The Independent Submarkets Model: An Application to the Spanish Retail Banking Market*

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Abstract

The aim of this paper is to test the predictions of Sutton's independent submarkets model with data on the Spanish retail banking market. The prediction of this model for aggregates of submarkets is that the form of equilibrium outcome must involve some minimal degree of size inequality. However, within each submarket, when the firms' market areas are overlapping, the products are close substitutes and price competition is weak, the only form of equilibrium outcome will be an extreme 'fragmented' structure. To test these predictions, firstly I propose methods to identify independent submarkets. Then I analyze the degree of inequality in bank sizes for markets with different levels of aggregation (submarkets, regions and national market). Using concentration by towns' data, I find that in single submarket towns the degree of inequality of the size among banks, measured by their number of branches, is zero. Moreover, multimarket towns with a significant degree of concentration are shown to be formed by a different number of independent submarkets where each bank owns one branch. Nonetheless, when the regional and the national bank markets are considered, the degree of inequality in bank sizes becomes high. These results are consistent with the predictions of the theoretical model.

Keywords: independent submarkets, fragmentation, concentration, banks, branches.

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1. Introduction

The Spanish retail banking sector is formed by a set of banks that show a high degree of asymmetry in the markets they cover: some of them are purely local and others cover nearly every local market. This, a priori, suggests that the Spanish bank market consists of a large number of independent local markets (i.e., districts, suburbs, towns,...) where branches of di¤erent banks[1] compete. It is possible to analyze this market structure using the model of independent submarkets developed by Sutton (see Sutton (1997) and Sutton (1998)). This model assumes that a market consists of …rms that compete in independent submarkets, and these independent submarkets can be, in particular, geographical. The prediction of the model for the aggregate of submarkets is that the form of equilibrium outcome must involve some minimal degree of size inequality. However, the model also predicts for each submarket that, when three conditions hold, the likely form of equilibrium outcome is the extreme 'fragmented' structure, in which all …rms have the same 'minimal' size. The three conditions are that (i) …rms' market areas are overlapping in the sense that each …rm in the submarket serves consumers throughout that submarket, (ii) products are close substitutes, and (iii) price competition is weak. With the exception of the empirical evidence for the U.S. cement market given by Sutton[2], the predictions of this theoretical model do not seem to have been tested empirically.

This work aims to test the predictions of this theoretical model with data on Spanish retail banking, a market in which the special conditions stated above appear to hold. I start from the measurement of concentration in almost 5,000 towns, measured in terms of the branches held by banks, using commercial data. But big towns, with a high number of branches, are likely to be the aggregate of several submarkets. Then, to analyze concentration by submarkets, I proceed in two di¤erent directions using di¤erent methods (regression and cluster analysis). On the one hand, I try to

[1] Banks refer to the set of credit or deposit institutions as banks and savings banks.

[2] See Sutton(1998), chapter 12.

detect single submarket towns and examine concentration in these towns. On the other hand, I try to identify submarkets in multimarket towns to decompose the concentration of the town in concentration by submarkets. Finally, I use the same data to construct the Lorenz curve that depicts concentration at regional and at national levels.

Spanish retail banking is a suitable and interesting industry on which to carry out this study for several reasons. Firstly, competition in prices (rates and commissions) has been traditionally weak. Secondly, the networks of branches held by banks are important and spread over all or part of the national geography. Thirdly, concentration is high at the regional and the national levels, as several studies have revealed (see Cebrián and Iglesias (1992) and Cebrián (1997)). But this concentration is obtained by considering these levels of bank operation. On the contrary, this work shows that national and regional markets are an aggregation of submarkets (i.e., districts, suburbs, small towns,...) in which the degree of inequality in bank sizes is minimum.

The main empirical results are the following. On the one hand, in 96% of single submarket towns[3] where there are two or more branches, these belong to different entities, and hence the degree of size inequality measured by branches is zero. On the other hand, submarkets of multimarket towns tend to show a high degree of fragmentation even when concentration at the town level is significant, i.e., town branches belonging to the same bank tend to be located at different submarkets. In sharp contrast, concentration at the regional and the national levels show a high degree of inequality in bank sizes. This inequality is heterogeneous, but always gives Lorenz curves that lie beyond Sutton's limiting curve.

The rest of the paper is organized as follows. Section two sets the theoretical framework. Section three summarizes the reasons why the retail banking sector may be considered an independent submarkets industry. Section four gives some background on the Spanish banking sector. Section five explains the tests applied to

[3] Town represents a municipality.

check the degree of inequality of size in submarkets as well as regional markets and national market. Section six presents the empirical results and in section seven some concluding remarks are made.

2. The model

The theoretical model of reference is a variant of the independent submarkets model developed in Sutton (1998), in which firms are considered to compete in prices. Sutton's model takes firms as competing across many independent submarkets. I assume that the national retail banking market consists of a large number of local markets. Every one of these independent submarkets consists of several branches of different banks competing among them. Every branch is considered as a variety of the bank services.

Under these assumptions, and adopting a 'stage game' approach, banks can be seen having first made their investments in branches and then setting prices. To obtain the number of branches per submarket, the concept of an Equilibrium Configuration[4], defined by Sutton, can be used. In this framework, the prediction of the model for the aggregate of submarkets is that the form of equilibrium outcome must involve some minimal degree of size inequality. However, the model also predicts for each submarket that, when three conditions hold, the only form of equilibrium outcome that we will observe at the submarkets level is the extreme 'fragmented' structure, in which all firms have the same 'minimal' size. The three conditions are that (i) firms' market areas are overlapping in the sense that each firm in the submarket serves consumers throughout that submarket, (ii) products are close substitutes, and (iii) price competition is weak[5].,

[4] The Equilibrium Configuration is a wider concept than the Nash equilibrium in that it only requires satisfying viability and stability conditions, while the Nash equilibrium also requires satisfying optimality.

[5] The price competition is weak in the sense that prices set by the firms are far from the competitive price.

Sutton derives a 'limiting Lorenz curve' for the aggregate of submarkets under two conditions. The curve provides an asymptotic lower bound to concentration. The two conditions are a 'symmetry principle' and a 'benchmark case'. The 'symmetry principle' maintains that the strategy of a bank in a submarket only depends on sunk costs and profit opportunities in the submarket. That is, there are not strategic linkages across submarkets. The 'benchmark case' is a situation in which the probability that the next submarket opportunity is filled by a new firm is constant over time, although an increasing probability does not pose a great problem to conclusions.

Under these conditions, for any fixed ratio $\frac{k}{N}$, the expression of the 'limiting Lorenz curve', when the number of the k largest firms and the total number of firms in the market N are high enough, is

$$\underline{C}_{\frac{k}{N}} \geq \frac{k}{N}\left(1 - \ln\left(\frac{k}{N}\right)\right) \tag{1}$$

where $\underline{C}_{\frac{k}{N}}$ represents the concentration ratio of the k largest firms in the market. In our case, this concentration ratio is defined as the fraction of the number of branches owned by the k largest bank within the market.

Therefore, the model predicts that if the degree of concentration in a market is measured with the Lorenz curve, this curve will lie beyond the reference curve. On the contrary, if the special conditions on local competition are satisfied (and we will argue that, in the present empirical context, they are) then, in any submarket, the Lorenz curve will lie along (or close to) the diagonal.

3. Retail banking as a submarkets industry

The core activities of commercial banks are the collection of deposits and the granting of loans (according to Freixas and Rochet (1997), a bank is an institution whose current operations consist of granting loans and receiving deposits from the public). Both activities imply the production of services to depositors and borrowers, for which they charge a cost in addition to the rates they set to remunerate deposits or charge loans. Most services must be supplied on a geographical basis, and the 'nearness' of the bank has been always considered to be a source of utility for most customers (at least for households and small …rms). This is the reason why commercial banks build networks of branches extended across the territory they operate in.

Drawing on these facts, retail banking must be taken as an industry in which banks sell slightly di¤erentiated products competing across many independent geographic submarkets[6], inside of which they compete basically in a symmetric way. Varieties of the services sold in a geographic submarket are given by the branches operating in the marketplace. In fact, positive sales at di¤erent prices on the part of each of the branches in the submarket is proof of the di¤erentiated nature of the product (as well as the presence of switching costs). Banks can open one or more branches in a given submarket. Submarkets can be taken as independent from the demand side in the sense that cross-price elasticities among submarkets are zero or very small. Null cross-elasticities are likely to characterize the geographically separated submarkets (small towns, suburbs,...). Small elasticities are likely to be the rule in partially overlapped markets in more important consumer agglomerations (districts of cities).

In a given moment of time, the history of investments across submarkets con…gures the distribution of branches of a bank. And banks can be seen competing in prices (rates, commissions) given their previous entry decisions. In this context, Sutton's 'symmetry principle' is likely to hold for entry in any geographic submarket. Cross-price e¤ects are at most negligible. Sunk costs and pro…tability are probably market-speci…c. As such, submarket strategies for two possibly entrant …rms have no reason to be di¤erent. If any, a possible advantage could be argued to hold for big entrants (banks with many branches) from the perception for consumers of some network

[6] This vision of the retail banking industry is more or less shared by other works on banking, except for the local markets, which are modelled by applying the spatial framework of the unit Salop´s circle. See, for example, Fuentelsaz and Salas (1992) and Barros (1999). Jaumandreu and Lorences (1998) however, start from the independent submarkets model, and the symmetric character of local competition, to specify and estimate aggregated demands.

advantages. However, small banks have reacted to this requirement by belonging to some networks (for example, ATM's)[7] and this e¤ect is likely to be small. Moreover, preferences of a fraction of consumers seem to be biased towards entities with strong regional and local contents, which probably balances the situation.

Note, in particular, that retail banking seems to be an industry that consistently meets the three conditions under which we can expect maximally fragmented outcomes, one branch per bank at the submarkets level. Competition at the submarket level is throughout overlapped areas. We have already implicitly seen that products can be taken as close substitutes. The main source of di¤erentiation is the services associated with deposits and loans. Moreover, price competition has been reported to be weak anywhere for the long time in which banking remained strongly regulated. And even now, liberalization seems not to have produced a dramatic change of this situation (See Neven and Röller (1999)).

4. Some background on the Spanish banking sector

In addition to adhering to the general remarks made above, the Spanish retail banking sector has some speci…c characteristics that make the exercise of this paper particularly interesting. Firstly, price competition has been historically very weak, and only the complete deregulation of rates started (by the 1990's) some episodes of sharp price competition. Secondly, the geographical spread of banks through the building of big networks of branches was very important in the years of regulated rates. Thirdly, the industry is highly concentrated and has even shown a recent tendency to become more concentrated.

The Spanish banking sector su¤ered strict regulation that limited deposit remunerations and established ceiling rates and commissions. Regulation was gradually reduced during the seventies and eighties, and only in 1981 and 1987 loan and deposit interest rates, respectively, could be considered wholly deregulated. Empirical studies

[7] See Matutes and Padilla (1994)

of competition in the sector, which cover up to the beginning of the nineties, point to weak price competition. For example, Jaumandreu and Lorences (1997) model competition among banks in the loans market from 1983 to 1991, and conclude that there was price coordination or collusion among national banks. Coello (1996) models competition among banks and savings banks in the deposits market from 1985 to 1994, and finds evidence for leadership practices in pricing and competition in branch networks. Unfortunately, studies of competition covering the more recent years still have not appeared. However, observation of the market suggests that some episodes of competition ('guerra de las supercuentas' in 1989, and competition on mortgage rates in 1993) have coexisted with periods of coordination on rates and commissions.

In the period of regulated rates, and even during the time of deregulation, many authors have suggested that competition switched to the opening of branches to be close to customers (see, for example, Fuentelsaz and Salas (1992), Gual (1994), and Chiappori, Perez-Castrillo and Verdier (1995)). This has produced a high ratio of branches/inhabitants, which is among the highest in Europe, although when spatial dimension is considered, Spain is among European countries with the lowest number of branches per square kilometer[8]. However, the growth of the number of branches has not been uniform. In 1974, the opening of bank branches was liberalized and this implied a subsequent rapid increase in the number of branches. In 1985 and 1986, restrictions were completely abolished and foreign banks were allowed to open branches on the same terms as national banks, but the impact of these measures on the total number of branches was small. Finally, in 1989, savings banks were authorized to open branches outside of their previous geographical place of operation (autonomous communities). This has created a period of relative increase in the number of savings bank branches. Hence, the entry opportunities of different kinds of competitors have changed over time, but this has not implied any systematic advantage related to size.

[8] See Fuentelsaz and Salas (1992), where they report a comparative analysis of the size and efficiency among different European bank markets for 1994.

Retail banking is characterized by a great number of operating entities but also a high level of concentration. In 1996, the number of banks was 165, and the number of savings banks 51. The two institutions are now equivalent and must be taken together in considering the banking industry (on this equivalence, see Coello (1996)). The size distribution of banks is more skewed than the size distribution of savings banks, including many entities with insigni…cant retail activities (most foreign banks among others). In 1996, banks owned 17,674 branches and savings banks 16,094. 56% of bank branches belong to the six largest banks[9], and 38% of savings bank branches belong to the …ve largest savings banks[10]. The distribution of activities across regions, measured by the networks of branches, is very unequal. Some entities cover nearly the whole national territory, others are regional or strictly local. In addition, concentration has been increasing in recent years. At the end of the eighties and the beginning of the nineties, two big mergers took place[11]. Nowadays, an acquisition and a new big merger[12] have again reduced the number of the biggest banks. Savings banks also knew an accelerated process of mergers at the beginning of the nineties, which reduced their number to 23.

5. Data and testing strategies

The theoretical model shows that we can expect a relationship between the degree of concentration and the level of aggregation of submarkets. That is, local markets will show the minimum level of concentration ('maximally fragmented' equilibrium)

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[9] The six largest banks at the time were: Bilbao Vizcaya, Central Hispano, Español de Crédito, Exterior de España, Popular Español and Santander (see, Anuario Estadístico de la Banca en España).

[10] The …ve largest saving banks, ranked according to total resources, at the time were: C.A. y pensiones de Barcelona, C.A. y M.P. de Madrid, C.A. de Cataluña, Bilbao Bizcaia Kutxa and Bancaja (see, Anuario Estadístico Cajas de Ahorros Confederadas).

[11] The mergers took place, respectively, in 1988 (Bilbao-Vizcaya bank) and in 1991 (Central- Hispano bank).

[12] Santander bank acquired the Español de Crédito bank in 1997 and the joint entity has merged with the Central-Hispano bank in 1999.

or, in other words, all firms will be the same size. However, the aggregation of submarkets will bring some level of concentration. Therefore, the natural strategy to test the model, applied by Sutton to the U.S. cement market, consists of the study of the actual concentration in markets representative of different levels of submarkets' aggregation.

The main data source used in this paper is the Guía de Banca, Cooperativas de Crédito y Cajas de Ahorros, which contains commercial information about the number of branches of every bank and savings bank in each Spanish town. This information allows measuring the degree of concentration in terms of branches in each town. According to this source, there are 4,977 Spanish towns endowed with banking branches (see the Data Appendix for details). As a complementary source, I have also used the Anuario Comercial de España, which supplies socio-economic information for towns with more than 1,000 inhabitants (number of inhabitants, area, per-capita disposable income,...). Therefore, this source can be matched to a subset of the Spanish towns for which I compute concentration.

The analysis will proceed as follows. First of all, I will examine the degree of concentration by town, using the whole sample, ranking towns by their number of branches. But big towns with a high number of branches imply the aggregation of several submarkets. Therefore, this analysis, which brings together independent submarkets and aggregates of submarkets, cannot go too far. One possibility then is to consider only the smallest towns, arbitrarily setting some number of inhabitants small enough to be sure I isolate independent submarkets (say 1,000 inhabitants). This turns out not to be very informative, because these markets have typically few branches (1 or 2). Consequently, in the second place, I will try a slightly different method: to identify the subset of towns with a single market irrespective of their number of inhabitants. This will be done by a regression method that is explained below. Then I will analyze concentration in the identified single market towns.

I will perform a third exercise. Aggregate markets may be analyzed in order to identify the independent submarkets, and hence examine concentration again at this level. To do so, I propose a cluster of geographical analysis. As this method is very time consuming (every branch must be located with its co-ordinates), this analysis will only be applied to a small subset of towns. I choose …rstly to apply it to a set of towns characterized by a number of branches that may imply the existence of submarkets (5 to 10) and by some degree of concentration. The result is expected to show the likelihood of an explanation of this concentration based on the aggregation of fragmented submarkets. Next, I apply the same method to a medium-size town with 86 branches in which the …rst bank owns 16 branches.

Finally, to give the other side of the picture, I will examine the degree of concentration at the highest levels of aggregation: regional and national levels.

The complementary instruments used to measure concentration are the 'one-bank concentration ratio' C_1 and the Lorenz curve. The one-bank concentration ratio is de…ned as the fraction of the number of branches owned by the largest bank within the market. And the Lorenz curve shows the fraction of the total of branches in the market accounted for by the biggest k banks as a function of $\frac{k}{N}$, where N is the total number of banks. I will compare C_1 with the minimum level of concentration possible, given the number of branches n, as de…ned by the function $C_1 = \frac{1}{n}$, to show whether the submarket is concentrated or not. If both coincide, the submarket is maximally fragmented. In terms of the whole distribution of bank sizes, if the submarket is maximally fragmented, the Lorenz curve will lie along the diagonal. When I examine broader markets, I will be interested in comparing the Lorenz curve with the limiting Lorenz curve, (equation 1).

The two methods used to count independent submarkets within each town are a regression analysis and a cluster analysis. The …rst estimates the number of submarkets per town. The second tries to identify the markets of a given town.

To estimate the number of submarkets, I propose to decompose the number of branches of each town (n_m) in two components: the average number of branches per submarket (n_m^S) and the number of submarkets (S_m)

$$n_m = n_m^S \cdot S_m \tag{2}$$

where the subscript $m = 1 \ldots M$ denotes the town. This breakdown of the number of branches per town can be useful if one accepts that the determinants of both components can be separated. On the one hand, the theoretical model suggests that the number of branches per submarket is a function of the relative size of the market and the sunk costs incurred on entry. On the other hand, it seems natural to relate the number of submarkets per town with the size of the town.

The components of expression (2) can be specified as two non-linear functions where the existence of at least one branch and submarket is required. Therefore, the econometric model[13] can be specified as

$$n_m = \exp^{\exp(x_m' \beta)} \cdot \exp^{\exp(z_m' \gamma)} + u_m \tag{3}$$

where the vectors x_m and z_m include the set of variables that explain respectively, the number of branches per submarket and the number of submarkets. β and γ are parameters to be estimated and u_m is a disturbance term.

Once the parameters β and γ are estimated, I replace them by their estimates in the two functions to give estimates of the average number of branches and the number of submarkets, respectively, for each one of the considered towns.

To try to identify the independent submarkets within a given town, I use a cluster analysis. The details are given in section 6.3.

[13] This econometric model can be considered a first approximation to the problem at hand. Alternatively, n^S and S could be modelled as the partially unobserved realizations of a bivariate Poisson process.

6. Empirical results

This section analyzes the degree of concentration at di¤erent levels of the aggregation of submarkets: towns and districts of towns, regions and national territory. In subsection 6.1, I carry out a purely descriptive analysis of the degree of concentration by towns in the whole sample (4,977 towns). Next, I try to count the independent submarkets per town through the two alternative methods explained in section 5. In subsection 6.2, I explain the results of estimating equation (3) for the subset of towns with a population between 1,000 and 5,000, which allows me to predict the number of independent submarkets per town. Then I focus attention on the concentration ratios of the subset of towns with only one independent submarket (single submarket towns). In subsection 6.3, I analyze the dendograms obtained for a subset of towns that have between 5 and 10 branches and show a high degree of concentration and the clustering of branches in one medium-size town. The dendograms allow me to identify the likely number of independent submarkets per town. Then I examine the degree of concentration in these submarkets. In subsection 6.4, I analyze the degree of concentration in the regions and in the national territory.

6.1. Concentration by towns.

The sample consists of 4,977 towns. The variable number of branches per town has an asymmetric distribution that ranges between 1 and 2,737 branches. The average number of branches per town is 7. And more than 85% of towns have a number of branches under this …gure.

To examine the degree of concentration at the town level, the one-bank concentration ratios in branches C_1 are calculated and compared with the values of the function $C_1 = \frac{1}{n}$. Figure 1 shows this comparison graphically[14]. The numbers report the number of towns with the same number of branches and the same one-bank concentration ratio for each point, i.e., there are 965 towns with two branches owned

[14] Figure 1 represents 99% of the towns in the sample. The …gure corresponding to the rest of towns with more than 101 branches is not reported because it does not change the results.

by di¤erent banks ($C_1 = 0{:}5$) and 38 in which the two branches are owned by the same bank ($C_1 = 1$). If the concentration ratio C_1 lies along the curve $C_1 = \frac{1}{n}$, the market structure is maximally fragmented. This occurs in 86% of the towns. The points above this bound lie on curves that depict the pairs concentration-number of branches corresponding to the cases in which the largest bank owns more than one branch (2,3,...). Figure 1 clearly shows that the higher the number of town branches, the higher the proportion of towns in which the largest bank owns a higher number of branches.

FIGURE 1 ABOUT HERE

Another useful way of reading the information of Figure 1 is to analyze the evolution of the probability that the largest bank in the town owns more than one branch according to the number of branches. Figure 2 represents this probability. It looks like a logistic functional form which increases with the number of branches. The probability is higher than 0.5 when there are more than 8 branches in the town, and is equal to unity when there are more than 16 branches in the town. That is, there is not any town with more than 16 branches where the largest bank has a unique branch.

FIGURE 2 ABOUT HERE

The probability of single submarket towns is higher for towns with smaller number of branches, and hence these results are clearly consistent with the hypothesis that submarkets are maximally fragmented and concentration emerges mainly as a result of the aggregation of submarkets.

6.2. Identifying single submarket towns.

I apply the regression analysis with the aim of identifying the number of independent submarkets in a subset of small towns (1,000 to 5,000 inhabitants) and then isolate the single submarket towns. The subset of towns consists of 1,768 towns, which represents roughly 36% of the sample. Towns with less than 1,000 inhabitants are dropped because I have not got socio-economic data, and towns with more than 5,000 inhabitants are dropped to avoid their excessive weight in estimation. I estimate equation (3) using a nonlinear least squares method. For determinants of the average number of branches per submarket, I use dummy variables (Y^0s) representing intervals of per-capita disposable income and a cubic polynomial in population density (D), and for the determinant of the number of submarkets, a cubic polynomial of the number of inhabitants (hab). Details on the variables are given in the Data Appendix.

Table 1 reports the results of the regression. The coe¢cients for the set of explanatory variables are signi…cant and show plausible signs. As for the set of the determinants of the number of submarkets per town, there is a positive highly non-linear relationship between the number of inhabitants and the number of submarkets. As for the set of the determinants of the number of branches per submarket, on the one hand there is a positive relationship between the per-capita disposable income and the number of branches per submarket and, on the other hand, the relationship between population density and the number of branches per submarket is a negative non-linear relationship.

TABLE 1 ABOUT HERE

Predictions on the number of submarkets and on the number of branches per submarket are obtained replacing the parameters by the estimated coe¢cients in the respective non-linear expressions. Table 2 shows the cross-tabulation of the predicted number of submarkets and number of branches per submarket. In each cell, horizontal percentages are reported in brackets. First of all, the distribution of the number of submarkets shows that 67% of the towns with a population between 1,000 and 5,000 can be taken as independent submarkets (1,189 towns) and that the rest would have two independent submarkets. The distribution of the average number of branches per submarket shows that 19% of towns (333 towns) present one branch, 67% (1,190 towns) have two branches, 13% (232 towns) have three branches and only 1% have more than 4.

TABLE 2 ABOUT HERE

Furthermore, notice that in more than 80% of the towns that can be considered as single submarket towns, two or more branches compete. Moreover, the distribution of the average number of branches per submarket is very similar when there are one or two submarkets, although the fact that the probability of one branch per bank increases somewhat with the number of submarkets could be interpreted as a sign of some misspecification.

Once the single submarket towns have been identified, I analyze their degree of concentration. The degree of concentration of 1,189 single submarket towns, measured by their one-bank concentration ratio in branches C_1, can be compared with the minimum level of concentration $C_1 = \frac{1}{n}$. This is done graphically by regions in 17 panels, one for each Spanish autonomous community, in Figure A1. One of these diagrams (Community of Aragón) is presented in the first panel of Figure 3.

In each panel of Figure A1 and the first panel of Figure 3, I depict the curve $C_1 = \frac{1}{n}$ and the concentration ratios C_1 corresponding to the different submarket-towns. Recall that when both coincide, the submarket is maximally fragmented. In Figure A1, it can be observed that in 9 of the 17 regions all the C_1 ratios lie along the curve $C_1 = \frac{1}{n}$ and, hence, all the represented submarkets are maximally fragmented. In the remaining communities, there are some non-fragmented submarkets. In six of these communities these submarkets account for less than 4% of the single submarket towns. In Andalucía and Cataluña, these submarkets account for 9% and 8%, respectively. In summary, 96.3% of the single submarket towns (1,145 towns) are maximally fragmented submarkets. Consequently, the isolation of towns with a unique submarket greatly increases the number of fragmented outcomes.

FIGURE 3 ABOUT HERE

Notice that the 17 panels shown in Figure A1, drawn in the $(C_1; n)$ space, can be seen as equivalent to Lorenz curves drawn in a $(C_1; \frac{1}{n})$ space. Figure 3 consists of 2 panels, which show this equivalence with an example. The first part reports the panel of Figure A1 corresponding to the Community of Aragón. The second panel depicts in the $(C_1; \frac{1}{n})$ space, the diagonal $C_1 = \frac{1}{n}$, the concentration ratios C_1 corresponding to the different submarket-towns, and the limiting curve $\underline{C}_1 = \frac{1}{n}\left(1 - \ln(\frac{1}{n})\right)$.

The concentration ratios C_1 of the single submarket towns will tend to be located in the area bounded by the diagonal $C_1 = \frac{1}{n}$, and the limiting curve $\underline{C}_1$. Recall that when the C_1 lie on the diagonal, the submarkets are maximally fragmented. It occurs in most of the single submarket towns of Aragon (96%).

6.3. Identifying independent submarkets in multimarket towns.

Now I apply cluster analysis[15] to identify the number of submarkets in multimarket towns. Firstly, I carry out this analysis for a subset of towns which have between 5 and 10 branches and show some degree of concentration; secondly, I apply it to a medium-size town.

The lack of homogeneity of geographical human agglomerations, together with the targets of 'being where the demand is' and taking advantage of positive externalities derived from common locations[16], suggest that submarkets may be identified by the relative closeness of groups of branches. That is, two branches can be considered belonging to the same submarket if the distance between them is 'small', while they can be taken as belonging to different submarkets if the distance is 'large'.

[15] See Chatfield and Collins (1980) and Aldenderfer and Blashfield (1984).
[16] See Tirole (1988).

The variables used for cluster formation are the co-ordinates (x,y) of the branches within the town. The method I will use to form clusters is the agglomerative hierarchical clustering, where clusters are formed by grouping cases, starting with groups of just one entity and ending up with all entities grouped into a single group. Under the agglomerative hierarchical cluster analysis, there are many criteria for deciding which cluster should be combined at each step, but these criteria are invariably based on a matrix of distances. The two methods I will employ in this study are the average linkage between groups method and the centroid method. The average linkage between groups method calculates the distance between two clusters as the average of the distances between all pairs of cases in which one member of the pair is from each of the clusters. The centroid method calculates the distance between two clusters as the distance between the means of the variables[17]. In both methods, the distance among cases is measured by means of the squared Euclidean distances. I choose these methods because they can be said 'to maintain the nature of the original space'[18] and use more information than other criteria to form the clusters. A way of visualizing the results of the clusters analysis is dendogram. This shows the clusters being combined and the actual distances rescaled to numbers between 0 and 25. More details on the cluster analysis are given in the Cluster Analysis Appendix.

FIGURES 4 AND 5 ABOUT HERE

Now, I apply this analysis for a subset of towns. I select a small subsample of towns which possess a number of branches between 5 and 10 and whose 'one-bank concentration ratios' C_1 do not lie along the curve $C_1 = \frac{1}{n}$. In these towns, I locate each branch and measure its co-ordinates (x,y) within the town (Figures 4 and 5 show two examples of location of branches[19]). Then, I obtain the dendograms using the average linkage between groups method. Figure 6 shows the dendograms for each

[17] See the chapter of cluster analysis in SPSS/PC +Statistics 4.0 manual.

[18] See Aldenderfer and Blash…eld (1984).

[19] The small towns are Pasaia de San Pedro (Guipuzcoa) and Segorbe (Castellón).

one of the 12 towns. The dendograms obtained with the centroid method are very similar. Both methods con…rm that natural groupings really exit.

FIGURE 6 ABOUT HERE

The nested tree structure of the dendograms suggests that there are many di¤erent groupings, and the question is where to 'cut' the tree so the optimal number of groups is found. Unfortunately this question is still an unsolved problem of cluster analysis, although there are some tests[20]. From the point of view of the present discussion, I am not interested in providing a unique de…nitive number of submarkets by town, and I simply distinguish the several possible groupings in each town according to the distances of the dendogram and I examine concentration through these groupings. In general, the two criteria used to obtain alternative groupings have been cutting the tree in the second and third level provided that their distances in the dendogram were between 0 and 10[21]. For example, Figure 4 shows the plane of one town. If the dendogram is 'cut' at a distance of 2 (second level of the grouping), the number of clusters in this town is 4. Three of the submarkets would be formed by one branch (1,3 and 5) and branches 2 and 4 would integrate the fourth. On the contrary, if the dendogram is 'cut' at a distance between 5 and 10 (third level), the number of clusters is 3. Two of them are formed by one branch (3 and 5), and the third by branches 2,4 and 1.

Table 3 reports the di¤erent groupings per town that I distinguish in the dendograms. This analysis …rstly suggests that these towns possess di¤erent numbers of submarkets. Moreover, the size of the submarkets of each town measured by the number of branches is not homogeneous. That is, in a given town, di¤erent submarkets may have di¤erent numbers of branches. Submarkets with the largest number of branches are usually located in the downtown area.

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[20] See Aldenderfer and Blash…eld (1984).

[21] With the exception of Berriozar, Boadilla del Monte and Vila-Seca, in which the second and the third level of the groupings are very similar. Thus, I report the third and fourth level.

TABLE 3 ABOUT HERE

To analyze the degree of concentration of the submarkets identified in each town, I also report the C_1 of each submarket in Table 3. These ratios show that in most of the submarkets, each bank owns only one branch, and this holds independently of the particular grouping used. Moreover, in those towns where exceptions occur, these exceptions arise in only one submarket in the town. According to these results, the (sometimes high) level of concentration observed in these towns is basically driven by the presence of larger banks having branches spread across several submarkets.

Next, cluster analysis is applied to one medium-size town (Alcalá de Henares, Madrid) with more than 160,000 inhabitants and 86 branches, 16 of which belong to the first bank. Figure 7 shows the plane of this town, where the 86 branches are located.

FIGURE 7 ABOUT HERE

I obtain the dendogram using the average linkage between groups method. This dendogram suggests that a sensible grouping is 14 clusters (in this case, I report only the second level of the grouping). Table 4 reports the result of this grouping and the degree of concentration per submarket. It can be observed that there are independent submarkets with a high number of branches (10, 12 or 20) that coexist with submarkets with few branches (1, 2 or 3). The submarkets with large number of branches are located in the downtown area. Once the independent submarkets of Alcalá de Henares have been identified following the method just described, their degree of concentration can be established. Table 4 reflects that the concentration ratios C_1 show fragmentation in all but 4 submarkets. Therefore, this medium-size town may be interpreted as a multimarket town integrated by 14 independent submarkets, most of them maximally fragmented.

TABLE 4 ABOUT HERE

The main conclusion of this subsection is that the majority of independent submarkets identi…ed and examined are maximally fragmented. This result is consistent with the game-theoretic model, given our maintained assumption that the Spanish retail banking market satis…es the three 'special case' assumptions of Sutton (1998) stated earlier.

6.4. Aggregated markets.

I check the prediction of the model for the regional markets and the national market using the whole sample of branches of Spanish towns. I construct Lorenz curves for each one of the 17 autonomous communities and for the national territory. Then I compare these Lorenz curves with the corresponding 'limiting curve'. The prediction of the model is that the observed Lorenz curve should lie beyond this reference curve. This comparison is done graphically by regions in 17 panels, one for each Spanish autonomous community, in Figure A2. One of them (Community of Aragón) is given in Figure 8.

In each panel of Figure A2 and in Figure 8, I depict the Lorenz curve corresponding to the di¤erent communities and the limiting curve $\underline{C}_{\frac{k}{N}}$. For the 17 communities, the Lorenz curve lies beyond the limiting curve. It can also be observed that the degree of inequality in bank sizes is heterogeneous by communities[22]

FIGURE 8 ABOUT HERE

In Figure 8, we can observe that the Lorenz curve lies beyond the limiting curve. The implication is that there is a signi…cant size inequality among banks operating in this community. This contrasts with the image of maximal fragmentation that the individual submarkets give (see Figure 3 corresponding to the same community).

[22] The communities with the greatest degree of inequality in bank sizes are Aragon, Cataluña and Madrid, while the communities with the lowest degree of inequality in bank sizes are The Canary Islands and Castilla La Mancha.

Figure 9 shows the Lorenz curve and the limiting curve for the national market. The Lorenz curve again lies beyond the limiting curve. Thus, there is a high degree of inequality in bank size on a national level.

FIGURE 9 ABOUT HERE

This study has found evidence that once the independent submarkets are identified, the majority of these submarkets are maximally fragmented. Nonetheless, the degree of concentration at regional and at national levels is high, i.e., these markets are concentrated. The degree of inequality in firms sizes exceeds the minimal level (lower bound) predicted on the basis of the independent submarkets' model.

7. Concluding remarks

This work proposes to test the predictions of the independent submarkets model with data on the Spanish bank market. To carry out the investigation, I have identified the submarkets in some towns through a regression analysis and a cluster analysis. Firstly, I have identified the submarkets in the towns with population of between 1,000 and 5,000 for the year 1996 (36% of the towns) through the estimation of a non-linear equation explanatory of the number of branches. With this exercise I have isolated the towns that can be considered a single submarket. Secondly, I have selected a subset of towns which have between 5 and 10 branches and whose one-bank concentration ratios C_1 do not lie along the curve $C_1 = \frac{1}{n}$ and for one medium-size town (more than 160,000 inhabitants). Then, I have identified their submarkets though cluster analysis. Afterwards, I have analyzed the degree of concentration in markets with different level of aggregation (single submarkets, communities and national markets).

The main empirical results are the following. Firstly, more than 67% of the towns with a population of between 1,000 and 5,000 can be considered independent submarkets. 80% of these submarkets consists of two or more branches. Secondly, in

96.3% of these submarkets, the degree of size inequality among banks, as measured by the number of branches, is zero. That is, nearly all the banks of these independent submarkets have an unique branch. Thirdly, more than 65% of the subset of towns with 5 and 10 branches are formed by di¤erent number of submarkets where banks are only owned of one branch. In the rest of their towns, only one of their submarkets are concentrated. Moreover, 71% of the independent submarkets of the medium-size town are maximally fragmented. But fourthly, when the regional markets are considered, the degree of inequality in bank sizes becomes high and heterogeneous. That is, the number of branches opened in each regional market varies widely from bank to bank. Finally, when the national bank market is considered, the degree of inequality in bank sizes is also high. These results are fully consistent with the predictions of Sutton's theoretical model.

Data Appendix

The main data source used in this paper is the Guía de Banca, Cooperativas de Crédito y Cajas de Ahorros, which contains commercial information about branches of every bank, savings banks and credit co-operatives in each Spanish town. As a complementary source, I have also used the Anuario Comercial de España, which supplies socio-economic information for towns with more than 1,000 inhabitants (number of inhabitants, area, per capita disposable income,...). This source can be matched to a subset of the Spanish towns. The data refers to the year 1996.

The initial sample of the Guía consists of 40,574 records, from which remain 40,477 after eliminating records with missing information. These observations are distributed among 5,401 towns. From this sample, I have firstly dropped 3,321 observations belonging to 'credit co-operatives', which are mostly located in very small towns and cannot be taken as standard banking institutions.

Then I have applied two filters, one in order to remove duplications (due to the special administrative role played by the same branches) and the other one to retain exclusively standard retail branches. The first filter eliminates 867 observations corresponding to central departments[23] located in retail branches. The second filter eliminates 2,649 observations corresponding to a list of special types of branches. There remain 33,640 observations, distributed among 4,977 towns that we will take as the population of retail branches.

The Anuario Comercial contains information about 3,196 Spanish towns with more than 1,000 inhabitants. I drop the towns in which there are only credit co-operatives and there remain 3,061 towns. The intersection of the two data sources gives a sample of 2,864 towns[24] for which we have detailed information about branches and socio-

[23] Central departments do not render external services.

[24] There are 197 towns of the Anuario Comercial that cannot be matched with the ones in the Guía sample due mainly to that the information published in both sources does not coincide. These towns are always between 1,000 and 3,000 inhabitants and their number of branches is lower than two.

economic data. In regression analysis I will use the subset of 1,768 towns which size is between 1,000 and 5,000 inhabitants.

In what follows, I specify the de…nitions of the explanatory variables that constitute the vectors x_m and z_m of equation (3) (Table A1 summarizes the variables and gives some statistics).

n_m: number of branches per town the 31st December 1996.

The vector x_m consists of the following variables:

D_m: population density, measured by the number of inhabitants per square kilometer.

Y_m: set of dummies representative of the di¤erent per-capita disposable income levels. The levels are the following

Levels	Per- capita disposable income (thousands of pesetas)
1	Until 900
2	900 - 1.000
3	1.000 - 1.125
4	1.125 - 1.250
5	1.250 - 1.400
6	1.400 - 1.600
7	1.600 - 1.800
8	1.800 - 2.000
9	2.000 - 2.200
10	More than 2.200

The vector z_m consists of the variable:

hab_m: De jure population of each town.

TABLE A1 ABOUT HERE

Cluster Analysis Appendix

'Cluster Analysis' is the generic name for a wide variety of procedures that can be used to create a classi…cation. The aim of these procedures is to form 'clusters' or groups of highly similar cases or entities. More formally, a clustering method is a multivariate statistical procedure that allows reorganizing the sample of entities into homogeneous groups in terms of some characteristics[25]. For example, cluster analysis is used to classify animals or plants in biology, and to identify diseases and their stages in medicine.

In cluster analysis, distance is a generic measure of how far apart two objects are. There are many di¤erent de…nitions of distance. The choice among the measures depends on which characteristics of the data are important for your particular application. The most used distance measure between two entities is the squared Euclidean distance, computed from the vectors of values of their characteristics.

In cluster analysis, the selection of variables determines the characteristics used to identify subgroups. In this paper, I apply this analysis for the identi…cation of submarkets in multimarket towns. Consequently, the variables used for clusters formation are the co-ordinates (x,y) of the branches within the town. Therefore, distance measures the relative physical closeness of groups of branches.

There are many methods to form clusters, the most used being agglomerative hierarchical clustering, or divisive hierarchical clustering[26]. In agglomerative hierarchical clustering, the clusters are formed by grouping cases, starting with groups of just one entity and ending up with all entities gathered into a single group. In divisive hierarchical clustering, the clusters are formed by splitting clusters, starting with all entities gathered into a single group and ending up with as many groups as there are entities.

Under agglomerative hierarchical clustering, there are many criteria for deciding

[25] See Aldenderfer and Blash…eld (1984)

[26] See, for example, the chapter of cluster analysis in SPSS/PC +Statistics 4.0 manual.

which clusters should be combined at each step, but these criteria are invariably based on a matrix of distances. They di¤er in how the distances between clusters at successive steps are estimated. In general, clustering methods are the following: linkage methods (e.g., the average linkage between groups method that I employ in this study), error sums of squares or variance methods and centroid methods (e.g., the centroid method that I also employ in this study).

Just as there are many methods for calculating distances and for combining objects into clusters, there are many ways of visualizing the results of cluster analysis (e.g., icicle plot, agglomeration schedule or dendogram). In this study, I employ the dendogram that shows the clusters being combined, and the actual distances rescaled to numbers between 0 and 25.

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Table 1

The determination of the total number of branches per town

DEPENDENT VARIABLE : Number of branches

Number of towns: 1,768

	NLSQ	
Variables	Coe¢cients	t-ratios
cte	-10.55	(-16.91)
hab	7.72	(12.78)
hab^2	-1.99	(-10.11)
hab^3	0.17	(8.91)
Y 2	-0.95	(-6.11)
Y 3	-0.47	(-6.82)
Y 4	-0.10	(-2.08)
Y 5	0.09	(2.13)
Y 6	0.01	(0.38)
Y 7	0.14	(2.95)
Y 8	0.47	(8.07)
Y 9	0.56	(7.68)
Y 10	0.65	(4.90)
D	-6.17	(-9.01)
D^2	12.09	(6.08)
D^3	-6.26	(-3.90)
R^2	0.23	
R^2 (ajusted)	0.23	

Table 2

The joint distribution of submarkets and branches

(predicted numbers, relative frequencies shown in parenthesis)

		Number of branches per submarket					
		1	2	3	4	5	Total
Number of Submarkets	1	186	791	200	7	5	1,189
		(15.7)	(66.5)	(16.8)	(0.6)	(0.4)	(100)
	2	147	399	32	1	0	579
		(25.4)	(68.9)	(5.5)	(0.2)	(0)	(100)
	Total	333	1,190	232	8	5	1,768

Table 3
Number of submarkets and degree of concentration per submarket

Town **(region)**	**Number of branches**	**C_1 (by town)**	**Possible number of submarkets**	**C_1 (by submarkets)**	**Maximally fragmented?**
Berriozar (Navarra)	5	0.4	3	1/2 1/2 1/1	Y Y Y
			2	1/4 1/1	Y Y
Noain (Navarra)	5	0.4	3	1/1 1/1 1/3	Y Y Y
			2	1/1 1/4	Y Y
Pasai de San Pedro (Guipuzcoa)	5	0.6	4	1/1 1/1 1/1 1/2	Y Y Y Y
			3	1/1 1/1 1/3	Y Y Y
Mejorada del Campo (Madrid)	6	0.33	4	1/1 1/1 1/1 1/3	Y Y Y Y
			2	1/2 1/4	Y Y
Montoro (Córdoba)	7	0.43	5	1/1 1/1 1/1 1/2 1/2	Y Y Y Y Y
			3	1/1 1/3 1/3	Y Y Y
Peñarroya (Córdoba)	7	0.43	3	1/1 1/1 2/5	Y Y N
			2	1/2 2/5	Y N
Leioa	8	0.5	3	1/1	Y

(Vizcaya)				1/1 2/6	Y N
Maliaño (Cantabria)	8	0.25	2	1/7 1/1	Y Y
Cardona (Barcelona)	8	0.38	3	1/1 1/1 2/6	Y Y N
			2	1/2 2/6	Y N
Segorbe (Castellón)	9	0.33	5	1/2 1/1 1/2 1/3 1/1	Y Y Y Y Y
			4	1/2 1/3 1/3 1/1	Y Y Y Y
Boadilla del Monte (Madrid)	10	0.3	5	1/1 1/1 1/1 1/2 1/5	Y Y Y Y Y
			4	1/1 1/1 1/1 1/7	Y Y Y Y
Vila-Seca (Tarragona)	10	0.4	4	1/1 1/1 1/3 1/5	Y Y Y Y
			3	1/1 1/3 2/6	Y Y N

Table 4
Number of submarkets in the medium-size town and degree of concentration per submarket

Town (region)	**Number of branches**	**C_1(town)**	**Possible number of submarkets**	**C_1 (by submarkets)**	**Maximally fragmented?**
Alcalá de Henares (Madrid)	86	0.19	14	1/1	Y
				1/1	Y
				1/2	Y
				1/3	Y
				1/3	Y
				1/3	Y
				1/4	Y
				2/4	N
				1/6	Y
				2/6	N
				1/9	Y
				1/10	Y
				2/14	N
				3/20	N

Table A1

Summary and statistics of the variables employed in regression

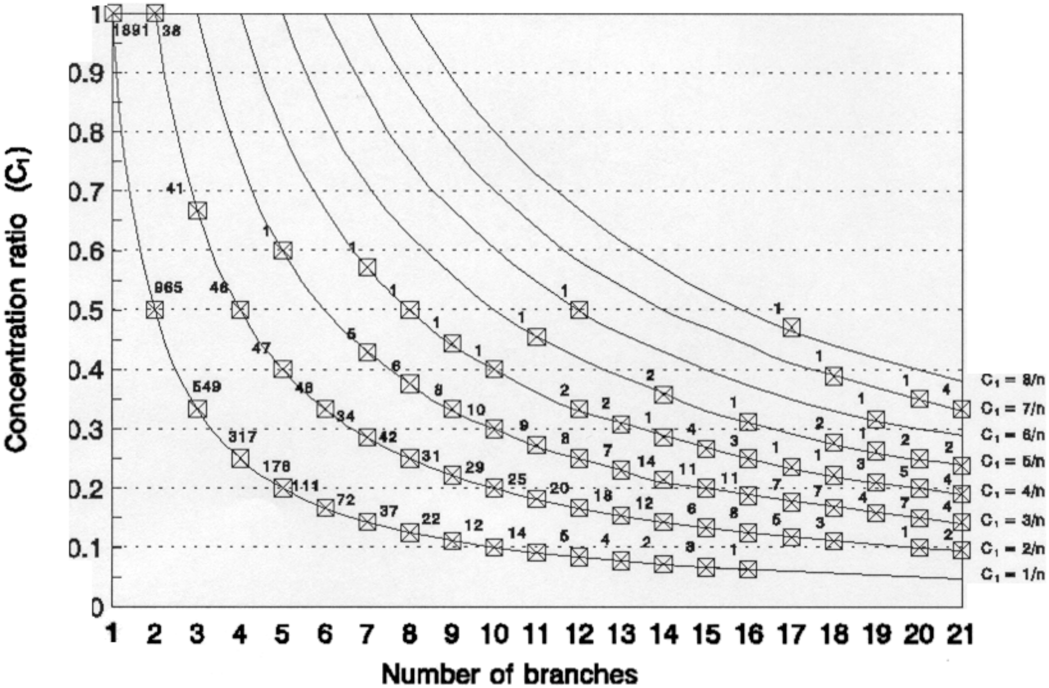
	Mean	Std.	Min.	Max.
Dependent variable				
Number of branches	2.56	1.54	1	12
Explanatory variables				
To account for the average number of branches per submarket:				
Population density[1]	0.09	0.18	0.00	2.91
Income levels:				
Y1	0.05	0.22		
Y2	0.14	0.34		
Y3	0.21	0.41		
Y4	0.15	0.36		
Y5	0.14	0.34		
Y6	0.21	0.41		
Y7	0.08	0.27		
Y8	0.01	0.11		
Y9	0.01	0.09		
Y10	0.00	0.05		
To account for the number of submarkets:				
Population[2]	2.30	1.04	1.00	4.97

Notes

1. Thousands of inhabitants per square kilometer.
2. Thousands of inhabitants.

Figure 1

Degree of concentration in towns according to the number of branches



The number on each datapoint reports its corresponding absolute frequency; i.e., there are 965 towns with two branches owned by different banks ($C_1 = 0.5$) and 38 in which the two branches are owned by the same bank ($C_1 = 1$).

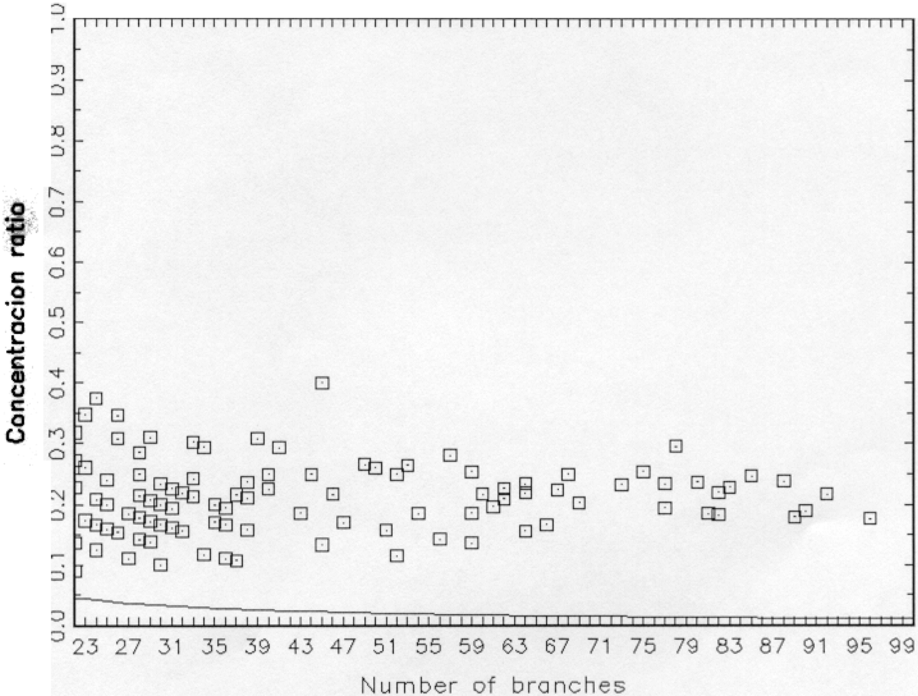


Figure 2

The probability of being town multibranch for the biggest bank

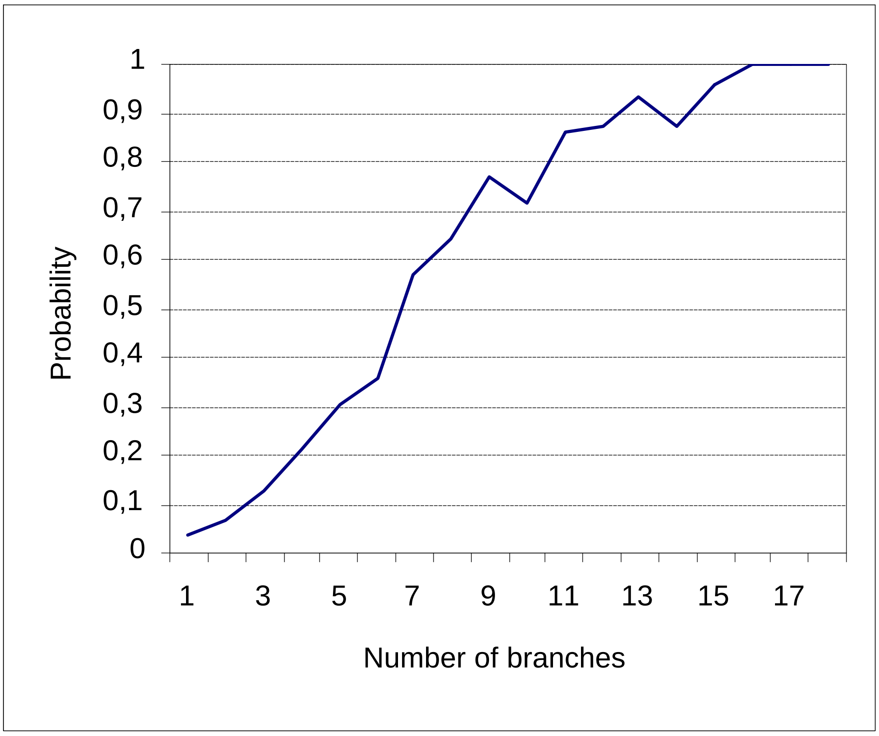
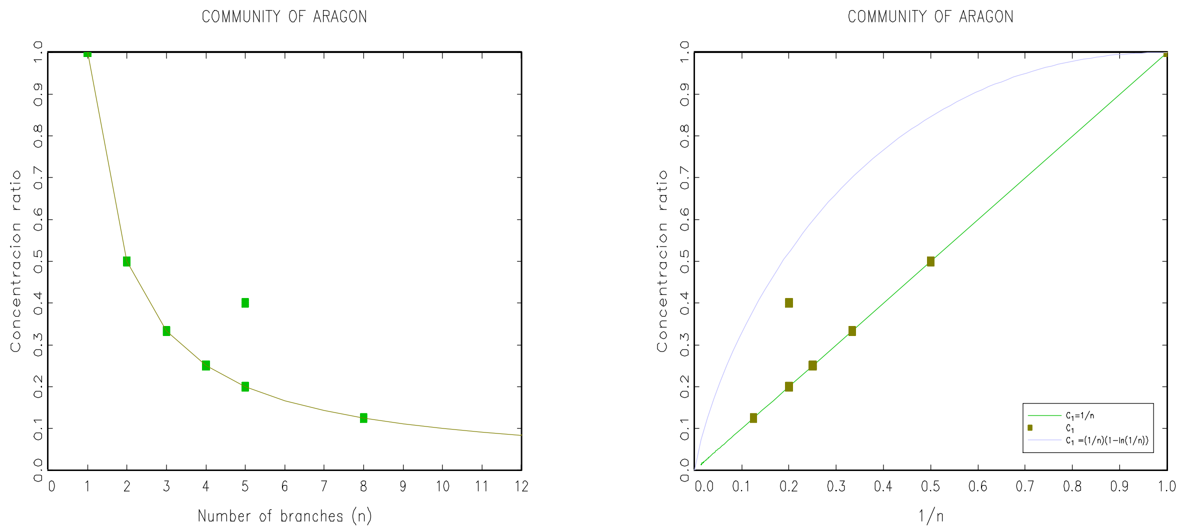


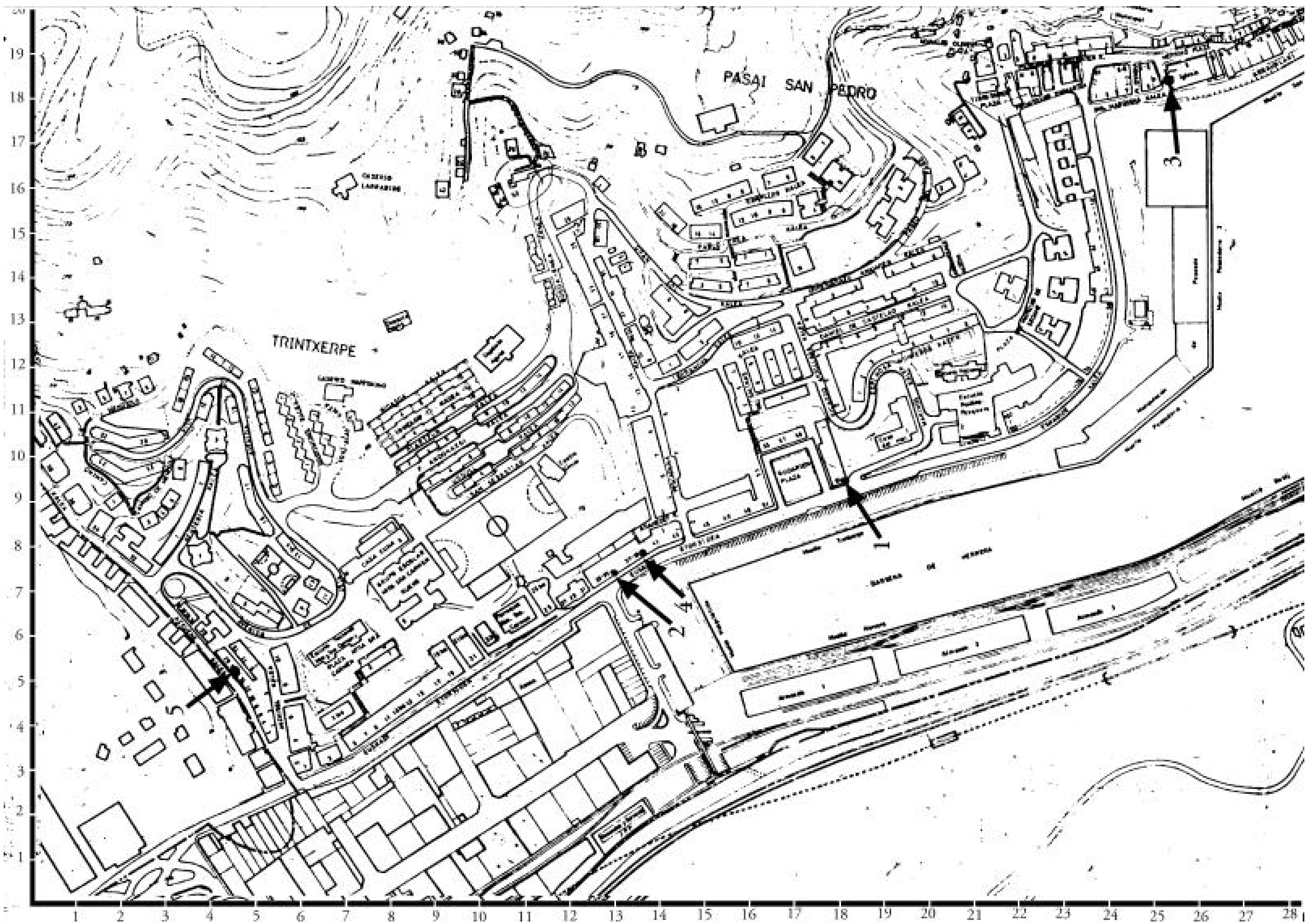
Figure 3

Concentration in individual submarkets. An example.



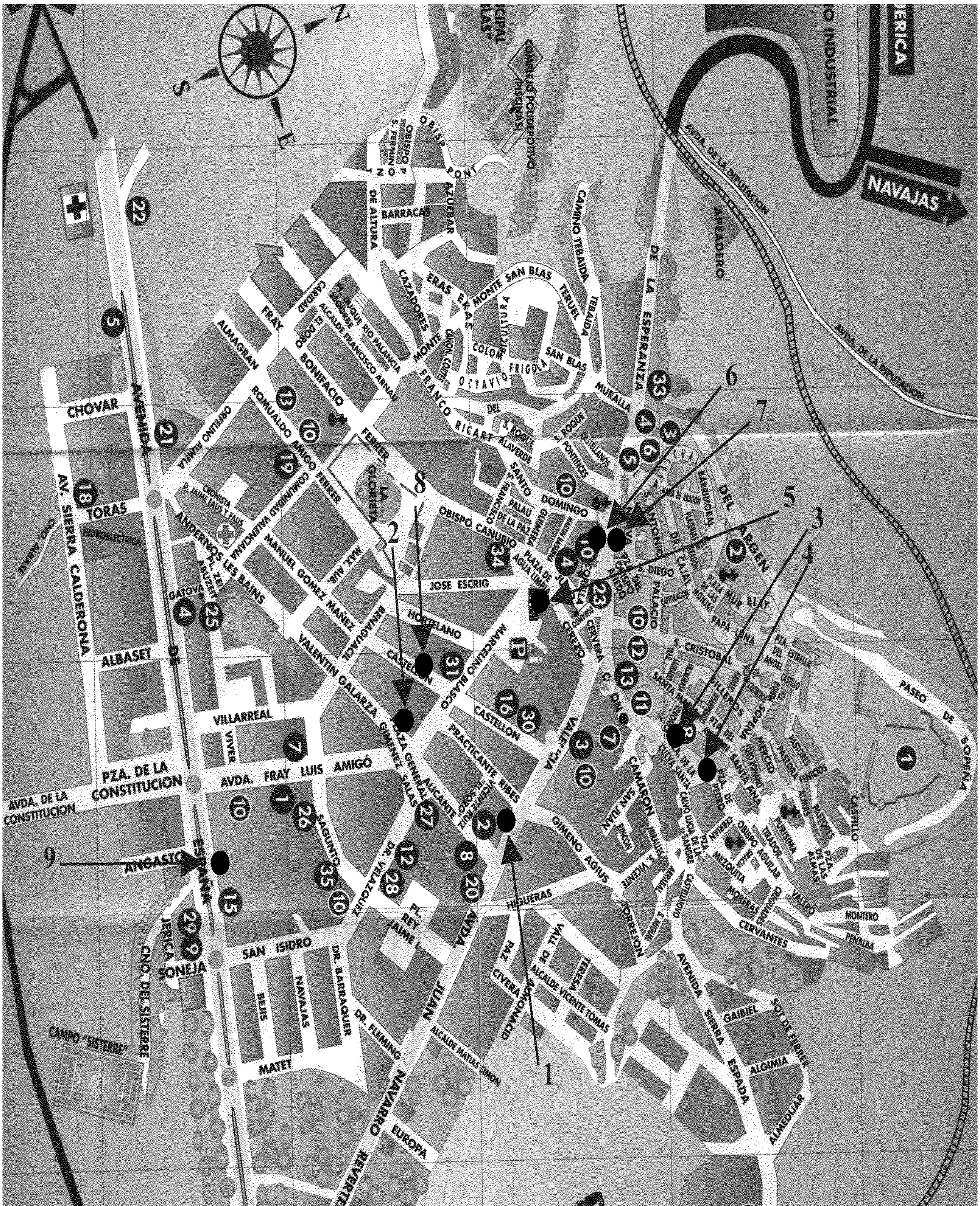
The …gure relates to the Community of Aragón.

Figure 4
Scaled map of a small town



TRINTXERPE
PASAI SAN PEDRO
1
2
3
4
5

Figure 5
Map of a small town

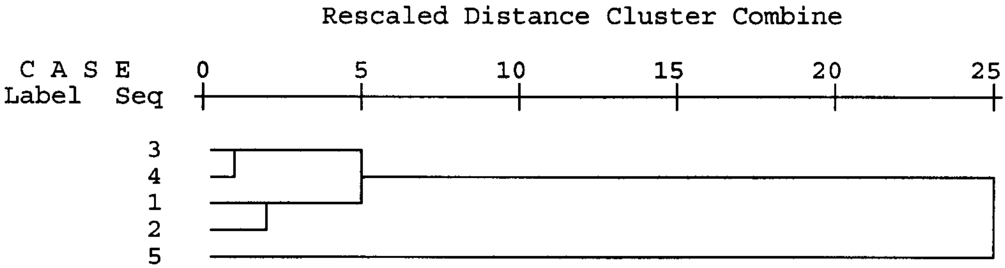


NAVAJAS
AVDA. DE LA DIPUTACION
APEADERO
CAMINO TEBAIDA
DE LA ESPERANZA
MURALLA
SAN BLAS
TERUEL
FRANCO RICART
OCTAVIO
FRIGOLA
COLOM
MONTE SAN BLAS
ERAS
CAZADORES
BARRACAS
AZUEBAR
PONT
DE ALTURA
OBISPO
FRAY
BONIFACIO
ALMAGRAN
FERRER
AMIGO FERRER
ROMUALDO
ORFELINO AMELA
CHOVAR
AVENIDA
TORAS
AV. SIERRA CALDERONA
ANDERNOS LES BAINS
HIDROELECTRICA
MANUEL GOMEZ MANEZ
GATOVA
ALBASET
DE
VILLARREAL
VIVER
PZA. DE LA CONSTITUCION
AVDA. DE LA CONSTITUCION
AVDA. FRAY LUIS AMIGÓ
ANGASTO
ESPAÑA
JERICA
SONEJA
CNO. DEL SISTERRE
CAMPO "SISTERRE"
SAN ISIDRO
BEJIS
NAVAJAS
MATET
DR. BARRAQUER
DR. FLEMING
JUAN NAVARRO REVERTER
AVDA.
EUROPA
EXPLANADA ESTACION
ALCALDE MATIAS SIMON
VALENTIN GALARZA
BENAGUACIL
HORTELANO
JOSE ESCRIG
OBISPO CANUBIO
LA GLORIETA
MARCELINO BLASCO
CASTELLON
PRACTICANTE RIBES
ALICANTE
DR. VELAZQUEZ
PL. REY JAIME I
SAGUNTO
HIGUERAS
VALENCIA
GIMENO AGIUS
CAMARON
SAN JUAN
CERVERA
SANTO DOMINGO
S. ROQUE
PALAU
ALAVERDE
S. DIEGO
PALACIO
PAPA LUNA
S. CRISTOBAL
SANTA ANA
SOPEÑA
MERCED
PASTORES
CASTILLO
PASEO DE SOPEÑA
CERVANTES
MONTERO
PEÑALBA
VALERO
OBISPO AGUILAR
MEZQUITA
MORERAS
AVENIDA
SIERRA ESPADA
GAIBIEL
SOT DE FERRER
ALGIMIA
ALMEDIJAR
TORREJON
PAZ
CIVERA
ALCALDE VICENTE TOMAS
TERESA
VALL DE ALMONACID
DEL ARGEN
ZONA INDUSTRIAL
1
2
3
4
5
6
7
8
9

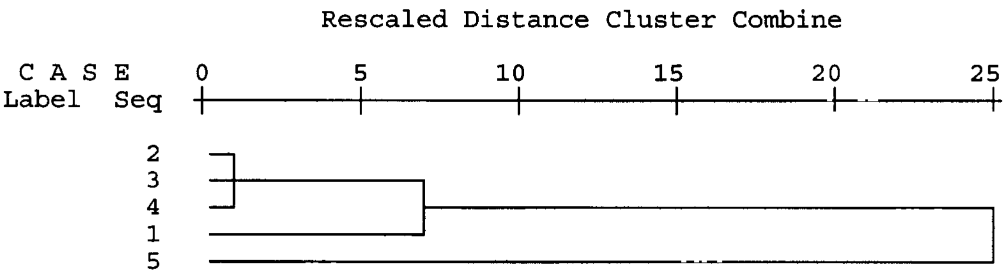
Figure 6

Dendograms using average linkage (between groups)

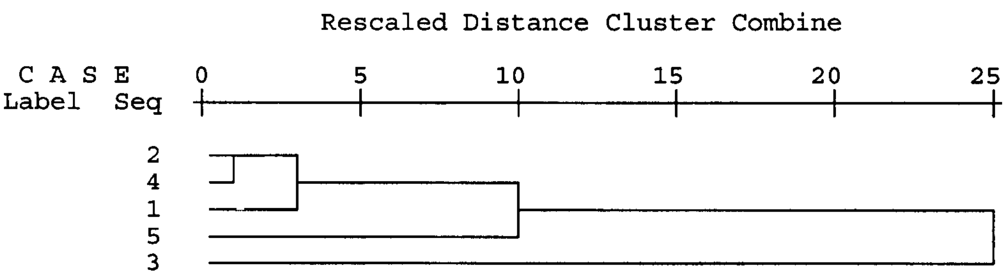
BERRIOZAR:



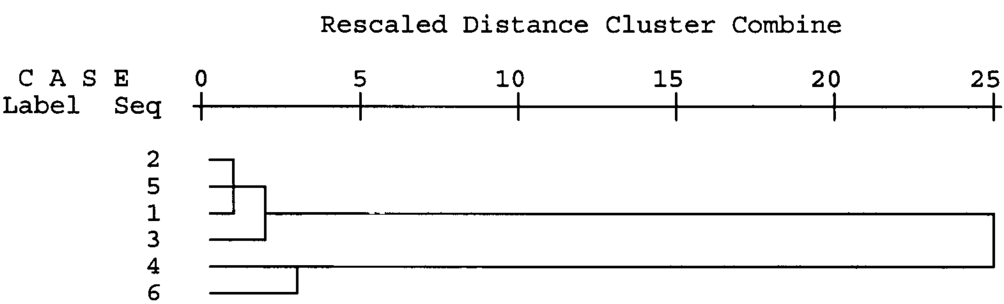
NOAIN:



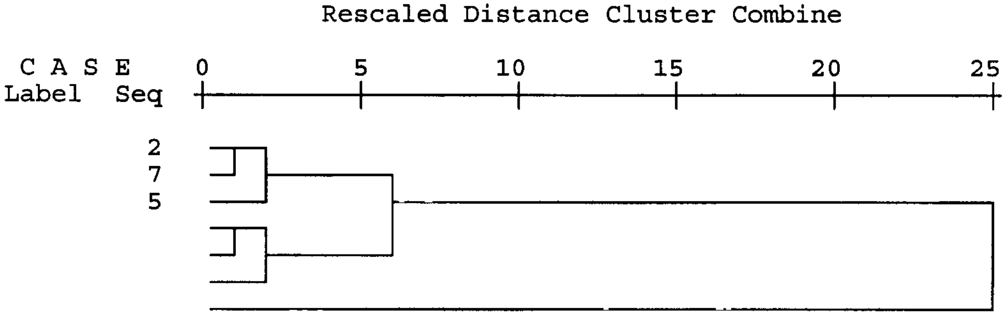
PASAIA DE SAN PEDRO



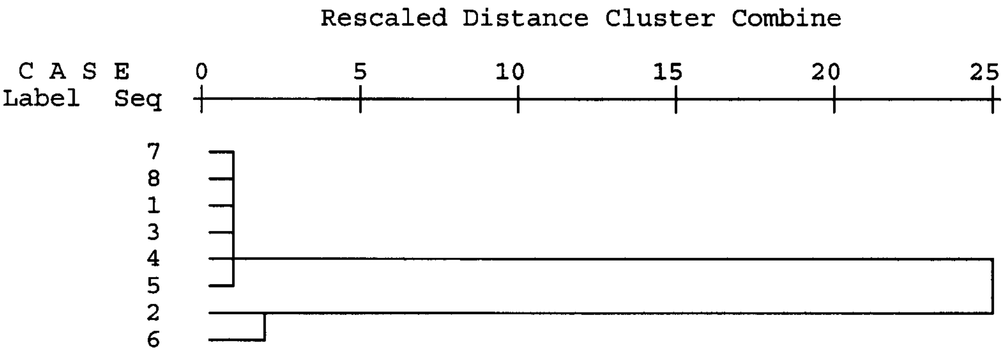
MEJORADA DEL CAMPO:



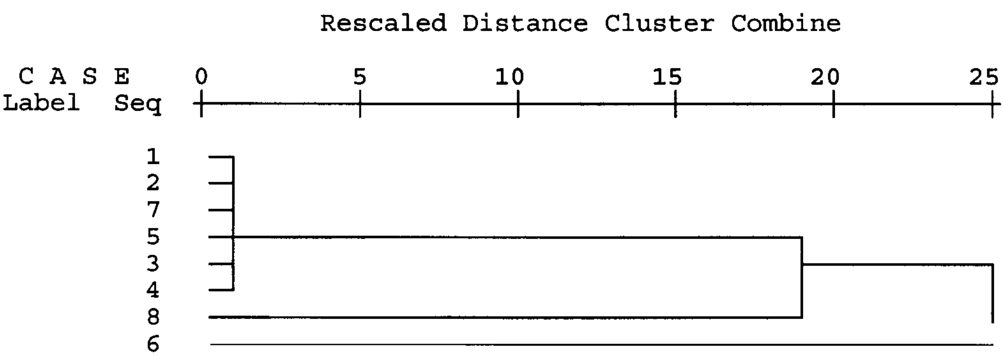
MONTORO:



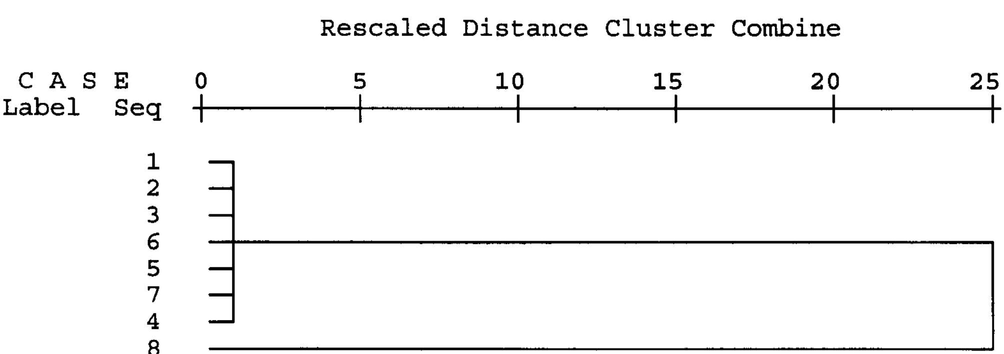
PEÑARROYA:



LEIOA



MALIAÑO:



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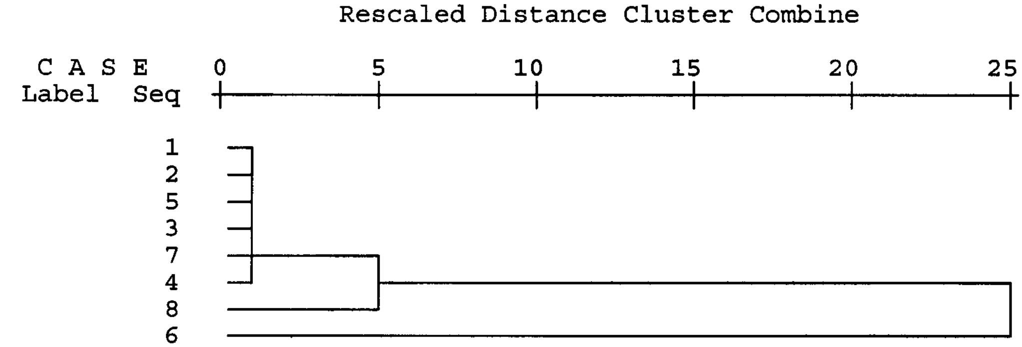
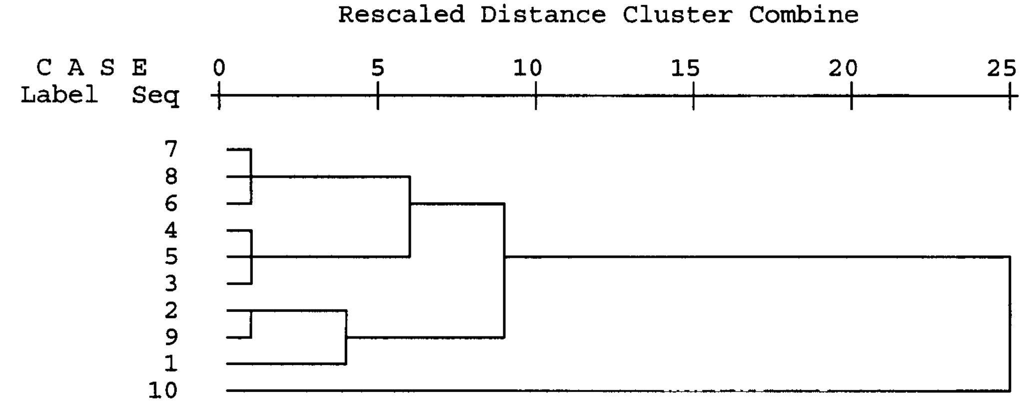
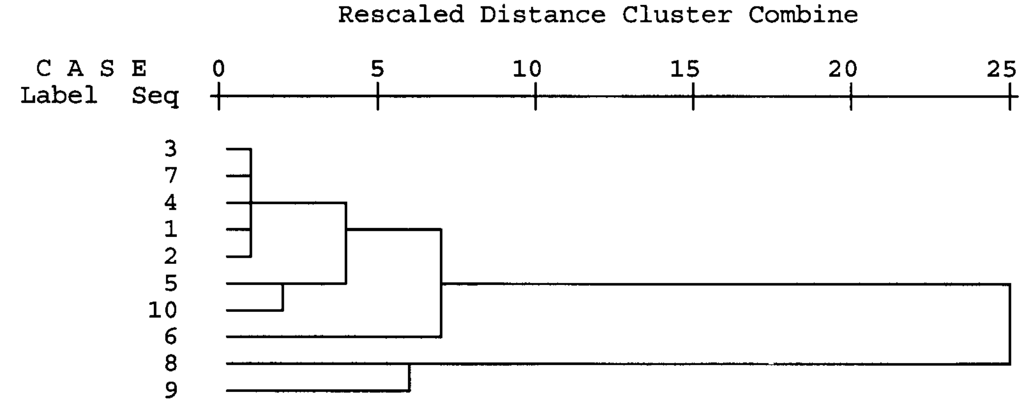


SEGORBE



BOADILLA DEL MONTE



VILA-SECA:

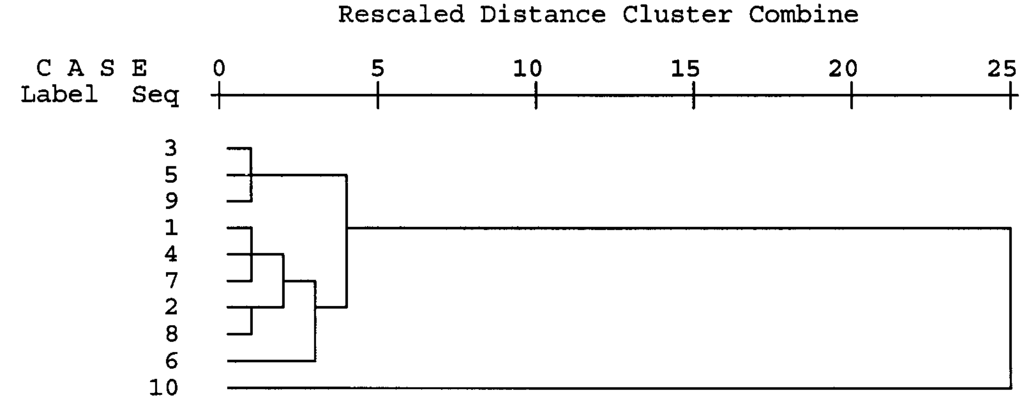


Figure 7
Map of the medium-size town

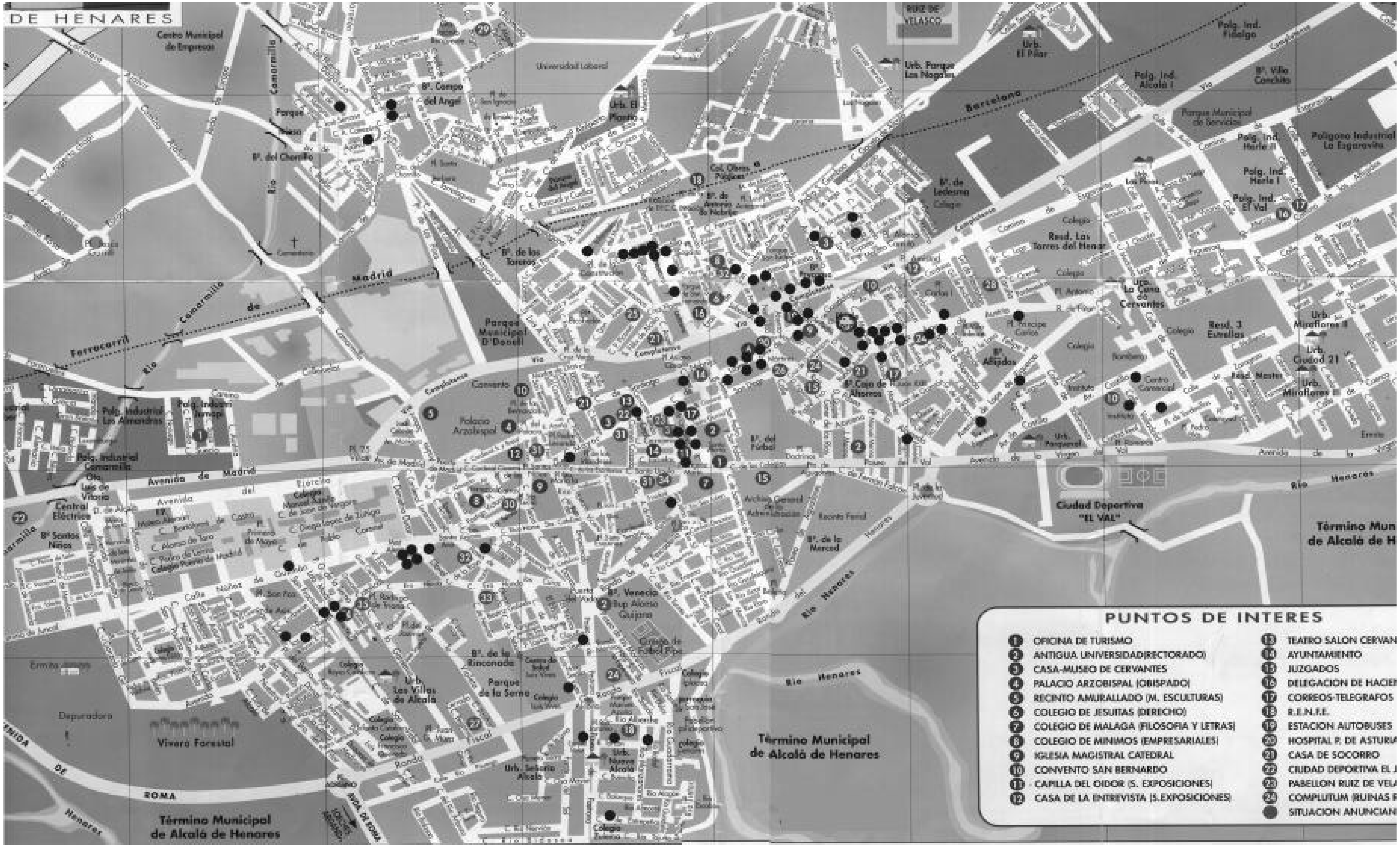
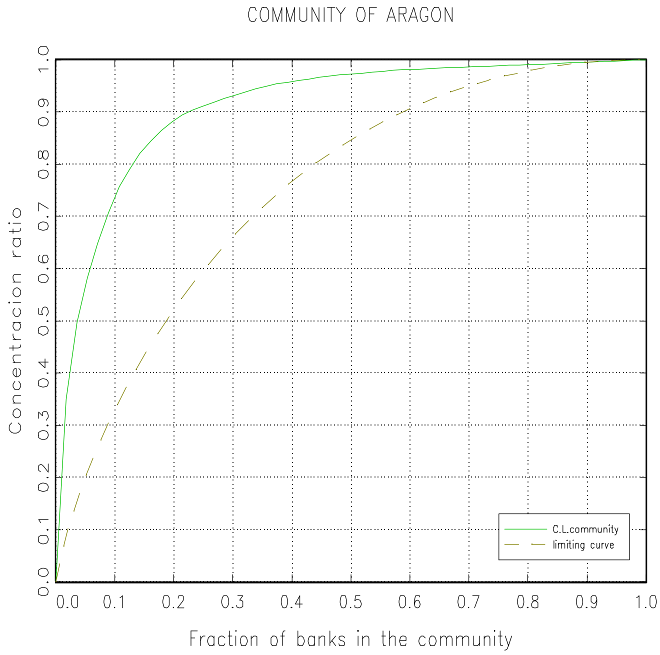


Figure 8

Lorenz curve of a community market



The …gure relates to the Community of Aragón

Figure 9

Lorenz curve of the national territory

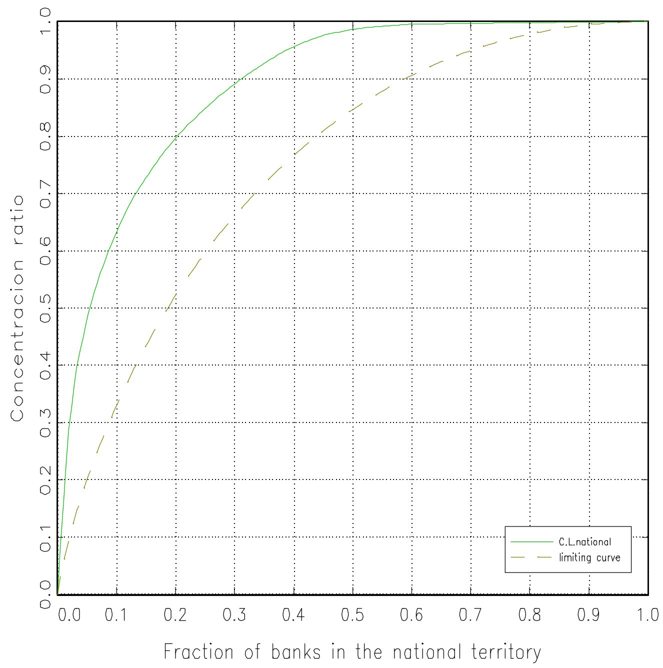
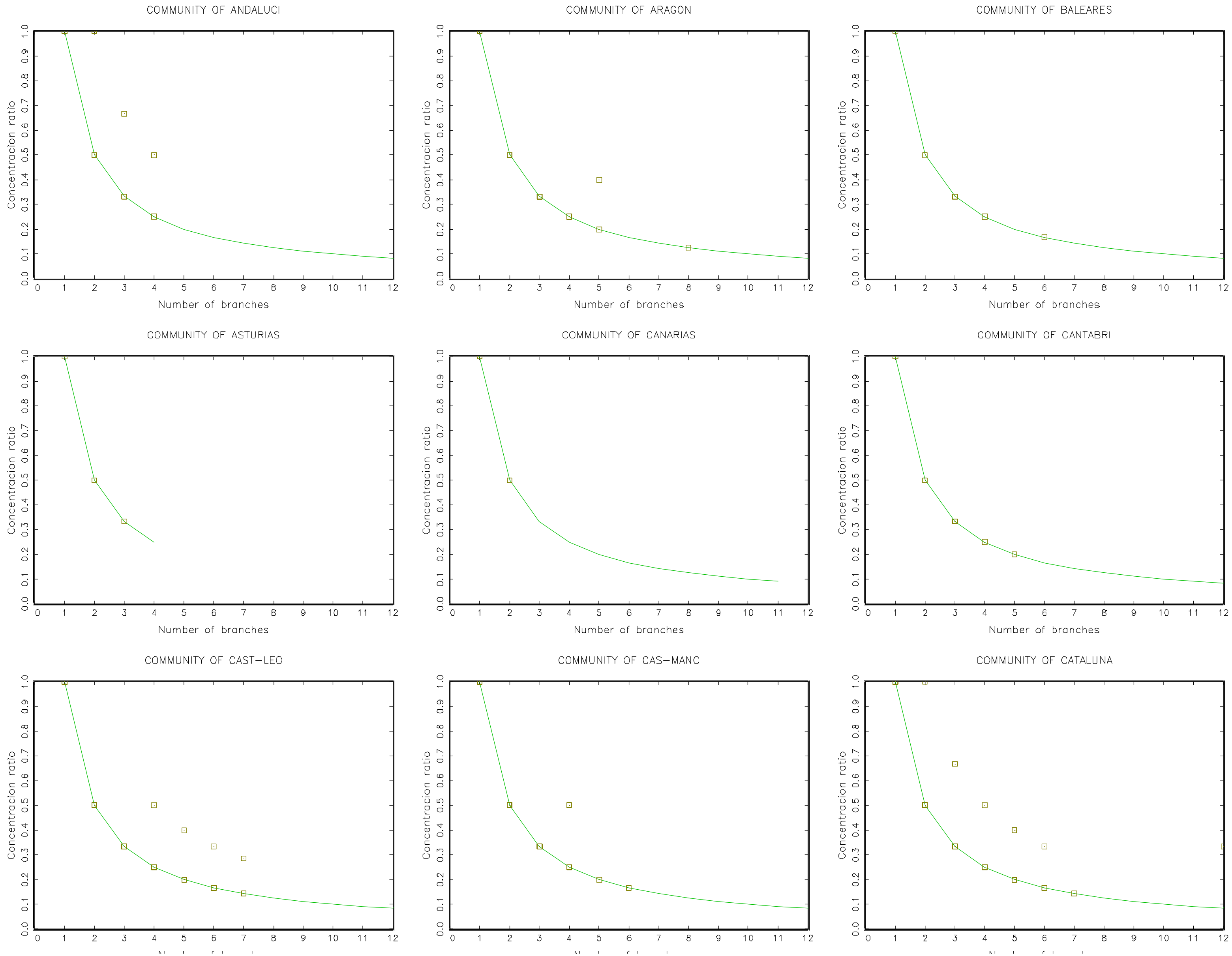
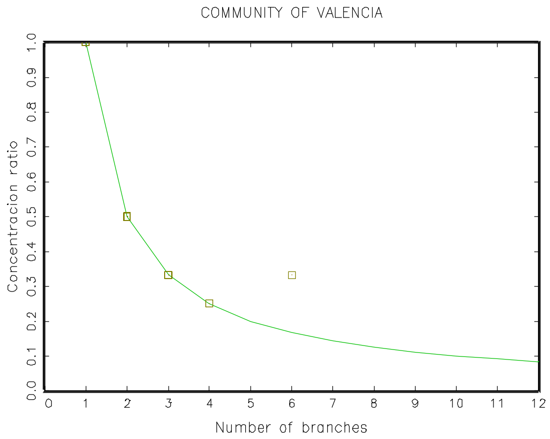
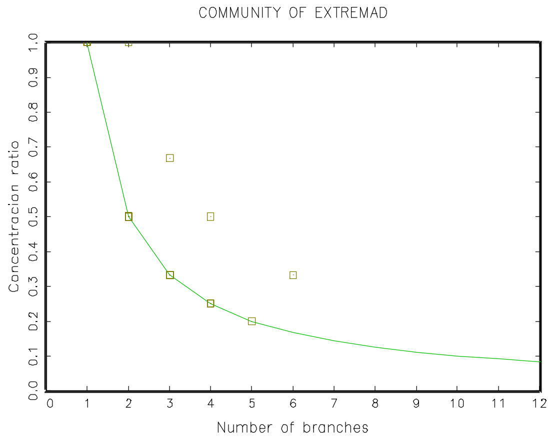


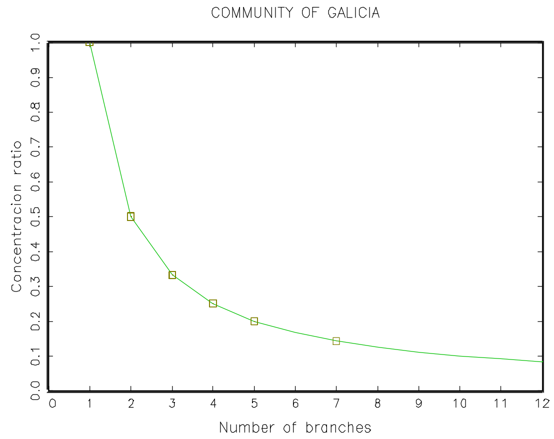
Figure A1

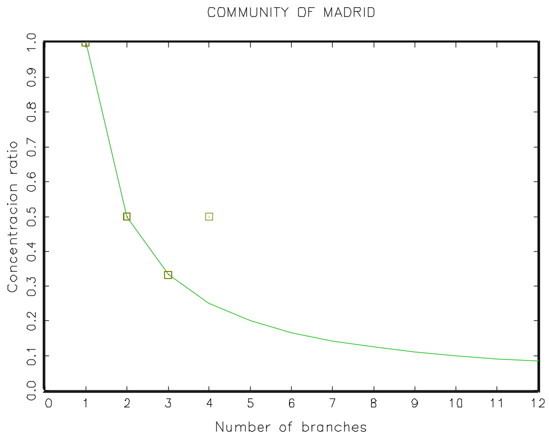
Degree of concentration in single market towns according to the number of branches (reported by regions)

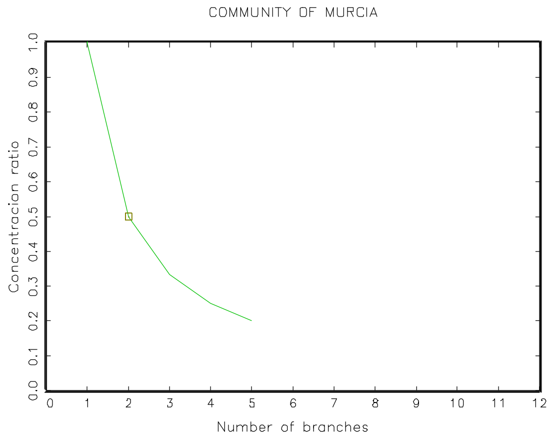


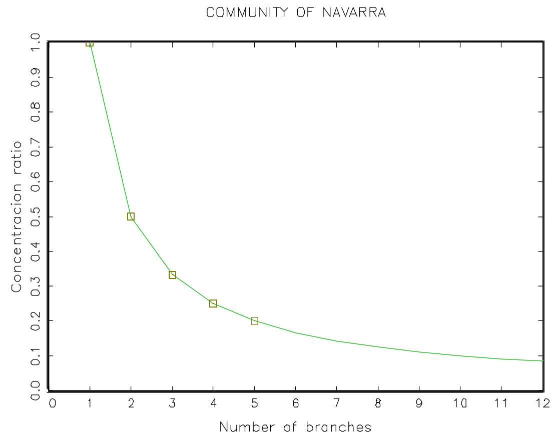

COMMUNITY OF VALENCIA
Concentracion ratio
Number of branches

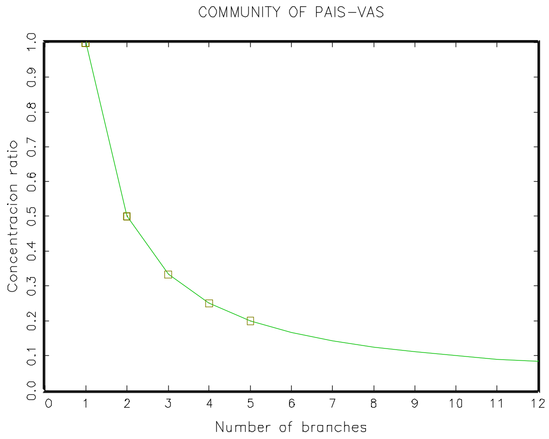

COMMUNITY OF EXTREMAD
Concentracion ratio
Number of branches


COMMUNITY OF GALICIA
Concentracion ratio
Number of branches


COMMUNITY OF MADRID
Concentracion ratio
Number of branches


COMMUNITY OF MURCIA
Concentracion ratio
Number of branches


COMMUNITY OF NAVARRA
Concentracion ratio
Number of branches


COMMUNITY OF PAIS-VAS
Concentracion ratio
Number of branches

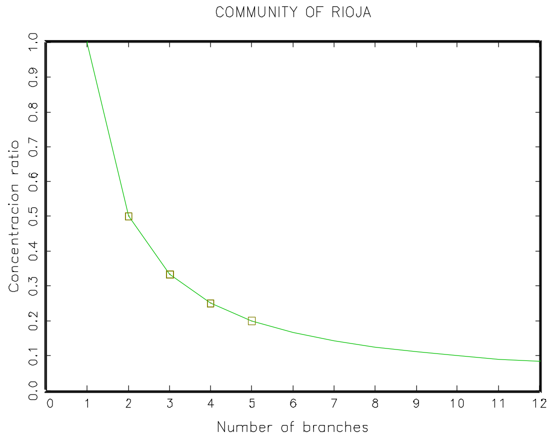
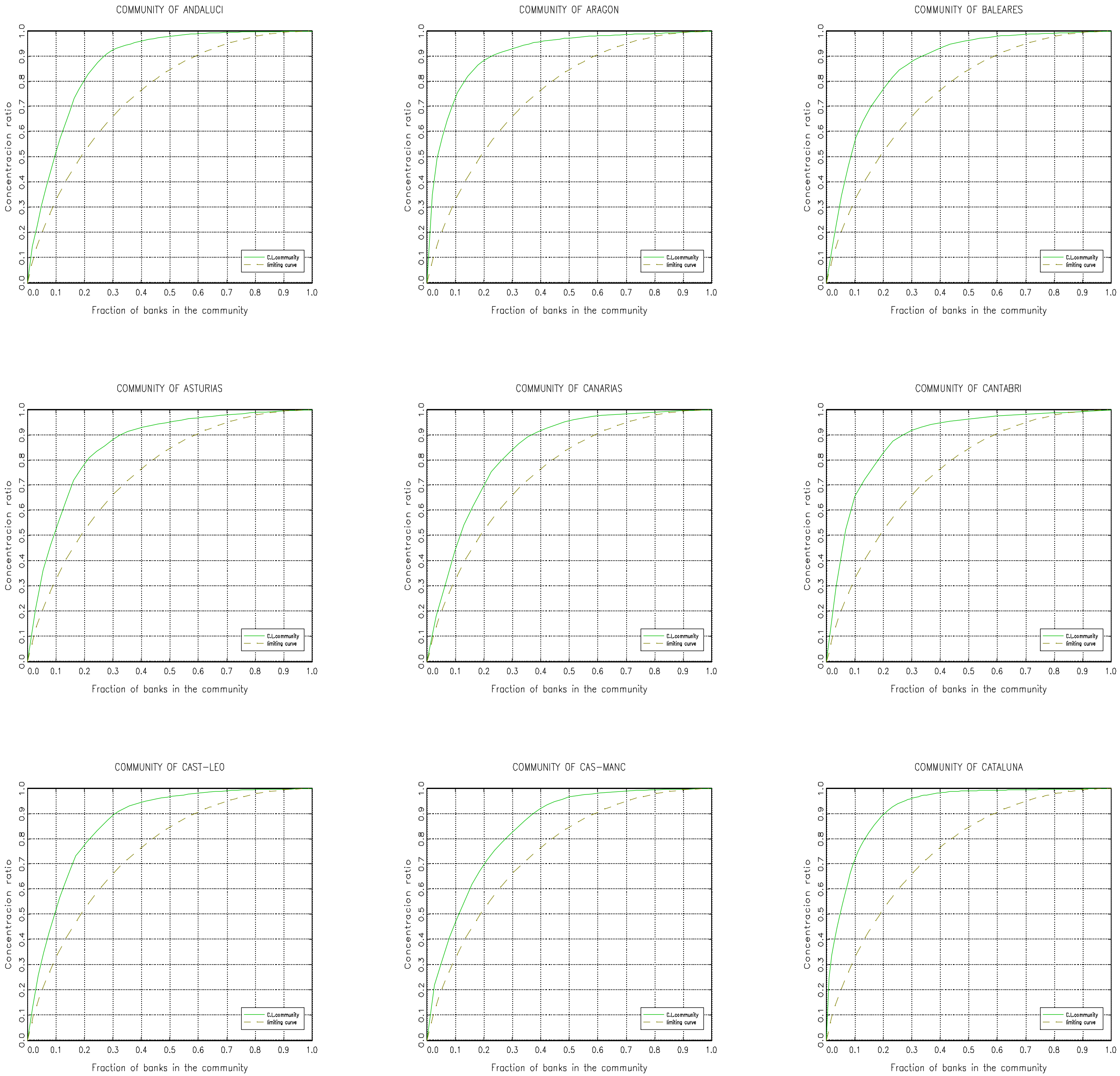
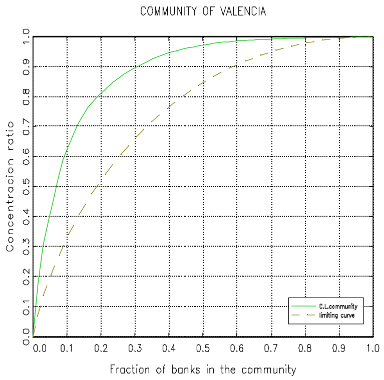
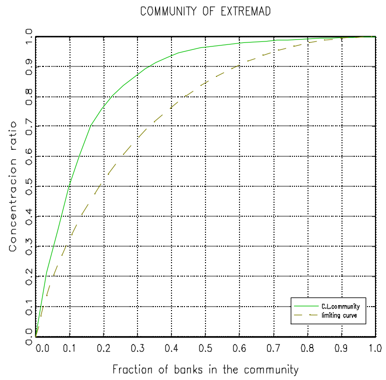

COMMUNITY OF RIOJA
Concentracion ratio
Number of branches

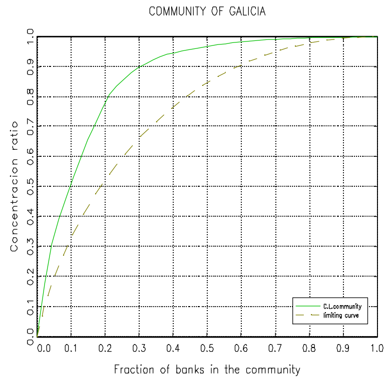
Figure A2

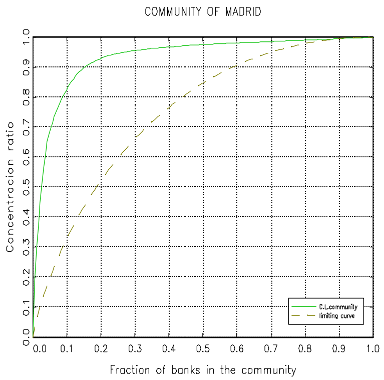
Lorenz curves by communities

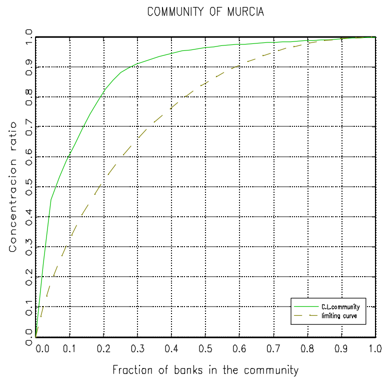


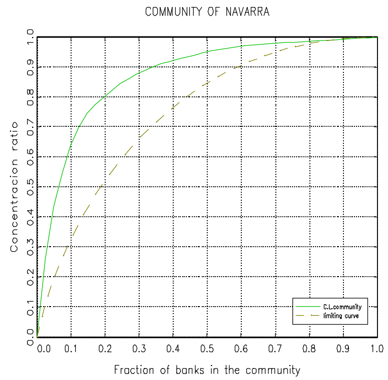

COMMUNITY OF VALENCIA
Concentracion ratio
Fraction of banks in the community
C.I.community
limiting curve

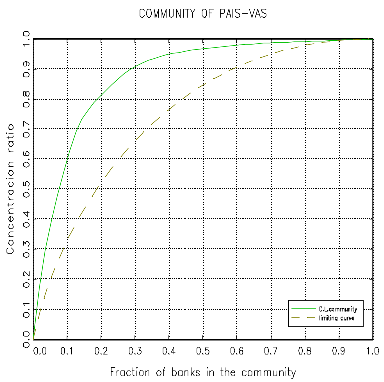

COMMUNITY OF EXTREMAD
Concentracion ratio
Fraction of banks in the community
C.I.community
limiting curve

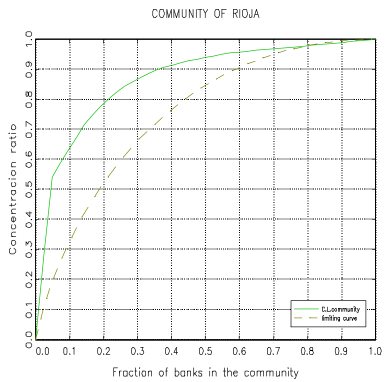

COMMUNITY OF GALICIA
Concentracion ratio
Fraction of banks in the community
C.I.community
limiting curve


COMMUNITY OF MADRID
Concentracion ratio
Fraction of banks in the community
C.I.community
limiting curve


COMMUNITY OF MURCIA
Concentracion ratio
Fraction of banks in the community
C.I.community
limiting curve


COMMUNITY OF NAVARRA
Concentracion ratio
Fraction of banks in the community
C.I.community
limiting curve


COMMUNITY OF PAIS-VAS
Concentracion ratio
Fraction of banks in the community
C.I.community
limiting curve


COMMUNITY OF RIOJA
Concentracion ratio
Fraction of banks in the community
C.I.community
limiting curve