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Maurizio Festa
Erika Ghiraldo
Alessandra Storniolo

Agenzia del Territorio

E-mail:
maurizio.festa@agenziaterritorio.it
erika.ghiraldo@agenziaterritorio.it
alessandra.storniolo@agenziaterritorio.it

Analysis of Real Estate market Cycles: an application on Italian data

Using Italian data, on the basis of economic theoretical approach of the honeycomb cycle by Janssen, Kruijt and Needham in 1994, this article proposes a further development in the study of the dynamics of real estate housing market in Italy.
Using the market indicators, we plot the "honeycomb cycle" graph for each region and greatest Italian cities. Regions showing similar patterns are grouped using cluster analysis method.
This practical work reaches its particular goal examining the national territory in terms of development and its evolution.

Key words: *cycle, market analysis, housing transactions*

1. Introduction

In 1994, Janssen, Kruijt and Needham used the economic theoretical approach of the honeycomb cycle in a study of Netherlands housing over the period 1976–1989. They demonstrated a cyclical manifestation in the national market as well as cycles at the metropolitan level that were different from each other and different from the national market aggregate.

Using Italian data, on the basis of this theory, this article proposes a further development in the study of the dynamics of real estate housing market in Italy. The aim is to analyze the dynamics that characterize the residential market even at sub-national level to research similarities and differences in data coming from the time series of the last decade.

Quality improvement of databases in recent years allows better statistical information treatment. It is possible to perform more and more accurate matching large databases, to obtain relevant statistical data even at a minimal territorial level.

National databases managed by the Agenzia del Territorio (which will be referred to as Agency in the article) represent an example in its institutional task. These data, processed and analysed, are published in statistical reports of great interest (*Rapporto immobiliare*, *Immobili in Italia*, etc.).

In this paper we use data provided by the Osservatorio del Mercato Immobiliare (OMI - Real Estate Market Observatory), real estate market monitoring system of Agenzia del Territorio. Since 2004, OMI provides more and more complete sta-

tistics about real estate market. These statistics are processed using databases of cadastre, real property registry and housing prices.

We elaborate this data at regional level with the aim to verify empirically cyclical behaviours in different residential markets, at the same time highlighting differences and similarity. We perform the analysis using statistical graphics, descriptive analysis and multivariate methods. The dataset contains the number of residential transactions normalised by property quote (NTN) and the average housing price for the period 2001-2010. Using the market indicators, we plot the "honeycomb cycle" graph for each region. Regions showing similar patterns are grouped using cluster analysis method.

Housing prices and transactions are important indicators to examine the real estate market cycles which allow detecting important turnaround signals. This practical work shows the utility to construct models highlighting the dynamics of the real estate market and its phases. It stands out that the national dynamics is the combination of local phenomena, which are not always evident and that can be grasped only through analysis of sub-regional levels.

This article is organized as follows. After the introduction, section 2 provides a brief presentation of the data sources used in the analysis followed by a section referring to the literature. Section 4 illustrates the methodology used. The following section contains the results of the analysis of real estate cycles in Italian regions and major cities. In section 6, cluster analyses will be performed on the analyzed series and the final section contains some brief conclusions.

2. Data sources

This study utilized data made available by the Osservatorio del Mercato Immobiliare which is part of the Agenzia del Territorio. OMI collects and compiles technical/economic information relating to the real estate market and, to that end, produces statistics using Agency archives ensuring the publication of periodic reports on real estate. The OMI databases are important sources of information on the real estate market, serving as useful tools for all real estate practitioners, researchers and scholars, public and private research institutions, public administrations and, more generally, for the individual citizen.

In detail, the data analyzed refer to the number of housing transactions and relative average transaction prices.

Transactions are quantified through NTN, which stands for "normalized number of transactions" indicating the number of real estate units bought and sold taking into account the ownership share transferred in the transaction. The NTN value over a given period and for a given type of property is derived from Public registers of real estate rights databases.

The transaction prices of houses refer to the values available from the OMI Quotation Database (see Manuale Operativo della Banca Dati dell'Osservatorio del Mercato Immobiliare). In fact, every six months OMI processes and publishes the average market prices of housing sales and rentals for different residential ty-

pologies (villas and small houses, luxury dwellings, ordinary dwellings, economic dwellings) throughout the entire country.

Since location is the characteristic with the greatest impact on real estate market value, the quotations refer to zones. Therefore, every Italian municipality is divided into homogeneous zones (OMI zones) having uniformity of economic and socio- environmental conditions. On a sample basis in each area, the average market values of properties of different use types (residential, offices, commercial, industrial) and property type are surveyed.

For the geographical areas examined in this study, weighted averages of municipal prices were produced using the relative housing stock as weights. The number of dwellings in each municipality is derived from the archives of the Cadastre.

The data utilized in this study concern the entire nation with the exception of the provinces of Bolzano and Trento, Gorizia and Trieste. Data on transactions in these provinces are not currently available because their Public registers offices are not managed by the Agency.

3. Literature Review

The beginning of the study of real estate market cycles dates to the early 1930s and in particular to an article by Homer Hoyt (Hoyt, 1933) who presented an analysis of land value trends in Chicago highlighting their cyclical features. Subsequently, and for a long time, the topic of the cycle in the real estate market garnered little attention. In particular, as described in the important article by Pyrr et al (1999), two schools of thought came to the fore. The first argues that real estate cycles are not relevant and can therefore be ignored. The second believes that real estate cycles are relevant, have significant and measurable impacts on investment returns and risks, and therefore have important strategic implications for investors.

The article on the "honeycomb cycle" by Janssen, Kruijt and Needham (1994) lies within the context of current macro-economic studies that highlight the importance of knowledge of real estate market cycles.

4. Methodology

The starting point for this paper is the theory upon which Janssen, Kruijt and Needham (1994) based their article seeking to explain variations in prices and transactions over a long time period. The authors state that, under certain conditions, variations are such that, when plotting a graph of prices and transaction volumes, the resulting form takes on a hexagonal or "honeycomb" shape. The authors point out, however, that there are other possible trends in the cycle, without prejudicing the validity of the theory regarding the combination of price and transaction volume. The theory of the variations in transaction volume and prices in the real estate market is based on the microeconomic theory. The honeycomb

cycle theory is a special version that examines the behaviour of supply and demand by observing trends in average prices and number of transactions. These observations indicate a cycle having six phases following a particular pattern (honeycomb) over a period of approximately 10 years.

Considering, therefore, only the combined trend in prices and transactions, the phases are characterized by the following trends:

1. increase in transactions and prices;
2. price increase and decrease in transactions;
3. stagnation in prices and decrease in transactions;
4. drop in prices and decrease in transactions;
5. decrease in prices and increase in transactions;
6. stagnation in prices and increase in transactions.

This article will analyze the trends in prices/transactions in Italian regions from 2001 to 2010 according to the lines of this theory, with the goal of verifying the existence of a cycle and examining the phases of the decade under study. The analysis was also performed for the 8 largest Italian cities having populations greater than 350,000 (2010 – ISTAT, Italian National Statistical Institute).

5. Data analysis and results

Preliminary work on data

Before proceeding with data processing and analysis, the necessary preliminary operations were carried out in order to create a database that would be adequate for representing trends in housing transactions and prices in Italian regions and cities.

The database covers the series of house transactions and prices from 2001 to 2010 every six months.

Quarterly data on housing transactions (in terms of NTN) are available starting with the first quarter of 2004; the six-month figures were obtained by summing the respective quarters.

Transactions for semesters prior to 2004 are available only on an annual basis. Semi-annual data prior to 2004 were obtained by applying the distribution between the two semesters examined in 2004 to the preceding years.

The six-month trend in transactions since 2001 demonstrated seasonality in the series; therefore for the purpose of this study, an appropriate correction was made to eliminate this phenomenon. Since the goal of the analysis is to identify an underlying trend in the series rather than variations at a single point in time, after testing several alternative methods of correction, it was decided to implement a simple smoothing of the NTN series. The smoothing consists of the application of a simple linear filter such as a moving average. The simple moving average method, whose goal is precisely to smooth and reduce variability in the time series, allows us to estimate the trend-cycle series. Given n observations of a

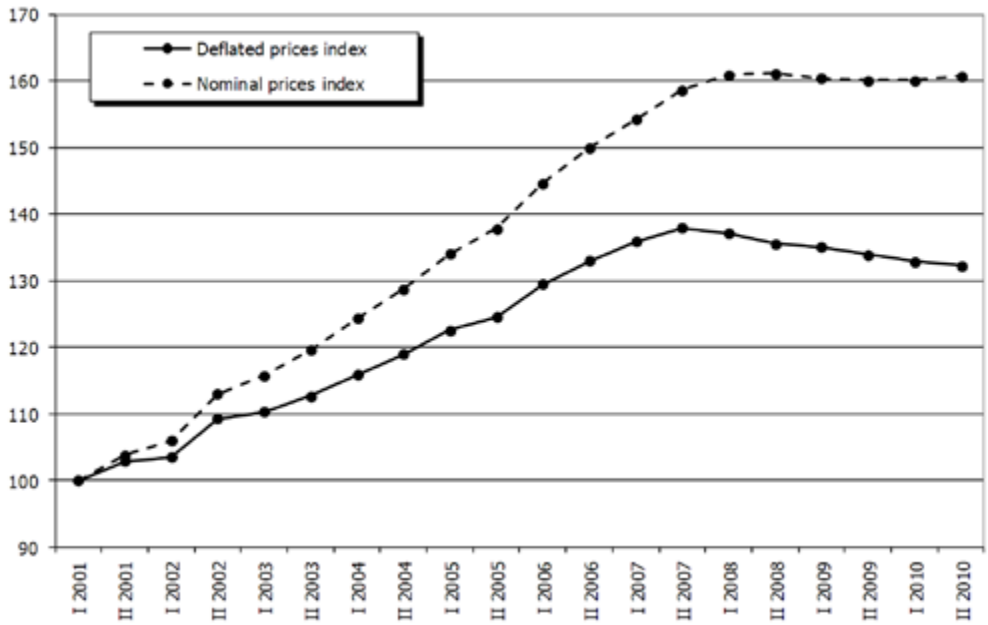
time series, the moving average over k time periods can be defined as the average of k successive terms, with $k < n$. The number of k terms can be chosen considering the number of sub-periods in the selected period. In this analysis, we have assumed that $k = 2$ because the series is semi-annual.

Data regarding average house prices were developed on the basis of quotations published semi-annually by OMI referring to the various zones into which each municipality is subdivided. In each municipality, the average quotation expressed in €/m^2 was calculated as the average of the midpoints of the intervals of all residential typologies in each OMI zone in the municipality. The average house price in each region was calculated as the average of the municipal quotations, each of which was assigned a weight equal to that of the housing stock in that municipality in relation to the region's total stock. The same procedure was applied to the calculation of the average national price.

The national and regional average prices thus calculated represent the nominal values for that period; they were deflated using the national and regional consumer price index calculated for the entire nation, including tobacco, published by ISTAT.

The following figure shows the national index of housing values in nominal prices and deflated prices.

Figure 1.



The database is thus made up of the series of transactions (seasonally adjusted) and average prices (deflated) from the first half of 2001 to the second half of

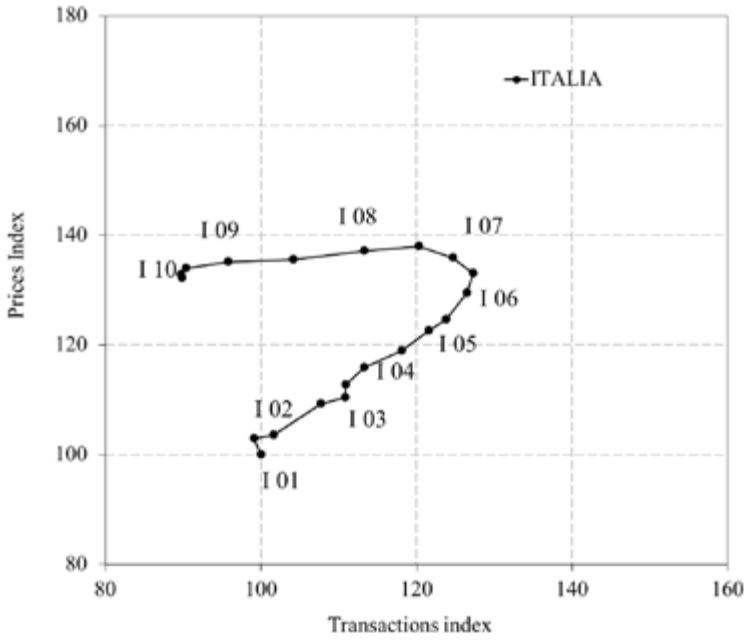
2010 referring to the entire country, each region and the 8 largest cities. The inflation data used for the major cities is the respective regional data. Then, for each series, simple fixed-base index numbers (2001) were calculated.

The honeycomb cycle in Italian regions

Price/transaction charts were plotted for Italy as a whole and for 19 Italian regions (Trentino Alto Adige is excluded) using the data sets described above.

The examination of national data in Figure 2 illustrates the strong growth in prices and transactions from the first half of 2001 until the first half of 2006. This was followed by a period of decline in transactions that was very strong until the second half of 2009 and basically unchanged until the second half of 2010 with a loss of a total of 37 index points. On the price side, during this period, there is first a clear slowdown in growth until the first half of 2008 when prices begin a slight descent losing about one point each semester until the second half of 2010.

Figure 2.



By examining these trends together in the price/transaction chart, it is possible to distinguish 3 phases of the honeycomb cycle theory.

The first phase is characterized by clear market expansion with transactions and house prices that display high and very similar growth rates (the value of the NTN

index and prices in the second half of 2005 is approximately 124). It is a growing market phase in which demand is very strong and meets the expectations of sellers.

Starting in the first half of 2007, this phase is followed by a short second phase in which the beginning of the decline in transactions is accompanied by prices slowing their growth, though still rising. This is the phase in which, above all, the increased difficulty in access to credit (rising interest rates and high cost of money) and high prices (especially in large cities) cause a reduction in demand that cannot satisfy sellers' needs.

In the third phase starting in the first half of 2008, in addition to the continuation of the substantial decline in transactions, we see the beginning of a slight but steady decline in prices. At this stage demand and supply prefer to wait rather than not have their expectations realized. On the one hand, the economic crisis may have reduced the disposable income of Italian households and on the other, the preference lies in removing property from the market because of an inability to obtain the desired price.

The last point on the chart, at the second half of 2010, still shows slightly falling prices and the slowdown of the decline in transactions. The market seems to be in a waiting phase and, as explained by cycle theory, this is a slow process that hinders further forecasting. The situation of the rest of the economy is very complex. On the one hand serious instability of markets might encourage real estate investments. On the other is the economic crisis that could still have long-lasting effects. This could result in a period of market stagnation - even a rather long one - in which prices do not fall and transactions do not increase.

In order to understand the different trends in the regional markets, the analysis goes on with an examination of the price/transaction charts developed for each Italian region.

We observe a variety of situations with some regions having trends very similar to national one. From 2001 to 2007, Calabria, Marche, Piemonte and Veneto show a strong increase in prices and transactions, followed by a sharp decline in transactions initially accompanied by slightly rising prices followed by a slight fall in prices.

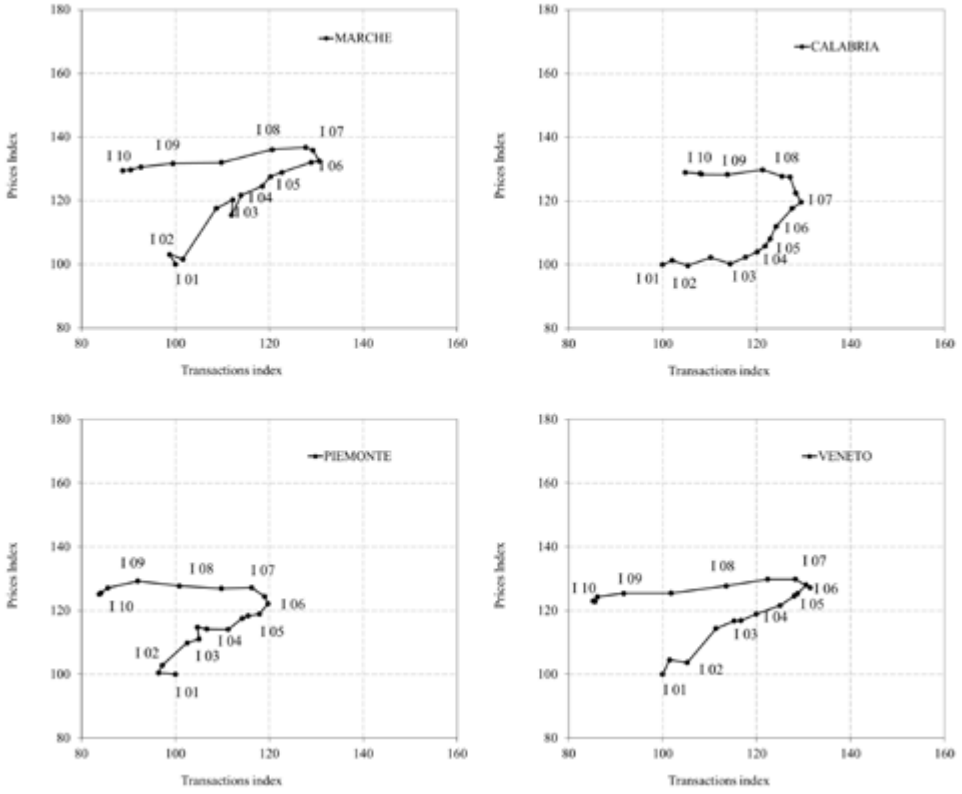
Until 2007 in Lombardia, Emilia Romagna, Abruzzo and Sicilia transactions grow in a pronounced and prevalent way in relation to prices; then transactions suffer a sharp downturn with house prices dropping slightly.

Until 2007, in the Campania, Puglia, Toscana and Lazio markets, house prices soar accompanied by a slight rise in transactions, except in the Lazio region where growth is strong even for transactions. In the following period, transactions return to levels much lower than those of the base year.

The performance of the Lazio region, due to its peculiarities, deserves further investigation. There is a rapid rise in house prices until 2006 with increasing transactions and until 2007, transactions decline. The decline in transactions continues until 2009 with falling prices. Then, transactions begin to grow again with house prices continuing to fall.

In Basilicata, Sardegna and Valle d'Aosta, house prices increased over the entire period under study notwithstanding the transaction trends - first rising and then falling - already examined in other regions.

Figure 3.



The small regions of Friuli Venezia Giulia, Molise and Umbria have a very flat chart because of the substantial invariance of house prices that accompanied variations in transactions during the period under study.

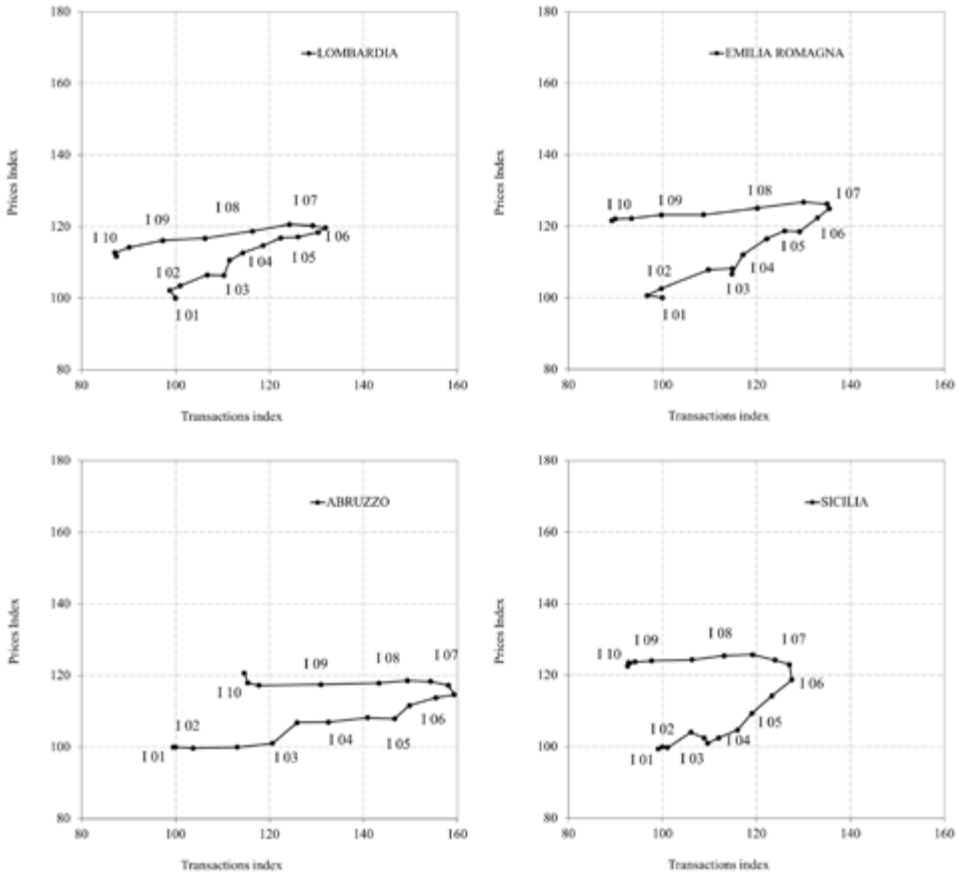
Finally, the case of Liguria should be highlighted: from 2003 to 2007, strong increases in house prices are recorded with small variations in transactions.

The honeycomb cycle on the greatest Italian cities

The real estate markets in cities with larger populations play an important role for the sector as a whole, especially in relationship to the markets in their respective regions. For this reason, the price/transaction trends in 8 cities with populations greater than 350,000 (2010 - ISTAT) were examined.

The following chart represents the cycle of all the large cities; until 2006 it shows a trend characterized by strong growth in house prices with substantially stationary transactions. This phase shows that the demand seems inelastic to growth of houses prices. Transactions decline with prices which first slow their

Figure 4.



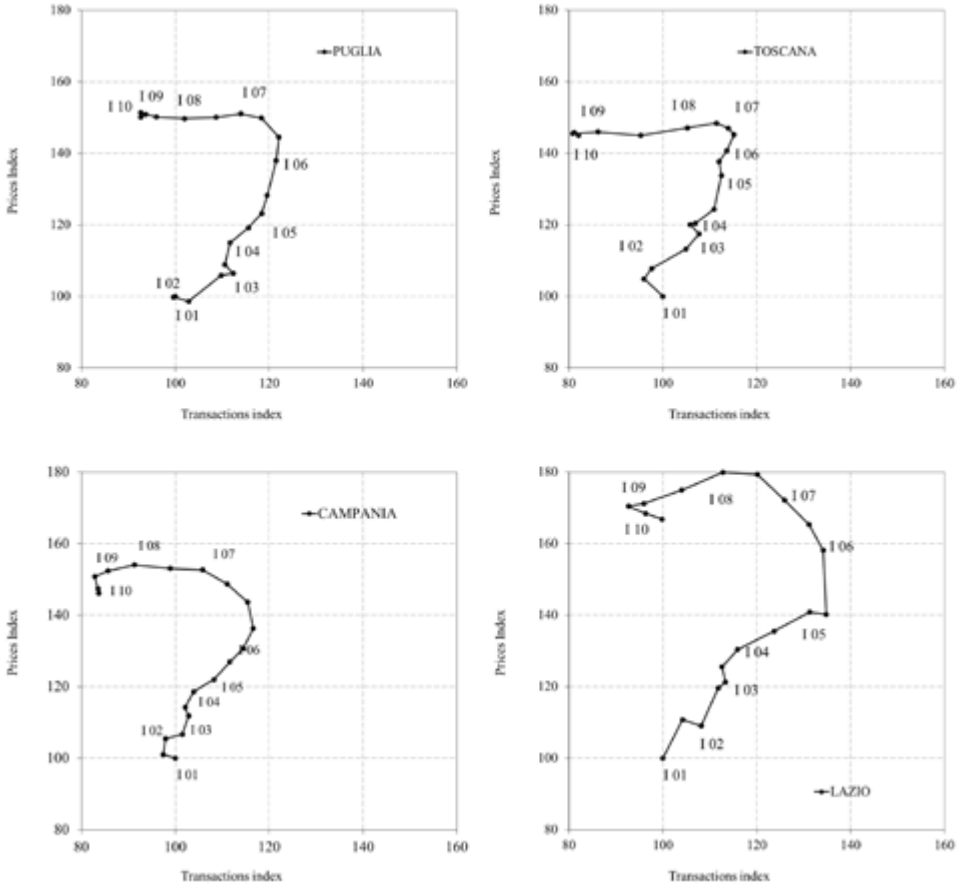
growth and then decline. In 2010, we observe the recovery of transactions and a continuous drop in prices.

By examining in detail the trends in the various cities over this time period, we observe clear differences that highlight the peculiarities of different local conditions. Until 2007, Firenze, Torino and Genova show an evident stagnation in transactions with a strong rise in prices followed by a fall in transactions and cooling of prices. The price/transaction trends in Bologna, Palermo and Milano record an initial increase in transactions with rising or substantially stable prices.

Napoli is distinguished from the other cities by a marked decline in transactions starting in 2001, despite rising prices which begin to fall only in 2008.

The capital, Roma, shows a cycle more like that of the set of cities as a whole and the national one. The clear inversion of transaction trends for the last three semesters with declining prices since 2009 deserves attention.

Figure 5.

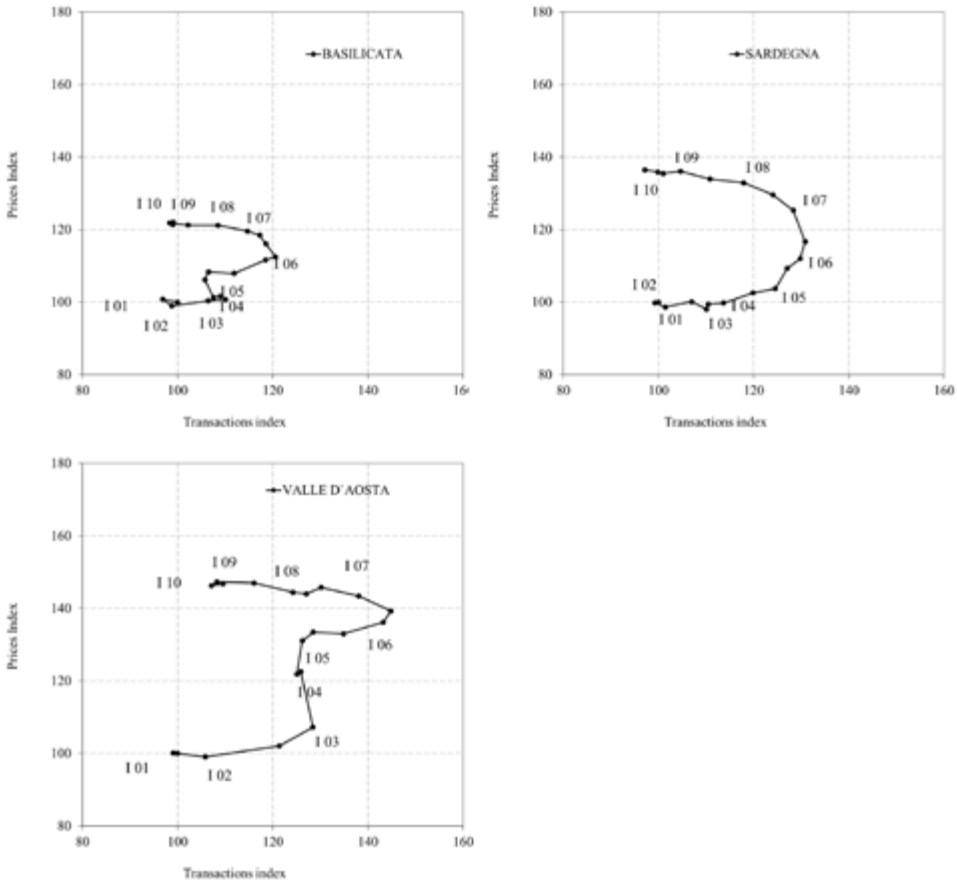


As shown in the following chart, in the first phase price / transactions patterns for all the major cities highlight a clear distinction from national trend. In these cities, as mentioned, the first phase is distinguished by a growing demand that seems to act inelastically to the strong growth of house prices. In later phases, the distinction between the trends only affects the degree of changes: the drop in prices and transactions until 2009 and the recovery of sales volumes in 2010 are more distinct in the largest cities than on national market.

6. Cluster analysis on cycles

After examining the trends in the transaction/price series individually, the study goes on with the goal of identifying sets of regions that display common patterns. To this end, the series of price index quotations and transactions, as pre-

Figure 6.



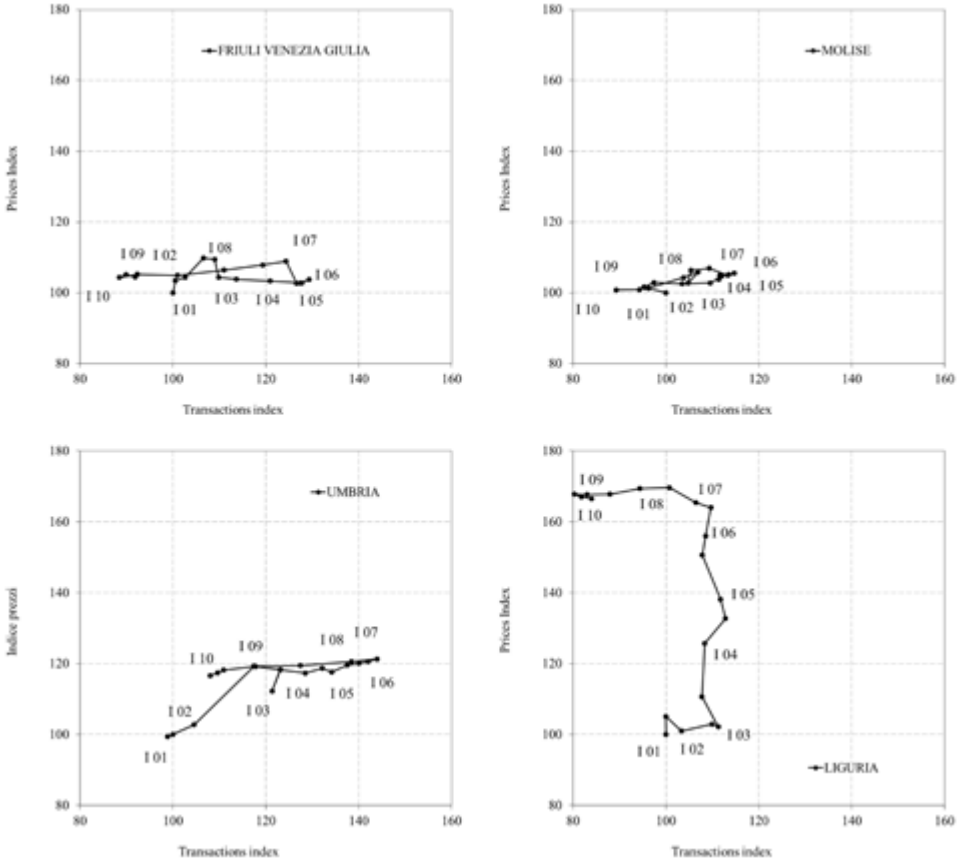
viously defined, was used as input matrix to carry out a clustering procedure.

Cluster analysis is a set of multivariate techniques that helps identify a number of groups of units that are similar with respect to a set of characteristics taken into consideration and according to a specific criterion. Clustering makes it possible to group statistical units in order to minimize the "logical distance" within each group and to maximize it between the groups. The "logical distance" is quantified by measures of similarity/dissimilarity that are often measures of distances in a multidimensional space.

Over the past 60 years, cluster analysis has received extensive theoretical treatment leading to a vast literature. In fact, the technique is so widely used in applied sciences that it is difficult to provide a single bibliographic indication. However, a general survey of cluster analysis is provided in the article by Jain et al. (1999).

Clustering techniques, however, do not always show well-separated clusters and often the results show overlapping. In other words, the assignment of a unit

Figure 7.



to a single cluster may not be the most correct one and the process requires, in this case, further exploration. It is said that these types of clusters contain fuzzy (confused, indistinct) borders.

As part of the theory of fuzzy sets (whose origin is traced to Zadeh's work, 1965), a unit may belong to a cluster with a certain degree of belonging having a value in the interval [0, 1].

So first a procedure that identifies defined groups will be applied to the input matrix which will then be explored using the fuzzy technique.

The first step in the clustering process was the production, starting from the input data, of the Euclidean distance matrix. Data was then aggregated using the agglomerative complete-linkage method. The process of agglomeration of the resulting data is shown in the dendrogram in the figure below.

Hierarchical clustering thus shows the progressive aggregation of the units in the cluster leaving the choice as to where to "cut" the tree diagram to subsequent analyses.

Figure 8.

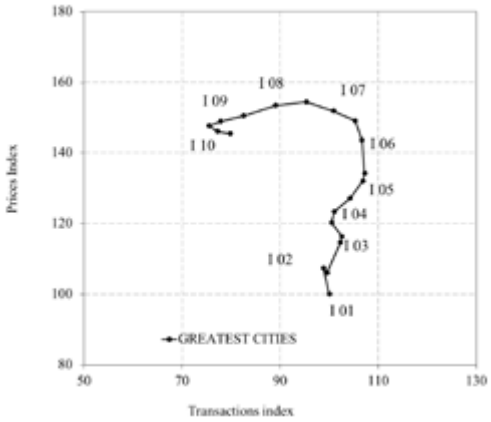
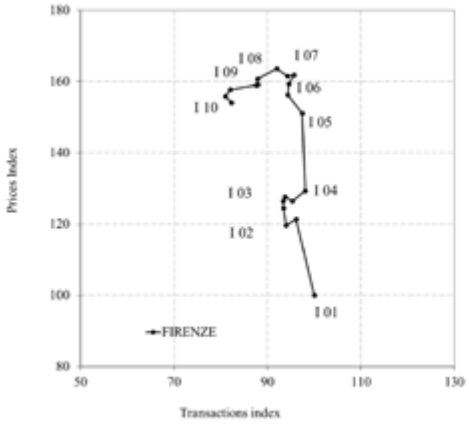
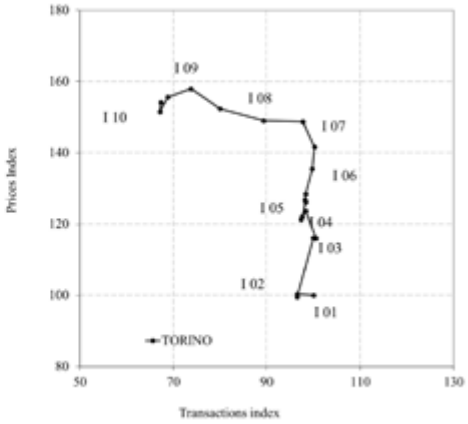


Figure 9.





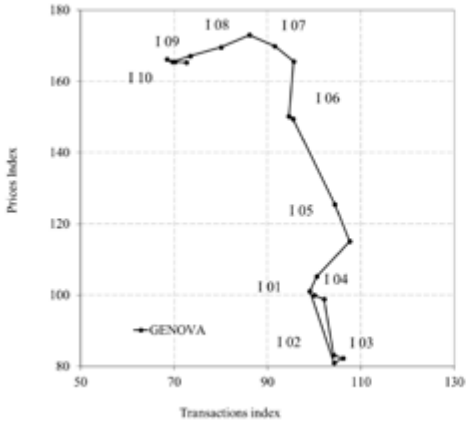
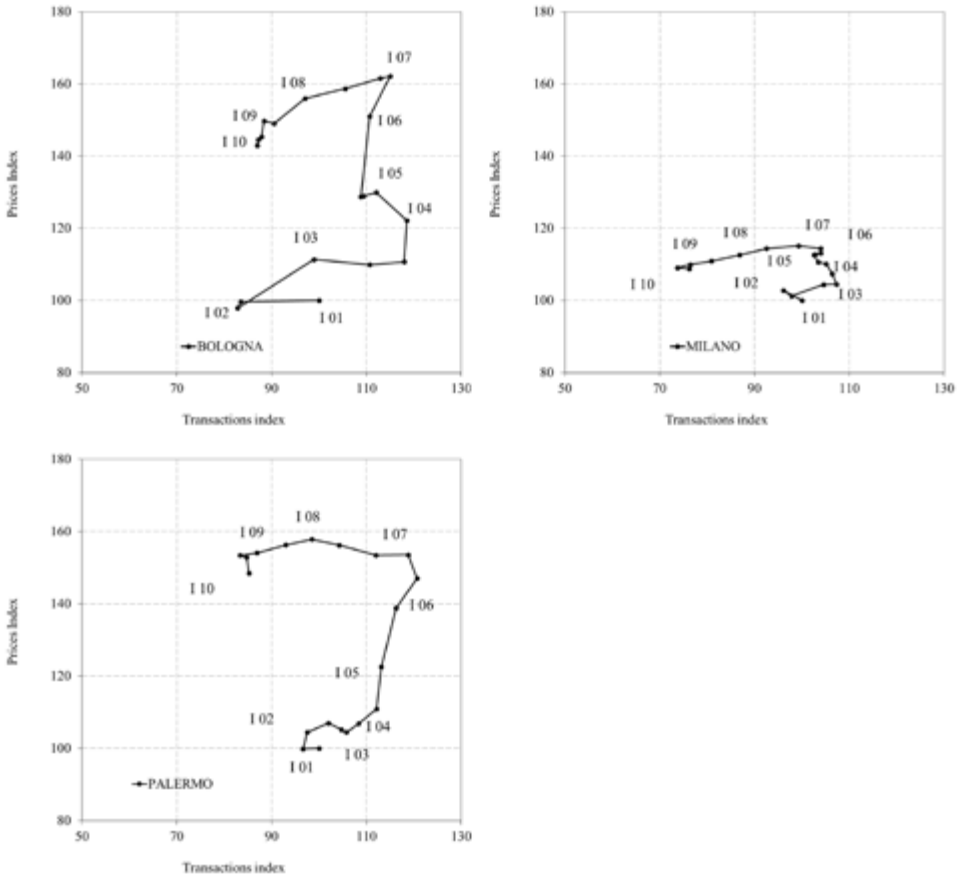


Figure 10.



The choice of the number of groups present in the database was made considering not only graphic inspection of the dendrogram but also the Bayesian Information Criterion BIC (Schwarz, 1978) which is widely used in statistics to select a model from among a finite number of models.

This work, performed using the R software, led to the identification of 9 clusters.

Analyzing the results, it becomes possible to distinguish the groups described below.

- Groups A, B and H contain a single region confirming the singularity already identified in the cycle analysis;
- groups E and F contain the regions in which the growth phase of the transactions, accompanied by rising prices, is followed by a period of decline (equal to growth or more pronounced) in NTN and falling prices. However in Group E, Basilicata and Lombardia show prices that rise or remain substantially stable during the contraction phase of the transactions;

Figure 11.

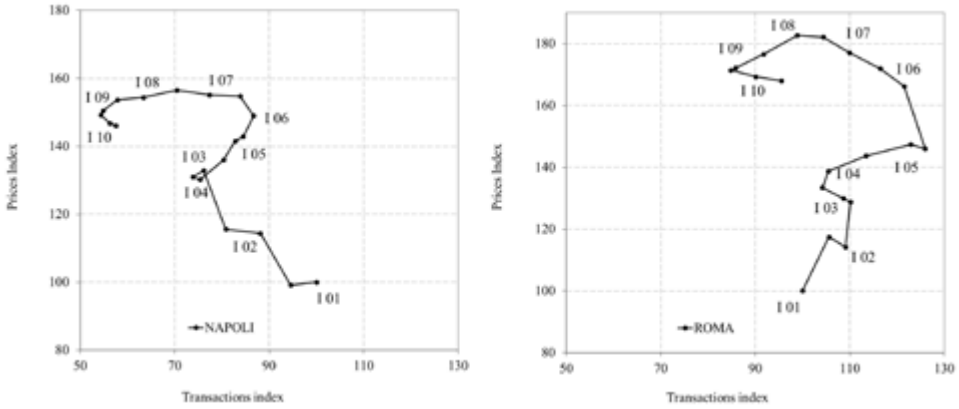


Figure 12.

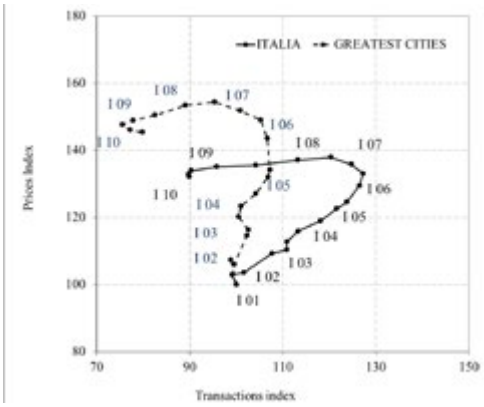


Figure 13.

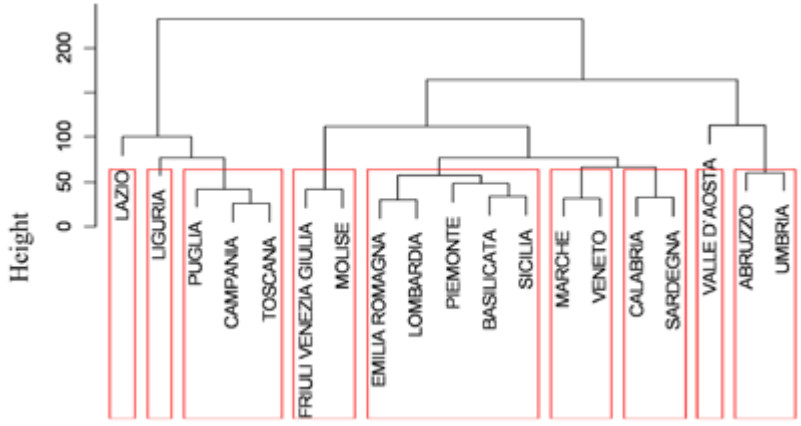
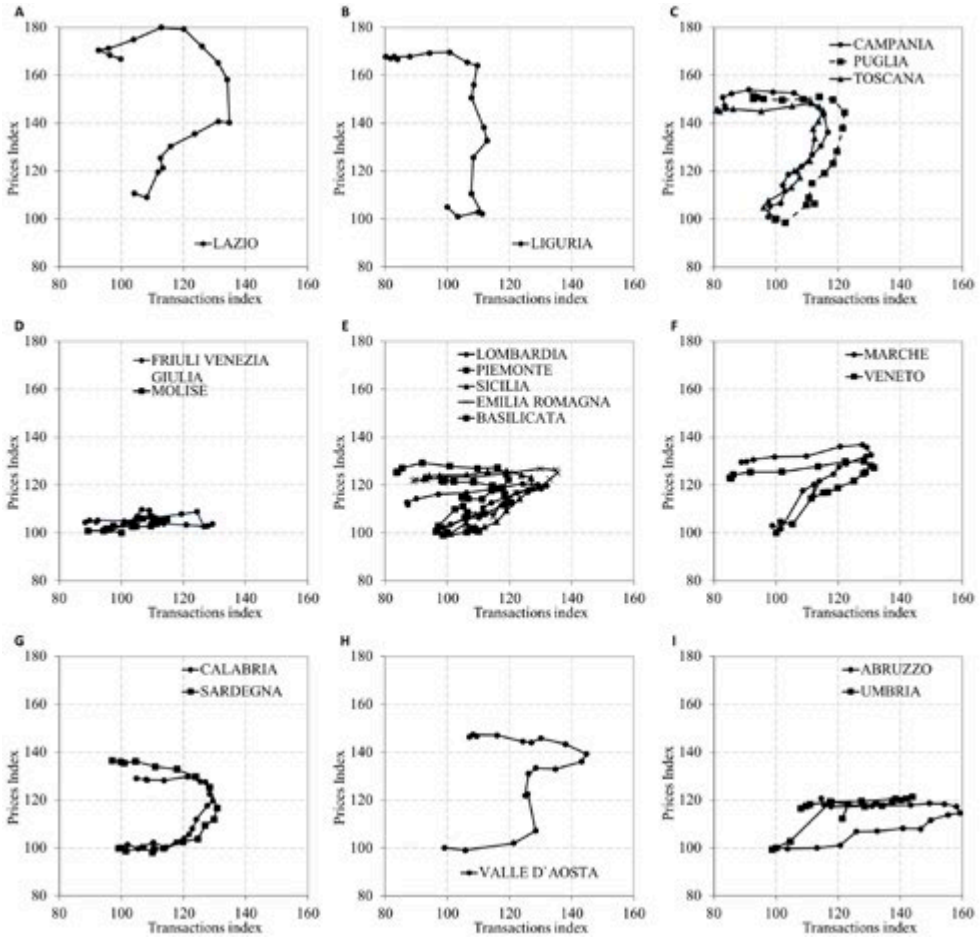


Figure 14.

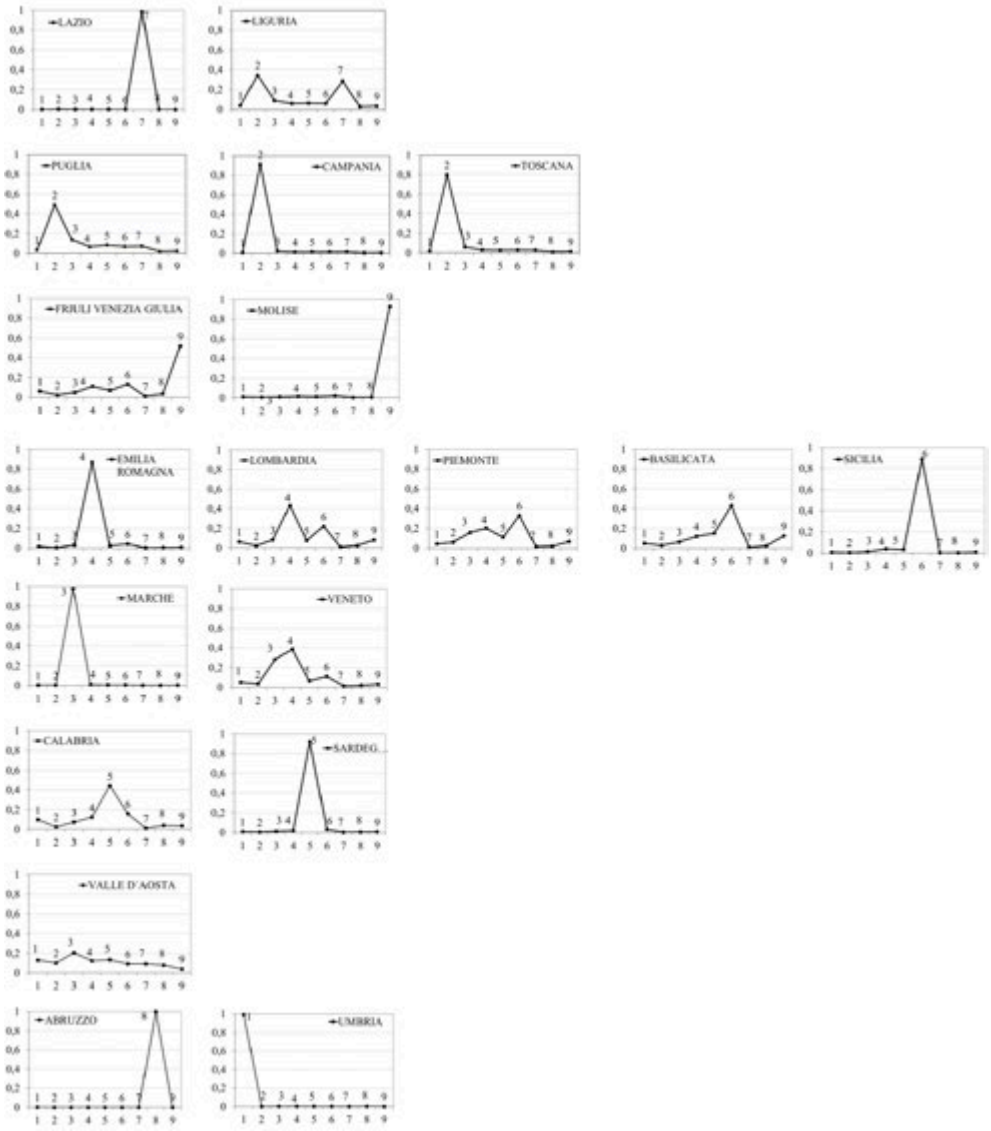


- group C contains the regions that show a sustained increase in prices accompanied by a steady but slight growth in transactions; the following loss of NTN is clear and with fairly stable prices;
- groups D and I contain regions that show strong expansion and subsequent analogous contraction in transactions, but with not strong growth in prices which, in some cases, remains static;
- group G contains the regions in which prices and transactions increased and then decreased more or less constantly.

From these descriptions, it is evident that not all clusters have clearly defined boundaries. So in order to investigate this phenomenon, the same data used in hierarchical clustering were used in fuzzy clustering (see for example Bezdek, 1981).

The charts in the figure below represent the probability of each region to belong to a cluster.

Figure 15.



The examination of the results of fuzzy clustering shows regions with greater probabilities of belonging to a single cluster and regions with comparable degrees of belonging to different clusters.

Lazio shows a high degree of belonging to a cluster which no other region seems to belong to. A moderate degree of belonging to the previous cluster is shown only by Liguria which, however, seems to move closer to the cluster that includes Puglia, Campania and Toscana. The latter two regions have both a high

probability (0.9 and 0.8, respectively) of belonging to the cluster. What has been illustrated thus far can be considered to be quite similar to what we observed in the dendrogram resulting from the preceding clustering operations regarding clusters A, B and C.

The method also confirms the solid belonging of Friuli Venezia Giulia and Molise (cluster D) to the same group, which is similar for Calabria and Sardegna (cluster G).

As we have already seen from the examination of the hierarchical cluster analysis, cluster E shows weaker ties between the included regions, confirming that it is the result of the union of two groups. In fact, the greater probability of belonging to more groups unites Emilia Romagna and Lombardia and Piemonte on the one hand, and Basilicata and Sicilia on the other.

Marche and Veneto have a certain degree of belonging to the same group but it is clear that there is a greater probability for Veneto to belong to the group including Emilia Romagna and Lombardia.

Valle d'Aosta is the region with similar degrees of belonging to all groups and cannot therefore be associated with any group, thus remaining singular.

Finally, differences from the previous analysis can be observed for Abruzzo and Umbria which belong to different and singular groups.

The examination of the results obtained shows similarities and differences between the regional patterns in the housing market, some of which were already known and very obvious and others definitely unexpected.

With the aim of increasing understanding of the aggregates obtained in economic terms, further exploration was carried out by clustering the data once more with the introduction of a new variable. The new variable is the series of the values of GDP for each region starting in 2001 and up to 2009 (latest published data), because this parameter was considered to be a good indicator of regional economic trends (ISTAT).

The hierarchical cluster method was then repeated with the introduction into the data matrix of the GDP variable with 2001 as the fixed base, with all the data up to 2009. The aggregations are shown in the dendrogram in the following figure.

The dendrogram shows great similarity to the results previously obtained. Small variations can be observed; in particular, group E grows to include the regions in cluster G, and the regions in cluster I show greater distances. In this case, the procedure was validated by applying the fuzzy method whose results are shown n the following figure.

The singularity of Valle d'Aosta remains; it still does not show a high probability of belonging to a specific group. The close link of belonging to the same cluster is confirmed for Campania and Toscana, with the addition of Puglia.

Lazio and Liguria, while still in distinct groups, are more likely to belong to the same group. The situation is more complex for group E which shows the instability of the probability of the regions to belong to one group. With different degrees of belonging, the union of Abruzzo and Umbria on the one hand and Marche and Veneto on the other can also be obtained in this case. Veneto, in the end, shows a significant degree of belonging that bring it closer to Emilia Romagna and Lombardia.

Figure 16.

7. Conclusions

Housing prices and transactions are important indicators for examining real estate market cycles allowing the detection of important turnaround signals. This practical work shows the utility of constructing models that highlight the dynamics of the real estate market and its phases.

The analysis of the dynamics of the houses market has made it possible to distinguish 3 phases in the decade analyzed. Strong market growth with rising transactions and prices lasted until 2006. In this phase, positive confidence in the market satisfies supply and demand.

A brief second phase follows, with a decrease in transactions and a cooling of prices. The economic context has changed and demand fails to meet the expectations matured in previous years by supply (high prices).

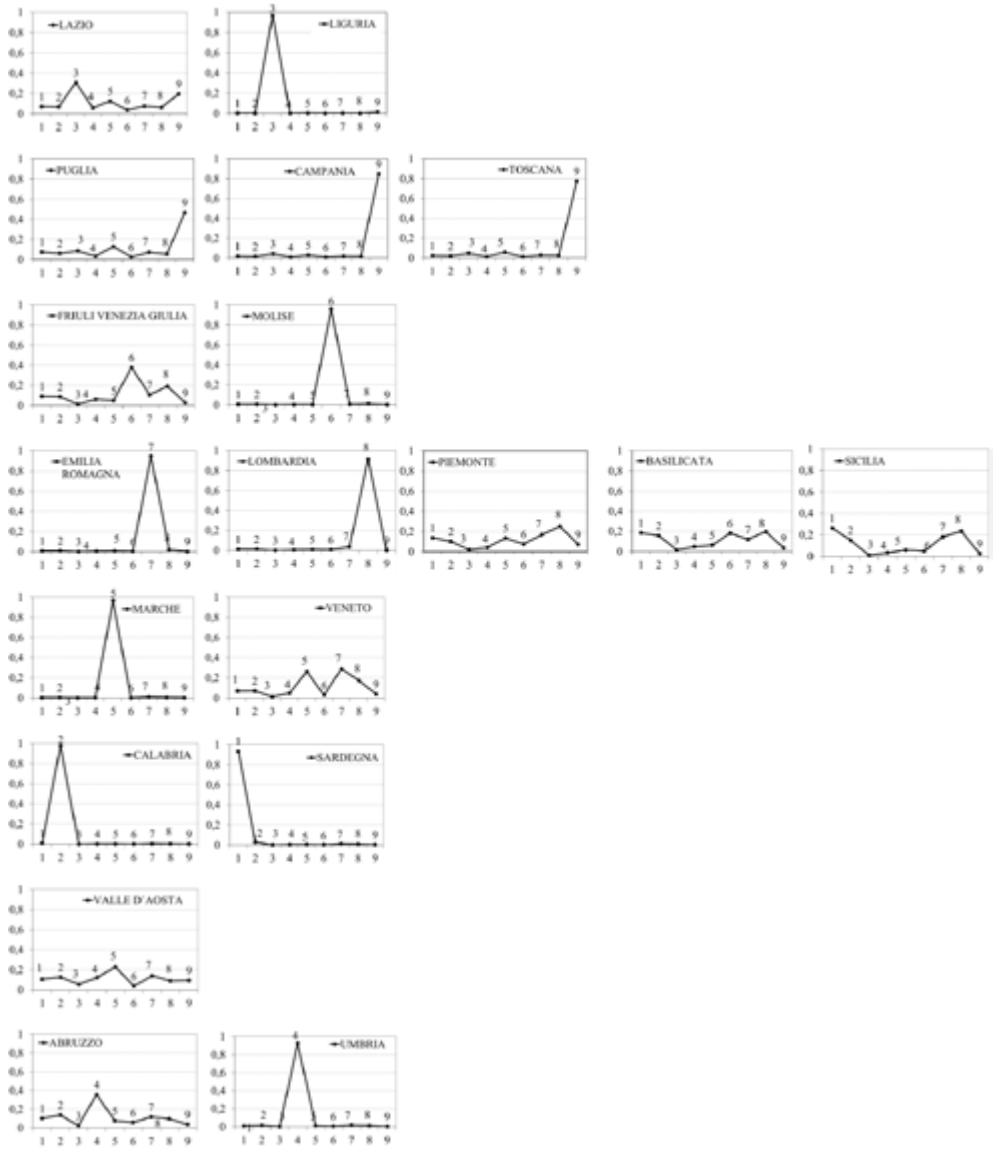
In 2008, the loss of transactions is aggravated (declining below 2001 levels) and prices show their first negative signs. The economic crisis begins to effect household disposable income (the main demand for housing in Italy) and both supply and demand prefer to wait for a better understanding of the economic future to make new choices.

The complexity of the current economic situation makes it risky to identify a further phase in the national market. The housing market seems to be on hold and we do not know if it will be for a short or a long period. In fact the variables involved are many and it will certainly take some time to understand the phenomenon currently under way.

The exploration of regional market dynamics showed that national dynamics are the combination of local phenomena, which are effectively not always evident and can only be grasped through the analysis of the sub-regional levels.

The analysis of similarity/diversity of regional real estate markets highlighted certain features in the trends over the last decade, even unexpected ones. The Italian regions that are frequently considered “distant” - and not only geographical-

Figure 17.



ly - were found to be "close," displaying similar phenomena of rises and falls in transactions/prices in the phases of the 20 semesters analyzed.

Very special, and thus singular, regional dynamics were also identified, in one case because they were very "distant" from all clusters and in another because they were never clearly associated with a specific cluster.

The methods utilized, taking into account that the boundary between clusters may not always be well-defined, have allowed us to understand that, within the same cluster, there are regions with "closer" market dynamics in relation to the resulting degree of belonging.

Finally real estate markets of the largest Italian cities were analyzed and price / transactions trends for all the major cities in the whole have shown a clear distinction from national trend in the first phase.

In the cities, in fact, the first phase is distinguished by a growing demand that seems to act inelastically to the strong growth of house prices.

In later phases, the distinction between the trends only affects the degree of changes: the drop in prices and transactions until 2009 and the recovery of sales volumes in 2010 are more distinct in the largest cities than on national market.

This analysis is a first step in the development of tools that are useful for improving knowledge of the market as well as its composition and even its dynamics. The study also represents a contribution to market transparency that can improve the evaluation of opportunities and risks which are still not sufficiently known, highlighting the stage of the market: development, slow-down, standstill or growth.

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