Measuring price expectations: evidence from the Spanish housing market

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Abstract

Price expectation is one of the less known components of housing markets. In the literature proxies are often employed due to a lack of observations, with interest rates or lagged prices commonly used variables. Expectation is recognized as the determinant factor in explaining the increase of the non-fundamental component of house price compared to more traditional drivers such as population, stock, income, wealth, interest rates and inflation. This paper proposes a method to measure house price expectations and one that more accurately reflects the market. The analysis utilises a valuation database of over 1,800,000 records for the Spanish housing market, each record contains information on the price that owners expect to obtain on the sale of their property. The methodology uses a hedonic model approach to separate that part of the price arising from housing heterogeneity and the general house price trend.

Keywords: House Price Expectation, housing market, hedonic models

JEL classification: R21, R31, D46,

Introduction

Price behaviour is one of the most important variables on the housing market but very difficult to identify, although the processes leading to a housing price bubble, or speculative period, are well documented in the economic literature and specifically that dealing with real estate cycles. Different approaches have been adopted to analyse prices and construct indices, amongst the most popular of which is hedonic modelling and the repeat sales methods. These methods permit an estimation of value based on housing characteristics though the value obtained, through such analysis, can differ from market value, introducing uncertainty into investment decisions. In particular, little is known about which variables introduce differences between the hedonic and observed prices and whether these variables respond to a common behaviour of the market or its agents. Also, there is a lack of definition and clarity on how house price expectations are formed.

In this paper, perspectives are advanced using information from a major database on housing valuations in Spain. The database contains information on properties which are

the subject of the valuation, information on comparable evidence (known as 'testigos') including housing characteristics, the asking price of each testigo and associated neighbourhood characteristics. In Spain, the vendor of the property agrees with a selling agent a price which in effect becomes asking or list price though often the buyer will bargain to reduce the final price below list price.

The nature of the database used in this study permits analysis to be undertaken to ascertain whether the asking prices of the testigos include evidence of price expectations and, whether these expectations change over time. The analysis employs observation from 1995 to 2006, for major urban centres in Spain. The paper is organized as follow. The second section reviews the literature on speculative bubbles, section three provides details of the database and variables used in the analysis. In section four the analytical models are outlined and section five draws conclusions.

2. Literature review

House price evolution is a much debated issue in housing economics literature. The heterogeneous feature of houses means that arriving at a correct definition of the price, estimating price levels and evaluating growth processes can be difficult. Such discussion is particularly difficult in periods of strong growth on prices when other factors such as expectations can play an important role in houses prices.

The literature has tended to take a long-term view of house price explanation, however house prices respond to short-term demand, with construction activity increasing as vacancy levels reduce. The converse does not necessarily occur due to the complexity and multi-faceted nature of housing, in particular the role of housing as a component of family or perceived wealth. Under these circumstances faced with a negative shock that may produce a downward trend among prices and demand, house prices decrease at a slower rate in response to the effort made by owners to maintain value. This behaviour introduces an asymmetric adjustment and in part disguises the existence of a speculative bubble. The latter has attracted much debate in the literature. Stiglitz (1993) claims if the reason the price is high today is only because investors believe that the selling price will be high tomorrow and fundamental factors do not seem to justify such a price, then a bubble exists. Mikhed and Zemcik (2007) in examining the discrepancy between house prices

and their fundamentals argue if prices are non-stationary but rents are not then a bubble exists. They suggest that price-rent ratios are suggestive that rational bubbles occurred in several periods in the late 1980s and the late 1990s to 2005: the latter coincides with evidence presented in this paper for the Spanish housing market.

In the housing sector, explanatory models for the behaviour of residential prices usually follow either the lifecycle model, in which prices represent the long-term market equilibrium component, or models concentrate upon price composition explanatory factors on the supply side (Meen, 2001; Dougherty and Van Order, 1982; Muellbauer and Murphy, 1997). Such analyses identify that the factors starting a bubble process include changes in the theoretical foundations that explain asset demand. For example, the financial liberalisation process that promoted growth of residential prices across most western countries since the 1980s (Ortalo-Magné and Rady, 2001). Both financial liberalisation and the increase of credits are common aspects found in the bubble processes that took place throughout the 1990s (Allen and Gale, 1998). Theory argues that bubbles appear when agents act rationally but in environments with imperfect information, heterogeneous beliefs and agency problems (Wang et al, 2000).

In residential markets it is argued that heterogeneity and lack of information are typical characteristics making it more complicated to distinguish speculative behaviour. Case and Schiller (2003) define a housing market bubble as excessive expectations of the general public about future price rises making prices become temporarily high. This definition introduces two important nuances: acceleration and temporariness with respect to what would be considered a normal reaction of the residential market. Acceleration implies that, in the common context of growth, the presence of a residential bubble would increase expansion speed with respect to the average, in fact prices would be subject to two growth rates at the same time, one justified by medium-term foundations and the other representing the response of short-term expectations. Temporariness implies that a correction would take place in a period of time that would bring growth closer to its long-term expansion rate. The possibility of a stronger correction (as it happened in Spain in the early 1980s) implies that other fundamental growth determinants, apart from residential market mechanisms, are important (Taltavull, 1999).

The existence of several components explaining house price change has also been argued by Ryddel (1999) who maintains that the market price for existing homes can be decomposed into three components: one based on economic and demographic variables known as the conventional component, the feedback component and the expected component. The feedback component considers changes in prices stemming from information about relationships with previous appreciation and which introduces an error correction mechanism to explain changes in house price. The expected component is driven by the prices observed in the previous period corrected by the forecast error producing a systematic price appreciation beyond that motivated by economic fundamentals. In Ryddel's model speculation arises from those that trade following the price expectations based on feedback experience and those who trade based on their forecast. Speculative buyers, with an interest in only capital gains, seek to advance the house purchase decisions as a strategy that hastens the expected house appreciation with speculative demand in excess of that driven by current prices, leading to price appreciation in the following period.

Speculation occurs and prices reflect speculative behaviour, when agents expect to obtain additional profit from the purchase of an asset by reselling it, often after a short period of time (Scheinkman and Xiong, 2002). The literature recognises that agents act irrationally in these situations and even buy at prices above equilibrium because they expect to find purchasers that will accept even higher prices. It is the view of many housing market researchers that the bubble is due to the existence of imperfect information and agency problems resulting in heterogeneous opinions and that agents by their actions develop strategies oriented to the creation and persistence of bubbles (Abreu and Brunnermeier, 2001). The bubble generated under these circumstances is referred to as a growing rational bubble based on rational expectations (Kim and Shu, 1993).

Prices are believed to instantaneously discount innovations (Case and Schiller, 2003) and agents receive (and incorporate to their expectations) market innovations/news through the observation of some specific variables. Among the factors that send out signals about market activity is the volume of transactions. Andrew and Meen (2003) have shown that transactions react faster than prices with temporary effects by returning to their equilibrium level, whereas prices react more slowly than transactions

but with permanent impacts on their equilibrium level. This contrasts with the perspective of Ortalo-Magné and Rady (2001) who found a strong causal correlation between prices and transactions supporting the idea that rational expectation in price formation could be based on transactions observed in the market.

The expectation of growing prices is equivalent to the existence of growing capital gains (Dougherty and van Order, 1982; Poterba, 1984, 1991). In those circumstances where there is a lack of capital gains, the future value of the property in real terms will decrease with respect to previous periods. From the point of view of investment goods, this represents a loss of wealth and would generate a massive property sale. Growing capital gains at normal rates guarantee balanced market growth but if gains grow at rates above the normal, this may kick-start the speculative process. Thus, formulation of a 'speculative' price model should include the components of a rational bubble where agents form their expectations on prices observing the market evolution (transactions) and the restrictions coming from the financial market[1].

Black et al (2006) identify three main characterisations of bubbles namely: momentum driven by price, explosive where prices deviate from fundamentals due to factors extraneous to asset value, and intrinsic behaviour driven by the non-linear relationships between prices and the fundamentals of asset value which periodically revert to fundamental value. The analysis by Black et al (2006) found that house prices in the UK were overvalued by 25% with the intrinsic bubble component accounting for 13%. They considered a periodic reversion back to fundamental value while Mikhed and Zemcik (2007) suggest that it may take three decades for house prices to revert to fundamental value.

Other literature focuses on the analysis of housing prices related to the heterogeneity of houses, extracting differences in price due to features, location or other characteristics. Analysis using hedonic models captures the relationships between the prices and the characteristics of the houses sold in differentiated product markets. This literature is well established and used mostly to estimate 'quality adjusted' housing price index

[1] This component is usually measured by means of the differential between the performance of dwelling units and that of alternative assets, including a form of discrimination between residential investment and other types of investment.

(Rosen, 1974, Linneman, 1980, Haurin et al, 1991, Peek et al, 1991, Geltner, 1993, Adair et al, 1996, Clapp, 2003) and also to test the impact of different characteristics on the level of prices and their evolution (Goodman and Thibodeau, 1995, Clapp and Giaccotto, 2002, Bourassa et al, 2005). Indirectly, hedonic models capture demand interaction through housing features.

Some authors argue that hedonic models have econometric problems and thus provide limited accuracy in the estimation of house prices (Goodman and Thibodeau, 1995, 2003). In fact, hybrid models have been developed in order to avoid underestimation of prices and errors (Case et al, 2006). The lack of capacity of hedonic methods to capture the full behaviour of house prices is an indication that they play a more linked role internalising dynamic evolution and serving as an indicator for other purposes (Case and Wachter, 2005).

Summarising, house prices are addressed by long-term demand components, those emanating from the life-cycle determinants. Such components interact with changing prices in the market as well as housing attributes. Each attribute reflects the degree to which demand satisfies residential needs. However, short run demand components like expectations may not be captured. If expectations are leading the prices, they could be expressed as:

$$ph_t = \alpha + \beta ph^{e}_{t+1} + \delta t_t - \lambda \pi_t - \gamma ri_t + \varphi\ (\delta ph/ph)_t + \mu_t \qquad (1)$$

where ph_t corresponds to the real prices of dwelling units, p^{e}_{t+1} is a measure of expectations about prices, t_t stands for the transactions carried out during the period, π is the general inflation in the economy, ri_t is the differential between mortgage interest rates and those of alternative assets that approximates the profitability associated with investment on non-residential assets, $(\delta ph/ph)_t$ refers to the capital gains obtained in real terms during the t period, α, β, δ y $-\gamma$ are parameters and μ_τ is a random component. The adjustment incorporates an independent term that absorbs the weight of the variables omitted in the adjustment.

Expectations imply that prices are those observed in the past plus the difference

so $ph^{e}_{t+1} > ph_{t-1}$ hence it can be argued that:

$ph^{e}_{t+1} = ph_{t-1}(1+\phi)$, being $\phi > 0$, substituting on (1)

$$ph_t = \alpha_1 + \beta(1+\phi)\, ph_{t-1} + \delta_1 t_t - \lambda_1 \pi_t - \gamma_1 ri_t + \varphi_1 (\delta ph/ph)_t + \mu_t \qquad (2)$$

$$\Delta ph_t = \alpha_2 + \psi\, ph_{t-1} + \delta_2 t_t - \lambda_2 \pi_t - \gamma_2 ri_t + \varphi_2 (\delta ph/ph)_t + \varepsilon_t^2 \qquad (3)$$

where $\alpha_2 = \alpha_1/\beta$.

Also $ph_t = (phn_t \,.\, phe_t)$ with *phn* being the normal price growth component and *phe* the component related to other non fundamental components, such as expectations[3]. Equation (3) implies long term behaviour is derived from the structural form and a cyclical component. Some authors assume that determinants of phn_t could be the fundamentals omitted from equation (3) namely population change, income growth or finance, among others reasons, and that the components linked to interest rates and capital gains expectations should approach the behaviour of phe_t. This double behaviour of prices approach is often found in the literature[4].

The presence of transactions in Equation 1 is justified as they are the elements which allow information to be added to the market dynamics through the agents' reactions. Within the residential market, the speculative process materialises through successive transactions at real prices that should incorporate residential capital gains with prices above their long-term equilibrium value. However, the literature usually deals with the analysis of prices without disaggregating them from their market determining factors. Prices are thus influenced by long-run and short-run conditions (Andrew and Meen,

[2] Note that the component $((\delta ph/ph)_t + \pi_t)$ represents nominal capital gains, as pointed out by Andrew and Meen (2003), p. 108.

[3] Ortalo-Magné and Rady, 2001, explain that the '..arbitrage across property types implies that the price of every dwelling can be broken down into two components: the price of starter home and the market value of the utility premium the specific dwelling provides relative to a starter home'. (pp. 4)

[4] Measurement of bubbles is carried out by calculating the differences between the value of prices estimated and the one observed from a structural function that establishes long-term relationships between prices and their fundamental variables. See Levin & Wright, 1993 measure it as Pt = Pz t + G t, where PZ t is the price assuming zero-capital gains, and G t is the present value of the expected capital gains. Also in Kim & Shu, 1993.

2003), or, to put it in another way, by the structural determinants present in the housing market and those associated with the influence of capital markets (DiPasquale and Wheaton, 1996).

3. Data

This study used data supplied by TABIMED, one of the largest valuation companies in Spain. TABIMED is involved in valuation throughout the whole of Spain but has a particularly strong regional presence in Alicante, Valencia and Murcia and significant activity in the two major cities of Spain, Madrid and Barcelona. The data are all valuations for residential property undertaken by TABIMED during 1995-2005 and first half of 2006. This includes information about the subject property and the supplementary evidence required by law to value the property. Importantly, for this paper, the database also has highly detailed information about each of the testigos (comparables) used in the valuation including estimations of construction cost and land value needed to rebuild the property, capitalization information, different valuations and the final value assigned to the subject property.

The total number of testigos included in the database is 1,980,131 with information on a further 284,958 subject properties that have been valued on the basis of the testigo evidence (Table 1). In total, the database contains 210 variables which can be sub-divided into three groups of variables. The first sub-set is housing characteristics that are common to the subject property and testigos. The second sub-set contains additional variables, largely physical matters, but also issues relating to legal status and neighbourhood and environmental features for the subject property. Within this group, there is a description of components and materials used in the construction process as a measure of building quality. Thirdly, there is a set of values in the database which are used to estimate at least, three measures of the final valuation. The latter is a necessary requirement of the legislation governing property valuation in Spain which states that the value has to be obtained through the best three measures that the information allows and, then, to choose the lower value of these valuations (Taltavull and McGreal, 2006).

Insert Table 1

This paper uses the information for the testigos, both property and neighbourhood information. Due to such a large database and the expanding geographical area of activity by the valuation company during the observed period, the total available database was reduced in order to provide homogeneity and avoid outliers in the dataset. The seven main provinces represented in the dataset (Alicante, Valencia, Murcia, Madrid, Barcelona, Castellón and Balearic Islands provinces) have been selected has they embrace the majority of the observations (Table 2) with 94.5% of the observations or 1,871,661 testigos.

Insert Table 2

The analysis utilises 27 (15 + 12) variables relating to the testigos and which are available throughout the entire time series (1995-2006) plus a further 27 variables relating to the neighbourhood (Table 3).

Insert Table 3

Price information is the asking price obtained from either agents or testigo's owners by the valuer in the data collection process. In Spain, transaction prices are not public information and are difficult to obtain, hence reliance is based on valuation evidence. The Spanish regulation defines that the testigo must be a very similar property to that being traded in the market and in a close period of time. As such 'testigos' are non-transacted properties and the price captured is the asking price not the transacted price. Asking prices should essentially include three different components: the fundamental price (which refers the real characteristics of the subject's property and location), the expectation component of the owner (who expects, at least, to obtain the same price as the last neighbourhood transaction) and the bargaining component which may include the transaction cost expenses. As the selling price of a close and similar property is used to fix the expected price of a property (Case and Quigley, 2007) though the bargaining process can affect the achieved price (Harding et al, 2003), it is reasonable to consider that the three components are present in the asking price of a house though with different weights which vary over time.

The evolution of asking prices (average value) over the period 1995-2006 in the dataset used in this paper is outlined in Figure 1. Asking price growth was accompanied by increased volatility reflecting changes in the market (Figure 2).

Insert Figures 1 and 2

4. Models

In seeking to identify the presence of price expectations in asking price and extract the expectation component, the analysis follows three stages.

First, a hedonic model is formulated (Equation 4) to obtain the implicit price of the characteristics of the testigos: the hypothesis being that asking price reflects the housing characteristics.

Definition of the hedonic model is:

$$Ph_{it} = \alpha_{it} + \beta_{it} \sum_{j=1}^{m} C_{jit} + \varepsilon_i \qquad (4)$$

where:

Ph_{it} = asking price of the property (testigo) '*i*' in the year *t*

α_{it} = Constant (fixed) component, not dependent from the market

β_{it} = parameters to be estimated

C_{jit} = is the characteristic '*j*' of the testigo '*i*'. *j* = 1 to 56

ε_t = error term

t is the year, being t=1995 to 2006

Hedonic models were run to obtain parameters which were allowed to change though time, to check for variation in the explanation capacity of the models and stability of the coefficients.

In the second step, a pseudo meta-dataset was built based on the previous estimations of *Phi*, in order to identify which housing features were responsible for changes in the

explanatory capacity of the models generated in stage one. The pseudo metadata model (Equation 5) is expressed as:

$$\kappa_t = \varphi_t \widehat{\beta}_t + \mu_t \quad (5)$$

where:

κ_t *are the explanation capacity (adj R2) of model (4)*

φt are the coefficients to be estimated

β the estimated parameters from (4)

μt the random component.

Third step tested the hypothesis that the difference not explained by the hedonic regressions reflects owner expectations. In this step, the residuals are regressed against variables that the literature indicates as being possible determinants of expectations namely: real interest rates (*ri*), inflation (π), volume of transactions by municipality (*tr*) and capital gains observed (*cg*) (Equation 6). While interest rates are common it is possible to adjust by provinces' inflation rate and by different region. Transactions are recorded at the municipality level, and inflation and capital gains are both observed using CPI and housing prices, at a province level.

The model fitted at this stage is expressed as:

$$\overline{Err}_t = \gamma_1 + \gamma_2 ri_t + \gamma_3 \pi_t + \gamma_4 tr_t + \gamma_5 cg_t + \eta_t \quad (6)$$

where:

Err_t are the estimated errors from (4)

γ are the coefficients to be estimated

ηt is a random component.

5. Results

Results for the first stage of the analysis, the hedonic modelling, are shown in Table 4. Model (4) is fitted using a two step estimation (2LS model)[5] for the period 1995-2006. The analysis highlights that the explanatory ability of the models varies over time with the highest adjusted R^2 values (0.7) occurring at the start of the time series (1996, 1997) and declining to circa 0.5 in 2003-2004 (Figure 3) indicating a difference in the hedonic explanation of asking prices[6]. The reduced explanatory capacity of the variables and potential at this stage of the property cycle for increased price expectation in the market is in accordance with the opinions of Black et al (2006) who refer to the persistence of price expectations.

Insert Table 4

Most *testigos*' characteristics have positive coefficients namely: type of house, quality of construction, quality of commercial area, income level in the neighbourhood, density of population, orientation and view, number of lifts, surface area of the house, areas not covered areas (gardens, patios), the type of activity in the neighbourhood, density of population, the degree of renovation, infrastructure provision as such public lighting, services (commercial, churches, sporting facilities), and the provision/accessibility of transportation systems (buses, trains, underground stops). The age of the property, the water system and the density of building construction have negative impacts on hedonic prices (Figure 4). These results agree with others studies (Harding et al, 2003) which found that the most important determinant of the hedonic model is the surface (living area) and age, the latter negatively affecting prices.

The housing characteristics show certain changes in their influence on asking prices over the study period. It is apparent that area has a lower weighting later in the time series and that age impacts less negatively on asking prices. These observations suggest that the both size and age become less important influences on the asking prices. The

[5] In order to check robustness of parameters, different specifications have been used to fit the model and check the differences on the parameters estimated. A weighted OLS model, weighting by type of property, provided results that were very similar than the ones obtained in 2SLS.

[6] Notice that the models are estimated using the level of the asking prices rather than the changes on them, as most analysis use to do.

other characteristics maintain their respective levels of explanation, though at the end of the study period, a further three variables had reduced impact namely: number of lifts, views and quality of construction. It would seem that in fixing the asking prices the effect of some traditional characteristics that define price are reduced arising from either very strong pressure on the demand side and/or the existence of a lack on housing supply in the markets analysed.

Insert Figure 4

Regarding the neighbourhood characteristics (Figure 5), there is a converse perspective with the perception of changes, notably population influenced by immigration (Taltavull et al, 2007), economic activity and level of income, reflecting the general demand factors, increasing asking prices. The degree of renovation exhibits a change of influence at the end of the 1990s from negative to positive suggesting a change in perception regarding the impact of this variable on price. School facilities, against expectations have a negative impact during most of the study period contrary to most analysis regarding the impact of the high quality schools in housing prices. This finding in parts reflects the habit in Spain to de-localize the good quality schools to out-of – town high quality areas.

Insert Figure 5

In order to explore more fully the model's reduced explanatory capacity, the second phase of the analysis (Equation 5) sought to establish which of the characteristics showed a significant correlation with the dependent variable (Table 5) [7]. These variables were then used to regress the adjusted R^2-κ against them. Table 6 contains adjusted results of model (5), constructed from a pseudo-metadata panel following the approach outlined by Sirmans et al (2006) and using the results from equation (4). This permitted the identification of signals of discrimination between those coefficients having a particular impact on the dependent variable.

[7] Table 5 avoid the results for those parameters non statistically significant in equation 2. The whole results can be send under request.

The results support the previous interpretation, indicating that plot area (living area), type of property, construction quality, the view, non-covered area and degree of renovation in the neighbourhood increase the explanatory capacity of the hedonic models. Those variables with negative impacts are the age of building, the type of economic activity in the municipality, the quality of the shopping area associated with the property and population density and growth. The analysis suggests that certain fundamentals (demographic and income growth) have changed during the observed period, reducing the capacity of the hedonic method to capture the house price components.

The third stage sought to analyse the extent to which there is a relationship among those variables that are determinants of price expectations as identified in the literature and the unexplained part of housing prices from the hedonic models. The residuals of equation 4 proxy the non-explained asking price component as the dependent variable and show a normal distribution around zero (Figures 6 (1-12)). Estimation of model 6 required that the data structure, a dynamic panel[8] of asking prices, characteristics and errors of previous estimations, be linked to real interest rates, inflation, transactions and capital gains for each observation. This required decisions to be taken in order to assign the variables, by space and by time. Real interest rates were calculated as the nominal mortgage interest rate minus the average province inflation rate by year and assigning to each observation the specific province, thereby enabling all valuations in a province have the same real interest rate by period (year). Housing transactions were available at municipal level (in number) and were assigned to each valuation. However, a limitation was imposed by the Spanish national database only having housing transactions from 2004-2007, for that reason housing transactions were not included as an independent variable. Real housing price was estimated as the province's housing prices minus the province's inflation and assigned to each observation.

To guarantee the robustness of the estimated parameters, three different econometric methods were used Weighted Least Squares Regression, Two Steps Least Squares and Optimal Scaling. The latter was used due to assign external observations to the database

[8] As noted by Mikhed and Zemick (2007) very few studies have used panel data methodology to assess bubbles in housing markets. These authors also suggest the use of income and interest rates as explanatory variables.

process to contrast the general results. The results obtained using Weighted and 2SLS models have a high degree of similarity and are also close to the estimated parameters.

The results presented focus on one of these approaches, the 2SLS method (Table 7). The coefficients obtained are all significant and the model has an explanation capacity which varies between 3% (1995) to the 18% (1999) of the total errors from the estimated hedonic model. This range potentially reflects to price expectation behaviour (Table 4). Observed real house price is amongst the most significant variables in expectation formation, suggesting that in observing house prices owners form expected prices of their properties and this is reflected in the asking price, which ultimately, as in the valuation approach discussed for Spain, is used to value subsequent properties. Seemingly, the expectation components most to explain the residuals are the observed prices (real) and the capital gains, with real interest rates having a negative affect. The estimated coefficients are highly significant and the robustness of the real price observed variable supports the idea of the rapid transmission of the price announcements among owners.

Insert Table 7

Given that real interest rates fell during the period 1998-2005, coinciding with the reduction of the explanation capacity of the models, it would seem that interest rate has increased the expectation component in housing prices. A similar argument can be advanced for capital gains but with a lower effect. The analysis indicates that the role of expectation components to explain the errors, vary with time, notably the changing role of interest rates and capital gains during the beginning of the period under consideration.

The explanation capacity of the expectations formation model is smaller than expected and also varies with time. Indeed, this model explains a very small proportion of the residuals during the first part of the period (only 0.03% of the total errors resulting from the hedonic model) but the explanation capacity increases until the 16-17% from 1999 onwards. These figures were recalculated in terms of the total asking prices in order to evaluate which part is explained by the two components: hedonics and expectations, and represented in Figure 7.

Overall, the total expectation components explain the equivalent to 0.79% to 7.7%[9] of the total asking price along the period (bottom line in figure 7). This is a very small component and the values obtained are much lower than those estimated by both the IFM (30%) and the Bank of Spain (25%) based on time series data for similar period and suggests the need for a deeper understanding of house price formation in order to know better how the housing market performs. The evidence reflects that the impact of expectation or the speculative component, if both concepts are taking into consideration in similar terms, affects the asking price to a lesser extent than may have been considered in the market.

When the explanatory capacity of the models is combined (Figure 7), the hedonic model explanation (pink line) plus the expectations explanation (the total is the blue line), shows the maximum capacity of the models to explain the asking prices varies from about 78% (1995) to 63% (2006). This means that anywhere in the range from 22% to 39% of the asking prices is unexplained over the time-series, hence asking prices in boom periods would seem to be influenced by other factors not considered by the theory. For instance, one component which could be added to the asking price by the owner could be the transaction costs, in order to reduce it after the bargain process. Transaction costs in Spain can be about 13% of the total price[10]. Allowing for this element, which is not captured by the hedonic model, the non-explained part of the asking price essentially is in the range of 9% - 26%. This represents the bargaining range of sellers in the house negotiation process.

[9] The value 0.79% is the product of (1- 0.758) which represents the remained unexplained part of the asking prices in the database resulting from the hedonic model (4), and 0.032, which is the part explained by the expectation model (6), both during 1995. So, (1-0.758)*0.032 = 0.0079. The figure 7.7% is, similarly, the product of the (1-0.55) and 0.172 for 2004 (= 0.0773). 0.758 and 0.55 are the Adjusted R2 in the model (4), table 4 for the two selected years 1995 and 2004. 0.032 and 0.172 are the adjusted R2 of residuals (expectation) from model (6), table 7. So, the total explanation of the expectation in the whole asking prices are the percentage unexplained by the hedonic model in the whole model times the total explained by the components of expectations in the residuals model.

[10] The different components are searching costs and agent costs, which could reach 3% (as a minimum), V.A.T. is 7%, Notary and Register process should be close than 1-1.2%, valuation fee and mortgage costs is close than 0.5%. These costs use to be paid by the buyer.

6. Conclusions

This paper analyses the role of expectations in house price formation from the owners' perspective using data from the Spanish market. Hedonic methodology was used to obtain implicit prices for over 1,800,000 residential units with 55 known characteristics by each property. The results show that the level of explanation from the hedonic model varies over time reflecting, in part, price expectations.

Using a dynamic panel approach, we estimate the hedonic model explaining asking prices and found that the explanation capacity vary over time, capturing the 68% of the properties' total asking prices during the first year and the 55% in the last year of the sample, moving down the capacity of explanation of the model. This suggests that the fundamental characteristics are appreciated by the owners in different way depending of the market moment and conditions. In other words, owners valuate the same characteristic depending on other variables doesn't captured by the hedonic model.

It is also estimated that between 14 to 20% of the total errors estimated from the hedonics is potentially due to price expectations, though the role of the expectation component to explain errors varies with time. Expectations appear to explain between 3-17% of the non-hedonic prices inside the asking price revealed and between the 0.79-7.7% of the total asking prices. This values are substantially lower than other estimations coming from IMF or Bank of Spain, ranged in 25-30% of overprice.

The paper contrast how the differences on explanation capacity over time could be understood due to the change on characteristics. Using a metadata-based exercise, the results show that both main property and neighbourhood characteristics (surface, type of property, quality of construction, view and renovation of the surround) increase the explanation capacity of the hedonic model and those which reduce the explanation capacity are related to the shopping area transformation and the demographic variables. These seems to suggest that the increase on population density in many Spanish cities coming from the relocation and immigration process experienced last ten years have affect (reduced) the capacity to perceive the property values from their characteristics, which is a reflect of a potential change on tastes from the demand, or of a stressed (tension) in the housing market from the demographic demand.

In addition, the paper raises wider issues on definition and the difference between speculation and expectation formation in housing market. In this context, the role of

pricing behaviour is an important debate in the analysis of the variation of asking price from fundamentals.

It is important to differentiate between speculation and expectation in the housing market price formation. Literature use to focus the housing market speculation regarding houses as financial assets rather than as a real asset. A way to clarify the differences is to explain how agents can speculate in a framework higher transaction costs, like in the housing market. The last exercise made in this paper shows that there are others variables out of the hedonic + expectation models which could explain between 9-26% of the asking prices, which is an important share to analyse in that sense.

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Table 1.- OBSERVATIONS IN VALUATION DATABASE

	total observations (testigos)	Subject properties	
	testigos		testigos/subject property
1995	45499	5616	8,10
1996	88461	11678	7,58
1997	105271	14081	7,48
1998	122708	17519	7,00
1999	155723	22116	7,04
2000	148698	21739	6,84
2001	179030	26347	6,80
2002	233853	34266	6,82
2003	266557	38673	6,89
2004	107052	15655	6,84
2005	348370	51318	6,79
2006	178909	25950	6,89
Total	1980131	284958	6,95

Table 2. FINAL SAMPLE USED INTO THE MODELS FROM THE VALUATION DATABASE

	NUMBER OF TESTIGOS	% S/ TOTAL OBSERVATIONS	Provinces						
	Nº properties	%	Alicante	Murcia	Valencia	Madrid	Barcelona	Castellón	Baleares
1995	45381	99,7	51,4	23,2	21,1	0,8		2,8	0,4
1996	88233	99,7	46,7	29,2	20,1	0,4	0,0	3,3	
1997	105074	99,8	47,2	30,4	19,5	0,1		2,6	
1998	121480	99,0	46,1	22,7	21,1	2,6	1,3	2,7	2,0
1999	151910	97,6	40,9	19,4	19,0	6,4	3,4	2,3	4,4
2000	144350	97,1	42,5	18,2	18,1	6,4	4,0	1,8	3,3
2001	172890	96,6	39,6	18,2	18,2	8,0	5,2	1,8	3,3
2002	225753	96,5	37,7	16,7	17,9	9,7	6,7	2,3	3,5
2003	256364	96,2	34,5	18,4	20,0	9,1	6,7	2,2	3,3
2004	100363	93,8	33,3	16,1	20,7	7,6	6,7	2,8	4,0
2005	306962	88,7	28,0	12,1	21,5	7,9	7,1	2,3	5,3
2006	152901	86,0	26,3	12,9	19,9	6,5	8,1	2,6	6,2
TOTAL	1871661	94,5							

TABLE 3		VARIABLES INCLUDED IN TABIMED DATABASE FOR TESTIGOS AND NEIGHBOURHOOD	
Refereed to the testigo's property			
1	Sqm_t	Superficievivienda_t	testigo's surface (m2)
2	Lift_t	Ascensoresenedif_t	number of lifts
3	Constq_t	calidadConstructiva_t	Quality of construction
4	Inc_t	nivelrenta_t	Income level in the testigo property building
5	Type_t	Tipologia_t	Type of building (flat building, detached homes or house with green area)
6	Ndwe_t	Vivtotalesenedif_t	number of dwelings in the testigo's building
7	Age_t	Edadcorriente_t	current age of the testigo
8	View_t	vistasPanoramicas_t	quality of the views from the testigo
9	Qshop_t	entornocomercial_t	quality of the shopping areas
10	Popdens_t	densidadPoblacion_t	Population density in the building where testigo is located
11	Orient_t	orientacion_t	subject property orientation (north, south…)
12	Sqmnoc_t	Superficiezonasnocubiertas_t	surface in non-cover areas in the testigo property
13	Duswim_t	dumpiscina	dummy: if swimmingpool is available in the testigo
14	Dusport_t	dumpdepor	Dummy: if sports instalations are available in the testigo
15	Dugar_t	dumjardin	Dummy: If garden available=1
Refereed to the testigo's neighbourhood			
1	Popdens	Densidaddepoblacion	Population density in the neighbourhood
2	qShop	Equipamientocomercial	quality of trade and shoping facilities
3	Income	Nivelderenta	Income level in the testigo area
4	Cons	gradoconsolidacion	Area consolidation, ranged from 1 to 100
5	Qlight	alumbrado	quality of light network in the neigbourhood
6	Qsport	Equipamientodeportivo	quality of the sport facilities
7	Bus	lineasdeautobuses	number of buses lines
8	Qrelig	Equipamientoreligioso	Level of religious facilities
9	Year	anyotestigo	year when the testigo was observed
10	Resarea	CaracterEntorno	if only first residencial, mixed between first and second residence area, only second residence area, industrial, business or shoping area.
11	Popgrow	CrecimientoPoblacion	population dynamism
12	Ecoact	Actividaddominante	Economic activity in the area: Agricultural, industry, services, tourism
13	renov	Renovacion	degree of renovation in the neighbourhood
14	train	Paradatren	Train stop available
15	front	longfachadatestigo	Front face in metres
16	qroad	estadovia	Quality of the roads
17	qhealth	Equipamientoasistencial	Level of health assistance facilities
18	urbanenv	SignifEntorno	Level of area: rural, suburban and urban
19	age	antiguedadmedia	average of years old of the neighbourhood
20	qwater	abastecimientoagua	quality of water network supply
21	qschool	Equipamientoescolar	quality of School facilities
22	urbandep	Tipodenucleo	urban dependence: total dependence from other urban area, autonomous urban area, county capital, province capital and national capital
23	qleisure	Equipamientoludico	quality of leisure facilities
24	underg	paradametro	underground stop
25	regpop	poblacionDEderecho	total population registered

27	towpop	poblacionhecho	total population in town
New characteristics observed in the 2005-2006 dataset for testigos and neighbourhood			
1	Qurban_t	calidadurbanizacion_t	Urbanization quality in the testigo property
2	urbenv_t	entornourbano_t	Urban environment of the testigo property: very bad, bad, depressing, acceptable, good, very good, exceptional
3	DUse_t	tipoResidencia_t	Type of testigo's residence: first or second residence: Dwelling use
4	Floor_t	Plantaelemento_t	floor where testigo is located
5	Nstorey_t	Plantastotales_t	Total storeys in the testigo's building
6	Nextroom _t	Piezasexteriores_t	Number of exterior rooms in the testigo's property
7	Nroom_t	Piezastotales_t	Total number of rooms in the testigo's property
8	Nbedr_t	Numerodedormitorios_t	Total number of bedrooms in the testigo's property
9	Nbath_t	Numerodebanyos_t	Total number of bathrooms in the testigo's property
10	Qurbenv	Entornourbanocalidad	Quality of urban environment: very bad, bad, depress, unacceptable, good, very good, exceptional
11	road	Categoriadevia	Road category
12	landclas	Clasificacionsuelo	Land classification

Figure 1. Asking prices average by year in euros. Time series

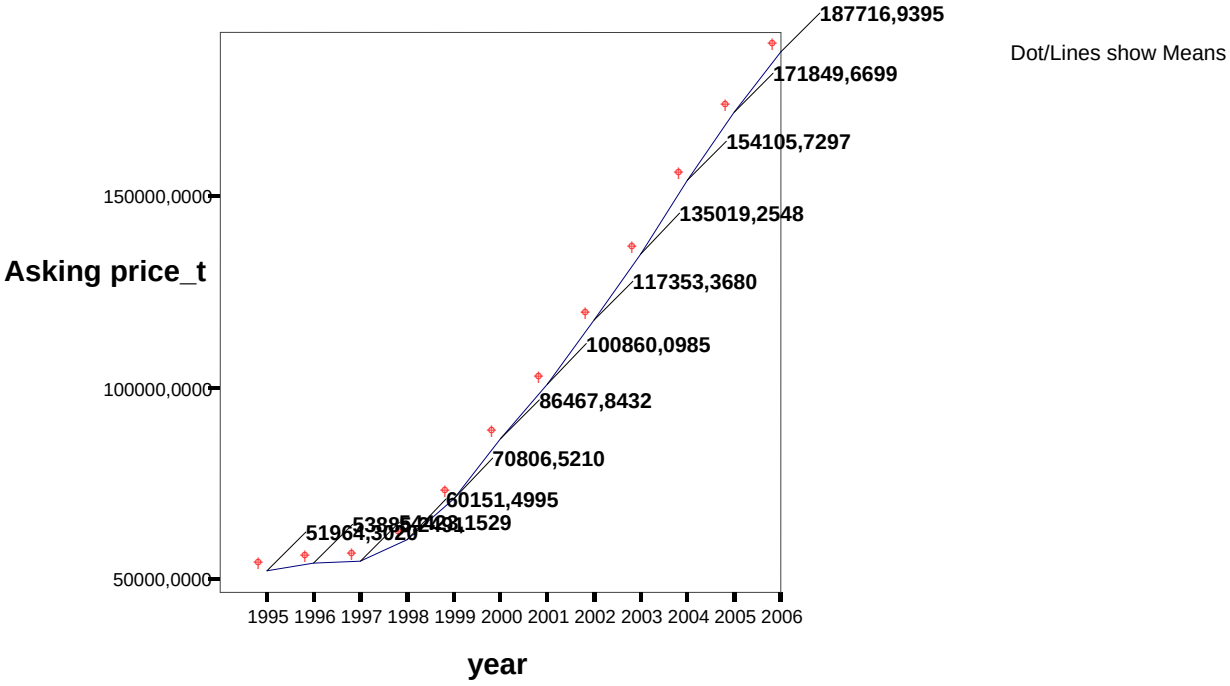


Figure 2- Asking prices volatility. Time series

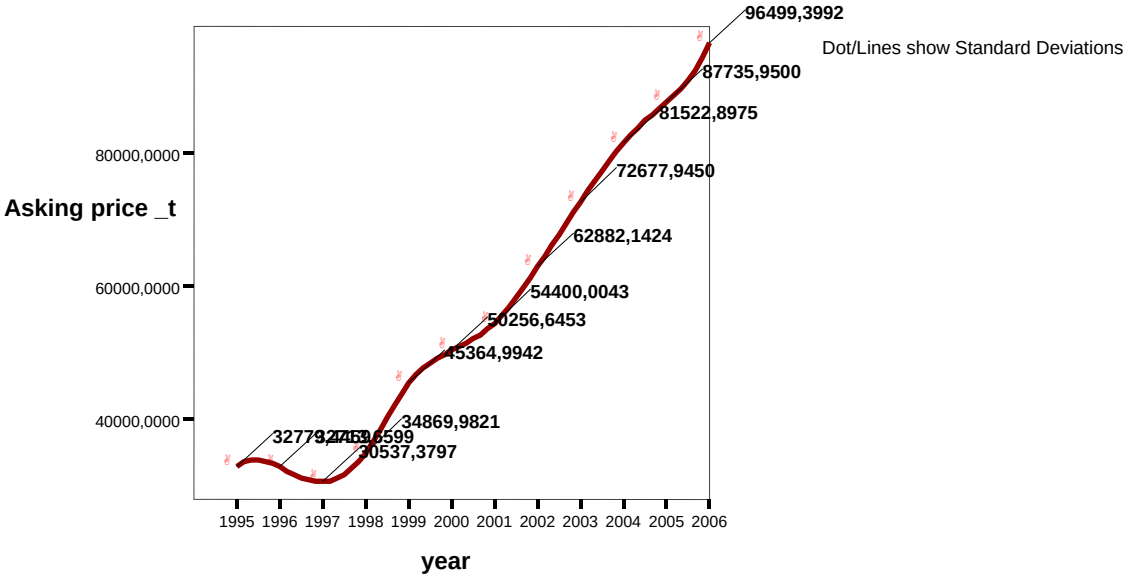


Table 4 2SLS MODEL: RESULTS OF THE HEDONIC MODEL OF ASKING PRICE

Dependent variable: asking price of testigo i

Years	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Multiple R	0,82	0,84	0,84	0,79	0,76	0,75	0,73	0,71	0,71	0,71	0,73	0,74
R Square	0,68	0,7	0,7	0,62	0,58	0,57	0,54	0,51	0,5	0,5	0,54	0,55
Adjusted R Square	**0,68**	**0,7**	**0,7**	**0,62**	**0,58**	**0,57**	**0,54**	**0,51**	**0,5**	**0,5**	**0,54**	**0,55**
Std. Error of the Estimate	11152	14017	13168	13513	18607	26383	23423	34424	31880	46007	46762	51175
Standardized Coefficients	Beta	Beta	Beta	Beta	Beta	Beta	Beta	Beta	Beta	Beta	Beta	Beta
Refereed to the testigo's property												
Sqm_t	0,64	0,64	0,67	0,58	0,54	0,55	0,54	0,56	0,51	0,55	0,5	0,53
Lift_t	0,12	0,12	0,08	0,04	0,04	0,04	0,07	0,1	0,14	0,05	0,01	0,02
Constq_t	0,11	0,11	0,1	0,1	0,1	0,11	0,09	0,09	0,08	0,01	0,06	0,07
Inc_t	0,09	0,13	0,13	0,12	0,12	0,13	0,15	0,11	0,1	0,1	0,11	0,1
Type_t	0,08	0,07	0,05	0,06	0,05	0,02	0	0	0,01	-0,03	0,05	0,02
Ndwe_t	-0,07	-0,09	-0,06	-0,02	-0,01	-0,04	-0,07	-0,08	-0,09	-0,06	-0,02	-0,03
Age_t	-0,1	-0,17	-0,19	-0,19	-0,14	-0,13	-0,07	-0,04	-0,01	-0,05	-0,02	-0,01
View_t	0,06	0,05	0,06	0,07	0,07	0,12	0,14	0,13	0,13	0,17	0,05	0,03
Qshop_t	0,02	0	0,03	0,08	0,09	0,02	-0,02	-0,08	-0,1	-0,09	-0,07	-0,08
Popdens_t	0,02	-0,02	0	0,02	0,01	0,03	0	0,03	0,03	0	0,04	0,01
Orient_t	0,01	0,05	0,04	0,05	0,04	0,05	0,04	0,05	0,05	0,04	-0,03	0
Sqmnoc_t	0,05	0,02	0,04	0,06	0,06	0,07	0,1	0,08	0,12	0,08	0,09	0,1
Duswim_t	0,01	0,02	0,03	0,03	0,04	0,04	0,05	0,06	0,07	0,04	0,04	0,07
Dusport_t	0	-0,03	-0,02	-0,01	0	-0,02	-0,01	0,01	0,01	0,1	-	-
Dugar_t	0,04	0,07	0,07	0,11	0,12	0,13	0,11	0,12	0,13	0,05	0,04	0,07

Table 4 MODEL (cont): RESULTS OF THE HEDONIC MODEL OF ASKING PRICE

Dependent variable: asking price of testigo i

Refereed to the testigo's neighbourhood												
Popdens	0,01	0	0,01	0,07	0,04	0,06	0,1	0,07	0,07	0,06	-0,01	0
qShop	0,01	0,04	0,06	0,02	0	0,03	0,02	0,02	0	0,03	-0,06	-0,05
Income	0,03	0,04	0,04	0,05	0,07	0,04	0,03	0,02	0,01	0,02	0,07	0,08
Cons	0,02	0,01	0,02	0,03	0,04	0,04	0,02	0,01	0,04	0	0,02	-0,02
Qlight	0,02	-0,03	-0,02	0	0,03	0,01	0	0	0	0	0	0
Qsport	0,02	0,01	-0,01	0,02	0,14	0,06	0,07	-0,02	-0,01	0,02	-	0,04
Bus	0,02	0,02	0,02	0,04	0,06	0,04	0,02	-0,01	-0,01	-0,02	-0,05	-0,02
Qrelig	0,01	0,03	0,02	-0,03	-0,1	-0,02	-0,08	-0,07	-0,03	-0,05	0,02	0,02
Year	0,01	0,02	-0,01	0,07	0	-0,07	0,04	0,05	0,06	0,16	0	0
Resarea	0,08	0,09	0,06	0,05	0,05	0,06	0,14	0,14	0,09	0,1	0,08	0,08
Popgrow	0,07	0,08	0,1	0,01	0	-0,03	-0,05	-0,05	-0,01	-0,02	-0,08	-0,09
Ecoact	0,05	0,07	0,06	0,06	0,08	0,08	0,12	0,14	0,13	0,16	0,22	0,19
renov	0,05	0,05	0,04	-0,02	-0,05	-0,04	-0,01	-0,02	-0,02	-0,04	-0,02	-0,05
train	0	0,03	0,04	0,05	0,07	0,07	0,04	0,06	0,05	0,05	0,14	0,17
front	0	0,04	0,05	0,02	0,02	0	0,01	0,03	0,02	0	-	-
qroad	-0,01	0,01	0	-0,02	-0,02	-0,02	0,01	-0,02	-0,01	-0,02	0,02	0,04
qhealth	-0,01	0	0,01	0	0,02	0,03	0	-0,02	-0,01	-0,03	-0,01	0
urbanenv	-0,02	0	0	0	-0,02	-0,03	-0,02	0	-0,01	-0,03	-0,05	-0,07
age	-0,02	0,01	-0,03	-0,02	-0,01	-0,01	0,01	0,01	0,01	0,02	-	-
qwater	-0,03	0	0	-0,01	-0,03	-0,04	-0,04	-0,02	-0,01	-0,01	-0,01	-0,01
qschool	-0,03	-0,02	-0,01	-0,03	-0,04	-0,11	-0,06	-0,01	-0,04	-0,04	0,04	0,02
urbandep	-0,04	0,06	0,04	0,03	0,02	0	0,01	-0,02	-0,01	0,03	0,03	0,06

qleisure	-0,04	-0,02	-0,02	0,02	-0,03	0	0,08	0,14	0,1	0,1	0,03	0,01
underg	-0,06	0	0,04	0,14	0,1	0,06	0,02	0,02	0,04	0,14	0	0,04
regpop	0,16	0,06	-0,02	0,14	0,09	0,28	0,28	0,34	0,31	0,2	0,19	0,15
towpop	0,15	0,1	0,12	0,01	0,14	-0,01	0,04	0	0,06	-0,04	-	-
New characteristics observed in the 2005-2006 dataset for testigos and neighbourhood												
Qurban_t											0,04	0,07
urbenv_t											0,04	0,06
DUse_t											0,06	0,05
Floor_t											-0,02	-0,01
Nstorey_t											0,03	0,03
Nextroom_t											0,16	0,16
Nroom_t											-0,06	-0,11
Nbedr_t											-0,05	-0,05
Nbath_t											0,06	0,06
Qurbenv											0,05	0,03
road											-0,03	-0,06
landclas											0,01	0

Figure 3.

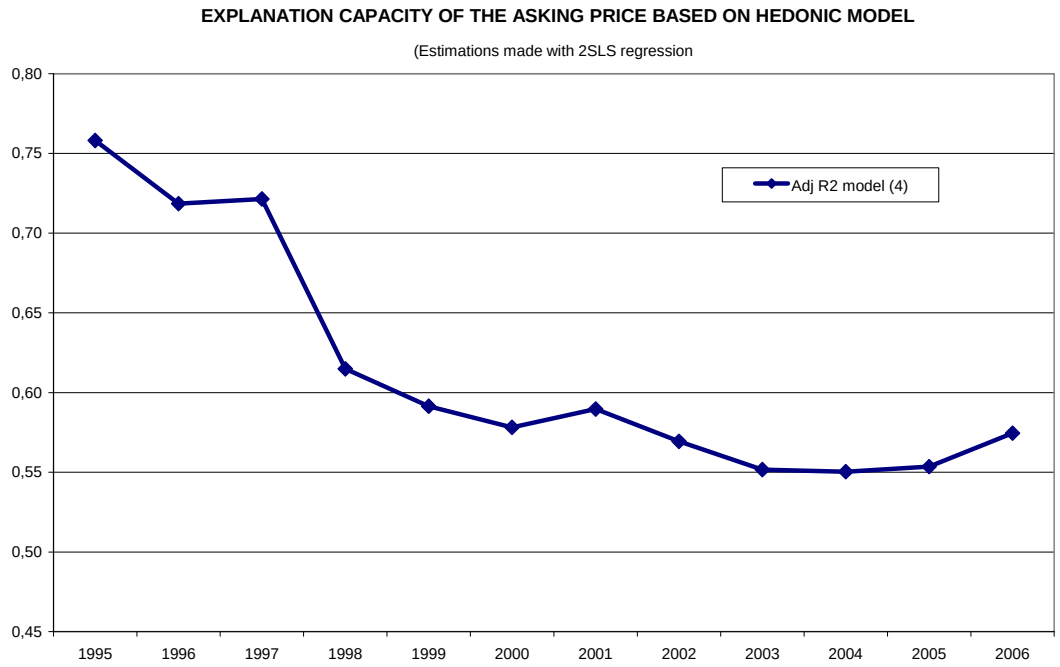


Figure 4

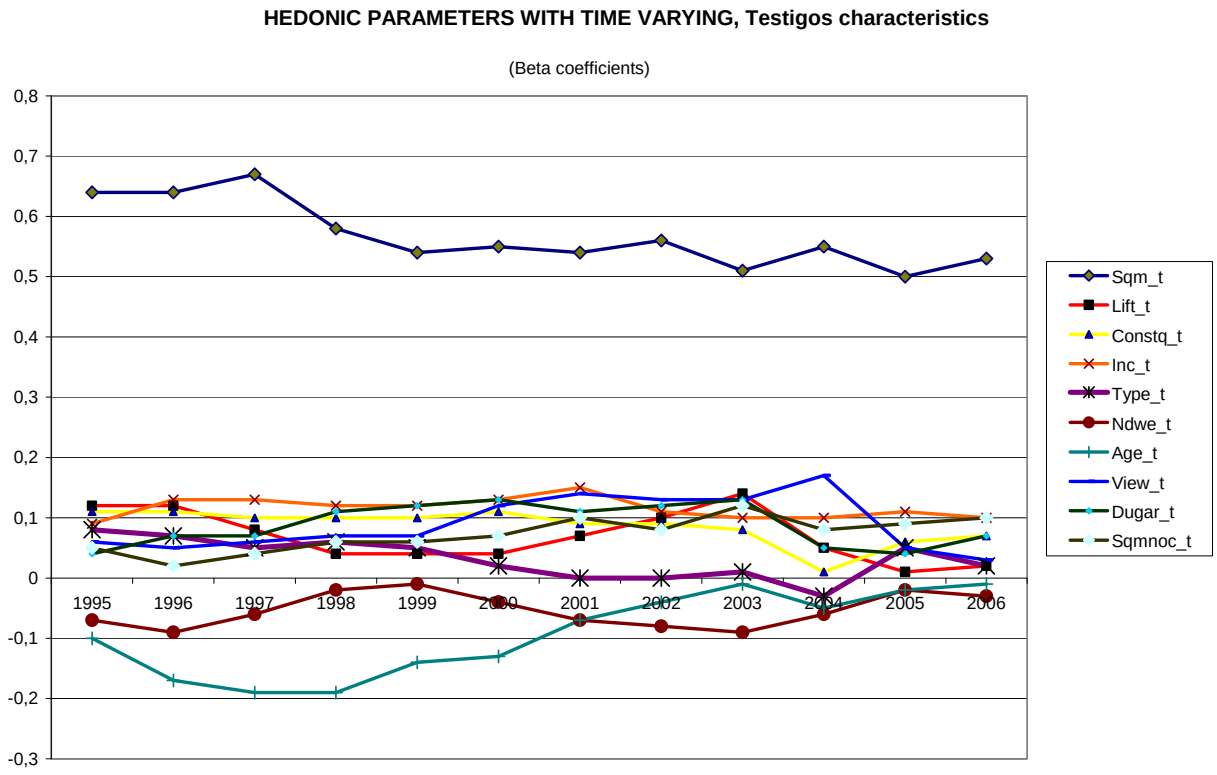


Figure 5

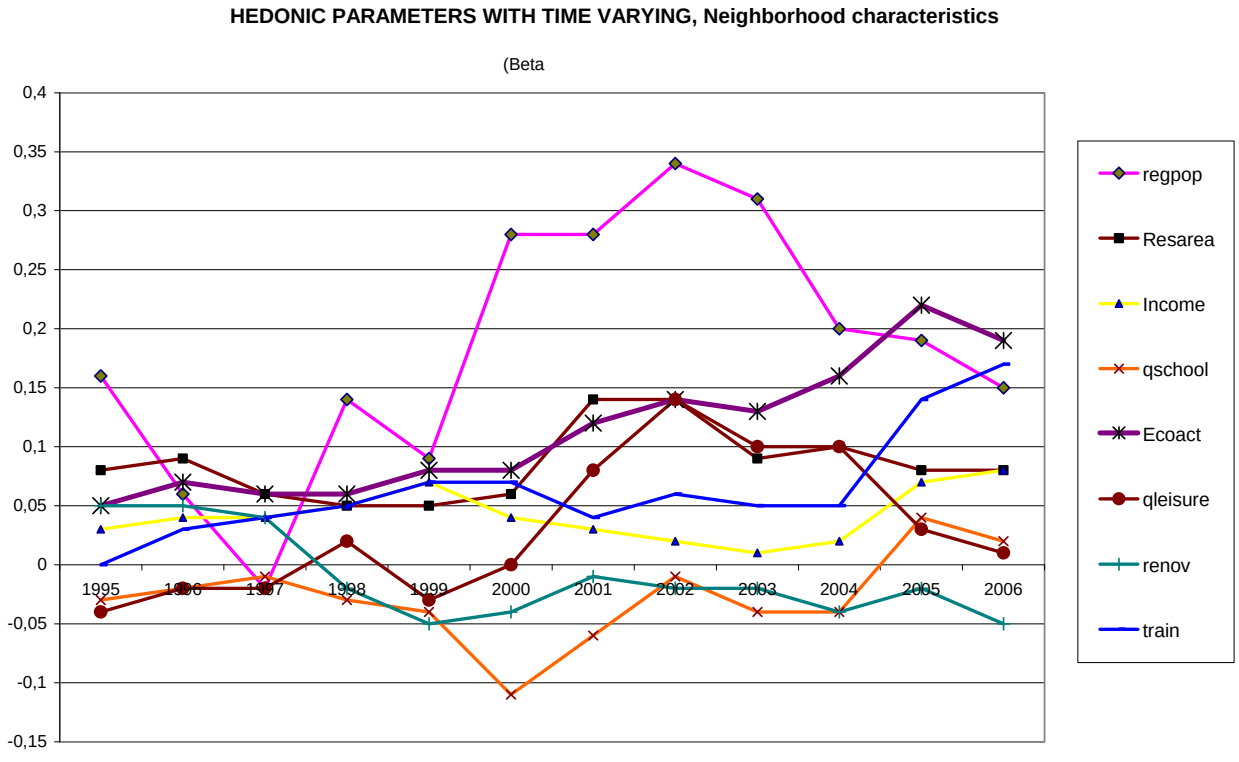


Table 5. Correlations between hedonic model explicativity and features parameters					
Correlations with	r2adj				
	Pearson Correlation	Sig. (2-tailed)		Pearson Correlation	Sig. (2-tailed)
Sqm_t	0,91	0,00	Sqmnoc_t	-0,88	0,00
Popgrow	0,87	0,00	Duswim_t	-0,81	0,00
Type_t	0,80	0,00	regpop	-0,80	0,00
renov	0,79	0,00	qleisure	-0,79	0,00
towpop	0,67	0,03	Age_t	-0,78	0,00
Constq_t	0,65	0,02	age	-0,75	0,01
Qshop_t	0,63	0,03	Ecoact	-0,72	0,01
			Dusport_t	-0,61	0,06
			View_t	-0,59	0,04

Table 6. Pseudo metadata analysis results

Dependent Variable: R2ADJ
Method: Two-Stage Least Squares
Sample: 1995 2006
Included observations: 12
Instrument list: all endogenous variables

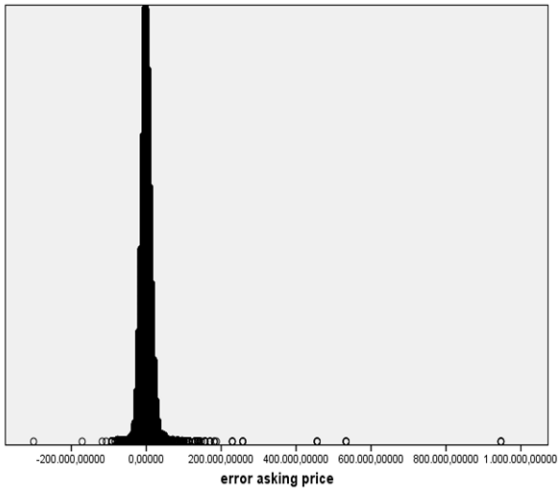
	Coefficient	t-Statistic	Prob,
Type_t	3,664```	109,43	0,006
View_t	1,904```	82,67	0,008
Sqm_t	0,861```	249,94	0,003
Sqmnoc_t	0,832```	71,41	0,009
Constq_t	0,300``	24,52	0,026
renov	0,217``	28,97	0,022
Age_t	-0,630```	-79,48	0,008
regpop	-0,992```	-88,17	0,007
Qshop_t	-1,670```	-86,63	0,007
Ecoact	-1,767```	-74,18	0,009
Popgrow	-2,339```	-83,07	0,008

R-squared	1,00	Mean dependent var	0,58
Adjusted R-squared	1,00	S,D, dependent var	0,08
S,E, of regression	0,00	Sum squared resid	0,00
Durbin-Watson stat	2,97	Second-Stage SSR	0,00

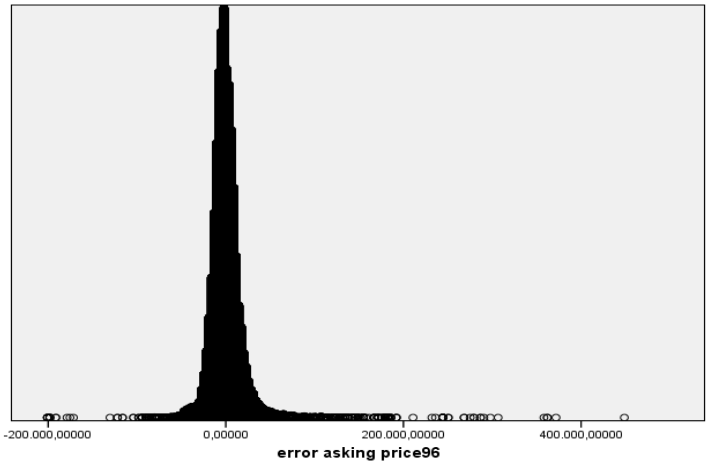
``` significant at 0.01 level
`` significant at 0.05 level
```

Figure 6(1 to l2). Errors obtained from hedonic regressions

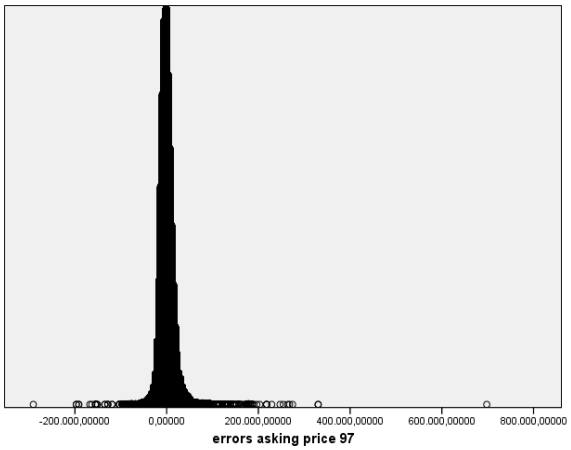
Error asking prices 1995



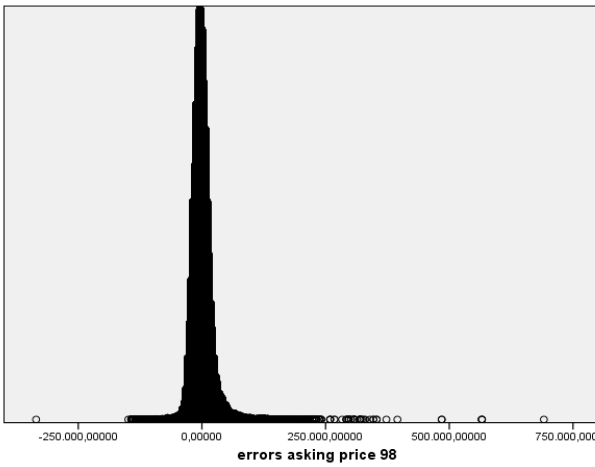
Error asking prices 1996



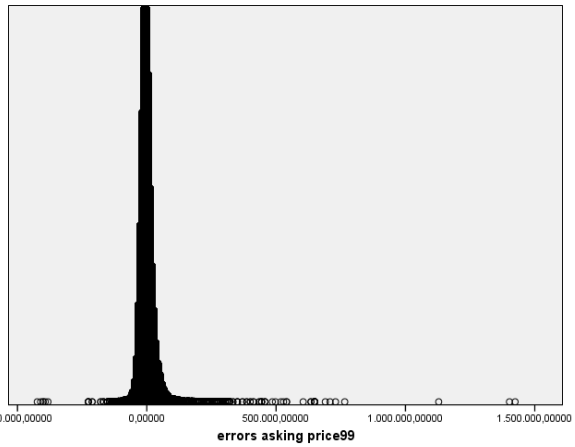
Error asking prices 1997



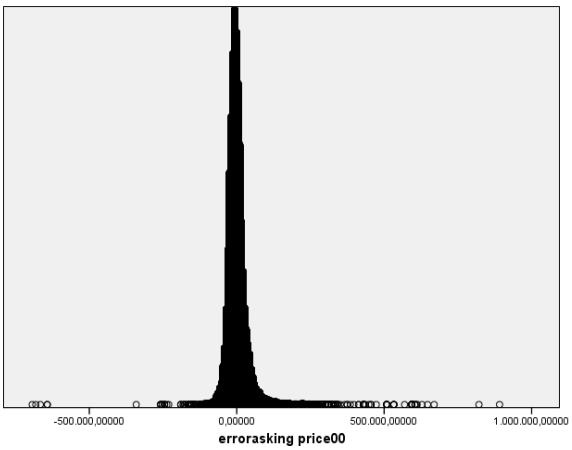
Error asking prices 1998



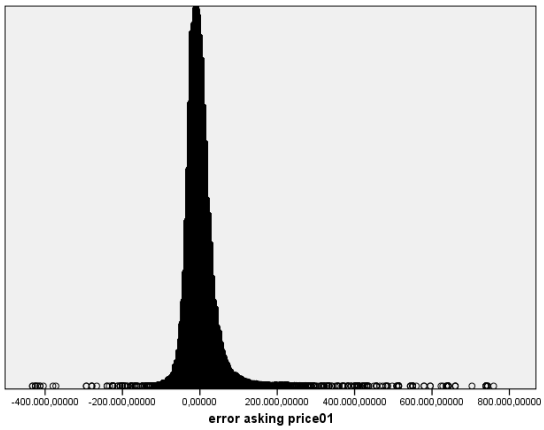
Error asking prices 1999



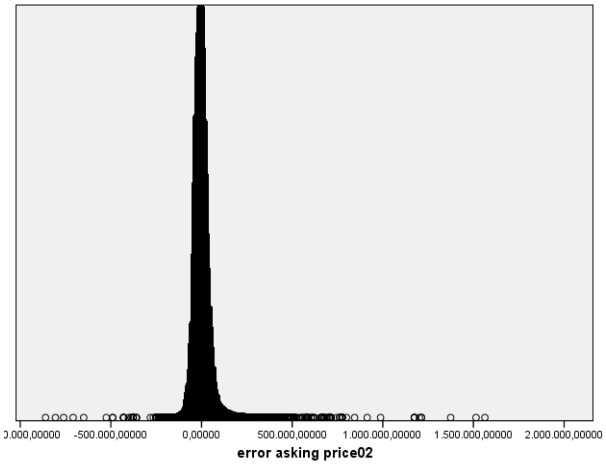
Error asking prices 2000



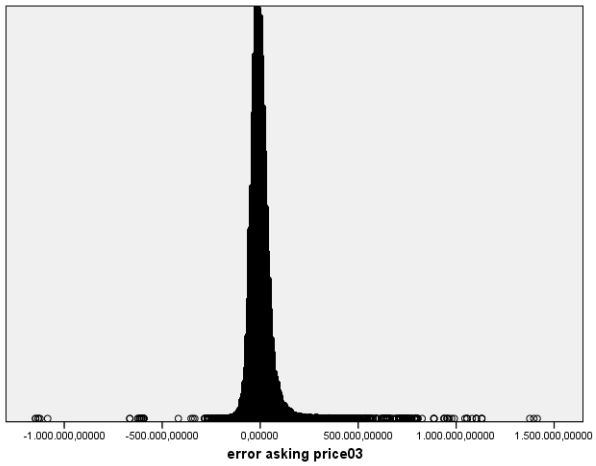
Error asking prices 2001



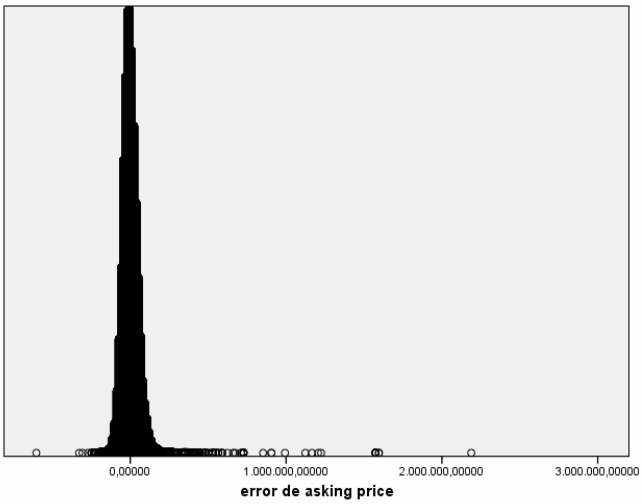
Error asking prices 2002



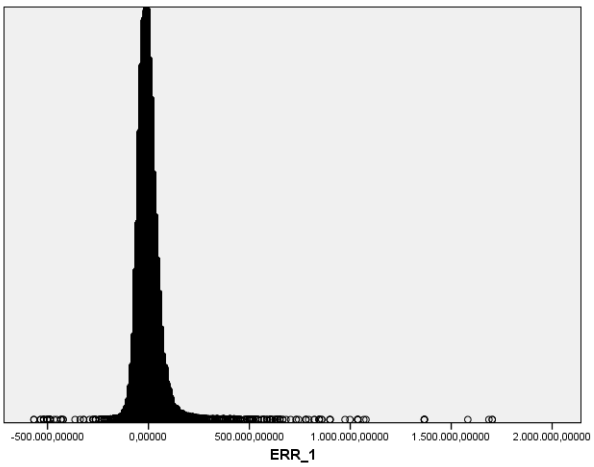
Error asking prices 2003



Error asking prices 2004



Error asking prices 2005



Error asking prices 2006

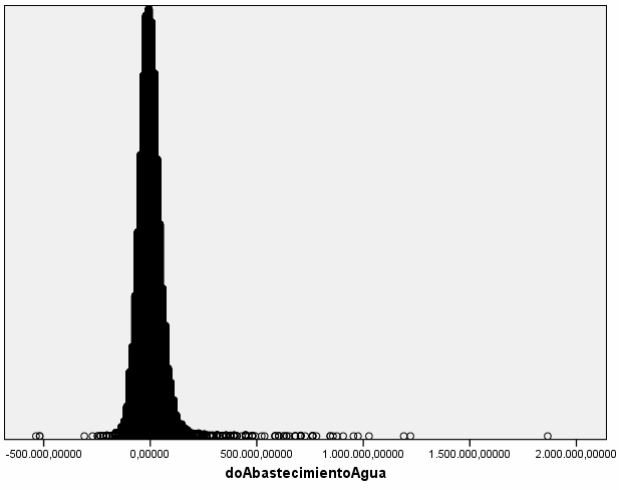
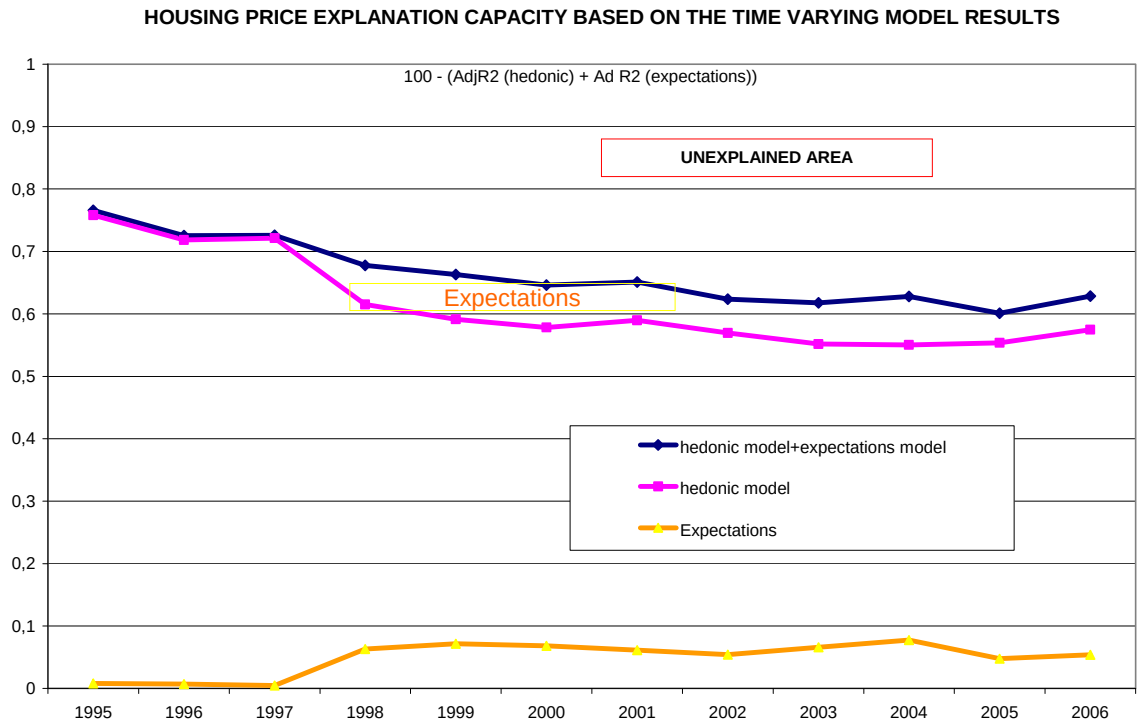


Table 7a MODEL: EXPECTATIONS MODEL: RESULTS OF THE RESIDUALS OF HEDONIC EQUATIONS TIME VARYING												
Dependent variable: residuals of hedonic determinants of asking price of testigo i												
Years	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Multiple R	0,18	0,16	0,13	0,40	0,42	0,40	0,39	0,35	0,38	0,41	0,33	0,36
R Square	0,03	0,02	0,02	0,16	0,18	0,16	0,15	0,13	0,15	0,17	0,11	0,13
AdjR Square	0,03	0,02	0,02	0,16	0,18	0,16	0,15	0,13	0,15	0,17	0,11	0,13
Std. Error of the Estimate	17779,09	17128,43	16270,68	19682,72	26842,96	30211,58	33690,71	40571,35	46295,08	51952,52	55844,68	57666,84
Standardized Coefficients	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*
(Constant)												
t-stat	*-2,39*	*26,00*	*34,02*	*16,93*	*-27,60*	*-129,70*	*-13,87*	*-62,78*	*-67,12*	*-108,12*	*-14,89*	*-5,50*
IR	**-0,03**	**-0,31**	**-0,39**	**-0,11**	**-0,07**	**-0,10**	**-0,05**	**-0,05**	**-0,04**	**0,01**	**-0,05**	**-0,07**
t-stat	*-5,95*	*-28,73*	*-38,50*	*-36,62*	*-25,14*	*-31,90*	*-22,74*	*-21,87*	*-19,16*	*3,69*	*-7,09*	*-5,07*
RPH	**0,20**	**0,28**	**0,20**	**0,43**	**0,40**	**0,43**	**0,38**	**0,35**	**0,38**	**0,42**	**0,32**	**0,28**
t-stat	*34,83*	*44,15*	*36,68*	*127,99*	*157,32*	*150,81*	*161,42*	*169,63*	*203,59*	*134,05*	*34,80*	*20,48*
RCG		**0,18**	**0,21**	**-0,01**	**0,01**	**0,05**	**0,01**	**-0,04**	**0,02**	**0,05**	**0,01**	**0,11**
t-stat		*21,34*	*25,79*	*-2,59*	*4,15*	*17,54*	*5,64*	*-20,44*	*10,65*	*15,73*	*1,04*	*14,38*

Figure 7


HOUSING PRICE EXPLANATION CAPACITY BASED ON THE TIME VARYING MODEL RESULTS
100 - (AdjR2 (hedonic) + Ad R2 (expectations))
UNEXPLAINED AREA
Expectations
hedonic model+expectations model
hedonic model
Expectations
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006