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## Understanding territorial distribution of Properties of Managers and Shareholders: a Data-driven Approach

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**Keywords:** managers and shareholder concentration score, real estate market, Turin, Rome, Milan.

**Abstract** The analysis and better understanding of the distribution of wealth of individuals in cities can be a precious tool, especially in support of the estimation of real estate values. These analyses can also be used to facilitate decision making in various sectors, such as public administration or the real estate market. In this paper, by making use of publicly available data and of data owned by Cerved, (a credit scoring company in Italy), we can observe the territorial distribution of the properties of managers and shareholders – categories of people usually linked to high economic well-being – and, based on that, we identify the areas of the cities where the value of real estate properties is presumably higher. More specifically, we introduce the Manager and Shareholder Concentration (MSHC) score and validate its accuracy and effectiveness in three Italian cities (Turin, Rome and Milan).

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## INTRODUCING THE MANAGER AND SHAREHOLDER CONCENTRATION (MSHC) SCORE

This paper introduces the “Manager and Shareholders Concentration (MSHC) score” – an index created with the aim of identifying the wealthiest areas within a certain municipality. This is of particular interest for the real estate market, especially when there are several wealthy areas within the same city. This paper will thus introduce the index and demonstrate how it can correctly identify the areas with high real estate values within a city, even when they are located far from the city centre. In fact, as suggested by Ioannides and Seslen (2002), ownership of a real estate property is one of the main components of a household’s wealth; this analysis provides interesting insights on how income, real estate value, and total wealth interact and are related. Moreover, the work proposed here is particularly thought-provoking in order to understand how neighbourhoods can be sorted and how they are composed in terms of wealth and income.

Many indicators currently under development by Cerved,<sup>1</sup> such as the number of historical points or the number of hotels within a 500-metre radius of a given place, can identify the city’s centre as the most favourable area in terms of prestige and high real estate value, in addition to other areas such as hills, which are wealthy and luxurious even if they lack hotels or historical monuments. These areas are as wealthy as the city centre, sometimes wealthier, but their characteristics are quite different. It is therefore necessary to understand which territorial or geographical features could best help in identifying such areas. Among the possible choices, only the presence of parks and green areas appears to be a sound alternative, but ultimately do not provide entirely satisfactory results because such indicators perform poorly in medium and small sized cities.

The approach proposed in this paper aims to directly observe the distribution of the properties of the wealthiest citizens, who usually choose to move to and live in the most prestigious areas. While this phenomenon can be observed in many cities around the world, in Italy it is particularly evident in the cities of Bologna and Turin: although they are endowed with fascinating city centres, many of the buildings of greatest importance are located on the hills far from the centre.

The crucial question becomes to correctly determine which sample of citizens to select and qualify as managers or, more generally, wealthy people. To do this, we used Cerved’s proprietary database – a database containing public data on all Italian companies – to extract information about individuals recognized as shareholders and/or managers. In the context of this work, a shareholder is considered anyone who owns shares above the threshold percentage of 25% of the company’s share capital, while a manager is defined as anyone who holds a key position within a company, accomplishes management duties, and is legally liable for the company’s debts.

In Italy, managers and shareholders are legally obligated to provide the address of their residence to the business register of the Italian Chamber of Commerce; moreover, the public Cadastral database for properties can also be queried.<sup>2</sup> However, it is necessary to proceed with caution, as this information is not always entirely reliable. This is why, to overcome this limitation, this information had to be checked against other indicators, such as distance in metres from an industrial area, or total number of residents per a given delimited geographical area; these additional indicators were developed by Cerved using ISTAT data from the fifteenth population census.<sup>3</sup> The general aim of this approach is to try to gain a more comprehensive understanding of the distribution of wealth within a single city; not only can this be thought of as a highly helpful instrument for the real estate market,

<sup>1</sup> <http://company.cerved.com/>

<sup>2</sup> <https://sister.agenziaentrate.gov.it/CitizenVisure/>

<sup>3</sup> <http://www.istat.it/en/population-and-housing-census/population-and-housing-2011>

but the results can be used, for example, in the area of public administration, in order to guide potential local investment policies.

In calculating the MSHC score, the basic idea is to observe the total number of properties of managers and shareholders per geographic area, comparing this information with the total number of residents in the same geographic area. This approach provides a result that can be immediately visualized graphically using thematic maps; for example, by plotting the score on a map of the cities of Turin and Bologna, it may be noted that the two most relevant areas are, respectively, the centre, the hill on the eastern side of the city, and the hill on the southern side.

The following sections illustrate the score calculation method, followed by examples for three Italian metropolitan cities: Turin, Rome, and Milan. Lastly, in the conclusions, we summarize the paper and provide an outlook for potential future developments.

## THE MSHC SCORE CALCULATION

To observe the territorial distribution of the MSHC score, we first have to decide how to split the territory into small areas to which we will assign the scores. For this analysis, we use the ISTAT census partition (ISTAT cells)<sup>4</sup> and, for the city of Turin, the micro-areas partition as well. Although these are widespread standards, it must be kept in mind how they were created, and what their underlying logic is, in order to avoid running into potential problems and to fully understand how the score is calculated.

ISTAT splits Italian territory into approximately 400,000 census sections of varying size and shape, creating a vast mosaic. The difference between cells is due to the different number of resident individuals. Larger cells are typically in smaller cities or in the suburbs, where there are fewer houses and buildings tend to have fewer floors, so the number of inhabitants is smaller than in the cells of the city centre, where the opposite occurs. In the city centre, a census cell typically corresponds to a city block, while in the suburbs it can cover a larger area.

The relevance of the partition of the territory is strictly connected to the MSHC score: the number of managers and shareholders is compared to the number of residents per individual ISTAT cell.

In Italy, out of a total of approximately circa 366,000 ISTAT cells, it was possible to associate the number of properties owned by managers and shareholders of all active Italian companies (as of June 2016) with approximately 200,000 ISTAT cells. This operation was also possible thanks to the extraction of information from the Cadastral database and from the information archived by the Italian Chamber of Commerce. Table 1 sets out the results of this extraction, both, Italy-wide and for the three analyzed cities, showing the number of properties belonging to managers (no. M), the number of properties belonging to shareholders (No. S), and the number of ISTAT cells (No. of ISTAT cells) for which the MSHC score could be calculated.

<sup>4</sup> Italian census cells: <http://www.istat.it/it/archivio/sezione+di+censimento>

City	N° M	N° S	No. of ISTAT cells
Italy	3,000,000	9,000,000	200,000
Turin	40,000	130,000	4,000
Rome	180,000	280,000	13,000
Milan	100,000	180,000	6,000

**Table 1** Analyzed data sample: Italy-side, and detail for the three analyzed cities

Moreover, for each cell, the total number of residents and the distance from an industrial area where calculated.

Based on the territorial partition and the available data, the MSHC score per individual ISTAT cell is calculated as follows:

$$\frac{N^{\circ}M + N^{\circ}S}{N^{\circ}R} \times DIZC$$

Where:

N°M is the Number of resident Managers per ISTAT cell;

N°S is the Number of resident Shareholders per ISTAT cell;

N°R is the Number of Residents per ISTAT cell;

DIZC is a weighting coefficient based on the distance from an industrial area.

For each individual ISTAT cell, the MSHC score is defined as the sum of the total number of resident managers and the total number of resident shareholders divided by the total number of residents present in that given cell. Although simple, this formula yields immediately valuable outcomes using maps for visualization. However, this result is further improved by the use of the weighting coefficient DIZC based on the distance from an industrial area.

The weighting coefficient DIZC consists of the Heavy Industries Concentration (HIC) score developed by Cerved using a proprietary database containing all active Italian companies (as of June 2016). This database is used to extract information related to the locations of the companies operating in various industries. This information is aggregated and distributed within each census cell and the HIC score is calculated as follows:

$$\sum N^{\circ}HI$$

Where N°HI is the number of heavy industries per census cell.

The reason underlying this adjustment lies in the fact that, from an initial observation of the results, some cells in areas recognized as non-prestigious garnered high scores. This phenomenon appears to be due to the fact that some managers or shareholders decide to reside in their company's vicinity. This behaviour chosen by managers and shareholders cannot justify classifying an area as wealthy and thus characterized by high real estate value. The weighting coefficient DIZC also reduces another problem: cells with a small number of residents.

As shown by the examples in the next sections, this score calculation method has proved to be rather accurate; however, the validation process has presented certain challenges that must absolutely be taken into consideration in order to fully comprehend the method's current strengths, and the situations where it could yield more satisfactory results.

The territorial division of the entire Italian peninsula into census sections (ISTAT cells) is a well-adopted standard: in fact, many other socio-demographic indicators provided by ISTAT use it as well. Nevertheless, it also presents some critical elements that require further consideration: the correlation between the size of the ISTAT cell and the number of residents is certainly one of them. This is especially relevant in the calculation of the MSHC score, and can create outliers that highlight how the score's different components can potentially create warped assessments of an area, and consequently lead to errors in any real estate appraisal processes. In the following sections, we discuss the results obtained by calculating the MSHC score for three Italian cities (Turin, Rome and Milan).

### EXAMPLES OF THE DISTRIBUTION OF THE MSHC SCORE IN CERTAIN ITALIAN METROPOLISES

The territorial distribution of the MSHC score can be easily observed through a heat map. On the maps, darker colours correspond to high scores, while lighter colours are associated with lower scores. Heat maps also allow the territorial distribution of real estate values to be easily compared, in order to verify whether there is a correlation between prices and scores.

For the city of Turin, it was possible to analyze the correlation between the MSHC score and the asking prices for real estate provided by Osservatorio Immobiliare della Città di Torino – OICT (Turin Real estate Market Observatory),<sup>5</sup> in comparison with their territorial distribution.

For the cities of Rome and Milan, the comparison between the MSHC score and real estate values was made using the values published by Osservatorio del Mercato Immobiliare (OMI) of Agenzia dell'Entrate (Italian Revenue authority),<sup>6</sup> an important reference for the real estate market on the national level. Nevertheless, this comparison cannot be made as it is not entirely accurate for the purpose of score validation: these values are in fact based in part on quotations and not asking or sale prices, which would be a more reliable source. Moreover, the OMI sets out, for each area, only the minimum and maximum values, but not the average ones calculated on the basis of the acquired data samples. Therefore, it was not possible to compare the score with the average values, because the average calculated starting from the OMI minimum and maximum values would have generated statistically warped results.

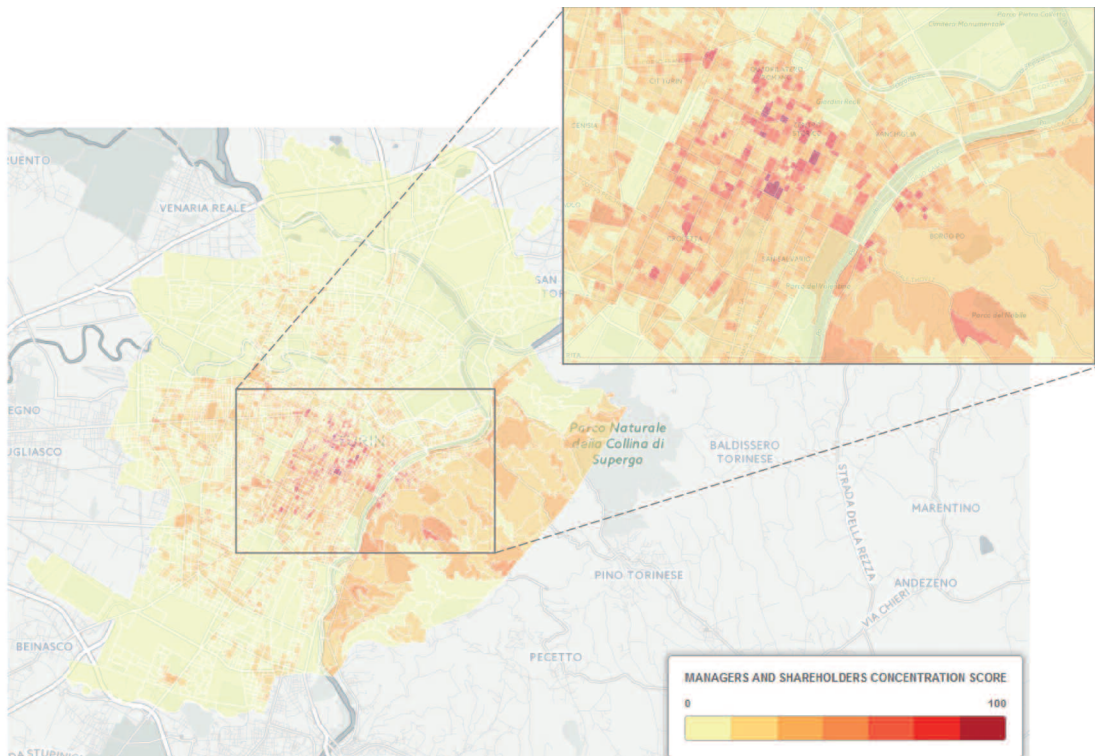
#### Turin

The first city used to analyze the MSHC score was Turin – an Italian city with various wealthy areas – as it is an effective case study to observe whether the score identifies the areas of the city characterized by the highest real estate values.

The historic centre has census sections with higher MSHC scores (Figure 1): the centre is in fact one of the wealthiest areas, with Piazza San Carlo, Piazza Castello, and Piazza Vittorio Veneto being just some of this area's points of interest. The Mole Antonelliana is certainly the major Landmark building, while Via Roma can be considered as one of the main thoroughfares where the predominant Baroque architecture may be admired. Crocetta and San Salvario are home to some highly rated residential buildings, and are in fact regarded by locals as prestigious neighbourhoods. At any rate, it is important to stress that in addition to the historic centre which boasts an elegant architectural style and refined buildings, at least two more areas where MSHC scores are high may be identified.

<sup>5</sup> <http://www.oict.polito.it/>

<sup>6</sup> <http://www.agenziaentrate.gov.it/>



**Figure 1** Territorial distribution of the MSHC score in the city of Turin. The MSHC score is displayed on the map, associating a darker colour with higher scores and brighter colours with lower ones

The centre is located on the western bank of the Po river, but in Figure 1 we may note that the hill on the opposite bank also has dark-coloured census sections; this is significant, because the hill is in fact home to many marvellous mansions and residential buildings, where many of Turin's wealthiest people live. This demonstrates how the score can identify a prestigious area or neighbourhood even when it is relatively far from the centre.

Another area with high MSHC scores, albeit not as high as the ones mentioned above, is the one that mainly covers the neighbourhoods of Cenisia and Cit Turin: this area starts from the western part of the city centre and expands to the city's western boundary. In this area, real estate values are growing rather rapidly, mainly due to the presence of the underground line providing a convenient link with the city centre and the railway stations.

Observing the map in Figure 1, it may also be noted that the areas with low MSHC scores are concentrated in the city's north and south: these are potentially industrial areas or neighbourhoods with relatively low real estate values. Turin is famous for the automobile industry which for years has represented the city's mainly economic activity, and there is still a significant presence of industrial districts. Today, the capital of Piedmont is trying to develop and sustain more innovative companies and initiatives in order to improve the service sector. In support of this new trend, it is pointed out that the European Commission has ranked Turin the second-most innovative European City.<sup>7</sup>

<sup>7</sup> [http://ec.europa.eu/research/innovation-union/index\\_en.cfm?section=icapital](http://ec.europa.eu/research/innovation-union/index_en.cfm?section=icapital)

The example of Turin is particularly eloquent, because it presents many challenging areas: the industrial areas, the Superga hill, and the areas served by the underground; the MSHC score is able to highlight the challenges posed by the heterogeneous characteristics of those areas, providing an excellent picture of the city and of the areas where its wealthiest citizens decide to live.

Table 2 shows the average scores aggregated by macro-areas for the city of Turin: the highest scores are located in the centre (38) and on the hill (24.75), while scores tend to decrease towards the suburbs. The semi-central area displays a similar level, but with a higher standard deviation with respect to the hill. The same table also shows the mean prices, again for the same geographical aggregation: it may be observed that the MSHC score and the mean prices per square metre follow the same trend. The hill area has higher prices per square meter than those in the semi-central area, and lower prices than the city centre. Mean prices refer to asking prices for residential units surveyed over the course of 2015 by Osservatorio Immobiliare della Città di Torino – OICT (Turin Real estate Market Observatory), which is assuredly one of the most reliable sources of information when it comes to the Piedmontese city's real estate market. However, for the sake of completeness, it must be noted that considering statistics aggregated by macro-area is not completely representative of how much the score is able to detect the price differences; this is why Figure 2 compares the territorial distribution both of the prices and of the MSHC scores in the census micro-areas (which group together a number of ISTAT census sections), in order to verify the score's ability to identify the most prestigious areas characterized by the highest real estate values. This processing is also supported by the detailed MSHC scores by micro-zone reported in Table 3.

The correlation is positive in numerous central micro-zones, in the hill micro-zones, and in those towards the city's western boundary.

MSHC score			Prezzi medi di offerta (Euro/m <sup>2</sup> ) anno 2015 (Fonte: OICT) <sup>a</sup>	
<i>Macro-area</i>	<i>Mean</i>	<i>Standard deviation</i>	<i>Mean</i>	<i>Standard deviation</i>
Central	38.00	5.03	3255.49	1118.03
Semi-central	24.62	8.18	2300.18	1058.33
Periphery	11.77	4.42	1666.58	528.53
Hill	24.75	3.59	2939.68	1066.71

**Table 2** MSHC score statistics by macro-area (city of Turin)

Microzone	MSHC score
01. Roma	44
02. Carlo Emanuele II	44
03. Solferino	44
04. Vinzaglio	35
05. Garibaldi	36
06. Castello	39
07. Vanchiglia	20

**Table 3** MSHC score by micro-area (city of Turin)

Microzone	MSHC score
08. Rocca	37
09. Valentino	22
10. San Salvario	28
11. Dante	23
12. San Secondo	36
13. Stati Uniti	37
14. Galileo Ferraris	39
15. De Gasperi	31
16. Duca d'Aosta	43
17. Spina 2 - Politecnico	21
18. Duchessa Jolanda	26
19. San Donato	21
20. Porta Palazzo	21
21. Palermo	17
22. Michelotti	24
23. Crimea	30
24. Collina	22
25. Zara	23
26. Carducci	12
27. Unità D'Italia	12
28. Lingotto	13
29. Santa Rita-Mirafiori	15
30. Mirafiori Sud	5
31. San Paolo	18
32. Pozzo Strada	20
33. Aeronautica/Parella	16
34. Spina 3 - Eurotorino	11
35. MadonnaCampagna	15
36. Spina 4 - Docks Dora	12
37. Rebaudengo	11
38. Corona Nord Ovest	6
39. Spina 1 - Marmolada	18
40. Barca Bertolla	5

**Table 3** MSHC score by micro-area (city of Turin)



Mean asking prices (Euro/m2) by micro-area – Turin

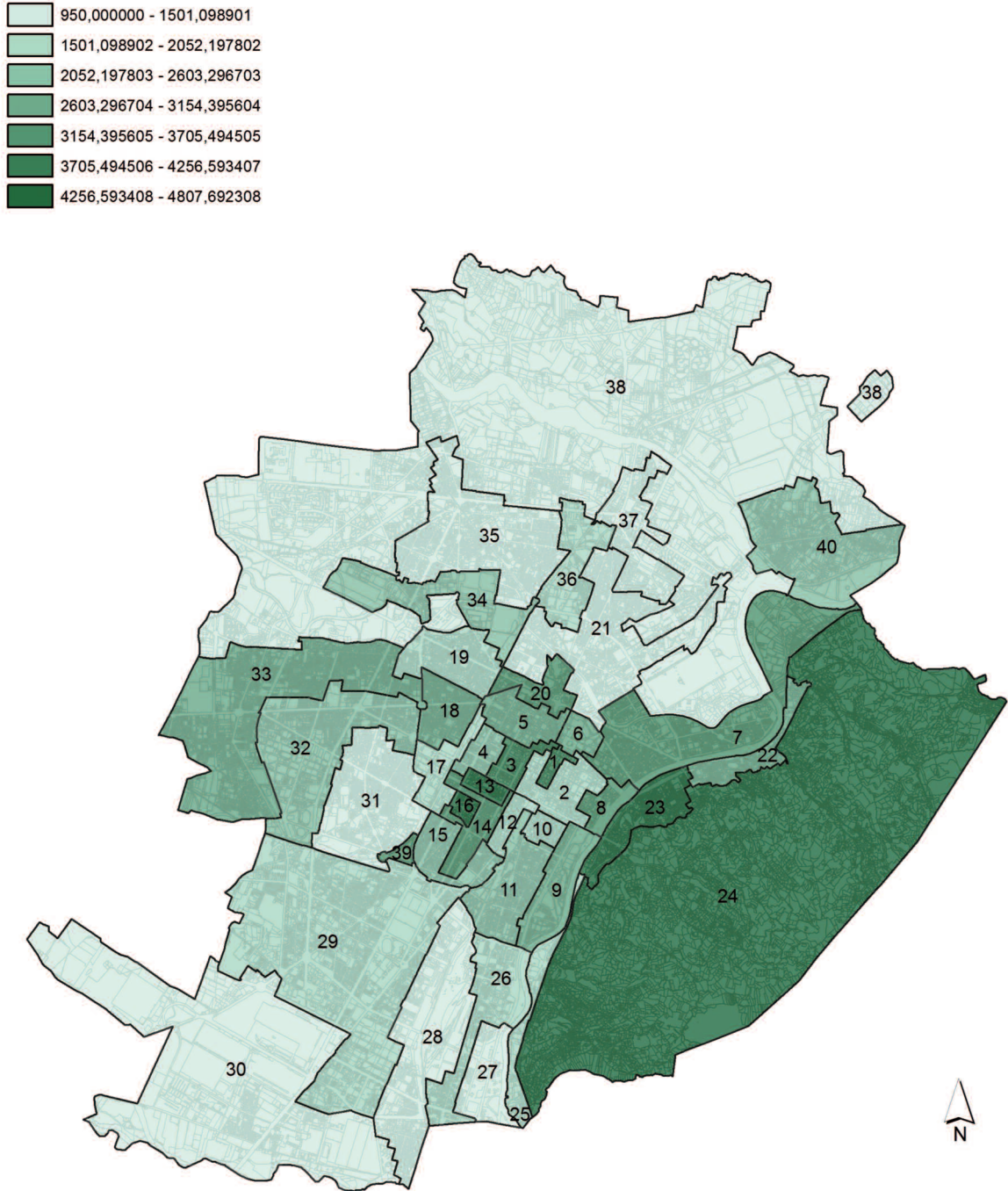


Figure 2a - Comparison between territorial distribution of prices and of MSHC score aggregated by census micro-area  
 Source: OICT - Osservatorio Immobiliare della Città di Torino

MSHC score for micro-areas - Turin

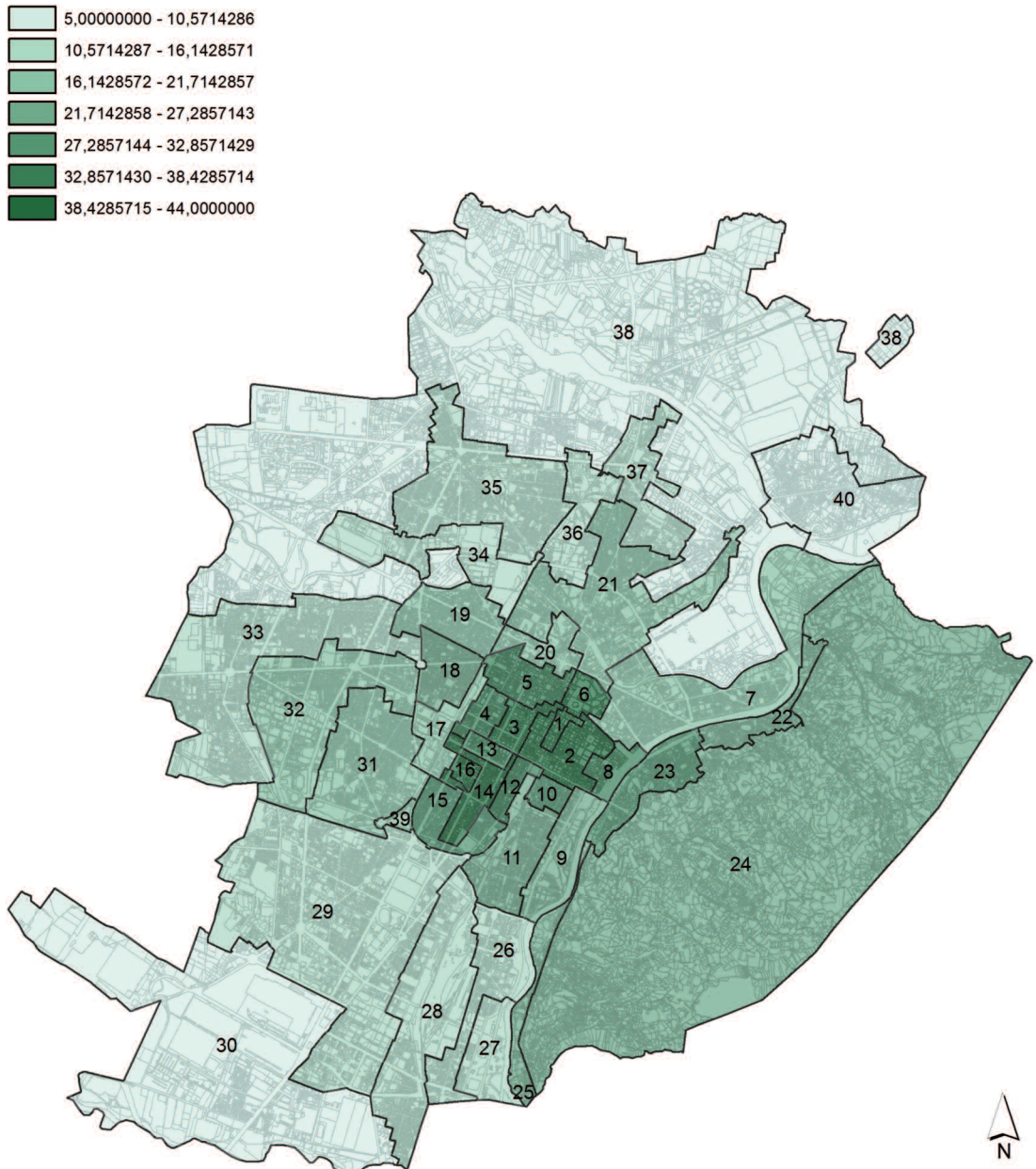


Figure 2b Comparison between territorial distribution of prices and of MSHC score aggregated by census micro-area  
Source: Cerved

The score shows high values in the city centre, the hill, and the micro-areas on the western side of the city, while it correctly identifies the south and north areas of the city as less prestigious. This result further confirms that the score can also be considered a valuable tool for predicting values on the real estate market. However, it is important to bear in mind that the existing correlations between the score and real estate values are to be taken as trend indicators, as the detailed relationship between the prices and the architectural characteristics of the properties (type, age of construction, size, etc.) should also be analyzed. It is also worth pointing out that the mean asking price was taken as a reference datum: in the research's future developments, actual sale prices may be considered, and it may be assessed whether the maximum prices may be more representative of the properties purchased by the parties considered for the calculation of the MSHC score.

### Rome

The second city chosen to analyze the MSHC score is Rome, a very complex city due to the vastness of the municipal area that is not comparable to any Italian metropolis, as well as due to the particular shape of some specific areas, namely the proximity to the city-state of the Vatican, the large number of historical and cultural points of interest, and access to the sea.

Macro-area	Mean	Standard deviation
Central	33.16	24.78
Semi-central	23.07	14.77
Periphery	14.21	10.14
Suburbs	12.07	10.17
Rural	5.72	7.84

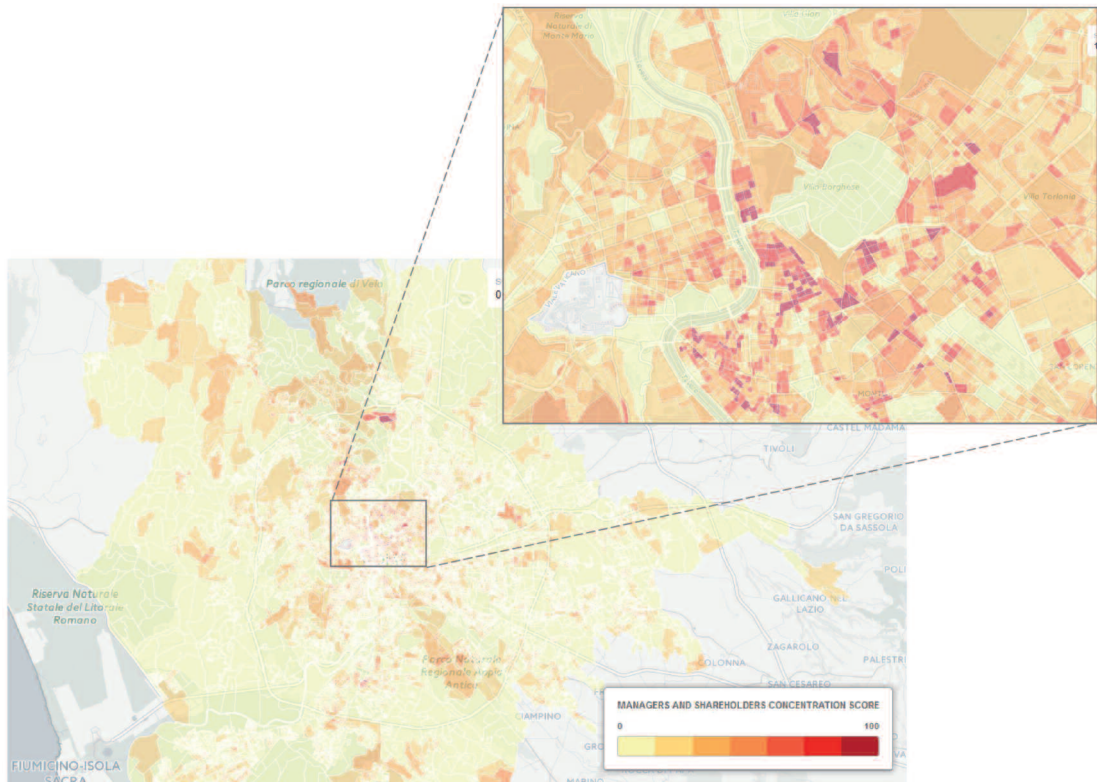
**Table 4** MSHC score statistics by macro-area (city of Rome)

The comparison between the MSHC scores and the real estate values published by the OMI for the city of Rome shows a close correspondence between score and market, even if it is not always perfectly truthful. For the most central area, in the heart of the city, the score slightly underestimates market values: in fact, the area is high-quality, very well served, and well linked to the rest of the city, and thus cannot be compared with similar scored areas in the periphery. This is due essentially to the peculiar aspects of the city of Rome, where the ownership of luxury property in the city centre does not always stem from current economic status, but is more closely linked to the socio-demographic legacy of the city itself.

The size of the Italian capital does not allow the distribution to be observed in detail, but it may be noted that there are more high-value areas. However, the scores show greater correspondence to market prices in Rome's suburbs. The value of the properties in those areas is on the rise, in consideration of the excellent service resources (with the presence not only of undergrounds and public transit, but also of universities and excellent educational institutions) that push up the price of residential property. Even though the increase in market value in these areas has been significant of late, it is still not enough to reach the price levels of the city centre, where the prestige of the buildings and areas, as well as of the commercial and tourist areas, also carries importance.

As for the individual neighbourhoods, centre versus periphery differences are found in some areas. Neighbourhoods such as Parioli, Pinciano, or Trieste indeed have scores comparable to some remote areas (like La Rustica or EUR), while market prices are higher.

To the contrary, the score can optimally approximate property values in some emerging neighbourhoods such as Montesacro, Pietralata, and Collatino, where prices are reaching medium / high standards.



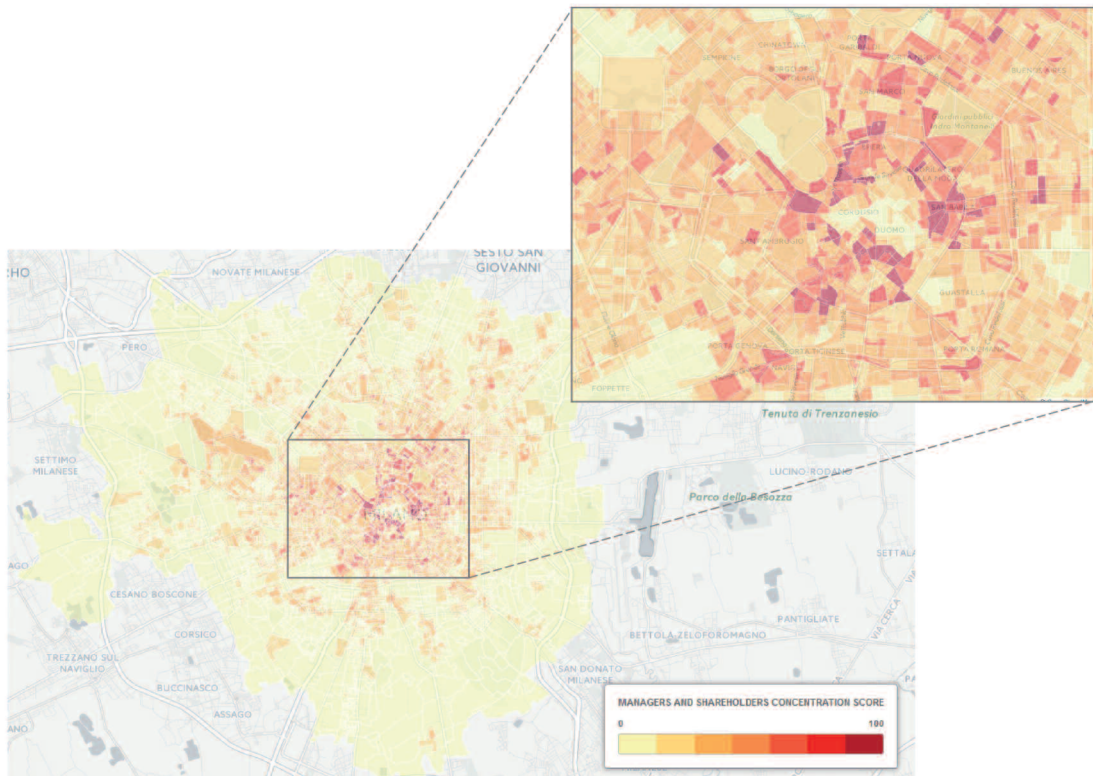
**Figure 3** Territorial distribution of the MSHC score in the city of Rome. The MSHC score is visualized on the map by associating a darker colour with higher scores, and brighter colours with lower scores

### Milano

The third city used to analyze the MSHC score was Milano – a city that has experienced major changes in recent years. Milan has seen the development of new neighbourhoods and skyscrapers, a universal exposition (EXPO), and a new underground line (with another under development) after years of inactivity. The highest MSHC score is found in the centre of the city, as could easily be foreseen, with the highest values concentrated in the central neighbourhoods, such as Duomo, San Babila, Verziere, and Brera. Other neighbourhoods such as Cinque Vie, Cordusio, Castello, and Magenta display an above-average MSHC score. Hence, around the city centre, the accuracy of the score is quite good at identifying valuable real estate areas. Other neighbourhoods such as Porta Vittoria, Porta Garibaldi, and Porta Genova have been gaining value in recent years. Moving towards the suburbs, neighbourhoods such as San Siro, Porta Romana, San Pietro, Maddalena, and, in part, Isola show very high scores. However, it may be stated that the census sections with the highest scores are located around the centre, while in the suburbs not many neighbourhoods are identified as particularly wealthy.

Macro-area	Mean	Standard deviation
Central	43.68	22.57
Semi-central	32.16	15.6
Periphery	16.07	11.35
Suburbs	7.3	6.69
Rural	4.95	5.79

**Table 5** MSHC score statistics by macro-area (city of Milan)



**Figure 4** Territorial distribution of the MSHC score in the city of Milan. The MSHC score is visualized on the map by associating a darker colour with higher scores, and brighter colours with lower scores

## CONCLUSIONS AND OUTLOOK

The MSHC score illustrated in this paper provides an interesting index that may be used to better comprehend where the richest segments of the population live, and consequently to identify the areas of the city with the highest real estate values. Obviously, although considering this score alone is not enough to support the valuation of real estate property values, together with other indicators under development at Cerved (for real estate valuation) it represents an excellent starting point.

One of Cerved's main goals is to predict the real estate market value for the entire Italian territory, and the MSHC score can provide an important source of information for this purpose. The estimate will be constructed through the use of a hedonic linear regression model (Kettani, Oral, Siskos, 1998; Pagourtzi, Assimakopoulos, Hatzichristos, French, 2003; Monson, 2009), and the score will be used as one of the fundamental regressors.

In addition to the cities presented in this document, the MSHC score was calculated for the whole Italian territory, and can be replicated in all European countries, if access to similar data is ensured. The MSHC score may therefore be used to support the estimation of real estate property values, by considering it jointly with other components. In future efforts, the result of the estimation will be compared to that of a previous analysis, focused on the Italian city of Turin (Curto, 2009), which provides a similar hedonic price estimation even though the data and regressors are different.

The MSHC score could be used in various sectors, such as input for additional research on the census of the city, social enquiries, or for property insurance assessments (of any kind) in a particular area of the city.

At Cerved, several activities are planned based on the MSHC score:

- Refinements to consolidate the score of heavy industry concentration (already used in the MSHC score) with the use of text semantics (corporate purpose and website analysis);
- Weighing managers and shareholders differently based on the current and historical financial performance of the underlying companies;
- Defining an MSHC score dedicated to managers and shareholders of companies defined as innovative startups, in order to find neighbourhoods with the greatest medium-term real estate growth due to the concentration of startups (gentrification).

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