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Chapter 9

The form of the city and the location strategies of households: empirical evidence from northern Italy

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1. Explaining the urban sprawl through the real estate market analysis

In the last twenty years, the Italian urban development has been marked by the growth of the midsize and small urban centers and of the suburban metropolitan areas and by the decline of the major cities. Such a phenomenon has raised a debate that, theoretically and empirically, questioned the very nature of the form of the city.

In particular, the evolution of the urban form has weakened some traditional oppositions such as city/country, center/periphery, partly inadequate to describe the empirical experience as the scientific analysis. To define rigorously phenomena that are still evolving is not easy. Somewhat schematically, there are two major elements that mark the *diffused cities* in Northern Italy (Cer 1996; Indovina 1990, 1996).

The first one is the low density in the land use. These new urban developments have all the physical and the functional elements that are present in the traditional cities, except the spatial density. In comparison with the traditional city, the diffused city loses a key attribute: the physical proximity (and the high density in the land use) are no longer crucial for agglomeration economies, the very base of the city formation (Camagni 1992).

The second element is the network form of the urban and territorial relationships. If in the past the relationships between the inner and the outer city were based on hierarchy, in the diffused city horizontal and non-hierarchical relationships are dominant, and specialization and complementary prevail on functional subordination[1].

Some researches have identified and classified this phenomenon, while some other ones considered its implications with concern to the planning (Boscacci e Camagni 1994; Camagni 1996). Its interpretation is crucial if we want to test the hypothesis according to which the sprawl would be "a new type of city that is born form the crisis of the former one" (Secchi 1994).

An important step ahead is represented by the analysis of the Northern Italy socio-economic processes. Indovina (1996) develops an analysis adopting two complementary points of view. The first one takes into account the agricultural and industrial developments as the key drivers of the urban settlements into areas much larger that in the past. The second one considers such an evolution as the result of individual behaviors. In a network functioning area, if the center does not represent the area offering the best accessibility, it is possible to sustain that households and firms location choice depends upon the identification of the new central locations that assure the highest advantages.

[1] On the evolution of the territorial structure into a network based model, Dematteis (1992, 1996).

Further elements are necessary for an adequate analysis of the individual location strategies. Indovina (1996) underlines that there is no location choice since households are actually compelled to leave the inner city: the high real estate prices and the higher cost of living would force households to leave.
This last point gets into conflict with the new relationships between inner and outer city analyzed before. If the inner city in no longer the area in which all the economic and recreational activities concentrate, the market should register that lowering the inner city real estate prices and rents: the first argument is in conflict with the second one and the result is that individual households location choice keeps on being unexplained.
The analysis of the individual location strategies is then crucial. Secchi (1994) states that the households location choice depends on the higher "quality of living" that mark these new settlements, in which more land and more urban facilities are available with respect to the traditional high density city.
More broadly, the arguments developed by Secchi (1994) move from the analysis of the social stock of infrastructure and facilities available. Northern Italy cities grew in these last decades with little concern for infrastructures and urban facilities. The urban sprawl would then represent the adaptive strategy of households to this inadequate social stock available in these recent years. Households would then get away from the discomforts of the traditional and compact cities.
Two problems remain with no answer. The first one concerns the impact on the urban form of the production of new infrastructure and urban facilities. There is no reason why new collective facilities should lead to a more compact city. It could perfectly be the opposite: the case of new urban highways or metropolitan railways seem to have the opposite effect. It is necessary to identify which facilities and which infrastructures appear to be crucial in the location choice. Infrastructure and facilities embrace any type of service and building. It is not correct to assume that they share the same importance.
Assuming the hypothesis that a relevant part of households principally decided to move to the urban sprawl and rejecting that people were just forced to leave (at least in the major part of the cases), it is important to analyze the individual preferences that lead location choices. If we determine which infrastructure and which facilities are crucial in the location choice, it is possible to identify the rationale of an individual decision - the real estate investment - that profoundly affects a collective process - the transformation of the urban environment.

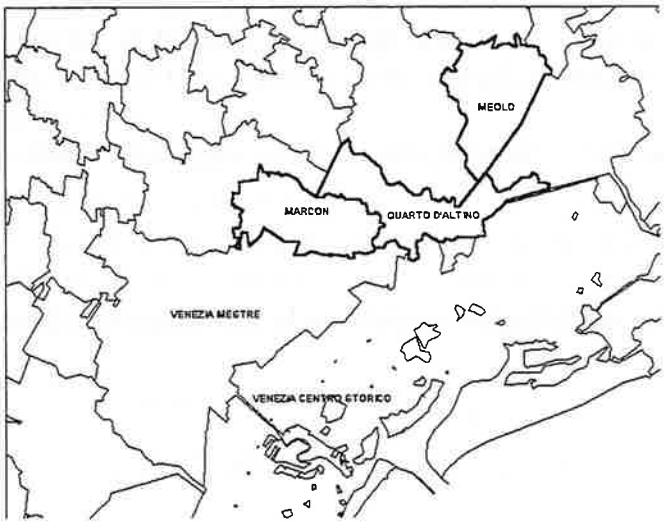
2. The real estate market in the Venice metropolitan area

The goal of the research is to give a contribution to the analysis of location choices of households in the urban sprawl areas through the real estate market analysis.
The case study concerns a part of the vast metropolitan area between Padova, Venice and Treviso. In This area has known in the last few years important migratory movements in particular from the city of Venice. Whereas Venice between 1981 and 1991 has lost one inhabitant out of ten, the population of the area considered in the case study grew 20% in the same decade[2].
Such a demographic growth was the base for an active real estate market. If we compare the housing price dynamics in the case study area with the Venice real estate prices trend, we find that

[2] Source: Istat.

in the four years period 1992-1995 annual rate of increase has been 5.6% while Venice real estate market has known a decrease of 4.3% per year[3].

Fig. 1- Location of the real estate markets



The sample taken into account considers 75 transactions in the market segment of the new living units built and sold between 1991 and 1995. Besides the price (total and per sq. m.), data around structural and location features has been collected (app. 1).
The area in which are located the living units of the sample have different accessibility to metropolitan network of roads. Two municipalities are connected to the metropolitan area through a free highway, whereas a third municipality is connected only through a county road.
The living units of the sample differ for their different accessibility to urban facilities. In the survey, data has been collected with concern to the distance to public transports, schools, nursery, malls, parks and natural areas.
The buildings in which the sample's living units are located count normally two or three floors, with around ten living units. Roughly the half of them have a private garden around the building. Considering the structural features, the size of the living units is around 90 sq. m, divided into 4 four rooms and two bathrooms. A terrace is normally present. The garage - always sold with the living unit - can receive one or two vehicles. The quality of the construction and of the maintenance are generally high and constant throughout the sample.
Total prices vary form a minimum of 84 million of Liras (around 47,000 $) to a maximum of 414 million of L. (around 230,000 $), while the average price is 215 millions (120,000 $). Prices for sq. m vary from 3.4 million per sq. m (1,850 $ per sq. m) - the top - to 1.5 million per sq. m (830 $ per sq. m) - the least price - while the average price per sq. m reaches 2 million per sq. m (1,100 $ per sq. m).

3. Hedonic prices and demand preferences

[3] Source: Cresme-Sistema Informativo.

An approach broadly used to analyze housing prices in order to estimate the implicit marginal prices is the hedonic price method. The hedonic prices are defined as implicit prices since they refer to just one characteristic of the living unit; they are also called marginal since they show the variation of the total price at the variation of the characteristic (Simonotti 1993, pp. 163-164).
Hedonic prices are normally estimated with multiple regression analysis. The forms of the models can be different. Three types of models are currently used in urban economics studies: linear, exponential (or semi-log) and multiplicative (log-linear) (Del Giudice 1994; Weirik e Jerry Ingram 1990).
In the linear model, the functional relationships can be expressed as follows:

$$y = k + b_i x_i + b_2 x_2 + \ldots + b_n x_n$$

The exponential and the multiplicative models can be expressed as follow:

$$y = e^{b0 + bi\,xi + b2\,x2 + \ldots + bn\,xn}$$

$$y = b_0 x_1^{\,bi}\, x_2^{\,b2} x_n^{\,bn}$$

These last two functional forms can be modified into linear models through the logarithmic transformation of the variables.
In the linear model, coefficients represent the hedonic prices and they estimate the constant variation of the living unit value for the variation of the feature taken into account. In the exponential and in the multiplicative models, hedonic prices vary in function of the amount of the characteristic and of the dependent variable. In particular, in the exponential model the hedonic price of the living unit characteristic can be determined as follows:

$$dy / dx_i = b_i\, y$$

The hedonic price can be estimated multiplying regression coefficient by the dependent variable: the hedonic price is no longer a constant value (as it was in the linear model) but it varies in function of the price.
In the multiplicative model, hedonic prices can be estimated as follows:

$$dy / dx_i = b_i\, (y / x_i)$$

In such a case, the hedonic prices are positively related to the price and inversely related to the extent of the characteristic.

The semi-log model and the log-linear one evaluate eventual non-linear relationships between the dependent and independent variables. It is not possible to state a priori the superiority of one specific functional form (Brotman 1990), even though the exponential form has been successfully used in several researches (Brookshire *et alii* 1982). In this study, the functional form has not been assumed *a priori*, but it has been chosen according to its specific performances.

4. The models

The first model presented in table 1 shows the relationships between the total price of the living unit and some structural and location characteristics.
Besides the number of square meters, the most relevant variable is the accessibility to the metropolitan area shopping facility: the mall. It must be underlined that this variable is strongly correlated with the proximity to urban highway (0.69).
The model shows also that some building and living unit features contribute significantly to the prices: the presence of the garden, the number of the terraces, the floor of the building. Finally, housing prices rise along the years.
The R^2 of the model is 95%. The real estate literature considers that 0.9 is the threshold value in order to use the model for predictive uses and not just for market interpretation (Simonotti 1989). The model has been successfully tested with concern to the multicollinearity problem and with respect to its basic assumptions (Curto e Simonotti 1994; Berenson e Levine 1989).

Tab. 1 - Total price regression model

$$\text{Total price} = 7.421.978\ \text{Supal}^{0,6582}\ \text{Terin}^{0,1211}\ \text{Garde}^{0,1055}\ \text{Annov}^{-0,1857}\ \text{Balcon}^{0,0561}\ \text{Piano}^{0,0480}$$

R^2= 0,955
R^2 adjusted 0,952
Standard error of the estimation: 0,08994

	Std error of the coeff.	"t" test	t prob
Intercpt	0,2086	75,8240	0,000
LNSUP	0,0450	14,6025	0,000
LNTIN	0,0164	7,3840	0,000
LNGAR	0,0214	4,9093	0,000
LNANN	0,0365	-5,0829	0,000
LNBAL	0,0215	2,6089	0,011
LNPIA	0,0253	1,8908	0,062

A second exponential model has been set putting as the independent variable the price per sq. m. of the living unit. New structural variables enter this model: the number of bathrooms, the number of rooms, the number of the apartments located in the building.

Tab 2 - Price per square meter regression model

Ln (price per sq m) 14,7716 + 0,1884 Terin - 0,0478 Annov + 0,0463 Terco + 0,0251 Piano - 0,0011 Supal - 0,0413 = Bagni + 0,0679 Garde - 0,0229 Vania + 0,0247 Balco - 0,0019 Allog

R^2= 0,812
R^2 adjusted 0,783

Standard error of the estimation: 0,09285

	Std error of the coeff.	"t" test	prob. of t
Intercpt	0,0975	151,4839	0,0000
TERIN	0,0333	5,6530	0,0000
ANNOV	0,0100	-4,7538	0,0000
TERCO	0,0265	1,7426	0,0861
PIANO	0,0084	2,9635	0,0042
SUPAL	0,0004	-2,4394	0,0174
BAGNI	0,0241	-1,7149	0,0911
GARDE	0,0467	1,4551	0,1505
VANIA	0,0153	-1,4922	0,1405
BALCO	0,0296	0,8356	0,4064
ALLOG	0,0026	-0,7171	0,4759

The R^2 index lowers to 0.81. Nevertheless, such a result is satisfying for a model in which the independent variable is the price per sq. meter and not the total price[4].
The interpretation of the two models is dived in two parts. In the first one, the goal is to understand the role of the structural features and the environmental ones in the value functions. In the second one, the goal is to analyze the relationships between accessibility and housing prices, a crucial issue in order to understand the new form of the urban structure.

5. The qualities that generate value

All the analysts agree that the most powerful driver in the housing market is the "quality of living"[5]. This expression is somewhat ambiguous. The expression "quality of living" have different meanings according to specific demand preferences that mark specific market segments.
Schematically, the quality of living can be divided into two dimensions. The first one relates to the quality of the housing structural and physical features: that means that demand is sensitive to the quality of design, construction, details. The second one relates to the environment - in a wide sense - in which the living unit is located: demand is then sensitive to the quality of the urban design, to the natural environment, to the social context. Housing demand can privilege the two aspects simultaneously or can select principally just one of them.
To translate the environmental quality features into quantitative indicators is not an easy operation. In this research, two aspects have been taken into account: the presence of any historical and/or architectural valuable element and the presence of any valuable natural environment feature. Other elements such as the quality of the social context (e.g. personal safety) have not been taken into account since the socio-economic context was the same throughout the area.
The regression models did nor show any significant preference of the demand for these environmental features. None of the indicators concerning the historical and architectural values (proximity to monuments) or concerning the natural environment (acoustic pollution, air pollution,

[4] As for the first model, the *variance increase test* was used successfully to test the multicollinariety and the dependent variable and all the tests carried out to verify the respect of their assumptions turned out satisfying results.

[5] On the role of the quality in the housing market Bravi (1994), Curto (1994), Lawrence R. (1995) and Padovani (1991).

proximity to valuable natural goods) entered the model. In this market segment, the environmental quality does not seem to affect housing demand.
Empirical results lead to different arguments as far as the building features are concerned. Several variables related to this part of the housing quality entered the models. In particular, demand preferences concerned the floor of the living unit (strongly correlated to other features as ventilation, brightness and privacy), the number of terraces, the presence of the garden around the building (also related to the quality of the immediate surroundings of the buildings).
In conclusion, empirical results put into evidence that demand preferences are oriented to the building and design quality, and not towards environmental quality, considered in this case as natural environmental quality and historical and architectural heritage quality.
These conclusions appear to be peculiar of the diffused city and significantly differ from what other study argue about the important role of the environmental quality in the housing market[6]. Nevertheless, different empirical results are consistent with the hypothesis of a progressive fragmentation of the housing market in market segments with peculiar characteristics (Curto 1994, p.1).

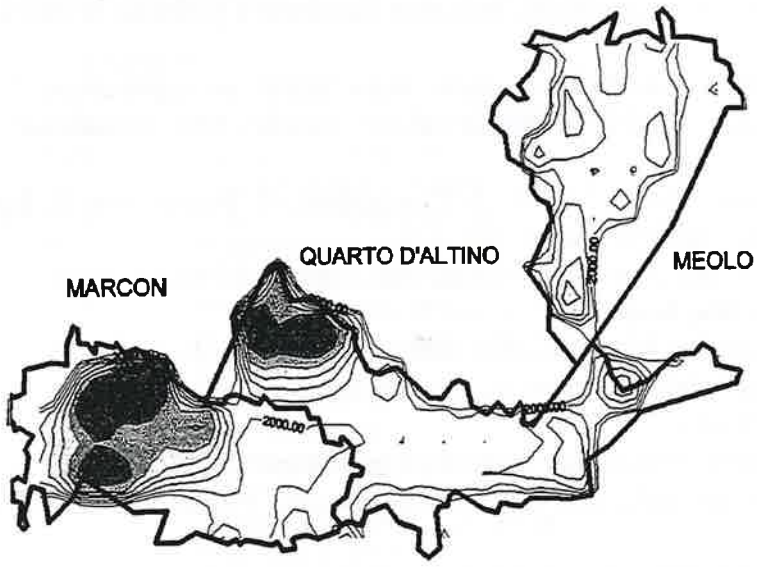
6. Housing prices and accessibility

The regression models previously presented put into evidence a strong relationships between housing prices and the location and the accessibility of the living units.
If a center is a pole of attraction since it gathers all the productive activities, the recreation facilities and, in general, if it represents the center of the social interaction, it is rational that housing demand looks for locations that allow the best access to these externalities (Camagni 1992, p. 86). The greater demand for central areas explains their higher prices. Consequently, a *trade off* must be operated by the individual between price and distance, between higher prices and growing accessibility to the urban facilities and services.
All the theoretical models that put into relationships location and housing values have traditionally assumed a simplified urban structure, in which the geographical center is the place in which are gathered all the principal urban facilities, the Cbd and so on. Such a simplification is no more admissible: the area we considered can be interpreted as a network in which all knots are complementary: in fact, in such areas to look for *the* center has no sense.
If the mono-centric and hierarchical model does not appear an acceptable hypothesis of research, accessibility cannot be measured as the distance (in meters, in minutes) from the Cbd and it is necessary to identify all the facilities - the knots of the network - source of externalities.
The regression models show that proximity to metropolitan area mobility infrastructure - free metropolitan highway - is an important element for the location strategies.
In these urban sprawl areas in which economic activities and households are mixed and dispersed, the location advantage is no longer related to the proximity to the traditional center, but it deals with the access to most important mobility infrastructure. In other words, accessibility is not mechanically related to the physical proximity to traditional urban center, but it relates to the crucial infrastructure that allow connections throughout the metropolitan area.

[6] See footnote # 4. For empirical evidence, see also in Micelli (1997).

Empirical evidence shows also that individual mobility relies heavily on private car. The proximity to the railway station and to the bus stops does not enter the model and therefore there is no evidence public transportation facilities allow location advantages for households.
This same independent variable (TERIN) also refers to the relationships between the metropolitan shopping facilities and the housing prices. The combined advantages of the proximity to the mall and to the free highway give the opportunity to reduce the cost living significantly in comparison to traditional urban centers: a location advantage that the markets transforms into a housing price differential. Furthermore, a radical transformation in lifestyle is occurring: the mall is no longer just a place that offers more competitive shopping facilities, but it is increasingly a center for social interaction.
The link between the urban sprawl and the new shopping facilities is not clearly a cause/effect one. Since there is a large part of the population that moved into these areas, shopping facilities can find an interesting potential market. Nevertheless, the fact that there are important shopping facilities is an incentive for moving away from the traditional urban centers. The two elements have in fact important feed-backs.
Both models show that there is a demand for location close to smaller shopping facilities (supermarkets, small shops). This variable is in fact a proxy of the living unit location in the small villages absorbed in the metropolitan area, and therefore it shows the connection with a broad spectrum of basic services for households.
In this case, the empirical evidence confirms more traditional location advantages. It is important to point out that the contribution of the two location features is different. The location that minimize the access to the metropolitan area "weighs" more than the location in the villages absorbed in the metropolitan area: a confirmation that location strategies now deal mostly with the metropolitan scale and much less with the opportunities offered by the small villages connected with the traditional main center.

Fig. 2 - Housing values orography



The curves have been obtained through normalization of the building and design features of the living units (Rosato e Stellin 1996). The most valuable areas are close to highway accesses and to the mall.

7. Conclusions

Real estate market analysis gives the opportunity to outline individual preferences that lead to the urban sprawl.
Regression models point out that the market segment taken into account privileges aspects that relate to one specific dimension of the "quality of living" - the building and design quality (presence of the garden; quality of the immediate surrounding of the building; terraces). The environmental quality - related to the natural environment quality and to the presence of the architectural–historical patrimony - does not affect significantly demand preferences.
The empirical results point out also the importance of the accessibility to the most important knots of the roads network (proximity to urban highways). Furthermore, the individual mobility appears to rely heavily on private car. The metropolitan shopping facilities are also a element of attraction for households. They ensure a lower cost of living but it must be noticed that they represent more and more important centers of social interaction, that can compete with the traditional historical centers.
It is highly predictible that other real estate market segments are differently oriented, with preferences that contradict the empirical results presented in this paper. Nevertheless, the strength of such a segment and the weakness of central area housing markets - confirms the relevance of the analysis carried out, either for real estate market understanding, either for planners and urban designers.

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Appendix 1 - Descriptive statistics of the variables

Dummy variables

	Variable description	*Frequency*
GARDE	Garden surrounding the building	30/75
ESPOS	Exposition to the sun	64/75
FINIT	High construction quality	19/75
MANUT	High maintenance quality	59/75
AUTOB	Proximity to bus stops	14/75
FERRO	Proximity to railway station	25/75
TERCO	Proximity to basic shopping services	44/75
STORI	Proximity to the historical heritage or to valuable natural goods	7/75
VERDE	Closeness to parks	59/75
ACUST	Acoustic pollution	34/75
AQUAT	Closeness to the urban highway	31/75
TERIN	Closeness to the mall	45/75
PRODU	Closeness to production areas	30/75
SCUOL	Proximity to school	47/75
ASILO	Proximity to the nursery	51/75

Cardinal variables

	Variable description	*Av.*	*Min.*	*Max.*	*Std. Dev.*
VANIA	Rooms of the living unit	4.28	2.00	8.00	1.19
ALLOG	Living units in the building	8.33	1.00	24.00	5.98
ANNOV	Years passed from the transaction	4.86	2.00	6.00	1.39
PIANO	Floor	2.89	0.00	8.00	2.55
BAGNI	Number of bathrooms	1.60	1.00	3.00	.65
BALCO	Number of terraces	.92	0.00	2.00	.48
SUPAL	Living unit surface (in sq. m.)	97.90	34.00	230.00	46.74
VALTO	Total price (mil. of liras)	215.82	84.600	414.000	91.582
VALMQ	Price per sq. m. (mil. of liras/mq sq. m.)	2.04	1.538	3.440	434