The Value of Real Estate between Building and Land

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Key words: real estate development, standards, valuation

SUMMARY

The allocation of value to real estate between the building and the land aims at separating the worth of the land from that of the appraised building.

It is also an operation required by international accounting standards to calculate depreciation of the real estate property.

The influence of any element on the property value is expressed through the complementary ratio; there is, therefore, a complementary ratio of the land and a complementary ratio of the building.

The measurement of these ratios is usually based on the observation of the price of the building site and on an estimate of the cost of reconstruction.

The study proposes a financial model for the calculation of the complementary ratio of the land when there are no available building sites and addresses the insurmountable difficulties met in the cost of reconstruction and in the level of the depreciation of older buildings. These circumstances are recurrent in large, long-established cities, as is often the case in the Italian real estate market.

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1. INTRODUCTION

In the Italian real estate situation, a property is considered in its totality because of the close complementarity that exists between the land and the building. The property value is estimated as a single whole, so that in the *income approach* there is only one capitalization rate which is applied in full to the property.
In Italy, the use of the land rate and of the building rate in the search for the capitalization rate with the band of investment is little known, if known at all. Residual techniques or residual methods are practically not applied, because in reality it is only in special situations that the land is transferred separately from the building standing on it with "surface" rights.

"Surface" rights may exist in two different situations. In the first, *a*) the landowner may detain the right to construct a building in favour of others, who acquire ownership of it ("ius aedificandi"). In the second *b*), the landowner may transfer ownership of a building already existing separately from ownership of the land ("proprietà superficiaria" or surface tenure). In both cases the owner retains title to the land and in the first case the "surface retainer" (the holder of "surface" rights) acquires the right to develop and retain ownership of a building on the land, in the second case acquiring ownership of a building separate from the land.

"Surface tenure" and "surface" ownership rights are acquired by virtue of a contract (sale, exchange, etc.) for which a consideration is envisaged that may consist of a sum paid in a single instalment or of a sum paid annually ("solarium").

The surface right may be set up on public site in order to permit the development of residential buildings for social purposes, with the aim of limiting construction costs and house lease. The houses may be redeemed by those to whom they are assigned together with the land. The regulations state that the consideration for the redemption can be set at a value below market value.

In the Italian real estate situation, superficial tenure finds limited application in the private sector but is more widespread in the public housing sector. Consequently, there are no data available on market prices for transfer of the land right, nor on "atypical" land leases. It is also important to mention that in Italy widespread lack of transparency persists in the real estate market and its various segments, and the immovable property and financial markets are poorly integrated.

These obstacles make it difficult to measure the land rates and the building rates, which otherwise can be carried out autonomously. The land rate is calculated by determining the ratio between the "atypical" land lease and the market price of the same site; and the building rate by determining the ratio between the lease of the property, net of the "atypical" land

lease, and the construction cost in the "*ius aedificandi"* or the consideration paid for the building transferred into "superficial" ownership.

This study first presents an experimental procedure for extraction of the land and building rates directly from market data on the prices and leases of buildings and the prices of building land, basing itself on the band of investment applied to the physical property components. In general, these conditions are found in the suburbs of cities, in developing areas where building land is available.

For central zones, the study proposes a recursive model for calculation of the land and building rates by extrapolation from the rates found in the suburbs.

2. METHOD OF ANALYSIS

According to the band of investment, the capitalization rate i of an immovable property is calculated by summing the land rate i_T determined on the basis of the land-to-value ratio c and the building rate i_F for the complement to the unit of the same ratio in the following way:

$$i = c \cdot i_T + (1 - c) \cdot i_F . \quad [1]$$

The land-to-value ratio represents a percentage of total property value. The measurement of the two rates relates to the respective property investments. The land rate relates to low risk and long term investments. The building rate refers to higher risk medium-long term financial investments. The capitalization rate of the property cannot exceed the building rate and cannot be less than the land rate. In fact the capitalization rate relates to an investment with characteristics intermediate between those of the building and those of the land, and holds a middle position for risk, duration, revaluation and management. For this reason the building rate is expected to be greater than the land rate and the capitalization rate lies between the two opportunity rates ($i_F > i > i_T$). This hypothesis defines a "principle of valuation coherence" which is applied in estimation of the two rates.

The land and building rates indicate the interval within which the capitalization rate falls; that is, they represent the minimum and maximum capitalization rate. The land rate is the minimum capitalization rate when one considers the land theoretically deprived of its building. In that circumstance, the land-to-value ratio is equal to the unit, because the building does not exist ($c = 1$ and $i = i_T$). The building rate is the maximum capitalization rate when, at the other end of the spectrum, one considers the building deprived of its land. In this case the contribution of the land to value is null ($c = 0$ and $i = i_F$), since the investment consists entirely of the building.

The appraisals of the land rate and of the building rate are performed: *a*) in the conditions of atypical property markets where the right to build is separated from the land and it is possible to survey the rates spontaneously as ratios between the "atypical" leases of the land and of the building and the corresponding market prices of the sites and the construction costs; *b*) for the land rate in the market of free site where it is easy to find the lease of the sites and the

corresponding market prices. In all other circumstances, the two rates remain hidden and their appraisal is based on the profitability of competing and similar investments. An example would be estimating the land rate based on the yield of risk-free property investments.

The search for rates can be performed experimentally in the property market, in the segments of trading and lease of the properties and in the segment of trading of the building lands.
One takes a sample of market prices of properties of element *Pj* with *j = 1,2,...n*, a sample of leases of element R_i and a sample of market prices of building lands of element L_k. The samples in general differ in the number of data.

The analysis is based on the sample of market property prices. For each of these, we estimate: the lease values Y_j on the basis of the rents sample; and the values of the sites V_j on the basis of the sample of building lands. Then we calculate the capitalization rate i_j of each property expressed as the ratio between the leases *Yj* and the prices *Pj* of the properties:

$$i_j = \frac{Y_j}{P_j}; \quad [2]$$

and the land-to-value ratio c_j of each property as the ratio between the value of the area V_j and the market prices of the properties:

$$c_j = \frac{V_j}{P_j}. \quad [3]$$

To calculate the land rate and the building rate we impose a system of linear equations, made up of as many band of investment equations [1] as there are properties observed, putting the land rate and the building rate as unknowns and the capitalization rates as known, as follows:

$$\begin{cases} c_1 \cdot i_T + (1 - c_1) \cdot i_F = i_1 \\ c_2 \cdot i_T + (1 - c_2) \cdot i_F = i_2 \\ \qquad\qquad \cdots \\ c_n \cdot i_T + (1 - c_n) \cdot i_F = i_n \end{cases}.$$

The answer to the system of equations leads to a land rate and a building rate for the observed property market segment. Substituting the formulas [2] and [3] in the equations of the system we obtain the following system:

$$\begin{cases} V_1 \cdot i_T + (P_1 - V_1) \cdot i_F = Y_1 \\ V_2 \cdot i_T + (P_2 - V_2) \cdot i_F = Y_2 \\ \qquad\qquad \cdots \\ V_n \cdot i_T + (P_n - V_n) \cdot i_F = Y_n \end{cases}; \quad [4]$$

the general equation of which is expressed as a function of the yield of the properties following the land residual technique, which aims at estimation of the land value based on preliminary appraisal of the yield of the property and of the building value, represented in this case by the difference between the price of the property and the value of the land.

The band of investment equation system can be applied when one knows the land-to-value ratio, calculated on the basis of the market prices of building lands. In central urban zone, however, there are often no free sites available, because they are all built on, or because there is no active market in them. To address this problem, one can impose a simulation, sourcing from suburban areas, where land market prices are generally available, to obtain rates for other areas of the city.

The simulation considers the zones of the city, representing them with the measure of land-to-value ratio, which normally rises from the suburbs towards the centre by way of the economic rent of the real estate property, or in other words, by the prevalence of the value of the site over the value of the entire property. The principle of valuation coherence expresses the relationship between the land rate and building rate and the capitalization rate. The starting point of the simulation is the land-to-value ratio, the land rate and the building rate extracted from the statistical survey and the system of band of investment equations. The zones are identified with regular intervals and three elementary hypotheses are formed regarding: a constant capitalization rate in the city and in the suburbs; a rising capitalization rate, and a decreasing capitalization rate.

Retrieval of the land and building rates takes place with a recursive model in which the rate of one zone enters into the calculation of the rate for the following zone according to a hypothesis of spatial continuity. The rates of the first (suburban) zone are respectively $i_T(0)$ and $i_F(0)$. The land-to-value ratio $c(0)$ and the rates are that have been surveyed. On the hypotheses of constancy, the capitalization rate $\bar{i}$ is only one. In the next zone the building rate $i_F(1)$ is calculated by applying the inverted band of investment formula [1]:

$$i_F(1) = \frac{\bar{i} - c(1) \cdot i_T(0)}{1 - c(1)};$$

the land rate is calculated using the moving average of the building rate referred to the same zone and to the preceding one for uniformity, as follows:

$$i_T(1) = \frac{\bar{i} - [1 - c(1)] \cdot \frac{i_F(0) + i_F(1)}{2}}{c(1)}.$$

In general, the building rate of the generic zone k of the m zones (in which the land-to-value ratio is divided up)(with $k = 1,2,..,m$) is calculated as follows:

$$i_F(k) = \frac{\bar{i} - c(k) \cdot i_T(k-1)}{1 - c(k)};$$

and the land rate is calculated as follows:

$$i_T(k) = \frac{\bar{i} - [1 - c(k)] \cdot \frac{i_F(k-1) + i_F(k)}{2}}{c(k)}.$$

On the hypotheses of increasing or decreasing capitalization rate, the rates *i(k)* linearly vary in increase or in diminution zone for zone according to the preceding formulas.

The results of these iterations aim to provide indications on trends in the land and building rates on a series of hypotheses, without claiming to replace surveying of the data. These results can prove useful in circumstances where there are no experimental alternatives available and in general in real estate appraisals when one has to adopt rates derived from competing property investments.

3. EXPERIMENTAL TEST

An experimental test was performed to search for land and building rates through the system based on the band of investment equation (Benvenuti A. & Simonotti M.). Three samples were surveyed: a sample of market prices of apartments in small blocks in a newly-built urban area in the suburbs of a small town in Tuscany (Italy); a sample of leases of apartments, and a sample of market prices of building land.

It is important to point out that experimental research in the property field generally relates to the prices and rents of buildings. The samples are often small in terms of the number of data recorded and complex in terms of the varied nature of the property characteristics. The difficulties in surveying the appraisal samples generally come from the lack of transparency and limited degree of competition in the real estate market. In the search for the rates, the intersection of market segments in the same property adds a further difficulty linked to the fact that data on the three segments are not available at the same time. This is less difficult in the market of new buildings.

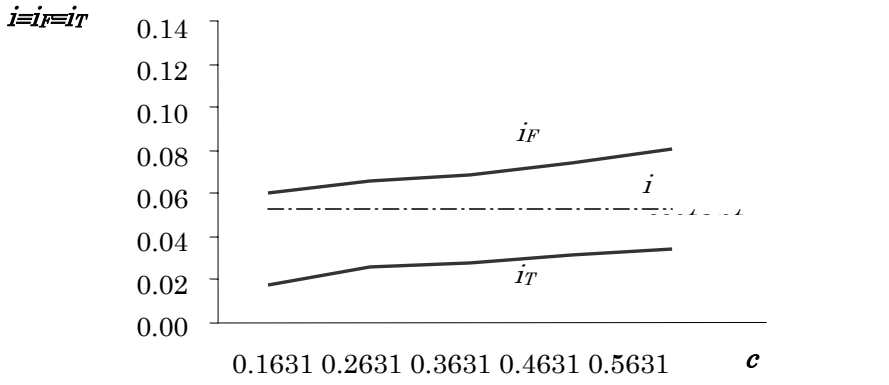
The search for the land and building rates was performed on the first sample, where the market prices were known, whereas the leases and land values respectively were estimated from the second and third samples.
The data and results of the appraisal analysis, performed with the system of band of investment equations [4] are shown in the following table.

Data and results of the analysis of the sample of properties

Data and result	**Average**	**Standard deviation**
Number of data	15	-
Rentable area of apartments (m²)	100.47	19.77
Market price of apartments (€)	167,400.00	30,558.61
Unit price of apartments (€/m²)	1,666.22	-
Unit price of rentable area (€/m²)	146.55	-
Lease (€/year)	8,966,01	369.78
Unit price of lease (€/m²·year)	92.29	16.71
Land-to-value ratio	0.1631	0.0117
Building-to-value ratio	0.8369	0.0117
Capitalization rate	0.0531	0.0039
Land rate	0.0174	-
Building rate	0.0600	-

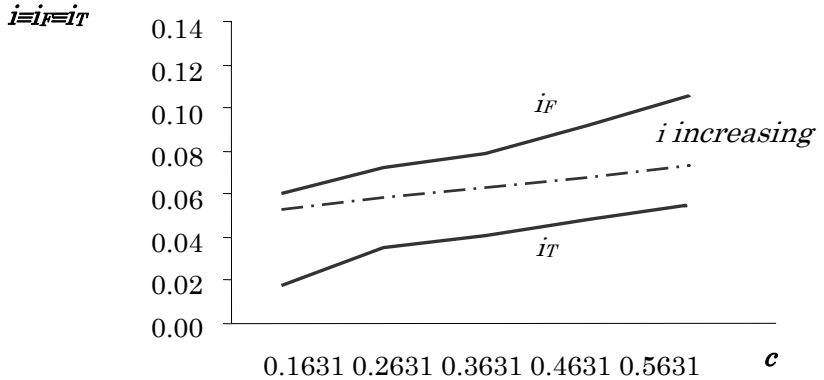
In the study sample, the average of the land-to-value ratio was 0.1631; the average of the building-to-value ratio was 0.8369 and the average capitalization rate 0.0531. The capitalization rates in the sample range from a minimum of 0.0495 to a maximum of 0.0573, delimiting a range of 0.0078. The solution of the system [4] leads to a land rate of 0.0174 and a building rate of 0.06, the difference between the two rates thus being 0.0426.
The simulation model for the land rate and building rate takes into consideration the calculated amounts of the rates and the average of the land-to-value ratio for the urban zone studied. The number of zones was set at equally distant sections, starting from the data available until an amount hypothesised for the central zone was reached. For the level of the capitalization rate, a constant rate for all zones was set, then one increasing linearly from the suburban to the urban zones, and a third rate decreasing linearly.
With the constant capitalization rate, the interval between the land and building rates tends to rise, even though the capitalization rate remains constant (Figure 1).

Figure 1 - Interval between rates from the suburbs towards the city (constant capitalization rate)



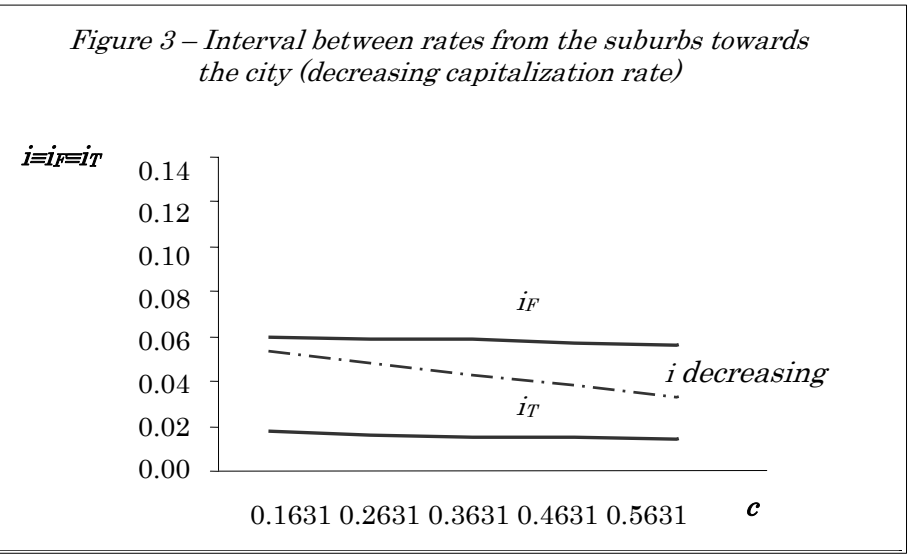
In the event of an increasing capitalization rate, the interval between the land and building rates tends to follow the same trend (Figure 2).

Figure 2 - Interval between rates from the suburbs towards the city (increasing capitalization rate)



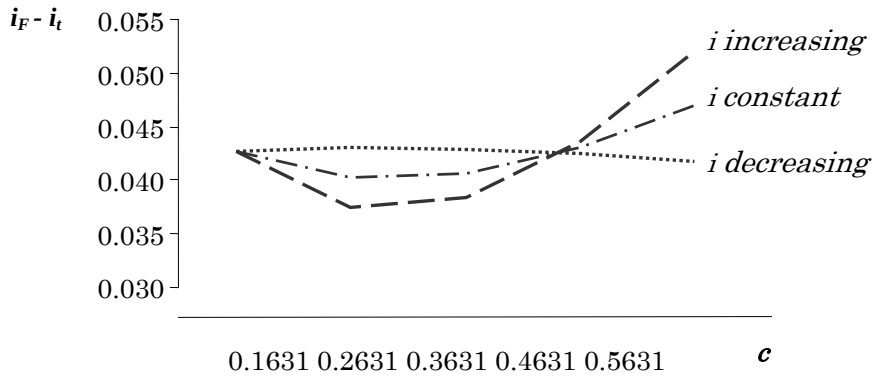
In the event of a decreasing capitalization rate, the difference between the land and building rates tends to remain constant (Figure 3).

Figure 3 – Interval between rates from the suburbs towards the city (decreasing capitalization rate)



The interval between the land rate and the building rate first decreases and then rises with a constant or rising capitalization rate (Figure 4). With a decreasing capitalization rate, the interval tends to decrease somewhat (Figure 4).

Figure 4 - Interval between building rate and land rate



4. CONCLUSION

The land rate and building rate are two capitalization rates practically unknown in Italian appraisal practice. In countries with a more ancient tradition, however, their use is widespread and their estimation does not create problems when there are data and information on the property market available and the property and financial markets are integrated. In fact, these two rates express the revenue from the corresponding investments: the land rate expresses the yield from investment in the land and the building rate expresses the yield from investment in the building. Where the right to build and surface ownership are separate from ownership of the land, it is possible to easily survey the two rates. In Italy, surface right is rare in the private sector, whereas it is sometimes applied in public residential building.

In this situation and in the absence of contracts, of rights and of partial interests exchanged on the market, the land rate and building rate are hidden rates that answer to a stringent economic logic but cannot take concrete form as real rates. In these circumstances, the two rates are appraised on the basis of alternative property investments.

The band of investment was used to design an experimental search for land and building rates, recording a series of sample of sale and lease of residential properties and of market prices of land in a suburban area of a town in Tuscany. With this purpose in mind, the band of investment was transformed into a set of equations, the solution of which indicated the land rate and the building rate.

It can be said that extraction of the two rates took place in favourable conditions, one being the availability of the market prices for building land. Conditions seem less favourable for central properties where free areas are unavailable, for example in the central zones of cities and historic town centres. In these latter circumstances one may, in fact, encounter practically insurmountable difficulties in calculating the land-to-value ratio starting from the depreciated cost of ancient buildings.

To this end, a model is presented for simulation of the land and building rates, based on the extraction of the rates surveyed in suburban zones or in other zones where the prices of free areas, or of those that can be freed up, are available, to the rates for urban areas where it is not possible to record market data for building land. The simulation model sets a gradient of zones based on the land-to-value ratio, which rises from the suburbs to the centre, and three hypothetical trends for the capitalization rate (constant, rising or declining from the suburbs to the centre). The results of the analysis show the trend in the land and building rates in the various urban zones and the trend in the interval between the two opportunity rates.

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