Universidade de Vigo
Departamento de Economía Aplicada

Documento de Traballo
0309

A Quality Index for Spanish Housing

Raquel Arévalo Tomé
José María Chamorro Rivas

Documentos de Traballo

Outubro 2003

Departamento de Economía Aplicada
Universidade de Vigo
As Lagoas Marcosende S/N, 36310 –Vigo
Tfno: +34 986 812500 - Fax: +34 986 812401
http://www.economiaaplicadavigo.org/
E-mail: depx06@uvigo.es

A Quality Index for Spanish Housing*

Raquel Arévalo Tomé† and José María Chamorro Rivas‡

University of Vigo

Abstract

The purpose of this article is to offer an empirical analysis of the geographical differences in Spanish housing quality. We derive an index of housing quality using the Multiple Correspondence Analysis (MCA) in the line with Arévalo (1999). The author obtains a housing quality index by using some structural characteristics of houses and those collected in the *Encuesta Básica de Presupuestos Familiares* (EBPF) in Spain for the periods 1980-81 and 1990-91. In addition, this paper includes location-specific characteristics of the house using in the analysis two new variables: city size and accessibility. Results confirm that location characteristics influence house quality. It is confirmed that the inclusion of these location-specific variables shows a more realistic view of geographical differences in the Spanish house quality. Firstly, urban characteristics reveal that houses located in densely populated cities do not significantly improve their quality whereas there is significant quality deterioration within sparsely populated cities. Secondly, as was to be expected, consideration of accessibility attributes reveals quality improvements of housing situated within those sparsely populated areas that have good road communication with densely populated cities.

Keyword: Housing quality index; Accessibility; Multiple Correspondence Analysis

Latest Draft: September 30, 2003.

---

* The authors acknowledge the financial support from the Spanish Ministry of Science and Technology and from European Regional Development Fund through DGICYT grant BEC2002-04102-C02-01, and Xunta de Galicia through grant PGIDIT03PXIC30002PN.

† Departamento de Organización de Empresas y Marketing, Facultad de Ciencias Económicas y Empresariales, Universidad de Vigo, Campus Lagoas-Marcosende, 36200 Vigo. E-mail: arevalo@uvigo.es. Phone: 34 986 813540. Fax: 34 986 812401

‡ Departamento de Economía Aplicada, Facultad de Ciencias Empresariales, Universidad de Vigo, Campus Sur, 32004 Ourense. E-mail: chamorro@uvigo.es. Phone: 34 988 368763. Fax: 34 988 368923.

1 Introduction

There has long been increasing interest in studying whether there are significant disparities in the quality of houses across different geographical areas. This topic has been widely analyzed in the literature both on housing quality and on urban and regional economics. In particular, several articles on urban economics relate to the relationship between quality and market price of housing in a particular metropolitan area: (for example, Bartik and Smith (1987) or Conniffe and Duffy (1999) review relevant literature on this topic).

In reviewing the debate on the appropriate definition of housing quality, we observe that there is no common interpretation of what a high/low quality house should be. For example, in a review of the literature on housing quality made by Kutty (1999) we can observe that authors are using different indicators and measurements of it. Two possible explanations for this are that, on the one hand, data availability conditions quality measurement; on the other hand, there is great subjectivity involved in the perception of quality. However, there are some indicators of housing quality commonly used in the literature. They are, for example, structural adequacy, neighborhood quality, access to work and other amenities, safety, provision of public services, room density and housing affordability among others.

The purpose of this article is to offer an empirical analysis of the geographical differences in Spanish housing quality at a provincial level.[4] To do this, we derive a measurement of housing quality using the Multiple Correspondence Analysis (MCA) based on Arévalo (1999). In this paper, the author obtains an index of housing quality using information on structural characteristics of Spanish houses for the periods 1980-81 and 1990-91. Her empirical investigation concludes that: (i) high-quality houses are highly localized in a limited number of provinces, and (ii) there is quality improvement between both analyzed periods.

[4]Spain has a population of 39 million people and an area of 504,750km2. This area is divided into 55 administrative provinces, including the islands and territories in North Africa. Each has a provincial capital which generally has the same name as the province itself.

However, while the physical structure of houses is an important determinant of housing quality, different works have claimed that housing quality is influenced by more than the structure of the house. Two major influences, for example, are urban and accessibility characteristics that determine the amenities and services affordable by householders in a particular geographical area. Thus, our concern in this paper is to analyze housing quality in Spain by considering location-specific variables, rather than only considering structural characteristics.

The importance of location in the determination of housing quality is demonstrated in several works. For example, Wolverton and Senteza (2000) show that characteristic house prices vary significantly across regions using U.S. data for the period 1986-1992. Shinnick (1997) determines the price of the various housing attributes (physical and location attributes) using a hedonic model for Irish data. In our work we include two location variables in the concept of housing quality with structural attributes: city size and accessibility. These variables are used as proxies of urban and accessibility attributes respectively. Thus, it is from this perspective that this paper intends to analyze the geographical differences in Spanish housing quality.

As we mentioned, the method used in the study is the MCA. This will involve explaining house quality in terms of the various attributes of the house. The most complete set of data on structural characteristics and city size in Spain is available in a Spanish housing survey called *Encuesta Básica de Presupuestos Familiares* (EBPF) provided by the *Instituto Nacional de Estadística* (INE). The EBPF is a survey that collects information on Spanish households to calculate a price index of the Spanish economy. A representative sample of Spanish households is chosen and they are asked about some structural characteristics of their house among other questions related to family budget (family expenditure, characteristics of house occupiers, etc.). To derive the accessibility variable we have also used information about road journey times between provincial capitals.

MCA has its origins in the works of Benzecri (1964) and has been used extensively in several empirical and theoretical studies. For example, Greenacre (2002) gives an explanation of this technique and applies it to the Spanish National Health Survey. In a theoretical context, Greenacre (1991) reviews the practical aspects of interpreting MCA, and Tenenhaus and Young (1985) discuss a variety of methods for quantifying categorical multivariate data. Correspondence analysis is a descriptive technique used to represent contingency tables. Using this method, we can assign a numerical value to each house that may be interpreted as a measure of its level of quality. This value is derived from an indicator which is a linear combination of categorical variables that define the characteristics of the house. The method summarizes data from the survey by counting frequencies of response and assigns to each category a weight which is interpreted as its contribution to the house quality. Besides, an interesting property of this index is that it is an ordinal variable. Thus, it allows us to make comparisons between a house and the average housing, and between two particular houses.

Note that this is not a house price index study. Price differences between two provinces may not be solely attributable to house quality differentials. As Conniffe and Duffy (1999) affirm, there are other factors, such as differentials of economic activity and demographic pressures, which may be also reflecting price differentials. For example, Bösch-Supan (1986), using data from German householders, proves via empirical estimations that the length of tenure has a significant negative effect on rental prices, the so-called tenure discount. In another work on Spanish housing quality, Arévalo (2001) estimates the effect of housing quality, location and tenure discount on house prices.

The index of housing quality is computed for Spanish provinces using data of housing in the period 1990-91. Our empirical investigation confirms that high-quality houses are highly localized in a few provinces. Results also show that structural plus urban quality (excluding accessibility) reveals that houses located in densely populated cities do not appreciably improve their quality if we compare their structural quality, whereas there is a quality deterioration within small cities, which supports the view that some structural variables (swimming pool, the presence of elevator, etc.) are correlated with city size. However, as was to be expected, the inclusion of accessibility reveals quality improvements in housing within sparsely populated areas that have good road communication with densely populated cities.

The paper is organized as follows. Section 2 gives a comprehensive explanation of the Multiple Correspondence Analysis. Section 3 shows how this technique can be used to derive a housing quality index and applies MCA to analyze the geographical differences in Spanish housing quality using structural and location-specific housing characteristics. Section 4 concludes the paper.

2 Multiple Correspondence Analysis

Multiple Correspondence Analysis (MCA)[5] is a statistical technique used to analyze categorical data (data on a set of qualitative variables, each with several categories). From a contingency table of a set of individuals, MCA finds linear-independent factors, each constructed as linear combinations of categories. These factors define orthogonal dimensions of a perceptual map, where the categories are represented by points projected onto the map. Factors can be ordered with respect to the percentage of variability that they explain so that all of them explain the total variability in the data.[6] The centre of the map can be interpreted as an "average individual", characterized by being associated with the most frequently observed categories.

Next, we explain in detail this technique. MCA applies to Q qualitative variables, possibly correlated, for N individuals, often as a result of a questionnaire survey. The objective of MCA is to obtain a set of K uncorrelated variables ($K < Q$) which are linear combinations of the Q variables analyzed. These K variables will help us to interpret the collected data.

Notation

Suppose we have data on Q qualitative variables from N individuals. Let Z be the matrix of data ($N \times J$) where J is the total number of categories of the Q variables. Let J_q be the number of categories of variable q ($q = 1, 2, \ldots, Q$).[7] The element z_{ij} of matrix Z takes the value one when individual i gives the response corresponding to category j and zero otherwise, $i = 1, 2, \ldots, N$, $j = 1, 2, \ldots, J$, where $N >> J$. Note that since each

[5] MCA is a generalization of the Simple Correspondence Analysis where a two-variable contingency matrix is used.
[6] Arévalo (1999) applies this technique to Spanish housing and finds that 88% of variability is explained considering just one factor.

individual only responds to one category of the J_q categories of variable q, the row sums for Z must be equal to Q, and that the sum of elements in column j of matrix Z is the absolute frequency of category j (frequency denoted by N_j).

For each variable q, we have that $N = \sum_{j \in I_q} \sum_{i=1}^{N} z_{ij}$, where I_q is the set of categories for variable q. Therefore, $NQ = \sum_{j=1}^{J} \sum_{i=1}^{N} z_{ij}$ is simply the grand total of Z.

The relative frequency matrix is $F = (1/NQ)Z$. From this matrix i´s row profile can be defined as the ith row of F. Analogously j's column profile can be defined. The vector of average column profile is the vector $r = F1_J$ with $r_i = 1/N$, and the vector of average row profile is the vector $c = F^T 1_N$ where each element is equal to $c_j = N_j / NQ$. The diagonal matrices of these masses are denoted by D_r and D_c respectively.

In this context, the similarities between two profiles are measured through the χ^2-distance. This is the standard Euclidian distance with metric defined by D_r^{-1} for the column profiles and D_c^{-1} for the row profiles.

Let now define the matrix

$$E = D_r^{-1/2} \left(F - rc^T \right) D_c^{-1/2}. \tag{1}$$

The element $e_j^T e_j$ in the diagonal of matrix $E^T E$ is the χ^2-distance between the ith column profile and the average column profile r, weighted by its relative frequency (c_j). Analogously the element $e_j e_j^T$ of matrix EE^T for the rows can be interpreted. The sum of these elements for matrix $E^T E$ is called the total inertia (TI). This is a concept used in the literature of correspondences, and it is associated with the notion of weighted variance.

[7] For example, in a context of housing quality a typical variable is the number of square metres of constructed surface which we will assume with four categories: less than 61 square metres, between 61

Procedure

MCA computes the singular value decomposition of *E*, say $UD_{\alpha}V^{T}$, *U* and *V* being orthogonal matrices. This matrix has $J-Q$ non-zero eigenvalues. In practice, since $N>>J$, it is more convenient to compute the eigenvalue-eigenvector decomposition of the $(J\times J)$ symmetrical matrix $E^{T}E$, say $E^{T}E=\Gamma D_{\lambda}\Gamma^{T}$, where $D_{\lambda}=D_{\alpha}^{2}$. The eigenvalues in the diagonal matrix D_{λ} quantify the inertia projected through each of the associated eigenvectors (columns of Γ). These eigenvectors represent orthogonal directions of projection of centered column profiles. The direction of the first eigenvector (that associated with the greatest of all eigenvalues) is the optimal projection; say, it is the linear orientation that collects the maximum disparity between individuals according to the *Q* variables. The second eigenvector is orthogonal to the first one and represents the linear orientation that captures the maximum residual disparity, that is, the disparity not taken into account by the first axis of projection, and successively we can interpret all eigenvectors until the total inertia is in *K* orthogonal axes with $K\leq J-Q$. In geometric terms, we are changing the original space of profiles which has dimension $J-Q$ to another reduced space with dimension *K*.

The coordinates used for plotting the column points in the reduced space are contained in the following matrix

$$M=D_{c}^{-1/2}\Gamma D_{\lambda}^{1/2} \qquad (2)$$

where the generic element is m_{ij}. The *K* indicator variables w_k ($k=1,2,\ldots,K$) are defined through linear combinations of all categories, and they are the columns of matrix

$$W=ZM \qquad (3)$$

The element m_{jk} of matrix *M* shows the contribution of the *j*th category in the new variable w_k, and z_{ij} takes the value one (alternatively, zero) if individual *i* has

---

and 90 square metres, between 91 and 130, and more than 130 square metres.

(alternatively, does not have) the *j*th category. By construction, it can be proved that the average individual satisfies that $w_k = 0$.

Since inertia λ_k represents a percentage of the total inertia, it is possible to calculate the percentage of inertia collected by each indicator or axis. Therefore the ability to explain the information in matrix *E* can be measured, and therefore, the ability to summarize MCA.

In MCA, in contrast with Simple Correspondence Analysis ($Q = 2$),[8] these percentages are always small and show a pessimistic idea of the proportion of the projected inertia (Greenecre, 1990). To know the real representative of axis, Benzécri (1979) proposes considering solely the relevant *P* axis, that is, the axis associated with those eigenvalues with $\lambda_p > 1/Q$, $p = 1, 2, \ldots, P$ and $P \leq K$. Analogously, he proposes correcting the eigenvectors with the transformation

$$\lambda_p^c = \left[Q/(Q-1)\right]^2 \left[\lambda_p - 1/Q\right]^2 \tag{4}$$

and show the proportion of inertia explained related to $\sum_{p=1}^{P} \lambda_p^c$. The dimensionality of the original matrix is reduced from $J - Q$ categories to *P* relevant indicator variables losing a small quantity of information.

Once the importance of each indicator is evaluated, we have to interpret it in relation with (a) its correlation with all initial variables, and (b) the weights of initial variables on the indicator.

3 Empirical analysis of the housing quality in Spain

3.1 Data

---

[8] For the special case $Q = 2$, TI is known to be equal to $(J/Q) - 1$.

The structural housing attributes employed in this paper were obtained from a representative sample of Spanish housing, the *Encuesta Básica de Presupuestos Familiares* (EBPF) reported by the *Instituto Nacional de Estadística* (INE) in the period 1990-91.[9] The EBPF is a large survey designed to establish the characteristics of Spanish householders at a particular moment in time. The INE sends data collection questionnaires to householders, and respondents provide detailed information concerning housing structural characteristics, among other information related with the family budget. The sample size is 21,155 houses representing a total of 11,298,509 Spanish houses.

The variable used to proxy urban characteristics is city size. We consider that population can be a good proxy of the existence in a city of services and amenities such us travel nodes, institutional and government services, parks, shopping centers, cultural and sports facilities, etc.

In addition, we construct another variable, called accessibility, that deals with the collection of information about the characteristics of the space outside the city (access attributes). New road infrastructures have reduced the cost of traveling not only within the city, but also between cities. Therefore, an individual living in a small city (possibly with few urban amenities) located close to a big city (possibly with many urban amenities) can travel to this other and enjoy the services and amenities located there. The intensity of the urban amenities enjoyed by a house located close to a big city will depend on the distance and the size of the big city. Therefore, we consider as a proxy of this potential quantity of services and amenities enjoyed by a particular house, the population of the capital province where the house (house province) is situated plus the population sum of provincial capitals that surround the province (surrounding provinces), weighted by the distance from the capital to the surrounding province. From this calculation we are assigning to each house a population that reflects the accessibility characteristics.

The accessibility variable, A_r, is then defined as follows. Let a house located at province be *r*, and let S_r be the set of provinces that surrounds province *r*, thus

[9] This paper has used the EBPF of the period 1990-91. The INE has made three extensive surveys for the

$$A_r = P_r + \sum_{i \in S_r} d_{ri} P_i \quad (5)$$

where P_i is the population of province capital *i* and d_{ri} is the distance between province capital *r* and province capital *i*. This distance is defined, in mean terms for each province, as the minimum time t_{ri} that a family takes to go from province capital *r* to province capital *i* using a road journey. We consider that the effect of accessibility attributes is limited to a circle with radius $t_{\max}$ minutes. Therefore, the distance between province capital *r* and province capital *i* is defined as $d_{ri} = (t_{\max} - t_{ri}) / t_{\max}$. In this work we have considered $t_{\max} = 90$. See in Table 1 the values that take the accessibility variable in our study at a province level when $t_{\max} = 90$.

3.2 Application of MCA to Spanish housing

This section begins the analysis of the geographical differences of housing quality in Spain at a province level by breaking down the quality of the housing into various structural and location characteristics. We consider that housing quality has three components: that due to the physical attributes of the house, that due to the characteristics of the city, and that due to accessibility.

Specifically, these characteristics are subdivided into three groups. The first group contains 18 structural characteristics, with a total of 61 categories. The second group consists of one urban characteristic, city size, with 5 categories. Our interest in city size is in their contribution in measuring the number of services and amenities shared by householders of a municipality. Some structural variables may also act as proxies for high quality cities (that is, cities with a high number of urban services and amenities), this would be the case of a house in a 3- or more-storey-building, houses with gardens, swimming pool, and sports area, and this would be reflected in a low contribution of city size to the level of housing quality when comparing structural and urban housing quality for higher quality provinces.

---

periods 1973-74, 1980-81, and 1990-91.

The third group contains one location characteristic, accessibility, with 4 categories. This variable acts as a measure of the number of services and amenities shared by households of a geographical area that covers the nearest main towns or cities. In general, the expectation is that house quality will decline with increasing distance from the nearest main cities. It is reasonable to assume that the nearer a house is to a big city, the nearer it is to social and government services, universities, cultural amenities, and good transport systems with easy access to other parts of the country. Therefore a high accessibility value may be reflected in a higher quality house. The structural, urban and accessibility variables used in this paper are outlined in Table 2.[10]

The analysis presented below has two principal objectives: (a) The application of MCA to Spanish housing to reduce available information, and the interpretation of results as a housing quality, and (b) comparison of housing quality at a province level. For each house we compute three different housing quality indices (see Figure 1). Firstly, we consider the structural variables of each house to obtain an S-quality index. Secondly, we compute the quality index using structural and urban variables. We define this index as the SU-quality index. Thirdly, we derive a SUA-quality index that considers structural, urban and accessibility variables.

3.3 Interpretation of results as a housing quality

In this section we report the results obtained by applying MCA to: (a) the structural variables, (b) the structural and urban variables, and (c) the structural, urban and accessibility variables among houses represented in the EBPF for the period 1990-91.[11]

As we mentioned in the previous section, as far as the variables used in MCA are correlated, we can define a small number of new variables, which, through optimal weightings of the original variables, we define as "indicators" or "projection factors." These new variables will permit the complete characterization of the houses analyzed. Furthermore, we can interpret these indicators in terms of the variables which summarize them. Such an interpretation must be made in terms of: (i) the relative

[10] We show the observed frequency of modalities in the first column of Table 4.

importance of different indicators when summarizing each group of variables, (ii) the influence of a variable on the definition of each indicator (i.e., correlations between an indicator and the original variables), and (iii) the weight of modalities in the contribution of the indicators.

The importance of the indicators

Now we examine the number and the real importance of the different indicators obtained in MCA. Results of all three analyses (Structural, Structural-Urban, and Structural-Urban-Accessibility analyses) are shown in Table 3.[12] In all three applications we observe that the first indicator in importance (that which explains the greater variability among variables) has a significant importance because it explains approximately 67% of the total variability of the original variables. The second indicator in importance explains 17% of this variability when the structural variables are used, whereas this value is equal to 15% in the Structural-Urban analysis, and 14% in the Structural-Urban-Accessibility analysis. Therefore, the simplification obtained when the Q original variables (with their J modalities) are substituted for the first indicator (or, if it is the case, the two first indicators) is very significant. The remaining indicators have considerably reduced importance. They merely explain marginal aspects of data, which are not considered in the two first indicators, so that their interpretation is of minor interest.

Given the importance of the two first indicators, in addition to showing the frequencies observed in each of the original variables, Table 4 presents only those results (correlations and weights[13]) which are related to the mentioned indicators.

Correlations

---

[11] The program used in the analysis is SAS (Version 8 of Windows). Results obtained from MCA can be requested at arevalo@uvigo.es.

[12] The decomposition of total inertia among the different factors of projection which are obtained from the MCA must be transformed using the Benzécri transformation (see equation (4)) to deduce the true representation of the obtained projection factors (indicators).

[13] Weights ($\overline{m}_j$ associated to each modality $j = 1,\ldots,J$) shown in Table 4 are derived from a normalization of original weights (m_j), so that the maximum value of $\overline{m}_j$ is 10, and the minimum value is -10.

We observe that variables common to all three analyses (that is, the 18 structural variables) behave in a similar way. So the most significant variables which define the first factor in the analyses are: "type of fuel used to heat the water", "for the central heating", and "for the cooker", as well as "type of building", "elevator", "central heating", and "other type of community services". In an intermediate position we find variables such as: "water", "hygienic services", "telephone", "age of the building", "garage", and "constructed surface". Finally, variables which show the lowest correlation with the first indicator are: "swimming pool", "sports area", "air conditioning", "garden", and "electric power". This last variable is the one which exhibits the major divergence between the frequencies of its categories (only 0.17% of houses do not have this service). Although there are few houses that do not present this attribute, we have decided its inclusion in MCA because they can be used to analyze those existing differences among houses according to their installed services.

If location variables (that is, city size and accessibility) are considered in the analysis, results show that the correlation between the first indicator and the city size is around 0.60, whereas the correlation with the access variable is 0.45.

The most represented variables in the second indicator are: "fuel for water and for heating", "water", "hygienic services", and "central heating".

Weights

Related to the modalities represented in both principal factors, in all three analyses we observe a very frequent phenomenon which is known as the *Guttman effect*.[14] Modalities of each variable show a parabolic structure when depicted in the plane defined by the two first indicators. This fact simplifies its interpretation. Indeed, *Guttman's effect* reveals that whereas a first factor summarizes the order structure of all modalities, a second factor shows opposition among extreme modalities (little frequency), and average modalities (major frequency) of a variable. Therefore, given this interpretation of the second indicator, the analysis can be limited to the first factor since it is the one that contains the significant information of the variability between

[14] Greenacre (1991).

houses so far as analyzed attributes are concerned. From now on, we will focus our analysis on the first indicator when interpreting the order of modalities in each type of analysis: Structural, Structural-Urban, and Structural-Urban-Access.

With respect to results obtained in the Structural analysis, we observe that there is no attribute that takes the maximum possible weight (value 10), implying that no housing attribute positively compensates the negative extreme value (-10) achieved by modality "not having water within the house". The same result is obtained in the penalization suffered by the first indicator when the house does not have "electric power" (-8.57) or "hygienic services" (-8.44). As one would expect, more frequent modalities of this variable, such as "having hot water", "having electric power", and "having a complete bathroom", take a weight around zero, reflecting their closeness to the average house.

The modalities with a higher positive contribution to the first indicator are: "sports area" (5.80) and "swimming pool" (5.58). However, not having these services (which is the most frequent case) hardly penalizes the value of the quality index. Results prove again that more frequent modalities approximate the value of the index to the average house, which, by definition, takes zero value.

Separate analysis of each structural variable shows that the order of its modalities assigns a negative weight to the worst characteristic, a positive sign to the highest modality, and a graduation which is appropriate to its meaning when the variable has two or more modalities. This result, and each variable contribution to the first indicator definition, allows us to interpret the indicator as an index of structural housing quality that we will denote by S-quality index.

On the other hand, the Structural-Urban analysis shows the same behavior of the structural variables as that observed in the Structural analysis. However, the "city size" variable has an additional effect on the indicator. This variable penalizes the indicator when the house is located in a city with fewer than 50,000 inhabitants, whereas, on the contrary, city size gradually assigns a positive weight so long as the city increases its population.

These results derived from the Structural-Urban analysis are shown again in the Structural-Urban-Accessibility analysis with the added effect that the new variable, accessibility, penalizes (favors) as a housing indicator when the house is situated in a location with a low (high) accessibility rank. From now on, we denote by SU-quality index and SUA-quality index indicators obtained in the respective analyses: urban and accessibility.

It is important to note that the consistency obtained in the results for the three analyses allow us to derive the complementary effect of location variables over those of structure. Although the quality concepts used in the analyses are restricted to the variables involved in each MCA, the usefulness of the derived indices (for example, the SUA-index) is in the ease in making comparisons between houses by using a unique ordinal variable, instead of working with 20 qualitative variables and a total of J=70 modalities.

3.4 Comparison of housing quality at a province level

The empirical analysis of housing quality in Spain shows the existence of interdependence between structural, urban and accessibility attributes on housing quality. As can be observed in our analysis, those houses with good urban and access attributes (reflecting the high probability of being close to social, cultural and government services) generally have good structural quality. This fact it not to say that urban and access have no effect on quality. As one would expect, being close to densely populated cities improves housing quality whereas the contrary does not. Therefore, sparsely populated provinces in Spain with a level of good quality structural housing have decreased in the quality ranking, even below the average quality house.

S-quality index

Table 5 shows the values of the S-quality index for the 52 Spanish provinces. They are in order from the province with the highest S-quality index to the lowest S-quality index. As we remarked before, an S-quality level of zero corresponds to the average S-quality house. All provinces ranked above this zero level will be considered as having high housing S-quality.

Results show that almost one third of provinces (15 out of 52) have a high housing S-quality. Among these are Alava, Navarra, Madrid, La Rioja and Barcelona. Therefore, good structural houses appear to be very localized. These high S-quality houses are mainly sited within provinces in the northeast of Spain. Furthermore, we note that these are rich provinces in terms of per capita GDP. As may be expected, there seems to be a high correlation between high-quality housing and wealth. However, this is not a result common to all rich provinces. Tarragona, Girona, Baleares, Castellón, Teruel, Soria, Segovia and Cantabria are provinces which have a high per capita GDP (above the Spanish average value) but present a low structural quality.

In the following analyses, when location variables are considered in the construction of the quality index, we will show that some of these provinces will increase their levels of housing quality. We note also that Madrid, where the capital city of Spain is situated, is not the province with the highest quality houses; it occupies the third position in the ranking. However, Madrid obtains a better position in the ranking when the accessibility attribute is included.

The explanation for the agglomeration of high quality houses in a limited number of provinces seems to lie in the location of the development focuses in Spain. Literature distinguishes between three development focuses (provinces with the highest rents). These correspond with the Mediterranean littoral, provinces along the Ebro River, and Madrid and neighboring provinces. We observe that high-quality provinces are in the two last focuses whereas there are just three provinces, Lleida, Barcelona and Valencia, situated on the Mediterranean littoral with high-quality houses.

The worst houses are located within provinces with low levels of per capita GDP. These provinces are mainly located in the west of Spain. The province with the worst houses corresponds to Melilla.

SU-quality index

As displayed in Table 5, if we now consider structural and urban characteristics of housing, results reveal that a quarter of provinces (12 out of 52) present a level of SU-quality above the average housing SU-quality. Comparing this result with that obtained for the S-quality, we observe that high-quality houses are more localized within the SU-quality index than within the S-quality index.

This result indicates that city size has especially penalized those houses sited in sparsely populated cities. This may be so because SU-quality is related to city size and the greater the population of a city, the greater the probability of having good services, and this is reflected in higher quality of housing.[15]

In Spain, as in other developed countries, populated cities provide householders with social, cultural and government services and the best transport systems (airports, central bus, railway stations, etc.) with easy access to other parts of the country. This is the case of some populated cities such as Madrid, Barcelona and Valencia. These are cities that have improved their levels of housing quality occupying better positions in the SU-quality index ranking. However, since these populated cities already had high levels of S-quality, the improvement is less than the loss experienced by the sparsely populated provinces. This is possibly because some structural variables, such as swimming pool, elevator, etc., may be correlated with city size variable.

Contrarily, sparsely populated provinces, such as Guadalajara, Teruel, Segovia, Palencia, Huesca or Avila, show worse levels of SU-quality reflecting a significant lack of services and amenities. In fact Palencia and Huesca now exhibit a quality level below the average housing SU-quality whereas they have a high level of structural quality.

SUA-quality index

We computed the quality index for each of the 52 provinces considering structural, urban and accessibility characteristics (see Table 5). Results show that for 13 provinces, the SUA-quality is above zero, i.e., the quality level is above the average value. High

[15] A similar result is obtained by Shinnick (1997). The author finds that housing prices are directly related to population in some counties of Ireland. Furthermore, Arévalo (2001) shows that house rent positively depends on city size.

quality houses appear therefore to be very localized in a few provinces. Madrid has the highest value of the SUA-quality housing index whereas Melilla is the province with the worst housing. As we noted, the capital city of Spain is situated in the province of Madrid. Therefore, SUA-quality index ranks this province in the first place of the ranking showing a more realistic view of the geographical differences in Spanish housing quality, since one expects that, on average, the best houses in Spain are situated in the capital city where many services are concentrated.

Results obtained with the SUA-quality index do not lead to significant changes in the identification of the highest housing quality provinces. The SU-quality index seems therefore to be sufficiently robust for these provinces. The most important differences are observed for the medium and lowest housing quality provinces. All high housing SU-quality provinces are also high housing SUA-quality provinces. However, whereas the province of Guadalajara displays an index of housing SU-quality index below zero, this province presents a SUA-quality level above zero. This result has a straightforward explanation. Guadalajara is a sparsely populated province. This fact has penalized this province with a low level of SU-quality. However, since Guadalajara has good accessibility to Madrid, which is the capital city, households living in Guadalajara are provided with social and government services and the best transport system in the country at a very low travel cost.[16] So in the case of Guadalajara, houses have a premium in SUA-quality.

The same applies to Avila and Toledo, which are situated close to the capital city Madrid. As could be expected, provinces with good accessibility improve their index positions when we consider the variable accessibility in the quality index.

However, provinces with medium and low accessibility level, as, for example, Teruel and Soria, now exhibit worse quality levels than when only structural and urban characteristics were considered.

4 Conclusions

Our empirical investigation shows the effect of structural and location attributes on housing quality of Spanish housing. We have applied Multiple Correspondence Analysis to define an indicator that synthesizes (a) structural variables, (b) structural and urban variables, and (c) structural, urban and accessibility variables. Results show that: (1) the consistency obtained in the results for all three analyses allows us to derive three concepts of housing quality as well as the complementary effect of the location variables over the structural variables. (2) First indicator explains approximately 67% of total variability of original variables, whereas other indicators obtained in the analyses do not give any relevant information about variables. (3) On the one hand, in all three analyses, the order of all structural modalities assigns a negative weight to the worst characteristic, a positive sign to the highest modality, and a graduation which is appropriate to its meaning when the variable has two or more modalities. On the other hand, city size gradually assigns a positive weight when the city is larger, and accessibility variable penalizes (favors) the indicator value when the house is sited in a location with a low (high) accessibility rank. Therefore, MCA derives an indicator that can be interpreted as a housing quality index allowing the comparison of houses in terms of their quality.

The previous study has been used to analyze the geographical differences in housing quality in Spain. It was shown that good houses are highly localized in a few provinces. Furthermore, we observe the existence of interdependence between structural, urban and regional attributes on housing quality. In Spain, those houses with good urban and regional attributes (reflecting the high probability of being close to social, cultural and government services) generally have also a good structural quality. This fact it not to say that urban and regional characteristics have no effect on quality. As one would expect, being close to densely populated cities improves housing quality whereas the contrary is not true. Therefore, sparsely populated provinces in Spain which have a good structural housing quality level have descended in the quality ranking, even below the average quality of such provinces as Palencia and Huesca. Furthermore, the housing quality in Madrid (the province in which the capital city is situated, which is the most densely populated city in Spain) is the highest when the quality index is calculated using structural, urban and access attributes. However, without considering access

[16] The capital city of Guadalajara is 46 minutes from the capital city Madrid.

attributes, Madrid does not have the best houses (on average) in the country. The results also show that those provinces situated close to densely populated cities and with a structural quality below the average in Spain have increased significantly in housing quality. Closeness to services and amenities provided by big cities improves the housing quality of sparsely populated provinces such us Guadalajara, Avila or Toledo. This fact is due to their proximity to Madrid.

References

Arévalo, R., (1999), "Construcción de un índice de calidad de la vivienda", Investigaciones Económicas, 23(2), pp. 267-280.

Arévalo, R., (2001), *El mercado de la vivienda en España*, Ph-thesis. Universidad Complutense de Madrid.

Bartik, T. and Smith, V., (1987), "Urban Amenities and Public Policy", Handbook of Regional and Urban Economics. Vol. II. Urban Economics, Edited by E. Mills, Elsevier Science Publishers, Amsterdam.

Benzécri, J., (1979), "Sur le calcul des taux d'inertie dans l'analyse d'un questionnaire. Addendum et erratum", Cahiers de l'Analyse des Données, 4, pp. 377-378.

Bösch-Supan, A., (1994), "On West German tenants protection legislation", Journal of Institutional and Theoretical Economies, 142 (2), pp. 380-404.

Conniffe, D. and Duffy, D., (1999), "Irish House Price Indices – Methodological Issues", The Economic and Social Review, Vol. 30, No. 4, October, pp. 403-423.

Greenacre, M., (1991) "Interpreting multiple correspondence analysis" Applied Stochastic Models and Data Analysis", vol. 7, pp. 195-210.

Greenacre, M., (2002), "Correspondence analysis of the Spanish National Health Survey", Gaceta Sanitaria, 16(2), pp. 160-170.

Kutty, N., (1999), “Determinants of Structural Adequacy of Dwellings”, Journal of Housing Research, 10(1), pp. 27-43.

Shinnick, E., (1997), “Measuring Irish housing quality”, Journal of Economics Studies, 24(1/2), pp. 95-119.

Tenenhaus, M. and Young, F., (1985), “An analysis and synthesis of multiple correspondence analysis, optimal scaling, dual scaling, homogeneity analysis and other methods for quantifying categorical multivariate data”, Psychometrica, 50(1), pp. 91-119.

Wolverton, M. and Senteza, J., (2000), “Hedonic Estimates of Regional Constant Quality House Prices”, Journal of Real Estate Research, 19(3), pp. 235-253.

Table 1. Accessibility variable at a province level

POSITION	PROVINCES	ACCESSIBILITY
1	Madrid	3.087.182
2	Barcelona	1.707.278
3	Guadalajara	1.537.862
4	Toledo	1.270.846
5	Segovia	907.179
6	Valencia	826.072
7	Sevilla	820.143
8	Tarragona	770.902
9	Vizcaya	656.623
10	Zaragoza	614.514
11	Ávila	611.447
12	Girona	598.242
13	Malaga	584.493
14	Álava	545.747
15	Castellón	535.764
16	Valladolid	490.463
17	Guipúzcoa	475.135
18	Murcia	456.141
19	Córdoba	436.202
20	Granada	420.700
21	Alicante	407.650
22	Palencia	393.164
23	Huelva	377.812
24	Cantabria	359.561
25	Navarra	357.223
26	Las Palmas	354.877
27	Burgos	335.618
28	Huesca	323.663
29	Cádiz	306.131
30	A Coruña	300.631
31	Baleares	296.754
32	Salamanca	289.344
33	La Rioja	264.091
34	Zamora	243.056
35	Jaen	233.768
36	Asturias	232.856
37	Lugo	222.685
38	León	201.760
39	Tenerife	200.172
40	Albacete	162.833
41	Pontevedra	156.516
42	Almería	155.120
43	Lleida	154.694
44	Ourense	145.870
45	Badajoz	138.800
46	Cáceres	101.750
47	Ceuta	73.208
48	Teruel	70.315
49	Ciudad Real	63.675
50	Melilla	63.670
51	Soria	55.452
52	Cuenca	42.817

Table 2. Variables and categories

Variable	Categories
Type of building	Fixed lodging or ends other than residential Building of only one dwelling Building of two dwellings Building of three or more dwellings
Age of building	*Pre-1940* *Between 1940 and 1959* *Between 1960 and 1969* *Between 1970 and 1979* *Between 1980 and 1991*
Square metres	Less than 60 Between 61and 90 Between 91and 130 More than 130
Hygienic Installations	Has no hygienic installations Shares with other dwellings One or two bathrooms or,, one or two toilets One bathroom, or toilet with one or two bathrooms A bath and one or two bathrooms or a bath and a toilet A bath, bathroom and toilet or two baths and bathroom(s) or toilet(s) Two baths, bathroom and toilet or more
Running water	Has none in the dwelling Cold water only Hot and cold water separately Centralised hot and cold water
Electric power	Has none Has
Heating	Has no heating Some mobile apparatus In dividual heating Collective heating
Fixed telephone	Has none Has
Garage	Has none Has
Air conditioning	Has none Private system Collective system
Lift / Elevator	Has none Has
Garden	Has none Has
Swimming pool	Has none Has
Sports Area	Has none Has
Other community services	Has none Has
Fuel or power to heat water	Has none, but has cold water Solid fuel: coal, logs or others Butane Electric power Town gas, natural gas, propane, fuel oil
Fuel or power for heating	Has none Solid fuel: coal, logs or others. Butane Electric power Others: town gas, natural gasl, propane, fuel oil
Fuel or power for cooking	Solid fuel: coal, logs or others. Butane Electric power Others: town gas, natural gas, propane, fuel oil
Size of Municipality	Up to 10,000 inhabitants From 10,000 to 50,.000 inhabitants From 50,000 to 100,000 inhabitants From 100,000 to 500,000 inhabitants More than 100,000 inhabitants
Accessibility (90 minutes)	More than 1,000,000 inhabitants From 500,000 to 1,000,000 inhabitants From 100,000 to 500,000 inhabitants Up to 100,000 inhabitants

Table 3. The importance of indicators obtained in the MCA

Breakdown of the explained variability	Type of MCA according to the variables considered					
	Structural Analysis		Urban Analysis		Suburban Analysis	
	Inertia	%	Inertia	%	Inertia	%
First indicator	0,0422	67	0,0438	67	0,0427	67
Second indicator	0,0105	17	0,0098	15	0,0091	14
Third indicator	0,0052	8	0,0063	10	0,0060	9
Rest of the indicators	0,0054	8	0,0054	8	0,0064	10
Total of inertia	0,0633	1000	0,0653	1000	0,0642	1000

* Inertia collected in each indicator (with the Bencecri correction 1979) and the total that it represents in the total.

Table 4. MCA results for the Structural, Structural-Urban and Structural-Urban-Access analyses

Relatión* between the original variables and indicators 1 and 2 obtained from the Multiple Correspondence Analysis (MCA).

		Type of MCA according to variable considered					
		Structural Analysis		Urban Analysis		Suburban Analysis	
	Frequency	Indicator 1	Indicator 2	Indicator 1	Indicator 2	Indicator 1	Indicator 2
VARIABLES AND CATEGORIES	Observed	(Corr.) Weight	(Corr.) Weight	(Corr.) Weight	(Corr.) Weight	(Corr.) Weight	(Corr.) Weight
Type of building		(0,61)	(0,30)	(0,68)	(0,28)	(0,69)	(0,37)
Fixed lodgings or ends other than residential	0,28	-4,90	3,11	-4,80	2,81	-4,86	2,73
Building of single dwelling	35,85	-2,75	0,65	-3,15	0,96	-3,26	1,08
Building of two dwellings	4,66	-1,74	-0,48	-1,97	-0,42	-2,00	-0,44
Building of three or more dwellings	59,21	1,82	-0,37	2,08	-0,56	2,15	-0,63
Age of Building		(0,37)	(0,31)	(0,35)	(0,35)	(0,33)	(0,36)
Pre 1940	12,47	-2,74	0,97	-2,75	0,95	-2,66	0,82
Between 1940 and 1959	12,92	-1,39	-0,17	-1,29	-0,30	-1,23	-0,44
Between 1960 and 1969	23,81	-0,18	-0,94	0,05	-1,26	0,16	-1,48
Between 1970 and 1979	32,91	1,17	-0,08	1,15	-0,06	1,11	0,02
Between 1980 and 1991	17,89	0,98	0,85	0,66	1,33	0,47	1,67
Area in square metres		(0,22)	(0,29)	(0,18)	(0,36)	(0,17)	(0,39)
Less than 60	9,42	-2,30	0,34	-1,95	-0,11	-1,74	-0,46
between 61 and 90	37,7	-0,01	-0,74	0,19	-1,03	0,28	-1,21
between 91 and 130	37,23	0,57	0,21	0,44	0,38	0,35	0,52
More than 130	15,65	0,06	1,06	-0,34	1,66	-0,46	1,96
HygienicInstallations		(0,56)	(0,58)	(0,52)	(0,56)	(0,49)	(0,55)
Has no hygienic installations	1,74	-8,44	7,34	-8,55	7,40	-8,51	7,34
Shares with other dwellings	0,14	-5,37	2,70	-4,53	1,79	-4,12	0,99
One or two bathrooms or, one or two toilets	3,09	-4,40	1,90	-4,36	1,72	-4,22	1,41
A bathroom, or toilet with one or two bathrooms	70,3	-0,53	-0,62	-0,48	-0,77	-0,43	-0,88
A bath and one or two bathrooms or a bath and a toilet	6,03	1,53	0,45	1,45	0,70	1,33	0,95
A bath, bathroom and toilet or two baths and bathroom(s) or toilet(s)	17,31	2,92	1,01	2,76	1,47	2,59	1,85
Two baths, bathroom and toiltet or more	1,39	4,69	3,31	4,37	4,49	4,25	5,17
Running Water	(0,61)	(0,61)	(0,69)	(0,58)	(0,61)	(0,56)	(0,57)
Has none in the dwelling	0,41	-10,00	10,00	-10,00	10,00	-10,00	10,00
Cold water only	5,23	-6,89	4,77	-6,86	4,60	-6,78	4,37
Individual hot and cold water	87,53	0,05	-0,54	0,05	-0,58	0,06	-0,61
Centralised hot and cold water	6,83	5,27	2,68	5,17	3,32	4,97	3,91
Electric power		(0,10)	(0,16)	(0,10)	(0,14)	(0,09)	(0,12)
Has one	0,17	-8,57	8,59	-8,69	8,75	-8,67	8,67
Has	99,83	0,01	-0,01	0,01	-0,01	0,01	-0,01
Heating		(0,67)	(0,59)	(0,63)	(0,57)	(0,63)	(0,60)
Has no heating	11,1	-3,70	2,20	-3,66	2,03	-3,90	2,32
Some mobile apparatus	62,13	-0,81	-0,94	-0,77	-1,11	-0,71	-1,31
Individual heating	18,46	2,30	0,70	2,15	1,11	2,15	1,35
Collective heating	8,31	5,87	2,53	5,89	3,10	5,77	3,66
Fixed telephone		(0,48)	(0,19)	(0,49)	(0,15)	(0,49)	(0,13)
Has none	23,1	-3,17	0,75	-3,34	0,73	-3,41	0,70
Has	76,9	0,95	-0,23	1,00	-0,22	1,02	-0,21
Garage		(0,33)	(0,21)	(0,28)	(0,29)	(0,25)	(0,32)

Has none	72,54	-0,72	-0,29	-0,64	-0,46	-0,59	-0,58
Has	27,46	1,91	0,76	1,69	1,22	1,57	1,54
Air conditioning		(0,13)	(0,07)	(0,13)	(0,08)	(0,12)	(0,08)
Has none	97,62	-0,07	-0,01	-0,07	-0,02	-0,07	-0,02
Private system	2,2	2,67	0,42	2,79	0,60	2,74	0,69
Collective system	0,18	4,84	2,32	4,86	3,03	4,81	3,45
Life / elevator		(0,68)	(0,14)	(0,70)	(0,13)	(0,69)	(0,14)
Has none	70,63	-1,58	-0,20	-1,68	-0,22	-1,68	-0,27
Has	29,37	3,80	0,48	4,03	0,53	4,04	0,65
Garden		(0,04)	(0,21)	(0,00)	(0,27)	(0,00)	(0,29)
Has none	84,98	-0,06	-0,20	-0,01	-0,29	0,00	-0,35
Has	15,02	0,37	1,12	0,07	1,66	-0,02	2,00
Swimming pool		(0,17)	(0,21)	(0,15)	(0,24)	(0,15)	(0,25)
Has none	98,81	-0,07	-0,05	-0,06	-0,07	-0,06	-0,08
Has	1,19	5,58	4,24	5,00	5,76	4,99	6,61
Sports area		(0,17)	(0,16)	(0,15)	(0,18)	(0,14)	(0,19)
Has none	98,96	-0,06	-0,04	-0,06	-0,05	-0,06	-0,06
Has	1,04	5,80	3,48	5,51	4,59	5,38	5,34
Other community services		(0,66)	(0,09)	(0,70)	(0,12)	(0,71)	(0,12)
Has none	53,11	-2,24	0,19	-2,46	0,30	-2,52	0,32
Has	46,89	2,54	-0,22	2,79	-0,34	2,86	-0,36
Fuel or power to heat water		(0,78)	(0,73)	(0,77)	(0,67)	(0,77)	(0,62)
Has none or has only cold water	5,64	-7,12	5,15	-7,09	4,99	-7,01	4,78
Solid Fuel: coal, logs or others.	2,26	-0,37	1,70	-0,66	2,22	-0,76	2,60
Butane	59,72	-0,81	-0,87	-0,83	-0,97	-0,86	-1,00
Electric power	16,12	0,12	-0,72	0,09	-0,78	0,07	-0,91
Others: town gas, natural gas, propane, fuel oil	16,26	5,38	1,89	5,51	2,30	5,64	2,56
Fuel or power for heating		(0,70)	(0,66)	(0,69)	(0,68)	(0,69)	(0,70)
Has none	11,1	-3,70	2,20	-3,66	2,03	-3,91	2,32
Solid fuel: coal, logs or others.	19,53	-2,02	0,51	-2,45	0,94	-2,52	1,05
Butane	13,09	-0,92	-1,10	-0,78	-1,38	-0,58	-1,72
Electric power	40,47	0,35	-1,31	0,54	-1,62	0,60	-1,83
Others: town gas, natural gas, propane, fuel oil	15,81	4,96	2,10	4,84	2,70	4,79	3,18
Fuel or power for cooking		(0,61)	(0,38)	(0,62)	(0,37)	(0,64)	(0,35)
Solid fuel: coal, logs or others	3,4	-4,89	3,25	-5,27	3,60	-5,44	3,92
Butane	76,9	-0,84	-0,40	-0,88	-0,47	-0,91	-0,51
Electric power	6,79	3,08	0,61	3,14	0,79	3,00	0,97
Others: town gas, natural gas, propane, fuel oil	12,91	4,69	1,23	4,96	1,44	5,26	1,49
Size of municipality				(0,58)	(0,24)	(0,61)	(0,25)
Up to 10,000 inhabitants	26,2			-2,98	1,03	-3,08	1,15
From 10.000 to 50,000 inhabitants	22,49			-0,92	-0,21	-1,02	-0,18
From 50.000 to 100,000 inhabitants	8,95			0,83	-0,36	0,79	-0,36
From 100,000 to 500,000 inhabitants	22,89			1,60	-0,45	1,45	-0,27
More than 100,000 inhabitants	19,47			2,82	-0,46	3,24	-0,86
Accessibility (90 minutes)						(0,45)	(0,25)
More than 1,000,000 inhabitants	26,51					2,62	-0,54
From 500,000 to 1,000,000 inhabitants	23,25					0,09	-0,91
From 100,000 to 500,000 inhabitants	45,07					-1,34	0,71
Up to 100,000 inhabitants	5,17					-2,15	0,68

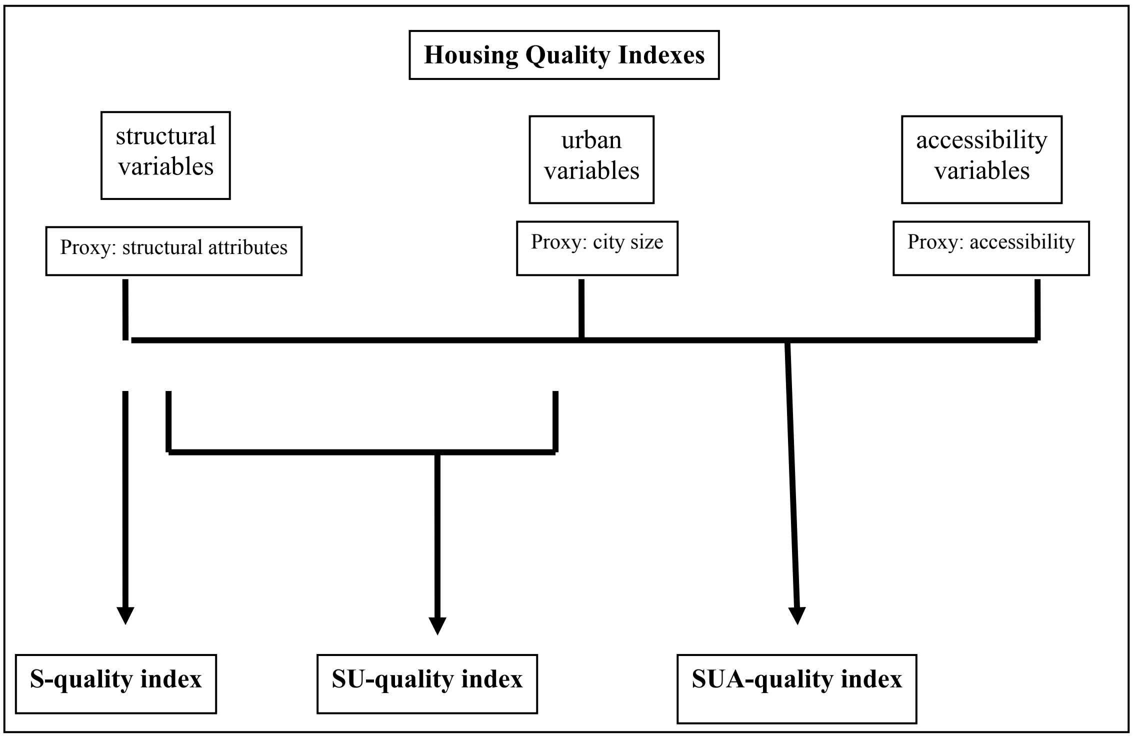
* Relation between the original variables (Xi, i=1,2,...,20) and the indicators (Yj, j=1,2) in terms of the correlations (Xi,Yj) and the weight of the Xi in the construction of the Yj.

Table 5. Housing quality index ordering at province level

position	province	S-index	position	province	SU-index	position	province	SUR-index
1	Álava	0,4083262	1	Álava	0,4012413	1	Madrid	-0,4199985
2	Navarra	0,3285653	2	Madrid	0,3565734	2	Álava	-0,3786941
3	Madrid	0,3096115	3	Navarra	0,2662152	3	Barcelona	-0,3230003
4	La Rioja	0,2332794	4	Barcelona	0,2552101	4	Zaragoza	-0,2431741
5	Barcelona	0,2323041	5	Zaragoza	0,2468129	5	Navarra	-0,2082569
6	Zaragoza	0,2293509	6	Vizcaya	0,1937947	6	Vizcaya	-0,18653
7	Valladolid	0,1885643	7	La Rioja	0,1932143	7	La Rioja	-0,13989
8	Vizcaya	0,1842688	8	Valladolid	0,1687575	8	Valladolid	-0,1191772
9	Lleida	0,1393464	9	Guipuzcoa	0,1188781	9	Guipuzcoa	-0,0799583
10	Burgos	0,1365368	10	Burgos	0,0996352	10	Burgos	-0,0521565
11	Guipúzcoa	0,126658	11	Lleida	0,0735327	11	Guadalajara	-0,0427302
12	Huesca	0,0570433	12	Valencia	0,0171256	12	Lleida	-0,0261094
13	Guadalajara	0,0271421	13	Asturias	-0,003153	13	Valencia	-0,0235337
14	Palencia	0,0151878	14	Huesca	-0,0195133	14	Asturias	0,04275
15	Valencia	0,0113101	15	Guadalajara	-0,0236218	15	Tarragona	0,0453939
16	Asturias	-0,0082205	16	Cantabria	-0,0295166	16	Huesca	0,0612721
17	Tarragona	-0,0107709	17	Palencia	-0,0431451	17	Cantabria	0,0659942
18	Soria	-0,0135044	18	Tarragona	-0,0470384	18	Girona	0,081989
19	Cantabria	-0,0183845	19	Alicante	-0,0507221	19	Palencia	0,0820954
20	Girona	-0,0243078	20	Baleares	-0,062029	20	Alicante	0,086124
21	Segovia	-0,0251627	21	Girona	-0,0830864	21	Segovia	0,0894603
22	Baleares	-0,0493094	22	Segovia	-0,0881628	22	Baleares	0,0957351
23	Alicante	-0,0509968	23	Soria	-0,1014675	23	Sevilla	0,1003756
24	León	-0,0753157	24	Sevilla	-0,1124392	24	Málaga	0,1071099
25	Albacete	-0,0913106	25	Málaga	-0,118904	25	Toledo	0,117066
26	Salamanca	-0,1170499	26	Albacete	-0,1234588	26	Albacete	0,1586539
27	Toledo	-0,1260962	27	León	-0,1243104	27	Soria	0,1617527
28	Sevilla	-0,131301	28	Salamanca	-0,143355	28	León	0,1628198
29	Granada	-0,1360136	29	Granada	-0,1616588	29	Castellón	0,1648753
30	Teruel	-0,1489453	30	Pontevedra	-0,1618785	30	Salamanca	0,1759886
31	Pontevedra	-0,1506726	31	Castellón	-0,1736589	31	Granada	0,1945861
32	Málaga	-0,1533661	32	Murcia	-0,1833187	32	Pontevedra	0,2024423
33	Castellón	-0,1612674	33	A Coruña	-0,1894627	33	Murcia	0,2148185
34	Ciudad Real	-0,1712666	34	Toledo	-0,1899332	34	A Coruña	0,2235714
35	Cuenca	-0,1734295	35	Ceuta	-0,1913783	35	Córdoba	0,2305104
36	A Coruña	-0,1773561	36	Córdoba	-0,2013201	36	Ceuta	0,2459934
37	Córdoba	-0,1933802	37	Ciudad Real	-0,2213729	37	Ciudad Real	0,2764488
38	Murcia	-0,1946975	38	Teruel	-0,2284428	38	Ávila	0,277582
39	Ávila	-0,2128481	39	Cádiz	-0,2298019	39	Cádiz	0,2800467
40	Ceuta	-0,2473633	40	Cuenca	-0,2545625	40	Teruel	0,2806505
41	Jaén	-0,2494932	41	Jaén	-0,2737293	41	Jaén	0,2983824
42	Zamora	-0,2535096	42	Huelva	-0,2811463	42	Cuenca	0,3060872
43	Cádiz	-0,2609151	43	Ávila	-0,2886466	43	Huelva	0,3101135
44	Huelva	-0,2695248	44	Zamora	-0,304703	44	Zamora	0,3327457
45	Cáceres	-0,2829786	45	Almeria	-0,3127604	45	Almeria	0,3409311
46	Almería	-0,3087364	46	Cáceres	-0,3372269	46	Cáceres	0,3613651
47	Tenerife	-0,3778413	47	Palma	-0,3493928	47	Palma	0,3820749
48	Badajoz	-0,3803839	48	Tenerife	-0,3560938	48	Tenerife	0,3898499

49	Palma	-0,3843486	49	Badajoz	-0,4092624	49	Badajoz	0,4277771
50	Lugo	-0,4068576	50	Ourense	-0,4407244	50	Ourense	0,4642009
51	Ourense	-0,4125523	51	Lugo	-0,4467546	51	Lugo	0,4694575
52	Melilla	-0,5154886	52	Melilla	-0,4524014	52	Melilla	0,4962939

Figure 1. Housing quality indexes



<u>Relación de Documentos de Traballo publicados</u>

9901 Philippe Polomé: Experimental E vidence on Voting Manipulation in Referendum Contingent Valuation with Induced Value
9902 Xosé M. González e Daniel Miles: Análisis Envolvente de Datos: Un Estudio de Sensibilidad
9903 Philippe Polomé: Combining contingent valuation and revealed preferences by simulated maximum likelihood
9904 Eva Rodríguez: Social value of health programs: is the age a relevant factor?
9905 Carlos Gradín e Mª Soledad Giráldez: Incorporación laboral de la mujer en España: efecto sobre la desigualdad en la renta familiar
9906 Carlos Gradín: Polarization by sub-populations in Spain, 1973-91
9907 Carlos Gradín: Polarization and inequality in Spain: 1973-91
0001 Olga Alonso e José María Chamorro: How do producer services affect the location of manufacturing firms?. The role of información accesibility
0002 Coral del Río Otero: Desigualdad *Intermedia* Paretiana
0003 Miguel Rodríguez Méndez: Margins, Unions and the Business Cycle in High nd Low Concentrated Industries
0004 Olga Alonso Villar: Large metropolies in the Third World: an explanation
0005 Xulia González e Daniel Miles**:** Wage Inequality in a Developing Country: Decrease of Minimum Wage or Increase of Education Returns
0006 Daniel Miles: Infecuencia de las Compras y Errores de Medida
0007 Lucy Amigo: Integración de los Mercados de Cambio: Análisis rentabilidad-riesgo de la cotización Peseta/Dólar
0008 Eduardo L. Giménez e Manuel González-Gómez: Efficient Allocation of Land Between Productive Use and Recreational Use.
0009 Manuel González-Gómez, P.Polomé e A. Prada Blanco: Sesgo sobre la Información Obtenida y la Estimación de Beneficios en Entrevistas a Visitantes de un Espacio Natural
0010 M. Xosé Vázquez Rodríguez e Carmelo León: Preferencias Imprecisas y Contexto en la Valoración de Cambios en la Salud.
0011 Begoña Alvarez: Can we Identify Fraudulent Behaviour?. An Aplication to Sickness Absence in Spain
0012 Xulia González, Xosé M. González e Daniel Miles: La Transición de la Universidad al Trabajo: una Aproximación Empírica.
0013 Olga Cantó: Climbing out of poverty, Falling back in: Low Incomes' Stability in Spain
0101 Arancha Murillas: Investment and Development of Fishing Resources: A Real Options Approach
0102 Arancha Murillas: Sole Ownership and Common Property Under Management Flexibility: Valuation, Optimal Exploitation and Regulation
0103 Olga Alonso Villar; José-María Chamorro Rivas e Xulia González Cerdeira: An análisis of the Geographic Concentratin of Industry in Spain
0104 Antonio Molina Abraldes e Juan Pinto-Clapés: A Complete Characterization of Pareto Optimality for General OLG Economies
0105 José María Chamorro Rivas: Communications technology and the incentives of firms to suburbanize
0106 Luci Amigo Dobaño e Francisco Rodríguez de Prado: Incidencia del efecto día en los valores tecnológicos en España

0309 Raquel Arévalo Tomé e José María Chamorro Rivas: A Quality Index for Spanish Housing