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Asking prices vs. Market Prices: An Empirical Analysis

Keywords: **real estate market, asking prices, market prices, linear regression.**

Abstract The issue of transparency in the Italian real estate market means that many analyses should be carried out by utilizing asking prices which should also be used by the industry for estimative purposes. Despite the fact that the importance of asking prices for the interpretation of the market is also recognized in the international literature, it might be worthwhile to delve into their relationship with final transaction prices. To this end, this paper proposes a methodology for analyzing whether and to what extent asking prices can be considered a proxy for market prices. Particular focus will be dedicated to verifying whether the variability of asking prices can be considered a reference for the analysis of the variability of the real estate market. The model will be tested empirically on a case study referring to the real estate market in the city of Turin and its component geographic submarkets.

INTRODUCTION

In Italy, researchers, analysts and developers must confront the issue of transparency in the real estate market which is a premise, albeit wholly theoretical, for an ideal state of equilibrium; above all, it is an important condition for limiting the stochastic components that are intrinsic to the market itself. The lack of transparency limits analysis and makes it difficult to use statistically significant samples of effective sales prices as well as quantitative and qualitative characteristics considered as explanatory variables. Analyses, therefore, must use asking prices, with all the limitations that these represent when they do not concern the supply component.

The model proposed in this paper uses the variability of asking and real market prices as a reference with the aim of exploring whether and to what extent the former can be proxies for the second and can therefore, be used in market analyses notwithstanding the evident limitations. The model also lends itself to subsequent applications including determining whether and to what extent the effective prices reported in deeds of sale – mandated by recently introduced fiscal legislation - can be regarded as truly representative of real transaction prices.

In the first part of the article the context and mathematical model will be introduced, followed by the presentation of the case study of the real estate market in the city of Turin. The discussion will then turn to the description of the sample used for statistical analyses, followed by the paper's conclusions.

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THE MODEL

Introduction

Using the very particular condition in Italy as a starting point, this paper will examine the role that the analyses of asking prices in the real estate market might play, relating the international literature to the case of Italy which is characterized by significant market opacity. Internationally, askings are considered as a specific moment in the analysis of supply as well as seller behavior. Yavas, A. and Yang, S. (1995) maintain that asking prices represent the link between sellers' two central goals: to sell at the highest price in the shortest time possible. In this context, the authors analyze the impact of askings both on the time it takes to sell and on market price. Anglin *et al.*. (2003) also studied the relationship between asking prices, sale prices and the time it takes to sell a given property.

The spread between asking and transaction prices is often used as a measure of a market's liquidity, along with the amount of time a property is on the market (see, for example, Jud, GD, DT Winkler and GE Kissling (1995)). In addition, Knight (2002) concludes that the incorrect definition of the asking price is a cost to the seller in monetary terms as well as in terms of the time it takes to close a sale.

Furthermore, the predictive capacity of asking prices in real estate markets has been studied both empirically and theoretically in the international literature as well. For example, Knight *et al.*. (1998) analyze the role of asking prices as indicators of housing values and as predictors of trends in the real estate market. Their empirical analyses confirm the importance of asking prices. As substantiated by Irving Fisher (1912) in *The Nature of Capital and Income*, the asking price is often higher than the sales price[1] and, therefore, indicators of centrality, like averages, of asking prices overstate market values.

In the Italian context, Curto *et al.*. (2009) considered the number of transactions as an indicator for detecting market dynamics, both in relation to location - represented by territorial segments of the local real estate market - as well as in relation to the physical characteristics of the traded properties (size, age of construction, architectural and building types, etc..).

On the other hand it might be interesting to see if asking price variability could represent market variability. The underlying basis of this hypothesis is the strong link of asking prices to market liquidity.

The statistical approach proposed for the analysis of asking prices should still be related to the specificity of the Italian context, characterized by generalized lack of transparency as well as by a high degree of differentiation of the properties and by the fact that supply is largely made up of subjects that can be assimilated to buyers. By acting simultaneously, such conditions amplify the variability of prices and the action of stochastic components present in every market.

This paper seeks to ascertain whether asking prices can be used to represent market variability. A similar approach was also developed in the real estate investment field (see Brown (1985) to empirically test the relationship between assessments and asking prices. Again, it is necessary to reiterate the fact that the Italian real estate market is quite opaque with no reliable sources for market prices. Therefore asking prices are most often the only data source available.

The Statistical Model

Consider a random vector (X, Y), where X represents the asking price and Y is the transaction price of a real estate property. The statistical analysis presented here is intended to introduce a measurement that can quantify the ability of asking price variation to represent market variation. To this end, a preliminary analysis of the variation of vector (X, Y), based on Principal Component Analysis (PCA), is proposed.

1 "Often has an "asking price," that is, a price at which he tries to sell, usually above the price of the actual sale. In the same way there is often a "askingding price," which is usually below the price of the actual sale. The price of sale thus generally lies between the prices first asking and asked." (Irving Fisher (1912) The Nature of Capital and Income).

The technique known as PCA was introduced by Pearson (1901) and Hotelling (1933). PCA is traditionally used in statistics to reduce the size of a vector; see for example, Wold, Esbensen and Geladi (1987). In fact, the goal of the analysis is to consider p variables and to use linear transformation to transform them into uncorrelated p variables. The transformed variables are ordered so that the first explains the largest total variance, the second is second with respect to the total variance that it can explain and so on.
The i-th variable is called the i-th principal component, which we name PCi. When PCA is performed, it is hoped that most of the contributions of the transformed variables to total variability will be negligible. In this case, the variability of the data can be adequately described by the few components whose variance is not negligible.
The best results are obtained when initial data is highly correlated; in fact, if the data is not correlated, PCA does not work. For this reason the linear correlation coefficient is calculated in advance. To summarize, the goal of PCA is to represent 20 or 30 variables having few principal components. In this study, we propose using PCA for a different purpose: to ascertain whether data supports the existence of a common component that can explain almost completely the total variability of the pair (X, Y). To this end, with PCA, vector (X, Y) is represented as a linear combination of the two principal components PC1 and PC2. The model shows the percentage of total variance explained by each component. To analyze the relationship between the variations in askings and sales, we must verify whether the contribution of the second principal component of total variability can be considered negligible. In this case, the ability of the first component to explain almost the totality of the variation would support a strong common source of variability in both markets, represented by asking prices X and sale prices Y. These preliminary considerations reinforce the analyses that follow.

We recall the classic linear regression model (as a classic reference see Mood, Graybill, Boes (1974) and Chatfield (1983)) to introduce a measurement that can represent the percentage of market variability explained by asking prices.

Assuming a linear relationship between the variables, we have:

$$E[Y|X=x]=ax+b, \tag{1.1}$$

or

$$E[Y|X]=aX+b. \tag{1.2}$$

The regression model is then:

$$Y=aX+b+E, \tag{1.3}$$

where E is the random component that cannot be explained by X, so we assume that the random error is independent from X.
Let

$$\hat{Y} = a\,X+b$$

The analysis of the standard variance of the linear model is based on the following formula:

$$V[Y] = V[\hat{Y}] + V[E] \tag{1.4}$$

The index normally used to verify the goodness of the linear model is based on the above formula and is defined by the following[2]:

$$R^2 = V[\hat{Y}]/V[Y] = 1 - V[E]/V[Y] \tag{1.5}$$

Since

$$V[\hat{Y}] = a^2 V[X]$$

we have

$$V[\hat{Y}] = a^2 V[X] + V[E] \tag{1.6}$$

The variance of Y is decomposed into two parts, through the variance of X and the variance of the residuals.
Since

$$V[\hat{Y}] = a^2 V[X]$$

we have

$$R^2 = \frac{a^2 V[X]}{V[Y]}$$

It follows simply that:

$$V[Y] = \frac{a^2}{R^2} V[X] \tag{1.7}$$

Since Y is the transaction price and X the asking price, we define the measurement of market variation explained by the variability of askings by means of the index:

$$I = \frac{a^2}{R^2} \tag{1.8}$$

Based on these theoretical considerations, we intend to verify if V [X] can be considered a good proxy to explain the variability of Y. To this end, we perform standard linear regression to estimate a, b and R^2. The expected result is that both slope a and R^2 are close to one. Consider therefore a

2 When we consider a simple linear regression, the coefficient R^2 is equal to the coefficient of correlation ρ.

random sample (X_1, Y_1), ..., (X_n, Y_n) extracted from the population (X, Y), where X is the asking prices and Y the sales prices. Let (x_j, y_j), j = 1, ... n the sample realizations and let $\hat{y} = ax_j + b$, j=1, ..., n.
We estimate the coefficients using the least squares method. The estimates â and $\hat{b}$ of a and b are respectively the solutions to the following optimization problem based on the sum of the squared deviations:

$$\min_{\{a,b\}} \sum_{i=1}^{n} (y_i - \hat{y}_i)^2 \tag{1.9}$$

Please note that the least squares estimators are the best linear, undistorted estimators. The estimator of the coefficient R^2 is:

$$\hat{R}^2 = 1 - \frac{SS_{Res}}{SS_{Tot}} \tag{1.10}$$

Where

$$SS_{Res} = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

and

$$SS_{Tot} = \sum_{i=1}^{n} (y_i - \bar{y}_i)^2$$

In order to take into account the model's degree of freedom, we consider the adjusted coefficient R^2, R^2_{Adj} (a standard reference is Mood, Graybill Boes (1974)).

By estimating R^2, R^2_{Adj} and the standard errors associated with the parameters, we verify, together with the estimates, the goodness-of-fit of the linear model in representing the relationship between asking and sales prices. In this way, we also verify if the regression model fits the data well, representing the relationship between asking and sales prices. Finally, in equation 1.7), we estimate the percentage of market price variability explained by asking prices. The sample incidence for the estimate is then:

$$\hat{I} = \frac{\hat{a}^2}{\hat{R}^2} \tag{1.11}$$

Furthermore the corrected sample incidence can be defined in a similar manner to (11) replacing R^2 with R^2_{Adj}:

$$\hat{I}_{Adj} = \frac{\hat{a}^2}{\hat{R}^2_{Adj}} \tag{1.12}$$

It should be emphasized that if the estimates of the intercept and R^2 are both close to the one, asking prices can be considered a good proxy for sales prices, relative to variability. It must also be stressed that the coefficient I is closely related to the linear model and its value depends on the regression coefficients. In the next section, we will carry out this analysis on the case study in question: the Turin real estate market.

THE TURIN REAL ESTATE MARKET

To begin, in Turin, like in all of Italy, the percentage of ownership is very high as a result of fiscal and credit policies that have historically granted access to the property market by lower and lower-middle classes, thus producing a contraction in the rental market. In all of Italy, Turin is the third city in terms of market dynamism, meaning the number of transactions in the residential sector. The city is also distinguished by generally lower property values than other Italian cities (Rome, Milan, Florence, Bologna, Bari, etc.) having better quality real estate.

The dynamism of the Turin real estate market is certainly due to the fact that since 1995, after a long period of virtually zero construction activity, the city has worked with a new City Plan that introduced a considerable number of brownfield sites into the real estate market, in particular into the residential sector. Their construction began in the late 90s in the presence of relatively low land costs - given the size of building lots offered. In fact, construction has been completed and almost totally absorbed by the market thanks to the competitiveness of new building - with respect to the "used" housing market - in terms of price and quality.

It can therefore be concluded that building, notwithstanding the fact that it began with the housing crisis during the second half of the 1990s, was virtually completed before the onset of the new crisis in 2009. In addition, the number of transactions grew due to the low cost of borrowing; the progressive increase in real estate values in Turin did not produce the real-estate bubble that had such devastating effects in many other cities - and not only in Europe.

In fact, the 1995 City Plan had the effect of moderating prices thanks to lower land costs, thus producing positive effects on the used housing segment consisting of existing stock. In fact, since the second half of the 1970s, the prevalence of constraint-based planning had effectively blocked construction activity - and as a consequence, supply - causing the real estate market to progressively include only existing stock and causing prices to increase due to the tensions in the relationship between supply and demand. The City Plan thus allowed a market of new housing to take form in Turin which thereby produced important changes in terms of spatial hierarchies and buyer behavior by helping restore a balance between quality and price, also by limiting variability.

In fact, variability, in and of itself, is a peculiar feature of the real estate market due to the fact that, as has already been mentioned, prices depend on a large number of variables that are mostly qualitative, due to the high level differentiation of the properties and the city's historic, urban and architectural stratifications. Today, the housing market is divided into 40 territorial segments denominated micro-zones (see Fig 1 and Table 1), whose boundaries and hierarchies are constantly monitored by the

Real Estate Observatory of the City of Turin (Osservatorio Immobiliare della Città di Torino - OICT). The OICT has been active since 2000. Instituted through the collaboration of the Turin Polytechnic with the City of Turin, the organization's primary goal is to monitor the real estate values in the city's 40 micro-zones. These zones were identified in compliance with DPR 138/98 (Regulations for the general revision of the census areas, the rates of valuation of urban real estate units and the criteria and the cadastral commissions pursuant to Article 3, paragraphs 154 and 155 of Law n. 662, 23 December 1996) segmenting the municipality into areas that could be more responsive to the quality of the real estate market and the territory itself. Semeraro empirically (2011) verified that these zones act as market segments that are unrelated to one another. At the same time that the databases were being systematically implemented, a robust methodology was developed for the detection and analysis of the residential real estate market. The OICT information system has been gradually strengthened and expanded so that it can now make use of structured databases with historic series and differentiated between the segments of used and new construction/total renovation.
The OICT uses a Geographic Information System as well as alphanumeric databases and appropriate cartographic bases; for further information regarding these aspects, see Curto Fregonara (2002). Of fundamental importance for refining observations and furthering its scientific mission (collection, analysis, communication, etc..) was the development of a "quality-control process" including the automation of some operations. This procedure has substantially improved the robustness and reliability of the results of the work carried out by the center. Since 2006, in accordance to a Memorandum of Understanding, the OICT relies on the presence of the Turin Chamber of Commerce and the involvement of major real estate organizations (brokers and builders).

Figure 1 Turin's 40-micro-zones

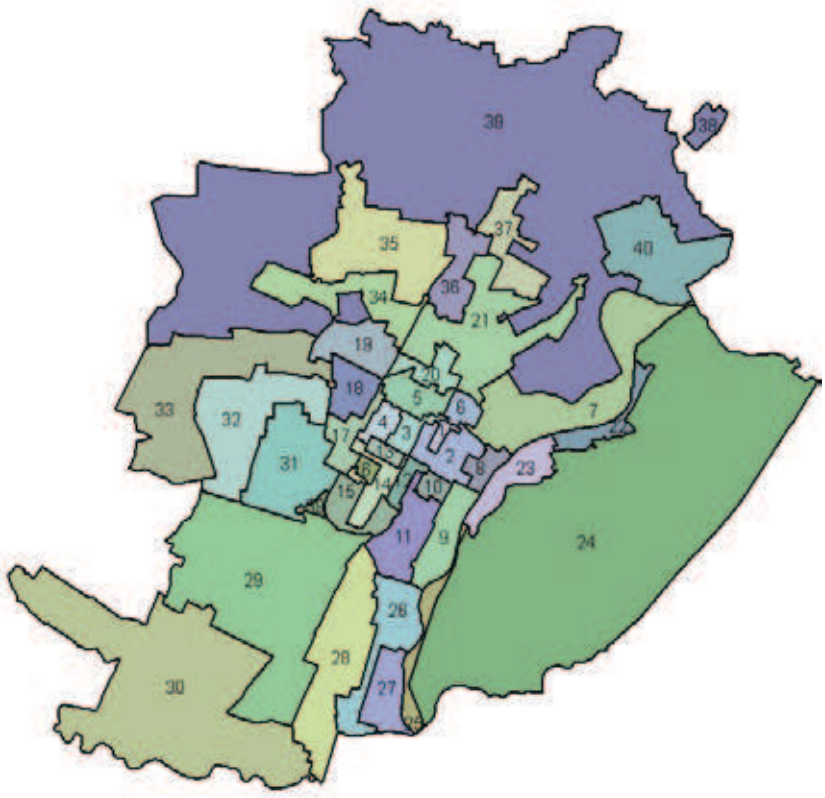


Table 1
The 40 Micro-zone

01	Roma
02	Carlo Emanuele II
03	Solferino
04	Vinzaglio
05	Garibaldi
06	Castello
07	Vanchiglia
08	Rocca
09	Valentino
10	San Salvario
11	Dante
12	San Secondo
13	Stati Uniti
14	Galileo Ferrarsi
15	De Gasperi
16	Duca D'Aosta
17	Spina 2 – Politecnico
18	Duchessa Jolanda
19	S. Donato
20	Porta Palazzo
21	Palermo
22	Michelotti
23	Crimea
24	Collina
25	Zara
26	Carducci
27	Unità d'Italia
28	Lingotto
29	Santa Rita - Mirafiori
30	Mirafiori Sud
31	San Paolo
32	Pozzo Strada
33	Aeronautica – Parella
34	Spina 3 – Eurotorino
35	Madonna Di Campagna
36	Spina 4 – Docks Dora
37	Rebaudengo
38	Corona Nord Ovest
39	Spina 1 – Marmolada
40	Barca Bertolla

THE SAMPLE

The sample is made up of asking prices and market prices (2008, 2009, 2010) organized in a real estate transaction database whose sources were real estate agents who communicated the data to the OICT.

Of the 514 transactions in the sample, the following characteristics can be observed:
Asking price, sales price, size (square meters), amount of time on the market and date of sale.
The data covers real estate units ranging in size from 45 to 160 square meters. The following tables show the mean and estimated variance in euro/sqm and (euro / sq m)^2.

Table 2 - Descriptive statistics: Total sample

Offer prices mean	Offer prices variance	Sale prices mean	Sale prices variance
2365,1	909857,7	2148,5	842106,7

Table 3 - Yearly descriptive statistics: Sale Prices

Year	Number	Mean	Variance
2008	244	2222.68	396418.2
2009	135	2602.45	1706438,5
2010	135	2386,14	967493,0

Tabella 4 - Yearly descriptive statistics: Sale Prices

Year	Number	Mean	Variance
2008	245	2007,790	363600,6
2009	135	2377,481	1667343,2
2010	135	2174,726	811032,1

One of the most important pieces of information regarding each real estate unit is the micro-zone in which it is located, making it possible to analyze local market dynamics. In fact, the micro-zones can be considered true territorial segments in the real estate market where properties are homogeneous not only in terms of their location but in terms of some of the building-related characteristics regarding period of construction, a condition which effectively reduces the variability of values in relationship to that of the entire city. For this reason, the regression is carried out not only in reference to the entire city but also to some sub-samples selected from different micro-zones. It is important to recall that the methodology for market data collection implemented by OICT aims at statistically significant data coverage in each micro-zone. Regarding the sample, referring to actual sales data provided by real estate agents[3], it should be noted that the data was not collected directly and so is not sufficient to cover all of the city's 40 micro-zones, also due to of their effective dynamism. In fact, the sample of effective prices is not evenly distributed geographically: the large amount of data is not significant only in some micro-zones . For this reason, as a first analysis, the micro-zones in which the sample size is greater than 30 were selected for the local analyses.
The number of findings for each micro-zone, the sample means and sample variance are presented below expressed in eur /sqm and (euro / sq m) [2].

Table 5 Descriptive statistics by micro-zone

Micro-zone	Number of sample components	OP Mean	OP Variance	SP Mean	SP Variance
7	33	2842,448	1033105,72	2623,159	988209,88
15	38	2905,784	339978,91	2715,039	293292,19
19	59	1764,983	168982,07	1646,902	156945,35
21	45	1804,882	67447,14	1553,959	76355,41
29	30	2471,613	215595,35	2264,998	205646,12
33	48	2375,015	340801,14	2158,353	310713,28
35	42	1834,914	90564,07	1660,709	78834,38
37	41	2017,998	89847,81	1746,593	79038,70

3 Data is communicated to OICT in the terms established by the 2006 Memorandum of Understanding between the Turin Polytechnic University, the City of Turin and the Turin Chamber of Commerce and the major industry associations (real estate agents and builders).

MICRO-ZONE EMPIRICAL RESULTS

As mentioned in paragraph 2, PCA was performed in advance confirming the presence of a strong common component explaining most of the total variance. The total variability shows strong common roots, therefore justifying the idea of approximating market variability through the variability of asking prices.

Principal component analysis

The analysis begins with the calculation of the empirical correlation coefficient between asking and sales prices p(X, Y) = 0.98, to then carry out PCA. The following table shows the estimated percentage of variance explained by each principal component, corresponding to each sample:

Tabella 6 Explained variance of the principal components

	PC1	PC2
Total Sample	0,99	0,01
Year 2008	0,99	0,01
Year 2009	0,99	0,01
Year 2010	0,99	0,01
Micro-zone 7	0,99	0,01
Micro-zone 15	0,99	0,01
Micro-zone 21	0,94	0,06
Micro-zone 29	0,97	0,03
Micro-zone 33	0,99	0,01
Micro-zone 35	0,97	0,03
Micro-zone 37	0,94	0,06

The conclusion that each sample has strong common roots that can explain at least 95% of the sample's volatility is evident. This analysis justifies the search for a measurement that can quantify to what degree the variance of askings might serve as a proxy for the variance of sales.

Incidence analysis

In this section we present the results of the regression. The estimated parameters for the total sample are:

Table 7 Estimates of the regression coefficients: Total Sample

$\hat{a}$	$\hat{a}$ **st.error**	b^2	$\hat{R}^2$	$\hat{R}^2_{Adj}$
0.95	0.06	-96	0.97	0.97

Both R^2 and R^2 a guarantee the goodness-of-fit of the linear model. The linear regression explains

97% of the volatility of market prices. Furthermore, the slope is 0.95 and the standard error is small. The total sample supports the hypothesis of a linear relationship between asking and sales prices in Turin's real estate market. We have:

$$\hat{I} = 93\%, \qquad \hat{I}_a = 93\%$$

The empirical values obtained allowed us to deduce that the variance in asking prices might be a good proxy for market variability.
Since the data covers a three-year period, we perform regressions on the samples from single years to test whether each year shows consistent behavior with respect to both the goodness of the linear model as well as the significant incidence found for the overall period. The following table shows the estimated results corresponding to each year as well as the estimated regression coefficients, the standard error associated with the slope, R^2, R_a^2, and the corresponding incidences.

Table 8 Estimates of regression coefficients: annual samples

Year	$\hat{a}$	$\hat{a}$ **st.error**	$\hat{b}$	$\hat{R}^2$	$\hat{R}^2_{Adj}$	$\hat{I}$	$\hat{I}_a$
2008	0,93	0,01	-63,23	0,95	0,95	0,91	0,910421
2009	0,98	0,01	-175,47	0,98	0,98	0,98	0,980000
2010	0,9	0,01	20,26	0,97	0,97	0,84	0,835052

The estimated values of R^2 and R^2_a confirm the goodness-of-fit of the linear model for each year. Moreover, estimated incidences are close to one, suggesting that, in each year, the supply market has a variability that is similar to transaction variability. The highest empirical incidence was calculated for 2009. It can be observed that the incidence for the entire period is closer to one than the incidence calculated for each year (except 2009) suggesting that, in the long run, the supply market is better able to represent the real estate market, in terms of variability.
On the other hand, the spatial heterogeneity mentioned in the previous section and represented by Turin's 40 micro-zones makes it necessary to extend the analysis to some spatial segments of the real estate market to see if these confirm the results obtained by analyzing Turin's overall market. The expected result is that the relationship between asking and sales prices remain valid even in the territorial segments considered, each with their own dynamics. This hypothesis is based on the results reported in Knight *et al.*. (1998): the relationship between asking and sales prices is substantially the same in the market segments that they considered, which, like Turin's micro-zones, are defined by geographic and typological characteristics.
Since the data samples from the 40 micro-zones are not numerous enough to carry out the analysis for each single year, we considered the overall 2008-2010 period. The following table illustrates the regression results showing, for each micro-zone, the estimated regression coefficients, the standard error of the slope, $\hat{R}^2$, $\hat{R}^2_{Adj}$ and incidences $\hat{I}$ and $\hat{I}_a$.

table 9 - Estimates of regression coefficients: micro-zones analyzed

Micro-zones	$\hat{a}$	$\hat{a}$ **st.error**	$\hat{b}$	$\hat{R}^2$	$\hat{R}^2_{Adj}$	$\hat{I}$	$\hat{I}_a$
7	0,96	0,03	-110,10	0,97	0,96	0,95	0,960000
15	0,91	0,03	77,95	0,96	0,95	0,86	0,871684
19	0,95	0,02	95,50	0,95	0,96	0,95	0,940104
21	0,93	0,07	-132,00	0,77	0,76	1,12	1,138026
29	0,91	0,07	16,10	0,87	0,86	0,95	0,962907
33	0,93	0,03	47,20	0,95	0,94	0,91	0,920106
35	0,87	0,05	64,00	0,87	0,87	0,87	0,870000
37	0,83	0,07	64,60	0,80	0,78	0,86	0,883205

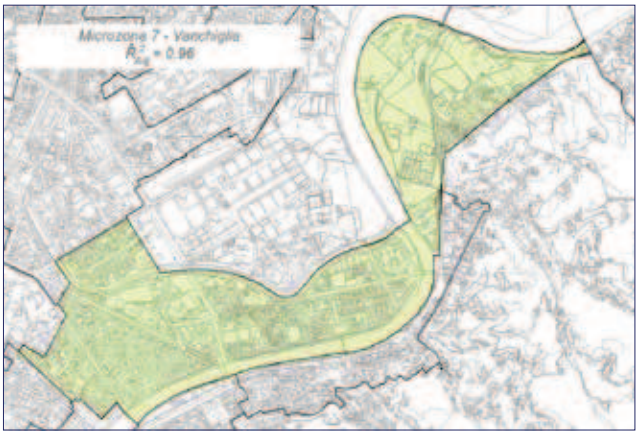
The assumption that each micro-zone is a market segment with its own characteristics and dynamics is confirmed by the results obtained through the local application of the regression model.

In general, it should be noted that in all micro-zones, the data is consistent with the hypothesis of representing market variability through asking prices:

- coefficient R2 is always greater than 70% and varies between 83% and 96%.
- the angular coefficient is always greater than 90%, with the exception of micro-zones 35 and 37 in which it is always greater than 80%.
- incidence is always greater than 85%. With the exception of micro-zone 21, it is always less than 100%, indicating that the volatility of askings is greater than that of the transaction market in which demand also acts.

It may be helpful to make some observations regarding the single micro-zones.
The best linear fit is found in micro-zones 7, 15, 19 and 33. The common feature of these four segments of the real estate market is that, during the period under consideration, they are characterized by the presence of a great deal of new construction and private residential buildings.
More in detail, micro-zone 7 (fig. 2) is characterized by a heterogeneous urban context in terms of construction, in part made up of 19th century construction and in part more recent construction. It is characterized by its qualifying relationship with the river Po and the presence of several quite extensive industrial areas (Italgas area, ex- Rivoira areas, ex- Cigala –Bertinetti areas). Examples of architecture by Alessandro Antonelli are also present. Buildings are destined mostly for residential and commercial use.

Fig. 2 Micro-zone. Source OICT

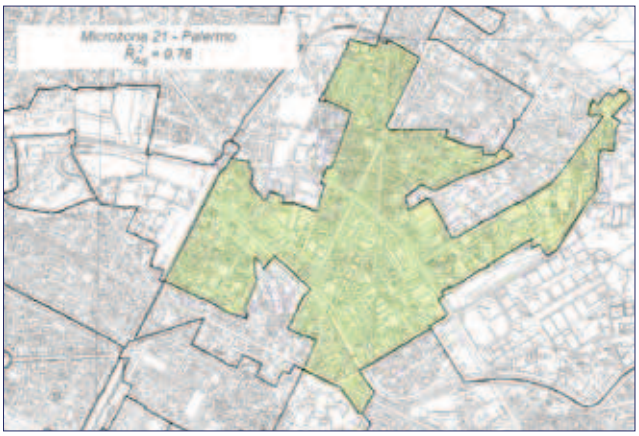


Micro-zones 15, 19, 33 (Fig. 3) are spatially homogeneous. From an urban point of view, micro-zone 15 is historically significant with an urban fabric developed between the last quarter of the 19th century and the early decades of the 20th with the important presence of the Orbassano extra-urban road axis. Recent urban transformations - with the construction of the railway link and the burial of the railway as a result of the implementation of the Central Spine - gave strong impetus to the area's regeneration. Micro-zone 19 is historically significant. Built after the first period of early industrialization, it has a homogeneous urban fabric formed during the second half of the 19th century along the historic Via San Donato road axis. The area is characterized by predominantly residential and commercial uses.
Micro-zone 33 is characterized by its heterogeneous urban fabric, in part with recent construction and in part with buildings dating from the early decades of the 20th century. The area has hosted numerous industrial activities mainly in the mechanical sector; it is characterized by building types that frequently display the characteristics and traits of the more recent industrial reconversion.

Fig. 3 Micro-zones 15,19,33. Source OICT.

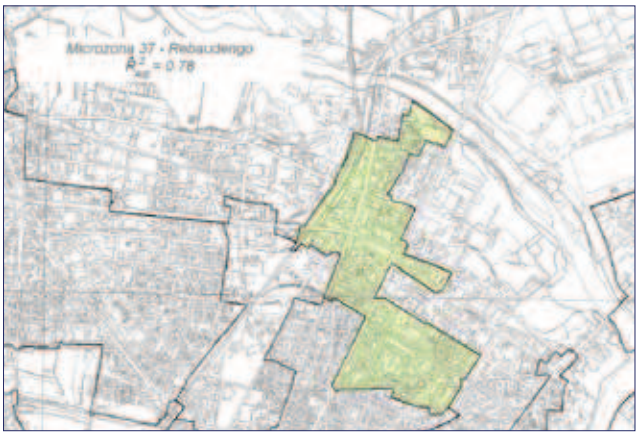
All of this is consistent with the fact that in the new housing segment - given the properties' greater homogeneity - there may be less variability in asking and sales prices and in any case, they are usually closer to real prices. Even the unexpected result in micro-zone 21 (Fig. 4), where empirical incidence is greater than 100%, can be explained.

Fig. 4 21 micro-zone. Source OICT



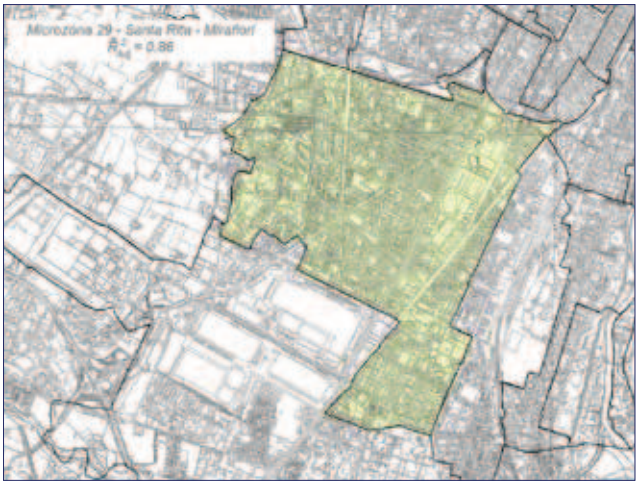
Micro-zone 21 is an environmentally significant urban context with connections of the city's periphery in the Milan direction. The urban image corresponds to late 19th century expansion and the built context is predominantly continuous residential fabric with many brownfields that are decommissioned or undergoing conversion. These last projects, in fact, may have increased the market variability. The worst fit was found, instead, for micro-zone 37 (Fig. 5), where the sample incidence is less than 90 %.

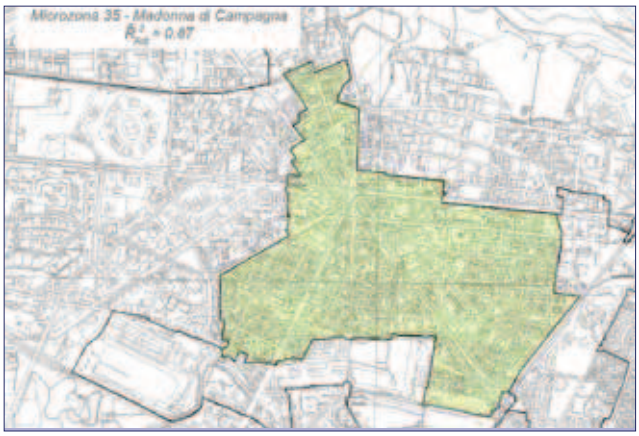
Fig. 5 - Micro-zone 37. Source OICT.



Micro-zone 37 (Fig. 5) is a peripheral area of urban expansion with recently constructed low-cost intensive residential fabric in fairly good condition, mainly characterized by its continuous street fronts creating closed blocks.
It should also be noted that micro-zones 35, 29 (Fig. 6), where R^2 is less than 90%, are peripheral and highly heterogeneous.

Fig. 6 - Micro-zones 29, 35. Source OICT.





In detail, micro-zone 29 is a large urban context with environmental and historical connotations, stratified in large part between the 1950s and70s and supported by important road axes. The urban fabric is characterized by commercial activities, by the presence of the Municipal Stadium complex and other public infrastructure with good quality services. Recent works carried out for the Olympics (2006) have triggered widespread regeneration processes. Micro-zone 35 is an urban context with environmental and historical connotations formed as a result of the presence of large industrial structures, many of which are undergoing conversion, with a varied building fabric in terms of period of construction and conditions.

CONCLUSIONS AND FUTURE RESEARCH

By its very nature, the real estate market displays great intrinsic variability of prices, insofar as many contributing factors that affect demand, supply and property act on their mechanisms of formation. In fact, the real estate market is characterized by a typical kind of monopolistic competition, taken to extremes:

- traded properties not only comply with the principle of homogeneity but have quite a high level of differentiation due to the variation in typological, historical and building characteristics and to their construction, technological, environmental, territorial and urban planning quality;
- demand consists of individuals with purchasing or investment behaviors that are not always rational , also taking into account aspects regarding use values;
- supply consists mainly of subjects or individuals rather than economic entities such as companies that should characterize it.
- The variability in real estate prices is also higher due - at least in Italy – to poor market transparency which amplifies the action of the stochastic components that are present in every market.

Even with these assumptions, the results of the experiments show with absolute clarity that asking prices are, in any case, proxies for real sales prices, albeit subject to certain specificities.

First, the ability of asking prices to represent effective sales prices improves and is greater when the market segments considered are homogeneous in terms of their physical/construction and spatial characteristics. From this point of view, therefore, once again, the importance of considering the market in segments that are as homogeneous as possible, in terms of construction (such as new and used) and location (like Turin's 40 cadastral micro-zones), is apparent. It follows - only in the absence of real prices of course - that transaction prices can be used while considering their relative limits and seeking to improve methodology. The work that lies ahead is the verification of the validity of marginal prices when undertaking predictive analyses.

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