Quality of urban area, distance from city centre, and housing value. Case study on real estate values in Turin

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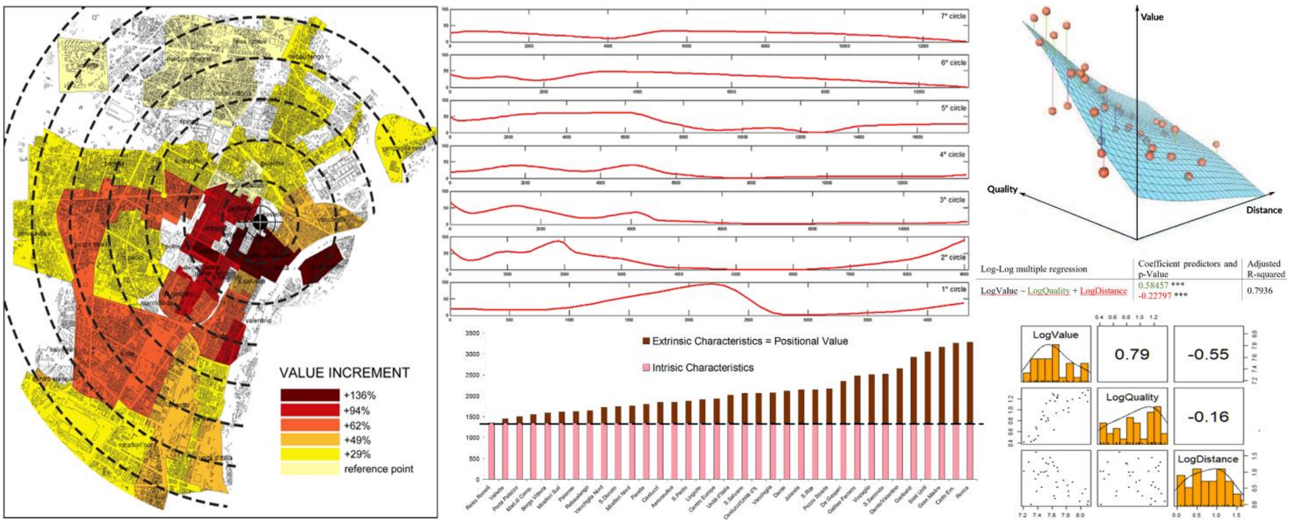
Abstract

A tremendous number of studies have investigated the relation between real estate value and characteristics of the area. This paper briefly shows more than one hundred empirical results from the literature, quantifying how much positional factors such as green, social context, pedestrian areas, pollution, aesthetics, views and accessibility influence the property value. We call Positional Value that part of the real estate value given from the characteristics of the area. As an empirical example, an analysis of the city of Turin shows how, changing the area of the city, the value of a house increases/decreases as much as 142% of its own value, *ceteris paribus*, even among areas quite close to each other. More specifically, the output of this study indicates that the real estate value decreases by 0.23% for each 1% increase of the distance from the city centre, but increases by 0.58% for each 1% increase of the quality of the site. The monetary costs of housing, time and transport, and the qualitative benefits received from the site's characteristics, play a main role within the households' decision processes when choosing among alternative dwellings. On the other way round, the quality of the area is capitalised by the real estate value which may then be seen an indicator of the former.



Keywords: real estate value; urban renewal and city transformation; urban quality of life; location value, real estate appraisal.

1. Introduction

"In classic economics the classic model of a city is monocentric […] Given no depreciation of buildings and no externalities within neighbourhoods, all prices and rents or implicit rents of urban and suburban housing decrease monotonically with the distance from the center. […] Prices and rents may no longer decrease monotonically with distance from the center because quality may increase with distance" (Williams 1999, p. 13).

Area's factors are a crucial determinant for property prices. The relation between housing value and characteristics of the area has been widely studied. These characteristics are considered by people before purchasing a house and are reflected in the property prices.

The literature (table 1), shows hundreds of researches on the effects on property values from neighbourhood, pollution, crime, urban parks, accessibility, quality of views, pedestrian areas, etc. Many studies have been conducted using least squares, minimum sum of absolute errors, multiple criteria regression models, quantile regression, rank regression, ridge regression, robust regression methods, neural networks, fuzzy logic, time series methods, Bayesian approach, goal programming, data envelopment analysis, hierarchical linear model, multiple criteria decision modelling, analytic hierarchy process and analytic network process.

The common goal of these studies is the quantification of the correlation between property values and desirable/undesirable characteristics of the area.

The aim of this study is to show how differences in quality among areas in the city of Turin increases/decreases the real estate asking prices.

Quality of life and quality of urban environments are becoming concepts more and more discussed in the scientific community and political arena.

Everyone knows that in order to achieve a higher quality of life it is better to build beautiful cities with nice gardens and parks, efficient and clean public transport systems, pedestrian areas and cycle paths, elegant squares and streets… but we need to translate this common sense into economic terms if we want to create a realistic dialogue with politicians and town and regional councils, who often straggle because of monetary constraints.

This paper tempts this quantification showing how, using the city of Turin as case study, the quality of a site induces at the same time a better life and economic returns.

By offering an example of methodology (here implemented on Turin, but which can be applied to other cities), in order to obtain a monetary quantification of the quality throughout different areas within a same city, this paper can also suggest tools to use in residential location decision processes (Pagliara, Preston & Simmonds 2010). "How does a household choose among alternative dwellings, each of which provides a different bundle of characteristics? The household must find the dwelling with the best combination of features at the best price" (O'Sullivan 2000, p.370). As Glaeser describes (Glaeser 2008, Glaeser, Kahn & Rappaport 2008), the individual location choices depend, in large part, on the amenities and local incomes, and "incomes are, in part, defined by the interaction between the demand and supply of labour; the latter is formed at the local level, based on individual location choices about where to work and live, while the demand of labour depends on the businesses decisions location" (D'Acci 2013). At an across cities level, residents, workers and businesses location choices all depend also from the quality of life which the overall quality of city guarantees. Initial work estimating demand and supply models were presented by Fortura and Kushner (1986), Rose (1989) and Manning (1989), while the first theoretical descriptions of the real estate sectors mechanisms were introduced by Ozanne and Thibodeau (1983).

"Income is generated by the labor market, which is affected by location decisions according to the spatial equilibrium approach. Market agents, in turn, orient themselves based on real estate prices, income and amenities according to their individual strategy. In sum, from a theoretical point of view, the spatial equilibrium model yields a justification for the interdependent relationship between income and housing prices" (Bischoff 2012, p.2). Therefore, showing how strong the relation between quality of a site and housing prices is, and extending it to a city level (urban improvements involving the entire city), also suggests further reflections about links among quality of built settlement (village, town, city or megacity), housing prices and income.

2. Intrinsic and extrinsic characteristics

The housing price is determined by intrinsic and extrinsic characteristics. The intrinsic are all the factors strictly connected to the dwelling (flat, house, building) such as: number of rooms, windows, balconies, floor, building aesthetics, artistic finishes, technical facilities, etc.

The extrinsic characteristics include all the factors of the area in which the real estate unit is, such as: urban quality (quality of roads, buildings, squares), green (public parks and gardens), social context, public transport, proximity to the Central Business District (CBD) or other centralities, beautiful views, historical significance of the area, pollution (atmospheric, acoustic), and so on. Fig. 1 shows some practical examples of extrinsic characteristics, and Table 1 summarizes some empirical results about the relation between various extrinsic factors and real estate value.

We call Positional Value (PV) the part of the real estate value given from the extrinsic characteristics. The goal of this research is to have the real estate value of a sample covering all city areas to deduce the part of the value given from the location, namely the 'value' of the area (PV).

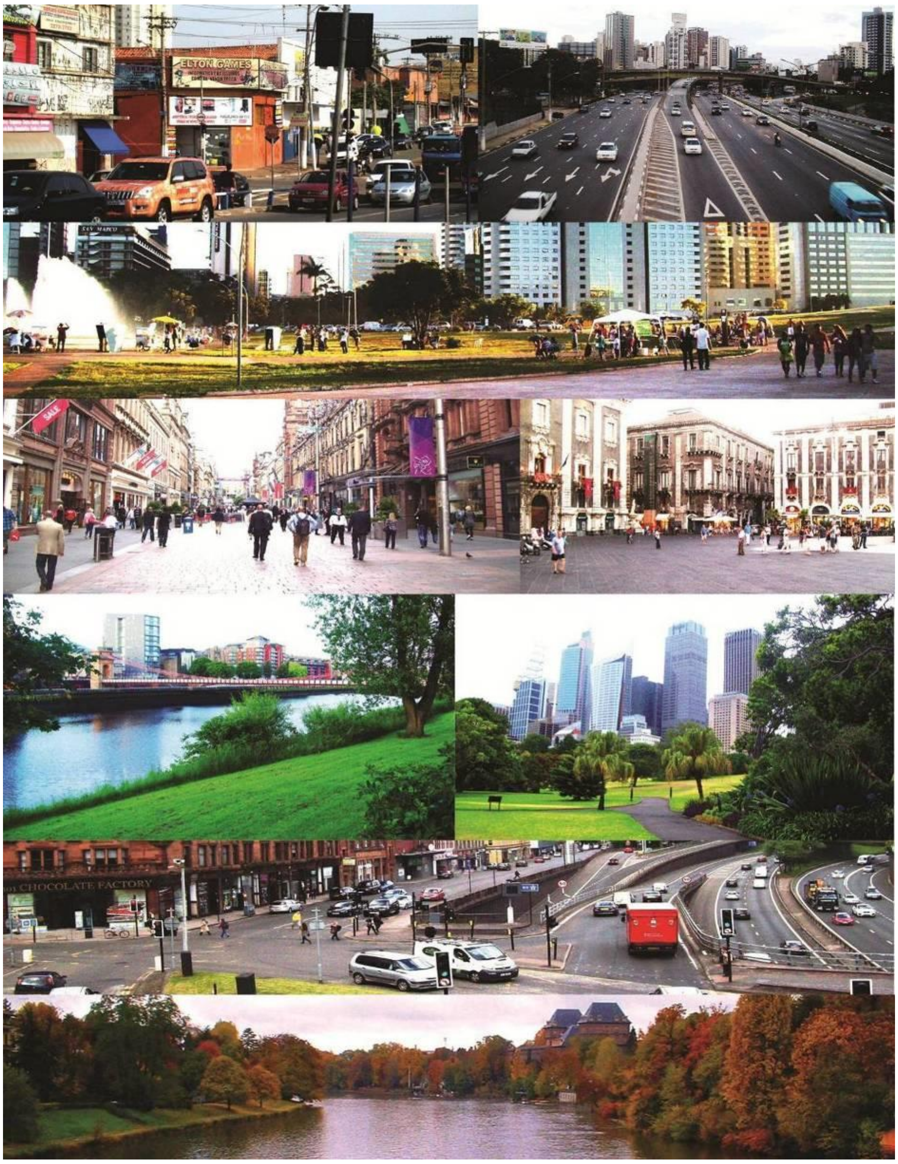


Fig. 1. Example of extrinsic characteristics (author's photos).

Table 1 (D'Acci 2014)

Real Estate Value increases associated with urban quality

Value change	Type of quality	Percentage increases	Sources
	Green Spaces		
Residential property value	proximity to green spaces	+5.9%	Tajima (2003)
Residential property value	proximity to green spaces	+117% after Centennial Olympic Park, in Atlanta, was built, adjacent condominium prices rose from $115 to $250 a square foot	City Parks Forum Briefing Papers, American Planning Association (2002)
Residential property value	proximity to green spaces	+60%	Fennema et al. (1996)
Residential property value	proximity to green spaces	-2.2% for each 1% increase in distance from a park	Troy & Grove (2008)
Residential property value	proximity to green spaces	+5% (a house that is 1 km away from a park is worth 5% less than an identical house adjacent to a park)	Troy & Grove (2008)
Residential property value	proximity to green spaces	marginal implicit prices of between +$342 and $13,916 depending on park type and distance	Lutzenhiser & Netusil (2001)
Residential property value	proximity to green spaces	+$0.24 per foot for a 1000 foot decrease in distance to parks	Wu, Adams &Plantinga (2004)
Residential property value	proximity to green spaces	+$246/$1790 depending on park type when the distance between a home and park is halved	Anderson & West (2006)
Residential property value	proximity to green spaces	+10% inner-city home located within 0.4km of a park	Wachter & Gillen (2006)
Residential property value	proximity to green spaces	+ 0.016% for a 1% decrease in distance from the parks (combining the mean real housing value and initial distance of 1 mile, the marginal implicit price would be $0.288: +$288 by moving the house 1000 ft. closer to an urban recreation park)	Poudyal , Hodges & Merrett (2009)
Residential property value	proximity to green spaces	+€1800 every 100m further away from a green area	Morancho (2003)
Residential property value	proximity to green spaces	+$209 million in the value of the property immediately adjacent to Central Park, New York, ($13 million spent on its creation) from 1856 to 1873	Frederick Law Olmsted (City Parks Forum Briefing Papers, American Planning Association, 2002)
Property tax	proximity to green spaces	Central Park (NY): the annual excess of increase in tax from the $209 million in property value was $4 million more than the increase in annual debt payments for the land and improvement. The City made a profit	City Parks Forum Briefing Papers, American Planning Association, 2002
Residential property value	proximity to green spaces	+$160 per household: +$6.5million (for 40984 properties within 1mile from the urban parks) increasing by 20% the parks size (from 35.13 to 42.15 acres)	Poudyal , Hodges & Merrett (2009)
Residential property value	proximity to green spaces	+$28 per household for each additional acre of nearby natural area	Bolitzer & Netusil (2000)
Residential property value	adjacent to naturalistic parks and open spaces	+8/10%	Crompton (2001)
Residential property value	natural landscapes	-5.9% for an increase of 1 km distance	Tyrvainen & Miettinen (2000)
Willingness to pay	natural landscapes	$302 as a household's one time willingness to pay to preserve 5.5 acres of open space in the neighbourhood	Breffle, Morey & Lodder (1998)
Residential property value	garden vista	+23.1%	Jim & Chen (2007)
Residential property value	view of an urban park	+18%	Damigos & Anyfantis (2011)
Residential property value	view of green spaces	+7.1%	Jim & Chen (2006)
Residential property value	view of green spaces	+4.9%	Tyrvainen & Miettinen (2000)
Residential property value	proximity to garden bordering on water	+28%	Luttik (2000), Tajima (2003)

	Pleasant view		
Residential property value	pleasant view	+50%	Damigos & Anyfantis (2011)
Residential property value	unpleasant view	-25%	Damigos & Anyfantis (2011)
Residential property value	different view in the same district	±5/45% (most probably about ±15%)	Damigos & Anyfantis (2011)
Residential property value	view of the Acropolis (Athens)	+46%	Damigos & Anyfantis (2011)
Residential property value	presence of uncontrolled disposal sites	-23%	Damigos & Anyfantis (2011)
Residential property value	presence of industrial installations	-21%	Damigos & Anyfantis (2011)
Residential property value	view to an abandoned quarry site	-15%	Damigos & Anyfantis (2011)
Residential property value	full sea view	+2.97%	Jim & Chen (2009)
Residential property value	confined sea view	+2.18%	Jim & Chen (2009)
Residential property value	view of the sea	+34%	Damigos & Anyfantis (2011)
Residential property value	view of the sea	+13%	Graves et al. (1988)
Residential property value	full ocean view	+60%	Benson et al. (1998)
Residential property value	full ocean view adjacent to the coast	+68%	Benson et al. (1998)
Residential property value	low-quality confined ocean view	+8%	Benson et al. (1998)
Residential property value	poor views two miles from the coast	+4%	Benson et al. (1998)
Residential property value	sea view	+18.5%	Kask & Maani (1992)
Residential property value	sea view	+1.1%	Hui et al. (2007)
Residential property value	sea view	+9.3%	Tse (2002)
Residential property value	sea view	+4.6%	Hui , Chau, Pun & Law (2007)
Residential property value	water view	+10%	Bourassa et al. (2003)
Residential property value	panoramic water views	+65%	Bourassa et al. (2004)
Residential property value	broad harbour view	+2.97%	Jim & Chen (2009)
Residential property value	confined harbour view	+2.18%	Jim & Chen (2009)
Residential property value	scenic sight of water bodies	+8/10%	Luttik (2000)
Residential property value	general attractive landscape	+5/12%	Luttik (2000)
Residential property value	river view	+7.8/13.7%	Jim & Chen (2007)
Residential property value	river view	+28%	McLeod (1984)
Residential property value	lake view	+11%	Smith (1994)
Residential property value	lake view	+44%	Doss & Taff (1996)
	Open spaces		
Residential property value	degraded open spaces, partially reclaimed quarries, and low-flow streams	-6%	Damigos & Anyfantis (2011)

Residential property value	view of open space	+6/12%	Luttik (2000)
Residential property value	cleaning the air, acquiring open space, and creating parks and trails	+127.5% (more than $11 million)	Chattanooga, in the early 1980s (City Parks Forum Briefing Papers, American Planning Association, 2002)
Residential property value	proximity to cleaned-up vacant lot	+17%	Wachter & Gillen (2006)
Residential property value	proximity to water bodies	+13.2%	Jim & Chen (2006)
Residential property value	proximity to open space	+0.137% for each 10 m decrease in distance to open space (unweighted average effect of 52 hedonic pricing studies)	Brander & Koetse (2011)
	Traffic, Noise, Pollution		
Residential property value	traffic noise	-5%	Luttik (2000)
Residential property value	traffic noise	-0.45% per dB	Blanco & Flindell (2011)
Residential property value	traffic noise	-0.47% per dB	Husted & Anker (2004)
Residential property rent	traffic noise	-0.2% / -0.38% per dB	Schaerer, Baranzini, Ramirez & Thalmann (2007)
Residential property value	traffic noise	-0.2% per dB (from a range of noise levels from 54 to 78 dB)	Bateman, Day, Lake & Lovett (2001)
Residential property value	traffic noise	-1.07% per dB (to noise levels greater than 68 dB)	Lake, Lovett, Bateman & Langford (1998)
Residential property value	traffic noise	-0.36% per dB (to noise levels greater than 55 dB)	Vainio (1995)
Residential property value	noise (airport)	-9.2%	Mcmillen (2004)
Residential property value	noise (airport)	-2.4%	Espey & Lopez (2000)
Residential property value	street view	-3.7%	Jim & Chen (2009)
Residential property value	air pollution	+1.3% than an identical one located in a neighbourhood whose annual average air pollution index was 1% smaller	Jim & Chen (2009)
Residential property value	PCB pollution	-3%/-8% for properties within two miles of the polluted site	Mendelsohn, Hellerstein, Huguenin, Unsworth, Brazer (1992)
Residential property value	hazardous waste site	-1.3%/-1.9% for each additional mile	Michaels & Smith (1990)
Residential property value	hazardous waste site	from -0.24% to -25%	Dunn (1986); Smolen, Moore & Conway (1991)
Residential property value	hazardous waste site	-13% within 100m	Neupane & Gustavson (2008)
Residential property value	hazardous waste site	+16%/+25% for each additional mile from an active hazardous waste landfill	Smolen, Moore & Conway (1991)
	Public Transport, Accessibility		
Residential property value	public transport	+1.8% for each additional transit line; -1.1% for each additional minute in travelling	Ibeas, Cordera, dell'Olio, Coppola & Dominguez (2012)
Residential property value	public transport	+13/14% (Bus Rapid Transit systems)	Rodríguez and Mojica (2009)
Residential property value	public transport	+10% (Bus Rapid Transit systems)	Cervero and Kang (2011)
Residential property value	public transport	+$2,370 per hour of travel time saved	Dewees (1976)
Residential property value	public transport	+ $1.05 per feet distance to the station	Nelson (1992)
Residential property value	public transport	+7.3% for every dollar saved in daily commute costs	Allen et al. (1986)
Residential property rent	public transport	-2.5% for each 0.16km distance from the metro station	Benjamin and Sirmans (1996)

Residential property value	public transport	+$2,237 near the rail lines	Bajic (1983)
Residential property value	public transport	+7%	Joint Center for Urban Mobility Research (1987)
Residential property value	public transport	+$5.714 for accessibility to train service	Voith (1991)
Residential property rent	public transport	+10/15% within 0.4km from railway station	Cervero (1996)
Residential property value	public transport	−18.7% within 0/0.4km from railway station, +2.4% within 0.4/0.8km, +0.9% within 0.8/1.2km, +3.5% within 1.6/3.2km	Bowes and Ihlanfeldt (2001)
Residential property rent	public transport	+13 cents per square foot within 0–1/4 mile from railway station, +7 cents within 1/4–1/2 mile, +1 cent within 1/2–3/4 mile,	Weinberger (2001)
Retail property value	public transport	+36.75% within 0.4km from railway station	Weinstein & Clower (1999)
Office property value	public transport	+13.85% within 0.4km from railway station	Weinstein & Clower (1999)
Residential property value	public transport	+5.97% within 0.4km from railway station	Weinstein & Clower (1999)
Industrial property value	public transport	+7.68% within 0.4km from railway station	Weinstein & Clower (1999)
Residential property value	public transport	-$1,593 for every 200 ft out of the station	Dueker and Bianco (1999)
Residential property value	public transport	+$31 per square foot within 0.4km of the station	Fejarang (1994)
Residential property value	public transport	+4.2% within 0.4km of the railway station	Debrezion, Pels & Rietveld (2007)
Residential property value	public transport	+4.6% within 500m of a Mass Transit Railway (the underground system)	Jim & Chen (2009)
Commercial property value	public transport	+16.4% within 0.4km of the railway station	Debrezion, Pels & Rietveld (2007)
Residential property value	city centre location	+9.1%/+10.5%	Schaerer, Baranzini, Ramirez & Thalmann (2007)
Residential property value	accessibility to central locations (Central Business District, CBD)	-0.8% per minute increase in the time required for a resident to travel from his apartment to CBD	Hui , Chau, Pun & Law (2007)
	Pedestrianised areas		
Economic activity: footfall for retail services	pedestrianised areas	+20%/+40%	Hass-Klau (1993)
Economic activity: footfall for retail services	pedestrianised areas	+32%	Gehl & Gemzøe (1999); Pearson (2000)
Economic activity: impacts on retail turnover	pedestrianised areas	+17%, a range of +10% to +25% is suggested	Newby (1992); Hass-Klau (1993); Saretzki & Wohler (1995); the European Federation for Transport and Environment (2002)
Economic activity: retail rents	pedestrianised areas	+22%, a reasonable range is +10 to +30%	Hass-Klau (1993); Colliers Erdman Lewis (1995); Hass-Klau & Crampton (2002)
	Schools		
Residential property value	proximity to schools	+0.1% for each additional reputable secondary school located in that district	Hui , Chau, Pun & Law (2007)
	Urban revitalization		
Residential property value	new housing	+$670 for each new housing construction within 2-3 blocks	Simon, Quercia & Maric (1998)

Residential property value	new housing	+6.1 $cents for each 1$ invested of new residential construction within 46 meters (+$5000 for a new house constructed nearby with an average investment of $82000)	Ding, Simons & Baku (2000)
Office rents	waterfront regeneration	from +3% to +53%	Frederick & Goo (1996)
Residential property value	improvements of green areas, housing, shops, pollution, streets/squares quality	from +8% to +63%	D'Acci (2007, 2008, 2009b)

As table 1 shows, the impact estimated for the same factor can vary widely across researches. This is due to several reasons such as, among many: different variables used, different methods, different cities, different appreciations (for various reasons) toward the same factor across cities/nations/cultures/geographies, different times, different ways (often subjectively biased) to quantify variables, and data availability constrains. Table 1 also shows results from other literature about how the quality of the area (in the Tab 1 separated by specific sub-factor determining, directly or indirectly, the quality of the location) influences property values.

3. An empirical analysis of the Positional Value: Turin

The sample is of around 400 real estate value observations (D'Acci 2007) covering the area of Turin; it has observations in 35 urban areas of the city. Each area has been delimited in a way to have the same characteristics inside them and they are taken from the 40 urban areas (microzona) delineated by Politecnico di Torino and approved by the Town Council in June 1999 on the basis of the DPR 138/99 (Decree of the President of the Republic) and of the Regulations issued from the Ministry of Finance. For Italian regulation, the 'microzona' is a part of the urban area that must be urbanistically homogeneous and at the same time must constitute a homogeneous real estate market segment. Fig. 2 shows the urban areas used.

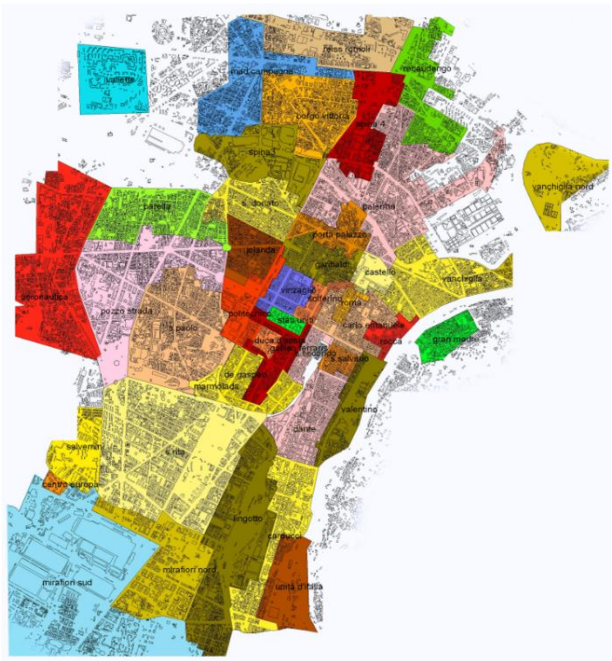


Fig. 2 Urban areas.

In order to estimate the Positional Value, the real estate sample was selected looking at the closest possible match regarding the intrinsic characteristics (features of the building such as aesthetics, level of finishing, size, etc., and the specific apartment factors such as layout, floor, rooms, brightness and so on). Outside a given range of dissimilarities, apartments were not to be included in the sample.
All the real estate units were equalised as a: 3 room, aesthetical building score = 2 (in a scale from 1 to 5), with elevator, without garage, immediately available to be lived in, medium floor, and medium internal level of maintenance. In this way a sample of elements was obtained, differing only in the extrinsic characteristics that can be called the *positional factor*.

3.1. Real estate asking prices data

The 400 individuals of the sample are real estate asking prices taken from website of local real estate agencies. They are not the final *prices* but *values*, namely not actual transition prices but the values that real estate agencies indicate as asking prices which can become a bit lower (often), higher or keep around the same. We can assume that the gap (changing across cities, nations, times, neighbours and typologies) between asking and selling prices under which the real estate transition finally occur is reasonably relatively similar among the sample, however this is part of the limitation of not operating with actual selling prices.
At the moment let's call *Va* (adjusted value) the Positional Value, to remember that is the *average value* of the property asking prices within each urban area that has been individually selected holding as similar as possible the intrinsic factors, and when dissimilar for some intrinsic factor has been adjusted (sales comparison approach) accordingly.
The mean of all the standard deviations of *Va* in each urban area is 184€/m^2. The mean of all the standard deviations of the real estate value in each urban area showed for the same city at the same time by the Turin real estate observatory (OICT – Osservatorio Immobiliare Città di Torino), is 454€/m^2.
As expected, the standard deviation of the real estate values obtained by this procedure (*Va*), is lesser than the standard deviation of the real estate values that usually one can get from real estate value observatories. The first in fact is the st.dev. of the values of a certain number of real estate units (in each urban microarea) in which all the intrinsic characteristics are very similar, and, when they are not, they have been equalised.
A general real estate value observatory provided by a real estate agency or institution (in Italy we could mention OICT, Agenzia del Territorio, Gabetti, Tecnocasa, etc.) usually gives the minimum, maximum and average real estate values of each city area calculated on the basis of all the real estate units without considering differences in factors such as floor, number or rooms, elevator, building aesthetics, etc, even if they also separate the sample among "new", "recent" and "old", or (but considering the apartment, not the building), between "old" and "new/totally restructured".
At the same time, as expected, the average standard deviations of the values, in each urban area, before any adjustment, is 276€/m^2. After the adjustments it becomes 184€/m^2; this shows the helpful contribution of the adjustments on the equalisation.
By comparing *Va* with the real estate value provided by OICT and by Gabetti for the same urban areas and at the same time, we can see (fig. 3, fig. 4) that the mean difference of the values between *Va* and OICT is 8% and between *Va* and Gabetti is 10%. We also notice that the mean difference between OICT and Gabetti is even higher, 13%.

Urban Area	Va	OICT	Gabetti Agency	DIFFERENCES (%) Va/OICT	mean	Va/GABETTI	mean	OICT/GABETTI	mean
Reiss Romoli	1350								
Vallette	1452								
Madonna di Campagna	1551	1750	1438	13%		7%		22%	
Spina 3	1583	1296		18%					
Borgo Vittoria	1590	1750	1567	10%		1%		12%	
Mirafiori sud	1609								
Palermo	1627	1547		5%					
Rebaudengo	1650	1633		1%					
Vanchiglia nord	1718								
S.Donato	1738	1841	1731	6%		0%			
Mirafiori nord	1761	2139		21%					
Parella	1798	1979		10%					
Spina 4	1815								
Carducci	1844	1819	1850	1%		0%		2%	
Aeronautica	1845	1979		7%					
S.Paolo	1875	1906	1800	2%		4%		6%	
Lingotto	1910	1867		2%					
Centro Europa	1934				8%		10%		13%
Unità d'Italia	2016								
S.Salvario	2060	1500	1700	27%		17%		12%	
Carducci/Unità d'Italia	2066	2120	2250	3%		9%		6%	
Vanchiglia	2079	2195	2192	6%		5%		0%	
Dante	2113	2150	2000	2%		5%		8%	
S.Rita	2149	2139	1850	0%		14%		16%	
Pozzo Strada	2170	2178	1780	0%		18%		22%	
Jolanda	2184	2313	2100	6%		4%		10%	
De Gasperi	2348	2458	2200	5%		6%		12%	
Galileo Ferraris	2476	2210	2900	11%		17%		24%	
Vinzaglio	2506	3166		26%					
S.Secondo	2515	2364	1850	6%		26%		28%	
Dante/Valentino	2647								
Garibaldi	2927	2939	2200	0%		25%		34%	
Stati Uniti	3045								
Gran Madre	3158								
Carlo Emanuele II	3254	2765		15%					
Rocca	3283	2980	2850	9%		13%		5%	

Fig. 3 Comparison among the real estate values provided from different sources (D'Acci 2007)

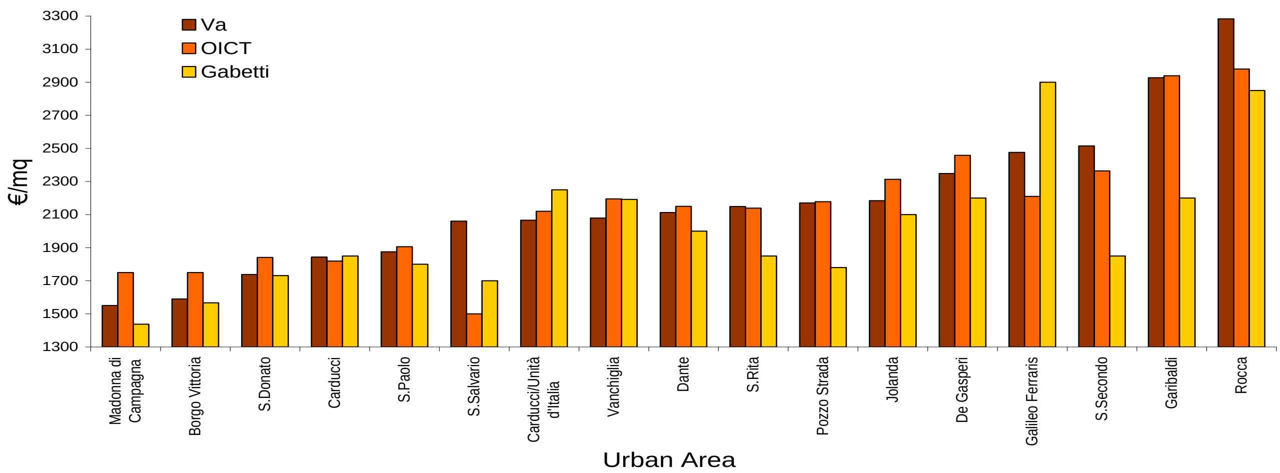


Fig. 4 Comparison among the real estate values provided from different sources

3.2. Real estate adjusted value and Positional value

It is in part possible to consider the real estate value as a barometer of the state of the general quality of life that a citizen is expected to receive when buying a certain house in a certain city area.
Fig. 5 shows the value increment (*Va,* in percentage) for each urban area of Turin.
It should be interpreted in the following way: a similar type of apartment, in a similar type of building, values *x*€/sqm if located in "Reiss Romoli" area (the area showing the lowest *Va*), values 15% more if located in "Madonna di Campagna", values 49% more if is located in "Unità d'Italia", 59% more if is in "Santa Rita", and so forth until it increases by 143% in the area of "Rocca".

The difference between *Va* (€/sqm) of the generic urban area *x* and *Va* of the area with the lowest value of *Va* in the city, can be *figuratively*[1] called "Positional Value" (PV).
PV of the area *x* (PV_x) is given by: $PV_x = Av_x - Av_{min}$. It can be seen as the *'value' of the area.*
Fig. 5 shows how the positional value in Turin can even increase the real estate value by 143% of its value.

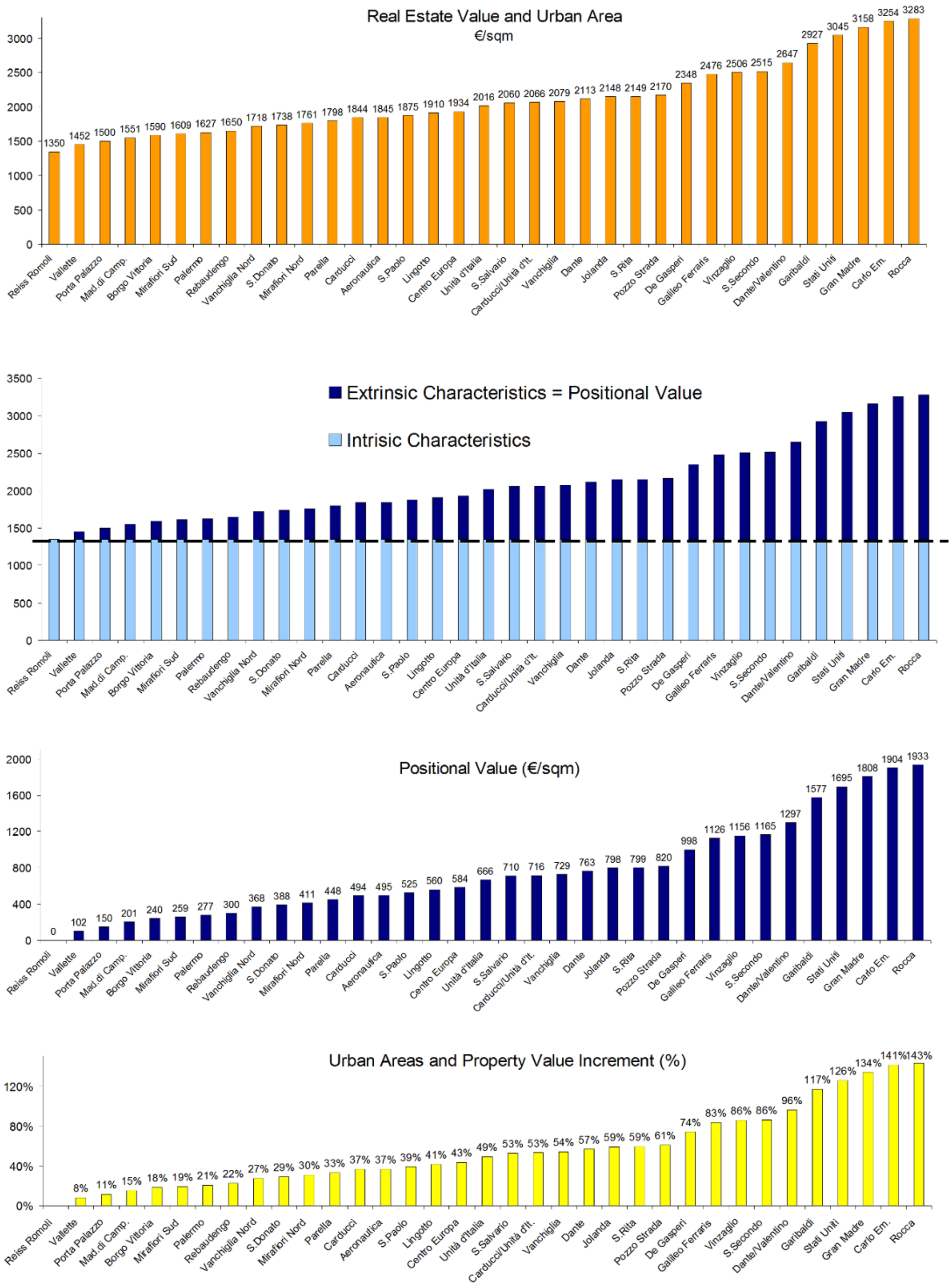


Fig. 5 From the top down: Urban area and Real estate value (€/sqm); Value due to the Extrinsic characteristics (PV) and the Intrinsic ones; PV (€/sqm); Real Estate value % increase (D'Acci 2014, 2007)

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[1] PV of the worst area (with the smallest *Va*) would figuratively be zero.

3.3. Distance from city centre and real estate value

By observing fig. 6, a type of relation between the real estate value (*Va*) and the distance from the city centre (for Turin this roughly means historical core, touristic centre and Central Business District at the same time), is moderately evident. Even if this is probably one of the most important factor influencing the formation of the real estate value, this is not the only one. For example, the general quality of the area has a strong influence too. The latter is given from several factors such as the aesthetical beauty of streets and squares, presence of public parks, social context, pollution levels, etc.

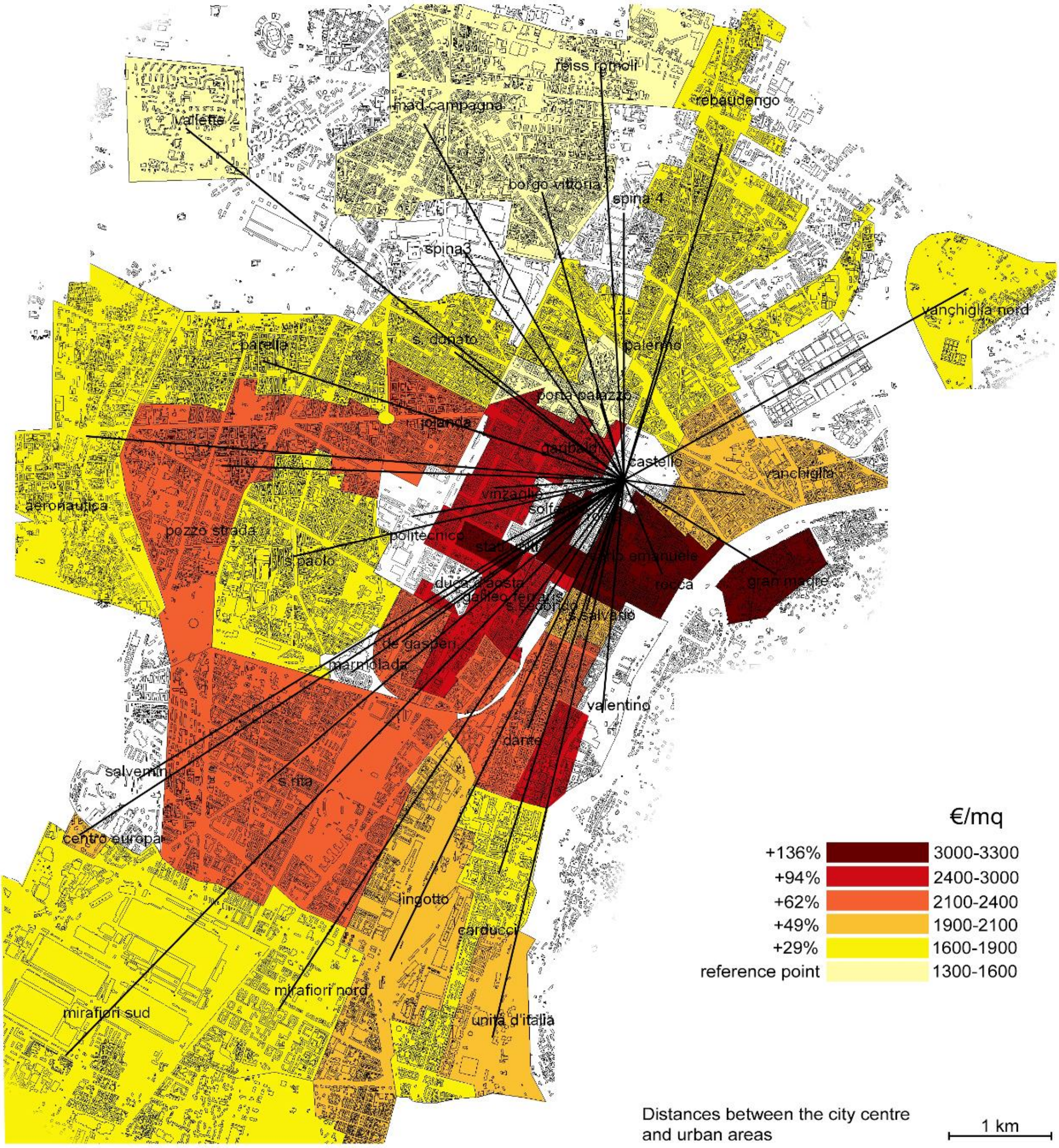


Fig. 6 Average real estate value (*Av*) in the Turin areas

The best regression line that interpolates the plot distance city centre - positional value is logarithmic (fig. 7). However, it is evident that this relation is not entirely explaining the variance of real estate value of the sample.
In fact, we can see better from fig. 8 and fig. 9 how the difference of the positional value can be much higher (around 120% higher, namely more than double) between adjacent urban areas with strong differences in their quality, than between areas very distant among each other. The points grouped in fig. 8 indicate the great value difference that one can see in urban areas localized at a similar distance from the city centre. At the same time, the points grouped in fig. 9 highlight the urban areas with similar values but with great differences in their distance from the city centre.
Fig. 10 shows, on the left, the real estate value (*Av*) in the city areas, and, on the right, the mean value of seven concentric circular bands in which the city has been divided.
Fig. 11 shows the % changes in property values within each band, moving clockwise from the south. Band n.1 (1° circle, the first at the bottom in the figure), is the most central and, therefore, the smallest one in length; band n.7 is the most peripherical and, therefore, the longest one.

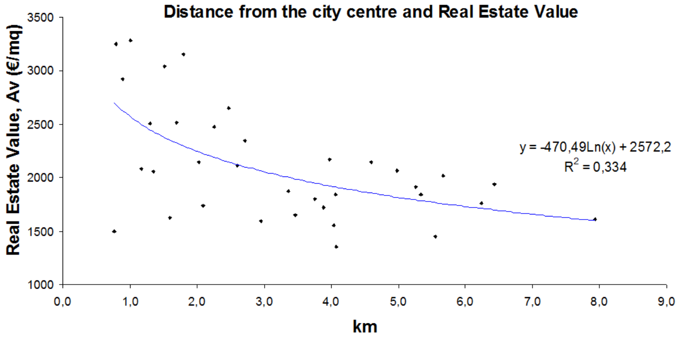


Fig. 7

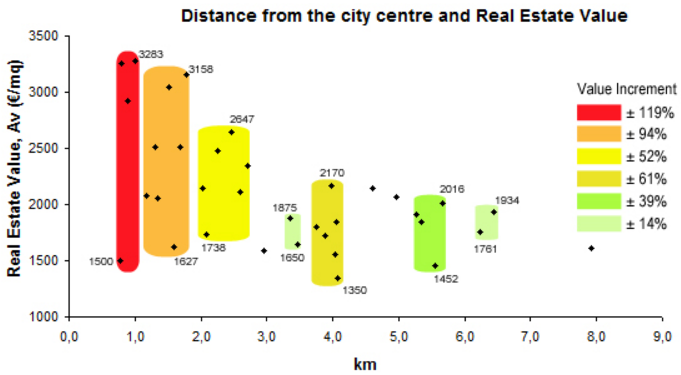


Fig. 8 Areas equally distant from the city centre but with different positional values.

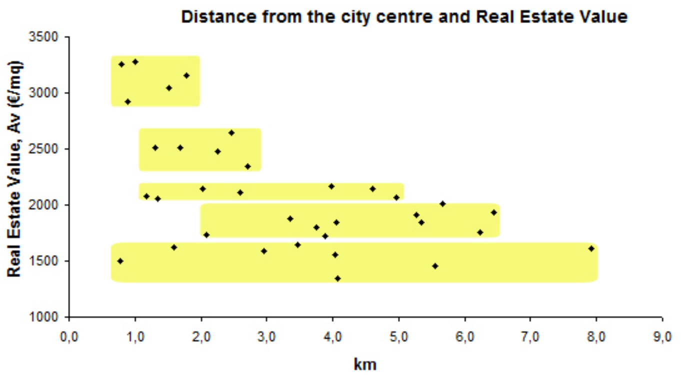


Fig. 9 Areas with similar positional values but with high differences in their distance from the city centre.

We can see (Fig. 11), how the highest variations of values are in the most central bands rather than the more peripheral ones. This means that the areas, even the closest among each other, show a strong variation of their real estate, due to deep differences in their characteristics (urban quality, social context, green quality, etc.) rather than the distance from the city centre.
In the case of Turin, we notice in particular a remarkable discrepancy in the positional value between the south and the north part. Fig. 12 shows the % changes in property values for each band separated in two: north and south from the city centre. Fig. 13 shows how the property value changes moving from the centre to the south (the left part of the figure on the top) and to the north (the right part of the same figure), indicating the mean value of the seven semicircular bands in the south size (left), and in the north (right). The bottom half of Fig. 13 shows the same, overlapping the two lines-value (moving from the centre to the south – the top line – and from the centre to the north – the bottom line). In this way one can read more clearly how great the difference in value is. This is mostly due to a general low quality in the north areas of the city in comparison with the south.

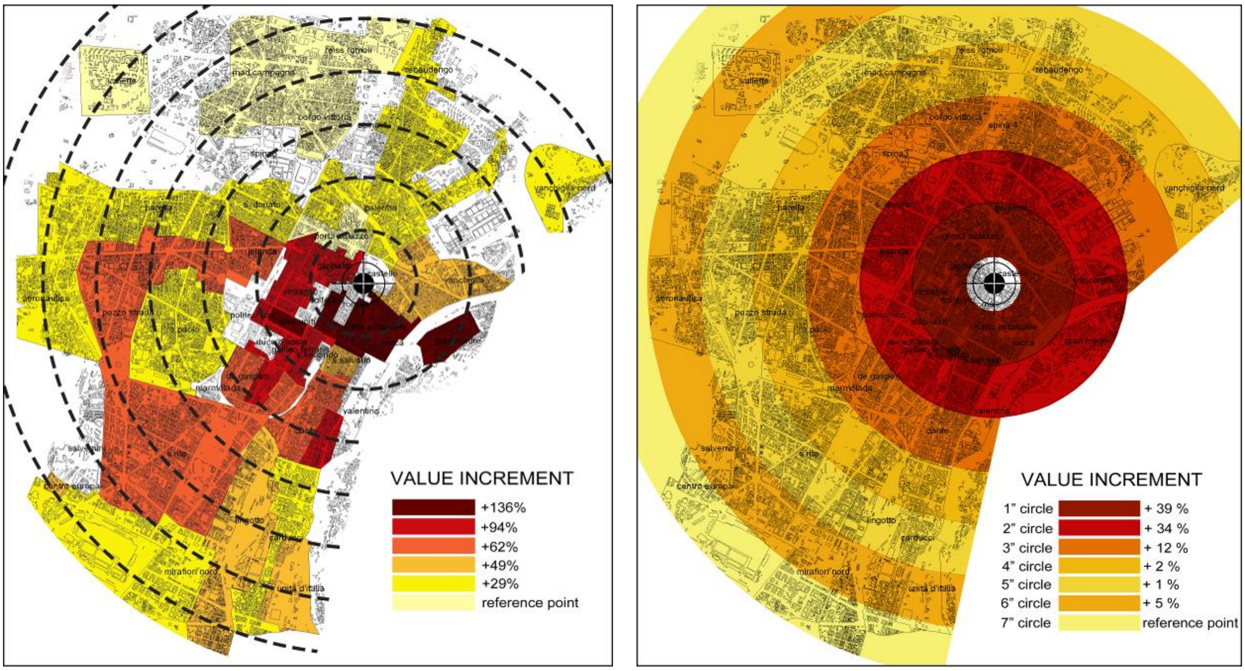


Fig. 10 Mean of the real estate value (*Va*) of the areas (left), and of the seven concentric bands (right).

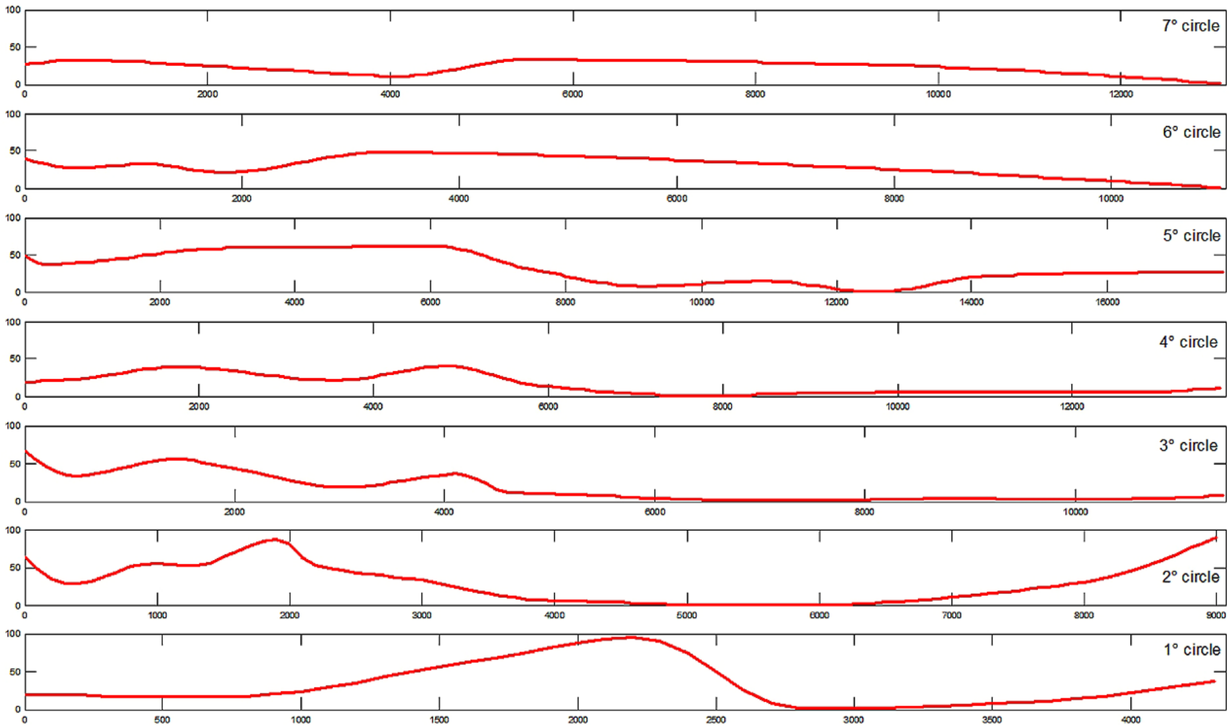


Fig. 11 Percentage changes in property values (*Va*) within each band, moving clockwise from the south.

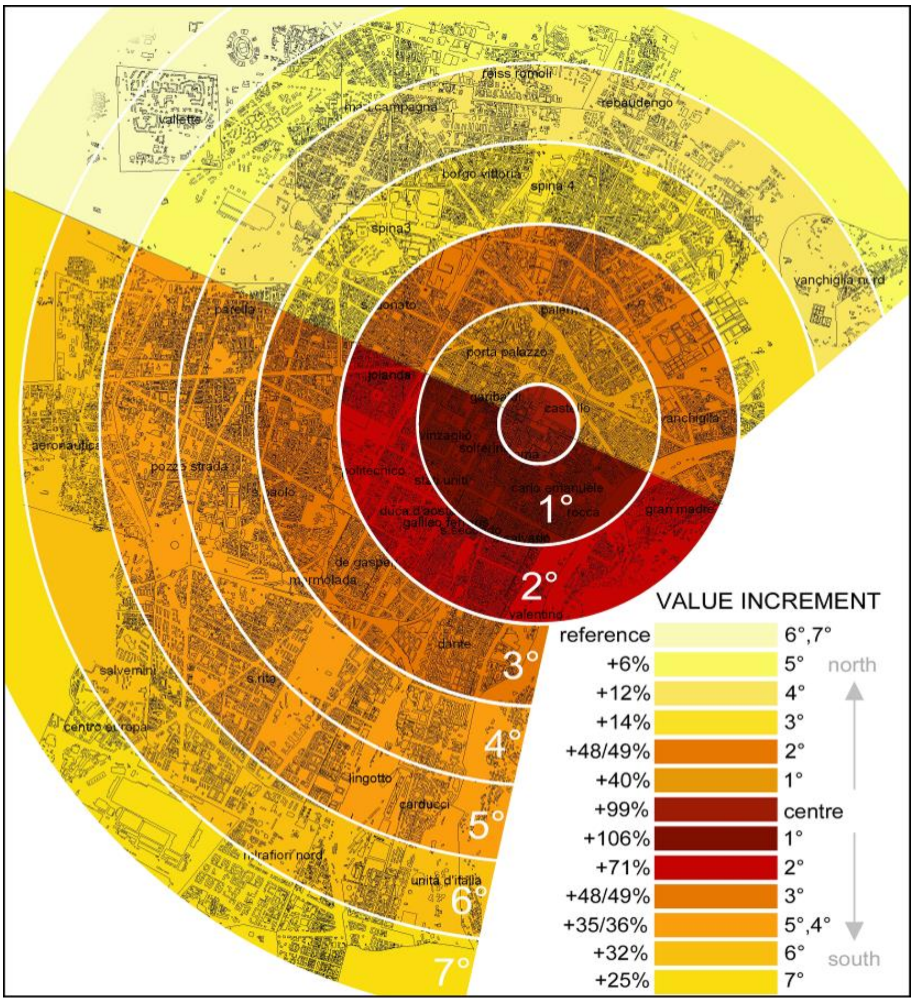


Fig. 12 Percentage changes in property values (*Va*) for each semicircular band in the north and south part of the city.

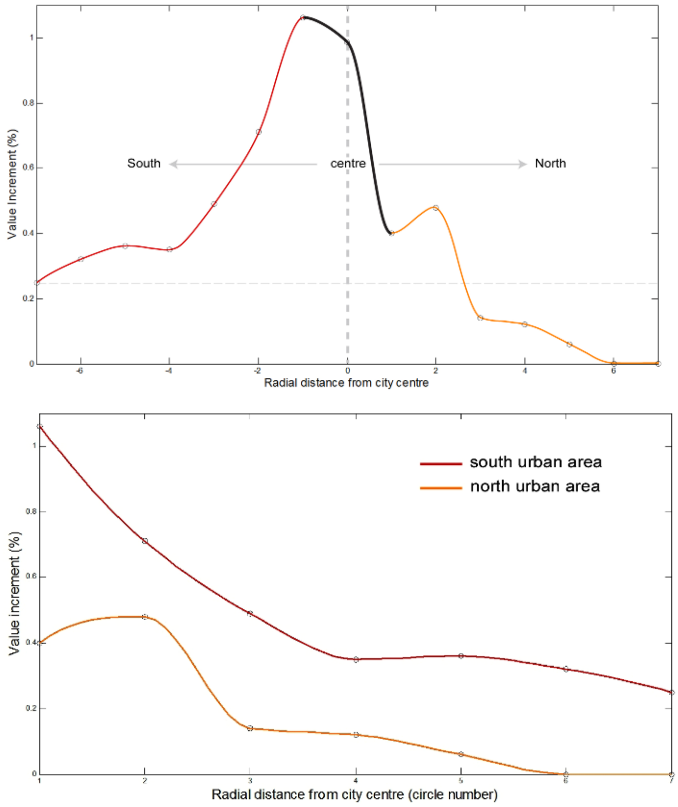


Fig. 13 Top: real estate value (*Va*) moving from the centre (line in the middle) to the south (left line), and to the north (right line). Bottom: overlap of the two lines; from the centre to the south – top line – and to the north – bottom line.

3.4. Quality of the site *versus* its Distance from the city centre

The measurement of the variable Quality of the area (that we will call Quality), is the arithmetic average of the following factors: green, shops, urban quality (quality of streets, buildings, squares, agreeable pedestrian areas…), and social context. Also this step involves a certain level of ambiguity and source of several errors as some components are subjective and limited in data availability, and the average was simply a non-investigated equal weighted average in which each factors is assumed to have the same influence in the final composition of the overall quality of the area. A quantification by *comparison* was adopted for each factor by taking as reference points the best, the worst and the medium area/s while qualitatively judging[2] the score from 1 (lowest) to 5.
The average real estate value (*Av*, the previously adjusted [or equalised] value, that we will now simply call Value) is quantified in €/m², while Quality in a scale from 1 (the worst) to 5, and Distance in km from the city centre[3] and translated in a scale from 1 (the closest) to 5 (Fig. 14).

[2] The judgments were made by the authors, as well (independently to avoid reciprocal influences) as by other 2 people knowing the city very well. All the judgments were rather similar therefore an average of them was used for each area. The judgments were conducted not by thinking about personal preferences but about the ordinary citizen. Nevertheless, it is clear the bias in this qualitative step, often no easily and completely avoidable in the social sciences.

[3] Turin, during the time where the data of Fig. 12 was collected, showed a roughly isotropic accessibility, as the public transport systems and the streets availability are more or less uniformly distributed throughout the city, apart from the recent new underground which at the time of the data collection did not exist. For this reason, in this case it may be not so wrong to assume the distance from the city centre as an indicator of accessibility to the city centre too, even if certainly a better analysis should consider a detailed quantification of the tiny anisotropic distribution of streets, public transport and cycle/pedestrian paths.

City Area (Microzone)	Average Equalised **Housing asking price**	Green	Urban quality	Social context	Shops	**Area Quality** (1-5)	**Distance from city centre** (1-5)	
	Value	G	UQ	SC	Sh	Quality	Distance	km
Reiss Romoli	1350	2.2	1.3	1.3	1.2	1.5	2.8	4.1
Vallette	1452	2.2	2.1	1.2	1.2	1.7	3.7	5.5
Porta Palazzo	1500	1.1	1.2	1	2.8	1.5	1.0	0.8
Mad.di Camp.	1551	1.4	1.2	1.2	2.5	1.6	2.8	4.0
Borgo Vittoria	1590	1.2	1.3	1.3	2.6	1.6	2.2	2.9
Mirafiori Sud	1609	2.3	1.5	1.2	3	2.0	5.0	7.9
Palermo	1627	1.2	1.7	1.5	3.3	1.9	1.5	1.6
Rebaudengo	1650	1.1	1.5	1.4	2.8	1.7	2.5	3.5
Vanchiglia Nord	1718	3.5	2	1.7	2	2.3	2.7	3.9
S.Donato	1738	1.5	2.2	2.5	3	2.3	1.7	2.1
Mirafiori Nord	1761	3	2.5	2.2	2.8	2.6	4.1	6.2
Parella	1798	2.8	2.6	2.3	2	2.4	2.7	3.8
Carducci	1844	2.8	2.3	2.8	4.4	3.1	2.8	4.1
Aeronautica	1845	2	2.6	2.2	2	2.2	3.6	5.3
S.Paolo	1875	1.3	2.2	2.2	3.7	2.4	2.4	3.4
Lingotto	1910	1.5	2.5	2.4	2.6	2.3	3.5	5.3
Centro Europa	1934	3.6	3.5	3.3	2.5	3.2	4.2	6.4
Unità d'Italia	2016	4.8	3.8	3.2	2.8	3.7	3.7	5.7
S.Salvario	2060	1.2	1.8	1.1	3.5	1.9	1.3	1.3
Carducci/Unità d'It.	2066	4.7	3.7	3.1	2.8	3.6	3.3	5.0
Vanchiglia	2079	3.8	3	3	3	3.2	1.2	1.2
Dante	2113	1.1	2.6	2.7	3.8	2.6	2.0	2.6
Jolanda	2148	2	4	4	3.5	3.4	1.7	2.0
S.Rita	2149	4.4	2.5	3	3.8	3.4	3.1	4.6
Pozzo Strada	2170	4.2	3.5	3.5	3	3.6	2.8	4.0
De Gasperi	2348	1.3	2.7	3.2	3.6	2.7	2.1	2.7
Galileo Ferraris	2476	2.3	3.9	4	2.5	3.2	1.8	2.2
Vinzaglio	2506	1.3	3.8	3.5	2.6	2.8	1.3	1.3
S.Secondo	2515	1.2	2.9	3.5	2.8	2.6	1.5	1.7
Dante/Valentino	2647	4.6	3	2.8	2.8	3.3	2.0	2.5
Garibaldi	2927	1.8	3.8	3.5	4.5	3.4	1.1	0.9
Stati Uniti	3045	4.1	4.7	4.8	1.2	3.7	1.4	1.5
Gran Madre	3158	4.5	4.2	4.3	1.3	3.6	1.6	1.8
Carlo Em.	3254	1.8	3.8	3.5	3.5	3.2	1.0	0.8
Rocca	3283	4.6	4.2	4	2.8	3.9	1.1	1.0

Fig. 14 Variables (columns Value, G, UQ, SC and Sh, from D'Acci 2007)

Useful for an initial overview of the data, a scatter plot, correlations matrix, frequency distributions, correlation ellipses, and loess smoothed fits are shown in Fig. 15.

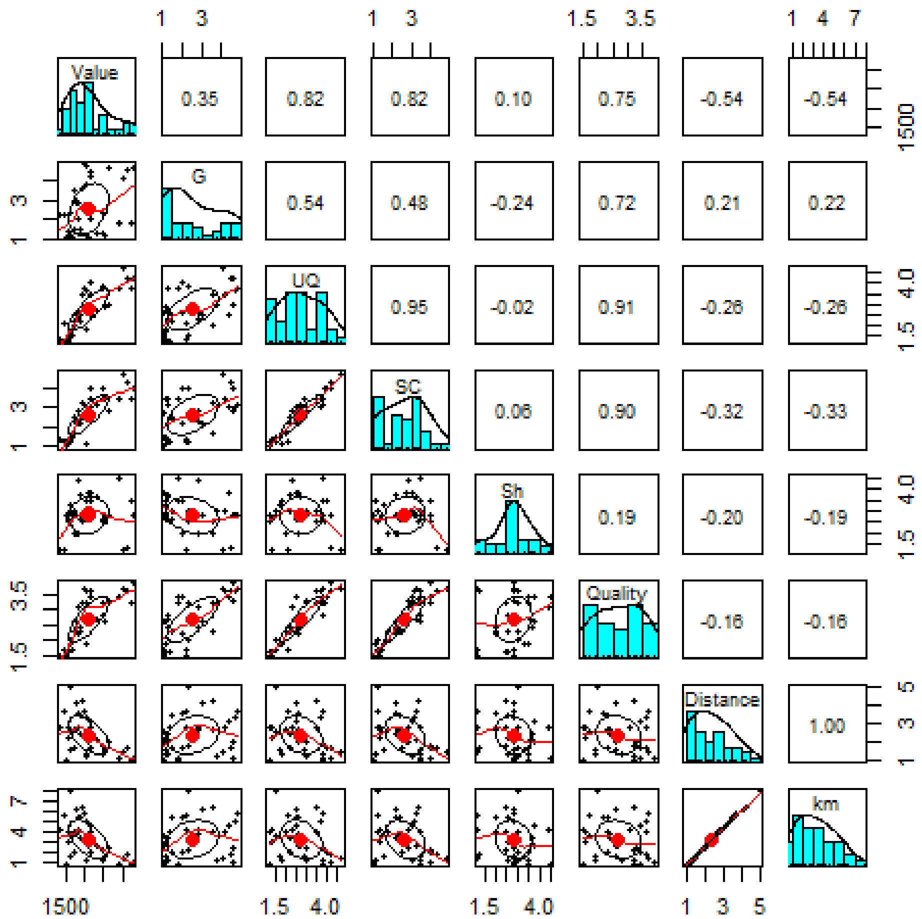


Fig. 15 Matrix of correlations and scatter plot

Among the four factors – Green (G), Urban Quality (UQ), Social Context (SC), Shops (Sh) – which build up the variable Quality, there is a strong correlation (0.95) between Social Contest and Urban Quality. This potential[4] issue together with the small number (35) of the subjects of the multiple regression in relation to the number of the independent variables – predictors – (5), called “Subject Per Variable”, SPV,[5] (in this case it would be SPV=35/5=7), and together with the main research interest of this paper which is to quantify the possible relation between the overall quality of an area and the real estate values (having as control variable the distance from the city centre), induce to assemble the four factors (G, UQ, SC, Sh) into one (Quality) having then a SPV=17.5.
Fig. 16 shows four least squares planes generated by a quadratic, additive, smooth and linear function interpolating the data of the table in Fig. 15, having on the axis x, y the independent variables Quality and Distance, and on the axis z the dependent variable Value.

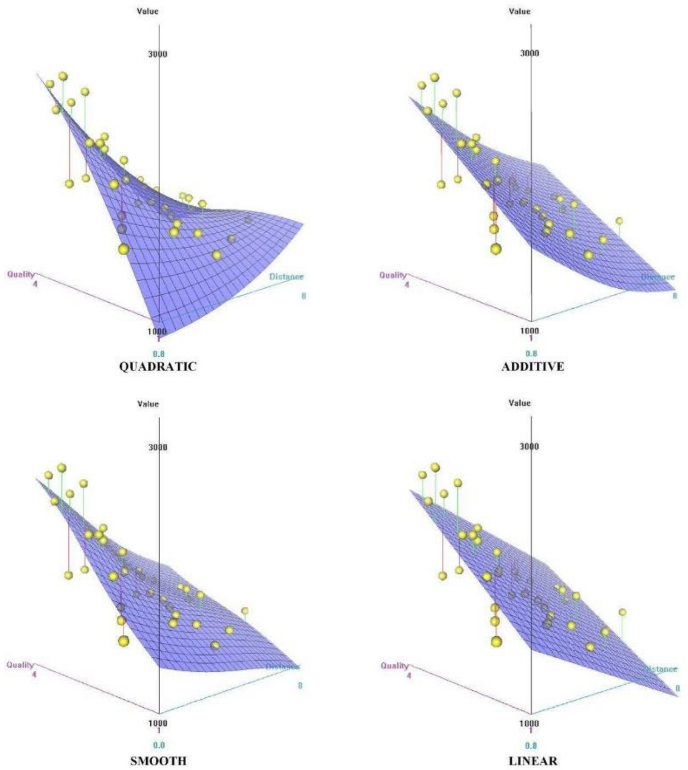


Fig. 16 Least squares planes interpolating the Value,
the Quality of the site and its Distance from the city centre.

[4] “Potential” because the Gauss-Markov assumption 3 *does* allow correlations among independent variables, as long as are not *perfectly* correlated (as obviously the variables called Distance and Km in Fig. 15 as same measures but in different scales). Without allowing a certain amount of correlations multiple regression would be of limited use in econometric. In fact, one often includes independent variables been suspected to be correlated with other independent variables *exactly* with the purpose to test their individual effect on the dependent variable by holing fixed the others. A high correlation will not violate the assumption GM3, and there is no absolute number to refer as barrier above which multicollinearity is a problem; what ultimately matters is not much the strong correlations, but whatever this will affect the variance of the beta coefficients $Var(\widehat{\beta_j})$ because a larger variance indicates a less precise estimator which means a larger confidence intervals and therefore less accurate model. Whether high multicollinearity induces a too large $Var(\widehat{\beta_j})$ depends on the sizes of the error variance $\sigma^2$and of total sum of squares (SST), a measure of the total sample variation in the *y*:

$$SST \equiv \sum_{i=1}^{n}(y_i - \bar{y})^2$$

[5] Numerous rules-of-thumb have been suggested regarding the SPV with different and often contradictory indications, ranging from no minimum SPV, to SPV of minimum 2, or 10, and so on. See Austina & Steyerberg (2015), and Green (1991).

No outliers are visible, no collinearity among the independent variables (Gauss-Markov assumption 3), and the model can be linear *in the parameters* (Gauss-Markov assumption 1). We then conduct a multiple regression to quantify the influence[6] which Quality and Distance have on the formation of the positional value.
A first linear multiple regression shows the following output (Fig. 17):

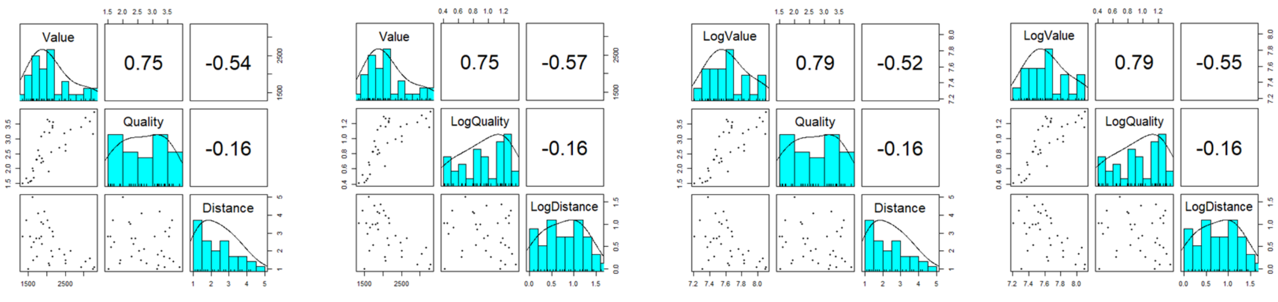
Call:
lm(formula = **Value ~ Quality + Distance**)

Coefficients:	Estimate	Std. Error	T value	Pr(>|t|)
Intercept	1309.27	223.45	5.859	1.63e-06 ***
Quality	**488.13**	64.28	7.594	**1.19e-08 *** **
Distance	**-216.89**	45.76	-4.739	**4.23e-05 *** **

Signif. codes:	0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Residual standard error:	275.6 on 32 degrees of freedom
Multiple R-squared:	0.7463
Adjusted R-squared:	**0.7305**
F-statistic:	47.08 on 2 and 32 DF
p-value:	2.937e-10

Fig. 17 Linear regression output

From the least squares planes in Fig. 16 (among many possible), and from the scatter plots and correlations matrixes (Fig. 18) of the dependent and independent variables in different combinations of their logarithmic values we can see as different potential models may fit the planes, however the matrix with the logarithms of all the variables (Fig. 18d) seems to best suits in terms of linearity of the functional shapes (Value-Quality, Value-Distance) and related correlations.



a **b** **c** **d**

Fig. 18 Scatter plots among variables and their logarithmic combinations

[6] We briefly mention the potential bias in the coefficients due to omitted variables: one could valuate to exclude a predictor when very correlated with another predictor if they are "logically" independent among each other so that you will not have a bias. If variables of interests (in our case the overall quality of the area and the distance from the city centre) are not correlated with the other predictors, and/or if the other predictors are not correlated with the *y*, one is not obligated to include in the model all the other independent variables. See omitted variable bias equation 3.46 p.91 in Wooldridge (2009).

Fig. 19 reports the regression coefficients of the two predictors, their related p-Value and the adjusted R-squared[7] under four models: linear, linear-log[8], log-linear[9] and log-log multiple regression.

	Coefficient predictors and p-Value	Adjusted R-squared
Fig. 16a: Linear Value ~ Quality + Distance	488.13 *** -216.89 ***	0.7305
Fig. 16b: Lin-Log Value ~ LogQuality + LogDistance	1206.4 *** -543.6 ***	0.7527
Fig. 16c: Log-Lin LogValue ~ Quality + Distance	0.23404 *** -0.09230 ***	0.7647
Fig. 16d: Log-Log LogValue ~ LogQuality + LogDistance	0.58457 *** -0.22797 ***	0.7936

p-Value magnitude order codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Fig. 19 Regression outputs comparison among different models

As the outputs suggest, all the above models are rather satisfactory in terms of explained variance (R-squared[10]) even taking into account the degree of freedom – number of variables and of observations – (adjusted R-squared[11]) and statistically significant (all the p-Values can be considered practically zero). If we decide to use the log-log model, the next figure (Fig. 20) summarises the main regression output:

Call:
lm(formula = **LogValue ~ LogQuality + LogDistance**)

Coefficients:	Estimate	Std. Error	T value	Pr(>|t|)
Intercept	7.24660	0.07518	96.393	< 2e-16 ***
LogQuality	**0.58457**	0.06402	9.131	**2.00e-10 *** **
LogDistance	**-0.22797**	0.04173	-5.463	**5.16e-06 *** **

Signif. codes:	0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error:	0.1089 on 32 degrees of freedom
Multiple R-squared:	0.8058
Adjusted R-squared:	**0.7936**
F-statistic:	66.37 on 2 and 32 DF
p-value:	4.107e-12

Fig. 20 Log-Log regression output

[7] In comparing the R-squared values we should also keep in mind that we are comparing logarithmically transformed variables models with non transformed variables model.

[8] Also called level-log.

[9] Also called log-level as the expression "log-linear" is also refered to the *linear* relations *among* (logarithmic) *variables* (namely, linear in parameters) in a multiregression with all *logarithmically transformed variables* (what we here called "log-log").

[10] $R^2 \equiv \frac{SSE}{SST} = 1 - \frac{SSR}{SST} = \frac{\left(\sum_{i=1}^{n}(y_i-\bar{y})(\hat{y_i}-\bar{\hat{y}})\right)^2}{\left(\sum_{i=1}^{n}(y_i-\bar{y})^2\right)\left(\sum_{i=1}^{n}(\hat{y_i}-\bar{\hat{y}})^2\right)}$; $SSE \equiv \sum_{i=1}^{n}(\hat{y}-\bar{y})^2$
where $\hat{y}$ is the fitted value and $\bar{y}$ the average value; SSE is the explained sum of squares and SST the total sum of squares. R-squared is the ratio of the explained variation to the total variation.

[11] $AdjR^2 = 1 - \frac{\frac{S_{res}^2}{n-k-1}}{\frac{S_y^2}{n-1}} = 1 - \frac{S_{res}^2}{S_y^2}\frac{n-1}{n-k-1} = R^2\,\frac{n-1}{n-k-1}$

Although not being the goal of our investigation[12], the model has a sufficiently good value of the coefficient of determination (Multiple R-squared = 0.8058) which is generally referred to an indicator of the Goodness-of-Fit[13]. Also the Adjusted R-squared is very good as explains more than 79% of the variance.
The F statistic[14] for the overall significance of the regression model is positive, in fact its associated P-value is very low (order of magnitude of 10^{-12}).
The interpretation of the coefficients of the model in the log-log regression (eq. 2) is the following: ceteris paribus, the Value decreases on average by around 0.23% for each 1% increase of the distance from the city centre, but increases on average by around 0.58% for each 1% increase of the quality of the site[15].

$$\text{LogValue} = 7.2466 + 0.58457(\text{LogQuality}) - 0.22797(\text{LogDistance}) \tag{Eq. 2}$$

These magnitudes of influence (read as *elasticity* in the log-log model) are also reliable as statistically significant for their P-values. The latter are 2.00e-10 for the Quality, and 5.16e-06 for the Distance, allowing to say that for the variable Quality, under the null hypothesis (Quality having no influence on Value) the probability to obtain our observed result (or higher 'influence') is only 2 out of 10 billion. Assuming that Distance had no effect, one would obtain the observed difference, or more (in the direction of refusing the null hypothesis that Distance has no effect on value), in just 0.000516% of random samples. These good results, especially despite the small size of the number of observations, are probably due to the process used to select the housing sample described in the previous part of the paper, which allowed to have a rather homogenous sample concerning the intrinsic characteristics, and the (rather large) variety mostly due to Distance and Quality.

4. Some considerations on urban betterments and positional value

The characteristics of an area can be modified by urban transformations, therefore her positional value will be altered, therefore the real estate value, and therefore, finally, the property taxes because they are calculated on the basis of the property value. This will be a return for the town council that can cover the costs for the realization of the urban transformations in part, fully, or even with a profit.
Just as an example, we remind how Frederick Law Olmsted, more than 100 years ago, from 1856 to 1873, tracked the value of properties adjacent to the Central Park in New York, founding a $209 million increase in the value of the properties impacted by the new park (the cost to his creation was $13 million). The next step to arrive more directly to the economic return of the town council, is the assessment of increased property tax revenue. Using the same example of Central Park in New York, the $209 million property value gave an annual tax excess of $4 million more than the increase in annual debt expenses for the land and development[16].

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[12] As our model has not as primary goal the prediction of the dependent variable (Positional Value), but the estimation of the beta coefficients of specific independent variables (Quality of the area, and Distance from the city centre), our attention should be given mostly to the statistical significance (P-values) of those variables rather than the adjusted R^2 of the full model.
[13] However, it always required attention as you may have wrong function model showing good R-squared and vice versa.
[14] The F statistic tests the null hypothesis, H_0, (all slope parameters are zero, claiming that the predictors have no effect on the y). Our associated P-value for the F statistic is zero at the twelve decimals, meaning that we can confidently refuse H_0.
[15] This is the approximated more intuitive way that use directly the coefficient predictor, b, to calculate the % increase of the y instead of using 100[(((100+p)/100)^b)-1], where p=%increase of the x; or instead of using 100[(q^b)-1], where q is the multiplicative factor of x (e.g. if x doubles, q=2).The smaller the % increases of x and the closer to 1 its coefficient, the smaller the error of this approximation.
[16] City Parks Forum Briefing Papers, American Planning Association, 2002.

Another example is the city of Chattanooga, in Tennessee: in the early 1980s the quality of life was improved by reducing the air pollution, acquiring open space, and building parks and trails. The direct monetary return was an increase in annual property tax revenues of $592˙000 from 1988 to 1996, almost 100% higher, because of the increased property values that rose more than $11 million, +127.5% (Lerner & Poole, 1999). Similarly, a greenbelt in an area of Boulder (Colorado) added annually around $500˙000 in property tax revenue[17].
The property tax that Turin city council and the government received for the year 2012 was 575˙036˙894 €. Just as a rough numerical example, let's assume some urban transformations that are able to induce a permanent alteration in the characteristics of some urban areas in Turin, and therefore in the cadastral income that is on the basis to calculate the property value and, ultimately, the property tax: hypothesizing that these urban renovations will produce an estimated 10% increase in the quality of the area directly involving 1/6 of the properties of the city. According to our results, a 10% increases in the quality of the area would generate a 5.73% increase[18] in the property value (and associated tax) of these 1/6 of properties in the city[19]; the economic revenue in annual property tax could then be around: (575 million/6)·0,0573 = around 5.5 million Euros higher.
Also at a micro-level, real estate retains a crucial role (if not the major for the ordinary person) in the economic life of companies and individuals; there are in fact other practical reflections regarding the relation between the quality of the area and real estate value that interest both governments/investors and any individuals owning properties: capital appreciation[20].
In our society, real estate is the major single element of wealth. In 1991 it was estimated[21] to count €190 trillion, roughly 50% of the world's economic wealth, becoming nearly 60% in 2015[22] (literally 2.7 times the global world's GDP) and around €246.2 trillion in 2017[23] (more than 3.5 times the total global GDP).
In the US (2011) the housing sector alone represented roughly the 18% of GDP[24] and considering the total real estate sector, it generates over 25% of US GDP[25]. In the UK, the part of properties generating income, have a market value of more than £1.5 trillion and generate a rent of £94 billion, namely 5.4% of the national GDP[26].
The above magnitude gave us an idea about how changes in the real estate value extremely affect the wealth and potential growth of countries, regions, firms, families and individuals.
It also emphasises the importance of making better decisions about real estate assets creation, transformation, use, and predictions.
Developing the ability to make informed, educated decisions and valuations about real estate plays a determinant role at any level of analysis: micro and macro.
As we saw, in the sample of this study, a similar real estate unit can more than double its monetary value if the quality of the location improves. Understanding the mechanism and the magnitude of the link between quality of the area and real estate value is essential to make decisions and proper

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17 City Parks Forum Briefing Papers, American Planning Association, 2002.
18 See note 15.
19 For this easy example we consider that this 1/6 of city properties have the average real estate value of the city, and then the average property tax amount.
20 For capital appreciation we refer to an increase of the value of an asset. This increase may happen because of strategic (relative cheap in relation to the final overall increase of value) interventions, or passively without any active action from the investor. The capital gain is the profit the investor eventually achieves when she sells the assets.
21 Ibbotson & Associates, cited in Archer W., Ling D.C. (2012). *Real Estate Principles: A Value Approach*. McGraw-Hill.
22 Savills World Research 2016. *Around the world in dollars and cents*. http://pdf.euro.savills.co.uk/global-research/around-the-world-in-dollars-and-cents-2016.pdf
23 Savills World Research: www.savills.com/impacts/economic-trends/8-things-you-need-to-know-about-the-value-of-global-real-estate.html
24 The State of the Nation's Housing: Cambrdige, MA: Joint Center for Housing Studies of Harvard University, 2011). www.jchs.harvard.edu
25 Real Estate Roundtable www.rer.org
26 www.bpf.org.uk/sites/default/files/resources/Britains-Property-CREdentials-Report-Jan-2016.pdf

economic evaluations about urban development/transformation projects, as it provides precious insights enabling urban managers, developers and politicians (as well as urban dwellers micro-decisions) to estimate probable cash flows paying back expensive urban beautification/renewal plans.

9. Conclusions

By assessing the weight that the quality of urban areas has on real estate values, one can quantify the importance to have agreeable/disagreeable area characteristics from an economic perspective too. In some sense, the real estate value encapsulates the appreciation of the location, which this paper shown to be quantified in an 0.58% increase in the value per each 1% increase of the quality of the urban area in which is located.

In Turin, the real estate value of the sample used in this study, changes as much as +143% from one area to another, *ceteris paribus*, even if these areas are very close to each other and with similar accessibility and equivalent distance from the city centre.

Fig. 11 showed that the highest variations of values are in the areas which are closest among each other. If the main reason of property positional value change was the distance from the city centre, the lines in Fig. 11 should have been horizontal; however, they are not, clearly showing how much the economic value of sites varies also when keeping their distance from the city centre constant.

The multiple regression analysis carried out for the case of Turin indicated that the real estate value decreases on average by around 0,23% for each 1% increase of the distance from the city centre (around 17% less doubling the distance[27]), and increases on average by around 0,58% for each 1% increase of the quality of the site.

This paper adds another case study to the literature (Tab 1), and contributes in impacting the policymaking process regarding urban planning.

Urban renovations should be suggested where they induct, directly or indirectly, an improvement on the quality of life of the citizens; but even considering those town/regional councils that are animated by noble purposes, their limited economic resources oblige them to conduct a rational calculation of costs and benefits as well as effectiveness from an economic point of view.

This study can suggest that also, strictly speaking in monetary terms, if the costs of urban transformations count the economic returns of their effects on the property market, the result could monetarily support expensive decisions.

Recalling the spatial equilibrium in cities[28] which – in free location decisions – occurs within and across cities, this paper offers another case study to the spatial equilibrium *within* city, as living more distant from the city centre (usually implying higher commuting costs-time for several activities) means cheaper houses (for this sample in Turin: 17% cheaper for each doubling of the distance). Similar reasoning could be made thinking about the quality of the area whose increase is offsets by higher housing prices (for this sample in Turin: 50% higher per each doubling of the level of quality of the area).

[27] See note 15.

[28] "It is not an equilibrium in terms of time and among people, but in terms of contingent situations as for example: I live in a small village just outside the city where I work, therefore [ceretis paribus] I pay less for my house but more for commuting. The equilibrium resides in this "less" and "more". In general simplified approximation, we can think of spatial equilibrium as a compensatory equality throughout the space of the relations among income, prices and amenities. Spatial equilibrium assumes that these three factors are, under certain conditions, offset against each other when moving from one location to another: high incomes are offset by high prices (housing, cost of living), and/or local negativity (climate, crime, congestion, etc.), and vice versa. When the study is addressed within a city by comparing the diversity (assumed to be compensatory) between its different urban areas, it is called Spatial Equilibrium Within Cities whose simplest form is the Alonso–Muth–Mills model. When it is turned to the comparison between different cities, comparing their incomes, costs and amenities, it is called spatial equilibrium across cities whose fundamental model is the Rosen-Roback's." (D'Acci 2015).

From an *across* cities angle perspective the argument is more complex but we may still speculate that (1) if the area's improvement embraces the entire city, the city itself will be more attractive, and being a more attractive city means attracting more tourists, residents, skilled people (able to pay for this attractiveness), and certain types of enterprises and business; and (2) an increase in the quality of the urban area determines higher property values: the above two points open interesting further discussions dealing with the type of likely links among nominal/real incomes, attractiveness of a city, and average housing values.
More intuitively, think about Venice, Florence, Zhouzhuang, Delft, Ouro Preto, Saint-Antonin-Noble-Val… when we make a beautiful place, it remains so for a great deal of time; therefore, the positive return, both monetary and psycho-sociological, embrace a very long time and also "space", because it is of interest and enjoyment not only for the local residents: the pleasure to be aware that such nice places exist, without necessarily having to visit them.
Finally, if we see citizens as location decision makers, this study underlined the "price of quality" which people are willing to pay for (in this example the Positional Value variation, holding constant the distance from the city centre), reminding how the quality concept must be inserted into a dynamic context rather that in a stable equilibrium over time, space and people: "is impossible to assume the constancy of anything over time, such as the supply of labour or capital, the psychological preferences for commodities, the nature and number of commodities, or technical knowledge" (Kaldor 1985, p.61, quoted in Nijkamp 2007, p. 514).

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