving on a growing trend in nominal (Chart 1A) and real (Chart 1C) terms. Over the total 26-year period considered, the relative price of housing –in relation to the consumption basket included in the CPI– has increased by somewhat more than twofold. However, this growth is not uniform over time. Periods of sharp growth (1977-79, 1986-91 and 1998-02) are followed by periods of moderate and even flat growth. While in real terms there are periods of negative growth, price falls in nominal terms are virtually non-existent. Throughout this paper –and with the exception of the following subsection, which analyses information on prices per type of house, which is available only in the data from the Ministerio de Fomento– an annual series will be used for house prices in Spain combining information from the Ministerio de Fomento with that from Tecnigrama (see Annex).

2.1. Characteristics-based house prices

As earlier mentioned, housing is not a homogenous good. The information from the Ministerio de Fomento allows recent average price developments to be analysed using houses with different characteristics. Analysed below are the differences in the level of prices and in their trend over time for houses valued distinguishing between age, size of municipality, geographical location (coastal as opposed to inland municipalities) and region.

As regards the age of housing, it can currently be seen that prices of new houses (defined as those less than one year old) are approximately 3% dearer than those from 1 to 10 years old, 13% dearer than those from 11 to 20 years old and 28% dearer than houses over 20 years old (see Chart 2). These differences (new versus old) are relatively smaller in Madrid and in the municipalities surrounding the capital because new houses tend to be located on the outskirts, which entails a lower value.

As to the trend over time of these differences, a bigger fall can be seen in the prices of new valued houses in 1992, following relatively higher growth in the previous years (see Chart 2A). Although not shown in the chart, this divergence is due exclusively to the behaviour of the prices of new houses in cities with over 500,000 inhabitants. Hence, in 1992 Q4 there was a year-on-year fall of approximately 20% in these prices, while this decline is non-existent or very small in the case of new housing in other municipalities or in houses over one year old in general. Although one possible explanation might be the more volatile behaviour of the price of new housing in major cities, amid a property boom, this is not corroborated by the data from Tecnigrama; according to the latter, the price of new housing in Madrid continued growing in 1992 and posted only moderate declines in 1993 and 1994 (see Chart 1). While both series

need not coincide exactly[4], the discrepancy observed in this period would advise caution in analysing the heavy falls in new house price valuations in the major cities observed in the Ministerio de Fomento data for 1992. Further, in the latest upturn there are no significant differences between the trend of prices of new housing and those of houses over one year old either for the national total or for the major cities.

The prices of valued houses also differ significantly depending on the size of the municipality in which they are located. Generally, there is a positive relationship between size of municipality and average house price (see Chart 2B)[5]. The highest prices are seen in Madrid and Barcelona (including their respective areas of influence). The difference in prices between the major cities and municipalities with fewer than 20,000 inhabitants has been rising over time, especially during the periods of highest price growth.

As regards differences between coastal and inland municipalities, the effect of coastal tourism would be expected to translate into higher average house prices for the former as opposed to the latter. However, in the case of the major cities, this effect may be masked by other factors. Foreseeably, tourism should have a lesser relative impact on major cities than on small municipalities. The data in Chart 2C corroborate these assumptions. For coastal municipalities with fewer than 100,000 inhabitants, there is a premium compared with inland municipalities of an equivalent size which grows all the more the smaller the municipality in question. This premium increased between 1987 and 1989, it fell until 1993 and it grew continuously once again thereafter, peaking at approximately 40% in the case of municipalities with fewer than 50,000 inhabitants. The premium reflects the effects of the demand for second homes, although the presence of a speculative component cannot be ruled out[6].

Table 1 summarises the changes in national average house prices in terms of size and type of municipality, distinguishing between three different periods: an expansionary period from 1987 to 1991; a period of flat growth between 1992 and 1997; and finally, a fresh expansionary period from 1998 to the present day. As can be seen, at the national level, the expansionary period from 1987 to 1991 was more intense than

[4] One (Tecnigrama) refers to the prices offered to the public in developments for sale and the other (Fomento) to valuations of houses less than one year old; one (Tecnigrama) is restricted to the city of Madrid and the other (Fomento) also includes municipalities on the city's outskirts.

[5] This is consistent with the spatial theory on the value of urban land (see, for example, Wheaton, 1974, and DiPasquale and Wheaton, 1996), in which it is assumed that the value of land diminishes commensurately with distance from the city centre, until reaching, in the absence of town planning restrictions, a value equal to that of land for agricultural use at the external limit of the city.

[6] Speculation is concentrated where there are greater expectations of price rises.

the current upturn[7]. Generally, during expansionary periods, house prices can be seen to grow more in the bigger municipalities, which may simply be the outcome of a greater slope in the supply curve owing to the greater relative shortage of land in these municipalities, or the result of greater speculative pressures in the major cities. In this respect it should be mentioned that in 1992, the first year in which real prices fell, and considering only the prices of houses over one year old, the adjustment was greater in the major cities than in the small inland municipalities.

There are, moreover, significant differences between both expansionary periods. In the current upturn, prices in coastal municipalities with fewer than 100,000 inhabitants have tended systematically to grow above the average of like-sized inland municipalities, while in the previous boom this only occurred until 1989. Notable, too, is the relatively moderate growth of prices in Madrid during the initial years of the current expansionary phase.

With regard to house prices across the different regions, their distribution is highly related to the above-mentioned factors, i.e. to the weight of the major cities and of tourism in each region. Thus, on data to 2002 Q4, the dearest average-per-square-metre prices were to be found in Madrid (€2,148), the Basque Country (€1,958), Catalonia (€1,649) and the Balearic Islands (€1,614), while the cheapest were those of Extremadura (€563), Castilla la Mancha (€704), Murcia (€817) and Galicia (€841). Over the whole of the 1987-02 period, the biggest cumulative growth was in Catalonia (392%), the Balearic Islands (374%) and Madrid (345%). In the latest expansionary phase (1998-02) the biggest growth has been in the Balearic Islands (138%), the Basque Country (104%) and the Canary Islands (91%), highlighting once more the significance of tourist municipalities in the current house price boom. Indeed, both in the Balearic and the Canary Islands cumulative growth over the past four years has been clearly higher than that of the 1987-91 period.

2.2. International comparison

In this case, data availability problems are even more pertinent[8]. It is not only that here are no readily available house-price series for the different countries, but also that those that do exist are not always homogenous. In some cases they measure the average price per house; in others, the average price per square metre; they may refer

[7] In that period the real annual average increase in prices was 12.6% compared with 9.2% in the current expansionary period. Moreover, although the current expansionary period may not yet be over, it should also be borne in mind that the previous property boom began prior to 1987. On the figures from Tecnigrama, between 1984 and 1991 the average price of new houses for sale in Madrid increased by 313% against 132% in the 1987-91 period considered in Table 1.

[8] See also Englund and Ioannides (1997) and ECB (2003).

to the whole of the country, to the capital alone or to the main cities. Further, data compilation methods differ greatly.

With this caveat, Chart 3 depicts real house prices in a set of developed countries. Generally, prices are seen to be on a growing long-term trend. That is to say, in the long run house prices tend to grow in relation to the price of the standard consumption basket. Nonetheless, while in certain countries this rising trend is very clear (for instance in the Netherlands, Luxembourg, Ireland or the United Kingdom[9]), in others it is non-existent or scarcely perceptible (for example, in Germany, Denmark, Canada or Sweden). Spain would be among the high-growth countries[10], with an annual average rate in real terms of 2.9% over the past 26 years, compared with the annual average long-term growth of 0.2% in Sweden, of 3.1% in the United Kingdom and of 3.8% in Ireland[11].

House prices also show significant fluctuations, in certain cases with signs of the possible presence of bubbles. The second half of the eighties is one period in particular in which real house prices tend to grow strongly in most countries, including Spain. However, the significance of the rise in prices in Spain in this period should be stressed. In real terms, average house prices in Spain between 1984 and 1991 would have increased by 106%, compared with 100% in Finland (between 1980 and 1989) or 90% in the United Kingdom (between 1982 and 1989).

These periods of strong price growth tend to be followed by periods of correction. In the case of the boom in the second half of the eighties, this correction was particularly substantial in Finland, where prices fell by 47% in real terms (38% in nominal terms) between 1989 and 1993. In Spain, the correction in nominal terms was virtually zero, standing at 17% in real terms, but extended over a long period (1992-97) in which house prices grew systematically below inflation. Other countries that underwent a significant price adjustment in real terms were the United Kingdom, Sweden and Austria, with real declines in prices of around 20-25%.

In recent years, house prices have once again risen substantially in many countries. Specifically in Spain, they climbed by 55% in cumulative real terms between 1997 and 2002. Nonetheless, this increase is lower than that posted in other countries such as Ireland or the Netherlands, where prices grew by 97% and 73%, respectively, in

[9] Holly and Jones (1997) show how, for the United Kingdom, this rising trend is maintained when an even longer period (1939-1994) is considered.

[10] See the Annex on the construction of the series used for Spain.

[11] Since 1987, however, and according to Ministerio de Fomento data, real annual average growth has been 4.9% in Spain. Germany is the only country with a negative real growth rate over the long term. Nonetheless, there are certain doubts over the reliability of these data.

cumulative real terms from 1995 to 2001, and similar to that in the United Kingdom. The latest data show a clear slowdown in the growth of prices in the first two countries, but not in either the United Kingdom or Spain, where growth rates in real terms remain higher than 10%. Finally, mention may be made of the absence of substantial growth in house prices in Portugal where, as in Spain and other countries, there has been a most significant structural decline in the cost of mortgage financing and a very strong increase in bank lending to households.

3. DETERMINANTS OF HOUSE PRICES

The housing market is characterised by a series of facts which should be borne in mind in any related analysis and which, to a greater or lesser degree, are shared by other property markets (offices, premises, garages, etc.). Firstly, then, housing is at one and the same time an investment and a source of use for its owner, as it provides regular accommodation services. This distinguishes it not only from financial assets (for example, shares), the mere ownership of which does not give rise to any utility, but also from other real assets that lack a sufficiently developed secondary market as to allow their inclusion in an investment portfolio[12]. Furthermore, housing has a long average life and a long production process which means that, in the short term, its supply is relatively rigid. Likewise, housing is linked to a specific location and, therefore, to limited land supply even over the very long term. Lastly, owing to its high acquisition value in relation to average household income, the house market is closely linked to the mortgage financing market. Changes in the supply of mortgage lending are, therefore, a significant determinant of the demand for housing.

Conceptually, it is worth separating the market for the consumption of housing services from the market for house sales and acquisitions[13]. Owner-occupier households are considered both as investors and consumers, buying a house that they rent out to themselves for an implicit rental. For example, this is the model presented in Poterba (1984). House prices would be determined in the market for house sales and purchases, for which demand will be a function of the expected discounted value of the house rental (whether this is explicit or implicit) and this, in turn, will depend on the demand for the consumption of housing services. Consequently, one possible initial approach for analysing house prices would be to study their relationship to rental prices. This, for example, is what Ayuso and Restoy (2003) do, using a general intertemporal

[12] Other examples of real assets similar in this respect to housing are works of art, collector's stamps or coins, etc. (see, for instance, Fase, 2001).

[13] This is possible owing to the existence of rentals. By means of this, a household can consume housing services without owning a house. Likewise, a household can own a house and rent it out, not using it for itself. In an equilibrium situation, however, all houses will have an owner and a user, although a single household may make use of more than one house (second homes).

asset valuation model. However, the data available on the value of rental prices pose several problems. In addition, it is worth considering what determines changes in rental prices[14]. Therefore, this conceptual distinction is less relevant in practice.

Equilibrium in the market for housing requires that the expected return, net of costs for depreciation and expected capital gains or losses, should be equal to the alternative return on investments with the same level of risk. That means the following equation between the price of housing and rentals must hold:

$$ph(t) = \frac{1}{(r(t) + d - \dot{ph}^e(t)/ph(t))} R(t) \qquad (1)$$

where *ph* is the price of housing in real terms, *R* is the rental, also in real terms, and the discount factor built in takes into account the real interest rate –net of tax– on alternative investments of similar risk (*r*), the rate of depreciation (*d*) and expectations of changes in real house prices between t and t+τ.

Equilibrium in the market for the consumption of housing services requires that, for each consumer, the relative price of such services (this price being the real rental, *R*) is equal to the relative marginal utility of housing services in relation to the consumption of other goods.

$$R(t) = \frac{U'(H(t))}{U'(c(t))} = f(y(t), H(t)) \qquad (2)$$

where *H* is the stock of housing, which is assumed to be proportionate to the volume of housing services demanded by the consumer, and *y* is permanent income.

Grouping (1) and (2) gives:

$$ph(t) = g(y(t), H(t), cu(t)) \qquad (3)$$

where *cu* is the user cost, defined as:

$$cu(t) = r(t) + d - \dot{ph}^e(t)/ph(t) \qquad (4)$$

[14] Unlike company dividends, which do not depend directly on the supply of and demand for shares, rentals do depend on housing supply and demand.

The same result would be obtained starting out from the dynamic problem of a representative consumer who derives utility from the purchase of a house[15]. This highlights the inevitable interrelatedness between the market for housing as an asset and as a consumer good. On one hand, the demand for housing for investment purposes depends on the expected equilibrium in the market for the consumption of housing services. On the other, investment and consumer demand factors have an inseparable bearing on the decision to buy a house for one's own use.

However, the existence of indivisibilities and costs (pecuniary and non-pecuniary) in the event of changing the main residence qualifies matters somewhat. The household that buys a house for use as its main residence is implicitly also making an investment decision, which will be conditioned, at least partly, by their expectations as to the future return thereon. But if these expectations change, the possibilities of reducing their investment will be limited by the impossibility of dividing their house and by the costs of changing it, whether by moving to a new owner-occupied house or to a rented one. This confers a degree of irreversibility on the demand for primary homes which does not occur in the case of second homes or those bought exclusively as an investment. Therefore, the greater the weight of the latter, the greater the possibilities of a downward correction in the event of a negative shock in the demand for housing[16].

As in most studies in the literature, equation (3) is our starting point for analysing house prices[17]. However, this is a demand equation where the price is conditional upon the stock of housing. This can be considered exogenous in the short run, since the long average life of housing and the long production process involved means that the flow of new houses is very small in relation to the stock existing at each moment in time, but not in the medium to long run. On the other hand, the alternative of explicitly modelling the supply of housing greatly complicates the exercise, due to the lack of sufficient information on the land market, a key determinant of that supply. Following the commonly used approach in the literature, it is possible to use the lagged housing stock to alleviate the endogeneity problem or, alternatively, to opt for a reduced-form approach in which the stock of housing is replaced by its related determinants on which we have information, such as construction costs and the supply of protected housing.

In relation to user cost, note that the interest rate on alternative investments of similar risk is included in its definition. This interest rate will depend on the set of return-risk alternatives available at each moment in time. Changes in the perceived

[15] See, for example, Dougherty and Van Order (1982), and Bover (1992).

[16] Prices will fall when there is surplus supply in the market. This might occur for several reasons. First, because of the excessive construction of houses due to an erroneous estimate of future demand. Second, because some house-owners decide to sell their houses due either to economic problems or to unsatisfied expectations regarding returns.

[17] See, for example, Muellbauer and Murphy (1997), and Meen (2002).

return-risk on specific assets will generate investment portfolio restructuring which would also affect the demand for housing through changes in the related user cost. A simple though rough means of incorporating these effects is through the inclusion of a variable that reflects not only the return on investments with little or no risk (interbank interest rate, for example), but also the return on alternative investments with greater risk (stock market investment, for instance).

Equation (3) should also be complemented with other determinants of demand, as well as with an appropriate treatment of price dynamics. Among those determinants are demographic factors and those relating to the supply of house financing. The equation is derived from resolving the problem of a representative consumer. Therefore, it does not take into account changes in the distribution of the population across different age groups and, in particular, in relation to the age brackets in which new households are normally formed (20-35 year-olds); the volume of immigration from other countries and migratory shifts in general (for instance, from the country to the city); and other factors affecting the formation of households, such as the tendency towards the formation of single-person households, marrying at a later age, etc.

The presence of constraints on the availability of credit for house purchases alters the equilibrium represented in equation (3). Thus, the behaviour of restricted agents will be determined essentially by the effect of this constraint and not so much by changes in income and the user cost as it is defined in the equation[18]. There is evidence in the United Kingdom (Meen, 1990, and Muellbauer and Murphy, 1997, among others) that fewer restrictions on the supply of house financing, further to liberalisation and competition between financial institutions, have contributed to explaining house price developments, making them more sensitive in recent years to movements in permanent income and the user cost. Moreover, in Nickell (2002) there is a very good example of how a fall in inflation, holding the real interest rate constant, reduces the financial burden of the loan in its first years (front loading), thus allowing a higher leverage on the part of potential home buyers[19]. Given the observed decline in the inflation rate and, consequently, in nominal interest rates in Spain in the last few years, this effect is particularly relevant in our case.

[18] How this equilibrium is altered will depend on the form of restriction, i.e. if the maximum available credit is given in absolute terms, in relation to income or to the financial burden in respect of income.

[19] In Nickell's example, with an inflation rate of 12% and a nominal interest rate of 15%, a loan for an amount of four times the disposable income of the borrower, to be paid in 25 years, would entail a financial burden of 60% of the borrower's income in the first year. This would hardly be affordable for the borrower or admissible by the lender. On the other hand, with an inflation rate of 2.5% and an interest rate of 5.5% (i.e. the same real interest rate), the same loan would entail a financial burden of around 25% of borrower's income in the first year. Hence, for a given real interest rate, a fall in inflation allows a higher level of debt, i.e. there is a relaxation of the credit constraint. The price of this relaxation is that, after ten years, the financial burden in the second case would still be 20%, while in the first case it would already be lower than that, due to the higher rate of erosion of the real value of debt caused by the higher inflation in this case. The front loading effect had already been explained by Kearl (1978).

Finally, equation (3) should be rounded off with an analysis of price adjustment dynamics. Normally, the analysis of dynamics is fundamentally empirical, but it is worth highlighting some consequences derived from the theory. Hence, for instance, the existence of specific short-term supply adjustment costs is obvious, owing among other things to regulatory factors[20]. An unexpected increase in demand can only be met over time, as houses started in response to this greater demand are progressively completed. As a result, a price over-reaction is to be expected in the short term, which would subsequently be corrected. But there is also some evidence that these adjustment costs are not symmetrical (Kenny, 1999). That is to say, it is more costly to increase the volume of newly built houses than to reduce it. Therefore, prices might, in the short term, overreact more upwards than downwards, with the adjustment process proving slower in the first case than in the second[21].

Furthermore, the housing market is far from being a friction-free market. The existence of search costs and other shortcomings mean that prices do not adjust automatically to supply and demand mismatches[22]. Genesove and Mayer (2001) document the existence of "loss aversion" in the behaviour of house-owners who wish to sell their house to buy a new one. Hence those owners whose house has undergone a loss in nominal value in respect of the purchase price tend to set a higher sale price in relation to the market price, and to spend greater time on average selling their house than owners whose house has risen in price since they bought it. This type of behaviour would tend to generate a lower volume of transactions –and, therefore, greater search costs– and a slower adjustment by prices downwards than upwards.

The significance of future price expectations in determining the user cost of housing also adds potential self-fuelling effects to price movements, via adaptive expectations. Nonetheless, this is not the only way in which past changes in house prices can affect housing demand. Stein (1995) and Ortalo-Magné and Rady (2001) highlight the importance, for house price dynamics, of the interaction between past changes in house prices and the presence of liquidity constraints. Thus, changing a house for a better (more expensive) one normally requires a minimum payment in cash. The ability of house-owners to meet this payment in cash depends on their net wealth (the market value of their house less the debt incurred in buying it). Consequently, rises in house prices increase their possibilities of meeting this initial payment, stimulating the

[20] See, for example, the comparison between house prices in the United Kingdom and in the United States in Meen (2002), and across various US metropolitan areas in Capozza *et al* (2002).

[21] However, in some cases, the existence of a floor in the supply of housing, given by the stock of existing dwellings, could have the opposite effect, i.e. to generate a stronger reaction downwards in the case of an excess supply.

[22] DiPasquale and Wheaton (1994) mention as evidence in this respect the fact that price is not a sufficient statistic in determining the volume of residential investment. Other housing market variables, such as the vacancy rate, have an additional explanatory content to that of prices in the determination of the volume of newly constructed houses, which would suggest that prices respond only gradually to supply and demand mismatches.

demand for housing which, in turn, generates fresh price rises. A self-fuelling phenomenon thus arises, which operates both upwards and downwards, and which has nothing to do with speculative processes but rather with the particular characteristics of the housing market. This dynamic process will be all the more intense the greater households' degree of leverage.

4. AN INITIAL ANALYSIS OF HOUSE PRICE DETERMINANTS IN SPAIN

The aim of this section is to conduct an essentially descriptive initial analysis of those variables which, in accordance with the preceding section, are liable to have contributed to determining how house prices trend in Spain[23]. Charts 4 and 5 depict some of these variables[24].

Table 2 presents the results of the order of integration tests of the series used. As usual when the number of observations is limited (26 in our case), these tests should be viewed with caution. Specifically, the real price of housing appears to be second-order integrated [I(2)], while real household income and the stock of houses per inhabitant would be I(1) or I(2). In the light of Chart 4B and of the theoretical relationship between the foregoing variables, it has been considered that they are all I(1). The user cost and the real interest rate would be I(0) or I(1), while the nominal interest rate would be I(1).

The income variable used is household gross disposable income per inhabitant aged over 25. This is because, while the number of total inhabitants per household has steadily declined over the last twenty years, the number of inhabitants aged over 25 per household has remained relatively stable, during the whole period, at around 2.15. Therefore, the measure used is a proxy –subject to a scale factor– of disposable income per household, and it has the advantage over this latter measure of being exogenous, since the number of inhabitants is exogenous while the number of households is not[25].

Chart 4C depicts the user cost defined as the nominal interest rate less the expected increase in house prices between t and t+1 (alternatively, the real interest rate less the expected increase in the relative price of housing). The interest rate used is the mortgage lending rate to households for house purchase. Meen (1990) shows that, in the presence of credit restrictions, the relevant interest rate for defining user cost is a weighted average of the interest rate on mortgage loans and of the interest rate on

[23] See also Martínez Pagés and Matea (2002).

[24] See the Annex for the source and definition of each of the variables used.

[25] The pace of household formation is not independent of the behaviour of house prices.

alternative investments with the same risk. Since different interest rates trend relatively in parallel and given that what is important is not the level of but the changes in user cost, this is considered to be an acceptable simplification[26]. The expected future price is estimated in different ways, with no qualitative differences in the results. Estimates presented in Table 3 correspond to the case in which the observed change in prices at t-1 is used as a measure of the expected future change for t+1.

It is worth noting that, in the estimate of the user cost, the effect of tax is not taken into account. Tax effects are obviously very significant [see, e.g. Dolado *et al.* (1999)]. However, marginal rates and not average rates are the relevant ones and the multiplicity of possible individual situations makes an adequate treatment of this aspect very difficult. Bover (1992) considers an average effective tax rate and obtains practically the same results with the tax-adjusted and unadjusted user cost. This may simply be due to the fact that, as can be seen in Chart 4C, movements in the user cost are mainly driven by the behaviour of expected house price changes and not by the interest rate, in spite of this being significant. But it may also reveal the problems involved in estimating in a relatively simple way –and, therefore, feasible in an exercise like the one carried out here– a very complex effect. An appropriate treatment of this issue goes beyond the scope of this work and this limitation should be taken into account when looking at the results.

Regarding the stock of housing, Chart 5B shows how the average number of homes per inhabitant aged over 25 in Spain has grown most significantly in recent years, from 0.67 in 1976 to 0.76 in 2002 (including houses started but not finished). This is largely due to the boom in second homes, the result in turn of Spanish households' higher level of income. Nonetheless, a further quite significant portion is attributable to the purchase of homes in Spain by non-residents, the lack of sufficient information on which makes it difficult to separate one effect from the other. The total number of houses constructed is particularly high at the beginning and at the end of the sample, and is much smaller during the expansionary period in the late eighties. As earlier mentioned, however, this cannot be interpreted as an indicator of the degree of flexibility of supply, since this variable is endogenous. Increases in the number of houses constructed may be due to both rises in demand and supply. As regards supply determinants, Chart 5B reveals how residential building costs are on a slightly diminishing trend in real terms, meaning they cannot contribute to explaining the rising trend of house prices.

In respect of demographic variables, this paper has used as its main variable the population aged over 25. The 25 to 29-year-old cohort as a proportion of the total

[26] In fact, when the mortgage rate is replaced by the average interest rate on term-deposits of commercial and savings banks (a possible measure of the investment opportunity cost), results do not change.

population aged over 25 has also been considered. Both variables are depicted in Chart 5C. It can be seen how demographic pressure on the housing market –as measured by the first indicator mentioned– would have been relatively stable throughout most of the sample period, with the exception of the years around 1980, when it would have been somewhat less, and the final years of the sample, in which it would have been greater. Nonetheless, this momentum in the closing years of the sample is not reflected in the 25 to 29-year-old population variable, which stems from the fact that this high increase in population does not correspond to higher natural growth but to strong immigration. Indeed, the data from the 2001 Census indicate that the INE population estimates used in this paper would be understating the effect of demographic pressure in the final years of the sample.

Finally, Chart 5D represents the real return on the Madrid Stock Exchange General Index. It can be seen how stock market returns tend to be greater at the onset of expansionary phases (1984-87 and 1996-98) and negative in slowdowns (1990-92 and 2001-02). This type of behaviour might also contribute to explaining in part house prices, especially in the last cyclical expansion, in which household investment on the stock market was more widespread than in earlier periods.

When looking at the price of housing and household disposable income (Chart 4), the close relationship between them stands out. The periods in which the former grows more in real terms (1978-79, 1986-91 and 1998-2002) generally coincide with periods of expansion of household disposable income. However, two facts should be highlighted: the lesser correlation between the growth of income and of house prices in the second half of the nineties (Chart 4B); and the trend rise in the house price/household income ratio (Chart 4A). Regarding the former fact, it can be seen how, in the last cyclical phase, the increase in real house prices was delayed until said phase was relatively advanced, while prices continued to grow strongly during the 2001-02 slowdown. Part of this behaviour could be explained by the trend in alternative investment returns, including the stock exchange return. As regards the second fact, were the rising trend of the house price/household income ratio to be maintained, this would ultimately convert housing into an unaffordable good for families. Therefore, it is to be expected that the trend observed in the sample period should correspond to some structural change in the long-term equilibrium relationship that will ultimately peter out[27].

From the inspection of Charts 4 and 5 and Table 2, several variables emerged as potential explanatory variables for the upward trend in the house price/household

[27] The evidence in the United Kingdom and in other countries where there are long series on house prices is that such prices tend to grow, in real terms, on a par with or to a lesser extent than income. See, for example, Holly and Jones (1997), for the United Kingdom, and Malpezzi (1999), for the United States.

income ratio. Firstly, there is income itself. A long-run income elasticity of more than one could explain part of that observable trend from the mid-eighties. However, a very high income coefficient could hardly be projected out of the sample period, since this would mean, as already mentioned, that housing would end up being unaffordable for most households. The housing stock and building costs, also trending variables, cannot explain the rising trend of the price-income ratio either, since that would require either a positive impact of housing stock increases on house prices or a negative impact of building costs, both contrary to what would be expected from the theory.

A more plausible alternative explanation is the existence of an upward impact on prices, during most of the sample period, coming from the relaxation of credit restrictions. Chart 4D shows how the housing credit/household income ratio has grown continuously since 1986, as has the housing credit/value of property assets ratio since the early nineties. As we have partially seen already, there are several potential factors supporting this growing indebtedness. First, greater competition and more flexible regulations may have encouraged greater availability of financing for housing. Moreover, the decline in inflation rates should have further stimulated loan supply by reducing the financial burden in the first years of the loan's life. Nonetheless, another part of the growing indebtedness can also be endogenous, coming from the house price increase by itself, which mean a higher collateral for the loan. The nominal interest rate fall in the second half of the sample picks up part of the first two effects, although much less of the third.

In view of the foregoing comments, the following section seeks to quantify some of the possible relationships mentioned between the price of housing and its determinants.

5. SOME EMPIRICAL RESULTS

5.1. Estimates

The approach chosen is, as previously mentioned, essentially empirical. It is not sought to estimate well-identified structural relationships, but only to analyse the dynamic relationship between house prices and their main determinants in Spain. To do this, equations with an error correction mechanism (ECM) are estimated, using annual series from 1976 to 2002.

Table 3 summarises the main results. The first column in this table shows the estimates of the coefficients of the basic theoretical model, in which the real house price is related to income, user cost, the stock of housing and the stock exchange return

since 1995, from when household investment in shares becomes more widespread. Though the R^2 of the equation is high, almost none of the variables is statistically significant. This evidences the existence of a multicollinearity problem in the data. Moreover, the housing stock, in spite of being lagged one period, has a positive coefficient reflecting the tendency for higher increases in the number of dwellings the higher the demand for houses. Instrumenting this variable with the residential building costs index, the long-run coefficient is still positive. Finally, when the housing stock is simply replaced with the costs index (reduced form), this proves significant in the long term, but with the opposite sign to the one expected (i.e. negative).

When the housing stock is dropped from the equation, multicollinearity problems disappear, but the user cost continues to be non-significant. This is so both when the user-cost' definition presented in the previous section is used as well as when the observed change in house prices at t-1 is replaced by a forecast at t of changes in house prices at t+1. This forecast is based on the past behaviour of prices and of the rest of the variables in the model.

Column 2 of Table 3 shows the results of a simplified model in which non-significant variables have been eliminated. As can be seen, income is highly significant, both in the short term and in the long term. The t-statistic test on the coefficient of the level of prices at t-1 shows that the null of no cointegration between house prices, income and stock exchange return is rejected, according to the critical values tabulated in Banerjee, Dolado and Mestre (1998), for the case of 25 observations and two regressors. The fact that the user cost does not appear explicitly in the equation does not mean at all that this was non-significant. House price growth at t-1 is highly significant and this may be reflecting the impact of past price increases on the expectations of future movements and, therefore, on the user cost of housing. In fact, when the lagged price growth rate is dropped, the user cost proves significant and with the correct sign, but the fit of the equation worsens and the null of no cointegration among the variables in the model cannot be rejected. This could be explained by the lagged house price growth reflecting not just the expectation (user cost) effect but also the wealth effect and the supply adjustment cost effect mentioned in Section 3.

The estimated long-run house price income elasticity, presented in column 2 of Table 3, is 2.8. This high value can be seen as partly reflecting the impact of the above-mentioned relaxation of credit constraints during the sample period. With a view to analyse this, in the following columns of Table 3, the mortgage debt/income ratio and the mortgage nominal interest rate are alternatively included in the model. Both prove non-significant in columns 3 and 4. Nonetheless, this seems to be the outcome of the high sample correlation between these new variables and income, which is 0.92 in the

case of the debt/income ratio and 0.51 in the case of the nominal interest rate. If a unitary long-run income elasticity is imposed in the model (columns 5 and 6), both new variables are significant and the null of no cointegration among the variables in levels is rejected, for the case of 25 observations and three regressors[28]. The estimated long-run elasticity of house prices to credit is 0.35 and the semi-elasticity to the nominal interest rate, -4.5. However, as is the case with income elasticity in the unrestricted case, these elasticities could be overestimating the real effects, as a result of the imposition of unitary income elasticity. In other words, the strong sample correlation between income, on the one hand, and household indebtedness and nominal interest rates, on the other, creates an important identification problem that prevents us from properly estimating the effect of these two factors on the long-term equilibrium house price[29].

Charts 6 and 7 show the coefficients of the recursive estimate of models 2 and 6 of Table 3 (the simplified unconstrained model and the model with unitary income elasticity and nominal interest rate)[30]. In both cases, some instability is observed in the parameters around 1995, when income elasticity diminishes as a result of the lesser correlation of house prices to income in the last cyclical expansion. Hence, it can be seen that the inclusion of the stock exchange return variable only partially solves this problem[31]. The instability of the coefficients is naturally more important in the unconstrained model, in which income has a greater explanatory role. Furthermore, in the model with unitary income elasticity, the nominal interest rate is only significant, in the long run, when at least the year 2000 is included. These results are consistent with the difficulties of accurately estimating the coefficients of the model in a period evidencing expensive and far-reaching structural changes. A greater effect of interest rates in the final part of the sample would, for example, be consistent with a reduction throughout the sample of the degree of credit restriction[32].

5.2. Market outlook

Although none of the specifications presented are totally satisfactory, it is worth exploring what they may tell us about the explanatory factors of recent house price

[28] Although not presented in the Table, the one-period lagged housing stock and the user cost are still non-significant in these two cases.

[29] Other variables which were tested but did not improve the estimate are: financial wealth, the proportion of the population aged 25-29 and the number of constructed protected houses per inhabitant aged over 25.

[30] In order to have recursive estimates prior to 1995, the coefficient of the stock exchange return is always made equal to the estimated coefficient for the whole sample.

[31] One possible cause might be the relatively volatile behaviour of average household income in the first half the nineties (see Chart 4B). Thus, for example, household disposable income in 1993 was boosted by an exceptional refund of taxes, delaying in this way the cyclical trough in this area to 1994. Nonetheless, both an adjusted measure of average household disposable income, and average real GDP per household, number of employed or average consumption per household give similar results.

[32] An attempt to capture this was made by interacting the interest rate variables with the mortgage debt/income ratio, but the interaction proved to be non-significant.

developments and about the possibility of a certain imbalance having built up. In this connection, Charts 8 and 9 offer, for each of the two models presented in columns 2 and 6 of Table 3 (the simplified unconstrained model and the model with unitary income elasticity and nominal interest rate), an analysis of the adjustment of the equation in the sample period and a simulation for the non-sample period 2003-2007. The assumptions considered for the simulation are: growth of average household disposable income of 0.8% per annum (that observed between 1976 and 2001), a progressive rise in the nominal interest rate to 5.75% by 2005, and the maintenance of a real return on the stock market of 2.6% (which also coincides with the average for the sample period). In addition, an analysis is made of the contributions to growth of real house prices in both the sample and non-sample periods. Finally, Chart 10 jointly depicts the growth rates of real house prices simulated with the two models.

Whichever the model selected, it can be seen how recent increases in house prices place these above their long-term equilibrium level, although this pattern does not differ from that recorded in past episodes. In 2002, real house prices stood between 8% and 17% above their long-term equilibrium, the difference being greater in the case of the model with unrestricted long-term income elasticity[33]. The differences between the two models are not confined to this but also affect the implicit adjustment process in the simulations. In the case of the unrestricted income elasticity model, there is a swifter correction which entails something of an over-reaction. Real house prices would thus fall below their long-term equilibrium, with a maximum cumulative decline of 15%, similar to that seen in the previous cycle in the late eighties/early nineties. However, against the current background of lower inflation rates, this would involve a fall in nominal terms of around 7-8%. In the case of the model with long-run unitary income elasticity, the adjustment is slower, with long-term equilibrium still not having been reached by 2007. Real house prices would grow at positive rates of 7% and 2% in 2003 and 2004, respectively, and would decline moderately in the following years. It should be recalled, however, that the foregoing is not a forecast but the result of a simulation, which depends on the ad-hoc assumptions considered. It is, nonetheless, useful in that it illustrates the different adjustment dynamics in the two models.

6. CONCLUSIONS

The housing market in Spain has seen a significant cyclical expansion in recent years which has made for high price increases. This paper has attempted to analyse this development in relation to the historical trend of house prices in Spain and to the associated theoretical determinants. Inevitably in a market as complex as that for

[33] These results are consistent with those obtained by Ayuso and Restoy (2003).

housing, various factors come into play, some of which are difficult to quantify like, for example, those related to tax treatment. Analysing the role of the different factors is made even more complicated by the existence of –presumably temporary– trends during the available sample period in several of the explanatory variables. This creates an important identification problem, that prevents us from estimating properly the effects on the long-term equilibrium price of housing of income growth and of the relaxation of credit restrictions during the sample period.

Given these circunstances, the empirical part of the paper considers two alternative basic models: one with long-run income elasticity restricted to unity, the other with unrestricted income elasticity. In the first case, the relaxation of credit constraints, reflected both in the growth of housing loans as well as in the fall in the nominal interest rates applied to those mortgage loans, accounts for a substantial portion of house-price growth, which has consequences for future price dynamics. In any event, prices would, in both models, currently be –albeit to a differing extent– above their long-term equilibrium level.

There are some limitations to the analysis performed here and we cannot draw strong conclusions. However, the evidence presented points to a current overvaluation of house prices which would, nonetheless, be compatible with trends in the explanatory variables and with the dynamic historical pattern of response of prices to those trends. Therefore, something of a correction –of an intensity difficult to estimate, but not necessarily sharper, in real terms, than in past episodes– may be expected in the future.

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TABLE 1

AVERAGE HOUSE PRICES IN SPAIN

National total	Cumulative nominal growth	Ann. avrg. rate (%)	Cumulative real growth	Ann.avrg. rate (%)
1987-91 boom	103.7	19.5	61.0	12.6
1992-97 stagnation	6.0	1.0	-17.4	-3.1
1998-02 boom	78.3	12.3	55.0	9.2
Total (1987-02)	**284.8**	**9.4**	**106.1**	**4.9**

By size and type of municipality	Cumulative real growth (%)							
	Madrid	Barcelona	Others over	500-	Inland municipalities		Coastal municipalities	
	& met.area	& met. area	500,000inhat	100,000	100-50,000	<50,000	100-50,000	<50,000
1987-91 boom	87.1	104.8	62.3	59.0	44.1	43.7	35.6	36.4
1992-97 stagnation	-19.1	-11.1	-12.5	-8.6	-5.3	-12.2	-12.5	-11.0
1998-02 boom	59.7	68.1	62.7	53.9	51.2	42.5	63.0	64.9
Total (1987-02)	**141.5**	**205.9**	**131.1**	**123.6**	**106.2**	**79.8**	**93.4**	**100.3**

Source: Ministerio de Fomento.

TABLE 2

Unit root tests

	ADF			PP		
	1	**2**	**3**	**1**	**2**	**3**
Log(ph)	-1.373	-1.881	-2.795 *	-0.195	-1.971	-4.343 ***
Log(y)	-0.563	-2.704 *	-6.881 ***	-0.075	-2.741 *	-6.764 ***
Log(yf)	-0.833	-2.567	-4.648 ***	-0.056	-2.380	-4.391 ***
Log(GDPr)	-0.702	-2.372	-3.467 **	0.415	-2.005	-3.624 **
Log(emp)	-0.130	-2.528	-3.948 ***	0.288	-1.832	-3.349 **
CU	-2.555	-3.990 ***		-1.883	-4.074 ***	
I	-0.417	-3.340 **		-0.204	-3.323 **	
IR	-2.531	-2.925 **		-2.398	-2.882 *	
Rstock	-2.652 *	-6.271 ***		-2.652 *	-6.271 ***	
Log(hh)	0.916	-2.352	-4.470 ***	-0.798	-2.398	-5.852 ***
Log(H)	2.516	-1.431	-4.737 ***	0.746	-1.656	-5.155 ***
Log(hou)	2.439	-1.421	-4.563 ***	3.978	0.051	-2.752 *
Pop_25_29	-5.471 ***			-1.165	-1.473	-1.976
Log(wfn)	-0.564	-3.287 **		-0.914	-6.192 ***	
Log(L/y)	0.888	-2.505	-5.568 ***	2.345	-2.452	-5.730 ***
Log(cc)	-1.154	-4.381 ***		-1.131	-4.378 ***	
Log(H_pro)	-0.727	-4.593 ***		-1.429	-4.611 ***	

(*) Rejects the null hypothesis with a 10% significance level
(**) Rejects the null hypothesis with a 5% significance level
(***) Rejects the null hypothesis with a 1% significance level

TABLE 3

EQUATIONS WITH ECM

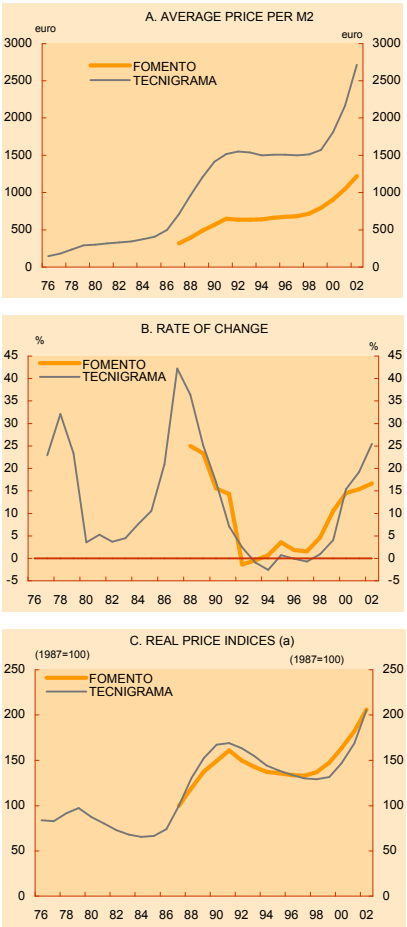
Dependent variable: ΔLog(ph). OLS. Annual data from 1978 to 2002

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.81	-1,32***	-0.43	-1.30	1,19***	0,72***
	(-1,06)	(-3,43)	(-0,26)	(-1,10)	(4,79)	(4,46)
$\Delta Log(ph_{t-1})$	0,77	0,66***	0,65***	0,66***	0,61***	0,59***
	(1,64)	(5,25)	(4,83)	(4,53)	(4,76)	(4,61)
$\Delta Log(y_t)$	1,72**	2,16***	2,03***	2,16***	1,77***	1,91***
	(2,76)	(4,42)	(3,65)	(3,80)	(3,66)	(3,90)
ΔCu_t	0.09					
	(0,19)					
$\Delta Log(hh_{t-1})$	0,59					
	(0,20)					
ΔI_t						-1,30*
						(1,90)
$Rstock_t$*DUM95	-0.11	-0,16***	-0,14**	-0,15**	-0,10*	-0,14**
	(-1,52)	(-2,92)	(-2,14)	(-2,45)	(-1,99)	(-2,54)
$Log(ph_{t-1})$	-0,39*	-0,49***	-0,44***	-0,49**	-0,32***	-0,19***
	(-2,04)	(-4,92)	(-3,07)	(-2,33)	(-4,70)	(-4,04)
$Log(y_{t-1})$	0,91	1,36***	1.01	1.35	0,32(a)	0,19(a)
	(1,36)	(4,67)	(1,39)	(1,83)		
Cu_{t-1}	0.12					
	(0,29)					
Log_hh_{t-1}	0.83					
	(1,05)					
$Log(L/y)_{t-1}$			0.04		0,11***	
			(0,53)		(4,26)	
I_{t-1}				-0.01		-0,86***
				(-0,02)		(-4,26)
			Statistics			
R^2	0,88	0,86	0.86	0.86	0.85	0,86
s_ε(*100)	3,45	3,23	3.30	3.32	3.33	3,25
DW	2,61	2,41	2.46	2.41	2.43	2,61
Q(4)	4,84	5,81	6.70	5.83	7.130	7,09
(p-value)	(0,30)	(0,21)	(0,15)	(0,21)	(0,12)	(0,13)
Critical value test ECM at 5% (b)	-4.18	-3.64	-3.91	-3.91	-3.91	-3.91
			Long-run elasticities			
Log(y)		2,78	2.32	2.78	1(a)	1(a)
I				-0.02		-4,50
Log(L/y)			0.09		0.35	

(a) Restricted parameter.
(b) Cointegracion test (Banerjee, Dolado and Mestre, 1998).
(*) Rejects the null hypothesis with a 10% significance level
(**) Rejects the null hypothesis with a 5% significance level
(***) Rejects the null hypothesis with a 1% significance level

CHART 1

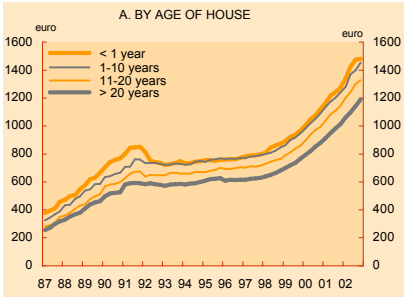
House prices in Spain

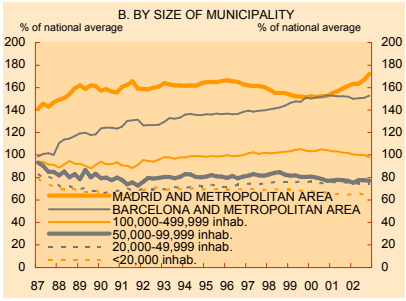


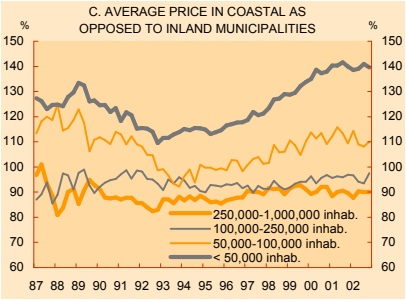
Sources: Ministerio de Fomento and Tecnigrama.
(a) Deflated by the CPI.

CHART 2

Average per-square-metre price of housing in Spain



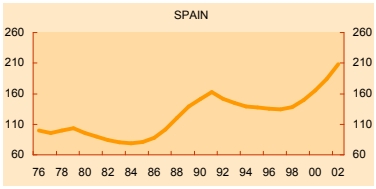


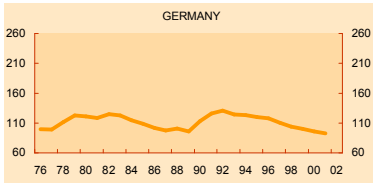


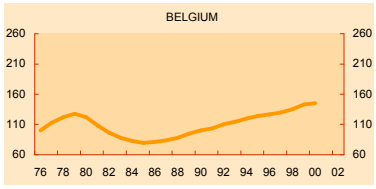
Source: Ministerio de Fomento.

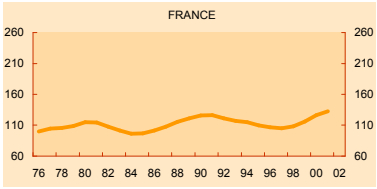
CHART 3

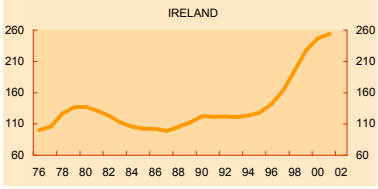
Real house price indices.
First observation available=100

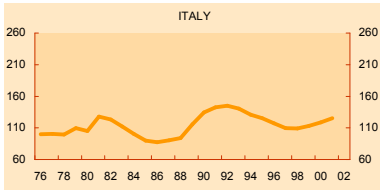


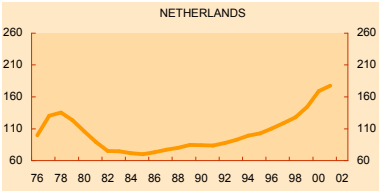


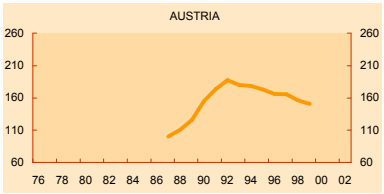


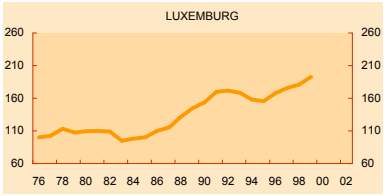


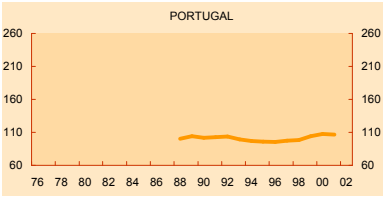


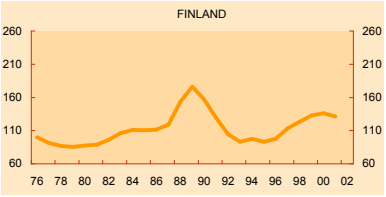








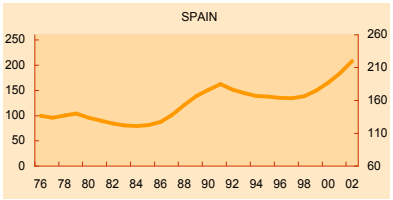


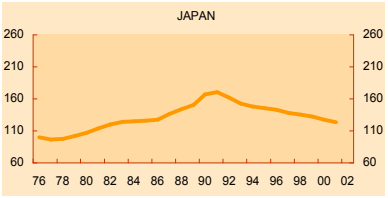


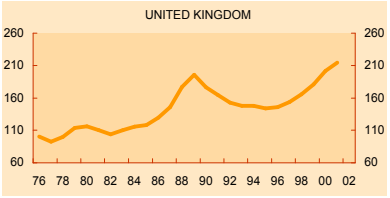
Sources: BIS, Ministerio de Fomento, Tecnigrama and authors' calculations.

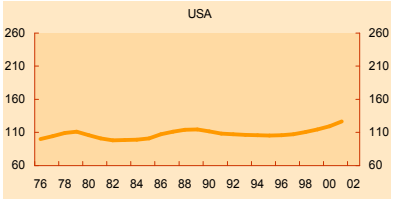
CHART 3 BIS

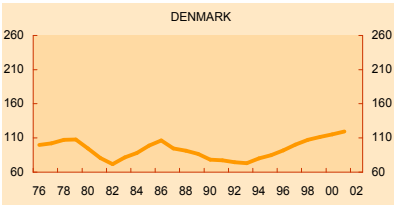
Indices of real house prices.
First observation available=100

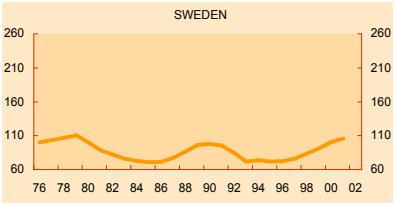


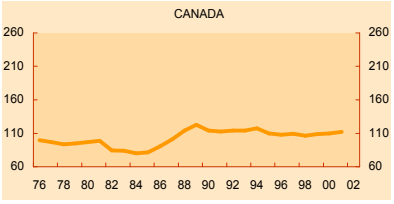








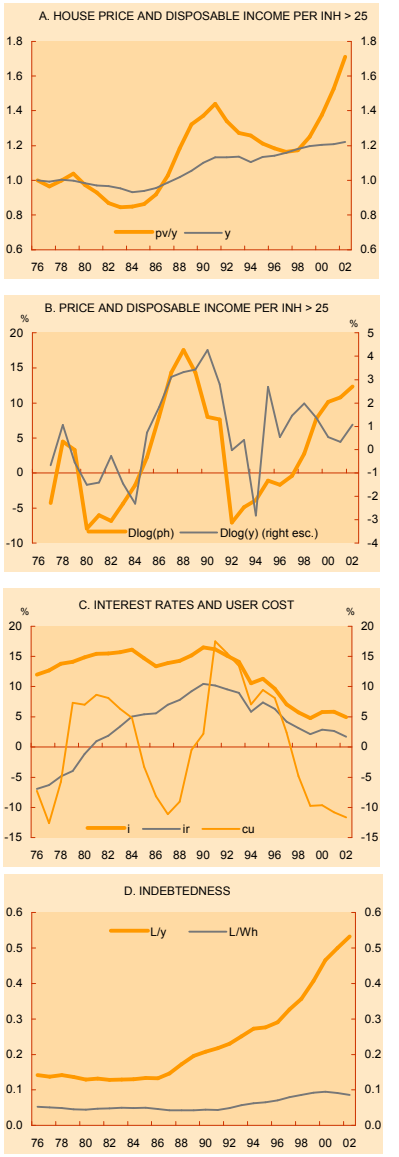




Sources: BIS, Ministerio de Fomento, Tecnigrama and authors' calculations.

CHART 4

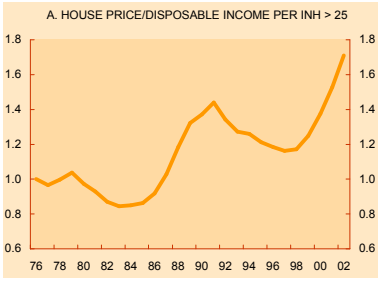
House prices and related determinants in Spain (I)

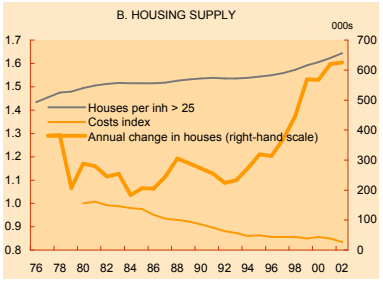


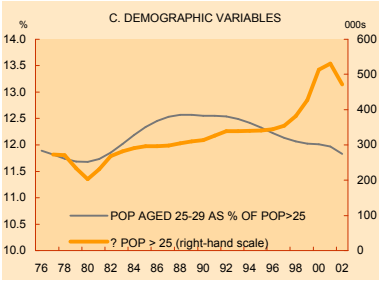
Sources: Ministerio de Fomento, INE, Banco de España and authors' calculations.

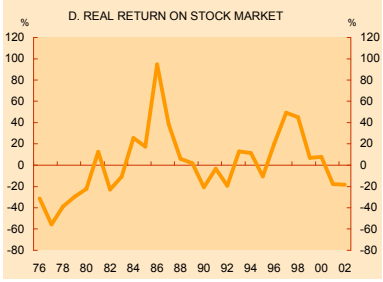
CHART 5

House prices and related determinants in Spain (II)









Sources: Ministerio de Fomento, INE, Banco de España and authors' calculations.

CHART 6: Recursive estimate of the unrestricted model

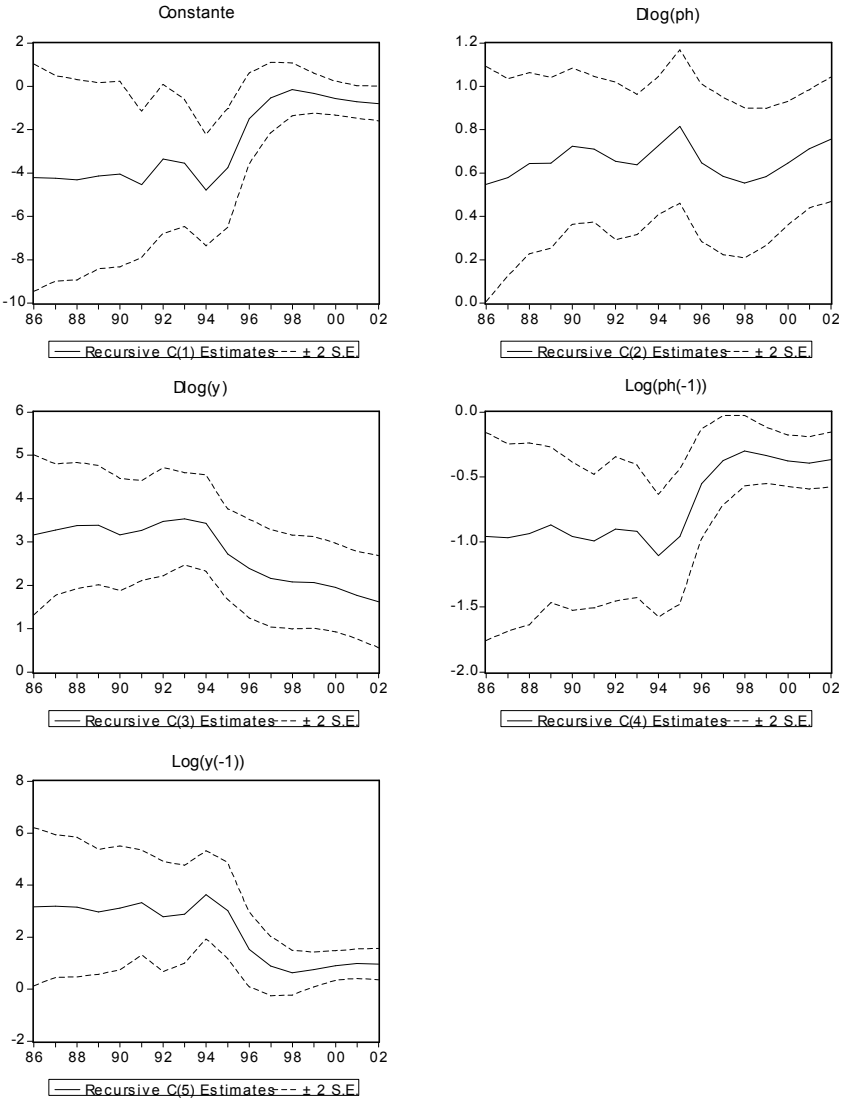
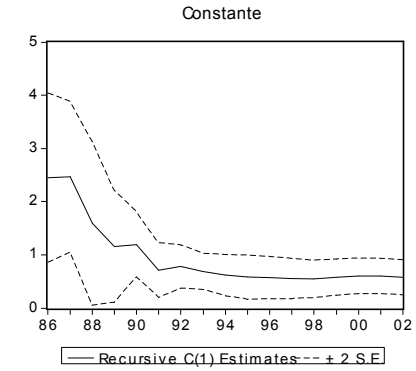
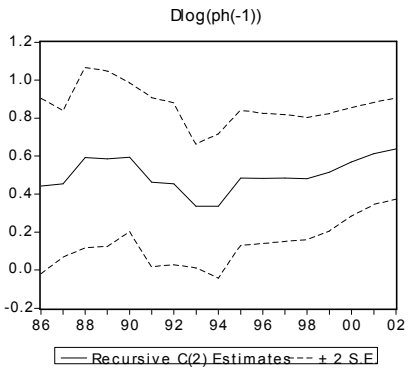
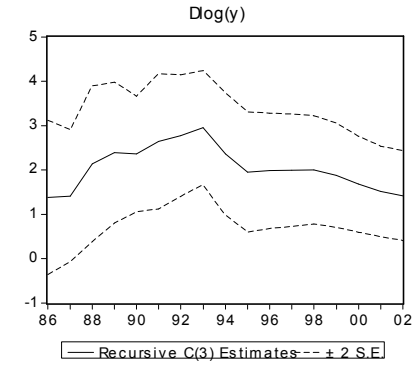
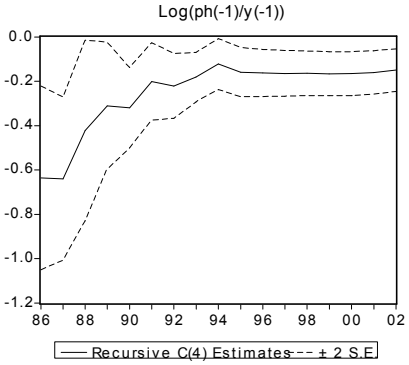


CHART 7: Recursive estimate of the restricted model









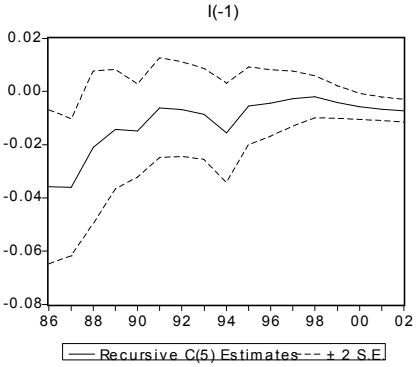
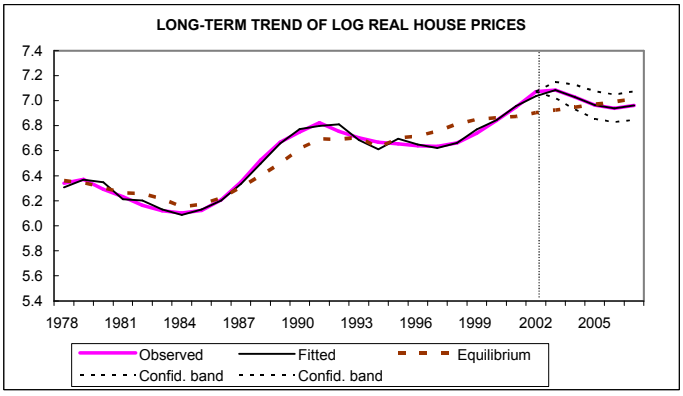
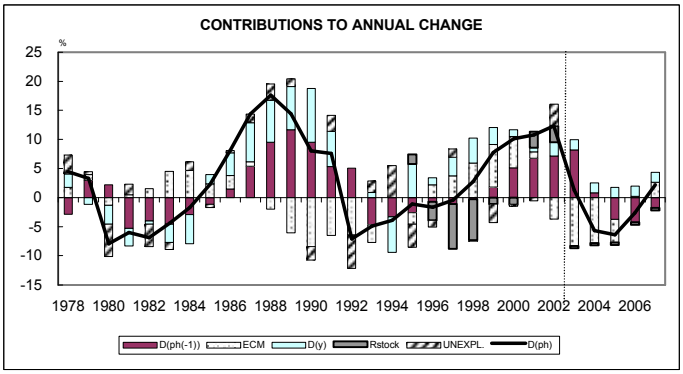


CHART 8: Results for the unrestricted model





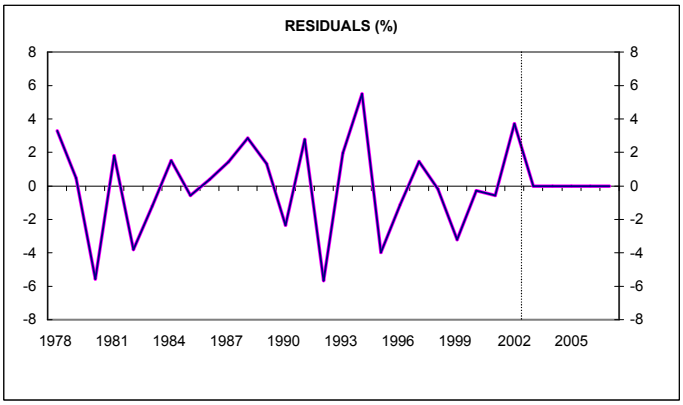
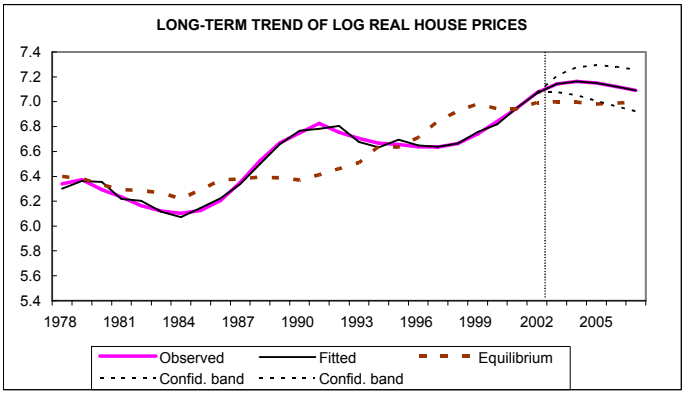
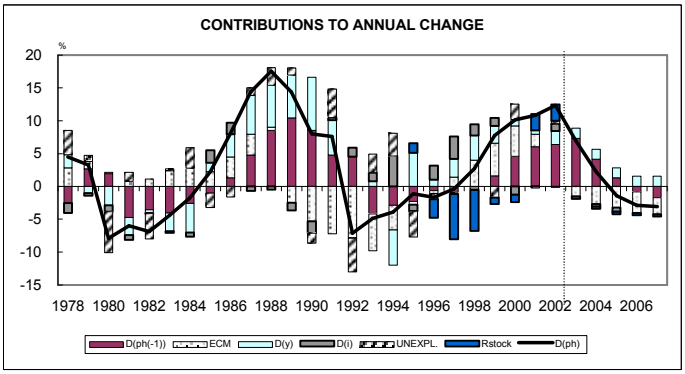


CHART 9: Results for the restricted model





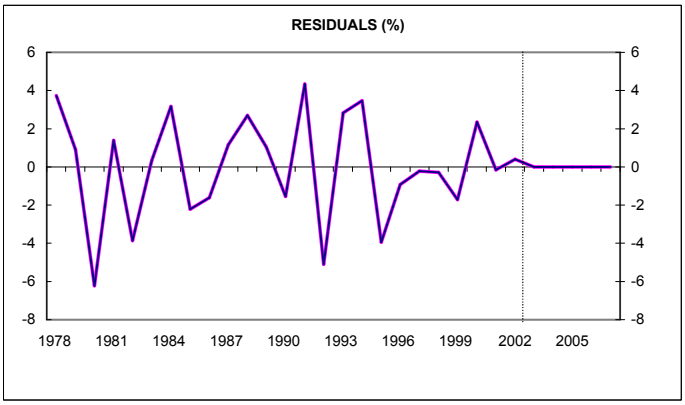
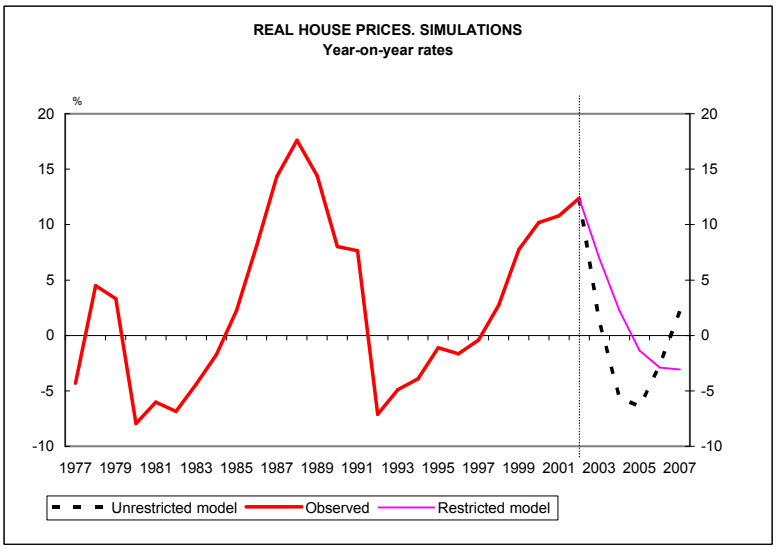


CHART 10: Comparison of simulations



ANNEX: DESCRIPTION OF THE VARIABLES USED

Ph: Real house price[34]. To calculate the nominal series, two different price series have been used.

- Tecnigrama: annual series in the period 1976-90, and half-yearly since 1991. The series relates to the average price per square metre of newly constructed housing for sale in the city of Madrid.

- Ministerio de Fomento: quarterly series since 1987. Average price per square metre of houses (new and second-hand) throughout Spain valued by the appraisal companies collaborating with the Ministerio de Fomento.

An annual series (average values) from 1976 to 2002 has been constructed with these two series, back-linking the Ministerio de Fomento data with those of Tecnigrama. For this link, regard has been had to the different volatility of both series, by means of the regression of the growth rates (in terms of deviation from the average) of the former over the latter, for the period in which both series are available. In addition, on the basis of certain information on divergences in the behaviour of house prices in Madrid and in Spain as a whole in 1987, the growth rate for this year has been adjusted by means of linear interpolation.

Y: Gross household disposable income in real terms (source: INE) divided by the number of inhabitants aged over 25.

Yf: Real gross disposable income per inhabitant aged over 25 adjusted for the effect of 1993 tax refunds. The adjustment is calculated using time-series intervention analysis in the relationship between the growth rates of gross household disposable income and of real GDP.

GDPr: Real GDP per inhabitant aged over 25. Source: INE.

Emp: Numbers employed according to National Accounts. Source: INE.

Cu: User cost of housing, defined as the nominal interest rate (I) less the expected future rate of change of nominal house prices. The latter is calculated either as the observed rate of change at t-1 or as the future rate of change forecasted on the basis of information up to t-1.

[34] All the real variables used are calculated deflating the related nominal series by the CPI.

I: Average interest rate on bank loans to households for house purchases. For data prior to 1980, this is chained with banks' and savings banks' average overall lending rate. Source: Banco de España.

Ir: Real interest rate, defined as the nominal interest rate less a centred five-year moving average of inflation. Inflation forecasts are used for the latest data.

Rstock: Real return on the stock market, calculated as the rate of change of the Madrid Stock Exchange General Index, deflated by the CPI. Source: Banco de España.

H: Number of houses for sale. This is calculated as the estimated value of the stock of finished houses plus the number of houses started in the past 18 months (source: Ministerio de Fomento). The stock of finished houses is constructed on the basis of the data from the INE censuses, an assumed annual depreciation rate of 0.5% and the accumulation of Ministerio de Fomento's series of finished houses per month, to which a variable adjustment factor is applied to have the estimated data coincide with census data when this is available.

Pop>25a: Number of inhabitants aged over 25 (source: INE). According to the INE Labour Force Survey, the average number of inhabitants aged over 25 per household has fluctuated between 2.14 and 2.18 in the period 1981-2001. Therefore, this variable is an approximation of the number of potential households, as opposed to the actual number of households, and depends only on demographic factors and not on economic variables or house prices.

Hh: Number of houses for sale per inhabitant aged over 25 (viv/pob>25a).

Pop_25_29: Population aged 25-29 as a proportion of the population aged over 25. Source: INE.

Wfn: Real net financial wealth per inhabitant aged over 25. To reconstruct stocks prior to 1995, information from the ESA 79 quarterly and annual Financial Accounts has been used, incorporating an estimate of the price effect to make it compatible with the market-price valuation included in ESA 95. Source: Banco de España.

Wh: Real property wealth per inhabitant aged over 25. This is calculated as the stock of housing multiplied by the average number of square metres per house (obtained from censuses using linear interpolation) and by the average per-square-metre price.

L: Real mortgage debt (deflated by the CPI) per inhabitant aged over 25. This is obtained as a specific percentage of total household debt. For the calculation of both total debt and the weight of mortgage debt in relation to total debt, information from the Financial Accounts and from bank balance sheets is used. Source: Banco de España.

H_pro: Number of protected houses started in the year per 1000 households. Source: Ministerio de Fomento and INE.

Cc: Real residential building total costs index. Source: Ministerio de Fomento.